LEAD Action News

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The newsletter of The LEAD (Lead Education and Abatement Design) Group Inc.
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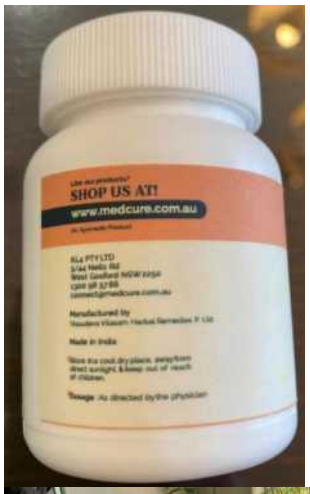
Two child cases plus two leaded products plus two LEAD Group Kits equals Lead Action News!

By Elizabeth O'Brien, Lead Scientist and Lead Advisor, The LEAD Group Inc

I've had the honour and the privilege this month of working with two families and a Building Biologist, to locate (and remove) two seriously lead-contaminated products causing the lead poisoning of young children. Do you have products like these at home?

If so, the action I prescribe is: read the related articles in this issue of *LEAD Action News,* organise blood lead testing through your GP and if results are elevated, buy a LEAD Group Kit and have a Building Biologist collect the samples! LEAD Group Kits now include the option that you or your Building Biologist pay NMI directly to test food and medications for heavy metals at the Australian government NMI lab, and The LEAD Group interprets the results. Finally, complain to government and the supplier.



Leaded Product imported from India, sold in Australia:

Medcure Manasamithra vatika Ayurvedic medication, made in India by Vasudeva Vilasam, purchased for $80 from Rama Prasad in May 2020, which contains Swarna Bhasma (sacred ash of gold), ash of silver (Rajata Bhasma), ash of iron (Loha Bhasma). iron pyrite (Tapya – Makshika Bhasma) and **1.08% lead** (enough to poison both children and adults).

Leaded Product made and sold in Australia:

Re-use painted timber dining table purchased for $1200 from Mitchell Road Antiques, Alexandria, Sydney, in September 2014, which contains 2.8% lead in the degraded paint.

Contents

Lead Poisoning of Our 3 Children

By Karen (not her real name – family and doctors and NSW Health Public Health Unit (PHU) staff names have been removed for this version for LEAD Action News*)*

On the 14th of October 2019 I took my youngest daughter, our middle child, then 2 years old, to see her Paediatrician, for a suspected food intolerance. Our middle child seemed to develop a rash / reddish cheeks and sometimes complained of a sore stomach, upon eating particular foods. This seemed to be getting worse and more common.

Our paediatrician requested blood tests. Heavy metals were tested amongst many other things. On 17th of October 2019 our middle child's blood was tested.

We got the results on 25 October 2019, showing that our 2 year old had a blood lead level of 10.6 ug/dL (micrograms per decilitre). The notifiable blood lead level in New South Wales is 5 ug/dL so the NSW Health Department was mandatorily notified of our daughter's blood lead result by the pathology laboratory.

The Public Health Unit called me on the 25 October 2019. I was completely shocked and devastated.

We had spent our whole time as parents focused on our children's health. This included a mainly whole food / organic diet. We were careful where we sourced our food, supplements (if any) and never used pharmaceutical drugs. The only supplements we have ever used for our children were high quality supplements recommended by specialist doctors. The children hardly ever got sick. Usually only one or two very mild colds per year if at all.

On the advice of our paediatrician the whole family was tested at this time. Myself and my husband were 2.1 ug/dL on 25 October 2019. My then 4 year old eldest daughter was 3.1 ug/dL, and my near 1 year old son was 3.3 ug/dL on 26 October 2019. The middle child was also X-rayed in case she had ingested anything. She hadn't.

We were so shocked and devastated by the news and wanted immediate action and it seemed as if the Public Health Unit was going to take a long time to come to our house and test the samples so I searched for private companies to do it. I spoke to a number of people.

I was highly recommended WSP Australia, Occupational Hygienists, and spoke on numerous occasions to Haysam Elhassan of WSP, who was very helpful and concerned. If we were going to stay at the Glenbrook house we would have enlisted their help at the end of 2019 but decided not to as the cost was going to be thousands.

We thought at the time the house was the problem so if we moved we would solve the problem. We planned on getting them or someone like them in after our move to ensure our new place was

healthy.

As we were living in Glenbrook in the Blue Mountains at the time, the Health Department Public Health Unit (PHU) Officer from Nepean Blue Mountains Local Health District came in and collected samples on 31/10/19 from our home for laboratory testing for lead.

While these staff were friendly, my husband and I were very concerned about their inexperience. One seemed inexperienced, and the other was new, and being trained by her.

We were desperate to find the source of the lead and did a huge amount of research in the days leading up to their visit. We made lists of possible sources and gave the PHU officers water bottles, toys, and all sorts of things to help them find the source. The officers didn't even know at the time of the visit that they were unable to test the food samples we gave them.

We were not at all satisfied with the sampling that was conducted by the PHU. They agreed on the day they collected them, through our desperation, to take more samples than they usually would.

We found out later that many of the extra samples were discarded, as they didn't take enough of a sample or the PHU didn't have a laboratory they were associated with that could test the sample (eg. the food samples). Discarded samples included the water from a water bottle our middle child used a lot and we asked that they take the bottle itself to be tested (as we had read that some stainless steel type bottles had tested high for lead) and a food item that she regularly ate at the time.

At the time of their visit we mentioned that we had recycled painted timber furniture (including our dining room table and pointed to it) but they said it would be fine if it was bought in a shop. They never examined any of these items carefully to ascertain the age. We told them we bought them from an antique / vintage / second hand shop. They didn't enquire any further. (We now know there are no regulations for recycled timber and this should have been checked. We had no idea about this at the time).

The furniture included a 2 metre long dining table (see photo) that was in full view in the centre of our open plan kitchen / dining / living area. They seemed to have a usual process of soil, water, house wall paint and dust of the home and didn't really seem to be interested in other sources.

Our own research helped us to show them many different possible sources. We identified the doll's house (see photos) ourselves and a painted timber doll's cot.

I doubt they would have picked up the doll's house themselves. They never tested the doll's cot, despite it having green and yellow paint and looking antique.

They commented at how much we knew about possible sources of lead and how much research we had done.

As mentioned, we were moving house to Avalon Beach, and had thought at the time that our children would be ok as we were leaving the house.

We thought there must have been something wrong with our house in Glenbrook so we immediately moved to my parent's home in Leonay for 4 weeks, from the 1st of November, 2019, before our planned move to Avalon Beach on the 27th of November 2019. We didn't want to risk continued exposure to the source of the lead.

Our middle child started detoxification treatment in Leonay, which was rigorous, and very stressful for her and myself.

We regularly contacted the PHU asking if the results had come in, as they said it would take 2 weeks. We asked for the samples to be tested as a matter of urgency due to the ages of our 3 young children. We were terrified of doing them any more harm.

The results were delayed and in the mean time I had a conversation with the Manager of Environmental Health, who lectured me on what I was feeding our children. He said the collagen we were putting in the family's smoothie was unsafe and we were putting our children at risk. He said any food at Woolworths was safe.

My husband and I were very concerned about this conversation. We had spent around double what other families we knew had spent on food over the years - sourcing free range, grain fed, organic whole foods that were pesticide-free.

