

## Who can mend old leaded men?

This issue of *LEAD Action News* is dedicated to occupationally lead-exposed men who in their twilight years have reached out to The LEAD Group for assistance in demonstrating to others (Veterans Affairs, Compensation Boards, etc) that their exposure to lead and other toxics at work has had significant health and financial impacts. The LEAD Group is appealing to all readers who may be able to offer any kind of help to these men. In the case of Brian Arndt, an ex-petroleum refinery worker from New Zealand, it would be marvellous if someone could create a Wikipedia page on his claim for compensation case, and to that end, I've published in this issue, everything he's written and collected that wasn't already web-published – so that the articles can be referenced in Wikipedia. Please write a letter to the editor if you can help in any way.

## Volcano Art Prize entry deadline extended to Monday 14<sup>th</sup> October 2019

We had more prizes than entries when the original deadline came and went so we've extended the deadline for Volcano Art Prize (VAP) 2019 to midnight at the end of the day, your time, on Monday 14<sup>th</sup> October.

Entering VAP is a great way to contribute to lead poisoning prevention, and you could win the Judge's Award, a cash prize, or your entry printed on one of 30 mugs!

Just go through your photos and choose a landscape-orientation A4 (rectangular) photo that's 1-3MB in size and for which you can create a Lead-Safety Message (words to inspire others to stay or become lead-safe or protect the environment from lead), then head to [www.volcanoartprize.com/submitentry/](http://www.volcanoartprize.com/submitentry/) to upload it! Photos of artworks and short films (after you've web-published it elsewhere) can also be entered.

If you're an adult in an OECD country, entry costs AU\$10 but for every child and all other adults, entry is free! Winners are announced during International Lead Poisoning Prevention Week of Action (20<sup>th</sup>-26<sup>th</sup> October 2019) in *LEAD Action News*.



**2019 Volcano Art Prize (VAP) Entry.** Artist's Name: Cameron Bestwick. Title of Image: Australian wildflowers flourishing and rotting together. Lead-Safety Message: The living and the dead: the difference could be lead. <https://volcanoartprize.com/peoples-choice/>



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## **Editorial, *LEAD Action News* volume 20 number 1, October 2019 – Who can mend old leaded men?**

*By Elizabeth O'Brien, instigator of ILPPWA, co-Founder of The LEAD Group Inc.*

As mentioned on the front page, this issue of *LEAD Action News* is dedicated to occupationally lead-exposed men who in their twilight years have reached out to The LEAD Group for assistance in demonstrating to others (Veterans Affairs, Compensation Boards, etc) that their exposure to lead and other toxics at work has had significant health and financial impacts. This issue is an appeal to all readers who may be able to offer any kind of help to these men.

Following this Editorial is a Letter to the Editor from a 90-year old Korean War veteran who worked as a cable splicer in the Bell System. He probably wrote to The LEAD Group because we have previously published:

*Blood Lead Levels in a Group of Bell System Employees - 1976 to 1980* [shows 36 telephone workers had blood lead levels similar to plumbers in NHANES II], at [https://lead.org.au/bellsystemleadpoisoning/images/NHANES\\_article.pdf](https://lead.org.au/bellsystemleadpoisoning/images/NHANES_article.pdf) and

*An investigation of circumstances surrounding an alleged case of lead poisoning*, at <https://lead.org.au/bellsystemleadpoisoning/images/an%20investigation%20of%20circumstances.pdf> which references (inter alia):

*Health status of cable splicers with low-level exposure to lead: results of a clinical survey*, by A Fischbein, J Thornton, W E Blumberg, J Bernstein, J A Valciukas, M Moses, B Davidow, B Kaul, M Sirota, and I J Selikoff, from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1619483/>

But if you can provide any other relevant articles which will help this ex-Telephone Trouble Shooter convince a US Veterans Hospital that he may have had lead poisoning, that would be highly appreciated.

The next *Letter to the Editor* is from another US War Veteran Sonny (Tex) Gilligan, who was exposed to lead, other heavy metals and radioactive metals as an underground miner, and who has lodged lead shot in his body from a hunting accident and was then exposed to wildfire flame retardant. I have already advised him to join our Lodged Lead Shot and Bullets Support egroup at <https://groups.yahoo.com/neo/groups/LLSBS/info> and our LeadWorkers egroup at <https://groups.yahoo.com/neo/groups/LeadWorkers/info> but this 75 year old veteran would appreciate our readers' suggestions to relieve his loss of memory, loss of vitality and breathing difficulties.



Sonny's lodged shot in his chest reminded me to publish: *Letter to the Editor: Buddy Bucksworth - 21 years of living with a lead bullet in my tibia bone.*

Les Wellington has written the next article: *Lead poisoning of apprentices and lack of blood lead testing of lead smelter and mine workers in Australia in the 1970*, and supported it with *Les Wellington's MIM Medical Records* (including his only blood lead result of 60 micrograms per decilitre, written only as 0.06) and *Job Transfers after the Lead Smelter.*

When I asked a member of the LeadWorkers egroup (run by The LEAD Group) – who's own story appeared in *LEAD Action News* 23 years ago in June 1996 (*Lead Worker: A Case History* at <https://www.lead.org.au/lanv4n3/lanv4n3-7.html>), to read Les's article, he advised: “the positive results of the belated medical treatment I received were significant.” He also advised Les to pursue his Workers Compensation entitlements – so any further advice or assistance in doing that would be much appreciated.

In between writing up the third case and the fourth case for this newsletter, I received the very sad news that our long term Spanish and French translator volunteer Orlando Aguirre-Lopez had passed away unexpectedly despite being in excellent health. His Obituary appears next – kindly translated from Spanish to English by our original translator volunteer, Sandra Patricia Palomino who now has the surname Buckley.

In the fourth case in this issue, Brian Arndt, born 2<sup>nd</sup> August 1940, currently 79 years of age and an ex-petroleum refinery worker from New Zealand needs your help to convince the New Zealand Accident Compensation Corporation (ACC) that he should be compensated for the disastrous health impacts which resulted from the work he did from 1965 to 1975 blending tetraethyl lead (TEL) and tetramethyl lead (TML) – collectively known as Tetra Alkyl Lead (TAL) – into petrol (which contains the known carcinogen benzene), along with the probable carcinogens called lead scavengers (which had to be added to leaded petrol to scavenge lead out of the vehicle engines and exhaust systems and stop the lead destroying the vehicle) and a myriad of other carcinogens and other hazardous substances in the air at refineries.

Brian had one child when he began his TAL-blending work in early 1965 but Brian suffered multiple health issues within months of starting his refinery work (including erectile dysfunction which stopped him having any more children), psychotic dreaming, and balance problems, and has already had numerous surgeries and treatments for 4 types of cancer.

On 15 December 2017, Kurt Bayer from the New Zealand Herald wrote an excellent summary of Brian's trials and tribulations up to that point, in “Ex-Marsden Point Oil Refinery worker with cancer wants compensation, claiming lead poisoning”, at





[http://www.nzherald.co.nz/nz/news/article.cfm?c\\_id=1&objectid=11959704&ref=rss](http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11959704&ref=rss) which includes:

ACC's toxicology panel concluded it was unlikely that Arndt's cancers were caused by workplace exposure to TEL and TML and recommended his claim be declined.

In September 2019 Brian is facing heart and neurological problems so anything any reader can do to help with his compensation claim while he's still alive would be much appreciated!

After all, **justice delayed is justice denied.**

Sure, *LEAD Action News* readers know that lead is hazardous but really, how many people are exposed ONLY to lead? My real concern is that I haven't found time to research the question of mixtures of hazardous chemicals as a cause of Sonny Gilligan's health issues or of Brian Arndt's health issues, especially the cancers and his inability to father children after he began working at the refinery! Here's a sample of the limited information that's out there on synergistic effects of multiple chemicals:

Deemed Diseases in Australia, by Safe Work Australia, August 2015, <https://www.safeworkaustralia.gov.au/system/files/documents/1702/deemed-diseases.pdf> states:

Occupational exposures and occupations that have been strongly implicated in adversely affecting reproduction in both males and females are **lead**, mercury, **multiple chemical** and pesticide exposures, **organic solvents** ..... Exposures implicated as being of concern specifically to males include ...; **ethylene dibromide [a lead scavenger in TAL]**; and styrene.

Just as I was about to call it a day (or a quarter! – Three months in the making!) for this newsletter, I found a fifth case story - *Ray Harvey phone account of lead detox with Vit D & colostrum on vegan diet* – which had been omitted from the previous issue of *LEAD Action News* because I was waiting on the lab report of his blood lead result in our Blood Lead Challenge. I do like to back up everything we publish with documentary evidence! Apologies to Ray for its late publication.

I would be so grateful if any *LEAD Action News* reader were to contribute articles on any of these cases/issues or on new lead-related cases/issues for a future edition! Please be inspired by what follows...



## Letter to the Editor re: lead poisoning of Bell Telephone Cable Splicers



June 30<sup>th</sup>, 2019

Lead Action News  
Post Office Box161  
NSW 2130, Australia

To Whom It May Concern:

I am inquiring to know if your firm has ever heard of any Bell Telephone Cable Splicer ever coming down with Lead Poison and later in their lives like over 65. I was a Korean War Veteran for six years U.S. Army and five and a half years a Telephone Trouble Shooter. Yes 'working with Lead, and I had a gut operation in 2006 by the VA. The Doctors could not tell what it was. They sent two samples to their labs, and could not tell what it was or how it got there. Then the Doctors sent a larger chunk to an outside lab from the VA. Hospital. The report came back still a mystery. My regular Doctor came in after I had my 54 stitches in place. Then he gave me my Christmas blessing, I would only have six more operations and that would be all. Can you tell I am still here?

In case you were wondering why I am still here I had a visitor at the Hospital, he was an old friend employee of mine. I was a Building Contractor later years, and he said he saw this 'thing' on the computer and made one for Mother and Dad, he and wife and made one for me. I still use it, it's called a Polarity Timer using Flashlight Batteries, D.C electrical. It can be found on EDK University, or Lee Crock internet.

My reason for asking is because I was investigating and read two letters about 2008 by splicer's and they both had develop problems in their abdomen, and both later in life. They did not mention in their letters whether or not they were cured just that they came down with the lead poison.

Searching for others, my representative for the veterans here passed away, so I got another Rep. This one passed on too before I had a package reading about Lead Poison. Here I am 2019 and noticed I made a big mistake not printing the letters I read as they are not there and now no splicer's or lead cable. I believe that any information of Splicer's with Lead Poison was removed from the internet because of fear of being sued. My problem is no proof no more and I wanted to ~~proof~~ **PROVE** to the Veterans Hospital I may have had Lead Poison. Oh yeah, I'm 90 now.

Any help would be appreciated thanks.



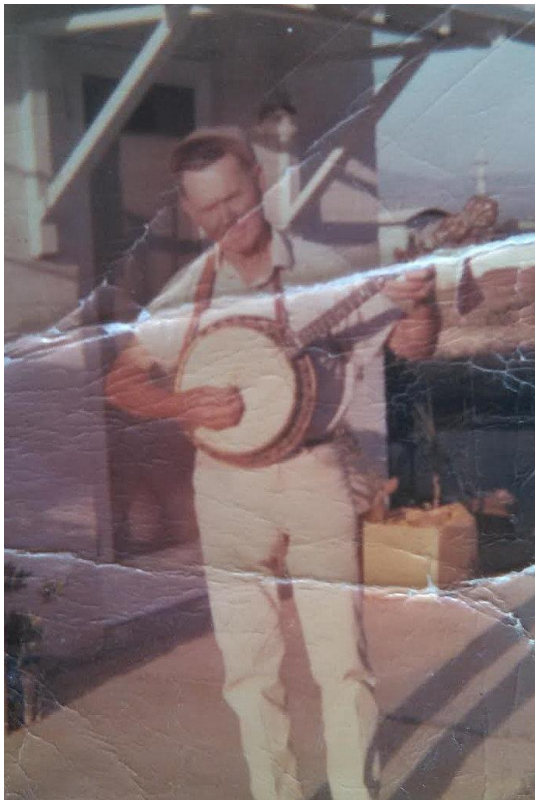
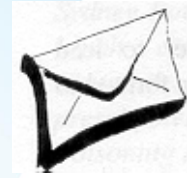
## Letter to the Editor: Tex (Sonny) Gilligan - hunter and ex-underground miner

Monday, July 29, 2019

To: The LEAD Group Inc

Subject: Lead and other heavy metals.

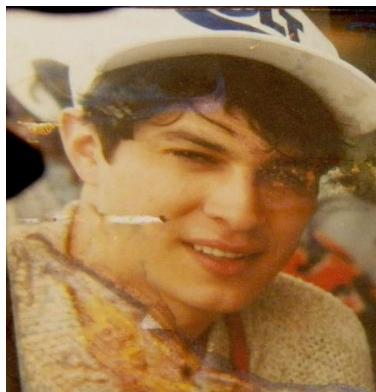
From: Tex (Sonny) Gilligan <[sonny95@protonmail.com](mailto:sonny95@protonmail.com)>



I have been an underground miner the greatest part of my life. That includes Uranium Mining, Zinc Mining, Gold, Tungsten and Copper mining. My mining started at age 9 when I would enter mines with my Dad whose life as a prospector/miner was many years. He died from prostate cancer I believe brought on by a small chunk of high grade Uranium that he carried for years. It looked like a small meteorite a bit larger than the size of what is termed a boulder in child marble playing.

*Archival photo of the father of Tex Harold Eldon Gilligan (Sonny).*

My hiking partner, Joy Collura for a period of about six years were the last two civilians to see the 19 Granite Mountain Hot Shot Crew alive that terrible day of June 30, 2013 when they were burned alive. It left a profound effect upon us since we were on the fire edge before they were and photographed, talked with their crew boss Eric Marsh and were at the very place they descended into a trap that would end their young lives.



I had lost a young son, Ted, due to similar circumstances so it bore especially hard upon my person so I felt the loved ones pain very deeply. So Joy and I took up to hiking hundreds of wild land fire fighters to the sight feeling it almost our duty. We have also posted much on Investigative Media where there is still controversy over why those men did the unthinkable and the questions involving what we believe was a faulty investigation.

*Archival photo of Ted Gilligan, the son of Tex Harold Eldon Gilligan (Sonny) who died from injuries later from an underwater welding incident.*





*Archival Photo of Tex Harold Eldon Gilligan (Sonny) New Mexico Logger Days - hauling firewood he cut from dead trees*

We had barely escaped that mega fire at Yarnell, Arizona by less than ten minutes ourselves. But that is not what I was concerned about in contacting you. You see Yarnell was surrounded by a saturation of the orange slurry in an attempt to save the residences. It was ineffective except that after the slurry drops and in these past years upwards of 200 individuals from Yarnell and its immediate area have died. Others have suffered illness related to oxygen deprivation such as heart attack, cancer, lung issues and the like. I myself fell dead in a hospital parking lot of a heart attack some months after the slurry drops. Since I have had more and six stents in my body now. Doctors have indeed saved my life more than once.

I know that lead is the end product of the half lives of Uranium. Both are heavy metals and the slurry as well carries depleted Uranium. A cursory search of the effects of the phosphates that are a major constituent of slurry show the terrible devastation on aquatic life and the death caused to millions of fish lying on river banks and beaches of Florida. We know that the phosphates and ammonium compounds also are heavy contributors to the ocean dead zones both in the Atlantic and Pacific.

There is a range of 5-15% of hidden chemicals added to the Phosphate slurry solutions. We do not know what they are since these chemical companies are able to hide them under trade secret laws. PhosChek slurry brand advertises 8% or less of hidden chemicals--that would be about three quarters of a ton of unknown chemicals spread about Yarnell since



information reports about 500 thousand gallons of the retardant were unloaded about Yarnell.

I had written EPA but they are not concerned about fire retardant effects. They have however spent hundreds of millions trying to clean up the abandoned phosphate mines in Florida. There are 16 abandoned mines I believe and another 9 that are still in production. The EPA concerns are that the Uranium, Thorium, Radium and Radon contents of the phosphates will enter the fresh water tables--well they already have.

So with your knowledge of the problem, I wonder have you any advice for people who have been subjected to these toxic solutions found in the slurries, namely the phosphates, ammonium and other hidden chemicals we can only guess at.

In a way I am one of the guinea pigs that Yarnell was. I have had 6 heart attacks, and in one month had 9 cancers removed which had gone rampant after my life at Yarnell. I have since moved to New Mexico leaving behind many friends who are now either dead or sick.

Unfortunately on a rabbit hunt with my three dogs, one was able to somehow get his paw so that he unlocked the safety and fired a twelve gauge shotgun into my back. It shattered my clavicle into many pieces, pierced my right lung and broke three ribs, yet I still have the ounce of number 8 lead shot scatter throughout my chest. Again the miracles of modern doctors and science saved me since I had bled out 6 units of blood some 25 miles out in the desert. You were dead at 5 says my son, a long time trauma RN.

But now I feel like the lead is taking a toll on my health--I feel like I am living somewhere fluctuating between a 1 and 3 in health and vitality on a scale of 1 to 10 and 10 being the best health. Do you have any suggestions to relieve this loss of memory, loss of vitality and breathing difficulties I have? I am 75 years of age, a war time Vet so I will request a blood test for chemicals such as lead at my next VA medical visit.



*Recent Photo of Tex Harold Eldon Gilligan (Sonny) by Joy A Collura*

Photo source: <https://www.yarnellhillfire revelations.com/single-post/2018/11/03/How-Many-Lives-Does-One-Man-Have-I-Always-Thought-It-Was-Two-The-Second-One-Began-When-One-Realized-They-Only-Have-One-Life-Not-For-Tex-Harold-Eldon-Gilligan-Sonny-This-Is-His-Medical-Status-Update-Post-Tex-Being-On-The-Weaver-Mountains-June-30-2013-Was-Very-Important-To-The-Wildland-Fire-Industry-Too-Many-Times-He-Has-Been-Thanked-For-His-Fire-Knowledge-Experience-Let-This-Post-Honor-The-Fallen-By-Sharing-About-Sonny-Who-Is-On-A-Road-To-Recovery->



When I was a child and throughout the years my Dad was quite the coffee drinker. It was coffee at least three times a day for him and he always like to add the carnation evaporated milk creamer when he could.

I was reminded of that when at the Yarnell Fire and on our hikes we would see those old rusted carnation evaporated milk cans from years gone. The gold mines surrounding Yarnell and in the Weaver Range still have the old dumps. After the hot wild fire of 2013 (reaching up to 1500 degrees Farenheit) and dispersing the energy of a Hiroshima type A-Bomb every 15 minutes, I happened to notice the effects on those old cream cans left by miners 50 and more years preceding the fire. In those days the center of the can was sealed by lead. The lead melts at 700F, and so you could see the lead melted like so much wax from the center of the can and frozen like and elongated bulb.

It demonstrates how even that they knew about the lead toxicity since the early 1900's, the industries were still game to use lead as a sealant on food products.

Thank you – Sonny Tex Gilligan

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[*Editor's note: Sonny's lodged lead shot in his chest, reminded me of the following Letter to the Editor not published until now.*]





## **Letter to the Editor: Buddy Bucksworth - 21 years of living with a lead bullet in my tibia bone**



From: Buddy Bucksworth

Sent: Wednesday, November 26, 2014

To: The LEAD Group Inc

Subject: 21 years of living with a lead bullet in my tibia bone. Lead levels are at 2.1 ug/dl (micrograms per decilitre)

Hello

I had been shot in the leg about 21 years ago and only about 5 years ago I realized I should have annual blood lead level tests done.

The bullet is broken up in several pieces inside of my left tibia bone.

Doctors do not understand the severity of the lead levels, when the labs come back they only see 2.1 ug/dl and think no big deal because they are used to lead exposure where someone breathes in lead and has high levels for a short time.

Typically Dr's do not understand that people living with lead bullet fragments means constant exposure 24hrs a day 7 days a week. So when Dr's see a lead level on someone with a bullet lodged in them and the levels are 2.1 or 3.0 they think it's no big deal.

I noticed on my label that was submitted for the levels to be checked it read Lead test levels due to exposure. Exposure to me means being around lead.

Anyhow I have noticed heavy heartbeats, pain in my side and finger nails starting to deteriorate along with some skin rashes like eczema.

My most recent blood levels were done October 2014 and came back 2.1 ug/dL. This number is just on the starting point of being a concern.

My white blood count was 6.1

Red blood count 5.13

Hope this helps for others

Buddy





# **Lead poisoning of apprentices and lack of blood lead testing of lead smelter and mine workers in Australia in the 1970s**

*By Les Wellington, 26<sup>th</sup> February 2019, Queensland, Australia*

My name is Leslie George Wellington and I went to All Souls College for six years in Charters Towers. I was a gymnast and I was in the cadets, and I was the junior champion in rifle-shooting.

I could play snooker like a champion and could also bowl like a champion. I could put a coin into a pinball machine and play for four hours for free.

After MIM I turned into a non-talent imbecilic moron, and consequently have been assaulted thirty times (lucky I did not lose most of my boxing skills).

My family organized for me to do an apprenticeship at Mount Isa Mines (MIM) in north-west Queensland in 1971 when I had just turned seventeen.

Half-way through my first year, I was placed in the MIM lead-smelter. Apprentices were made to do the dangerous jobs, for example: Cut bolts off machines that had black sinter covered over all the machinery, and with white lead-acetate crystals growing out of the black sinter (acetate crystals are also found on top of paint and they taste like sugar).

We also had to work on top of the lead-furnace, which was an open hole in the work shop floor. There were no railings around the hole, and when I was working there the extraction fans were malfunctioning up to ten times a day (the extraction fans were to the side of the work shop).

Because the fumes were mainly ammonia a person could not breathe or see and had to run away from the area to obtain fresh air (we were also covered in sweat and the fumes would mix with our sweat).

We also had to wear our overalls home with us, and they were always completely covered with black sinter and acetate crystals powder.

I noticed that where I worked, there were no tradesmen working with us. I asked one of the tradesmen why, and he told me it was too dangerous an area, and that they refused to go into these areas, because MIM did not supply the proper safety-gear.

The cheapest way out of this situation was to have apprentices from the age of fifteen upwards to do the job, and to not tell them of the dangers involved. Also, MIM could cut-back on costs by not treating these children. I was one of the oldest apprentices (I had started at MIM when I just turned seventeen).



Most of the children working at MIM were aged from fifteen to sixteen, and I am fairly sure that two of the children were fourteen.

I complained to the union representative about the dangerous work and lack of safety gear and they said, in a casual and disinterested tone, that because I was an apprentice, that they could not help me, and suggested that I go to the MIM worker who was responsible for apprentices.

I went to see him, and he advised me that if I didn't do the job then I would have to cease my apprenticeship at MIM.

I had no option but to go back to work. I went back to work, mainly because I thought that I would be cared for, if something was to happen to me, and I didn't want to disappoint my family.

We had numerous safety meetings and watched many films of mine dangers, but MIM never said one word about lead-poisoning or showed us any films concerning lead-poisoning.

I knew absolutely nothing about the effects of lead-poisoning. I just knew it wasn't good for you and that I would be cared for if I ever had an accident or became sick. If I had known the facts, I would have left MIM.

We had lead-tests every month and I was informed that my lead-count was high and that I had to go to another area to work. When I perused my MIM medical-files fourteen years later, I found that I had (extreme-exposure) to lead three weeks before I was moved out of the lead-smelter.

I was kept in the lead-smelter for three further weeks before being moved to the copper-smelter and then to the small lead-concentrator, and then to the large lead-concentrator.

I was doing the same type of work as in the lead-smelter (without any further lead-testing). I worked for another three years in the mines without any further lead-testing at all, as is shown in my MIM medical file, which I have a copy of.

Dr Watson, who was my back specialist, sent my MIM files to a toxicologist to examine my MIM lead-testing results. He stated in his extensive report that I had severe exposure to lead; relating to my last lead-test at MIM. I still have this report.

My daughter contracted paranoid schizophrenia at the age of seventeen, which was caused by my lead-poisoning (I obtained this information from industrial toxicology books at the James Cook University).

When she was younger, she was always the teacher's pet, and was very good at school and worked very hard at her studies, but slowly turned into a moronic dropout, which was no fault of her own.



**Please Note:** If I was given treatment at the MIM Medical Centre or made aware of my lead-poisoning results, then I could have been administered chelating-agents to remove the lead from my body. It only takes injections of these agents for twelve months to clear the lead and other toxins out of the body. Please refer to:

[https://en.wikipedia.org/wiki/Chelation\\_therapy](https://en.wikipedia.org/wiki/Chelation_therapy)

As stated above; I have been bullied by fascist and communist Australians all my life (as is the same with my daughter) and I now have severe spinal injuries. For example: I have eight fractured vertebra disks, a fractured hip and a busted tail bone, and I also suffer from osteoarthritis in and along my whole spine, and in my hip and tail-bone. I also suffer from polyneuropathy, which has been caused by my lead-poisoning. Please refer to:

<https://patient.info/doctor/Polyneuropathies>

My daughter and I have been on an invalid pension for decades, and the Australian tax-payers have to foot-the-bill, including unnecessary medical costs etc.

As stated above; if I had been given proper medical treatment, then both my daughter and I would have contributed to society rather than being a burden.

It costs the tax-payers millions of dollars to look after the both of us, and billions to look after other victims of these heinous, murderous crimes. As I have stated above; all it takes is chelating-agent for twelve months to clear the body of these ugly toxins.

I live alone and in constant pain, and I have only one child and no grandchildren. They terminated two of my daughters' pregnancies without informing me until it was over. They killed the only two grandchildren that I had.

I receive no help from my family or caring-agencies. I live like a recluse and have no real close friends. Nobody cares!

**Please Note:** I can clearly see why we are running out of trades-people in Australia. Australian being the lucky-country is just a lie.



# Les Wellington's MIM Medical Records and Job Transfers after the Lead-Smelter

Information collated by Les Wellington, ex-Mt Isa Mines Lead Smelter worker

## MIM (Mt Isa Mines) Medical Records

**Table 1:** Copy of Dr Neville's attachments to his report.

Lead	Normal	Slight	Moderate	Severe	My results	Date
Blood Mgs/100gm	<0.04	<0.06	>0.06	>0.08	<b>0.06 only test</b>	<b>16/3/72</b>
Urine Mgs/Litre	0.07	<0.12	>0.12	>0.40	<b>0.46 last test</b>	<b>13/4/72</b>

**Table 2:** Copy of MIM lead testing results.

Date	Urine Code No.	Pb Mgs/Litre	Blood Lead Tests	
16th December 1971	57	0.26	No blood test	
21st January 1972	104	0.19	No blood test	
<b>16th March 1972</b>	<b>LAB</b>	<b>0.23</b>	<b>Pb Blood 0.06</b>	<b>One and only blood test</b>
21st March 1972	135	0.20	No blood test	
13th April 1972	87	<b>0.46</b>	No blood test	<b>Last urine test</b>
	<b>More than doubled</b>	No more urine tests	No more blood tests	





Dr Neville stated in his letter that the last urine test showed 0.46 Mgs/Litre of lead in my urine, which indicated severe exposure to lead. In a photocopy from a toxicology book dated 1971, attached to Dr Neville's letter, it shows that only 0.40 Mgs/Litre in the urine indicates severe exposure. Please refer to Table 1.

Information I have received from the Lead Group states that my lead level (shown in the lead urine test 3 weeks before moving from the lead smelter on the 4th May 1972) indicates that I had 6 times above the acceptable level of lead.

The MIM 'lead testing table' (Table 2 above) indicates that;

The lead level in my last urine test on the 13th April 1972 had more than doubled, compared to the previous urine test on the 21st March 1972.

This last urine test showed severe exposure to lead at 0.46 Mgs/Litre.

That I had only one blood test on the 16th March 1972, which showed 0.06 Mgs/100mL.

That this blood test was done when my lead urine level was low at only 0.23 Mgs/Litre.

That I had not received a blood test when my urine lead level at 0.46 Mgs/Litre had more than doubled on the 13th April 1972.

Information I obtained from the JCU states that lead stays in the stomach, liver and kidneys for up to 4 months or more, which is the reason as in my case, for the dark urine and stomach problems, which is shown in my MIM medical records.

According to the information, people who experience severe stomach problems have had severe poisoning and should be treated immediately. In my case this never happened.

According to this information the only true blood reading to obtain is 6 months after the person has left lead-hazard areas.

As stated above the last lead-tests and urine-tests I had received were two and a half years before I was moved from lead-hazard areas (lead-concentrators, as explained below in more detail).

## **Job Transfers after the Lead-Smelter**

MIM kept me working in the lead-smelter for 7 weeks after the one and only lead-blood test on the 16th March 1972, and 3 weeks after having the last lead-urine test on the 13th April 1972.

I was then transferred to the adjacent copper smelter for the next six months without further lead blood or urine tests or any treatment.



MIM then transferred me to the small-concentrator and then to the large-concentrator for a year, doing the same type of work I was doing in the lead-smelter. MIM never gave me any further lead-blood or lead-urine tests or any treatment.

Concentrators are where chemicals are mixed with copper and lead-concentrates before going to the smelters.

I then worked underground for six months without further lead-blood or lead-urine tests or any treatment.

I was then given jobs in several different areas in the MIM mining complex for the rest of my apprenticeship, without further lead-blood or lead-urine tests or any treatment.

I was then unceremoniously terminated from MIM after finishing my apprenticeship and given no further lead-tests or any treatment whatsoever.

If I had received the required lead-blood tests with the last two lead-urine tests on the 21st March 1972 and on the 13th April 1972, then the question would be; what would the results have been?

If I had been tested after the first signs of lead-poisoning for the two and a half years I was in lead-hazard areas, the question again is; what would the lead-blood test results have been?

If I had also been tested for lead for the mandatory 6 months after I had left the lead-hazard areas then the question is; what would the blood-lead test results have been?



## OBITUARY: Orlando Aguirre López, tribute to humility



2019 VAP Entry. Title: **Vale Orlando Aguirre-Lopez, The LEAD Group's French & Spanish Translator for 11 years.** Vale Orlando Aguirre-Lopez, El traductor de Español y Frances por 11 anos del grupo de plomo.

**Lead-Safety Message:** Over 100 of Orlando's excellent translations are helping The LEAD Group create a lead-safe world. Mensaje de seguridad del lider: mas de 100 excelentes traducciones de Orlando que han ayudado al Grupo del Plomo en crear un mundo seguro de plomo. Photographer: **Vanessa Aguirre.**

<https://volcanoartprize.com/portfolio-item/vale-orlando-aguirre-lopez-the-lead-groups-french-spanish-translator-for-11-years/>

*Orlando Aguirre López, homenaje a la humildad (Obituary for Orlando Aguirre-Lopez) was written in Spanish by Roberto Restrepo Ramírez, Special for THE CHRONICLE DEL QUINDÍO, COLOMBIA, JUN 09 2019, at <https://www.cronicadelquindio.com/noticia-completa-titulo-orlando-aguirre-lopez-homenaje-a-la-humildad-nota-130846> and translated from Spanish to English by Sandra Patricia Buckley for The LEAD Group Inc, Sydney, Australia, September 2019.*

Orlando Aguirre López has physically disappeared, but his written legacy in the memory of this land [Colombia] survives. He died abroad on May 5, 2019.

Two well-written works, with their dedications are one of the best gifts he has given me; they are for me the greatest bibliographic heritage in Filandia. Their titles range between clarity and rigor of style. The books have left the most honest and intellectual work in the last years that this municipality has had. His pseudonym as a writer was Hermes.

In his first work, simply titled *Filandia, between fire and ice*, its lines describe in detail the two local tragedies suffered by the inhabitants of the “Colina Iluminada del Quindío”. They were the fire of 1995 and the hailstorm of 1996.

In this first work, *Filandia between fire and ice*, he describes two major climatic events in the municipality.

The author does not remain in the mere narration of the two disasters. He also makes an x-ray of the municipal problem and ends his writing with the visionary proposal of what a development plan should be for his land.



In his second book, with the title *The human being and his destiny*, published ten years after his first work, Orlando Aguirre writes an excellent essay presentation on good and evil, the two poles of human nature that have been addressed by the different Theories or schools of thought.

Ironically, on page 122, the author presents this deep paragraph, as a reflection:

"Between death and madness, the human being should prefer death, because if madness is that wonderful approach to happiness, death is the madness of having lived".

Only a lucid mind could have understood this sublime reflection, which was revealed with the death that has come upon it, with a gloomy silence.

The two books were prologized by illustrious writers. They are Jaime Naranjo Orrego, the Filandeño (From Filandia) librarian, who points out in the first one that Orlando Aguirre "has written an important and solid essay on critical and analytical scrupulousness about the existence and development of our disastrous municipal regime.

What is intended in its pages is precisely to achieve an interesting comparison between official corruption such as the fire of inferno and the passivity of the citizen as the ice that stuns our initiatives.

Meanwhile, Umberto Senegal, the poet of Calarcá, in his introduction to the philosophical essay by Orlando Aguirre, does not hesitate to highlight "the balanced amalgam that its author makes of Eastern and Western ideas, which is a good starting point for those who want to revalue the world we inhabit"

To relieve his greatness as a writer, two works were enough. Unlike those who boast about publishing numerous books that teach little. Only two, judiciously written, will tell us who was the Orlando Aguirre López to whom we say good bye.

His life and his unpublished essays are a tribute to humility. This was testified in his dedication, directed to me, with his handwriting he wrote: "To the friend and admirer of these modest works."

It shines with height the other value of our countryman, modesty.

To the two beautiful qualities, we would add a third, simplicity.

It is curious to find that humility, modesty and simplicity are also the attributes of wise characters. Because that was Orlando Aguirre López, a wise man that never hid his origin and who always showed his pride in the root of his ancestors.

In the University of Pereira [Colombia] that welcomed him, many people admired the early age that marked his beginning as a teacher.





And it is that from Orlando, all the people from Filandia learned to be humble, and also to be happy, because this is consubstantial with wisdom and even with the feeling of being born on this earth.

From the wisdom of their parents and ours, because they left us the wealth of their expertise and the value of honesty.

Orlando never forgot the artistic spirit of his father Don Pablito Aguirre, who also cultivated with the grace of music in the municipal band.

But he also did not forget the value of the word and the honor of the truth, the two pillars of an anti-corruption policy for which he fought so hard.

I think Filandia lost the most sensible, balanced and bright of its men.

But we have his writings, which any leader should read and transmit for the application of his teachings.

I dare to say that not only has a great man left us. We never estimate the best mayor or cultural leader that Filandia could have had in its history.

Hopefully the reflection on his life will lead us all to keep the flame of his wisdom with our future actions.

He was an excellent intellectual, industrial engineer from the Technological University of Pereira. Master's degree from the University of Pittsburgh –USA—. University Professor, Emeritus, polyglot and visionary of science and culture.

However, Orlando, among us, was also the friend, the pleasant fellow member, the intrepid walker and the ambassador of Filandia abroad, where his land was always in the first place of his heart.

His brother Alcides as humble as him, his wife and his two children live in Filandia.

*[Editor's note: actually, Orlando was living with his daughter Vanessa Aguirre and granddaughter Laura in Sydney, Australia at the time they travelled to Thailand for a holiday, where Orlando died of a heart attack on 5<sup>th</sup> May 2019, aged 74, and was given a Buddhist funeral, and later a Catholic memorial service in Sydney – such was his openness to the world's philosophies and religions. This beautiful Obituary by Roberto Restrepo Ramírez, says so many things Orlando never told me despite us working together for 11 years, such was his humility. I really miss Orlando – a most wonderful, intelligent, generous, good man.]*



## NZ TEL-exposed refinery shift operator compensation claim - letters to The LEAD Group



From: Brian Clinton ARNDT  
Sent: Tuesday, June 21, 2016  
To: The LEAD Group  
Subject: ex-Refinery Operator, New Zealand  
[brianarndt@xtra.co.nz](mailto:brianarndt@xtra.co.nz)

Dear Sirs,

I was employed as an Operator at the Refinery located at Whangarei, New Zealand. The refining plant was situated at Marsden Point because of its nearness to deep water facilities. We had to operate a manual plant, the lead arrived in a small cargo ship in approx 44 gallon drums the drums were double lined with a neutralizing liquid in the lining. The lead was used to increase octane ratings. After removing the outer cap a 3 inch approx plug was removed and the lead was then drawn by vacuum into the blending vessels. I left the Refinery in 1975 after having been there for 10 years. The manual system was removed in the late 70's apparently to make the plant more efficient, an inline sealed unit was installed. It is now known this was done for health concerns and the Management "lost" or can't find employment and health/safety records. [See 19770111 Advocate newspaper article Lead industry procedures not archaic - Dr Wilson below.]



Can you please help me with a document detailing the health hazards of this substance as I am claiming for health issues against my old Employer, who have now reluctantly agreed to the plant being there. I have had both breasts removed, extensive hormone/radiation to the prostate, countless squamous cells removed from head/arms and have lost all my teeth to what appears lead crumble. Please can you help me or direct me where to go. The lead plant was never registered in NZ. Best Regards, Brian.

Photo of Brian Arndt, 29 July 1976, aged 25 (born 2<sup>nd</sup> August 1940)

[The above email was not seen by The LEAD Group until Brian sent his third email in June 2019]



-----Original Message-----  
From: Brian Arndt



Sent: Monday, December 4, 2017  
To: The LEAD Group  
Subject: Organic Lead Absorption.

Dear Sirs,

I was employed in the NZ Refinery at Marsden Point, Whangarei.

My job as a shift operator frequently involved work in the TEL/TML bulk plant. The tetramethyl and tetraethyl lead was transferred by inducting the liquid lead into the bulk vessels for blending regular and premium petrol. Safety gear was minimal, health checks non-existent and there was no warnings or training with this extremely toxic material. It has now been uncovered that the Company destroyed all records that involved any persons involved with this, now known extremely toxic substance. I am trying to find where I can obtain K fluoro X-rays to prove my lead/bone absorption levels. I have managed to have my teeth assessed for lead content by Dr Malcolm Reid at Otago University [see *20170811 Otago University lead analysis of Brian Arndt's teeth* below] and they are 1659% above normal controls. The Authorities are saying I must have had "Lead Fillings". Please can you help me find where to go to have these X-rays to prove my case and hopefully gain recognition for myself and a lot of dead men. Thank-you so much.

Brian Arndt

This e-mail was sent from a contact form on LeadSafeWorld by The LEAD Group Inc.  
(<http://www.lead safeworld.com>)

[Although Elizabeth O'Brien replied immediately to the above email with contact details for bone x-ray fluorescence – bone XRF -testing by Dr Howard Hu or Dr David Chettle, no reply was received from Brian Arndt until June 2019]

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**From:** Brian Arndt  
**Sent:** Monday, June 3, 2019  
**To:** The LEAD Group  
**Subject:** Re: Exposure to Tetra-Ethyl Lead.

Dear Elizabeth,

So nice to talk with you just now on the phone.

I have included a summary of my Medical History, in hind sight I should have said in my summary that I've had balance issues developed within a year of working at the Refinery.

As the Refinery covertly operated under the cover of being a "Licensed Customs Bonded Area" they avoided all controls and checks from the Ministries of Health and Labour. I



have managed to obtain Government Files of their attempts to view Operations and recommendations to test the workers for lead.

[See the following articles below this series of letters:

*19640313 Medical officer proposal to deal with extremely toxic TEL & TML;*

*19650512 NZ Refining Co on List of Factories to be visited by Public Health Nurses;*

*19651208 Dept of Health letter re considerable risk of lead poisoning from handling leaded sludge;*

*19651223 Dept of Health letter emphasising lead-safety & PPE for handling leaded sludge;*

*19660128 Dept of Health letter re Octel SS Limerick spill & brochure on hazards of TEL & TML;*

*196405 Octel Bulletin No 12 The safe handling of Octel Antiknock compounds (the above mentioned brochure)]*

When they removed the Manual Lead System in 1977 because of health issues with Employees they shredded all employment records and the standards of PPE were very low and no Health checks were done on the Plant Operators. The plant was replaced with a fully automated system supplied by a dedicated ship from Innospec [then known as Associated Octel].

Thank you for your time taken to read my sorry story and if you can help me you will be my Angel for the rest of my life.

Yours sincerely,

Brian Arndt.

### **Brian Arndt: Summary of my Medical History**

Dear Elizabeth,

I have found your contacts via The LEAD Group that you promote and to your credit have devoted yourself to.

As a young man I was employed as a Shift Operator at New Zealand's only Refinery at Marsden Point, Whangarei. I started work in early 1965 and left late 1975.

A lot of time was spent operating the "Manual Lead Transfer and Blending Plant".

After a few months I observed that I was becoming sexually dysfunctional and started having Psychotic Dreams - often violent in nature. I awoke one morning to find my Wife





lying in bed bleeding and crying, to my shame I had attacked her in my sleep. I still get violent dreams to this day. My marriage ended as a result and I ceased work at the Refinery in late 1975.

1976/77 saw me getting dental worries - mainly teeth crumbling - and this lasted until 2016 when I had all my teeth removed. My teeth have tested for lead levels of 1659% above Normal Controls. [See 20170811 Otago University lead analysis of Brian Arndt's teeth below.] When the teeth were removed, I could taste Lead in my mouth for a couple of days.

In the early 1980's I found recurring Squamous Cancers occurring all over my body. In late 1980's I had a tumour removed from my left lung which was followed by Right Breast Cancer 2010 finally Prostate Cancer in early 2012 resolved by Hormone and Radiation treatment completed in late 2013.

The only fortunate incident was breaking my neck in 1980 as a very observant Orthopedic Surgeon tested and found I had damaged the C5 nerve canal that carries the nerve system for the control of the "Involuntary Muscles" and put me onto a large dosage of Psyllium which we now know helps to remove heavy metals from the body. From the time of the surgery for Lung Cancer I have taken large amounts of Vitamin C and continue to this day having 3000 units of Lypo-Spheric Vit C and since June 2018 have also taken 10 grams a day of MSM. I continue with Squamous Cancers continually being treated with "Efudix Cream" with Surgical removals as required.

Please can you help me with some Authoritative Evidence to use with my case for help for funding from our Health and Workers Compensation Authorities.

[See the following articles in this newsletter, prepared for publication in response to the above request:

*IARC Evaluation of Lead as a Human Carcinogen 2006 –Organic Lead (TEL/TML) & Skin / Dermal Exposure extracts;*

*Hunter's The Diseases of Occupations - Lead Poisoning 1955-1975;*

*19651126 Dept of Health letter re safe handling & disposal of leaded sludge;*

*Lead scavengers & other carcinogens in gasoline, New Zealand 1965-1975;*

*Associations between Brian Arndt's non-cancer health issues and his occupational exposures]*

My problem is that there are no Health Records here for me to use in an upcoming Court Case.



Please can you help me,

Yours faithfully,

Brian Arndt.



**From:** Brian Arndt  
**Sent:** Monday, June 17, 2019 3:17 PM  
**To:** Elizabeth O'Brien  
**Subject:** Re: Research on the Toxic Effects of Organic Lead.

Dear Elizabeth,

Thanks for your very informative and helpful email.

I still have psychotic concerns ie. very lurid and violent dreams.

I am worried that I am finding increasing memory problems which is of concern and while at the Refinery I developed an anger problem, fly off the handle easy which I have tried to and mainly now have controlled.

The sexual dysfunction became apparent within 6 months of starting work and this has been the case for the last 54 years.

Squamous Cancers and Balance Problems are still a major concern to this day. I guess I could be described as a bit of a mess but one has to keep on trying and smell the roses.

Lead whole Bloods showed as 0.05 umol/L (1.04 ug/dL) in Aug. 2017 and 0.04 umol/L (0.83 ug/dL) in Oct. 2018. My Dr. believes that these have been reduced by my use of Psyllium, Lypo-Spheric Vit. C and MSM 10 grams per day. These have also been approved by Dr. Levi from the USA.

I have saved up and have NZ\$5000 that I can use for further travel for testing/assessment. Your thoughts would be greatly appreciated as I can't find an Occupational Dr. here who is not contracted to the Accident Compensation Corporation (ACC) [*Editor's note: See Lead Poisoning – ACC Review Issue 16 (March 2005) published below in this newsletter (because it is no longer online) which gives the ACC motto as "Prevention Care Recovery" so hopefully, since prevention has failed in Brian Arndt's case, some assistance with Care and Recovery can be provided by ACC.*]

Best regards and heartfelt thanks,

Brian Arndt.



PS. I believe the Teeth Analysis by Dr Malcolm Reid at Otago University [see 20170811 *Otago University lead analysis of Brian Arndt's teeth* below] is sufficient evidence for Lead Absorption as IARC says that Teeth are the most reliable as there is no apatite of Bone in the teeth.



From: Brian Arndt  
Sent: Friday, June 21, 2019  
To: The LEAD Group  
Subject: Re: Historic Files Relating to Tetraethyl Lead and Health Issues.

Hi Elizabeth,

It's really nice of you to give me your time and attention, I thank you so much.

Please see the historic files (following this series of letters) as below:-

1. Renewal of Licence, Annual Certificate, of note no mention of Lead Transfer and Blending Plant. Dated 12<sup>th</sup> January 1982. [See 19820112 *New Zealand Refining Co Renewal of Licence application*, below.]
2. The original 1966 plan of New Zealand Refining Company Limited plot, as updated in February 1972, showing the TEL plant. [See 19661224-197702 *New Zealand Refining Co Ltd Overall Plot Plan*, below.]
3. Proposed Plan of Plant Extensions, believed drawn late 70's. NB TEL Plant shown centre right by Gasoline Compound. [See 1978 or 1979 *NZ Refining Co Proposed Extensions showing Gasoline Comps (TEL plant)*, below.]
4. Schedule of Air Polluting Chemicals in "Expanded Refinery" NB Lead use 0.84 grams per Litre. [See 19790125 *Northern Advocate article: Doctors back campaign for safer petrol in New Zealand*, below, which says: "Marsden Pt refined petrol is boosted by twice the amount of lead as that of most European countries"; and the two pages 198004 *NZ Refining Co Air Polluting Chemicals (Pb in petrol) in Present & Expanded Refinery*, in the article below titled "The Lead Content of Petrol/Gasoline in New Zealand 1965-1975".]
5. Simplified Flow Scheme of Expanded Refinery. [See 198004 *NZ Refining Co Simplified Flow Scheme of Expanded Refinery*, below the article below titled "The Lead Content of Petrol/Gasoline in New Zealand 1965-1975".]

The last 2 as above appear to be published April 1980.

Have just received an email from the District Court The Refinery is trying to be excused as Second Respondent maintaining they have no responsibility and want to be removed from the proceedings because they "reject my account of working conditions and lead handling



practices” (See 20190619 NZ Refining seeking to be removed from Arndt Vs ACC & NZ Refining case, below).

I am really feeling the pressure some “Big Gun” Legal Firms are getting involved.

We are having a problem to find independent Medical Consultants here.

Sincere and best regards,

Brian.



**From:** Brian Arndt  
**Sent:** Wednesday, July 3, 2019  
**To:** Elizabeth O'Brien  
**Subject:** Re: Tetraethyl Lead Health Problems.

Hi Elizabeth,

These are the symptoms that I suffered with in order how they happened:-

Troubled sleep and disturbed broken sleep.

Psychotic dreams.

Anger and short temper concerns would get upset easily.

Approximately after 6 months, sexually inadequate, which has lasted all my life to date.

Early on Balance problems and still ongoing.

Early 70's developing dental problems. New Dentist in 1977 said “you must be a Refinery Boy. I see a lot of you blokes with teeth like these.”

Broken neck 6th Jan 1980.

Neurological worries and depression still to this day.

Lung Cancer 1989 after breaking a rib 18 months earlier.

Breast Cancer 2010/11.

Prostate Cancer 2012 treatment completed 2013/14.

Teeth extracted Jan 2016. NB as local pain killers abated in 2 hours I could taste TEL coming from tooth sockets in jaw and skull.





As my tests are indicating and from the health issues I have had, I count myself fortunate that I am still alive and perhaps the “Natural Medications” that I’ve been taking could be of interest with your valued research.

My dosages have been:-

Psyllium Fibre 10 grams daily, since early 1980.

Vitamin C as in the Product: Res/V 2 tablets daily since 1989 to 2010.

Vitamin C as in the Product: Lypo-Spheric 2000 units per day 2012-2016, then 3000 units Jan. 2016 to the present.

Methylsulfonylmethane as MSM: 12-14 grams total per day since June 2018 to the present.

Probiotic: 1 tablet daily since 1980.

Vitamin B Complex: 1 tablet daily since 1989.

Joint Care Advanced: 1 tablet daily since 1989.

Vitamin D: 1 tablet per month since 2016.

The most positive testing result has possibly been indicated by the regeneration of the Macular Base in my eyes which have shown regrowth in the last 2 years.

Hope this gives you an insight into me a little,

More thanks and regards,

Brian Arndt.

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**From:** Brian Arndt

**Sent:** Sunday, July 28, 2019

**To:** Elizabeth O'Brien



**Subject:** Re: Tetraethyl Lead Health Problems - please add detail of falls + IARC text.

Hi Elizabeth,

With reference to your email questions:-

1. I started at the Refinery early March 1965, second week I think.
2. Neurological problems, ie. Psychotic dreams, short temper etc about July '65 including sleep problems.



3. Sexual inadequacies Aug/Sept. '65.

4. Aware of balance issues mid '66.

5. 1972/73 Dental crumbling needing teeth capping etc. New Dentist '77 who said "You must be one of the Refinery boys, I see a lot of you".

6. Jan. 1980 I was working for "Starkist" from America on a Tuna Boat in New Zealand waters. C5/C6 broken vertebrae.

7. Broken Rib 1986/7 working on my own yacht.

Hope this helps in understanding my history.

Many thanks,

Brian.

*Editor's Note:* on Monday 29<sup>th</sup> July 2019 Brian Arndt wrote to his solicitor (from the union he belonged to when working at the refinery): "Having done a lot of work over the weekend I have completed my own Memorandum." [See 20190729 *Brian Arndt's requests for restricted document release & Medical review prior to Appeal Court Hearing*, below. Brian Arndt's 29<sup>th</sup> July 2019 Memorandum included one wrong figure: 9 g/L of lead in New Zealand petrol 1965-1975 should have said 0.9 g/L, or, if Associated Octel is to be believed, actually 0.84 g/L as of 1968.]



# 19770111 Advocate newspaper article re: New Zealand lead industry “procedures not archaic” – Dr Wilson

Article includes:

He [Dr I. S. Wilson] was commenting on a letter in a recent [on 11th January 1977, “recent” could be 1977 or 1976] medical journal in which two Christchurch doctors said “an urgent reappraisal of the parameters used for screening occupationally-exposed lead workers and a thorough updating and enforcing of the obsolete 1950 lead process workers regulations, is necessary.”

[Editor’s note: could anyone provide the reference referred to above, the “letter in a recent medical journal” please?]

**Procedures not archaic – doctor**

Wellington, NZPA.—New Zealand and monitoring procedures and regulations setting maximum levels of lead in the bodies of lead process workers are not archaic, according to the Health Department's assistant director of occupation health, Dr I. S. Wilson.

He was commenting on a letter in a recent medical journal in which two Christchurch doctors said “an urgent reappraisal of the parameters used for screening occupationally-exposed lead workers and a thorough updating and enforcing of the obsolete 1950 lead process workers regulations, is necessary.”

**MUCH THE SAME**

Dr Wilson said monitoring procedures were very much the same as those used overseas.

“And although these procedures are being reviewed there is no indication that they are archaic,” he said.

“Levels and monitoring procedures are the same as those used at present in the United States.

“There is no indication that, if correctly enforced, the New Zealand regulations will not provide protection for the workers, although implementation can be a problem with all legislation.”

Safe levels for lead workers, as well as those exposed to mercury and arsenic, were being reviewed all the time.

If these levels were exceeded workers could be suspended and under the Factories Act, factories had to adopt safe procedures.

“Therefore we are able to

keep the whole thing under control.”

He said the Hazardous Chemicals in Industry Committee set up late last year, which will be holding its first official meeting on January 18, would be looking at permissible levels as well as legislation which applied to lead and other dangerous substances used in industry.

Dr Wilson, who is chairman of the committee, said the meeting would consider things to be looked at.

Dr Wilson would not comment on the specific cases of lead poisoning reported by the two Christchurch doctors without a report from the medical officer of health in Christchurch.

“We don't know to what extent statements given to the doctors have been verified,” he said.

Cases of lead poisoning as reported by the Christchurch doctors did happen occasionally and no legislation would completely correct this.

Dr Wilson said the responsibility in these cases lay with the department, the employer and with the workers in particular.

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## **20170811 Otago University lead analysis of Brian Arndt's teeth**

Otago University –Chemistry Department -August 2017

Dr Malcolm Reid

Request –investigate possible elevated lead levels in teeth.

Method of analysis

Laser Ablation inductively coupled plasma –mass spectroscopy

Two teeth molar and another (assumed to be incisor) from Brian Arndt and a control were cut to avoid cavities and to present a flat surface to allow laser sampling from as much of the tooth length as possible. 0.3mm tracks were positioned at 5 different positions on each tooth –all numbered from enamel to root. Samples were moved under the laser (193nm excimer firing 50µm spot at 10Hz 2.5Jcm<sup>-2</sup> fluence) at 5µms<sup>-1</sup>. Ablated material transported in helium to ICP-MS for multiple element detection.





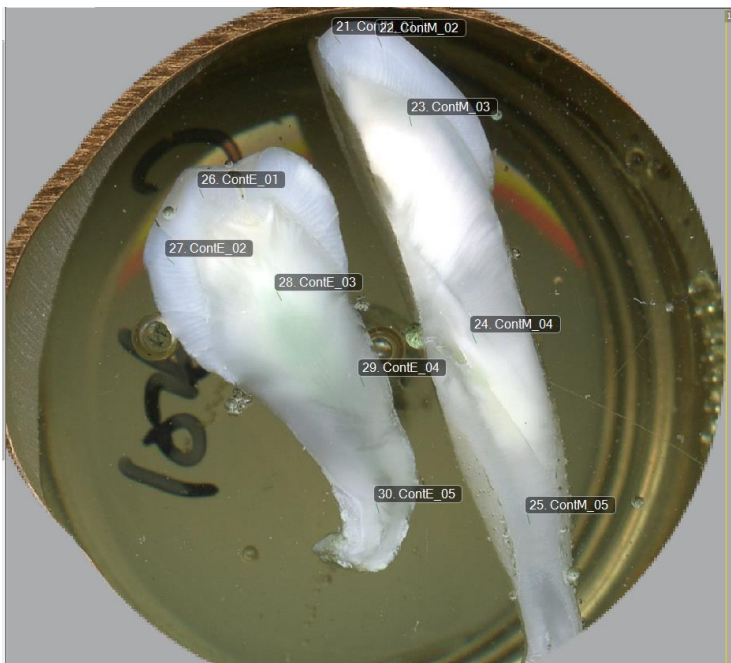
A molar and incisor from Brian were sectioned along indicated lines then mounted and polished to present a smooth flat surface to the laser. Control teeth supplied via Brian from his dentist were treated similarly.



Section of Brian's molar mounted in resin showing planned laser sampling tracks. Top BA1\_01 and \_02, middle BA\_03 and \_04 and root tip BA\_05

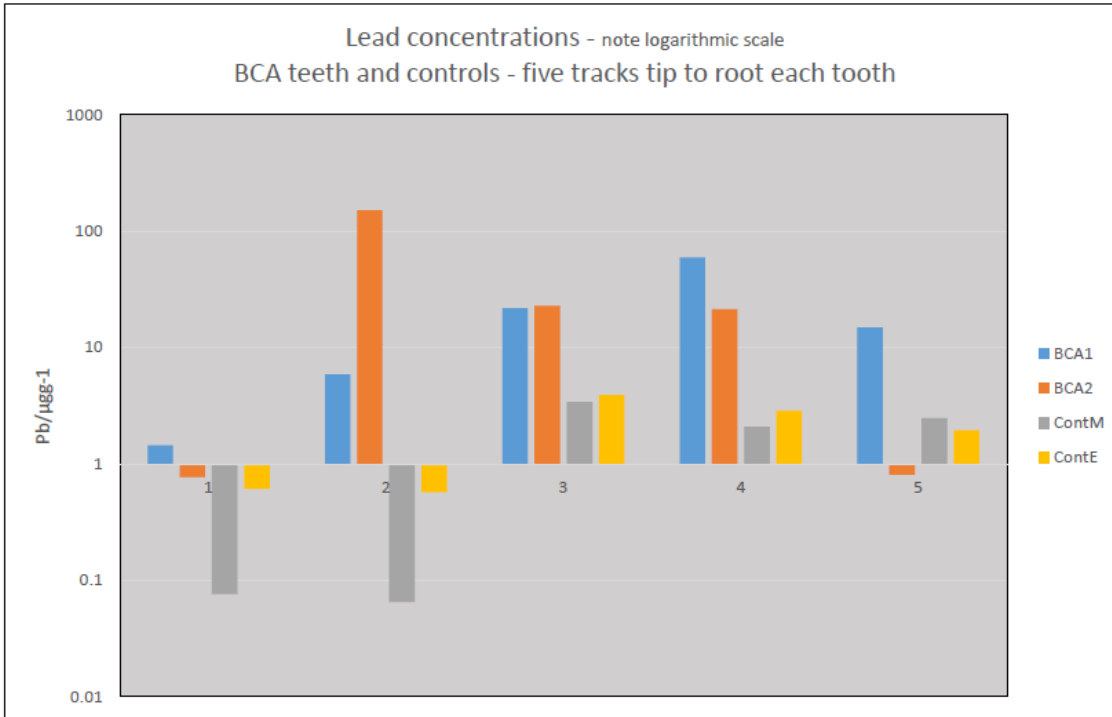


Section of Brian's incisor mounted in resin showing planned laser sampling tracks. Top BA2\_01 and \_02, middle BA2\_03 and \_04 and near root tip BA2\_05. Note bright white zone in enamel may not actually be tooth material.



Control teeth –molar and incisor sectioned and mounted in resin.

Laser sampling tracks labelled ContM\_01 –ContM\_05 and ContE\_01 to ContE\_05.



	[Pb]/μg <sup>-1</sup>			
Track no.	BCA1	BCA2	ContM	ContE
1	1.4	0.8	0.1	0.6
2	5.9	151.2*	0.1	0.6
3	21.7	22.9	3.4	3.9
4	59.4	21.3	2.2	2.9
5	14.9	0.8	2.3	2.0

\* Other elements from this trace suggest the area sampled may be some sort of filling so this point should be treated with caution.

Raw instrument data calibrated against NIST 610. Signals normalized to Ca –assumed teeth structure calcium hydroxyapatite.

Lead detection limit ~0.05μg-g<sup>-1</sup>

**Observations:**

Low Pb in enamel of all teeth –as expected

Large differences in Pb in middle and root tip zones between Brian’s teeth and control.



# 19640313 Medical officer proposal to deal with extremely toxic TEL & TML at NZ Refinery

es/aw

71/6/2

P.O. Box 137, WHANGAREI  
13 March 1964

The District Officer,  
Department of Labour,  
P.O. Box 5,  
WHANGAREI.

### TETRAETHYL/TETRAMETHYL LEAD

There is, at the Marsden Point Refinery, a section of the plant wherein employees will be handling one or both these compounds which are added to petrol to reduce "knock". Both are extremely toxic, affecting the central nervous system of persons exposed to a harmful concentration.

The risk is present wherever the compounds are handled, and also when petrol tanks are de-sludged. I have not yet taken a careful look at the arrangements, nor satisfied myself that a properly planned routine for tank cleaning has been laid down.

Could you please contact me after 23rd March if you would care to visit the refinery with me to deal with this hazard.

COPY TO:

E. SIMPSON  
MEDICAL OFFICER OF HEALTH

Dr A. Park,  
Medical Officer,  
WHANGAREI.

2. Miss Foot,  
Nurse Inspector,  
WHANGAREI.

for your information,

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Senior Inspector



E. SIMPSON  
MEDICAL OFFICER OF HEALTH





# 19650512 NZ Refining Co on List of Factories to be visited by Public Health Nurses

<u>LIST OF FACTORIES TO BE VISITED BY PUBLIC HEALTH NURSES</u>		REF.:
		12.5.65
<u>PRINTING WORKS</u>	<i>lead.</i>	
Calders Printery Ltd, 5 Rathbone St, WHANGAREI		8
Corbett & Horne Ltd, Vine St, WHANGAREI		6
News Ltd, Broadway, KAIKOHE		12
North Auckland Times Co. Ltd, Normanby St, DARGAVILLE		9
Northern Publishing Co. Ltd, Water Street, WHANGAREI		96
Northland Age, Commerce Street, KAITAIA		8
<u>FLAXMILLING</u>	<i>Noise.</i>	
Northern Wairoa Flax Co. Ltd, Waihue, R.D., DARGAVILLE		10
<u>BRICKMAKING AND WORKS</u>	<i>Dust. Heat (3).</i>	
Kamo Potteries Ltd, Bay of Islands Rd, KAMO.		46
<u>GLASS WORKS</u>	<i>Heat. Noise. Dust.</i>	
Hawthorne Glass Co. Ltd, James St, WHANGAREI		29
N.Z. Window Glass Co. Ltd, Port Rd, WHANGAREI		177
<u>FERTILISER MANUFACTURERS</u>	<i>Dust.</i>	
Fagans Fertilisers Ltd, Reyburn St & Port Rd, WHANGAREI		13
E.E. Bellingham & Co., P.O. Box 53, MAUNGATUROTO		5
<u>CEMENT MANUFACTURING</u>	<i>Dust. Noise. Heat.</i>	
Wilson's (N.Z.) Portland Cement Ltd, PORTLAND		296
<u>REFINING</u>	<i>T.E. lead.</i>	
N.Z. Refining Co. Ltd, P.O. Box 44, WHANGAREI		M: 151 F: 9
<u>ENGINEERING</u>	<i>Eyes. Chrome Dust. Noise.</i>	
Whangarei Engineering and Construction, Port Rd, P.O.Box 24, WHG.		49
Modern Chromium Platers, John St, WHANGAREI.		2
Whangarei Diesel and Precision Engineering, Port Rd, P.O.Box 24, WHANGAREI		25
<u>PLATING</u>	<i>Chrome.</i>	
Avon Industries Ltd, Clyde St, WHANGAREI		16
<u>GOVERNMENT WORKSHOPS</u>	<i>general.</i>	
P. & T. Workshops, Selwyn Ave, WHANGAREI		26
<u>FISH FACTORIES</u>	<i>Shair. sepsis.</i>	
Hikurangi Fisheries Ltd, King St, HIKURANGI		8

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## 19651223 Dept of Health letter emphasising lead-safety & PPE for handling leaded sludge

Telephone: 87019

P.O. Box 137, WHANGAREI.

23 December 1965

Mr I. Rolfe,  
Ormiston Road,  
Onerahi.

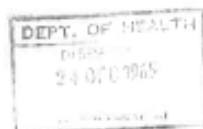
Dear Mr Rolfe,

Mr McLeod our Supervising Inspector has forwarded to you a copy of the article "Safe Practices in the Handling of Leaded Sludge", which covers most of the safety aspects of tank cleaning.

Points I would like to emphasize are:

1. The hazard in the operation of cleaning rich tanks is one of lead in air with its attendant danger of inhalation, in addition to the danger of contact contamination. These facts should be clearly understood by all men engaged on this type of work.
2. Initial medical check-ups of men carrying out this work is essential. The doctor carrying out this examination should be informed of the nature of the work to be undertaken.
3. Careful attention must be given to the provision of personal protection of operatives. Compressor air supplied P.V.C. suits are recommended.  
  
N.B. Canister-type masks should on no account be used under the tanks, and when used outside must be fitted with the canisters recommended by Compound supplies. Their limited value must be recognised.
4. Adequate facilities must be provided for workmen to change into their special working clothing, to put on or test breathing apparatus and after work, to remove clothing. Good working arrangements with plenty of hot or cold water are essential. Clean clothing and equipment must be provided each day.
5. Entry into a tank after cleaning requires the wearing of breathing apparatus. Maximum ventilation must be maintained until all work in the tank is completed.
6. Site selected for the disposal of sludge must be approved by this Department.

Yours faithfully,



J.M. Brownlie,  
MEDICAL OFFICER OF HEALTH.

Above, 23<sup>rd</sup> December 1965 Letter to Mr Rolfe, Ormiston Road, Onerahi, **Whangarei**, New Zealand from Medical Officer of Health emphasising "Initial medical check-ups of men carrying out this [handling of leaded sludge] work is essential"; and required Personal Protective Equipment (PPE) eg "Entry into a [leaded sludge] tank after cleaning requires the wearing of breathing apparatus."



# 19660128 Dept of Health letter re Octel SS Limerick spill & brochure on hazards of TEL & TML

H.-T. 5

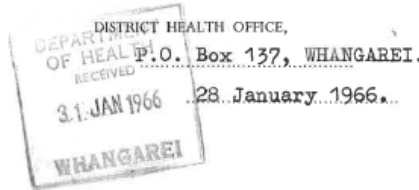


In your reply quote reference.

## DEPARTMENT OF HEALTH

Telephone: 87019

The Medical Officer of Health,  
WHANGAREI.



### OCTEL S.S. "LIMERICK"

I attended the inspection of the above named ship when it was inspected by the Refinery decontamination squad and representatives of the Octel firm from Melbourne, after tetra Methyl lead had been spilled on the deck during a storm in the Atlantic.

The ship and crew members were inspected in Curacao and given a clearance to sail through the Canal, though slight readings were obtained from the dunnage on deck. No ill effects were reported among the crew.

Readings were taken on the ship's arrival at Marsden Point with a Uni-Jet lead in air detector, on the deck, two readings where the spilled cargo was stored and in No. 2 and 3 holds. A total of five readings were made in all areas that could possibly have been affected and the readings were zero. Though showing zero all dunnage on which the deck cargo was stored is being destroyed by the Refinery decontamination squad on the firms representatives advice.

Please find attached a bulletin on Tetra-ethyl and methyl lead issued by the Octel company in which the hazards of the compound are described including the M.A.C. and decontamination procedures.

A Uni-Jet lead in air detector is kept at the refinery for detecting contamination.

*MOH  
S/E  
[Signature]*

*[Signature]*

*[Signature]*

P.G. Brown,  
SENIOR INSPECTOR OF HEALTH.