My understanding is that the food at Woolworths is not all safe - non-organic farmers use pesticides. Despite the Environmental Health Manager criticising the collagen, it was never tested at the laboratory to deem it unsafe, even though we gave them a sample on the day the other samples were collected.

The results from the PHU came back around the 18th of December 2019, after a long wait. We were originally told two weeks. They found high lead 1.3% or 13000 mg/kg in the red paint on the roof of the doll's house that was made in the 1970's.

We had already immediately discarded the doll's house and anything else we considered suspect - the painted dolls cot that looked wooden vintage style that was second hand. The PHU didn't test this. No other samples - soil and water, showed concern according to the PHU.

We had also asked them to collect dust on the 31st of October 2019, as we had recently painted our ceiling and the man hole had been open. They forgot to collect a sample from the area while at our house so I rang and I emailed the PHU on the 31st of October saying our 2 year old middle child slept near the man hole. Her bedroom was the closest room to it. I told them that the manhole was open during painting and I had wanted them to check it to ensure it wasn't the ceiling cavity dust that led to her high lead levels.

The PHU said they would come back to our house if nothing came back from the laboratory showing a lead source. Assuming that every child with an elevated blood lead level only has one lead source!

I don't think they had any dust wipes to assess for lead when they came to our house and they didn't check the dust in the home at all from memory.

I let them know we were going to have the house fully cleaned - walls, ceilings - everything just after they had been there to collect samples to ensure that if there was anything toxic in the house that it was removed. We were about to rent the house out and wanted to ensure the property was safe.

We also washed and wiped down all the kids toys and chucked out anything that had been near the doll's house.

When I requested the results from the PHU, the emailed attachment received on 18th of December 2019 showed the results in simple form and the only explanation or "interpretation" provided in the report from NSW Pathology was one remark, that said:

"The maximum permissible concentration of lead in paint is 0.1% according to the Third Schedule, Uniform Paint Standard, " Standard for the Uniform Scheduling of drugs and Poisons" No22,2007."

Glenbrook Bath Tub Water: <0.002 mg/L lead
Glenbrook Shower Head Water: <0.002 mg/L lead
Glenbrook Backyard Soil: 0.00% or 44 mg/kg lead
Glenbrook Soil Red Pot Plant: 0.01% or 72 mg/kg lead
Glenbrook Cream Pot Plant Soil: 0.01% or 80 mg/kg lead
Glenbrook Dolls House Paint: 1.3% or 13000 mg/kg lead
Glenbrook Front Bedroom Paint: 0.01% or 76 mg/kg lead
Glenbrook Water Bottle: not processed – 0.00% lead

Liz O'Brien from The LEAD Group later advised me that the "Remark" is irrelevant to paint scraped off a surface as the Poisons Standard only applies to new paint sold (since 1997). The "Remark", in order to be applicable, should state something like:

Australian/New Zealand Standard "AS/NZS 4361.2:2017 Guide to hazardous paint management Part 2: Lead paint in residential, public and commercial buildings" defines Lead paint as: A paint film that contains greater than 0.1% or 1,000 mg/kg lead by mass in the dry film.

She also said that despite it being useful for the paint lead results to be reported in both % and mg/kg, the only time soil lead results should ever be reported in % is when a lead mining exploration company wants to figure out whether it would be economically feasible to mine the soil for lead (greater than 1.5%).

The backyard soil sample result of 0.00% could easily be misinterpreted by parents and PHU Officers alike as meaning "there's no lead in the backyard" whereas The LEAD Group recommends that soil should be less than 30 mg/kg lead if a child has pica or you keep poultry in the yard and eat their eggs. It certainly was by us - misinterpreted.

We were unaware at the time that this soil was also cause for concern with young toddlers exploring. I want to ensure my children are safe so I want the lead to be lower than 30mg/kg. I was never given adequate information from PHU to help protect my children. I only heard this information from Liz O'Brien of the LEAD Group when I sought her help as I had completely lost faith in PHU helping us save our children from lead exposure.

We had specifically told PHU when they came to our house that I had caught our children playing in the cream and red pot plants (that were tested by PHU) and had wondered if this soil was contaminated. This is why this soil was tested.

In the email sent on 18th of December 2019 with the results the PHU also noted:

"Please be advised that there are no results for the organic collagen powder, clay samples, fishing weights and water bottle as our laboratory was unable to process the samples. I'm not too sure what's involved in the analysis as the laboratory work is out of my scope, however from my understanding the methods and facilities they have at the labs to test for lead were not able to be used on those samples."

My impression is that the PHU took a lot more samples from our house than usual. They did because we pushed them.

We had and have water filters on our bath, shower, and drinking water to ensure we bathed, showered, and drank the purest water possible. We wanted everything tested, as we had been focusing on keeping our children safe and we could not understand how they could have been poisoned.

PHU also didn't test our drinking water. We requested that they did. They didn't plan ahead like our Building Biologist later did and ask us, as advised in The LEAD Group Kit sampling instructions, to not use the kitchen tap overnight in order to collect a first flush sample.

We had a reverse osmosis water filter but wanted to cover all bases. Our house was built in the 1960's so we wanted to make sure the house drinking water was not the problem.

We were disappointed that the other samples we gave were not tested. As noted, we had read that some water bottles had been found to have high lead in them and we wanted our middle child's water bottle tested. As I said, we had done a huge amount of research on possible sources and we wanted to cover all bases.

The PHU Officer determined that the case was solved in December 2019 because the red paint on the roof of the doll's house had 1.3% lead. We were convinced that the doll's house was not the source. We told them.

We cannot understand why, if they believed the collagen was a problem, they never tested it. Nor why they never tested our drinking water, or the dust outside the manhole.

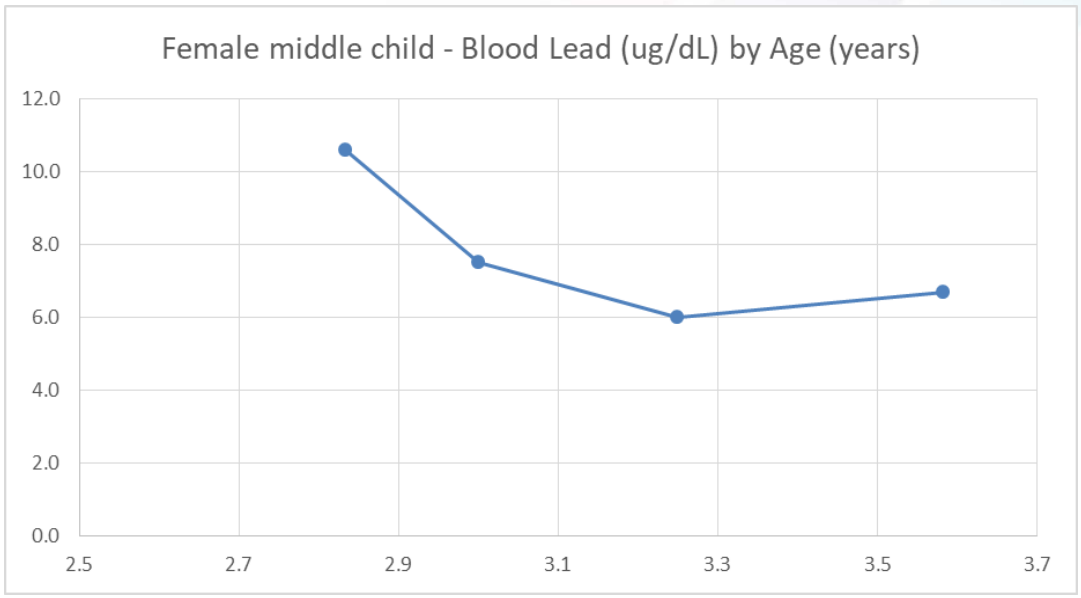
We never used the organic collagen again - even though the company says that it tests for lead. I showed Jo Lia, our Building Biologist, from NoToxRox, in September 2020, the Great Lakes Collagen Powder we had stopped taking on the Environmental Health Manager's advice when Jo came to investigate our home for the source of lead poisoning. She knew this product, and checked with the Great Lakes Company. Jo sent me an independent study by a functional medicine practitioner, at https://gallery.mailchimp.com/36f67b141008ab16392748797/files/76dd7b45-a07a-4c41-bc8d-fd4a497e1710/2019_Bone_Broth_Report_2_.pdf?mc_cid=d7e7a163d7&mc_eid=71c0e7c4b9 which reports that the Great Lakes Collagen Powder contains 0.001 parts per million (ppm) lead or 0.001 mg/kg (an almost undetectable tiny amount).