*J E Batchelor*


51 QUEEN STREET, MELBOURNE C1  
TELEPHONE: 61 2624  
TELEGRAMS & CABLES: OCTEL MELBOURNE  
YOUR REF: [Signature]  
OUR REF: 5/A/12

Above, 28<sup>th</sup> January 1966 Letter from Senior Inspector of Health to the Medical Officer of Health, Whangarei, New Zealand re: Tetramethyl lead spilled on the deck of the Octel SS Limerick during a storm in the Atlantic. At right, the Contact details of Octel Melbourne sent with brochure on hazards of TEL & TML (see next article: 196405 Octel Bulletin No 12 The Safe Handling of Octel Antiknock Compounds, by Associated Octel).





# 196405 Octel Bulletin No 12 The safe handling of Octel Antiknock compounds

 **OCTEL BULLETIN**

**THE SAFE HANDLING OF OCTEL ANTIKNOCK COMPOUNDS**

Number 12 May 1964

THE ASSOCIATED OCTEL COMPANY LIMITED

## Contents

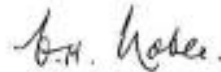
1. Composition of Compounds
  2. Properties of TEL, TML and Compounds
  3. Toxic hazard
  4. Blending Plant design
  5. Fire and Explosion hazards
  6. Protective equipment
  7. Emergency Action—Spills
  8. Emergency Action—Fire
- Table 1—Decontamination Methods.
- Table 2—Information on Decontaminant, Solvent and Absorbent Agents for use on Lead Alkyl Spills.
- Table 3—Materials and Methods for Sealing Leaks in Containers.

## Foreword

Octel Antiknock Compound containing tetraethyl lead (TEL) has been in use for many years and the procedures recommended for its safe handling have been well proved.

The introduction of tetraMethyl lead as a constituent of certain types of Compound necessitated a reappraisal of these procedures.

In general they proved to be adequate for all types of Compound. This bulletin restates the general principles involved, and emphasises some points of difference between the types of Compound.



Sales Manager

20 BERKELEY SQUARE LONDON W1 ENGLAND



## 1. Composition of Compound

Octel Antiknock Compounds are mixtures containing one or more lead alkyls together with ethylene dibromide, alone or with ethylene dichloride. Compounds containing TML also contain up to 12.5% toluene which is added to the TML during manufacture.

## 2. Properties of TEL, TML and Compounds

Lead alkyls are readily soluble in oils and spirits but virtually insoluble in water. TEL compounds have a sweet ethereal smell, similar to that of geraniums. TML compounds may be odourless but can often have a smell of rotten cabbage.

TML is more volatile than TEL. Its boiling point is 110°C whereas that of TEL is about 200°C, at which temperature it tends to decompose. The vapour pressure of pure TML is 100 times greater than that of pure TEL (17.5 and 0.17 mm Hg respectively at 15°C). The vapour pressure of TML Compound is similar to that of TEL Motor Compound over a wide range of temperatures.

This greater volatility results in very much higher concentrations of lead alkyl vapour in air in the vicinity of leaks or spills of Compounds containing TML.

## 3. Toxic hazard

All types of Compound are regarded as having the same toxicity. Absorption into the body can occur by inhalation of the vapour, ingestion of the liquid or penetration of the skin by the liquid. TML penetrates the skin less rapidly than does TEL.

The maximum acceptable concentration of the vapour of Compound in air, for unprotected personnel who may be regularly exposed during an eight-hour working day, is that which is equivalent to 0.75 mg. Pb/10m<sup>3</sup> (2µg/ft<sup>3</sup>). The higher volatility of TML increases the difficulty of keeping below this figure when Compounds contain TML, especially in the event of accidental leaks or spills.



## 4. Blending Plant design

The introduction of TML has made it necessary to redesign the layout of the vacuum pump unit which is usually incorporated in the larger Octel blending plants. In the original design two absorption towers were placed on the low pressure side of the vacuum pump to absorb any toxic vapours drawn from the Octel weigh or storage tanks. Because of the higher volatility of TML it was found necessary to place these towers on the high pressure side of the pump, and also to rearrange the seal-water system.

Full design details are available from The Associated Octel Company Limited.

## 5. Fire and Explosion hazards

Octel Compounds are capable of producing flammable vapour at ordinary temperatures, but the amounts which can be produced are strictly limited and for this reason Compounds are not regarded as "highly flammable". Extensive spills of Compound in a confined space give rise to a vapour explosion hazard.

Liquid Compounds can be made to burn, the difficulty of ignition is comparable with kerosine or heavier hydrocarbon fractions.

Compounds are stable at ordinary temperatures but if heated, decomposition takes place. If the Compound is enclosed in a drum or other container, heating may lead to explosion.

Considerable heat is generated when Compounds are mixed with solid or undiluted strong oxidising agents such as bleaching powder, bromine, chlorates, dichromates, nitrates, permanganates, peroxides, etc. Such materials should never be stored near to Compound.

Permanent storage areas for drums and all storage tanks for Octel Compounds should be provided with water sprinkler systems or suitably sited fire fighting monitor nozzles. Electrical equipment should be intrinsically safe or flame proof to the standards applicable to gasoline or paraffin hydrocarbons (e.g. B.S.229 Group II). Smoking and the introduction of any source of ignition should be prohibited in all storage areas and blending plants.

The detection of flammable concentrations of vapour from TML Compounds cannot be made reliably with some explosimeters incorporating platinum catalyst filaments, due to poisoning of the catalyst by lead. This problem of detection is discussed in Octel Bulletin No. 13—The use of explosimeters in atmospheres containing lead alkyl compounds.





## 6. Protective Equipment

For normal blending operations involving exposure to Compound (opening or closing drums, containers or tankers) and in the event of minor spills occurring in relatively open situations the standard equipment recommended comprises overalls, cap, PVC gloves and apron, rubber boots and an approved canister mask (e.g. Siebe Gorman CC or equivalent).

With larger spills, particularly in any confined space, the much greater volatility of TML calls for special precautions to be taken to achieve adequate respiratory protection. Significant leakage of contaminated air can take place through the edge of the facepiece of a canister mask. With high concentrations of lead in air this may produce a hazard to health for those involved. Under such circumstances the use of a positive pressure air supplied mask is strongly recommended. If this is not available a self-contained open circuit breathing apparatus affords a higher standard of protection than a canister mask. In an emergency a canister mask may be worn for a short period to enable the extent of a spill to be assessed and immediate first aid measures to be effected. Such use should be restricted to open situations or only in the presence of TEL. It should never be worn in confined spaces where there may be high concentrations of lead alkyls or a deficiency of oxygen. Great care should always be taken to ensure that the best possible fit of the facepiece has been achieved.

## 7. Emergency Action—Spills

Should Compound be spilled, speedy application of the recommended procedures should be effected. The area should be cleared of persons not directly involved in dealing with the accident. Adequate protective equipment (see section 6 above) should be worn by all persons who are so involved. Further spread of contamination should be prevented immediately by plugging any sources of leakage of Compound and containing and absorbing any spilled material. Smoking or other means of ignition in the vicinity of the spill should be strictly forbidden.

With TML Compound due to the high volatility of TML, relatively rapid decontamination of smooth, impervious surfaces in open situations may occur simply by evaporation of residual Compound after absorption of any gross accumulation of liquid by suitable absorbent.

Full decontamination procedures for spilled Compounds are given in Tables 1-3.

## 8. Emergency Action—Fire

Water sprays should be applied to all containers of Compound threatened by fire to keep the contents at a reasonable temperature.

Burning Compound should be attacked by foam, dry powder or water as fog or fine spray, taking care not to spread Compound by forceful application of water.

Since burning Compound results in the emission of copious toxic fumes, suitable respirators should be worn by all personnel involved.





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**Table 1—Decontamination Methods**

Material	Procedure <sup>1 2 3</sup>	Remarks
Skin	Swab thoroughly with kerosine, gasoline, or light mineral oil as soon as possible. Then wash thoroughly with soap and water.	Solvent swabs must be burned.
Hard PVC and rubber (lightly contaminated)	Swab thoroughly with cloth dampened with gasoline, kerosine, light mineral oil, carbon tetrachloride or trichloro-ethylene. Repeat and dry thoroughly.	For light contamination only. Heavily contaminated articles must be burned. Solvent swabs must be burned. Certain types of rubber are damaged by mineral oils and should be destroyed by burning.
Smooth impervious surfaces—tools, steel decks, etc.	Absorb excess fluid with Rags, "Dresser-Dri", Sand, Sawdust, etc. Swab thoroughly with kerosine or gasoline. Wipe dry.	Avoid spread of contamination. Absorbents, swabs and solvents to be burned.
Rough or rusty metal <sup>4 5</sup> and other rough but impervious surfaces.	Absorb excess fluid with "Dresser-Dri", Sand, Sawdust, etc. Soak in potassium permanganate solution for several hours. Scrape surface and repeat. Hose or wipe clean.	Avoid spread of contamination. Absorbents and swabs to be burned.
Concrete	Absorb excess fluid with "Dresser-Dri", Sand, Sawdust, etc. Scrub twice with permanganate solution. Leave covered with solution for several hours. Hose or swab clean. Repeat procedure if necessary.	Avoid spread of contamination. Where contamination is heavy and penetration is deep, the concrete may have to be dug up and buried elsewhere.
Absorbent materials, Bitumen, Asphalt, Wood, Canvas, Leather, Fabrics, Rope, Rubber and PVC (heavily contaminated), etc.	<b>NO EFFECTIVE DECONTAMINATION POSSIBLE.</b> Material must be removed and burned or buried.	

- NOTES:
1. Always wear adequate protective clothing during decontamination of spills. As much Compound as possible should be removed before applying decontaminants.
  2. **NEVER USE A DECONTAMINANT DRY, UNDILUTED OR WITH ANOTHER DECONTAMINANT SINCE A FIRE MAY RESULT.**
  3. Burning or heating (say to dull red heat) converts organic lead compounds to lead oxides, etc. Where this method may be safely applied it is the preferable means of decontamination. Such lead oxides, etc., although poisonous by ingestion do not give rise to lead-in-air hazard.
  4. Any burning should be carried out well away from the area of the spill and at least 50 yards from any habitation and preferably after the area has been decontaminated. Toxic fumes are emitted during burning of Compound.
  5. TML vaporises quite readily. Small spills of Compound in OPEN SITUATIONS on surfaces where little or no penetration has occurred may often be adequately neutralised by allowing evaporation to take place. This procedure **MUST NOT** be applied in enclosed spaces nor with any compound containing TEL.
  6. "Dresser-Dri" is available from the Magnus Chemical Co. Ltd., Uxbridge, Middlesex, England.



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**Table 2—Information on Decontaminant, Solvent and Absorbent Agents for Use on Lead Alkyl Spills**

Decon-taminants	Description	Precautions in Handling and Storing	Solutions, quantities required, etc.		Application (Never use decon-taminants dry or with another decontaminant)
			Decontaminant in Diluent	Remarks	
Potassium Permanganate $KMnO_4$	Dark purple salt. Strong oxidising agent.	Store in air-tight container. Contact with skin will cause brown stains.	2 lb (1 kg) dissolved in 4 gal (20 litres) 1:1 water-acetone mixture.	If acetone (flammable) not available, use water only and add 50 ml detergent before use	Suitable for decontamination of all materials especially concrete, wood, soil—provided penetration has not been too deep. Stains may be later removed with dilute hydrochloric acid (HCl.)

**Solvents or absorbents**

Kerosine	Flammable	Avoid naked lights	Apply direct	}	Solvents dilute but do not destroy.
Gasoline	Flammable	Avoid naked lights	Apply direct		
Light mineral oils	Flammable	Store in metal container	Apply direct		
Carbon tetrachloride $CCl_4$	Non-flammable Poisonous	Store in metal container	Apply direct		
Trichloroethylene $CHCl_2$	Flammable Poisonous	Store in metal container	Apply direct		
"Dresser-Dri", or other absorbent clay.	Absorbent Clay	—	Apply direct		Absorbents are suitable for damping or mopping-up spilled Compound.
Sand, dry earth, sawdust, rags.	—	—	Apply direct	Avoid using dry sawdust with potassium permanganate or fire may result.	No destruction of Compound is achieved, and used absorbents must therefore be removed and treated with decontaminant or fire; the area of the spill should then be finally decontaminated.





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**Table — Materials and Methods for Sealing Leaks in Containers**

Name and Description	Source	Remarks	Approx. Setting Time	Approximate Quantity for about 10 leaks	Other Items required	Method
1. S.77 Isophthalic resin (liquid) S.11 Catalyst (liquid) Fibreglass tape, open weave cloth as reinforcement.	The Fibro-Resin Corporation, 1914 West Burbank Blvd., Burbank, California, U.S.A.	This material is the best for making a strong permanent seal, and can be improved by adding powdered aluminium to the mixture.	30 min.	Resin: 1 pint (500 cc.) Catalyst (amount for 1 pint of resin: approx. 5 cc.) Fibreglass tape, 3 in. wide, 1 yard (1 metre).	Coarse emery cloth, sheets 2 Shallow tin, suitable for mixing 1 Putty knife 2 Scissors 1 Soft 1-inch paint brush 1	1. Clean round hole to bright metal and roughen with emery cloth. 2. Cut fibreglass cloth to cover hole and give good overlap (say 1 in. or 2 cm. round the hole). 3. Add requisite amount of catalyst to resin and stir well. 4. Soak fibreglass cloth in the mixed resin, and apply over hole. 5. Brush more resin over the cloth, especially at edges.
2. Hermetal Double Bond Putty; A and B putties supplied separately, to be mixed immediately, before use.	The Kenilworth Mfg. Co. Ltd., West Drayton Middlesex England.	This material requires no reinforcement, and is as effective as the S.77 resin, but takes longer to set (about 2 hours, setting time being shortened at higher temperatures).	2 hrs.	Hermetal Double Bond: Putty A—1 lb (500 g.) Putty B—1 lb. (500 g.)	Coarse emery cloth, sheets 2 Putty knife 2	1. Clean round hole to bright metal and roughen with emery cloth. 2. Mix equal quantities of A and B components by hand to give putty-like texture. 3. Use the mixed material to plug the hole with excess material overlapping edges of hole.
3. Glycerine and litharge. Open weave cloth or fibreglass tape as reinforcement.	Most chemical suppliers.	This material is suitable for quick, temporary repairs, but the seal is less permanent and more brittle than the S.77 resin. The glycerine should be 30% (i.e. 30% glycerine, 70% water). The litharge should be finely powdered (preferably passing 200 mesh B.S. sieve).	20 min.	30% glycerine; $\frac{1}{2}$ pint (250 cc.) litharge: 1 lb. (500 gm.) Open weave cloth: $\frac{1}{2}$ sq. yd. ( $\frac{1}{2}$ sq. metre).	Coarse emery cloth, sheets 2 Shallow tin, suitable for mixing 1 Putty knife 2 Scissors 1	1. Clean round hole to bright metal and roughen with emery cloth. 2. Cut cotton mutton cloth or fibreglass cloth to cover hole and give a good overlap. 3. Add the litharge to the glycerine until a thick paste is obtained. 4. Soak the cloth in the litharge paste, and apply over hole. 5. Add further paste over cloth, especially at edges.
4. Salt (sodium chloride) and zinc dust. Open weave cloth or fibreglass tape as reinforcement.	Salt: Any grocer or chemist.  Zinc dust: Most chemical suppliers.	This material, made up as a paste using a saturated solution of salt in water with zinc dust, is adequate as a sealing material, but has a longer setting time (about 2 hours) than the glycerine/litharge cement; it is, however, less brittle.	2 hrs.	Salt: (sodium chloride) $\frac{1}{2}$ lb. (500 gm.) Zinc dust—1 lb (500 gm.) Open weave cloth: $\frac{1}{2}$ sq. yard ( $\frac{1}{2}$ sq. metre).	Coarse emery cloth, sheets 2 Shallow tin, suitable for mixing 1 Putty knife 2 Scissors 1	1. Clean round hole to bright metal and roughen with emery cloth. 2. Cut cotton mutton cloth or fibreglass cloth to cover hole and give good overlap. 3. Add zinc dust to a saturated salt solution. 4. Soak cloth in paste and apply over hole. 5. Add further paste over cloth, especially at edges.

7



196405 Octel Bulletin No 12 The safe handling of Octel Antiknock compounds, page 8 of 8

Designed, Printed and Published by the Associated Octel Company Limited



# IARC Evaluation of Lead as a Human Carcinogen 2006 –Organic Lead (TEL/TML) & Skin / Dermal Exposure extracts

[Extracts collated by Elizabeth O'Brien, Editor of *LEAD Action News*, from: IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Inorganic and organic lead compounds, by International Agency for Research on Cancer (IARC) Working Group of 20 experts from 11 countries (2006), at <https://monographs.iarc.fr/wp-content/uploads/2018/06/mono87.pdf>

**Note:** all text in square brackets was added by the Editor of *LEAD Action News*.]

## EXTRACTS

[page 209]

### 2.1.7 Exposure to organic lead

Organo-lead compounds such as tetraethyl and tetramethyl lead have been used historically as components in gasoline. Gasoline engine exhaust has been previously evaluated as possibly carcinogenic to humans (Group 2B) (IARC, 1989). Studies on gasoline are not further reviewed here as there are mixed exposures and the effects of lead cannot be characterized separately. A cohort study and a nested case–control study of workers employed in the manufacture of tetraethyl lead are described below. Sweeney et al. (1986) investigated the mortality of 2510 men employed at a chemical plant in east Texas, USA. Tetraethyl lead was produced during the study period from 1952 to 1977, together with ethylene dichloride and chloroethane. Vinyl chloride monomer was also manufactured from 1960 to 1975. Other chemicals (ethylene dibromide, ethylene, inorganic lead, dyes) were used in the manufacturing processes of tetraethyl lead. Male employees who had worked at least 1 day at the factory between 1952 and 1977 were eligible from company records and workers' union files. More than 50% of the total workforce had been employed at the plant for at least 5 years. Vital status was ascertained for 99.3% of the cohort members. Expected numbers were calculated from the national rates by ethnicity, age groups and 5-year calendar periods. Mortality from all causes of death was lower than expected (SMR [Standardized Mortality Ratios], 74; 156 observed; 95% CI [Confidence Interval], 64–84). The SMR for malignant neoplasms was 103 (38 deaths observed; 95% CI, 77–135). The SMR for lung cancer was 112 (14 observed; 95% CI, 68–175). There was a slight excess of laryngeal cancers (SMR, 364; two deaths observed; 95% CI, 65–1145) and of brain and central nervous system tumours (SMR, 213; four deaths observed; 95% CI, 73–487). Among white men [page 210] employed between 1952 and 1960, when the manufacture of tetraethyl lead was the principal process, the SMR for lung cancer was 122, based on 13 deaths (95% CI, 73–194) and the SMR for brain tumours was 186 (three deaths observed; 95% CI, 51–482).

When deaths among male workers employed before 1960 were restricted to those deaths occurring 15 or more years after first employment, the SMR for respiratory cancers was 154 (14 observed; 95% CI, 84–258); for length of employment < 10 years, the SMR was 199 (six observed; 95% CI, 73–432); and for





employment > 10 years, the SMR was 132 (eight observed; 95% CI, 57–260). [There were no further details on mortality by employment at departments using tetraethyl lead or with other chemical exposures.] Fayerweather et al. (1997) reported a case–control study among employees who worked at a tetraethyl lead manufacturing company in New Jersey, USA. The plant began producing tetraethyl lead in 1923 and production was closed in 1991; thereafter, the tetraethyl lead plant was involved in lead remediation. The study subjects, 735 male cases of cancer other than non-melanoma of the skin, and 1423 controls matched by year of birth, sex, and most recent payroll class, were drawn from the cancer and mortality registries of the company and from employment rosters. Neoplasms that occurred during 1956–87 were included. The cancer registry mainly covered active workers; workers who left the company were missing from the registry (but those who left the active workforce and were put on the company’s disability rolls were included in the registry). The mortality registry covered all active and pensioned employees since 1957. Information on ever having worked in the tetraethyl lead area, years of employment in tetraethyl lead manufacture, rank (degree) of exposure to tetraethyl lead and cumulative exposure to tetraethyl lead were estimated using employment information from the personnel records, industrial hygiene data and records of biological measurements available at the factory. Tetraethyl lead exposure ranks were based on job titles. Employees manufacturing tetraethyl lead could have been exposed both to organic and inorganic lead compounds, but it was not possible to distinguish between these in the exposure assessment because of insufficient data. Exposure (ever/never) to other known or suspected carcinogens (such as aromatic amines, nitriles, benzene, asbestos, radioactive materials) was also assessed. Smoking histories were available from reports of periodical pulmonary function tests for 38% of the cases and 51% of the controls. Cases and controls for whom there was no available information on employment from personnel records were excluded.

Odds ratios for cancer of the digestive tract were elevated for the group who had ever worked in the tetraethyl lead manufacturing area compared with the group who had never worked in that area (odds ratio, 1.3; 45 cases observed; 90% CI, 0.9–1.9); the risk was increased for high (odds ratio, 1.3; 90% CI, 0.7–2.7) and very high (odds ratio, 2.2; 90% CI, 1.2–4.0) estimated cumulative exposure.

Further latency analyses, adjustments for smoking, and exposure to aromatic amines, radioactive materials and asbestos did not markedly change the results. Risk for rectal cancer was increased (odds ratio, 3.7; nine cases observed; 90% CI, 1.3–10.2), and was associated with high cumulative exposure to tetraethyl lead. The odds ratio for colon cancer was 1.3 (16 observed; 90% CI, 0.7–2.5) and was moderately elevated for the highest cumulative exposure category. Not all workers exposed to [page 211] organic lead were followed-up, e.g. workers who had terminated their employment without pension eligibility. Losses in tracing and follow-up were not described in this study. Quantitative information on the exposure categories was not available. Detailed results on other primary cancer sites were not reported.]



## 4. Other Data Relevant to an Evaluation of Carcinogenicity and its Mechanisms

### 4.1 Absorption, distribution, metabolism and excretion

[page 254]

#### Dermal exposure

Little information is available regarding absorption of lead in humans after dermal exposure. Moore et al. (1980a) conducted a study in which commercially-available lead acetate solution (6 mmol/L lead acetate) or skin cream (9 mmol/kg lead), labelled with  $^{203}\text{Pb}$  acetate, was applied to the forehead skin of eight male volunteers for 12 h and then washed off. Blood and urine samples were collected. The percentage of absorption was estimated by measuring the  $^{203}\text{Pb}$  activity in blood samples, by counting over the subject's calf region using a whole-body monitor, and also by counting 24-h and 48-h urine samples. Absorption through intact skin was  $0.18 \pm 0.15\%$  of the dose applied; that through scratched skin was  $0.26 \pm 0.46\%$ . Lead exposure from the use of hair-colouring agents containing lead acetate was reported to be insignificant (Moore et al., 1980a; Cohen & Roe, 1991). However, this assumes that only adults will be in contact with the colouring agents and ignores human behaviour in the home environment (Mielke et al., 1997b).

Measurements of lead on hands and surface wipes (including combs, hair dryer, faucet) from subjects using hair-colouring agents showed between 150 and 700  $\mu\text{g}$  lead per hand and more than 100  $\mu\text{g}/9.3 \text{ dm}^2$  [ $\sim 10 \mu\text{g}/\text{dm}^2$ ] on the surfaces. At such concentrations, there is a potential for hand-to-mouth and hand-to-surface transfer of lead not only to adults but also to children (Mielke et al., 1997b). The dermal absorption studies of Florence and colleagues (1988), although limited in subject numbers (nine workers), remain the most comprehensive to date. Following observations that workers in a lead battery factory exhibited high concentrations of lead in sweat, Florence et al. (1988) and Lilley et al. (1988) showed that finely-powdered lead metal and lead oxide (20 mg; particle size  $< 0.45 \mu\text{m}$ ) or 60  $\mu\text{L}$  of 0.5 M lead nitrate solution (6 mg lead) placed on the skin of one arm was rapidly absorbed. The absorbed lead [page 255] appeared in sweat (induced by pilocarpine iontophoresis) on the other arm and in saliva, but was not detectable in blood or urine. The authors found that the rate of lead absorption through the skin increased with increased sweating and, as observed by Moore et al. (1980a), suggested that the mechanism was one of rapid diffusion through filled sweat ducts followed by a slower diffusion through the stratum corneum (Lilley et al., 1988). The authors (as also observed by Moore et al., 1980a) noted that the absorbed lead must be transported in the plasma and concentrated quickly into the extracellular pool (sweat and saliva), that its mean residence time in the plasma is very short and that little lead enters the erythrocytes (Lilley et al., 1988). {No quantification of the amount of lead absorbed was undertaken and there were inconsistencies between the concentrations of lead in sweat from the two arms on certain days.} In later experiments using compounds made with  $^{204}\text{Pb}$  tracer and employing the sensitive thermal ionization–mass spectrometry (TIMS) and ICP–MS methods, lead acetate or lead nitrate was applied to the skin of four volunteers and perspiration induced by either pilocarpine iontophoresis or thermally in a sauna (Stauber et al., 1994). The lead compounds were rapidly absorbed through the skin and detected in sweat, blood and urine within 6 h of application. In one subject, 4.4 mg lead (as lead nitrate) was applied to the skin under a patch and perspiration induced by iontophoresis. Of the applied dose, 1.3 mg lead was not recovered from skin washings, indicating that 29% of the applied dose was absorbed into or through the skin. The authors suggested that some of the absorbed lead was still present in the epidermis and had not entered the circulatory system as the other experiments indicated that an equivalent of only 0.2% of the  $^{204}\text{Pb}$  applied to the skin was detected in blood. However, no measurable



increase of total lead in blood or urine was found in this study. {The Working Group agreed with the authors in their concern about this lack of increase in total lead in blood or urine, since blood lead is the accepted biomarker of exposure.} (ii) Distribution Lead enters and leaves most soft tissues reasonably freely. The clearance from the blood into both soft tissues and bone dominates lead kinetics during the first few weeks after an exposure, with an apparent half-life of several weeks (Table 83). Once an approximate equilibrium is reached between soft tissues and blood, the concentration of lead in blood is determined almost entirely by the balance among absorption, elimination, and transfer to and from bone. In the absence of continuing exposure, the whole-body half-life represents the loss of lead from bone. Lead enters and leaves bone by physiologically-distinguishable mechanisms (reviewed and summarized in O'Flaherty, 1991a, 1992, 1993), which include rapid exchange between blood plasma and bone at all bone surfaces, incorporation of lead into forming bone and its loss during bone resorption, and very slow diffusion of lead throughout undisturbed bone. Slow diffusion accounts for the gradual build-up of large quantities of bone-seeking elements such as lead in quiescent, largely cortical bone (Marshall & Onkelinx, 1968).

[page 258]

## **Blood**

... Whole-body half-lives of lead in blood estimated for workers occupationally exposed to lead are commonly much greater than those shown in Table 83 for non-occupationally exposed individuals, and reflect a much greater loading of the skeleton with lead (O'Flaherty et al., 1982; Hryhorczuk et al., 1985; Schütz et al., 1987; Nilsson et al., 1991; Fleming et al., 1997, 1999). They are comparable to half-lives of lead measured in cortical bone (Christoffersson et al., 1986; Erkkilä et al., 1992).

[page 281]

### *4.1.2 Organic lead compounds*

The toxicity of organic lead compounds is generally high, but varies widely between animal species and according to the chemical structure of the compound. Most of the information available concerns tetraethyl lead, but the toxicity of tetramethyl lead and some of its metabolites is also well described. Organic lead compounds are toxicokinetically distinct from inorganic lead compounds in terms of absorption and distribution and, owing to their greater lipophilicity, they are rapidly partitioned into soft tissues.

[page 282]

#### *(a) Humans*

##### *(i) Absorption*

## **Inhalation exposure**

Inhaled tetraethyl and tetramethyl lead vapours behave as gases in the respiratory tract and, as a result, their pattern and extent of deposition and absorption differ from that of inhaled inorganic lead particles (US EPA, 1994; ATSDR, 1999). These differences result in a higher fractional absorption: approximately 60–80% of the deposited tetraethyl and tetramethyl lead was absorbed by the lungs (Heard *et al.*, 1979).



## Dermal exposure

Tetraethyl lead is a lipophilic substance that can penetrate intact skin in lethal quantities. The amount absorbed is proportional to the surface area exposed and the concentration. Accidents involving transdermal absorption of tetraethyl lead and tetramethyl lead in humans have been described (Hayakawa, 1972; Gething, 1975). Due to its higher lipophilicity, tetraethyl lead is more readily absorbed than tetramethyl lead.

### (ii) Distribution

Inhalation of tetraethyl lead results in much higher concentrations of lead in the brain than does inhalation exposure to inorganic lead. Distribution of organic lead in humans has been observed to be highly variable and measurements are complicated by metabolism of the alkyl lead to inorganic lead. For example, in a man who ingested a chemical mixture containing 59% tetraethyl lead (38% lead w/w), the highest concentrations of triethyl lead and inorganic lead were found in the liver and kidneys followed by the brain, pancreas and heart (Bolanowska *et al.*, 1967). In another report in which a man and a woman accidentally inhaled a solvent containing 31% tetraethyl lead (17.6% lead w/w), concentrations of triethyl lead and inorganic lead were highest in the liver and lower in the kidney, brain, pancreas, muscle and heart (Bolanowska *et al.*, 1967), although the liver/kidney ratio for triethyl lead was 5:1 in the woman compared with that of 1.3:1 in the man. Trialkyl lead metabolites have also been detected in brain tissue of subjects not occupationally exposed to air pollution (Nielsen *et al.*, 1978).

Organic lead compounds are ultimately metabolized to inorganic lead and the latter is stored in the bones (Schwartz *et al.*, 1999, 2000a).

### (iii) Metabolism

Alkyl lead compounds are actively metabolized in the liver through oxidative dealkylation catalyzed by cytochrome P-450. Relatively few human studies that address the metabolism of alkyl lead compounds were found in the available literature (Bolanowska *et al.*, 1967; Nielsen *et al.*, 1978; ATSDR, 1999).

### (iv) Excretion

Tetraethyl lead is excreted in the urine as diethyllead and inorganic lead (Turlakiewicz & Chmielnicka, 1985; Vural & Duydu, 1995). Following inhalation exposure, exhalation of tetraalkyl lead compounds is a major pathway of elimination in humans. Heard *et al.* (1979) showed that 48 h after inhalation exposure, 40% and 20% of inhaled tetramethyl and tetraethyl lead doses, respectively, that were initially deposited in the lung, were exhaled, and there was little urinary excretion. [Presumably, the lead that was not exhaled or excreted via the urine or sweat, was stored in the bones, teeth and soft tissues.]





## Hunter's The Diseases of Occupations 1955-1975 Excerpts on Lead

*Editor's Note:* Originally typed by a LEAD Group volunteer in 2007, from now-lost photocopies of lead-related pages of *The Diseases of Occupations*, by Donald Hunter, Consulting Physician, The London Hospital, The English Universities Press Ltd, (1<sup>st</sup> edition 1955) 5th Edition 1975; typing corrected (without reference to the original) by Elizabeth O'Brien, The LEAD Group Inc, September 2019. If you can make corrections from the original, please send them in a Letter to the Editor.

These 1955 (revised edition 1975) excerpts need to be read with caution as many of the findings have been overturned, for example: "There seems little evidence, therefore, that lead significantly predisposes to hypertension" and "By attention to plant design, further catastrophies of this sort [occupational exposure to Tetra ethyl lead (TEL) or Tetra methyl lead (TML) – collectively known as Tetra alkyl lead] and severe health and behavior consequences] were avoided." Any reference to Kehoe should be particularly viewed with skepticism as Robert A Kehoe was the chief medical advisor of the Ethyl Corporation, a tetraalkyl lead (TAL) manufacturer, and according to Wikipedia: "Kehoe's work is now considered discredited." Eg Hunter quotes Kehoe as saying the following patently untrue statement: "To prevent such unnecessary exposures [of leaded petrol tank sludge cleaners who suffered consequent lunacy or death], adequate supervision of the cleaning of tanks has now been instituted all over the world (Kehoe, 1953)."

See 19651126 Dept of Health letter re safe handling & disposal of leaded sludge below this article.

One statement below completely contradicts the advice from Associated Octel in 1964, to clean up Alkyl Lead spilled on the skin, using gasoline. See 196405 Octel Bulletin No 12 *The Safe Handling of Octel Antiknock Compounds*, by Associated Octel, reprinted in this issue of *LEAD Action News*. By comparison, Hunter (1975) writes: "Although ethyl-petrol contains less than one part in a thousand of tetra-ethyl lead it should not be used for cleaning the skin, and to prevent this it is coloured by a dye."]

### Hunter's The Diseases of Occupations 1955-1975 – Excerpts on Lead

#### Diagnosing - some signs of lead poisoning

- A. Organic forms of lead such as Tetraethyl lead in leaded petrol produce effects on the brain as it is fat soluble and readily absorbed through the skin and lungs. A symptom of poisoning includes shakiness, insomnia, delusions. More severe poisoning can produce mania and violent movements and has been fatal, including workers who cleaned fuel storage tanks without adequate protection.
- B. Inorganic lead is acutely dangerous if breathed in as fumes or dust. If it enters the body orally it may pass through or be absorbed and cause immediate symptoms or be stored (without immediate harm) in the bones. Nerve inflammations (sometimes called encephalopathy) include muscle pain, weakness and shakiness, nerve swelling (papilloedema), coma, convulsions, head-ache, mental dullness, delirium, blindness and deafness. Palsy or paralysis, particularly of the wrist(s) was a common affliction of housepainters in the nineteenth century, using leaded paint. Lead colic is the most common form of lead poisoning and creates intense pain in the lower abdomen. Lead anemia is due to damage and destruction of red blood cells. A stained blood cell examination can give early



warning of lead poisoning as observation of spots in red cells, while not specific to lead poisoning is a most common sign. A blue line may show around the gums, near the teeth. Kidney inflammation (chronic nephritis) is more common in children than adults with lead poisoning and can be fatal. Particular types of damage to the heart and raising of blood pressure (hypertension) can be due to lead. Symptoms of lead poisoning may be latent; only showing years after exposure to lead, and often due to the person eating certain mineral salts, or when the acidity of body fluids and tissues is abnormally high (acidosis)

#### **Lead:**

Lead, Pb, is a soft bluish-grey metal, heavy, malleable, and ductile. It is protected from corrosion by the formation of a thin coating of grey oxide. There is evidence that lead has been used for about 6,000 years, for there is a lead figure in the British Museum that was made before 3800 B.C. It was among the earliest metals used by man and was known to the early Egyptians and Hebrews. The Phoenicians mined it in Spain about 2000 B.C. The Hanging Gardens of Babylon had lead pans to hold plants, and the Romans, to satisfy their great enthusiasm for sanitation and bathing, exploited the lead mines in the Mendips, Shropshire, Derbyshire and Flint. Together with Spain, Britain became the principal source of lead in the Roman Empire. Lead pipes made 2000 years ago have been excavated in Pompeii, Rome and Bath, and found to be in good condition. In modern times the principal lead-production countries are the United States of America, Mexico, Australia and Canada. World production of lead for the year 1953 was 2,050,000 tons. The principal lead ore is galena, PbS, and this is usually associated with the sulphides of silver, copper, arsenic, antimony, bismuth and tin. Other common ores of lead are cerussite,  $PbCO_3$ , and anglesite,  $PbSO_4$ .

#### **Uses:**

Lead is so soft that it can be easily rolled into sheet and foil and extruded cold into rods, pipes and tube containers. In building construction it is used for roofing, cornices, tank linings, electrical conduit, water pipes and sewer pipes. Because of its weight and malleability it is utilized in yacht keels, plumb-bobs and sinkers in diving-suits. Alloyed with tin and antimony, lead proved the most satisfactory substance for casting type when movable type was invented in the fifteenth century, for it made a sharp impression and when broken could be easily recast. Antimonious lead is now the chief type-metal. Lead-antimony alloys are also used for accumulator plates, cable coverings, toy soldiers, ornamental castings and the fillings of bullets for small-arms ammunition. Soft solder, used chiefly for soldering tinsplate and lead pipes, is an alloy of lead and tin which remains in a plastic state sufficiently long to enable the plumber to wipe the joint. Certain lead-base alloys are used in engineering to make bearing-metals. Lead is now encountered in more than 200 industries. The annual world production of pig lead exceeds two millions tons, and in Great Britain alone more than 25,000 tons of white lead and 20,000 tons of red lead and litharge are manufactured annually. In 1951 in Great Britain there were more than 1500 workers in the lead industries and 150,000 painters.

#### **Nature of Alloys:**

Two or more metals when fused together usually form a homogeneous liquid; when this solidifies the resulting metallic substance is an alloy. It may be either a solid solution or a pure chemical compound.



### **Reasons for Alloying:**

A particular metal may have properties of great value while being deficient in some other special respect and the purpose of alloying is to remedy this deficiency. Certain beryllium-copper alloys have six times the tensile strength of copper. Antimony is added to lead to harden it, and lead-antimony alloys are used for type-metal, accumulator plates, cable coverings, toy soldiers, ornamental castings and bullets. Lead-tin alloys are used as soft solders and lead-bronze alloys to make bearing metals for motor-car and aero plane engines.

### **Tellurium-lead alloy:**

As small a quantity as 0.05 per cent of tellurium added to lead hardens it and improves its resistance to acids. When fully toughened, tellurium-lead has a tensile strength which is twice that of ordinary lead and this enables sheets to be bent double and hammered flat without fracture. Compared with ordinary lead, tellurium-lead pipes have twice the resistance to bursting by frost.

### **Lid Labels for Lead Paint:**

The hazard of lead poisoning in children from ingestion of compounds of lead is serious especially during the age of teething. In Baltimore, U.S.A. between 1931 and 1959 a total of 744 such children were poisoned, and of these 123 died. A special ordinance for the City of Baltimore was adopted as a regulation on 27<sup>th</sup> April, 1959. The text of the regulation is as follows: "Lid Labels. No lid label bearing the warning as required by this ordinance shall be less than three inches in diameter for pint and larger size containers or less than one and one-half inches in diameter for cans smaller than pint size. In addition to the warning statement the lid label shall contain the name and address of the manufacturer. The word WARNING preceding the warning statement shall be of larger letters than the name and address of the manufacturer. The warning statement shall be as large as the lid will permit. The lid label shall adhere firmly to the lid of the container." The text of the label warning required by the Baltimore ordinance for all paint containing more than one per cent of lead reads as follows: "WARNING - Contains lead. Harmful if eaten. Do not apply on any interior surfaces of a dwelling, or of a place used for the care of children, or on window sills, toys, cribs, or other furniture."

### **Litharge Rubber:**

The use of litharge rubber - that is, rubber in which litharge has been incorporated in excess in a mother batch even to the extent of to 90 per cent - has abolished lead poisoning in men who vulcanize rubber (Klein, 1952). The litharge rubber is manufactured in a central factory and is sent to scores of other factories where vulcanizers throw it in solid pieces into batches of crude rubber. Prior to the invention of litharge rubber they used powdered litharge, some of which inevitably they inhaled.

The rusting and corrosion of iron and steel is a phenomenon of great economic significance, resulting as it does in the financial loss throughout the world of many hundreds of millions of pounds per annum. The authorities responsible for ships, lighthouses, bridges, railways and other iron and steel structures are particularly alive to the value of lead paint as a protection against atmospheric attack. For example, in



London squads of men are continuously on duty painting the Tower Bridge, and for this purpose they use 25 tons of lead paint every year. Similarly, in Australia thirty painters are continuously employed on Sydney Harbour Bridge. It takes five years to paint the bridge, and when they have finished they start again. The bridge is made up of 51,300 tons of steel. In each painting cycle 90 tons of red-lead paint and 250 tons of battleship grey are used.

#### **Manufacture of White Lead:**

Theophrastus (300 B.C.) states that in his time white lead was made artificially from lead and vinegar. After the metal was corroded the white lead was scraped off, boiled with water and allowed to settle. This is probably the earliest record of the manufacture of white lead.

#### **The Blood-pressure in Lead Workers:**

Vigdortchik (1935) found an association between lead absorption and hypertension, but he based this on single observations of the blood-pressure of 2,769 workers in whom only the systolic pressure was recorded. He gave no serial figures of individual cases and he omitted to state the amount of lead absorption in each worker. Belknap (1936) reported 2,600 serial blood-pressure readings made month by month for over a year in workers who had absorbed large amounts of lead. Of eighty-one men observed all were heavily exposed either to fume of molten lead or to dusts of lead oxides, and all showed either a blue line on the gums, punctate basophilia or high lead excretion in the urine. Fifty-eight per cent of them had been exposed for periods varying from five to nine years. The cases were studied by age-groups. The writer concluded that there was no variation from normal in the blood-pressure. Teleky (1937) disputed the validity of these results on the ground that the men had not worked long enough in the lead industries to develop high blood-pressure. He stated that he would have expected, from his experience, only sporadic cases of high blood-pressure in men exposed for such relatively short periods.

#### **Standard Mortality in Paperhangers and Painters:**

Fouts and Page (1942) failed to produce hypertension in dogs treated with lead for a long time. One animal received large amounts of lead for three years, a third of its life-span. Dreessen (1943) showed that among 776 workmen, albuminuria and symptoms of early plumbism were most common in those exposed to the highest atmospheric lead concentration, but the prevalence of arterial hypertension among these employees was not significantly different from that observed in other industrial workers. The figures of the Registrar-General for 1931 show there were then 178,170 paperhangers and painters in Great Britain and that deaths from cerebral vascular lesions numbered 398, arteriosclerosis 40, and Bright's disease 265. The standard mortality for the same disease was 263, 33, and 202. There seems little evidence, therefore, that lead significantly predisposes to hypertension or Bright's disease, except perhaps in children.

#### **Historical Summary:**

In 1923, when it [tetra ethyl lead (TEL)] was first manufactured in the United States of America, cases of encephalopathy began to occur in men employed on three separate plants. The victims were not only workmen engaged in blending and quite ignorant of any danger, but also chemists who handled the liquid





recklessly, for there was general ignorance of its extreme toxicity and the ease with which it enters the body. Within seventeen months 139 cases with 13 deaths were reported. Much excitement and alarm were caused, and this led at first to the prohibition of the manufacture. The men affected suffered from restlessness, talkativeness, ataxia, insomnia and delusions. There were no paralyses or convulsions, but the condition terminated with violent mania, the patient shouting, leaping from the bed and smashing furniture. By attention to plant design, further catastrophies of this sort were avoided. In the U.S.A. it was proved that the lead exposure associated with the handling and dispensing of gasoline containing tetra-ethyl lead at service stations is negligible (Kehoe, 1953). Apprehension as to the possibility of the poisoning of garage and aircraft workers by lead from the exhaust gases of petrol engines has proved to be without foundation.

#### **Exposure Hazards:**

In the Second World War a new hazard arose in the process of cleaning storage tanks which had ethyl-petrol [leaded petrol / leaded gasoline]. In England some of these tanks were underground and were of 4,000 tons capacity. After the petrol had been pumped out and the air rendered gas-free by ventilation, the floors, walls and supporting pillars were scraped clean. Men engaged in the work were required to wear an air-line mask and were supplied with a complete outfit of clothing including boots, gloves and headgear. The protection afforded was satisfactory, but there were occasional instances of failure to obey the regulations, with the results that twenty-five cases of poisoning by tetra-ethyl lead occurred, two of them fatal (Cassells and Dodds, 1946). War conditions in countries of the Middle East and Far East made the cleaning of tanks difficult to supervise, and there were 200 cases of poisoning, with forty deaths. Unhappily many of these cases were not recognized soon enough. Mistaken for drunkards and lunatics, some-times they were starved and beaten instead of being treated properly. To prevent such unnecessary exposures, adequate supervision of the cleaning of tanks has now been instituted all over the world (Kehoe, 1953).

#### **Symptoms and signs:**

The early symptoms include insomnia, loss of weight, anorexia and morning nausea, but there is no colic. Metal manifestations dominate the clinical picture, and in severe cases restlessness, bad dreams, hallucinations and delusions are common. Several symptoms-complexes have been distinguished - the delirious, manic, confused, and schizophrenic (Machle, 1935). With severe exposure there may be the abrupt onset of acute maniacal symptoms with suicidal tendencies or the occurrence of a convulsion. Less severe cases begin with insomnia, sleep being difficult, broken and restless, sometimes with wild and terrifying dreams. By day, mental excitements may be marked, headache is usual and often severe, and vertigo is frequent. Blurred vision and diplopia owing to weakness of the extrinsic ocular muscles are occasional complaints. Evidences of meningeal irritation are absent; the cerebrospinal fluid may at times be under increased pressure, but it is not otherwise abnormal.

#### **Colic, Palsy and Stippling are absent:**

Punctate basophilia is absent or slight, and the test for its presence in the blood therefore has little significance. Anorexia, nausea and vomiting are constant, but colic does not occur. Many patients complain of a metallic taste in the mouth, and diarrhea sometimes occurs. Weakness, tremor, muscular pain and



ease of fatigue are frequent complaints. The tremors affect the extremities, lips and tongue, and are coarse and jerky, and aggravated both by effort and by attempts at control. In the patients who recover, all symptoms disappear in from six to ten weeks. Occasionally an anxiety state persists for a time.

#### **Facilities from Dry Cleaning:**

In 1947 Bini and Bollea described two fatal cases of poisoning, where ethyl-petrol intended for use as aviation fuel was used for the dry cleaning of clothes. The patients were Italians, aide men of American airmen stationed in Italy. They worked in a room which was small, closed and poorly ventilated, and they ironed the clothes while they were still wet with the leaded petrol. After a few days' exposure they suffered from anorexia, vertigo, general weakness and insomnia. About a week later there was psychomotor agitation, with a rapid stream of disconnected talking and mental confusion in the nature of a toxic confusional delirium with visual and auditory hallucinations occurring together, tremors affecting all muscles, myoclonus and choreiform movements. Two days later they became comatose and died with a temperature of 105 degrees F.

#### **Conjugation and Pathology:**

Tetra-ethyl lead is insoluble in water so that if it is inhaled it must be made water-soluble before it can be excreted. It does not concentrate in the brain as is sometimes supposed but is metabolized in the liver, where one of the ethyl groups is removed to form the water-soluble tri-ethyl lead ion (Cremer, 1959). This gets into the circulation, and by its interference with cellular metabolism in the brain it produces serious and often fatal effect. At necropsy the brain shows diffuse hyperemia of the cortical grey matter and the basal ganglia. Historically there are both diffuse and focal changes. Throughout the cerebral and cerebella cortex there are diffuse acute degenerative changes in almost all the nerve cells. In places, groups of nerve cells show severe degenerative changes with complete disintegration of the cell bodies. Focal lesions are found especially in the mamillary bodies [located on the undersurface of the brain] and to a lesser degree in the floor of the fourth ventricle [within the brain] and in the corpora quadrigemina [in the midbrain]. The nerve cells in the mamillary bodies appear to be severely injured and in some areas they completely disappear. In addition there is intense proliferation of the glia with predominance of microglia cells [located throughout the brain and spinal cord]. Where this occurs, there is also new formation of capillaries and perivascular infiltration with small round cells including mast cells.

#### **Treatment:**

In mild cases removal from exposure, a normal diet with extra fluids and the relief of insomnia by the proper choice of barbiturates are all that is required. Severe cases call for strict supervision and skilled nursing because of hallucinations and impulsive suicidal tendencies. Morphine is contra-indicated; the sedative actions of repeated doses of barbiturates together with adequate fluid intake are the essentials in treatment (Kehoe, 1953). Pentobarbitone sodium may be given in repeated full doses to obtain rest. Glucose, 5 per cent in saline, may be given intravenously up to 3 litres a day, and if it is given as a drip, hexobarbitone may be added. Machle (1935) recommends the intravenous administration of from 2 to 4 grams of magnesium sulphate in 2 per cent aqueous solution, accompanied by doses of pentobarbitone sodium up to 15 gr. daily by mouth. Cassells and Dodds (1946) found the enemata of 6 ounces of a



saturated solution of magnesium sulphate often had a sedative effect when they could be retained. Neither EDTA nor BAL is of any value in treatment; this is to be expected since it has been shown (Cremer, 1959) that tri-ethyl lead, the toxic metabolite formed in the liver in these patients, does not combine with either EDTA or BAL.

**Preventive Measures:**

By meticulous attention to detail, it is possible to manufacture tetra-ethyl and to blend it with petrol without risk to the workers. Both manufacture and blending are carried out in closed systems. Elaborate precautions are taken in transport, storage and handling of the fluid and great care is exercised to avoid leakage or spilling (Kehoe, 1935). In blending and laboratory works, impervious gloves and respirators are used. Strict regulations must be laid down for the cleaning of any tank which has contained leaded petrol. Those responsible should make it quite clear that such work is never to begin without reference to some authorized person. This makes it possible to do the work under supervision and to use trained workmen properly equipped with protective clothing (Kehoe, 1953). Although ethyl-petrol contains less than one part in a thousand of tetra-ethyl lead it should not be used for cleaning the skin, and to prevent this it is coloured by a dye. While decarbonizing engines which have burned leaded petrol, mechanics must wear dust masks. Routine medical examinations should be carried out whenever possible.



# 19651115 Dept of Health requests hygiene info re leaded sludge cleaning from petrol storage tanks

34/8/4

Telephone 87019

P.O. Box 137, WHANGAREI  
15 November 1965

The Director-General of Health,  
WELLINGTON.

## DISPOSAL OF LEADED SLUDGE

I have had a request for information concerning the cleaning of petrol storage tanks and the disposal of leaded sludge.

There is an article on this subject in the "British Journal of Industrial Safety", Volume 6 Number 65 August 1963 and I should be pleased if two copies of this article could be forwarded to this office.

I would appreciate any other information you may have concerning this matter.

  
W.D. McLEOD  
SUPERVISING INSPECTOR  
for MEDICAL OFFICER OF HEALTH

To be noted  
by  
B.U. 30 " 65  
Action complete

DEPT  
15 NOV 1965  
WHANGAREI

15<sup>th</sup> November 1965 Letter on behalf of New Zealand Medical Officer of Health to Director-General of Health requesting information on cleaning of petrol storage tanks and the disposal of leaded sludge, from the British Journal of Industrial Safety, Volume 6, Number 65, August 1963. [Editor's note: please send a copy if you have one!]





## **Lead scavengers & other carcinogens in gasoline, New Zealand 1965-1975**

*Questions posed and answers collated by Elizabeth O'Brien, Lead Scientist, The LEAD Group Inc, Australia*

### **Q: What are lead scavengers and why are they used?**

A: The ATSDR Agency for Toxic Substances and Disease Registry (ATSDR), US Department of Health and Human Services, May 2006, *Lead Scavengers Compendium: Overview of Properties, Occurrence, and Remedial Technologies*, <https://www.epa.gov/sites/production/files/2015-03/documents/compendium-0506.pdf> states:

#### **EXECUTIVE SUMMARY**

##### **Introduction**

Ethylene dibromide (EDB) and ethylene dichloride (EDC; also known as 1,2-dichloroethane or 1,2-DCA) are synthetic organic chemicals used in leaded gasoline as “lead scavengers” to prevent the buildup of lead deposits that foul internal combustion engines. Even though leaded gasoline for on-road automobiles has not been used for more than a decade, leaded gasoline containing lead scavengers is still used as aviation gasoline (Avgas) and in some off-road applications such as automobile racing fuel.

### **Q: When were lead scavengers first added to leaded fuel additives?**

A: ATSDR (May 2006) states:

#### **Historical Uses of Lead Scavengers**

The use of EDB as a lead scavenger began in 1925. Beginning in the 1940s, EDB was partially replaced with EDC as a cost saving measure.

### **Q: at what point in the manufacturing process of the lead additive for fuel are lead scavengers added?**

A: The Toxnet - Hazardous Substances Data Bank (HSDB), Toxicology Data Network, US National Library of Medicine, US National Institutes of Health entry (reviewed May 8, 2008) on *TETRAETHYL LEAD - CASRN: 78-00-2* states:

#### **General Manufacturing Information:**

Immediately following the production stage, the manufacturer is responsible for blending the lead alkyl with ethylene dichloride or dibromide to create the full gasoline additive package ...[[European Chemicals Bureau; IUCLID Dataset, Tetraethyllead \(CAS # 78-00-2\) p.4 \(2000 CD-ROM edition\)](#)]. Available from, as of January 30, 2008: <http://esis.jrc.ec.europa.eu/>



### **Formulations/Preparations:**

Composition: Tetraethyl lead (TEL) /as additive to gasoline/: 61.49 wt %; Ethylene dibromide: 17.86% by wt; Ethylene dichloride: 18.81% by wt; Dye, stabilizer, kerosene, and inerts: 1.84% by wt. [Verschueren, K. *Handbook of Environmental Data on Organic Chemicals*. 3rd ed. New York, NY: Van Nostrand Reinhold Co., 1996, p. 1690] \*\*PEER REVIEWED\*\* ...

A typical motor mix for automotive gasolines consists of about 62% tetraethyl lead (TEL), 18% ethylene dibromide, 18% ethylene dichloride, and 2% of other ingredients, such as dye, petroleum solvent, and stability improver. For overall best performance of aviation piston engines, the scavenger consists entirely of ethylene dibromide, and a typical aviation mix includes about 61-62% TEL, 35-36% ethylene dibromide, and 3% of dye, solvent, inhibitor, etc. [Kirk-Othmer *Encyclopedia of Chemical Technology*. 3rd ed., Volumes 1-26. New York, NY: John Wiley and Sons, 1978-1984., p. 11(80) 665] \*\*PEER REVIEWED\*\*

...some tetraethyl lead (TEL) is mixed directly with lead scavengers (usually ethylene dichloride & ethylene dibromide) to make one type of additive containing about 65% TEL. Another type of additive is made by mixing TEL with tetramethyl lead to produce physical mixtures containing 10-75% tetramethyl lead (TML). [IARC. *Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work). Available at: <http://monographs.iarc.fr/ENG/Classification/index.php> p. V2 P151 (1973)] \*\*PEER REVIEWED\*\*

### **Impurities:**

Tetraethyl lead used as an anti-knock compound in gasoline ... contains ethylene dibromide, ethylene dichloride, dye, stabilizer, kerosene, and inerts as impurities. [Verschueren, K. *Handbook of Environmental Data on Organic Chemicals*. 3rd ed. New York, NY: Van Nostrand Reinhold Co., 1996., p. 1690] \*\*PEER REVIEWED\*\*

### **Q: were lead scavengers incorporated into the fuel lead additives made by Associated Octel and imported into New Zealand?**

A: Nick Wilson and John Horrocks (January 2008) in *Lessons from the removal of lead from gasoline for controlling other environmental pollutants: A case study from New Zealand*, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2263033/> wrote (referring to the period 1994-1995):



## Lead in petrol 'small factor'

Northland's Medical Officer of Health, Dr J. S. McKenzie-Pollock, believes the issue of lead content in petrol has been blown out of proportion.

Responding to a recent statement by the Friends of the Earth condemning Government moves to reduce lead levels, Dr McKenzie-Pollock said today that lead in petrol was only a small percentage of the lead in the environment.

"I would put the emission from cars as maybe about 10 per cent of the lead problem," he said.

Other sources such as some pottery glazes — "a lot of the Friends of the Earth people are potters" — old paint on old houses and solder were more of a problem, he said.

FOE's national organiser, Mr Roger Wilson, described the proposal to reduce lead levels in petrol to 0.45 grams a litre as "totally unsatisfactory."

Expansion plans for the Marsden Pt oil refinery failed to recognise the

dangers of adding lead to petrol, he said last week.

"All that would happen is that small lead particles would be released from exhausts, and these are the particles that are most easily absorbed by breathing," he said.

He said the current level in the United Kingdom was also 0.45 grams per litre. This was worrying enough in that country for a group of parents to be suing the oil companies in a current court case claiming damage to their children.

The health risks from lead were now well known, Mr Wilson said. But, he claimed, leaded petrol contained the further danger of the additive ethylene dibromide.

This was shown in a study by the United States National Cancer Institute, reported last year, to cause stomach cancers in rats and mice, he said.

"Concentrations of this compound have been found in the air near petrol stations and along well-travelled highways."

Not surprisingly, the industry ignored the existing source of likely carcinogens in leaded gasoline (according to the knowledge at this time). These were the "scavengers" ethylene dibromide and ethylene dichloride [61,62], added to leaded gasoline in order to help prevent a build-up of lead deposits in the cylinders.

*At left, 19790507 Advocate newspaper article Lead in petrol small factor - mentions the lead scavenger ethylene dibromide as being carcinogenic in animal studies.*

### Q: Are lead scavengers considered to be carcinogenic?

A: ATSDR (May 2006) states:

#### Toxicology of Lead Scavengers

...EPA has determined that both EDB and EDC are probable human carcinogens. The U.S. Department of Health and Human Services has determined that both EDB and EDC may reasonably be expected to cause cancer.

#### 5.3.2.3 Carcinogenicity

**EDB:**... Carcinogenic effects were observed in workers who were occupationally exposed to EDB, primarily via the respiratory route (Ref. 5-1). EPA has designated EDB as a probable<sup>1</sup> human carcinogen (Ref. 5-20), and the U.S. Department of Health and Human Services (DHHS) has determined that EDB may be reasonably anticipated to be a carcinogen (Ref. 5-4).

**EDC:** Several agencies have determined that EDC has carcinogenic potential; DHHS has determined that EDC may reasonably be expected to cause cancer; EPA has determined that EDC is a probable human carcinogen while the International Agency for Research on Cancer (IARC<sup>2</sup>) considers EDC to be a possible<sup>3</sup> human carcinogen (Ref. 5-5). In animal studies, increases in the occurrence of cancers of the stomach, mammary gland, liver, lung, and endometrium have been observed (Ref. 5-5)...

The ATSDR (May 2006) references cited above are:

5-1 Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological Profile for 1,2-Dibromoethane. U.S. Department of Health and Human Services, Public Health Service.





5-4 ATSDR. 2004. ToxFAQs™: 1,2-Dibromoethane. [Editor's note: Previously: Website Accessed on March 26, 2004. <http://www.atsdr.cdc.gov/tfacts37.html>; Website Accessed on September 7, 2019. <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=131> - Page last updated: March 3, 2011: "**Affected Organ Systems:** Dermal (Skin), Hepatic (Liver), Renal (Urinary System or Kidneys), Reproductive (Producing Children) **Cancer Classification:** NTP: Reasonably anticipated to be a human carcinogen. EPA: Likely to be carcinogenic to humans based on strong evidence of carcinogenicity in animals and inconclusive evidence of carcinogenicity in an exposed human population. IARC: Probably carcinogenic to humans"]

5-5 ATSDR. 2004. ToxFAQs™: 1,2-Dichloroethane. [Editor's note: Previously: Website Accessed on August 17, 2004. <http://www.atsdr.cdc.gov/tfacts38.html>; Website Accessed on September 7, 2019. <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=110> - Page last updated: March 3, 2011: "**Affected Organ Systems:** Hepatic (Liver), Renal (Urinary System or Kidneys) **Cancer Classification:** EPA: Probable human carcinogen. IARC: Possibly carcinogenic to humans. NTP: Reasonably anticipated to be a human carcinogen"]

5-20 EPA. 2004. Toxicological Review of 1,2-Dibromoethane: In Support of Summary Information on the Integrated Risk Information System (IRIS). EPA 635/R-04/067.

A: the National Toxicology Program (NTP) (1978) *Bioassay of 1,2-dibromoethane for possible carcinogenicity*, in Natl Cancer Inst Carcinog Tech Rep Ser. from <https://www.ncbi.nlm.nih.gov/pubmed/12830212> states:

A bioassay for possible carcinogenicity of technical-grade 1,2-dibromoethane was conducted using... rats and... mice... There was a positive association between increased dosage and accelerated mortality in rats and mice of both sexes.... All male mice and high dose female mice died or were sacrificed by week 78, while the low dose mice were observed for an additional 37 weeks after a 53-week period of chemical administration. In rats squamous-cell carcinomas of the forestomach were observed in 45/50, 33/50, 40/50 and 29/50 of the low dose males, high dose males, low dose females and high dose females, respectively, while none were observed in controls.... Each of these incidences was statistically significant. These lesions were seen as early as week 12 in rats and week 24 in mice; they invaded locally and eventually metastasized. Increased incidences of hepatocellular carcinomas were observed in dosed rats, but the incidence of this neoplasm was significant only in females. Increased incidences of hemangiosarcomas were observed in each dosed rat group, but was statistically significant only in males, where they appeared as early as week 26. Early development of squamous-cell carcinomas which invaded and metastasized was also observed among mice. Squamous-cell carcinomas were found in 45/50, 29/49, 46/49 and 28/50 of the low dose males, high dose males, low dose females, and high dose females, respectively, but none were found in controls. Each of these incidences was statistically significant.

A: In L S Gold, G M Backman, N K Hooper, and R Peto, *Ranking the potential carcinogenic hazards to workers from exposures to chemicals that are tumorigenic in rodents*, Environ Health Perspect. 1987 Dec, two lead scavengers (out of 41 chemicals which cause tumours in rats) were ranked first (ethylene dibromide) and second (ethylene dichloride) for potential carcinogenic hazards to workers





(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1474483/?page=1>), and the discussion (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1474483/?page=8>) points out that we have little knowledge of the **potential interactions of individual agents in chemical mixtures** [like the lead additive for fuel which contains both lead scavengers and tetra-alkyl lead, or like leaded petrol, which contains the lead additive mixture plus benzene, ranked 10<sup>th</sup> of the 41 chemicals] and with other carcinogenic exposures such as smoking:

For 41 chemicals there exist both reasonable data on carcinogenic potency in experimental animals and also a defined Permissible Exposure Level (PEL), which is the upper limit of legally permissible chronic occupational exposure for U.S. workers. These 41 agents are ranked by an index that compares the permitted chronic human exposure to the chronic dose rate that induces tumors in 50% of laboratory animals. This index, the Permitted Exposure/Rodent Potency index, or PERP, does not estimate absolute risks directly, but rather suggests the relative hazards that such substances may pose... Ranked by PERP, these chemicals are: ethylene dibromide, ethylene dichloride, 1,3-butadiene, tetrachloroethylene, propylene oxide, chloroform, formaldehyde, methylene chloride, dioxane, and benzene.

### **Q: do lead scavengers have other health impacts in humans?**

A: ATSDR (May 2006) states:

#### **Toxicology of Lead Scavengers**

...EDC [affects] the human central nervous system, lungs, and liver as well as... the cancer risk ...EDB [affects] the human stomach, adrenal glands, reproductive system, respiratory system, nervous system, liver, heart, and kidneys as well as... the cancer risk...

#### **5.3.2.4 Reproductive and Developmental Effects**

**EDB:** There is inconclusive but suggestive evidence that EDB may cause abnormal sperm and decreased male fertility (Ref. 5-1). A study of agricultural workers exposed to EDB used as a fumigant revealed statistically significant decreases in sperm counts and in the percentages of viable and motile sperm as well as significant increases in sperm with morphological abnormalities (Ref. 5-1). Another study concluded that human exposure to EDB concentrations between 0.5 and 5.0 ppm was associated with lower sperm counts (Ref. 5-8)...

#### **5.3.2.5 Mutagenic Effects**

**EDB:** EDB is a potent mutagen and can cause genetic damage, including point mutations, chromosomal aberration, and primary DNA damage in both *in vivo* and *in vitro* systems. Chromosomal aberrations and sister chromatid exchanges were seen in cultured mammalian cells (Ref. 5-22).

**EDC:** *In vitro* genotoxicity studies have shown that EDC can interact with human DNA and produce point mutations in human cells (Ref. 5-3).

**Q: what's the best way for an employer to get away with exposing worker's to a probably or possibly carcinogenic chemical and rest easy that they won't be liable for compensation payouts?**



A: expose the workers to a mixture of probably or possibly carcinogenic chemicals, such as the mixture that is leaded petrol. And ensure that no industrial process only exposes a worker to a single toxic chemical. That way, the worker can never prove that their cancers or other health impacts were caused by any one carcinogen or hazardous substance, and the IARC can write things like the following in their monographs.

Reference: IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, 1989, VOLUME 45 Occupational Exposures in Petroleum Refining; Crude Oil and Major Petroleum Fuels: Gasoline <http://publications.iarc.fr/63> states:

**Table 1. Composition by hydrocarbon type of typical automotive gasolines<sup>a</sup>**

Composition	Range
Alkanes	4–8 wt %
Alkenes	2–5 wt %
Isoalkanes	25–40 wt %
Cycloalkanes	3–7 wt %
Cycloalkenes	1–4 wt %
Total aromatics	20–50 wt %
Benzene	0.5–2.5 wt %
Paraffins (naphthenes)	30–90 vol. %
Olefins	0–30 vol. %
Aromatics	10–50 vol. %

<sup>a</sup>Adapted from CONCAWE (1985, 1987)

#### 4.5 Evaluation

...Benzene is carcinogenic to humans (Group 1)

...

Overall evaluation

Gasoline is possibly carcinogenic to humans (Group 2B).

Reference: IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 120: Benzene (2018), <http://publications.iarc.fr/576> states:

### **BENZENE**

#### 6.1 Cancer in humans

There is *sufficient evidence* in humans for the carcinogenicity of benzene. Benzene causes acute myeloid leukaemia in adults.



Positive associations have been observed for non-Hodgkin lymphoma, chronic lymphoid leukaemia, multiple myeloma, chronic myeloid leukaemia, acute myeloid leukaemia in children, and cancer of the lung.

#### 5.2.6 Other cancers [other than lung cancer]

Occupational cohort studies also reported data for several other cancer types and tumour sites, including cancer of the: nasal cavity, pharynx, larynx, and related sites; oesophagus; stomach; colon, rectum, and anus; pancreas; kidney; liver and biliary tract; prostate; bladder, brain, and central nervous system; and skin.

### 6.3 Overall evaluation

Benzene is *carcinogenic to humans (Group 1)*.

Ref: IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, 1999, VOLUME 71, Re-evaluation of Some Organic Chemicals, Hydrazine and Hydrogen Peroxide, <https://publications.iarc.fr/89> states:

1,2-DICHLOROETHANE

...

#### **4. Other Data Relevant to an Evaluation of Carcinogenicity and its Mechanisms**

...