We did not consider the case closed. Our middle child did not suck on the doll's house and the children rarely used the doll's house. The side with the paint on it was facing the window so they would not have touched the roof enough to gain the readings they had. My 11 month old son was also affected by lead at the time and he never went near the doll's house. He had only just begun walking.

Our middle child had blood lead testing on the following dates, these are her results (all results

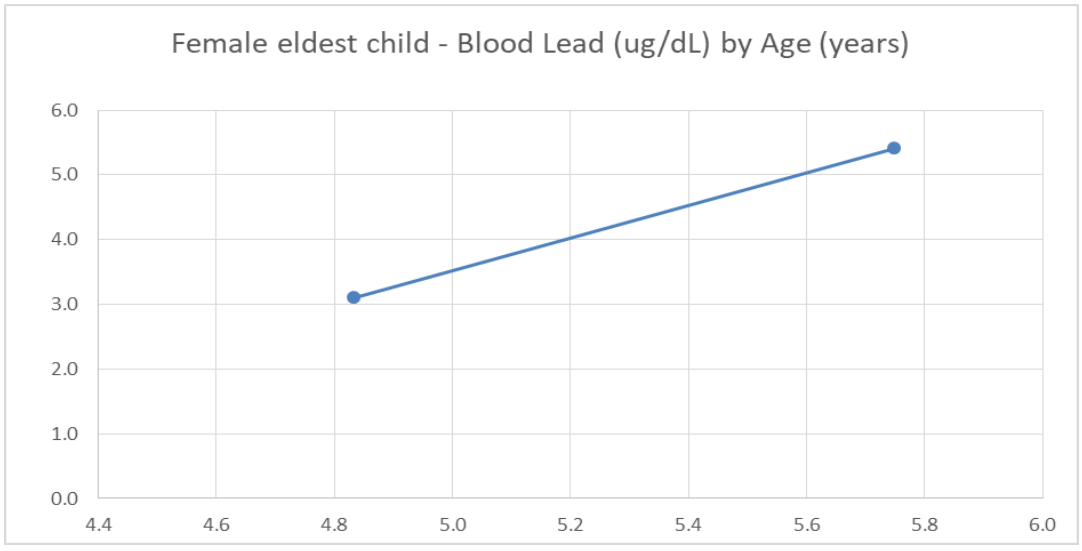
graphed by The LEAD Group):

17/10/19 - 10.6 ug/dL (aged 2 years, 22 months)
10/12/19 - 7.5 ug/dL (aged 2 years, 23.5 months)
09/03/20 – 6 ug/dL (aged 3 years, 2 months)
27/7/20 - 6.7 ug/dL (aged 3 years, 7 months)



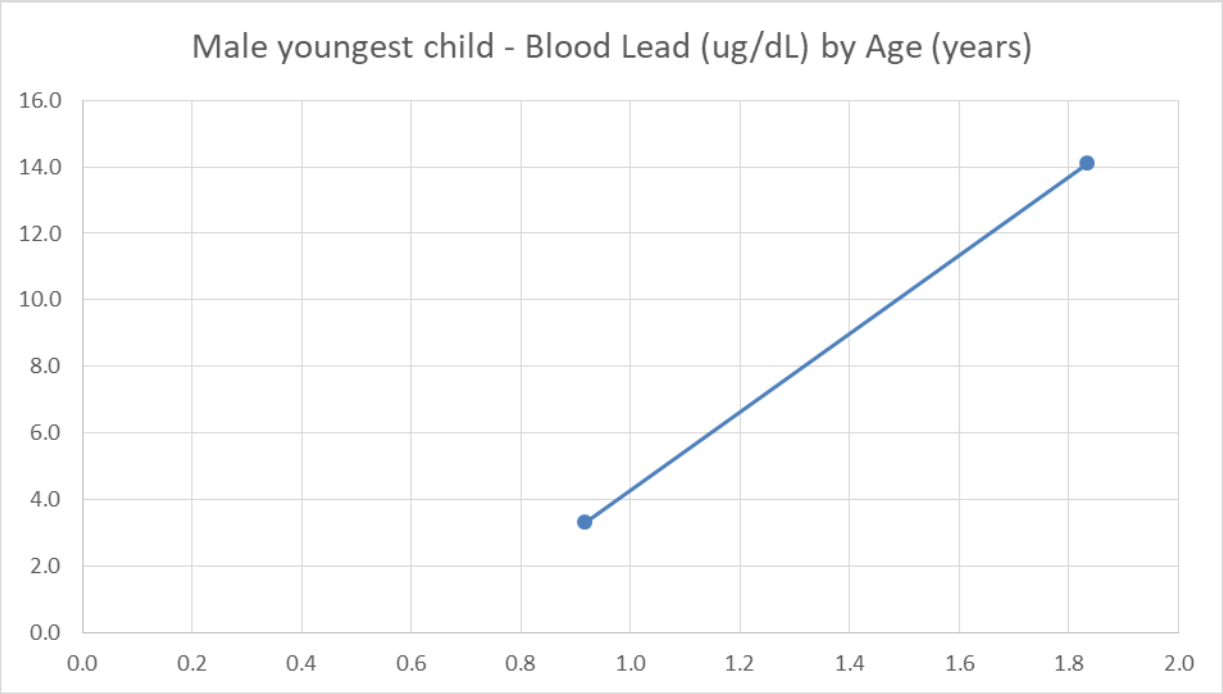
Our eldest daughter's blood lead results were:

26/10/19 - 3.1 ug/dL (aged 4 years, 23 months)
7/9/20 - 5.4 ug/dL (aged 5 years, 8 months)