#### **4.3 Reproductive and developmental effects**

##### 4.3.1 Humans

No data were available to the Working Group.

...

#### **4.4 Genetic and related effects**

##### 4.4.1 Humans

No data were available to the Working Group.

...

**5.2 Human carcinogenicity data**...All the cohort studies included workers with potential exposure to multiple agents and were not able to examine the excess risk associated with 1,2-dichloroethane.”

### **ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE)**

...

#### **4. Other Data Relevant to an Evaluation of Carcinogenicity and its Mechanisms**

...

#### **5.2 Human carcinogenicity data**

Three cohort studies have included workers exposed to ethylene dibromide, but because of their low statistical power and/or lack of information about individual exposures, little can be concluded about the carcinogenicity of this compound in humans.

...



### 5.5 Evaluation

There is *inadequate evidence* in humans for the carcinogenicity of ethylene dibromide.

There is *sufficient evidence* in experimental animals for the carcinogenicity of ethylene dibromide.

#### Overall evaluation

Ethylene dibromide is *probably carcinogenic to humans (Group 2A)*.

In making the overall evaluation, the Working Group took into consideration that ethylene dibromide is genotoxic in a broad range of in-vitro and in-vivo assays and binds covalently with DNA *in vivo*.

**Q: If you are a manufacturer of mixtures of hazardous chemicals (like the lead additive with its lead scavengers, that is mixed with petrol to make leaded petrol), what's the best way to control information about workers' exposures?**

A: be the only source of the information. For example, Associated Octel (now called Innospec, previously called Associated Ethyl Company Limited of London), manufacturer of the lead additive for petrol, wrote in 1994, in **Letter and Briefing from Associated Octel to Consumer's Health Forum of Australia**, March 24, 1995, titled "GASOLINE COMPOSITION: NO SUCH THING AS A "GREEN" FUEL" by Dr David Gidlow, Company Medical Officer, Associated Octel:

Associated Octel - one of the world's leading fuel technology companies - has been at the forefront in pressing for a re-evaluation of fuel composition and its risk to health. Indeed, the company's Worldwide Gasoline Survey is the only source of authoritative information on motor fuel composition available in the world.

**Q: How can a lead scavenger manufacturer best increase the volume of sales?**

A: by buying a tetra-ethyl lead manufacturer. According to Jamie Lincoln Kitman in "The Secret History of Lead", March 20, 2000, <https://www.thenation.com/article/secret-history-lead/> - in The Nation:

In 1989 Octel was sold to Great Lakes Chemical of West Lafayette, Indiana, makers of bromine and brominated chemicals, including EDB, the chemical scavengers used in ethyl gasoline to clear lead deposits from engines. In 1997 Great Lakes Chemicals spun off Octel into a separate company, which in 1998 was sold for \$430 million to a highly leveraged management team led by Octel's managing director (now CEO), Dennis Kerrison.

**Q: How much tetra-alkyl lead (total of tetra-ethyl lead and tetra-methyl lead) and lead scavengers are we talking about in New Zealand?**

A: again, Jamie Lincoln Kitman (2000) states:

Off the record, company officials admit they could be selling [tetra-alkyl] lead in 2020 and beyond. Until then, Octel, "through the specialist facilities of Octel Environmental, provides a range of decontamination, destruction, removal and





recycling services to refineries throughout the world to help to reduce the environmental impact of toxic lead residues." Under its Product Stewardship Programme--"a public service," Octel calls it--fifty tons of lead alkyl sludge were removed from New Zealand refineries as part of a cleanup beginning in 1996. Octel had supplied the refineries with 4,000 tons of TEL annually for years.

**Q: when Brian Arndt was working during refinery shutdowns (turnarounds), what hazardous chemicals (including carcinogens) was he likely exposed to?**

A: Appendix 5: Examples of Hazardous Agents...from *Management of Occupational Health Risks during Refinery Turnarounds*, by M. Molyneux, D. Bonte, P. De Wilde, J. Ilinyi, T. Kaitale, A. Tiltnes, B. Simpson, J. Urbanus (Technical Co-ordinator), CONCAWE (established 1963), Brussels 2000, <https://www.concawe.eu/wp-content/uploads/2017/01/2002-00233-01-e.pdf> - lists the following hazardous agents which require management during refinery shut-downs:

**CRUDE OIL**

- Hydrogen sulphide
- Sulphur dioxide

**PETROLEUM GASES**

- Propane
- 1,3-Butadiene

**NAPHTHA / GASOLINE /**

**CONDENSATE**

- Hydrocarbons C4-C11
- Benzene
- n-Hexane

**KEROSENE / MID DISTILLATES**

- Hydrocarbons C9-C25
- Gasoils (cracked and unspecified)

**HEAVY BOTTOMS**

- Heavy fuel
- Bitumen
- PAH / Coke

**LUBRICANTS**

- Unrefined oils
- Unrefined greases

**EXTRACTION SOLVENTS**

- Furfural
- Toluene
- Ketones, e.g. MEK
- Chlorinated solvents
- Phenol

**SULPHUR**

**ADDITIVES**

**PROCESS**

- Amines / Ammonia
- Phosphates / H<sub>2</sub>PO<sub>5</sub>
- Caustic / KOH
- Chlorides / HCl
- Sulphuric acid

**BOILER WATER**

- Hydrazine

**FUEL**

- Oxygenates
- TEL / TML
- Octylnitrate
- Mercaptans

***SURFACE STRIPPING / COATING***

**ABRASIVE BLASTING**

- Dust
- Lead

**HYDROBLASTING**

- Polluted water / aerosol

**APPLICATION OF PROTECTIVE COATINGS**

- Two part (reactive) coating
- Solvent based coating

**CHEMICAL CLEANING**

- Corrosives
- Solvents

***WELDING & CUTTING***

**FUMES**

- Lead
- Metal oxides (Galvanized steel)
- Stainless steel (Ni, Cu)
- Carbon steel
- Surface coatings

**GASES**

- Ozone
- NOx
- Carbon monoxide

***INSULATION REMOVAL / INSTALLATION***

**MMMF**

- Glasswool

**REFRACTORY CERAMIC FIBRES**

**ASBESTOS**

**POLYURETHANE**

- Isocyanates

***CATALYST REMOVAL / LOADING / REGENERATION***



ACTIVATED ALUMINA  
HEAVY METALS

- Molybdenum
- Cobalt
- Platinum
- Vanadium
- Antimony
- Nickel

ORGANIC SULPHIDES

- Dimethyl disulphide
- Dimethyl sulphide

CHLORINE

CHLORINATED HYDROCARBONS

- Perchloroethylene
- HYDROGEN FLUORIDE
- SULPHURIC ACID

**UTILITIES**

- NITROGEN
- HEAT TRANSFER OILS
- HYDRAZINE
- POLYAMINES Eye
- PCBs

**Q: which other carcinogens and mutagens does Shell list as chemical hazards for refinery workers?**

A: Table 7a (i) Refinery: Chemical Agent Inventory: Examples of chemical agents and the principal areas in which they may occur, from "Shell Occupational Health Hazard Inventory", web-published by Petroleum Development Oman on 6th May 2012, available as link at: [https://www.pdo.co.om/hseforcontractors/Health/Documents/Forms/AllItems.aspx?Paged=TRUE&p\\_SortBehavior=0&p\\_FileLeafRef=PDO%20HEALTH%20HAZARD%20REGISTER%20122016%2exlsx&p\\_ID=370&RootFolder=%2fhseforcontractors%2fHealth%2fDocuments%2fHRAs&PageFirstRow=31&View={CA6B6393-9515-41E4-8223-61BADE2DAB33}](https://www.pdo.co.om/hseforcontractors/Health/Documents/Forms/AllItems.aspx?Paged=TRUE&p_SortBehavior=0&p_FileLeafRef=PDO%20HEALTH%20HAZARD%20REGISTER%20122016%2exlsx&p_ID=370&RootFolder=%2fhseforcontractors%2fHealth%2fDocuments%2fHRAs&PageFirstRow=31&View={CA6B6393-9515-41E4-8223-61BADE2DAB33}) includes among refinery carcinogens and mutagens:

Products: Gasolines (contain benzene); Streams containing PCAHs (Polycyclic Aromatic Hydrocarbons) - Gas oils, Heavy fuel oils, Cycle oils, Crude oil; 1-3 Butadiene (may contaminate LPG streams)

Internal streams: Low boiling naphthas (benzene); Streams containing PCAHs including Base oils, Gasoil, Heavy fuel oil, Long/short residues, Waxy distillate

Raw materials: Crude oil (PCAHs and benzene); Low boiling naphthas (Benzene); Benzene heart cut; Long residues (PCAHs); Waxy distillate (PCAHs); Furfural extract (concentrated PCAHs); Gas oils (PCAHs); Light cycle oils (PCAHs)

Auxilliary chemicals: Hydrazine salts; crystalline silica (calcined diatomaceous earths, filter aids); Fuel oils (PCAHs furnace heating)

By-product/Wastes: Furfural extract (concentrated PCAHs); Slops containing PCAHs; Coke (PCAHs); Sludges from black oil tank bottoms (PCAHs); Furnace residues (nickel compounds); Some used transformer oils (PCBs)

Maintenance, construction and cleaning: Asbestos (gaskets, insulation, partitions); Some man-made vitreous fibres (furnace linings, insulation); Chromates (some paints); Chromium (VI) stainless steel welding fume (e.g. furnace tubes); Nickel in anti-seize compounds; Used engine oil (PCAHs).



# Associations between Brian Arndt's non-cancer health issues and his occupational exposures

Collated by Elizabeth O'Brien, The LEAD Group Inc

## Erectile dysfunction and lead exposure

*Health Impacts of Lead Poisoning - A preliminary listing of the health effects & symptoms of lead poisoning* - updated January 2014 and April 2018 – by Vella, Vance; O'Brien, Elizabeth; Idris, Elisa; Wibowo, Erik; Zhu, Hugh Xin Xi; & Choong, Emily, The LEAD Group, <https://www.lead.org.au/fs/fst7.html> includes:

### Perinatal Development and Reproductive Health Effects

#### Adults

Erectile dysfunction, impotence (3) (Reference 3: National Research Council (US). (1993). **Measuring lead exposure in infants children and other sensitive populations**. National Academy Press, Washington DC. )

*NTP Monograph on Health Effects of Low-Level Lead: Appendix E: Human Studies of Reproductive and Developmental Effects of Lead Considered in Developing Conclusions*, by NTP (National Toxicology Program), US Department of Health and Human Services (DHHS), 13<sup>th</sup> June 2012,

[http://ntp.niehs.nih.gov/NTP/ohat/Lead/Final/LeadAppendixE\\_Final\\_508.pdf](http://ntp.niehs.nih.gov/NTP/ohat/Lead/Final/LeadAppendixE_Final_508.pdf) states:

In a case control study by Anis (2007) in Cairo Egypt: Blood Pb and penile cavernous tissue Pb was higher in men with erectile dysfunction. Reference: Anis TH, ElKaraksy A, Mostafa T, Gadalla A, Imam H, Hamdy L, Abu el-Alla O. 2007. Chronic lead exposure may be associated with erectile dysfunction. *J Sex Med* 4(5): 1428-1434; discussion 1434-1426. [https://www.jsm.jsexmed.org/article/S1743-6095\(15\)31652-0/fulltext](https://www.jsm.jsexmed.org/article/S1743-6095(15)31652-0/fulltext)

*Chronic lead exposure may be associated with erectile dysfunction*, by Tarek H. Anis, MD, Ahmed ElKaraksy, MD, Taymour Mostafa, MD, Amr Gadalla, MD, Hager Imam, PhD, Lamy Hamdy, PhD, Omayma Abu el-Alla, PhD, in *J Sex Med*. 2007 Sep;4(5):1428-34; discussion 1434-6. <https://www.ncbi.nlm.nih.gov/pubmed/17727353> states in the

#### Abstract:

**INTRODUCTION:** Heavy metals constitute significant potential threats to human health in both occupational and environmental settings. Research examining the etiology of lead toxicity-induced hypertension reveals that the free radical production and lowering of inherent antioxidant reserves resulting from lead



toxicity are directly related to vasoconstriction underlying lead-induced hypertension. A similar mechanism would affect smooth muscle relaxation in the cavernous tissue leading to erectile dysfunction (ED).

**AIM:** Is to study the possible hazardous effect of chronic lead exposure on the erectile function, and to document the deposition of lead in the cavernous tissue.

**METHODS:** ...Sixteen of the 34 patients [with ED in the study group], and none of the 15 controls, had elevated lead serum levels (above 25 µg/dL)....

**RESULTS:** The ED group had significantly higher blood lead level when compared with the control group. A significant positive correlation was found between the blood lead level and cavernous tissue lead level of the ED group. Individuals with high blood lead had significantly higher levels of serum ROS and significantly lower levels of serum antioxidants, compared with those having low blood lead. Histological sections from patients with high blood lead showed deposition of grayish lead granules in the cavernous tissue.

#### **CONCLUSIONS:**

Chronic lead exposure may be associated with ED [erectile dysfunction].

#### **Lead was recognized as a reproductive toxicant 2000 years ago**

Chapter 6 on *Lead Exposure and Its Effects on the Reproductive System*, by Rebecca Z. Sokol Department of Obstetrics and Gynecology and Medicine Keck School of Medicine, University of Southern California, in *Metals, Fertility, and Reproductive Toxicity*, edited by Mari S Golub, CRC/Taylor and Francis, Boca Raton, 2006, <https://epdf.pub/metals-fertility-and-reproductive-toxicity.html> begins:

Greek physicians described lead poisoning over 2000 years ago. Both the Greeks and the Romans recognized lead as an abortifacient and a reproductive toxicant.... Since the 1970s, animal and clinical studies have documented reproductive toxicity in both men and women exposed to lead in their workplace and in their environment.

#### **Brian Arndt may well have been exposed to vanadium, another reproductive toxicant in the petrol**

Adverse Effects of Aluminum, Uranium, and Vanadium on Reproduction and Intrauterine Development in Mammals Jose L. Domingo Laboratory of Toxicology and Environmental Health, School of Medicine, "Rovira i Virgili" University, Reus, Spain, in the Golub book: includes:





Vanadium is also one of the metallic components contained in crude petroleum oils... [in mammals] reproductive and developmental toxicity have been demonstrated to occur following vanadium exposure.

### **Workplace hazards which cause infertility can only be observed by the absence of offspring**

In his review of the above Golub book, *Book Review: Metals, Fertility and Reproductive Toxicity*, 27th March 2006, Professor Chris Winder (late, of The LEAD Group's Technical Advisory Board) - +

(from Professor Winder's archives he donated to The LEAD Group's Library), he made the pertinent observation (considering that Brian Arndt had one child before he began working at the refinery and developed erectile dysfunction soon after working there, and fathered no further children) that:

Effects on fertility, reproduction and development are one health consequence where it is difficult in the main, to show that a workplace or an environmental hazard has produced an adverse effect. The causes of the majority of birth defects are invariably unknown, as is the aetiology of the majority of malformations. As well as observable adverse effects, one major end result of reproductive or developmental problems is infertility, which can only usually be measured by observing an absence of reproductive outcome.

### **Shell says refinery organic lead additives (TEL/TML) are “toxic to reproduction”**

Reference: *Table 7a (i) Refinery: Chemical Agent Inventory: Examples of chemical agents and the principal areas in which they may occur*, from “Shell Occupational Health Hazard Inventory”, web-published by Petroleum Development Oman on 6th May 2012, available as link at:

[https://www.pdo.co.om/hseforcontractors/Health/Documents/Forms/AllItems.aspx?Page=TRUE&p\\_SortBehavior=0&p\\_FileLeafRef=PDO%20HEALTH%20HAZARD%20REGISTER%20122016%2exlsx&p\\_ID=370&RootFolder=%2fhseforcontractors%2fHealth%2fDocuments%2fHRAs&PageFirstRow=31&&View={CA6B6393-9515-41E4-8223-61BADE2DAB33}](https://www.pdo.co.om/hseforcontractors/Health/Documents/Forms/AllItems.aspx?Page=TRUE&p_SortBehavior=0&p_FileLeafRef=PDO%20HEALTH%20HAZARD%20REGISTER%20122016%2exlsx&p_ID=370&RootFolder=%2fhseforcontractors%2fHealth%2fDocuments%2fHRAs&PageFirstRow=31&&View={CA6B6393-9515-41E4-8223-61BADE2DAB33})

### **Balance problems and lead exposure**

*Health Impacts of Lead Poisoning - A preliminary listing of the health effects & symptoms of lead poisoning* - updated January 2014 and April 2018 – by Vella, Vance; O'Brien, Elizabeth; Idris, Elisa; Wibowo, Erik; Zhu, Hugh Xin Xi; & Choong, Emily, The LEAD Group, <https://www.lead.org.au/fs/fst7.html> includes:



## **Peripheral nervous system**

Proprioceptive pathways involved in balance altered (2) (Reference 2: Silbergeld, E. K. (1992). **Neurological perspective on lead toxicity. In Human Lead Exposure**, ed H. L. Needleman, CRC Press.)

## **Balance problems and exposure to gasoline fumes**

*Gasoline poisoning*, Updated by: Jesse Borke, MD, FACEP, FAAEM, Attending Physician at FDR Medical Services/Millard Fillmore Suburban Hospital, Buffalo, NY. Also reviewed by David Zieve, MD, MHA, Medical Director, Brenda Conaway, Editorial Director, and the A.D.A.M. Editorial team; Medline Plus, US National Library of Medicine, 16th October 2017, <https://medlineplus.gov/ency/article/002806.htm> includes the following symptoms of exposure to gasoline/petrol fumes:

### **Symptoms**

Gasoline poisoning can cause symptoms in various parts of the body:...  
NERVOUS SYSTEM...

- Dizziness...
- Staggering

## **Psychotic dreaming and exposure to Tetraethyl Lead (TEL) or Tetramethyl Lead (TML)**

See 19651208 Dept of Health letter re considerable risk of lead poisoning from handling leaded sludge in this newsletter.

The abovementioned 8<sup>th</sup> December 1965 Letter on behalf of New Zealand Division of Public Health Director to the Medical Officer of Health to Director-General of Health notes that worker's exposure to leaded [petrol tank] sludge must be medically supervised, including blood or urine lead surveillance and that:

The warning sign [of organic lead poisoning] is considerable dreaming, usually of an unpleasant content.

*Handbook on the Toxicology of Metals*, Edited by Lars Friberg, Gunnar F Nordberg and Velimir B Vouk, Elsevier/North-Holland Biomedical Press, Amsterdam, New York, Oxford 1979 says on page 477:

The toxic effects of tetramethyllead do not differ essentially from those of TEL...

The earliest symptom of TEL poisoning is insomnia, and the main organ affected is the central nervous system. The poisoning is usually acute, developing into toxic



psychosis with hallucinations, delusions, excitement and bad dreams, and may result in death.

And on page 478:

The most important measure for detecting accidental exposure and for preventing early effects of TEL is the periodic monitoring of urinary lead levels and lead concentrations in the air of working environments.

*Toxnet - Hazardous Substances Data Bank (HSDB), Toxicology Data Network, US National Library of Medicine, US National Institutes of Health: TETRAETHYL LEAD - CASRN: 78-00-2, by Toxnet - Toxicology Data Network, US National Library of Medicine, US National Institutes of Health, reviewed 8<sup>th</sup> May 2008, <https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+841> includes:*

### **Clinical Effects:**

#### 0.2.1 SUMMARY OF EXPOSURE

##### 0.2.1.1 ACUTE EXPOSURE

Severe **exposure [to TETRAETHYL LEAD] leads** to delusions, hallucinations, mania, **psychotic** behavior, ...

#### 0.2.7 NEUROLOGIC

##### 0.2.7.1 ACUTE EXPOSURE

A) Clinical neurologic effects of TEL intoxication can be divided into MILD, MODERATE, and SEVERE.

B) MILD - Anxiety, irritability, insomnia, lurid dreams, anorexia, metallic taste, dizziness, pallor, lassitude, tremor, incoordination, and cerebellar ataxia.

C) MODERATE - Disorientation, hyperexcitability, hyperreflexia, and lurid dreams, tremors, and chorea.

### **Metabolism/Pharmacokinetics:**

#### **Metabolism/Metabolites:**

..... Tetramethyl lead (TML) is metabolized more slowly than tetraethyl lead (TEL) to the trialkyl derivative, and hence is considered somewhat less toxic than TEL; however, it is more volatile than TEL, and thus probably is more available for respiratory absorption.



## **The association of hypertension with lead exposure**

*Health Impacts of Lead Poisoning - A preliminary listing of the health effects & symptoms of lead poisoning* - updated January 2014 and April 2018 – by Vella, Vance; O'Brien, Elizabeth; Idris, Elisa; Wibowo, Erik; Zhu, Hugh Xin Xi; & Choong, Emily, The LEAD Group, <https://www.lead.org.au/fs/fst7.html> includes:

### **Adult**

#### **Cardiovascular and circulation**

Hypertension, elevated blood pressure (2,14,17,22,35,38,60)

(Reference 2: Silbergeld, E. K. (1992). **Neurological perspective on lead toxicity. In Human Lead Exposure**, ed H. L. Needleman, CRC Press;

Reference 14: Wedeen R. P. (1992). **Lead, the kidneys and hypertension.** In Human Lead Exposure, ed H. L. Needleman, CRC Press;

Reference 17: Schwartz, J. (1992). **Lead, blood pressure and cardio-vascular disease** In Human Lead Exposure, ed H. L. Needleman, CRC Press;

Reference 22: Hu, H., Pepper, L. & Goldman, R. **Effect of repeated occupational exposure to lead, cessation of exposure, and chelation on levels of lead in bone..** American Journal of Industrial Medicine 1991;20(6):723-35. <http://www.ncbi.nlm.nih.gov/pubmed/1805610> Abstract.;

Reference 35. Royce, S. E. (1992). **Lead toxicity.** US Dept of Health and Human Services Agency for Toxic Substances and Disease Registry. Sept . <http://wonder.cdc.gov/wonder/prevguid/p0000017/p0000017.asp> ;

Reference 38: Werbach, M. F. (1997). **Foundations of nutritional medicine.** Third Line press, Tarzana California;

Reference 60: National Toxicology Program (NTP). **NTP Monograph on Health Effects of Low-Level Lead.** U.S Department of Health and Services 2012.)

NTP Monograph on Health Effects of Low-Level Lead: Appendix C: Human Studies of Cardiovascular Effects of Lead Considered in Developing Conclusions, by National Toxicology Program (NTP), US Department of Health and Human Services (DHHS) 2012, [http://ntp.niehs.nih.gov/NTP/ohat/Lead/Final/AppendixC-CardioEffects-prepublication\\_508.pdf](http://ntp.niehs.nih.gov/NTP/ohat/Lead/Final/AppendixC-CardioEffects-prepublication_508.pdf); (ie the abovementioned Reference 60: NTP Monograph) lists the Prospective Cheng (2001) study in Boston, MA, USA with a study population described as:

519 men in the Normative Aging Study who were not hypertensive when baseline Pb levels were measured and followed for 3 to 6 years (n=474);





Year 1991-1997; Male = 100%

And observed effect:

Bone Pb [bone lead measured by XRF] was significantly associated with higher BP [blood pressure] 3 to 6 years later, but blood Pb [blood lead] was not associated. [Reference: Cheng Y, Schwartz J, Sparrow D, Aro A, Weiss ST, Hu H. 2001. Bone lead and blood lead levels in relation to baseline blood pressure and the prospective development of hypertension: the Normative Aging Study. *Am J Epidemiol* 153(2): 164-171.]

Thus the importance of the availability of bone XRF machines!!

Lead, Ageing and Death, by Ewan MacAulay McDonnell (revision of original factsheet by Alycia Bailey, The LEAD Group Inc, 20<sup>th</sup> April 2008, <https://lead.org.au/fs/fst24.html> includes:

Adults who have been exposed to lead in the workplace and at home throughout their lives are more susceptible to lead-related health risks such as cardiovascular disease, high blood pressure (hypertension), stroke, renal failure and osteoporosis. ([5](#); [6](#); [7](#); [9](#); [10](#))

Reference 5: Chicago Tribune, 20021227, Kotulak, Ronald , "**Study links early adult deaths to lead - 30 million in U.S. could be at risk**"  
[http://inchesnetwork.net/updates\\_jan03\\_36.htm](http://inchesnetwork.net/updates_jan03_36.htm)

Reference 6: Hu, Howard; Aro, Antonio; Payton, Marinelle; Korrick, Susan; Sparrow, David; Weiss, S & Rotnitzky A, "**The Relationship Of Bone And Blood Lead To Hypertension - The Normative Aging Study** [abstract]"  
<http://www.ncbi.nlm.nih.gov/pubmed/8609684?dopt=Abstract>

## **Crumbling teeth and lead poisoning**

George W. Kell Esq pages 58-60 in AFFIDAVITS Safe Water Association Incorporated (Plaintiff) vs Fond du Lac County (Defendant) PRESS RELEASE June 30 1993: Judge Grimm found fluoridation harmful but did not have the power to "enjoin" (forbid) the practice, State of Wisconsin Circuit Court, Fond Du Lac County, at [https://firewaterfilm.files.wordpress.com/2013/04/affidavits-safe-water-assn\\_plaintiff-vs-fond-du-lac\\_defendant.pdf](https://firewaterfilm.files.wordpress.com/2013/04/affidavits-safe-water-assn_plaintiff-vs-fond-du-lac_defendant.pdf) claims:

I found several texts which discussed chronic lead poisoning, and the symptoms of chronic lead poisoning closely paralleled, to the point of almost virtual identity, those symptoms that I had been experiencing.

The reason for this: lead and fluoride are both "free radicals", which assault the enzymes, and impairment of various enzymes was the cause of my physical deterioration [including brittle and crumbling teeth].



# Lead Poisoning – ACC Review Issue 16 (March 2005)

[By Accident Compensation Corporation (ACC), New Zealand. Previously at [http://www.acc.co.nz/for-providers/clinical-best-practice/acc-review/WCM2\\_020299](http://www.acc.co.nz/for-providers/clinical-best-practice/acc-review/WCM2_020299) accessed 8th April 2011 - not found online on 28 Sept 2019. *Editor's Note*: only information related to adults has been retained for this version for *LEAD Action News*]

[ACC - Prevention, Care, Recovery](#)

[For Providers](#)

[Clinical best practice](#)

[ACC Review](#)

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Issue 16 March 2005

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General points

Lead is a bio-accumulative toxin and prolonged and/or heavy exposure can give rise to a wide range of adverse health effects

Diagnostic criteria include clinical features and/or evidence of end organ damage in association with elevated blood lead level...

Risks to the foetus may occur at lower blood levels than those associated with other adverse effects. Care is required to minimise exposure during pregnancy

Treatment includes removing the source of excess exposure, plus chelating agents for certain specific toxic effects and/or particularly high blood levels



Lead poisoning is a serious-harm illness of occupation and is notifiable under the Health and Safety in Employment Act 1992.

## Background

Lead is bio-accumulative, with a half-life of about 30 days in blood and soft tissues, but is released only very slowly from bone. It causes dose-related dysfunction of the nervous, hematopoietic, gastro-intestinal, renal, endocrine and musculoskeletal systems. In New Zealand, normal levels in the general population can range up to 0.50 umol/L [0.50 micromoles of lead per litre of blood is equivalent to 10.36 micrograms/decilitre or 10.36 ug/dL] in men, 0.35 umol/L [7.25 ug/dL] in women and 0.55 umol/L [11.40 ug/dL] in children.

Blood levels of 0.72 umol/L (15 ug/dL) or more are notifiable to the Ministry of Health under Section B, Second Schedule of the Health Act 1956. Occupational lead poisoning is notifiable under section 25 of the Health and Safety in Employment Act 1992, at whole blood levels of 2.6 umol/L (53ug/dL).

## Prevalence and risk

In New Zealand in 2003, 119 cases of lead poisoning were notified, of which 5 were hospitalised. Children ( $\leq 14$  years) accounted for 21 cases. The next highest age-specific rate was 40–49 year olds. Most of the occupational exposures were for painters, builders, plasterers, sanders and foundry workers.<sup>1</sup> Inhalation, especially of fumes from burning lead based paint, is the key mode of occupational exposure.

Adults absorb around 10% through ingestion and practically none through skin. ... Other sources include lead dust (e.g. brought home on clothes), drinking from unglazed vessels or lead pipes.

## Diagnosis and clinical features of poisoning

Multi-system signs and symptoms, albeit subtle, are a key diagnostic feature<sup>(2)</sup>. Blood level is the most informative biomarker but not the sole diagnostic consideration given individual differences in susceptibility at different blood levels. In some adults, symptoms may manifest at blood lead levels of 1.95 umol/L (40 ug/dL), but in others at  $\geq 3.40$  umol/L ( $\geq 70$  ug/dL)<sup>(3)</sup>. The rate and duration of blood lead elevation can influence effects at any given level. Blood levels may indicate current exposure as well as long term release from bones. Hair analysis and post-chelation urinary levels may not be reliable tests for toxicity....

In adults, common symptoms include abdominal pain, fatigue, arthralgia, decreased libido, headache, irritability, impotence, depression, anorexia, muscle pain and/or weakness, change in bowel habits, weight loss and paresthesiae<sup>(5)</sup>. Impaired short-term memory, concentration, reaction time, mood, verbal concept formation and visuospatial functions may appear at  $\geq 1.95$ – $2.45$  umol/L ( $\geq 40$ – $50$  ug/dL). Slowed nerve conduction velocities (e.g. small motor fibres of the ulnar nerve) can occur around  $\sim 1.45$ – $3.4$  umol/L ( $\sim 30$ – $70$  ug/dL) but peripheral neuropathy (muscle weakness with minimal sensory loss) is rare below 2.90 umol/L ( $<60$  ug/dL). Overt neurological signs are not usual until levels exceed 2.90–3.90 umol/L (60–80 ug/dL) for several months. Neurological and gastrointestinal effects are often less marked in chronic poisoning.



Severe encephalopathy is rare under 4.85 umol/L (<100 ug/dL) but has been described in children at ~3.4 umol/L (~70 ug/dL). Mild to moderate anaemia has been found in 5% of adults with levels of 1.95–2.85 umol/L (40–59 ug/dL)(6).

However, frank anaemia does not usually develop until levels exceed 3.85 umol/L (>80 ug/dL) for a prolonged period.

Renal changes are not uncommon(7). Exposure for years, especially at levels  $\geq 3.85$  umol/L ( $\geq 80$  ug/dL) increases the risk of chronic insufficiency but rarely progresses to renal failure. Decreased uric acid clearance occurs with the risk of 'saturnine' gout. There is some evidence to suggest that levels of 0.95–1.95 umol/L (20–40 ug/dL) may be associated with a rise in systolic blood pressure (0.5–3.0 mmHg).

Decreased sperm counts have been observed at 1.95 umol/L (40 ug/dL) and abnormal morphology and motility at mean levels of ~2.55 or 2.95 umol/L (~53 or 61 ug/dL). Decreased female fertility has been described mainly in the context of high exposure.

Significant associations exist between lead levels and pre-term birth, lower birth weight, reduced post-natal growth, increased incidence of minor congenital abnormalities,(8) and early deficits in post-natal neurological or neurobehavioral status. Mild foetal impairment may occur at maternal levels of 0.75–0.95 umol/L (15–20 ug/dL)(9)(10). There is little evidence of major congenital malformations.

## Management

The key to managing chronic lead toxicity is to identify and remove the source of exposure. Clinical management involves treatment of life-threatening effects, minimising absorption, and enhanced elimination.

Activated charcoal does not bind lead. However, absorption may be reduced in some situations by timely gastric emptying procedures or whole bowel irrigation.

Chelation is recommended when blood levels reach 2.15 umol/L (45 ug/dL) in children or 3.40 umol/L (70 ug/dL) in adults, and/or where there is encephalopathy, neuropathy, anaemia, nephropathy, severe abdominal colic, arthralgia or myalgia.... In severe acute cases, hospitalisation and dimercaprol followed four hours later by calcium disodium edetate, for five days is favoured. Oral DMSA (dimercaptosuccinic acid) is the preferred oral therapy....

In the workplace, three successive levels of  $\geq 2.6$  umol/L ( $\geq 54$  ug/dL) require suspension from work. A slightly lower suspension level of  $\geq 2.4$  umol/L ( $\geq 50$  ug/dL) applies in Australia, with a return to work level of 1.93 umol/L (~40 ug/dL), with lower levels for females of reproductive capacity.

## Issues relevant for ACC

Patients with a raised blood lead level and evidence of personal injury (anatomical derangement or functional impairment) as a result of their employment are eligible for cover. In the absence of personal injury, weekly-earnings compensation for time off work to reduce blood lead levels is unlikely to be payable, as there is no incapacity secondary to personal injury.





## References

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Rempel D. The lead-exposed worker. *J Am Med Assoc* 1989;262:532

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The environmental case management of lead exposed persons. Guidelines for Public Health Services. Ministry of Health; 1998.




# 19820112 New Zealand Refining Co Renewal of Licence application

FORM 3

In completing this form please refer to the Clean Air (Licensing) Regulations 1973 and their schedules.