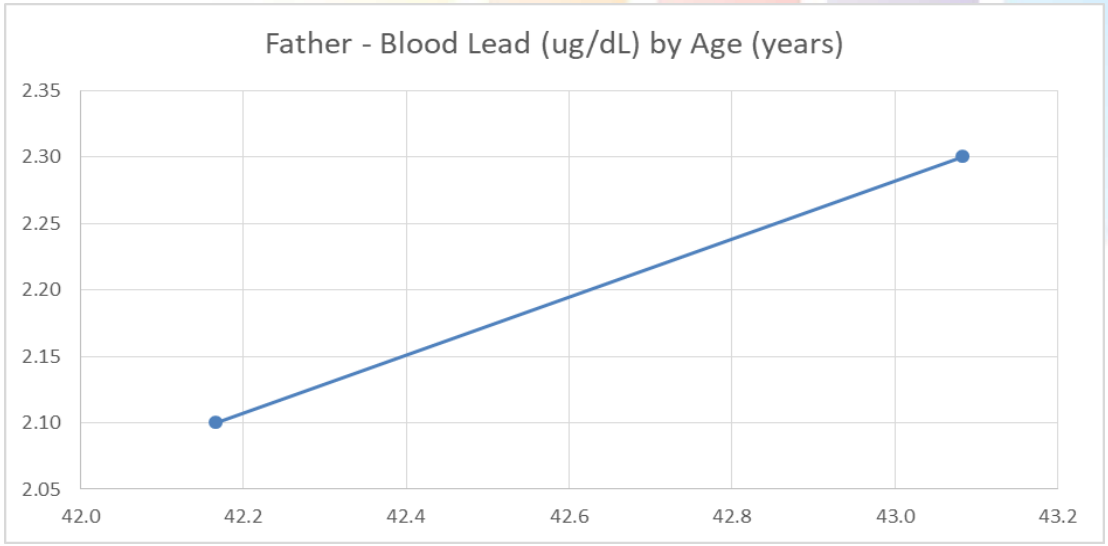
Our son's (the youngest child's) blood lead results were:

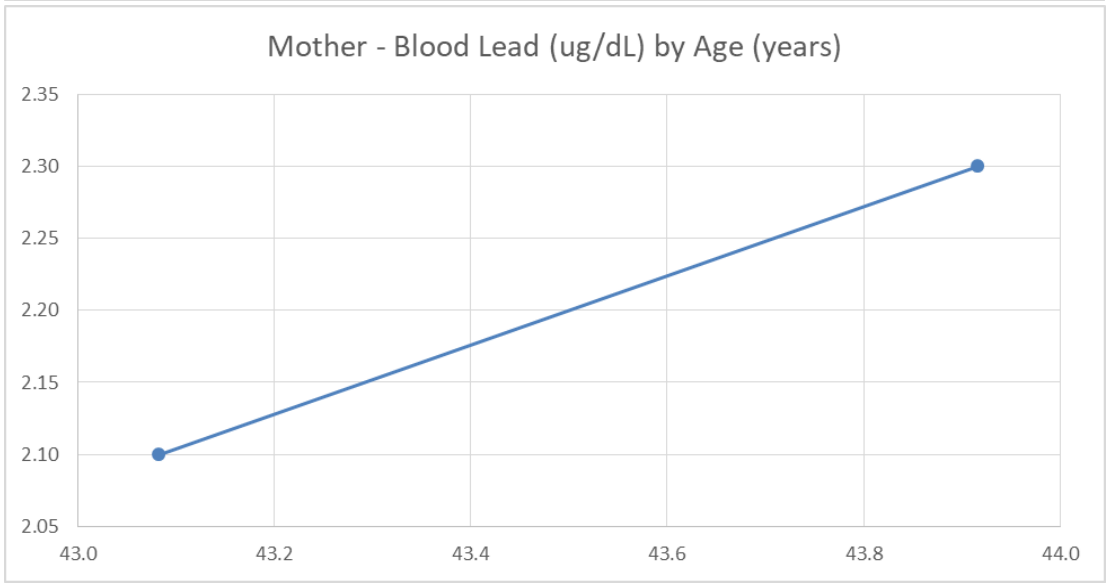
26/10/19 - 3.3 ug/dL (aged 11 months)
1/9/20 - 14.1 ug/dL (aged 22 months)



My husband's and my blood lead results were:

25/10/19 – 2.1 ug/dL (I was aged 43 years and he was aged 42)
15/8/20 – me - 2.3 ug/dL (I was aged 43 years)
8/9/20 – my husband - 2.3 ug/dL (my husband was aged 43)





Our middle child underwent Chelation and supplementation therapy from November 2019. She remains on this treatment. The treatment continued throughout the time indicated on her graph.

Our paediatrician requested twice that the PHU for the Northern Beaches visit our new home in Avalon to ensure our children were safe but they refused to come. We never heard from them.

Our middle child's blood lead level was tested in December 2019 to ensure the treatment was working. Her blood lead level was tested again in March 2020.

The paediatrician was concerned that our youngest daughter's blood lead level was not going down as fast as she thought it would.

Our middle child had a traumatic experience giving blood in March 2020. While we asked for senior collectors (as we always had with our children) to take the sample I don't believe the man who took

the blood was experienced enough. He tried numerous times to find a vein, sticking the needle in to 3 different sites.

We were then told to try another centre 5 minutes away, where a trainer was. She found a vein the first time. I was extremely distressed watching my three year old go through this, particularly given I knew she had many blood tests ahead of her to check for lead poisoning.

As a result, we didn't re-test for lead until the end of July 2020, hoping the lead levels would have gone down substantially by then, and that she would have forgotten the traumatic experience.

We were very distressed to find that in fact our middle child's lead levels had increased between March and July 2020.

Her blood lead level rose to 6.7 ug/dL in July 2020. This was her fourth notifiable level, and PHU was informed by the lab as usual.

Our paediatrician suggested testing the whole family once more.

We had now moved back to Leonay, and so we were in the Nepean / Blue Mountains PHU area again. The Public Health Officer from PHU, who had worked on our case in 2019, called me shortly after our middle child's fourth notifiable blood lead result.

She seemed more focused on finding out our new address so she could send me a letter once again, than she was in coming to our house to determine the source of the lead. We were beside ourselves, and requested the PHU test our food. We could not understand how the lead could be rising again and that it was occurring at the third house we lived in.

The PHU refused to come and test our house in Leonay, saying that it was likely to have been the house in Avalon that caused the lead levels to rise. They also said they can't test food. I asked them how I could and they provided me with the details of the National Measurement Institute (NMI). We would have to pay for food testing ourselves.

I asked our paediatrician to request that the PHU come to test our house in Leonay, and she did but they refused again around 25 August 2020.

My understanding is that this paediatrician had requested the Health Department come to help us twice in Avalon and again in Leonay and they refused. We also asked them to come again in Glenbrook to test the dust from the manhole and again in Leonay and they refused. I also asked the Environmental Health Manager again on 23rd September and he avoided the question and began going over details that had been provided on a number of occasions already.

We retested the whole family over a few weeks in August and September 2020 as advised by our paediatrician.

The results were as follows:

My husband and I again had the same blood lead result as each other, but we had gone from 2.1 ug/dL (25/26 October 2019) to 2.3 ug/dL when tested 21 August / 8 September 2020.

My son, 22 months, had the highest blood lead level of anyone in the family - 14.17 ug/dL on 1st of September 2020. He was X-rayed on 11 September 2020 to rule out that he had ingested anything. He hadn't.

Even my eldest daughter, had a blood lead level of 5.4 ug/dL, blood taken on 8 September 2020.

At this point all three children now had notifiable blood lead levels (ie above 5 ug/dL) and were diagnosed to have lead poisoning.

I emailed my son's results to the PHU on 8 September 2020 asking what they would do now that two children were lead poisoned in one home. I didn't know at the time that three of my children were in fact lead poisoned.