## Application for Renewal of Licence to Carry on Scheduled Process. Section 28(1) CLEAN AIR ACT 1972

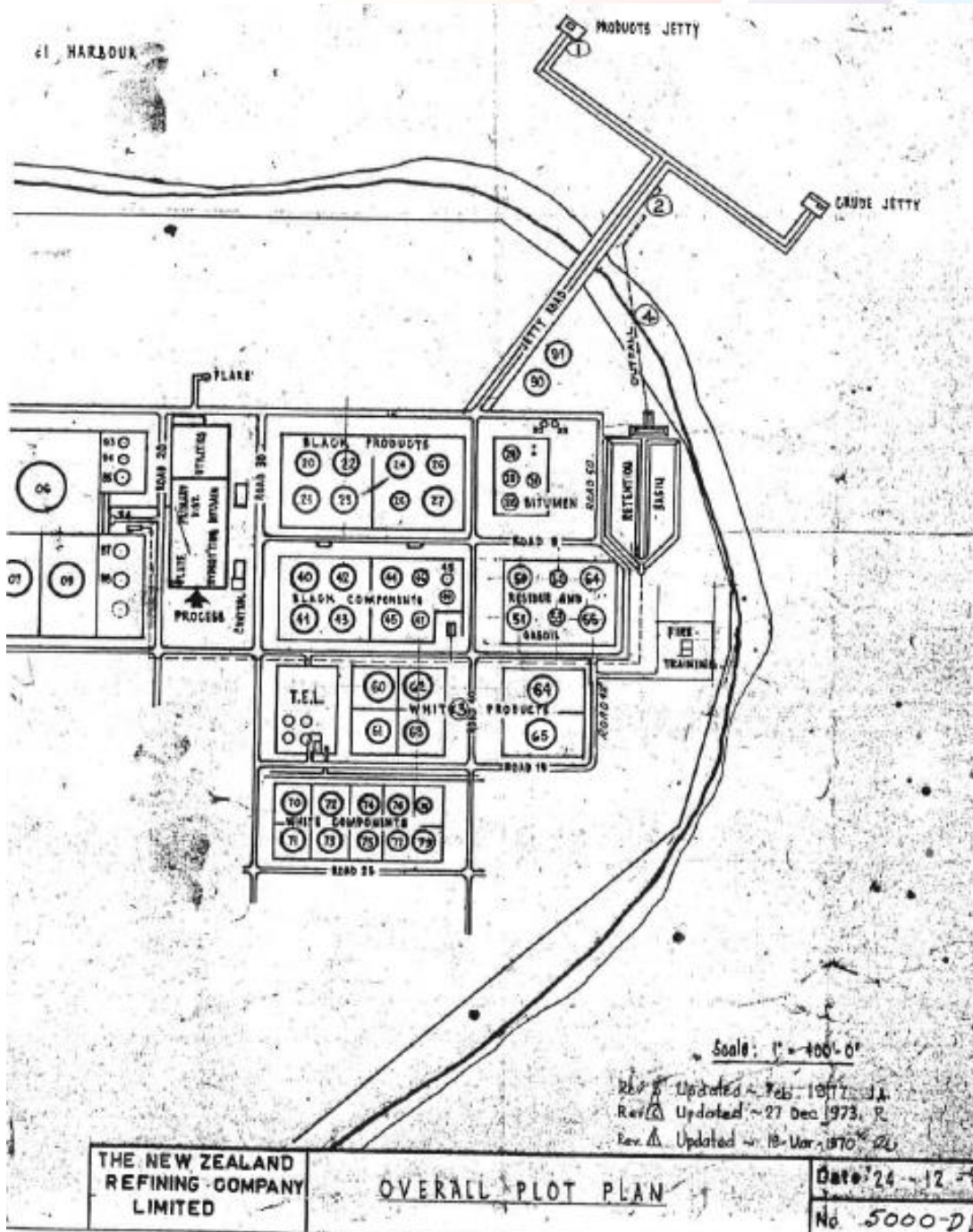
TO	WHANGAREI COUNTY COUNCIL, COUNTY CHAMBERS, SPRINGS FLAT, KAMO <small>Name and address of local authority</small>
APPLICANT	THE NEW ZEALAND REFINING COMPANY LIMITED PO BOX 44 WHANGAREI <small>Name and address</small>
LICENCE	HD/02/0003/81 DATED 28 JULY 1981 <small>Number of current licence and date of issue</small>
PREMISES	MARSDEN POINT RUAKAKA <small>Full address</small>
APPLICATION RELATES TO	OPERATION OF AN OIL REFINERY ENCOMPASSING THE FOLLOWING PROCESS UNITS: (A) CRUDE DISTILLER (B) HYDROTREATER (C) PLATFORMER (D) HYDRODESULPHURISER (E) BITUMEN UNIT  TOGETHER WITH THE NECESSARY ANCILLARIES AND OFFSITE EQUIPMENT  <small>Insert full particulars, identifying individually the processes for which renewal of the licence is required</small>

1. OCCUPIER	THE NEW ZEALAND REFINING COMPANY LIMITED PO BOX 44, WHANGAREI <small>Name and address</small>
2. CLEAN AIR ZONE	The premises <del>xxx</del> or ARE NOT situated in a Clean Air Zone
3. LEGAL DESCRIPTION OF THE LAND	SECTION 2 BLOCK VIII RUAKAKA SURVEY DISTRICT. DESCRIBED IN THE SPECIAL LEASE 5374 REGISTERED IN VOL 1310 FOLIO 6 OF THE NORTH AUCKLAND REGISTRY
4. COMMUNICATIONS REGARDING THIS APPLICATION TO BE SENT TO	MR F.C.A. ROOS (TECHNICAL MANAGER) THE NEW ZEALAND REFINING COMPANY LIMITED PO BOX 44, WHANGAREI TELEPHONE RUAKAKA 27-011 <small>Name, address, telephone number of and position held by responsible person</small>
5. FEE OF \$60.00. IS ENCLOSED.	
DATED AT MARSDEN POINT THIS 12TH DAY OF JANUARY 1982	
This application is to be in triplicate	
 <small>Signature of applicant</small>	

**Brian Arndt:** of note no mention of Lead Transfer and Blending Plant.



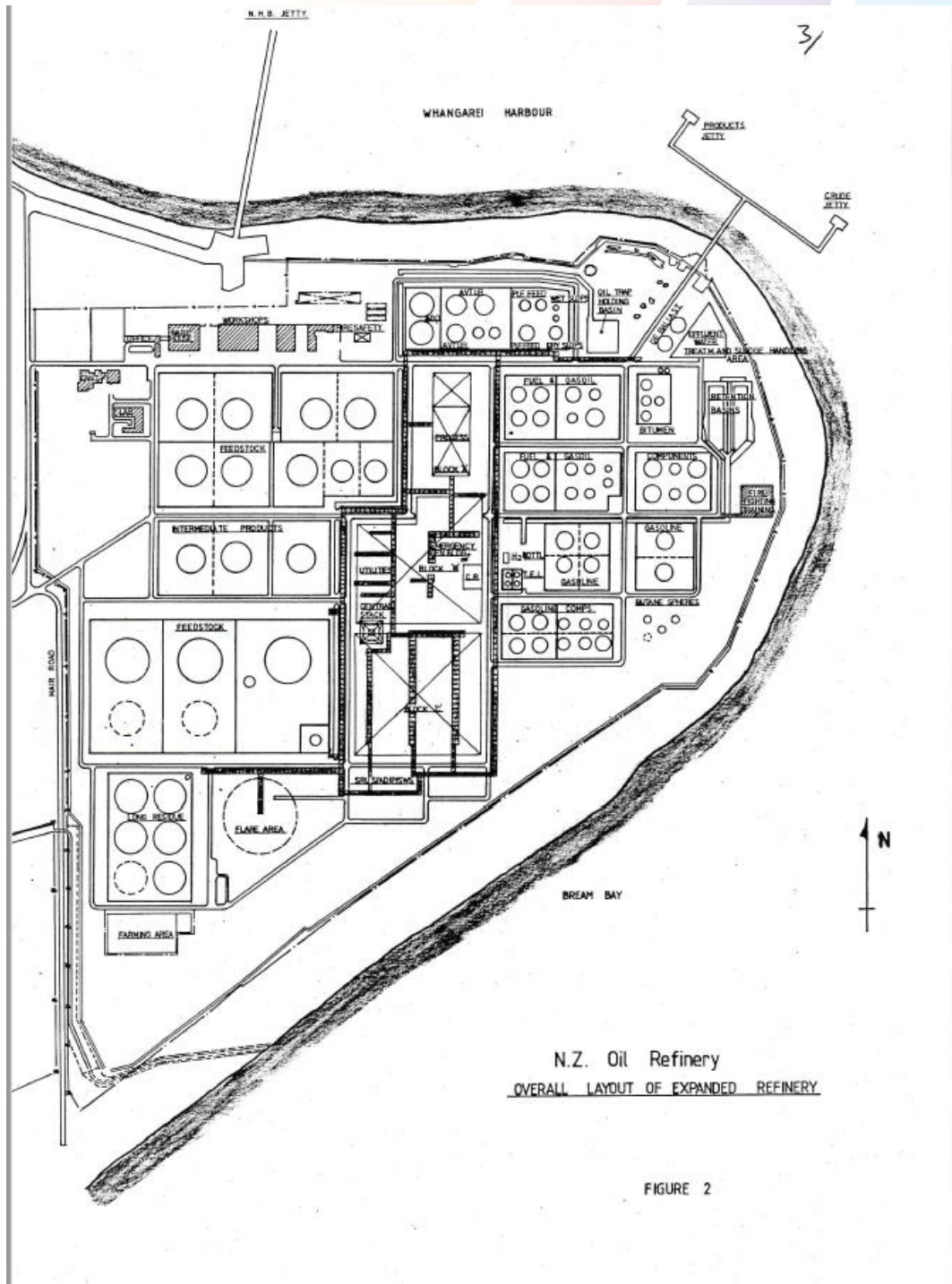
# 19661224-197702 New Zealand Refining Co Ltd Overall Plot Plan



This 24<sup>th</sup> December 1966 plan updated in February 1977 clearly shows the TEL (Tetra Ethyl Lead) Plant at the centre lower half (between the Black Components and the White Components) on the New Zealand Refining Company Limited overall plot plan. Yet when Brian Arndt was talking to the Professor who runs the New Zealand Register of Poisons and Toxic Substances, he [the Professor] was amazed that they had no record of the Lead Plant at Marsden Point Refinery.



# 1978 or 1979 NZ Refining Co Proposed Extensions showing Gasoline Comps (TEL plant)



Brian Arndt: Above is the Proposed Plan of New Zealand Refining Company Limited Plant Extensions, believed drawn late 1970's. TEL Plant shown centre right by Gasoline Compound.





# 19790125 Northern Advocate article: Doctors back campaign for safer petrol in New Zealand

Includes:

Marsden Pt refined petrol is boosted by twice the amount of lead as that of most European countries and the lead content has been condemned by scientists and health authorities as a cause of brain damage in children.

## Doctors back campaign for safer petrol

25 179

Pressure is mounting in Whangarei to get the lead out of our petrol and save the mental and physical health of our children.

Marsden Pt refined petrol is boosted by twice the amount of lead as that of most European countries and the lead content has been condemned by scientists and health authorities as a cause of brain damage in children.

Today Whangarei paediatrician Dr Donald Beasley and the medical officer of health in Whangarei, Dr J. S. McKenzie-Pollock, added their support to a drive for lead-free petrol for New Zealand.

And the Victorian Government has asked the Australian National Health and Medical Research Council to investigate claims that lead released by car exhaust can cause a cut in children's IQ levels.

Dr Beasley, who has a special interest in the diseases of children, has made unsuccessful approaches to the Government about the dangers of lead.

Today he supplied the Advocate with an American campaign label button exhorting Americans to "get the lead out."



DR BEASLEY

"In high proportions it can cause severe mental retardation and even small amounts can cause a loss of five to 10 points of IQ.

"I'm personally concerned and have been aware of the danger for many years.

"We have to work toward reducing, ultimately to zero, the lead in our petrol.

"Public opinion several years ago resulted in legislation which took the lead out of paint.

"I would strongly support a new approach to the Government about the lead in petrol. If we can get something started in Whangarei I think we could get somewhere nationally."

### WORRIED

Dr McKenzie-Pollock said he and a lot of people were worried about the effects of lead poisoning from car exhausts and he would "certainly" strongly support any move to reduce lead in the environment.

"It's a fact lead from any source does cause brain damage and I will do everything I can to reduce the amount.

"It's a national problem not only a local one and anything we can do to reduce lead in the community the better.

"This could cause

affects the mental growth of children."

He could not volunteer any technical suggestions for getting the lead out of petrol but said he thought health departments were "stronger" than big oil companies.

Visiting British science professor Mr D. Bryce-Smith told the Advocate on Monday the addition of lead to boost octane ratings in petrol was "a sloppy alternative to good refining".

In Auckland to address a science congress, Mr Bryce-Smith sharply criticised New Zealand-refined petrol for its lead which he said "gets pumped out of car exhausts for the 'benefit' of children on the streets."

Victorian Health Minister, Mr Vasey Houghton said yesterday he was concerned at the statement made by Professor Derek Bryce-Smith at the conference in New Zealand.

Mr Houghton said he had decided to refer the question to the Australian National Health and Medical Research Council with a request that it examine any possible dangers and report its findings as soon as possible.

On January 18, it was announced that the amount of lead allowable in petrol sold in Victoria, Australia, had been reduced to 0.45 grams a litre from 0.8 grams a litre when the programme was begun in 1976.

Today Shell Oil NZ Ltd public affairs officer Mr Paul Kelly told the Advocate from Wellington that adding lead to Marsden Pt petrol was a "numbers game of costs."

He said the lead was added because it was a cheaper way to boost octane ratings.

"One way round it is to import a lighter type of crude oil but this would cost more overseas funds and that's where it goes to the Government.

"Adding lead is a convenient way to boost octane ratings."



An American label button urging the omission of lead from petrol.

He said that in many American states it was obligatory of oil companies to market lead-free petrol and he said the damage caused by the absorption of

FILE  
N/A  
P. 1  
S. 1  
Total of 9



## The Lead Content of Petrol/Gasoline in New Zealand 1965-1975

Questions posed and answers collated by Elizabeth O'Brien, Lead Scientist, The LEAD Group Inc, Australia

The question in the heading went unanswered for months after I began investigating it, so I developed the following Q&A as steps on the way to finding the answers.

### **Q: is there an upper limit to the lead content of motor fuel/petrol/gasoline?**

A: yes, according to *Phasing Lead out of Gasoline: An Examination of Policy Approaches in Different Countries*, by United Nations Environment Programme (UNEP) & Organisation for Economic Co-operation and Development (OECD) 1999, <https://www.un.org/esa/gite/iandm/unep-lead.pdf> :

The octane boost# due to lead does not increase linearly with lead concentration. The first 0.1 g/liter of lead additive gives the largest octane boost, with subsequent increases in lead concentration giving progressively smaller returns. ... Further, refinery modernization investments necessary to reduce the lead content of gasoline often improve productivity and refining efficiency, and can increase revenues.

# Octane is a measure of the ability of a fuel to resist self detonation in the combustion chamber. In 1929, the octane scale was established in which two hydrocarbons were selected as references: one that tended to knock in an engine under almost all conditions (*n*-heptane) and the other having a much higher knock resistance than any known gasoline component at that time (*iso*-octane).

### **Q: how did the lead content in petrol in New Zealand compare to the lead content of gasoline in other countries and why was it so high for so long compared to other countries?**

A: Chemistry in New Zealand, April 1983 Volume 47 No. 2 (pages 28-30): A Review of Lead Hazards in the Motor Service and Repair Industry, by RV Winchester, Northern Occupational Health Unit, Department of Health, Auckland, states:

...New Zealand petrol contains a relatively high level of lead alkyls compared with many other countries...

*Association of Childhood Blood Lead Levels With Criminal Offending* – [a publication from the Dunedin Study], by Amber L. Beckley, PhD; Avshalom Caspi, PhD; Jonathan Broadbent, PhD; Honalee Harrington, BA; Renate M. Houts, PhD; Richie Poulton, PhD; Sandhya Ramrakha, PhD; Aaron Reuben, MEM; Terrie E. Moffitt, PhD, in *JAMA Pediatr.* 2018;172(2):166-173, <http://dx.doi.org/10.1001/jamapediatrics.2017.4005> includes:







19790503 Advocate newspaper article (at right) Lower lead content praised

**Q: Which country had a high lead content in petrol in 1991?**

A: *Lead Content of Petrol and Diesel and its Assessment in an Urban Environment*, by Pravin P. Parekh, Haider A. Khwaja, Adil R. Khan, Ronaq R. Naqvi, Abdul Malik, Khalid Khan and Ghazanfar Hussain, in *Environmental Monitoring and Assessment*, March 2002, Volume 74, Issue 3, pp 255-262, Springer Link, <https://link.springer.com/article/10.1023/A:1014296713553> states:

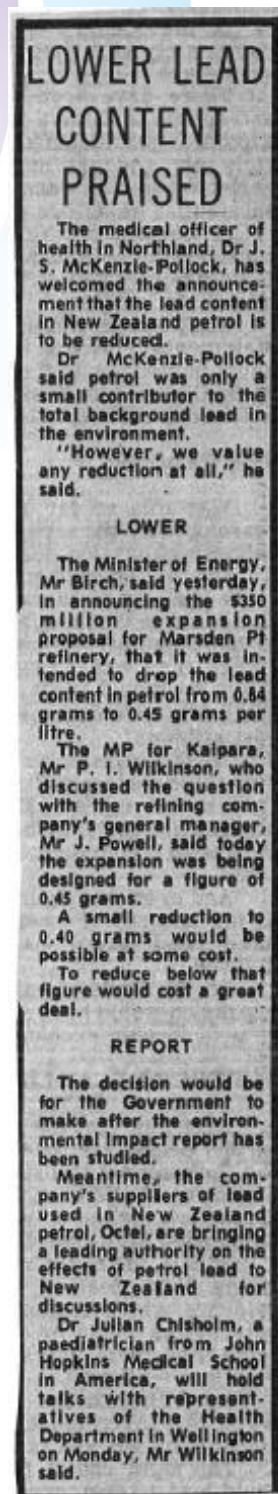
Pakistan is one of the few countries in Asia that continues to use only leaded-petrol as vehicular fuel. The concentration of Pb in its petrol reported in 1991 was the highest (1.5 – 2.0 g Pb L<sup>-1</sup>) [1.5 – 2.0 g/L] of all produced by the various Asian countries and far exceeded the WHO's guideline of 0.15 g Pb L<sup>-1</sup>.

... Samples of 'Regular' petrol collected in 1999 was found to contain 0.363 gPb L<sup>-1</sup> (range: 0.335 – 0.390 g Pb L<sup>-1</sup>), a factor of 5 lower than that marketed prior to 1991.

**Q: which country was the first to move downwards in lead content of motor gasoline?**

A: *Ethyl-leaded Gasoline: How a Classic Occupational Disease Became an International Public Health Disaster*, by William Kovarik, PhD, Professor of Media Studies, Radford University, INT J OCCUP ENVIRON HEALTH 2005;11:384-397, <https://www.tandfonline.com/doi/abs/10.1179/oeht.2005.11.4.384> explains:

In 1973, [US] EPA announced regulations requiring a gradual reduction in the lead content of each refinery's total gasoline pool. At that time, [1973, in the United States] the average gallon of gasoline had 2.2 grams of lead [0.58 g/L]. The lead phase-down would start January 1, 1975, with a reduction to 1.7 grams [0.45 g/L] and continue to 1979 with a reduction to 0.5 grams per gallon [0.13 g/L]... Meanwhile, automakers equipped new cars with pollution-reducing catalytic converters designed to run only on unleaded fuel starting in 1975 and 1976, and new unleaded gasoline pumps began appearing at filling stations nationwide. At that time, the average blood lead level in children under age 6 was 16.5 µg/dL. By 1985, 40% of all gasoline sold was still leaded, but in July of that year, the refinery pool standard of 1.1 grams per gallon dropped to 0.5, then dropped further to 0.1 grams per gallon [0.026 g/L] on January 1, 1986. Over all, the 1986 standard represented a drop of more than 98%







in the lead content of U.S. gasoline from 1970 to 1986. With the phase-out of leaded gasoline, the average blood lead level had dropped by 1996 to 3.6 µg/dL, and it continues to decline.

**Q: what was the lead content of New Zealand petrol after Associated Ocel provided an automated TEL mixing system to the New Zealand Refinery in 1977?**

A: Another document (see below the two pages from 198004 NZ Refining Co Air Polluting Chemicals (Pb in petrol) in Present & Expanded Refinery) from NZ government archives refers to 0.45 g/L as being the “level specified by Ministry of Energy in 1979”, though it was clearly not a regulated limit, since the same document (apparently dating from April 1980) gives 0.84 g/L as the “current” concentration of lead in NZ petrol.

2.

Air Pollutants

There are two aspects to air pollution as a result of oil refining - emissions at the refinery itself, and emissions wherever the products are burned. This paper is primarily concerned with the former, although the latter is probably of greater public interest, particularly emissions of lead from gasoline combustion. Table 2 lists levels of contaminants in certain refinery products.

Table 3 lists five significant types of emissions from the expanded refinery and their potential sources. Only emissions of sulphur oxides and particulate matter will routinely occur in significant quantities. Hydrocarbons, other malodorous compounds, and flame emissions will only occur during short-term (emergency) situations, from minor leaks, or during infrequent catalyst regeneration at certain processing units. The general design philosophy for the expansion is to incinerate all significant quantities of hydrocarbons, hydrogen sulphide and other malodorous compounds at a flare or in a furnace before release to atmosphere.

The principal source of sulphur oxides and particulate matter from the expanded refinery will be combustion of asphaltic residue (a high sulphur and ash substance) as a refinery fuel. Although dispersion studies by New Zealand Meteorological Service predict sulphur dioxide concentrations at ground below levels of concern, this Department is conscious the discharges will be clearly visible, and the concentrations of these pollutants should therefore be reduced. Unfortunately, there is not at this time a satisfactory method for reducing emissions from combustion of asphaltic residue. However, there is a significant international effort being made into technologies for processing high sulphur crude oils (the source of the asphaltic residue) in an environmentally acceptable manner. New Zealand Refining Co Ltd are required, as a condition of their Clean Air Act licence, to keep abreast of these technologies and to report progress on the matter at regular intervals.

Table 2 : Air-polluting Contaminants in certain Refinery Products

Product	Contaminant	Specified Maximum Content	
		Present Refinery	Expanded Refinery
Gasoline	Lead	0.84 g/l	0.45 g/l*
Automotive Gas Oil (Diesel)	Sulphur	0.5%	0.3%
Light Fuel Oil	Sulphur	1.5%	1.6%
Heavy Fuel Oil	Sulphur	3.5%	3.5%
Power Station and Bunker Fuel Oil	Sulphur	4.0%	4.0%

\*This is the level specified by Ministry of Energy in 1979. Public pressure and/or the impact of blending the Mobil synthetic gasoline product and/or a decision to produce an alternative octane raiser (MTBE) from Maui gas may cause a reduction in this.

Monographs on the Evaluation of Carcinogenic Risks to Humans: Volume 87 Inorganic and organic lead compounds, by International Agency for Research on Cancer (IARC), (2006) <http://publications.iarc.fr/105> includes the following data in:



Table 37

Country	Location	Year/s	Lead Concentration in Gasoline g/L
New Zealand	Christchurch	1978-81	0.84
New Zealand	Christchurch	1982-83	0.84
New Zealand	Christchurch	1984-85	0.84
New Zealand	Christchurch	1989	0.45
New Zealand	Christchurch	1994	0.2

**Q: Why did the level of lead in New Zealand petrol drop from 0.84 g/L in 1984-5, down to 0.45 g/L by 1989?**

A: The IARC 1978-85 level of 0.84 g/L was the lead content of petrol before the refinery upgrade/expansion. *Lessons from the removal of lead from gasoline for controlling other environmental pollutants: A case study from New Zealand*, by Nick Wilson and John Horrocks, *Environ Health*. 2008; 7: 1. Published: 7 January 2008, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2263033/> states:

New Zealand has only one oil refinery, operated by the New Zealand Refining Co Ltd [at Marsden Point, Whangarei]. The absence of a precautionary principle was repeatedly demonstrated in its decisions (in consultation with government), regarding the form of successive refinery expansions. The capacity to produce enough unleaded gasoline to supply the bulk of the local market was reduced by the decision to base the refinery modifications in the early 1980s around a hydrocracker, rather than a catalytic cracker [20].

*NGO Power Versus Leaded Petrol in New Zealand*, by John Horrocks and Nick Wilson, in *The International Journal of Environmental, Cultural, Economic & Social Sustainability*, Volume 4, Number 5, January 2008, <https://www.researchgate.net/publication/307763431> *NGO Power Versus Leaded Petrol in New Zealand* includes:

Another member of EDS [Environmental Defence Society, based in Auckland, New Zealand] was Dr David Williams, now a High Court Judge#. In 1974 he was a member of a special committee of the Clean Air Council set up to report on vehicle emissions. In a dissenting statement, he suggested that the committee's recommended schedule for a lead phasedown to 0.45 g/l by 1 January 1981, or by the completion date of extensions to New Zealand's refinery, needed to be more far-reaching and the aim should be a reduction to 0.15 g/l by 1980 (Clean Air Council, 1974).

# according to *Once were judges: Life in the law after 'the Bench'* by Nick Butcher in *New Zealand Law Society Lawtalk* 922, 09 October 2018,



<https://www.lawsociety.org.nz/practice-resources/practice-areas/courts/once-were-judges-life-in-the-law-after-the-bench> :

...former Justice David Williams, better known now as Sir David Williams QC...was appointed in 1992 to the High Court but resigned in 1994...[and is] One of the best arbitrators in the world...is a barrister and arbitrator at Bankside Chambers... on Shortland Street. *Chambers Global 2014* listed Sir David as among the top 40 most in-demand arbitrators worldwide for public international law, and he is frequently appointed to arbitrations involving Treaty-based disputes.

*Waste Management Guide: 03. Treatment and disposal of leaded petrol sludges*, by Health Protection Programme, Department of Health, Wellington, New Zealand, (September 1988)

[http://www.moh.govt.nz/notebook/nbbooks.nsf/o/4F9340FoFA162AC54C2565D7000E18F7/\\$file/treatment-disposal-leaded-petrol-sludges.pdf](http://www.moh.govt.nz/notebook/nbbooks.nsf/o/4F9340FoFA162AC54C2565D7000E18F7/$file/treatment-disposal-leaded-petrol-sludges.pdf) finally answers the question:

In July 1986, with the completion of the expansion of the Marsden Point refinery the lead content of 96-octane petrol was reduced from 0.84 g/l to 0.45 g/l.

**Q: surely a New Zealand government agency would hold documents with the answer to the question: What was the lead content of petrol in New Zealand from 1965-1975?**

A: I sent emails asking this question to the following New Zealand government agencies:

New Zealand Ministry for Energy (MfE)  
New Zealand Ministry of Transport  
New Zealand Ministry of Business, Innovation & Employment (MBIE)  
Statistics New Zealand  
New Zealand Transport Agency  
New Zealand Ministry of Health  
New Zealand Parliamentary Information Service

All replied to my emails and although no agency had any information to answer the question, the most useful reply, from the New Zealand Parliamentary Information Service, pointed out that **the first time** the lead content of petrol was regulated in New Zealand was in 1988 (after it had already been reduced to 0.45 g/l in July 1986) when it was limited to 0.45 grams per litre. See the First Schedule Requirements for Leaded Petrol, in *Ministry Of Energy (Petroleum Products Specifications) Regulations 1988*

[http://www.nzlii.org/nz/legis/num\\_reg/moepsr1988694/](http://www.nzlii.org/nz/legis/num_reg/moepsr1988694/) - this regulation also set a 5% benzene volume mass limit.

**The final time** that the lead content of New Zealand petrol was limited was in 1995. The 1995 regulations came into force on 1<sup>st</sup> January 1996, in readiness for the final phaseout of leaded petrol. See *Ministry of Commerce (Petroleum Products Specifications) Regulations 1995*, [http://www.nzlii.org/nz/legis/num\\_reg/ppsr1995488/](http://www.nzlii.org/nz/legis/num_reg/ppsr1995488/) which in both the First Schedule – Requirements for Regular Grade Petrol (minimum 91 octane), and the Second Schedule – Requirements for Premium Grade Petrol (minimum 95 octane) set the limit for lead to 0.013 grams per litre – which indicates no lead was permitted to be added, as 0.013



g/L is the usual maximum natural contaminant lead content of crude oil and therefore all unleaded refinery products. This 1995 regulation also kept the 5% benzene volume mass limit for both grades of petrol, introduced in the 1988 regulation (above).

In terms of what might have been the lead content of petrol, the NZ Parliamentary Information Service also advised:

Although in the NZ Gazette of 1969 (p. 794) [http://www.nzlii.org/nz/other/nz\\_gazette/1969/24.pdf](http://www.nzlii.org/nz/other/nz_gazette/1969/24.pdf) ... there was a British Standard on petrol being considered for adoption.

The British Standard listed on page 794 as under consideration (pending comments from interested parties) was:

4040: Petrol for motor vehicles-4040: Part 1: 1967 Specification and nomenclature for grades of petrol. Amendment No. 1 90.

I was able to find the following fuller description of the Standard online, but not the actual standard. Can anyone tell me what the lead content of petrol was limited to in this standard? That is: **Standard Number: BS 4040-1-1967. Title: Petrol for motor vehicles. Specification and nomenclature for grades of petrol. Publication Date:** 1967/3/9. **International Classification for Standards (ICS) :** [PETROLEUM AND RELATED TECHNOLOGIES](#)>>[Fuels](#)>>[Liquid fuels](#). **Publisher:** British Standards. **Number of Pages:** 16.

According to *History of the European Oil and Gas Industry*, Edited by J. Craig, F. Gerali, F. MacAulauy and R. Sorkhabi, in Geological Society Special Publication 465, 2018, <https://books.google.com.au/books?id=szdpDwAAQBAJ&pg=PA37&lpq=PA37&dq=BS+4040:1967?&source=bl&ots=KS3Rprf2Mr&sig=ACfU3UohZ91hWmVWqyjdkg9NvzXOQa5m6g&hl=en&sa=X&ved=2ahUKEwjHqJzi4ePkAhUHU3oKHRSKBE4Q6AEwAXoECAgQAQ#v=onepage&q&f=false> :

[BS 4040-1 : 1967] became mandatory in **1976** when the [British] government introduced a statutory instrument (**1976 SI number 1866**).

When I later discovered that UK lead (Pb) content of petrol in 1968 ranged from

0.82 g Pb/USG (0.217 g Pb/L) to 3.15 g/USG (0.832 g/L), and made the assumption that the actual UK petrol lead limits possibly voluntarily matched those in **BS 4040-1-1967**, I realized that if the British standard had been adopted in New Zealand in 1969 (it wasn't) then the NZ Premium grade lead content of 0.84 g/L would have been reduced slightly – if it was matching the UK 5 star grade upper limit, or significantly – if it was matching the UK 4 star grade upper limit of 2.69 g/USG (0.711 g/L). I'm guessing it was the NZ Refinery that put the kybosh on the British Standard being adopted in New Zealand...





## ORAL QUESTIONS TRANSFERRED FOR WRITTEN ANSWER

### Geothermal Field, Kawerau

17. Mr McLEAN (Tarawera) to the Minister of Energy: In view of the 2-year delay in the large-scale development of the Kawerau geothermal field, because of fear of subsidence of land at the north of the town, is he considering the reinjection of geothermal fluids to minimise subsidence and pollution?

Hon. W. F. BIRCH (Minister of Energy) replied: Yes, reinjection of geothermal fluids at Kawerau is being considered to minimise any subsidence. The Ministry of Works and Development is monitoring the field for subsidence.

### Lead-free Petrol

18. Mr CAYGILL (St. Albans) to the Minister of Energy: Is he aware of the recent decision of the Labour Government in New South Wales to introduce lead-free petrol in that State from 1 July 1984, and what steps is he taking to ensure its similar availability in this country?

Hon. W. F. BIRCH (Minister of Energy) replied: It is not the Government's intention to introduce lead-free gasoline in New Zealand. The present lead level of 0.84 g per litre of gasoline will be reduced to 0.45 g per litre as soon as the refinery expansion comes on stream, and this is at present scheduled for early 1984. This level of 0.45 g per litre is recognised by most EEC and OECD countries as being a reasonable compromise between the energy conservation provided by high lead levels and the desire to reduce those levels for environmental reasons. Work is now being carried out by my ministry pursuant to the recommendation about lead in the environmental impact audit for the refinery expansion, looking at alternative ways of providing octane numbers in petrol, and their economic and

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Oral Questions Transferred for Written Answer

22 August

environmental effects.

The NZ Parliamentary Information Service also directed me to this New Zealand Parliament Question and Answer (above) *Oral Question from Mr Caygill (St Albans): NSW will introduce Lead-free Petrol on 1 July 1984? What about NZ? Written Answer by Mr Birch (Minister of Energy [New Zealand]) given on 22 August 1981*, from Parliamentary Debates: Volume 432 New Zealand Parliament. House of Representatives, January 1, 1981. Published on Dec 31, 1981. Pp 2901-2902. <https://play.google.com/store/books/details?id=9nUrAQAAIAAJ&rdid=book-9nUrAQAAIAAJ&rdot=1> indicates no intention on the part of the Minister to reduce the NZ petrol lead level prior to the refinery expansion, due to the cost: "The present lead level of 0.84g/L [provides] energy conservation."