The Manager of Environmental Health, at PHU Nepean Blue Mountains, rang me on 8 September 2020. They were not prepared to come and test our Leonay home. He told me that our middle child was detoxing normally and her results show a normal metabolism / detox process. I didn't get that impression from our paediatrician. Our middle child's results in fact showed her lead levels were increasing at the last blood test (despite discarding the doll's house – the only source of lead identified by PHU).

The Manager of Environmental Health emailed me a food diary for us to look for common foods the kids and us were eating. They were not prepared to test these foods, however.

This was our last contact with the PHU until I received a voicemail on Thursday, 17 September 2020, requesting our address and that of our doctors. They had received our eldest child's results. They didn't seem to have realised that our eldest child was the sister of our middle child and our youngest child. I am not sure who rang. I couldn't hear the message very well. I have not had any contact with this person so far. She left a number (02) 4734 2207 that no one answered and there was no option for voicemail on 21st September 2020. I rang the number twice around 2.25pm.

On 23rd September 2020, the Manager of Environmental Health from Nepean PHU called asking me about the food diary. He said that he now had my three children with a "notifiable condition" in the database. I asked him what he was going to do now that they had three.

He avoided the question and asked about some mail he had received from me the day before. I said I hadn't sent him any mail and he said "oh I had only had a preliminary read of it".

He then looked at it again and said it must have been from a doctor looking after our children. He asked which doctor and I said I didn't know. He then asked why we had three doctors. I explained that

one was a local GP that we needed to refer us to the Paediatrician and the other was a functional GP with extensive experience and knowledge of heavy metal detoxing.

I told him this functional GP was recommended by a psychiatrist I began seeing this year for insomnia that has come as a result of ongoing stress without help with our children's lead poisoning. He mentioned the food again and the dining table. One of our doctors had returned a letter to PHU with the information we had provided to the doctors. I said we were doing our own investigations and had a number of samples in for testing at the moment. He then asked for me to contact PHU with the results. I asked for his Director's name.

To this day, we have not had a letter telling us of my son's or eldest daughter's results - despite the fact that both of them, along with our middle child, currently meet the criteria for notifiable blood lead levels. Our son's result is also substantially higher than our middle child's was last year when they visited our home.

I would have thought they would be very concerned to know that three young children were diagnosed in one home, and there was no known source of lead.

I would have thought the Manager of Environmental Health would arrange for our house to be retested as a matter of urgency to investigate the lead poisoning of three young children in one home.

Again, like the PHU Officer, he was more interested in dates of when we moved and addresses and going over the details of the "investigation" as he called it, which in my mind involves collecting physical evidence. All they seemed concerned with was collecting dates and addresses for the second, third, fourth time.

Their lack of help has me concluding they do not really care about protecting the health of young children.

The PHU sent a letter about our middle child's fourth notifiable blood lead result on the 11th of August 2020 telling us her result, and providing us with information about lead exposure in children - including possible sources. But the information is outdated, for example "Lead-based household paints were used before 1970 in Australia..." should be changed to "Lead paint was used before 1997 in Australian homes…" given the new definition of Lead paint in the 2017 update of the Australian/New Zealand Standard "AS/NZS 4361.2:2017 Guide to hazardous paint management Part 2: Lead paint in residential, public and commercial buildings."

The letter included wrong information, namely: "Your child's/children's blood lead level result was between 5 ug/dL and 10 ug/dL… **Blood lead results in this range have not been shown to cause any health effects**, but this level is considered higher than most other Australians."

According to the World Health Organization's publication on "Childhood Lead Poisoning" at https://www.who.int/ceh/publications/leadguidance.pdf (2010):

> In light of the growing amount of evidence on neurodevelopmental and other systemic effects of lead at levels below 10 µg/dl, some researchers have suggested that the current level of 10 µg/dl may not be adequately protective of child health (Lanphear et al., 2000; Canfield et al., 2003; Bellinger & Needleman, 2003; Wasserman et al., 2003; Lanphear et al., 2005; Hu et al., 2006; Kordas et al., 2006; Schnaas et al., 2006; TellezRoj et al., 2006; Surkan et al., 2007).
>
> Some jurisdictions in the United States (e.g., the California Environmental Protection Agency and the New York City Department of Health) have translated more recent evidence on low-level lead toxicity into policy. A number of public health agencies are considering or have already taken action to recognise that any level of exposure to lead is associated with harm to the developing child, and scientists have suggested that a lower blood lead level – perhaps 2 µg/ dl – should be the trigger for follow-up and assessment of a child by health professionals (Gilbert & Weiss, 2006).

And The LEAD Group has published quotes from dozens of research articles in a fact sheet called: "Health effects of a blood lead level below 10 µg/dL in both adults and children and even below 1 µg/dL in pregnancy" at:
https://www.lead.org.au/fs/Health_Effects_of_PbB_Level_Below_10_ug_per_dL_&_Even_Below_1_ug_per_dL_20200922.pdf

This is in line with the view of our Paediatrician, who says there should be no lead (ie a non-detectable level, below the limit of detection) in our children's blood. This is what we are working tirelessly to achieve.

The letter from the PHU also said "while the test results do not indicate a current health risk, should your children's blood level/s increase further, it could result in health effects."

This standard letter, apart from being inaccurate, also had no meaning in our situation. Our middle child's levels had begun to rise again despite treatment. It was evident that the source of the lead had not been picked up, and that it had followed us to three houses.

I think the PHU had written us off because of the organic collagen (because it was not bought at Woolworths) but interestingly they never tested it.

Since their visit on 31st of October 2019 we had removed this from our diet, just in case.

We had always had an unprocessed diet and only ate organic / free range / grass fed meats and fruits and vegetables. And more recently our food was largely sourced from Woolworth's organic section.

For clarification, with regard to our housing situation during this period.

We lived in Glenbrook from the end of 2014 until the end of 2019.

We moved house on these dates:

1 November 2019 we moved from Glenbrook to Leonay (for 4 weeks to get away from the lead – our middle child's blood lead levels went down fastest in this first period - see blood results - the recycled timber table in question was not with us during this period);

27 November 2019 we moved from Leonay to Avalon and the table came with us;

18 July 2020 we moved from Avalon to Leonay and the table came with us;

We are now in Leonay in the Nepean Blue Mountains Local Health District.

In early September 2020, we were desperate to find out what was going on. We couldn't understand why the problem was following us and had got worse and was affecting all of us.

We now suspected our food or toys. Still we received no help from the PHU.

Our paediatrician recommended we contact Jo Lia, a Building Biologist, from NoToxRox, to help us uncover the source.

Jo came to the house in Leonay on 16th of September 2020 armed with a LEAD Group Kit purchased from The LEAD Group charity at www.leadsafeworld.com/shop - to collect environmental samples (paint, soil, dust wipes, water, etc) to be sent for lead analysis at Sydney Analytical Laboratories (SAL).

Jo also had some sample containers (also from The LEAD Group) to collect foods and supplements for testing at the National Measurement Institute (NMI) government lab, and 3M LeadCheck colour-change Kits for on-the-spot screening for lead paint.

Jo was in regular contact with Liz O'Brien from The LEAD Group throughout her time at our house. Liz was helping Jo decide which samples to collect from a range of toys, children's jewellery, and foods we had identified that may be problematic.

We were desperate to find the source and very grateful for Liz's expert knowledge in finding the sources of lead.

If only we had Jo and Liz to help us last year, we could have saved our children's little bodies from massive lead exposure and neurotoxins for a year of their young lives.

It is heart-breaking and unbearable to think about this as a parent. Unfortunately, I didn't know Jo or Liz existed at the time or we would have contacted them straight away.

I had made a long list of suspected items before Jo arrived. We worked through this list as well. On

my list was our white wash recycled timber dining room table. The table was made from a re-used painted timber door. Jo used the LeadCheck Kit on the table and the table instantly tested very high for lead, turning bright pink straight away.

Jo first tested under the table and took samples and then she tested various spots on top of the table. Every spot was bright pink upon testing.

Even the floor underneath where Jo collected the samples was smeared in pink where some of the testing kit liquid had fallen in the dust that had been dislodged from the table by Jo when collecting the sample.

Jo followed-up by collecting dust wipe samples (the laboratory-grade dust wipes come in The LEAD Group Kit) from the table and the floor underneath it, and paint from where the door was peeling underneath, and sending the samples to SAL for lead analysis (as per usual in a LEAD Group Kit.

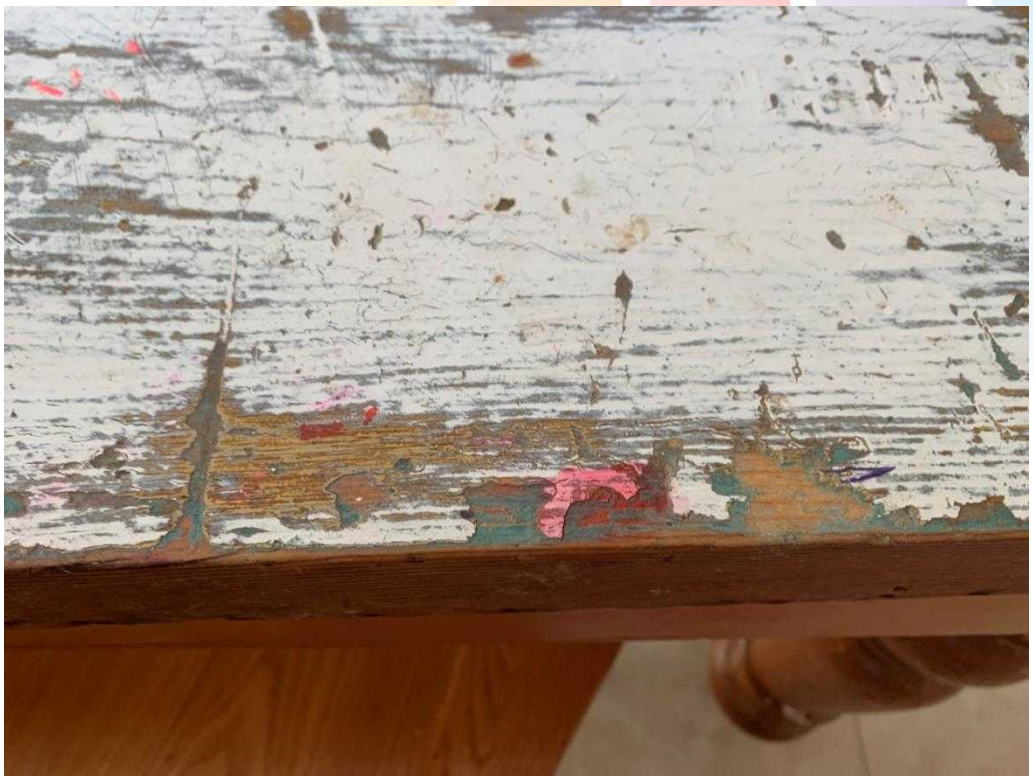
As at 24th September 2020, we are still awaiting NMI lab results on food and Kombucha, which we'll receive via The LEAD Group and NoToxRox.

The LEAD Group Kit results from SAL arrived on 23rd September 2020 with an Interpretation Guide and Comments from The LEAD Group. The degraded paint on the table had **2.8% lead** and dust wipe samples from the re-use painted timber dining table and a dust wipe sample from the floor beneath it – confirmed extremely high lead results as foretold by the LeadCheck screening Kit turning dark pink instantly. (See the results and Liz O'Brien's Comment's in red below.)

This all now makes sense. My two youngest have been most affected by lead. They were seated in the same spot at the head of the table in a heighten child seat to reach the table.

I put them at the head of the table so that they had a wall or couch behind their chair.

Upon inspection there is a green / aqua old fashioned colour paint here becoming more and more exposed under the white wash. Their food and fingers would have touched this area daily while they ate their 3 meals a day. A sickening thought.



My children have eaten at this table their whole life and played under it. We realised while Jo was here that there is peeling paint underneath it. They had been playing under the table the morning Jo came to our house.

As soon as Jo left, I called the owner of Mitchell Road Antiques in Alexandria, where we purchased the table for $1200 in September 2014.

We removed the table and called the local Council to remove it as toxic waste on 21 September 2020. We cleaned the floor and windows and whole area with sugar soap and then had cleaners do more cleaning of the area.

We emailed asking Mitchell Road Antiques for a refund and to pay for the costs of all the testing we've had to do to finally find out the likely source of the lead on 18 September 2020. We have not heard back from them.

I am devastated to think that had an experienced PHU officer visited our home on 31st of October 2019 and identified the table, our children would have received a year's less lead poisoning from this table.

I want to see a revision of the training given to PHU officers and if they are following a protocol for following up notifiable blood lead levels, then the protocol needs serious revision, including that it not be so limiting of the number of samples that can be tested or so focused on finding one source of lead then refusing to investigate further. The WHO (2010) document mentioned above states:

A recent cost–benefit analysis suggests that for every US$1 spent to reduce lead hazards, there would be a benefit of US$17–220. This cost–benefit ratio is better than that for vaccines, which have long been described as the single most cost-beneficial medical or public health intervention (Gould, 2009).

With a cost-benefit ratio better than that for vaccines, why isn't more of the NSW Health budget put aside for lead?

Even if a cost limit for testing is applied, parents should be given the option to pay for extra samples to be tested, or to pay for a LEAD Group Kit or NMI analysis and have the PHU Officer/s (properly trained and experienced) come to the home to follow The LEAD Group Kit instructions and collect the samples.

If I had been told about The LEAD Group Kits in the letter from the PHU about our middle child's notifiable blood lead level, I would have used a LEAD Kit myself to test the table in 2019. If PHU Officers brought their own LEAD Group Kit to a home, they'd be far better prepared and informed on collecting the right samples and having the equipment to collect all relevant sample types, such as dust wipes, water and ceiling dust.

Furthermore, had there been Australian standards and mandatory testing in place for recycled furniture, our children would not have been poisoned by lead their whole lives.

I hope this case will also invoke NSW WorkCover to inspect workplaces where re-used painted timber is turned into furniture or other items, to ensure the workers are not lead poisoned too, or taking lead paint dust home to their families.

We may still have 6-12 months of having to detox our three children. This treatment is rigorous and stressful for the whole family. My children often refuse treatment. My whole day is spent chasing them around trying to get the needed supplements and DMSA (chelation therapy) into them. I currently have a combination of 17 supplements / medications and cream to help with the detox – including DMSA, vitamins, minerals, topical creams and salts. I have an unwilling 5, 3 and 1 year old to get these into numerous times per day. Very stressful. Very preventable with the right assistance from the PHU. Prevention is way better than cure.