**Q: is there any other evidence that petrol lead levels were higher in New Zealand from 1965-1975 when Brian Arndt worked at the refinery?**

A: Brian Arndt: The environmental issue was studied by Aaron Reuben from Duke University and others, where they tested a Dunedin cohort of kids born in 1972 to 1973 for their blood lead level at age 11 years, and re-examined them including in 2012 when they were 38 years old but all of them are in lower socio-economic jobs, quite a lot of them have a history of domestic violence and all of them have early signs of Alzheimers.

The following quotes from *Association of Childhood Blood Lead Levels With Cognitive Function and Socioeconomic Status at Age 38 Years and With IQ Change and Socioeconomic Mobility Between Childhood and Adulthood [Dunedin cohort]*, by Aaron Reuben, MEM; Avshalom Caspi, PhD; Daniel W. Belsky, PhD; Jonathan Broadbent, PhD; Honalee Harrington, BA; Karen Sugden, PhD; Renate M. Houts, PhD; Sandhya Ramrakha, PhD; Richie Poulton, PhD; Terrie E. Moffitt, PhD, in JAMA March 28, 2017 Vol 317, Number 12,

[https://jamanetwork.com/journals/jama/fullarticle/2613157?utm\\_campaign=articlePDF&utm\\_medium=articlePDFlink&utm\\_source=articlePDF&utm\\_content=jama.2017.1560](https://jamanetwork.com/journals/jama/fullarticle/2613157?utm_campaign=articlePDF&utm_medium=articlePDFlink&utm_source=articlePDF&utm_content=jama.2017.1560) support Brian Arndt's contention that petrol lead content in New Zealand was higher than in many other countries when he worked in the New Zealand refinery from 1965-1975, and goes on to support Brian's summary of the conclusions drawn (published in 2017) from the 2012 38 year old follow-up assessment:

The Dunedin Multidisciplinary Health and Development Study observed a population-representative cohort of children born in New Zealand in 1972-1973. The most recent assessment included cognitive and socioeconomic evaluations and was completed when participants were 38 years old. In the 1970s and 1980s, lead exposures in New Zealand cities were consistently higher than international standards, largely due to poor air quality related to motor vehicle emissions.<sup>10</sup> Consequently, childhood blood lead levels in the Dunedin cohort were similar to those of other cohorts tested in the early 1980s from larger developed cities.<sup>11,12</sup> However, unlike with other cohorts,<sup>13,14</sup> a social gradient in lead exposure was not observed. This provided an opportunity to test the hypothesis that childhood lead exposure is associated with cognitive impairment and downward socioeconomic mobility by midlife without having to disentangle such exposure from correlated socioeconomic disadvantages.

Analyses also tested whether the association between blood lead levels and downward social mobility was mediated by cognitive decline....

Conclusions...:

In this cohort born in New Zealand in 1972-1973, childhood lead exposure was associated with lower cognitive function and socioeconomic status at age 38 years and with declines in IQ and with downward social mobility....



The following extracts support Brian Arndt's summary of the findings of the 38 year follow-up of the Dunedin cohort.

*Association of Childhood Lead Exposure with Adult Personality Traits and Lifelong Mental Health*, by Reuben, Aaron; Schaefer, Jonathan; Moffitt, Terrie; Broadbent, Jonathan; Harrington, Honalee; Houts, Renate; Ramrakha, Sandhya; Poulton, Richie; Caspi, Avshalom, *JAMA Psychiatry*. Published online January 23, 2019;76(4):418-425. <https://jamanetwork.com/journals/jamapsychiatry/fullarticle/2720691> concludes:

In this multidecade, longitudinal study of lead-exposed children, higher childhood blood lead level was associated with greater psychopathology across the life course and difficult adult personality traits.

*Association of Childhood Blood Lead Levels With Criminal Offending*, by Amber L. Beckley, PhD; Avshalom Caspi, PhD; Jonathan Broadbent, PhD; Honalee Harrington, BA; Renate M. Houts, PhD; Richie Poulton, PhD; Sandhya Ramrakha, PhD; Aaron Reuben, MEM; Terrie E. Moffitt, PhD, *JAMA Pediatr*. 2018;172(2):166-173, <https://jamanetwork.com/journals/jamapediatrics/fullarticle/2666777> says:

**Findings** In this cohort study of 553 New Zealanders observed for 38 years, lead exposure in childhood was weakly associated with official criminal conviction and self-reported offending from ages 15 to 38 years....

A total of 154 participants (27.8%) had a criminal conviction, 68 (12.3%) were one-time offenders, 86 (15.6%) had recidivated, 101 (18.3%) were nonviolent offenders, and 53 (9.6%) were violent offenders. Criminal conviction was more prevalent and more frequent at higher BLLs: 8 of 33 participants (24.2%) with a BLL of 5 µg/dL or less had a criminal conviction compared with 24 of 82 participants (29.3%) with a BLL above 15 µg/dL.

*Childhood Lead Exposure and Adult Neurodegenerative Disease*, by Aaron Reuben, Department of Psychology and Neuroscience, Duke University, Durham, NC, USA, in *Journal of Alzheimer's Disease* 64 (2018) 17-42, <https://content.iospress.com/articles/journal-of-alzheimers-disease/jad180267> refers to the above Reuben et al 2017 article as Reference [84] and concludes:

This year [2017] the oldest age follow-up in lead exposed children, in a population-representative cohort of New Zealanders born in 1972–1973, reported evidence of cognitive deficits in middle-aged adults exposed to lead as children and, further, of cognitive decline across the 30 years preceding follow-up [84]. As noted earlier in this review, cognitive deficits relative to peers and cognitive decline measured across many years represent risk factors for AD [Alzheimer's Disease], although these are generally used as risk predictors in older populations (e.g., those >65 years old).





**Q: How did New Zealand’s lead content in petrol compare to Australian states and territories?**

A: Quantification of atmospheric lead emissions from 70 years of leaded petrol consumption in Australia, by Louise Jane Kristensen, in Atmospheric Environment 111 (2015) 195-201,

<https://www.sciencedirect.com/science/article/pii/S1352231015300157?via%3Dihub>

gives the following graph showing all states and territories at the start of the graphed period, in 1973, had the same lead content in petrol – 0.84 g/L – as New Zealand had from at least 1978 to July 1986, but only the Northern Territory (NT), Queensland (QLD) and rural New South Wales (NSW 2) maintained that level beyond 1976 (until the early 1990s):

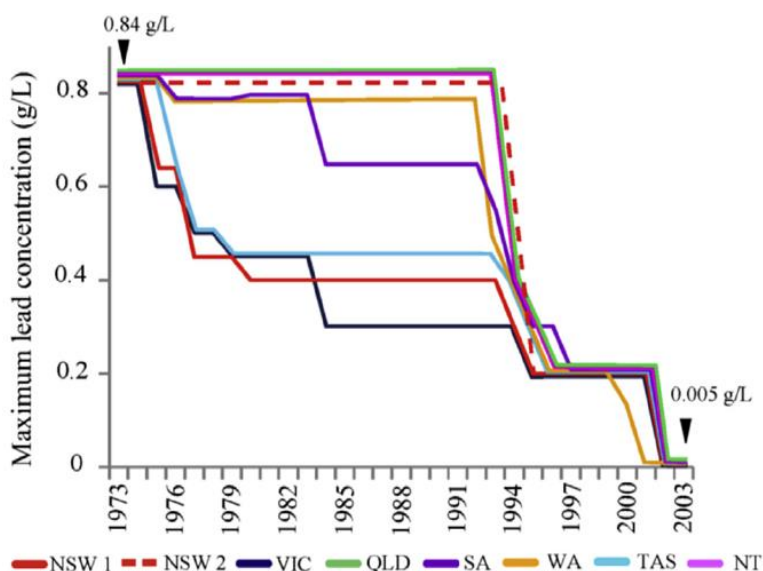
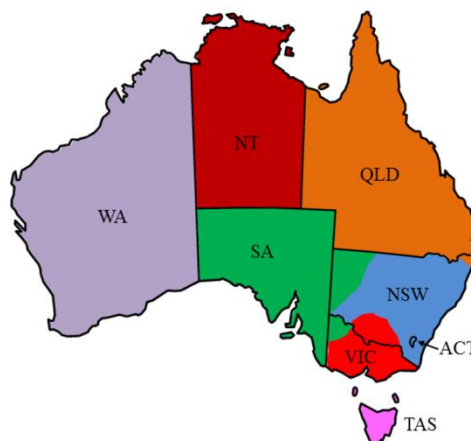


Fig. 1. The reduction of maximum lead in petrol concentrations for state and territories of Australia. (ACT) is included in the NSW state marketing area.

**Supplementary Figure S1 [MAP]:** State marketing areas for leaded petrol sales (adapted from Australian Institute of Petroleum<sup>1</sup>). The state marketing areas used for the sales of leaded petrol follow the state borders with the following exceptions: the Murwillumbah district in New South Wales (NSW) is included in the Queensland (QLD) state marketing area, the Broken Hill-Wilcannia district of NSW and the Murrayville district of Victoria (VIC) are included in the South Australia (SA) state marketing area, the Riverina district of NSW is included in the VIC state marketing area and the Australian Capital Territory



Louise Kristensen’s **Supplementary Table S2:** Concentration of lead in petrol in Australia...from 1964... gives the following lead in petrol ranges for the period from 1964 to 1969:

1964	0.25-0.84 g/L ♦ 0.17-0.72 g/L * <sup>34</sup>
1967	0.84 g/L * <sup>35</sup>
1968	0.17-0.84 g/L ♦ 0.00-0.75 g/L * <sup>36</sup>
1969	0.17-0.84 g/L ♦ 0.00-0.75 g/L * <sup>37</sup>

KEY: \* Petrol regulation; # Actual lead concentration averages; ♦ Premium grade petrol; \* Regular grade petrol





The excerpt (above) from **Supplementary Table S2** implies that 1967 was the first year in Australia when the maximum lead content of petrol was limited by regulation. That's 21 years earlier than when the lead content of petrol in New Zealand was limited by regulation (1988), as stated above.

But most importantly, the references for the information in the graph (Fig. 1 above) and in the Supplementary data for the Kristensen 2015 paper, for the relevant period in New Zealand (1965-1975) were listed as:

1. Associated Octel, 1964. World-wide Survey of Motor Gasoline Quality - May 1964. The Associated Octel Company Limited, London.
2. Associated Octel, 1968. World-wide Survey of Motor Gasoline Quality - May 1968. The Associated Octel Company Limited, London.
3. Associated Octel, 1969. World-wide Survey of Motor Gasoline Quality - May 1969. The Associated Octel Company Limited, London.
4. Associated Octel, 1975. World-wide Survey of Motor Gasoline Quality - May 1975. The Associated Octel Company Limited, London.

And when I searched World Catalogue for these Octel issues, all four were listed as being at the New Zealand Ministry of Business, Innovation & Employment (MBIE). When I asked MBIE again for the information, they said they couldn't find the Octel documents but if I came into the Wellington office of New Zealand Archives (from Sydney, Australia), I could read issues dating from 1970 onwards, of *Oil industry - Motor Vehicle Emissions - Lead Content of Petrol - Technical Studies*. Thankfully my New Zealand colleague John Horrocks agreed to check out the documents for me and on 25th September 2019, John reported (personal communication by email):

Re: *Oil industry - Motor Vehicle Emissions - Lead Content of Petrol - Technical Studies* (R17158262) 1970-1979. Unfortunately this was only a collection of papers about technical features of lead in petrol, with no reference to New Zealand or mention of health issues... focus was on vehicle performance, measures of RON, MON, lead traps etc. (Authors: Texaco, Ethyl Corp., Esso, Du Pont, National Petroleum Refiners Assn.)

In his searching though, John Horrocks did find the following proposed phase-down of the lead content of petrol, from the *Report of the Motor Vehicle Committee on Proposed Motor Vehicle Emission Standards*, 1974, published by Department of Health, Wellington, New Zealand. Note that the proposed first reduction in lead content down to 0.82 g/L in 1974 implies that at the time of writing (possibly late 1973 or early 1974), the lead content of New Zealand petrol was higher than 0.82 g/L:

#### SUMMARY OF RECOMMENDATIONS

...

4. That until the oil refinery expansion takes place the maximum lead content of gasoline should be progressively reduced at least in accordance with the following programme:



Year	Premium gasoline lead level
	g/L
1974	0.82
1976	0.78
1978	0.71
1980	0.68

John Horrocks goes on to point out (in his 25<sup>th</sup> Sept 2019 email):

The personnel on the committee were all engineers, with the exception of D.A.R. Williams, a highly-qualified Auckland lawyer [see above note about David Williams now being a barrister and arbitrator] who was also a member of the Environmental Defence Society. His 8 page long dissenting opinion called for a much more rapid move to reduce lead content, and was notable for the references he made to rulings by the US EPA and early research on the health effects of lead on children. It is a far-sighted and implicit rebuke to the other members of the committee, who were too reliant on data provided by the oil industry. There was, however, no mention of the danger of the lead additives themselves, except for their role in vehicle emissions, and an alarming lack of any sense that the committee (with the exception of Williams) had drawn on advice from health experts. The thrust was very much about how much it might cost to reduce lead in petrol. The aim [of the New Zealand oil industry proposal ie the phasedown steps listed above] was to ensure that the amount of lead emitted did not increase as the vehicle fleet grew!!! "The aim would be to prevent increase in the overall amount of lead emitted..."

And of course, in the end, nothing was legislated until 1988 (when New Zealand lead content of petrol was limited for the first time, to 0.45 g/L) and the oil refinery expansion completed in July 1986 had already ensured that the lead content was reduced from 0.84 g/L – ie, no steps were taken to phase out the lead from New Zealand petrol.

Also on 25<sup>th</sup> September 2019, the National Library of Australia finally found and made available to me by Inter-Library Loan, their only issue of *World-wide Survey of Motor Gasoline Quality* - May 1968, by The Associated Ocel Company Limited, London. And if the company that makes the TEL/TML additives for petrol are to be believed, then this was the first written evidence of the lead content in New Zealand petrol in the period 1965-1975. *World-wide Survey of Motor Gasoline Quality* - May 1968 gives the following information:

The Summary on page 4 says New Zealand increased by one RON in both Premium and Regular grades; the Preface on page 5 says info for this May 1968 survey was gathered in the first two months of 1968, implying that Associated Ocel published a *World-wide Survey of Motor Gasoline Quality* annually, rather than as irregularly as indicated by the references quoted by Kristensen (2015) above. Page 58 shows New Zealand with up to 3.17 g Pb per US Gallon which converts to 0.8374 or 0.84 g Pb per Litre and the same figure is given as the highest in the range for several other countries/grades on page 58 ie: Australia, Guam, Hawaii, Marshall Islands also with 3.17 g Pb per US Gallon - 0.84 g Pb per Litre.



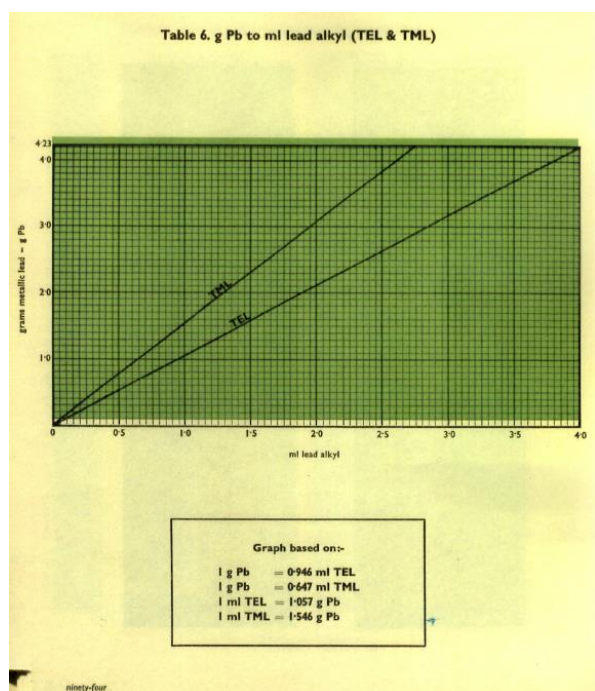
I find it fascinating and mysterious how Pakistani petrol was found to contain 1.5-2.0 g Pb per Litre in 1991...when Pakistan (East & West) is given as having one grade in January-February 1968 with a lead content range from 0.84-2.11 Pb per US Gallon – 0.222-0.557 g Pb per Litre... perhaps the 0.84-2.11 was already in g Pb per Litre??? Page 92 would seem to imply that 1.12 g Pb per Litre is the highest lead content possible, so again, what about Pakistan in 1991 – did the researchers (Parekh et al, mentioned above) just get it wrong?

So, if Associated Octel is to be believed, the lead content of New Zealand petrol (see excerpts below from the World-wide Survey) was 0.84 g/L in January and February of 1968 and that may be the oldest written record to be found in Australia and New Zealand.

Grade	Range of Octane Number		Range of Lead Content per USG		
	Research method	Motor method	ml TEL	g Pb	
New Zealand Premium	↑	97	93	3.0	3.17
	↓	96	89	2.3	2.43
Regular	↑	84	83	2.6	2.74
	↓	83	81	0.4	0.42

### Lead Content of New Zealand Petrol in January-February 1968

Grade	Range of RON	Range of Lead Content Per US Gallon		Range of Lead Content Per Litre	
		ml TEL	g Pb	ml TEL	g Pb
Premium	97-96	3.0-2.3	3.17-2.43	0.79-0.61	0.84-0.64
Regular	84-83	2.6-0.4	2.74-0.42	0.69-0.11	0.72-0.11



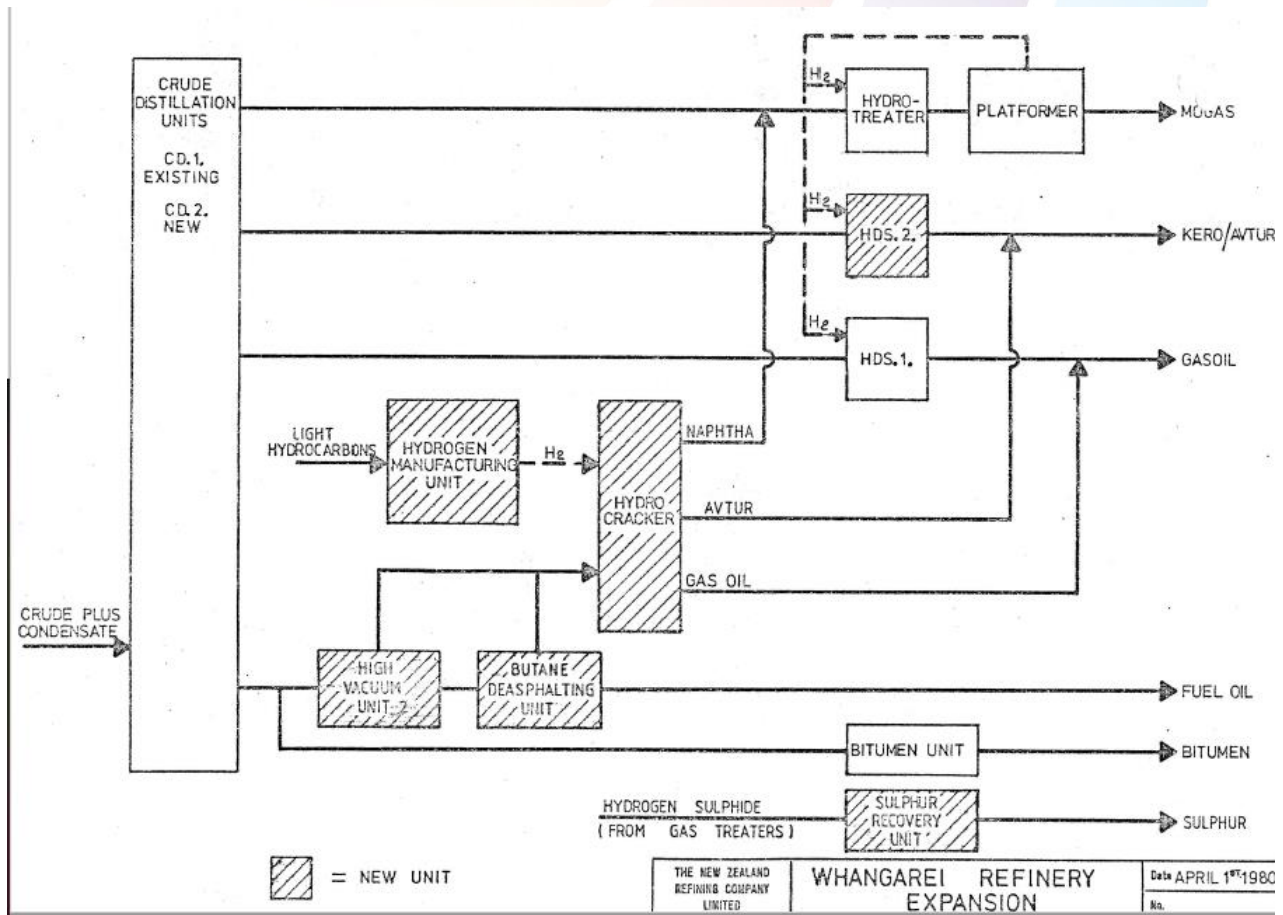
Graph [at left] based on:

- 1 g Pb = 0.946 ml TEL
- 1 g Pb = 0.647 ml TML
- 1 ml TEL = 1.057 g Pb
- 1 ml TML = 1.546 g Pb





# 19800401 NZ Refining Co Simplified Flow Scheme of Expanded Refinery



Brian Arndt: this Whangarei Refinery Expansion flow chart appears to have been published along with 198004 NZ Refining Co Air Polluting Chemicals (Pb in petrol) in Present & Expanded Refinery, in April 1980. See the article above titled "The Lead Content of Petrol/Gasoline in New Zealand 1965-1975"





# **20190619 NZ Refining seeking to be removed from Arndt Vs ACC & NZ Refining case**

IN THE DISTRICT COURT  
AT HAMILTON

ACR 110/19

UNDER the Accident Compensation Act 2001

IN THE MATTER of an appeal under section 149 of the Act

BETWEEN Brian Arndt  
Appellant

AND Accident Compensation Corporation  
First Respondent

AND The New Zealand Refining Company Limited  
Second Respondent

---

MEMORANDUM OF COUNSEL FOR THE NEW ZEALAND REFINING  
COMPANY LIMITED SEEKING TO BE REMOVED FROM PROCEEDING

---

Dated: 19 June 2019

Next Event Date: TBC

MinterEllisonRuddWatts  
PO Box 2793, Wellington 6140  
TELEPHONE +64 4 498 5000  
SOLICITOR ACTING: MATTHEW FERRIER  
PARTNER RESPONSIBLE: OLIVER SKILTON

20960813 3



MAY IT PLEASE THE COURT:

This memorandum is filed on behalf of The New Zealand Refining Company Limited (Refining NZ), further to:

the Notice of Appeal filed by Brian Arndt, dated 2 May 2019; and

the Support Officer's email sent on 9 May 2019, asking Refining NZ to advise whether it wishes to be a party to Mr Arndt's appeal.

Refining NZ's name was incorrectly given to the Registry, and recorded in the Initial Minute of Judge Henare dated 9 May 2019, as New Zealand Refinery Limited. The correct name is The New Zealand Refining Company Limited.

3. Mr Arndt appeals a review decision pursuant to s 149 of the Accident Compensation Act 2001, which in turn relates to various decisions of the Accident Compensation Corporation (ACC).

4. Although the decisions below have focused on the absence of literature/evidence supporting any causal link between exposure to lead and cancer, Refining NZ rejects Mr Arndt's account of working conditions and lead handling practices during his time working at the Refinery.

5. However, because the issues to be determined in the appeal relate to liability as between ACC and Mr Arndt, Refining NZ does not seek to appear at the hearing of the appeal.

Orders sought

6. Accordingly, Refining NZ respectfully seeks the following orders:

Refining NZ is to be removed as the second respondent in these proceedings; and

Refining NZ's name is to be removed from the intituling used in these proceedings.

DATED at Wellington this 19th day of June 2019

[signed]

O J Skilton/M J Ferrier

Counsel for the Second Respondent

---



# **20190729 Brian Arndt's requests for restricted document release & Medical review prior to Appeal Court Hearing**

In The District Court

At Hamilton

ACR 110/19

Under the Accident Compensation Act 2001

In the matter of AN APPEAL UNDER S 149 OF THE ACT

Between BRIAN CLINTON ARNDT

And ACCIDENT COMPENSATION CORPORATION

First Respondent

And NEW ZEALAND REFINERY LIMITED

Second Respondent

MY MEMORANDUM IN ADVANCE OF INITIAL CASE

MANAGEMENT CONFERENCE

Dated: 29 July 2019

Brian C Arndt,

Matamata, Waikato. 3400



MAY IT PLEASE THE COURT

1. My appeal concerns the first respondent's the Accident Compensation Corporation (ACC) decision to decline my application for:-
  - (a) Cover for multiple work related injuries and cancers.
  - (b) Entitlements for treatments and procedures that I have had to finance personally.
  - (c) In excess of loss of 54 years of my life's enjoyment.
2. I claim that my multiple medical concerns relate to excessive exposure to Organic Lead whilst employed at the New Zealand Refining Company Limited (NZRC) as a Shift Operator from early 1965 (March) to late 1975 (Oct.)
3. My application is based on evidence from the International Agency for Research on Cancer (IARC) and multiple other International Agencies and Research Groups. In addition there are papers from Auckland Archives that I've properly and legally obtained. In addition I present a Teeth Analysis prepared at the University of Otago. All of this evidence has been made available to ACC. Please note the Lead in Teeth was 1659% above N/C.
4. This memorandum highlights some of the evidence that has been recovered by me taking over 6 years of diligent research which culminates in the presentation to the initial case management conference set for 2.45 pm this Tuesday, 30<sup>th</sup> July 2019.

Issues.

5. I have had Neurological, Psychological, Sexual Dysfunction and Balance Problems which last to this day. I have had physical injuries ie a broken neck C5/C6 with Cancers of the Lung, Breast and Prostate as well as reoccurring multiple Squamous Cancers. Some of these health worries started within 4 months of employment and are still ongoing.
6. (a) NODS and ACC have relied heavily on reports from a Dr. Jim Mcleod and Dr. David Prestage, both of these Doctors are Occupational Physicians and I believe are on current contract to the ACC. These reports are not truly correct in what they state. It is of note that NZRC destroyed all Employment and Operational Records circa 1977 when the "Manual Lead Transfer and Blending Plant" was replaced with a fully "Automated Lead Blending Plant". This Plant was fully sealed, supplied through a dedicated pipeline from the Refinery Jetty. A dedicated ship came at regular intervals from Octel/Innospec, the manufacturers in England.
6. (b) There are 2 types of Diagnostic X-rays for ascertaining Lead absorption being K Fluorescence X-rays and XRF. The former uses a Radioactive Potassium injection into the body which irradiates any heavy metals absorbed into the bones. The latter uses a weak strength radioactive beam of low intensity aimed at bone areas near the skin's surface.
7. ACC's attempts claiming to have tried to have a K X-ray here was incorrect as I have evidence that there is a unit at Auckland Hospital/University/Nuclear Science/Radiology controlled by a Dr. Qasar. This was much needed to substantiate my Teeth Analysis from my teeth extraction in Jan. 2016. It is of note that I could taste lead coming out from the tooth sockets for the next 2 days. Again I draw your attention to the Teeth Analysis by Dr. Malcolm Reid of the University of Otago.
8. As per IARC and other Research Institutions it is agreed that TEL readily passes through the skin damaging the second and third epidermal layers thereby causing re-occurring Squamous Cancers.





9. Following the XRF testing at New York which was booked for a half day for multiple tests I was somewhat shocked when after 25 minutes I was left by Professor Todd in the hands of his Assistant to finish the paperwork, I was then directed to the exit. I have emails confirming I was booked for the whole morning.....of interest I noted as I left was a large shield above the doorway proudly proclaiming Mt. Sinai was supported by EXxon/Mobil.....a part owner of Octel/Innospec. The XRF results of which I have still not obtained a written report apparently show a low level on the surface of the Tibia. Professor Todd has stated that this is probably due to Operators wearing knee high rubber gum boots, rubber being the best and preferred protective material for TEL use, I have an email confirming this.

It was diagnosed by my Orthopedic Surgeon in 1980 following my broken neck that I had damaged the nerve canal through the C5 Vertebrae. And in this canal runs the nerve system that controls the involuntary muscles. To maintain good bodily functions he directed I was to take daily 2 well raised dessert spoons of Psyllium. This I have faithfully done ever since and as well it is now also accepted that large amounts of Vitamin C in conjunction with the psyllium help and assist with the removal of heavy metals from the body. I have taken high levels of Vitamin C since my Lung operation in 1989, currently I now take 3000 units daily along with 14-15 grams of MSM with well recorded health benefits. These natural medications may also help account for the lower Tibia Lead Levels.

10. The Reviewer in March 2019 took part of a paragraph from IARC Monograph Vol.87 "That Organic Lead is not a known Carcinogen" and based her decision on this but failed to quote the balance of the paragraph which clearly states the transformation of the Organic Lead while in the bones to which it is readily attracted metabolizes into 2 Ionic Lead Compounds that have the characteristics of Inorganic Lead which is a Class 2a Carcinogen. The same Monograph also says in the absence of Human Testing, tests done on Animals of these compounds are deemed equally to apply to Humans as a Class 2a Carcinogen. I draw attention to this because IARC is considered to be the highest Authority on Cancers.

At the completion of the recent Review and the phone link was turned off along with the recorder the Reviewer went on to ask what, did I know about the Refinery Workers from Takahiwai and Iwi and Bream Bay Beach re the Lead Pollution and Health issues saying this had to be put right. I have 2 witnesses to this conversation being my 2 support people.

11. My appeal raises 3 issues:

- (a) TEL is readily absorbed into the body through the skin.
- (b) In the blood it is also carried to the brain causing Neurological Problems etc.

TEL in the bones metabolizes into 2 particular ionic compounds which have the same characteristics as inorganic Lead which is a 2a Carcinogen. Please see IARC Monograph Vol. 87.

- (c). I claim for loss of enjoyment of life for 54 years including Broken Neck, Teeth Damage and finally removal, internal Cancers, multiple re-occurring Squamous Cancers and ongoing Psychotic and Neurological Damage.

12. I file this Appeal against both ACC and NZRC. NZRC used TEL at an excessive amount of 9 grams per Liter which equates to 36 grams per US Gallon purely as a cost saving profit maker. The recommended usage of TEL in America England and Europe was up to 2 grams per US Gallon.

Many men and Women have died from exposure with TEL associated with the Refinery and local services.



There is evidence that in some cases Mesothelioma has been blamed for Cancer deaths by the NZRC however some Medical reports have been obtained that show death was caused by unidentified Ductile Tumours.

13. NZRC have shown questionable work practices with the handling of TEL and should be held to account.

14. Your Honour I respectfully request the NZRC's request for Removal as Second Respondent be Denied.

#### FURTHER EVIDENCE

15. I am still attempting to have clearances for my Cancers of Prostate and Breast but my Oncologist says he can't talk to me. The other men that had treatment with me which seems to have been experimental have all had checks done.

In addition it appears that my NHI Files have been tampered with.

16. I am still trying to have Independent Specialists to ascertain my Health position but it maybe several months.

#### TIMETABLING

17. (a) I respectfully ask your Honour can Court Orders be Given for Files that are Restricted until 2043/48 and some for 100 years to be released to be read by your Honour or a Court Authorized Officer to enable the Truth to be told.

(b) That I be given assistance to obtain Independent Medical Reviews as needed. Reports to be given jointly to ACC and my Doctor.

Dated 30<sup>th</sup> July 2019

Signed B C Arndt



# Q&A: Brian Arndt's Answers to Elizabeth O'Brien's Questions

From a series of emails, Sat Sept 28, Sun Sept 29, and Mon Sept 30, 2019. Brian Arndt worked at the New Zealand refinery from early 1965 to late 1975. Elizabeth O'Brien is the Lead Scientist at The LEAD Group.