My mental health and that of my husband has been majorly affected by this situation. I am currently on a mental health care plan, as I write due to the stress this situation has caused us. My husband is about to start one.

We are both doing this under the care of a psychiatrist. I wrote in my initial consult with the psychiatrist that my mental health deteriorated the moment my daughter was diagnosed with lead poisoning with no known cause as far as we were concerned.

I have never seen a psychiatrist in my life and have never needed to. Knowing my daughter's health was at such high risk of life long consequences led me down this path. I began seeing the psychiatrist in June this, as I had insomnia for the first time in my life. I was really struggling to work and look after my three young children while my husband worked long hours out of the home.

I am sharing this about my and my husband's mental health only to illustrate the far reaching consequences of not finding a convincing source of the lead in October last year. Had a competent, well trained team visited our house in October 2019 our children would have been spared a huge amount of neurotoxins, and stress from the amount of supplements to detox them. My husband and I would have been spared immeasurable stress at not knowing how to protect our children from poisoning, and the stress of trying to get so many medications / supplements into our children to try to help them combat the poison.

Since Jo, our Building Biologist came last week and identified the lead on the table, I have had countless nightmares and woken up startled in a Post Traumatic Stressed state. My brain is subconsciously processing all the stress of the past year. These nightmares are about the detrimental effects of lead on my children.

We have been fighting an unknown enemy for a year. Every day since my daughter was diagnosed with lead poisoning in October 2019 has been stressful, not knowing how we could help her.

We currently have a Paediatrician who specialises in nutritional and environmental medicine, and a functional GP, who also specialises in nutritional and environmental medicine and has had extensive experience dealing with heavy metal detoxing helping us detox our children. This doctor has post-graduate qualifications in Public Health. We got him on board as a recommendation from my psychiatrist. We were desperate to find out what was going on with our daughter and wanted to get as much help as possible. These two doctors are world leading experts who I am sure could help PHU update their outdated, inaccurate information on lead and detoxing.

Had it not been for the help of these expert doctors our children could have ended up with irreversible effects of lead poisoning. We are extremely grateful for their help and hope that other affected families could have access to such great expertise.

Over the past year we have also had appointments with an integrative GP and Biomedical GP. We have spent about fifteen to twenty thousand dollars on Doctors, supplements, medications, and therapists to reduce the whole family's stress levels and bought the "cleanest" organic whole foods we

could find to help our children detox. Our middle child has had two hair trace mineral analyses, a urine test, and numerous blood tests.

This situation could have been avoided had we access to an expert team trained in truly investigating sources of lead.

Our experience of Nepean PHU was that they were merely interested in finding out the dates and addresses. Countless times they asked for the same information over the phone rather than actually visiting our house and finding the source.

Three children have been lead poisoned in one house. This was avoidable had PHU done an adequate investigation last year.

The information PHU provided us was out of date, inaccurate, inadequate, and more harmful than helpful. We only realised this in the last week once we paid for private assistance and had the latest, world class information, investigations, and actually identified the source.

Something needs to change and fast. A thorough assessment needs to be made of the actual skills of PHU officers in relation to lead testing. Huge changes need to be made so no more lives are at risk.

We are seeking the PHU to exponentially improve their training of PHU Officers so they can identify lead sources more quickly and easily.

Better still that PHU immediately outsource their lead testing to The LEAD Group / Building Biologists such as Jo Lia who are up to date on the harmful effects of lead and its sources and are able to identify and test multiple sources of lead exposure.

I am confident they would have solved our problem last year. Their dedication, expert knowledge and skills meant they would stop at nothing until the source was identified.

PHU was the opposite. They just tried to find something to close their file. Our house had multiple sources of lead. We never would have known had we remained trusting the PHU officers.

Our impression of the PHU from this years' experience was that they are more of a bureaucratic organisation focused on sending letters and updating their database than actually protecting young children's health.

Our doctor let us know on the last appointment that research has found that in animal studies, high lead combined with high mercury levels leads to death. Children who are currently exposed to high levels of lead and mercury could die or have serious illnesses and probably are getting ill without parents even knowing the reason. Something needs to change immediately to protect Australian children.

Our doctors have also told us that our children could have / would have been likely to develop all sorts

of serious, lifelong, chronic conditions had this table been our family dining room table until they were adults. We had planned to keep this table indefinitely.

If we left our situation in the hands of PHU's phone call and paper-only "investigations" our children could have been seriously affected for life. This is not good enough.

We are also calling on the Government to now bring in mandatory standards for testing recycled furniture before it is sold.

I also request that our story (without the children's names) be shared publicly in the media so other families with young children can avoid this situation.

Our children were largely asymptomatic and we believe there may be many other children currently affected and their parents are completely unaware that their vintage furniture / items are poisoning their children.

We have to find gratitude amidst our devastation for the fact that our children have not yet developed any overt illnesses from their lead poisoning, but at the same time we are furious that our children have been poisoned their entire lives so far.

The only way I can rest as a result of this situation is to ensure that Government changes are made to protect other children around the country.

Please help me to help others.

See the laboratory results we received a couple of days ago with regard to our dining room table below.

Thanks for your help.

Karen
B Psych (Hons) LLB (Hons) MDR (Hons) M Psych (Org)
25/9/20

Dust Wipe Lead Loadings and Comments from LEAD Group Kit Number 202009038, samples collected by NoToxRox Building Biology

Sample Collection Location	Detailed Description Of Sample Source	Results *ug/m2 – micrograms of lead per metre squared*
Residential Dining Table Top	30cm X 30cm degraded painted Top of Table made from reuse painted timber, purchased from Mitchell Road Antiques in Alexandria NSW in Sept 2014	15,100ug/m2
Residential Dining Table Underside	30cm X 30cm degraded painted Underside of Table made from reuse painted timber, purchased from Mitchell Road Antiques in Alexandria NSW in Sept 2014	304,000ug/m2
Residential Dining Room Floor	30cm X 30cm Tile Floor Under Dining Table made from reuse painted timber, purchased from Mitchell Road Antiques in Alexandria NSW in Sept 2014	148,000ug/m2

There are no government guidelines for lead dust loading limits on dining tables because it is assumed dining tables will be lead-safe, so these results have been compared to Australian and US lead dust loading "clearance" levels for floors. A clearance level is the level below which the floor is considered lead-safe for children to play on.

All three dust wipe lead loading results (above) are astronomically high but the highest one, 304,000ug/m2, from the underside of the table – where it hasn't been touched by the family and ingested, or wiped up during cleaning – is:

- **304 times the superseded 1998 lead dust loading clearance level (of 1,000ug/m2) from the Australian New Zealand Lead Paint Management Standard (ASNZS4361.2:1998) aimed at achieving child blood lead levels below 10ug/dL;**
- **2,815 times the 2017 US Department of Housing and Urban Development (HUD) lead dust loading clearance level (of 108ug/m2), aimed at achieving child blood lead levels below 5ug/dL;**
- **3,040 times The LEAD Group's 2018 recommended level (of 100ug/m2) for child-accessed painted surfaces where the paint is in excellent condition, aimed at achieving child blood lead levels below 1ug/dL; and**

- **25,334 times The LEAD Group's 2018 recommended level (of 12ug/m2) for child-accessed painted surfaces in degraded condition or for non-painted floors, aimed at achieving child blood lead levels below 1ug/dL**

Anyone exposed to this dust should ask the GP for a blood lead test marked urgent.