**Q1. do you have any documentary evidence that the refinery was a “Licensed Customs Bonded Area”? The phrase “Licensed Customs Bonded Area” only comes up twice in my Google search - as a selling-point to investors due to tax-free operation for non-customs cleared cargo:**



1. “As a licensed customs bonded area cum tax free facility, KSB [Kemaman Supply Base – a logistic supply base for Peninsular Malaysia’s offshore petroleum exploration and production industries] is an efficient and effective gateway for the manufacturing, import and export of oil and gas equipment and hardware.”  
[https://cdn1.i3investor.com/my/files/st88k/8265\\_EPIC/annual/2008-12-31/8265\\_EPIC\\_AnnualReport\\_2008-12-31\\_EPIC-Cover%20to%20Page%2040%20\(3.1MB\)\\_944296279.pdf](https://cdn1.i3investor.com/my/files/st88k/8265_EPIC/annual/2008-12-31/8265_EPIC_AnnualReport_2008-12-31_EPIC-Cover%20to%20Page%2040%20(3.1MB)_944296279.pdf)
2. Vizag Coal Service Center, situated in a location adjoining Gangavaram port and Visakhapatnam steel plant, India – run by Steelmont, UK: “Licensed Customs bonded area is available for non customs cleared cargo” - [www.steelmont.co.uk/services/servicecenters\\_vizag.html](http://www.steelmont.co.uk/services/servicecenters_vizag.html)

DEPARTMENT OF HEALTH INTER - OFFICE MEMORANDUM			
FROM	OUR FILE	YOUR FILE	
PNN KPC Cook	Date:	Date:	
TO	SUBJECT:		
MOH	<p>Jetty Operator hazard Pt. Refinery The Ships bulk lead system is completely closed.</p> <p><u>Petrol</u> When connecting and disconnecting hoses men get petrol on their hands and are exposed to fumes. When taking samples &amp; dipping tanks men get petrol on their hands. No marks are used. Leather gloves are available if requested.</p> <p><u>clothing</u> Operators are supplied with hard hat, leather boots &amp; bosler suits.</p> <p><u>Washing facilities</u> 2 emergency cold showers are on the jetty, in the open air, 4 wash and basins in washroom are available.</p> <p><small>THERE IS NO NEED TO HAVE THIS MEMO TYPEWRITTEN—HANDWRITING IS ACCEPTABLE</small></p> <p><small>on 2279, Dr. B. H. Kemp, Alibonks report PNN contacted Capt Williams &amp; requested that he contact the Refinery manager at Vizag and get information on all jetty personnel contact records since lead tests taken before the Ever Horn Suez.</small></p>		

A1. The Refinery was and still is a “Licensed Customs Bonded Area”. You will get no Refusal or Denial from the powers that be. The Crude came in bulk shipments and was divided between the Oil Companies here. When being shipped out for distribution around the Country witnessed dips were done on the Shipping Tanks by Refinery Operators and witnessed by Workers from Williams Rochester Limited who were Contractors to the Refinery running the Jetty Operations. See 19780202 Jetty Operators at Refinery to have blood and urine lead tests after lead ship sails (at left) and 19790302 Jetty Operators at Refinery to have blood and urine lead tests before and after loading ship (below).



DEPARTMENT OF HEALTH  
INTER-OFFICE MEMORANDUM

FROM FOR K.P. COOK	OUR FILE DATE 2-2-79	YOUR FILE DATE 2/2/79
TO NON		
SUBJECT Jetty Operators handle their Refinery Jetty		

1.8.79 The Joint Union Council of the Steamers and Packers Union became alarmed at the possibility of exposure of the Jetty workers to dust from the "Iron Man" due to built at 2200 1.8.79 and he demanded that Williams & Reckless Ltd (-Contractor for the Jetty, supervision) should make arrangements for the Jetty operators to have "lead tests" before and after loading the ship. All the Jetty operators are members of the Steamers and Packers Union.

Williams & Reckless Ltd have a contract from the oil refinery to manage the Jetty, and all Jetty operations. They are not oil refinery employees.

- Staff:
- 1 Manager & Contractor Capt H Williams
  - 2 Day Supervisors
  - 2 Evening & night Supervisors
  - 2 Day workers
  - 8 Ship workers

FILE  
NON  
PT  
S  
7/3

THIS IS AN OFFICE COPY OF THE ORIGINAL  
FORWARDED TO THE DEPARTMENT OF HEALTH

DEPARTMENT OF HEALTH  
INTER-OFFICE MEMORANDUM

FROM K.P. Cook	OUR FILE DATE 2-2-79	YOUR FILE DATE
TO NON		
SUBJECT Jetty Operators handle their Refinery Jetty		

- Working hours:
- 1 Manager - 5 day week 8am-4pm
  - 1 Day Supervisors - 5 day week 8am-4pm - work alternate
  - 2 Evening and night Supervisors cover 4pm - midnight
  - 2 Day workers - 8am-4:30pm 5 day week - occasional
  - 8 Ship workers Relative 12 hour shift
- 3 days 7:30am - 7:30pm then  
4 days 7:30am - 7:30pm then  
2 nights 7:30pm - 7:30am then  
4 days 7:30am - 7:30am then
- All operators may be asked to work overtime according to shipping movements.

Job description:  
Contractors and discharging Bulk rubber shoes between ship and shore. These carry loads of that is discharged, and refined products for coastal distribution. The jetties are manned when there are ships. Samples are taken and loads "slipped" for water use

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FORWARDED TO THE DEPARTMENT OF HEALTH

DEPARTMENT OF HEALTH  
INTER-OFFICE MEMORANDUM

FROM FOR K.P. COOK	OUR FILE DATE 2-2-79	YOUR FILE DATE
TO NON		
SUBJECT Jetty Operators handle their Refinery		

required from ships tanks and from Jetty Sampling points.  
The operators hose down the jetties and use soap for cleaning up oil spills on the jetties using Granulin oil spill remover. They are also responsible for monitoring the Refinery water ballast tank and slop tanks. (Ships carry ballast as ballast & h-o-s to discharge before loading is possible). The men occasionally do check "ships" on refinery tanks to measure the amount of oil in the tanks.

- The Jetty hoses carry
- 1 CRUDE OIL (No lead content)
  - 2 FUEL OILS (No lead content)
  - 3 DIESEL OILS (No lead content)
  - 4 PETROL (Contains lead)
  - 5 BITUMEN - No lead - h-o-s is 1500

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FORWARDED TO THE DEPARTMENT OF HEALTH

DEPARTMENT OF HEALTH  
INTER-OFFICE MEMORANDUM

FROM FOR K.P. COOK	OUR FILE DATE 2-2-79	YOUR FILE DATE
TO NON		
SUBJECT Jetty Operators handle their Refinery		

Bulk lead shipments:  
Every 2-3 months there is a bulk lead shipment in special ships. The ships crew are trained to do all the work attached to discharging, and they wear protective gear and have their own Safety Supervisor on board.  
The only duties undertaken by the Jetty Operators are:  
1 Manager to Jetty telephone  
2 Manager a radio telephone to pass messages between ship and shore.

In the event of a "lead spill" the ship's crew are trained to deal with it and Williams & Reckless Jetty operators have orders to immediately evacuate the area.

THIS IS AN OFFICE COPY OF THE ORIGINAL  
FORWARDED TO THE DEPARTMENT OF HEALTH

Above, 19790302 Jetty Operators at Refinery working hours & job description and Bulk lead shipments every 2-3 months.





Address all communications to  
Teletype Address  
H. Auckland

DEPARTMENT OF HEALTH  
RECEIVED  
21 MAY 1979  
DEPARTMENT OF HEALTH  
ENVIRONMENTAL LABORATORY  
3 FENTON STREET, AUCKLAND 3, NEW ZEALAND.

20/2  
Reply reference  
340/3/164

P.O. BOX 8944  
SYMONDS ST.  
TELEX NZ 2573  
TELEPHONE:  
775 978

17 May 1979

The New Zealand Refining Co. Ltd,  
P.O. Box 44,  
WHANGAREI.

ATTENTION: Mr Keith Allum

Dear Sir,

CLEAN AIR ACT 1972 - LEAD-IN-AIR TESTS DURING LOADING OF CONTROL TANKER

The following are the results of lead-in-air tests obtained by Dr Graham during the loading of coastal tanker "Kuoka" with premium mogas on 10 April 1979:

Site	Time	Concentration (mg/m <sup>3</sup> )
1	0934-1056	0.4
2	1106-1155	< 0.02
3	1214-1327	< 0.01
4	1340-1433	< 0.04

The sites are indicated on the attached diagram. They are -

1. At end of jetty, about 20m from Mogas lines and 15m from nearest vent on tanker.
2. Half-way down jetty, about 150-175m from tanker vents.
3. Beside control valves for storage tanks being emptied.
4. On beach, downwind of jetty and tanker, about 300m from tanker vents.

Sites 1, 2 and 4 were selected as positions of maximum mogas odour, downwind of the tanker. Wind speed was a steady 5 knots for test 1 and 5-10 knots for the remainder.

Threshold limit values for alkyl lead compounds (as Pb) are as follows -

Tetraethyl Lead - 0.10 mg/m<sup>3</sup>, time-weighted average concentration for a normal 8-hour work day or 40-hour work week (TWA)  
- 0.30 mg/m<sup>3</sup>, short-term maximum concentration for a period of up to 15 minutes (STEL).

Tetramethyl Lead - 0.15 mg/m<sup>3</sup>, TWA  
- 0.45 mg/m<sup>3</sup>, STEL

*Handwritten signatures and initials: P.L., R.S. 1, etc.*

Above and below, 19790517 Lead in Air results done while loading the MV Kuoka:



The results show that the lead-in-air concentration at site 1 exceeds the TWA limits for both tetraethyl and tetramethyl lead and, in the case of tetraethyl lead, the short-term exposure limit is also exceeded. The worker located in the hut at the end of the jetty, adjacent to site 1, is therefore at risk.

As requested a copy of these results have been sent to JASMAD Research (Attention: Mr J.R.P. Clarke).

Yours faithfully,

K.A. Rolfe  
Regional Air Pollution Control Officer

ENCL.

Medical Officer of Health,  
Department of Health,  
P.O. Box 137,  
WHANGAREI.

Copy for your information.

K.A. Rolfe  
Regional Air Pollution Control Officer

Lead in Air 0.4 mg/m3.  
Maximum allowable 0.1 mg/m3. Limits exceeded by 400%.

Despite these hazardous air lead results in May 1979, lead hazards for refinery workers were not mentioned in an otherwise "comprehensive" Advocate newspaper article (at the end of this article).

General Comment: What were we exposed to sitting on the end of the Drums to drain the last of the TEL liquid and another open drum beside us ready to place the Education Tube to keep up speed?

Also see the statement about 5 Staff at the Refinery notified to Joint Meeting of having TEL Poisoning 6/3/1981 (in 19810306 NZ Refinery has 5 workers with TEL poisoning notified to Depts of Labour & Health article in this newsletter – excerpt below).

A general discussion was held on the notification of T.E.L. poisoning at the refinery; Five staff being notified - Of these, only one having a higher than average lead blood.

7  
Surely I didn't say that.  
*[Handwritten signature]*

**Q2. did you ever receive my email of Tuesday, December 5, 2017 which included the following:**

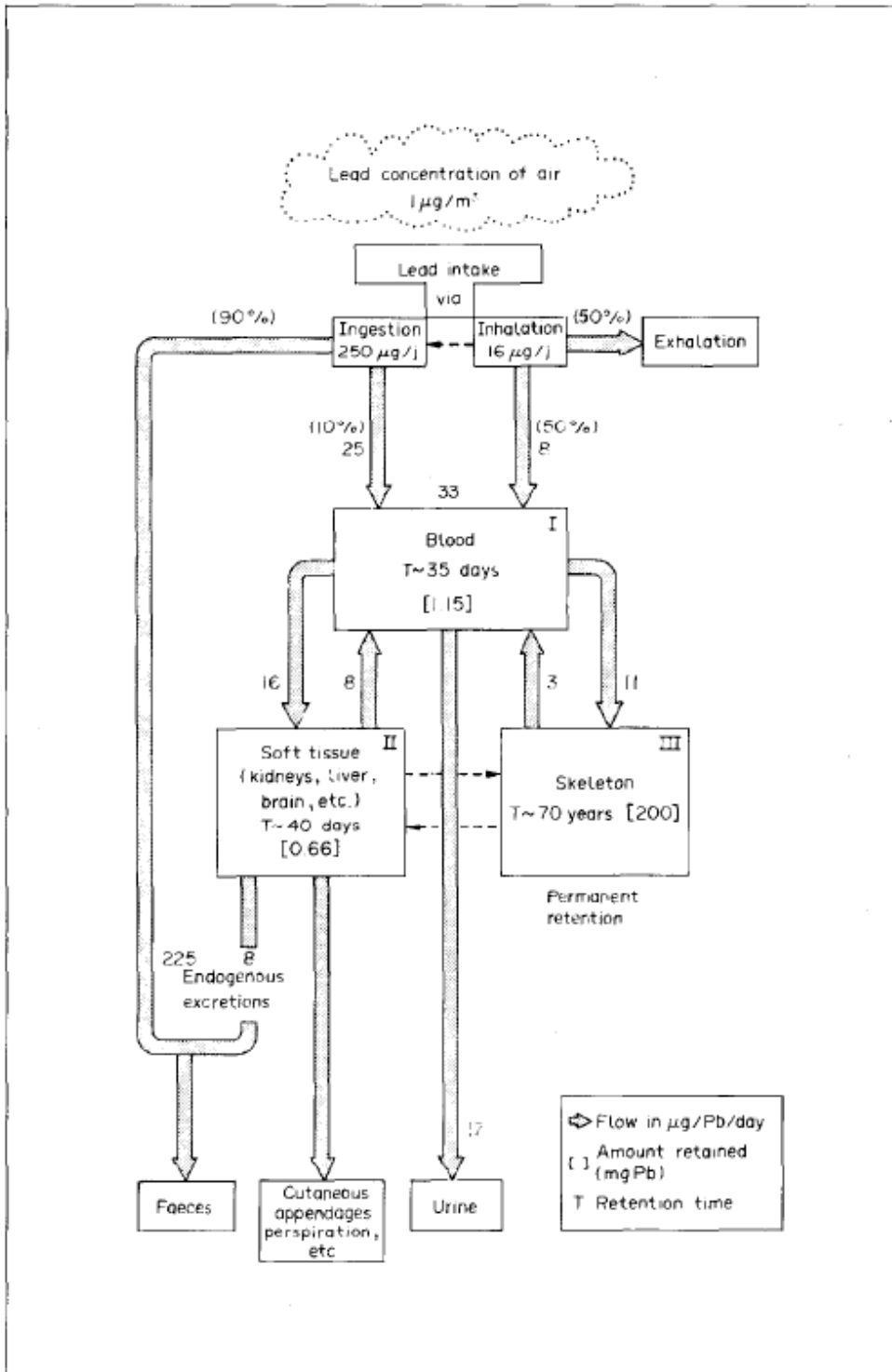
If a person happens to be going to Canada, or can afford to go for the purpose, they can undergo x-ray fluorescence (XRF) testing of their bones for lead. Contact details of Professor Hu and Professor Chettle [included].

**and did you ever contact Prof Howard Hu or Prof David Chettle, and if so, how did they respond?** [Editor's note: see the graphic on the next page and associated text on bone lead from *Lead in petrol* (Caplun et al 1984) to get a better idea of why The LEAD Group has for many years recommended that people who were lead poisoned decades ago should go to Canada to have XRF bone lead testing done.]

A2. Yes I tried to contact but at that time we now have pretty clear evidence that my emails were being hacked and I never got a reply from either.



**Q3. When did you have the bone XRF test done for which you never received the results? Who paid for your trip to the US for that bone XRF test? Who was the doctor/researcher you were scheduled to meet, and where, for the half day appointment that was cut short after the first bone XRF was done?**



*Editor's note:*

The graphic at left: *Schematic representation of fate of lead in the human body* and the following text are from *Lead in Petrol*, by Elisabeth Caplun, Daniel Petit, and Edgard Picciotto, Endeavour. New Series, Volume 8, No.3, 1984. Pergamon Press. Printed in Great Britain.

<https://www.sciencedirect.com/science/article/pii/0160932784900073>



Compartment III comprises the skeleton, which contains almost all (more than 95 per cent of the body burden of lead, amounting to 200 mg for a male 70 years old (the total weight being approximately 7 kg, not counting the spinal cord). Lead uptake increases constantly with time since, with constant exposure levels, lead intake exceeds the lead eliminated. The gradual accumulation of lead in the skeleton has been demonstrated in several studies, which correlate\* the increase in the burden of lead in the bones and the age of the individuals observed [1X]. That is why the concentration of lead in a tooth or the amount of lead released from bones into the blood or urine under the effect of chelating agents provides an accessible indicator not of an individual's recent exposure but of the cumulative effects of exposure. Furthermore, the rate of accumulation and the lead concentration in the bones are observed to be considerably higher in men than in women.

A3. I paid myself a total cost of NZ\$6000 and have emails confirming I was going for a half day of Testing with Prof. A R Todd. I had used a friend's computer to organise to get these tests done and Prof Todd had booked the lab from 0800 to 1130. Half way through the first XRF he said "sorry I have to go to a meeting - Kelly my Assistant will finish this off. By 0845 I was walking out the door and looked up at the Lintel seeing a bold shield saying "This Research Establishment Proudly Supported By ExxonMobil" ....! The Tests were done at Mt Sinai, New York. Professor Todd said after several emails that perhaps as we wore Knee High Rubber Boots this may account for the lower Lead Levels in the shin. I never got a report in writing just a lot of algorithmic numbers that I couldn't find anyone to read. When I tried to get a written report I was told by email under USA Security Laws they were not allowed.....??.....!!!!

**Q4. Have you found or received from anyone by email, any information on your non-cancer health issues and how they might be associated with lead exposure? I could spend the rest of the weekend just researching this question so if you have already gathered information, please email it to me pronto!**

A4. Multiple documents from IARC, American Agencies, Canadian Researchers all saying that Organic Lead is readily dermally absorbed, damaging 2nd and 3rd epidermal layers resulting in skin cancers. Then is carried in the blood causing Neurological Damage, Psychotic Dreams, Sperm Damage, Sexual Dysfunction then becoming lodged into the bones. It remains there for up to decades where it metabolizes into 2 Ionic Lead Compounds that are recognized as being Class 2a Carcinogens. IARC also states that in the absence of Human Testing, Testing done on Animals is deemed to apply to Humans.

**Q5. How is it that your non-cancer health issues seem to have been dismissed by the Accident Compensation Corporation (ACC), New Zealand?**

A5. The health problems I have had have been studiously ignored by their Occupational Physicians, I have witnesses to this happening. They even got a Doctor to write a report talking glowingly about how well the Refineries Health checks etc were done yet the Doctor wasn't even at the Refinery at the time. In fact he was in short pants at Secondary School when the Manual Transfer and Blending Plant was in operation, up until 1977. The Refinery also shredded all Employment and Training Records etc when the Manual Plant was removed. Dr. Jim Mcleod started as Company Dr. in late 1988/89 period.





**Q6. Is it the case that you already had one child when you began working at the refinery and no further children after your employment there began?**

A6. My Wife had a second child while we lived there but I was NOT the father. I was totally sexually dysfunctional. When I got married the second time I went to the “Men’s Clinic” who said they had never seen someone like me and made up a “Penile Injection” that I was only allowed to use a maximum of twice a week. My second wife said it was too “Artificial” and ultimately that marriage failed too.

**Q7. Have you been tested for infertility or would erectile dysfunction (or something else) on its own explain why you had no more children? Is your child still alive and still in your life?**

A7. Fully covered in A6. If I had fathered more children there would have been high odds the child would have had problems. My only Daughter is still alive and she with her Husband and Family live approx. 1 km from me now. She is a lovely girl and a great mother.



Photo (above) of Brian Arndt in 1998

**Q8 Would you say that it is highly likely that you were constantly exposed to refinery fumes for all the time you lived at the refinery site (when did that finish?) and all the hours you were working there? Did you wear any protective gear when you weren’t working with the TEL/TML barrels?**

A8. You could smell “Refinery Smells” 24/7. When the Lead Transfer was being operated and wind/breeze in the South/East the smell of Lead was very noticeable at our home in the Staff Area. We shifted into our own home which I built in 1969 around September if I recall. The only low lead petrol that came in direct was imported by Europa Oil which was finally taken over by I think Caltex. When the shipments arrived the Ship would berth at the adjacent Harbour Board Wharf and it would be unloaded at night by the Ship’s Crew and 2 Refinery Operators would unload the drums off the truck into the Lead Compound. There was no safety gear used at all. I have statements from 2 other Employees who verify there was no Health Checks done.

**Q9: Did you work at the refinery during turnarounds? If you did, please give approximate dates / frequency of turnarounds you worked at. I hope I’m right in thinking that a turnaround is the same as a shut-down, which you said the refinery strongly resisted doing because they lost production during it...**

A9: During my 10+ years I was involved in at least 6 shut-downs and was placed as “Night Supervisor” in at least 3 of them.

I was on Shift when an emergency call came in re: a fault had caused a Fire in the Refinery in South Africa. A product tube collapsed in one of the Crude Heaters, Furnaces named as the F100’s. As our plant was the same design we went into a “Crash Shut-down” at approx. 0200 hours in the morning. Yes there was a fault with the Tube Supports.



[Editor's note: It is easy to imagine that when Brian was working in the New Zealand refinery, precisely none of the following hazard warnings were heeded.

*Management of Occupational Health Risks during Refinery Turnarounds*, by M. Molyneux, D. Bonte, P. De Wilde, J. Ilinyi, T. Kaitale, A. Tiltnes, B. Simpson, J. Urbanus (Technical Co-ordinator), CONCAWE (established 1963), Brussels 2000, <https://www.concawe.eu/wp-content/uploads/2017/01/2002-00233-01-e.pdf> states:

During a TA [refinery turnaround or shut-down], delays in completing the work can result in significant costs in lost production. It is essential, therefore, to check the availability of likely additional resources, such as occupational hygiene specialists, so that they can be called upon as and when required. The nature of the work pattern, for example shift work covering 24 hours a day, should be taken into account.

The presence of large numbers of contractors on site for the duration of a TA has significant environmental health and welfare implications. Provision needs to be made for temporary office and living accommodation plus amenities for personal hygiene, protective clothing and equipment used at work. Easy access to dedicated clean areas for eating and drinking is essential.

**Q10. You asked in your 29<sup>th</sup> July 2019 Memorandum to the District Court at Hamilton “can Court Orders be Given for Files that are Restricted until 2043/48 and some for 100 years to be released to be read by your Honour or a Court Authorized Officer to enable the Truth to be told” – do you know why the files are restricted?**

A10. The Files that are Restricted I believe hold details of Workers Health and their ultimate Death. The files that are restricted until 2043/2048 are “Commercially Sensitive”.

There also are files that have 100 Years restriction on Privacy Grounds, these I believe are details of Workers who have died. Accident Compensation Corporation (ACC) have as their Head Spokesman on Toxic Problems a Mr. John Monigatti who says quite blandly that Organic Lead is not a Carcinogen. He totally ignores IARC Monograph, Vol. 87 that explains in clear detail the route that this material takes through the skin and ultimately ends up in the Bones where it Metabolizes into 2 particular Ionic Lead Compounds that are a Class 2a Carcinogen.

He has also stated that no one died of Cancer at the Refinery.....

I have the Medical Reports that show quite clearly that one of the Employees who Died of Cancer - being Ductile tumours - where the Refinery Medical Team told his Family that he had “Mesothelioma”.....

He also said that the high lead levels in my Teeth were caused by Lead Fillings.....



### **Other general comments from Brian Arndt:**

Feel free to use anything I have written. I strongly believe everything I have written in all my emails is true and correct and have backup emails to prove it. It's astounding that workers health issues as in general have gone under the radar.

You must have had "Manual Plants" in Australia same as here, where have all the records gone I wonder. The absence can almost be taken as guilt because if it was so safe as Kehoe and his cohorts said they would have kept them.

Talking of Kehoe I read the article *Hunter's The Diseases of Occupations - Lead Poisoning 1955-1975* (in this newsletter) and it is of great historic interest and certainly shows up the falsehoods they spread and most likely were paid to fabricate.

My latest tests have had one bright side in that my Prostate looks to be all clear in my recent PET/CT Scan. On the negative I have to go to a Heart Specialist and Neurologist, there is a suspicious something on my brain, Bugger! For good measure to make my day I have to have a Colonoscopy as soon as, life never gets dull and boring.....I am not too well this morning - woke up with BP [blood pressure] 202/97 and feel bloated and thick in the head. I cooked a slow cook lamb dish with vegies it was yummy but food is obviously not agreeing with me.

The story just goes on and on, I just want to see the Truth come out.

Brian Arndt

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# 19790627 Advocate newspaper article: Lead poisoning problems persist after centuries, by Pippa Roberts

## Lead poisoning problems persist after centuries

By Pippa Roberts  
Lead is the softest of the common metals. It is ductile, malleable and can be rolled into sheets or squirted into pipes. It can be cut with a knife and it will mark paper. But behind that dull, bluish-white exterior lies a toxic substance that can become a health hazard.

Lead builds up in the brain. In acute cases of lead poisoning the patient can experience mental deterioration and feel confused. If the source of the poisoning is not cut off after a lengthy period, the patient can suffer a permanent mental disability.

**REVERSIBLE**  
Take the source away, on the other hand, and the condition is reversible — the patient will recover quickly. Recently, concern was expressed at the link between the contents of petrol fumes and lead poisoning in children. Medical men condemned the use of lead additives in petrol.

With the expansion of the Marsden Oil refinery the authorities announced they intended dropping the lead content in petrol from 0.84 grams to 0.45 grams per litre. The news was welcomed.

But petrol is not the only product that can lead to lead poisoning... old paint also contains the hidden danger.

Whangarei's medical officer of health, Dr J. M. McKenzie-Pollock, said that in houses where the paint was beginning to peel, children were particularly exposed to its dangers. Toddlers were able to lean over window sills, pick off flakes of paint and chew them, thereby absorbing the lead properties. He described this as a significant source of lead poisoning.

Lead is also a health hazard to workmen involved with its industrial uses. This is particularly true in the ship building industry, Dr McKenzie-Pollock said, where old ship plates containing red lead were cut with acetylene torches.

This procedure could be dangerous if workers did not wear protective gear, he said.

**POTTERY**  
The lead glazes used by potters can be a danger to the potter and his immediate environment. Dr McKenzie-Pollock said most potters were responsible people and did not use lead glazes on food containers. The Department of Health had a monitoring programme, he said, and potters' products were checked for lead content.

The solder line on tin cans also contains lead. If it has not been covered with varnish on the inside, lead can be absorbed into the food the tin contains. Once again, the Department of Health monitors tin cans to make sure the lead level in food is kept low. And it also examines canning operations at their source to ensure they are well done.

Plumbers who use lead for flushing roofs are exposed to the metal's danger when they melt it down. But most take the necessary precautions. However, amateur fishermen who made their own sinkers by melting down lead and putting it into moulds could be working at risk, Dr McKenzie-Pollock noted, as they were unaware of the potential dangers and neglected taking the protective precautions.

**NOT NEW**  
Lead poisoning is not a new occurrence. The Egyptians knew about it and some people contend that it may have led to the downfall of the Roman Empire, Dr McKenzie-Pollock said. The Roman upper class used pewter-ware for eating and drinking and these vessels had a high lead content. The lead was absorbed into the food. Slowly the build-up in the bloodstream of the ruling class would have caused degeneration in their mental capacity. The lower classes could not

afford pewter-ware. In England's Industrial Revolution, processes used in the manufacturing of red and white lead produced serious lead poisoning in workers. Nowadays, Dr McKenzie-Pollock feels people are alive to the dangers of handling lead. He said people should never inhale vapour containing lead and should always wash their hands after handling a lead product in a concentrated form. Plants such as the Marsden Oil refinery do vigorous, routine testing of all the workers with likely exposure to lead.

**WEAKNESS**  
A patient suffering from the type of lead poisoning contracted through contact with old paint, the making of lead sinkers and various other operations — as opposed to poisoning related to petrol fumes — will get colic and muscle weakness. For instance, in the old days of lead paint, painters

suffering from lead poisoning would often have trouble gripping a brush and would frequently drop it. Although lead is no longer a major contaminant of the environment, the level must be reduced to its absolute minimum. Dr McKenzie-Pollock recommended, and the sources of lead pollution found.



Handwritten notes and signatures including: NCH, P.I. 2/17, S.I. 1/17, PPHN, SPHN (2) 1/1/77, PHN whg sk KPC, PHN Kame, Central, 2/17, 2/17

Editor's note: This 27<sup>th</sup> June 1979 Advocate newspaper article: *Lead poisoning problems persist after centuries*, by Pippa Roberts, is very comprehensive but does not mention refinery workers.





## **Ray Harvey phone account of lead detox with Vit D & colostrum on vegan diet**

*Contemporaneous notes by Elizabeth O'Brien (ELO) of The LEAD Group, of a February 2019 phone conversation with Ray Harvey (RH)*

RH: I was diagnosed with lead poisoning at 5-6 yrs old from sucking my lead soldiers then worked in automotive spray-painting for 10 yrs then at Roseberry lead mine & Savage River & Tulla, Tasmania lead mine. I was diagnosed with multiple sclerosis but two MRIs I had to pay for myself say I don't have MS and from a mate who is 90+ his son has MS & I don't have his symptoms.

I'm functional now. In my teens I had an IQ test which showed 135 at Ultimo Technical College in Sydney but I've always had poor memory.

My ability to multi-task and my knowledge has decreased. I'm 72 now, 73 in a couple of months. I stopped sucking on the lead soldiers when I was 5 or 6 but I was living at Mortlake near the gasworks which burned coal and put the gas in large tanks which supplied the whole of Sydney with cooking and water heating gas. I lived there until I was 22. I was the dux of my class at age 7 and bottom of the class at 8.

People raised there didn't smell the gas but everyone who visited the suburb could smell it and said it was putrid.

I follow God's vegan diet from Genesis: seeds, vegetables, no wheat (because its genetically modified), no honey, no sugar etc. I was a very sweet tooth and had a lot of honey and sugar. I had 7-8 amalgam fillings and had them taken out some years ago.

I got diagnosed with MS some 20 yrs ago but I was never given any medication for it until I demanded it 6 yrs ago but that damaged my kidneys and made them sore so I stopped and since I went on to the vegan diet I feel good. Now I feel like I'm in my 20s after taking a massive dose 10,000 units per day (one tablet) of Vitamin D, plus another thing I'll go and get (in my wheelchair) because I've forgotten the name of it.

Colostrum is a cow's milk product I've been taking for the past 4 wks. Both medications were from America off the internet.

I'm having trouble with my legs, with walking.

ELO: do you have footdrop?

RH: not that I know of. The dr recently diagnosed me with arthritis, not rheumatoid arthritis.



He put me on a painkiller - Osteomol 665 Paracetamol - I took 3 doses and I'm feeling a lot less pain. I'm using 3 kg weights and working on the stomach area because being in the wheelchair I have trouble with my bowels. So I do mild exercise 1-2 hrs a day, including lifting myself up on a ladder in the back yard. When I was working, I'd lift a whole car engine up and put it in the car - that's how fit I was.

ELO: have you ever had a blood lead test? You must have had it at the mines.

RH: I never had it at the mine but I asked for one recently and it was 0.10.

ELO: what unit was that?

RH: I don't know. The mines in Tasmania never had blood lead testing but workers there were diagnosed with multiple sclerosis. I had a 2nd IQ test done a few years ago but they couldn't finish it off because I am dyslexic. I always had trouble reading and everything although I could retain facts like the first car (a steam car) was made in 1770. I'm very knowledgeable about the Bible, the stars and the planets but I can no longer speak fluently. I keep forgetting things. The Bible is the greatest psychology book. Freud had cancer and committed suicide so I don't regard him as sane. My attitude is there's always tomorrow and I will always fight another day.

Food is the greatest thing to clean the body out. Look up Professor Walter Veith on the internet. I do a Ministry. I don't belong to a church but I do [www.amazingdiscoveries.tv](http://www.amazingdiscoveries.tv) - <https://amazingdiscoveries.tv/media/2540/3002-food-for-thought/> - he was the one that found out about the carcinogenic enzymes that are in milk. Holland has the highest rate of milk-drinking and osteoporosis in the world and countries that don't have milk have the lowest rates of osteoporosis. He also says there's carcinogenic enzymes in meat, especially in pork - that's why the Bible says not to eat pork. The Bible says you can eat meat if you let the blood run out of it and use herbs and spices to overcome the two enzymes.

Some people in Africa found a baby lion cub and raised it on milk but when they went to feed it meat it wouldn't eat it so they fed it grass.

Walter Veith says the lion's back teeth are for grinding.

Through having the MRI I found out I had a heart attack (which I had put down to gastric reflux) and didn't know it.

I've been taking Vit C tablets. A friend of mine knew someone who had lead poisoning and he was given a high oral dose of Vit C & he got rid of the lead out of his system.

My friend John was an orthopaedic specialist until he came to Australia and is now my naturopath.

The guy at the health food store and his 85 yr old father were both diagnosed with multiple sclerosis and they took Colostrum and I've been on it for about a month. I feel fantastic. I



found 30 years ago that vibration is good for pain. I pushed my leg onto a vibration machine that you are meant to stand on and it helped my arthritis. If you phone me 0754636244 - give me extra time to get to the phone. I live in Rathdowney QLD 4287.

I've been in the wheelchair off and on for about 8-9 years. I'm currently concentrating on using the walker.

I had fantastic balance and came second in marathon ice-skating which I did at Homebush Rink which is now closed.

I can't wear my Akubra because it gets too hot to wear it. I'm on blood pressure tablets which brings it down to normal. I live on my own in a granny flat and I can't prepare my food on my own so I make a salad with vegies I buy pre-washed and put it with tomatoes.

I rang Mount Isa Hospital who put me on to the Qld Health Department's government office in town who put me on to your 1800626086 number.

Diabetes is in my family - my grandfather had it. My high blood pressure was noticed 5-6 years ago when I was in hospital and I've been taking the blood pressure tablets ever since.

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