As the three youngest members of the family have notifiable blood lead levels and the water and soil results were acceptable but the paint result from this table was high, and the home was assessed by a trained and experienced Building Biologist, it is fair to say, that this dining room table is the most likely source of the lead in the blood of all family members.

Thankfully the table has been removed by the Council as toxic waste on the basis of the LeadCheck Kit result used by Jo Lia, Building Biologist of NoToxRox on 16/9/2020.

A public health warning about lead exposure risks from all recycled furniture made of pre-1997 painted timber or metal or ALL (if the age is impossible to determine) painted timber or metal, is warranted.

NSW Fair Trading needs to be notified so they can order the mandatory testing for lead by dust wipe and paint samples, of all re-use painted timber and metal items currently on sale in NSW. Those re-used painted timber and metal items already sold should be recalled for lead testing or offered free lab testing of dust wipes and paint samples with the furniture in situ; and purchasers should be advised to ask their GP for blood lead testing.

WorkCover NSW needs to be notified to inspect the premises where this and other re-use timber furniture is made so that Lead Paint Management Plans, including blood lead testing of workers are instituted at these premises. Recycled furniture business owners should be required to offer their employees free lead dust wipe testing of their homes and vehicles, to track any take-home lead-contaminated dust, so employees families can be advised to ask their GP for blood lead testing as appropriate.

NSW EPA needs to be notified so they can create a re-use timber and metal waste policy which does not allow painted timber or painted metal to be sold without lead testing at a lab, using dust wipe and paint samples.

Can the lead poisoning of a 3 yr old in Australia help end lead poisoning from Ayurvedic medications globally?

By Elizabeth O'Brien, The LEAD Group Inc, Australia, in collaboration with Professor Venkatesh Thuppil, National Chairman, InSLAR (Indian Society for Lead Awareness and Research), Ex-Director, NRCLPI (National Referral Centre for Lead Poisoning in India) & Advisor, QCI (Quality Council of India)

What's the purpose of this article?

A three-year old child has a notifiable blood lead level in Australia after taking an imported Ayurveda medication from India, "prescribed" by an "Ayurveda doctor" in Australia's largest population city, Sydney, who specialises in "treating" children. This article is aimed at leveraging this "index case" to finally bring about an end to lead poisoning from Ayurvedic medicines globally. Because over one billion people believe in the therapeutic value of Ayurvedic medicines, this article is NOT aimed at banning those Ayurvedic medicines which contain tiny trace or non-detectable amounts of lead and other heavy metals. Professor Venkatesh Thuppil wrote in an email to me on 22nd Sept 2020, that:

"AYURVEDA SYSTEM SHOULD NOT BE BLAMED. It is some self-declared Ayurvedic practitioners need to be blamed. IN GENERAL AYURVEDA IS A SAFE HMP [herbal medicine product]… With one case study it will be difficult to convince global leaders. We do have hundreds of cases across all age group where traditional and folk medicines have caused lead poisoning. Let us work together and make society and people better."

My purpose is not to blame at all, but rather to figure out the actions needed to remove toxic Ayurvedic medications from the global market, actions triggered by one case but collating information from many other cases and taking it to the top – the World Health Organization. Surely the preventable intentional lead poisoning of a billion or so people is something WHO will take action on.

How did an Australian child come to be lead poisoned by a herbal remedy from India?

When the child's paediatrician found out that the child had been taking the Ayurveda medication, he referred her for blood lead and blood mercury testing. When the child's blood lead level was reported to the paediatrician on 24th August 2020 to be **7.1 ug/dL** (micrograms per decilitre) after only 6-8 weeks on the Ayurvedic medication (one pill per day), the paediatrician phoned and advised the mother to immediately stop giving her child the Ayurveda medication. So the medication was started near the beginning of July 2020 and stopped by 24th August 2020.

By the time the state (New South Wales) Health Care Complaints Commission (HCCC 2020a and 2020b) and the Australian Therapeutic Goods Administration (TGA 2020) had responded to the case, my first sentence in this article would more correctly be written:

A three-year old child has a notifiable blood lead level in Australia after taking an imported Ayurveda medication from India which contained concerning levels of lead and other heavy metals and which was not registered by the importer Medcure as a Therapeutic Good in Australia, but which was sold to the child's mother by a man, Mr Rama Prasad, claiming to be an "Ayurveda doctor" but who was not actually registered as an Australian Health Practitioner, in Australia's largest population city, Sydney.

Since I began writing this *LEAD Action News* article, other clients residing in NSW of Mr Prasad (who has clinics in Sydney and Melbourne and online) who are considered to have been placed at risk have now been contacted by NSW Health public health personnel, so more notifiable blood lead levels, including Mr Prasad who claims he took the medication himself, may eventuate.

What advice does the Australian governments give regarding Ayurvedic medicines and practitioners who supply them?

Here's the advice from NSW Health Care Complaints Commission (HCCC 2020b):

The Commission strongly urges those individuals seeking alternative therapies to be vigilant in their research prior to proceeding with any natural therapy medications or medicines and to discuss any such proposed therapies with their treating registered health practitioner.

Individuals can check to see if a practitioner is registered in Australia through the Australian Health Practitioner Regulation Agency (AHPRA) website at www.ahpra.gov.au

Individuals can also check the website at https://www.tga.gov.au/ to see whether medications or medicines have been approved by the TGA.

And the Therapeutic Goods Administration (TGA 2020) adds:

If you, or someone you care for, has Manasmithra Vatika (Manasamitram Pills), do not use them. If you have already taken some of these pills, you should seek medical advice from your doctor or call the Poisons Information Centre on 13 11 26.

If you suspect you have had a side effect (also known as an adverse event) to this product, please report it to the TGA. In addition, if you have concerns about this or other products, you can make a report to the TGA on 1800 020 653 or through our website.

What happens in Australia when a blood lead level exceeds 5 ug/dL?

All pathology laboratories in Australia are legally required to notify the state health department when a blood lead level exceeds 5 ug/dL so, in this case, New South Wales (state) Health department was notified of the child's blood lead level by the lab.

Before the Health Department contacted the parents to follow up on the case, the mother contacted The LEAD Group Inc (lead poisoning prevention and management health promotion charity) and I immediately organised for the pill the little girl had been taking (1 Gulika or pill per day) to be delivered that day (25th August 2020) for heavy metal analysis at the Australian government laboratory, National Measurement Institute (NMI).

How much lead, mercury and arsenic was found in the Ayurvedic medication?

I've compared the results of the heavy metal testing on the Ayurveda medication to the Australian Government (2013) soil Health Investigation Levels (HILs), as there are no specific limits in Australia for heavy metals in Ayurvedic medications or other complementary medicines. It is simply assumed there are no toxic heavy metals in medicines and it is mandatory that all products sold are safe when used as intended.

The results were:

10,800 mg/kg lead or **36 times or 3600%** of the Australian soil HIL for lead (300 mg/kg)

130 mg/kg mercury or **8.67 times or 867%** of the soil HIL for mercury (15 mg/kg), and

77 mg/kg arsenic or **77%** of the soil HIL for arsenic (100 mg/kg)

How do we know the child's lead didn't come from multiple sources?

At the same time as the 3 year old who took the Ayurveda medication was referred for blood lead testing, the younger sibling who did not take the medication was also tested. The 1 year old younger sibling's blood lead result was "not detectable". When NSW Health local Public Health Unit sent Public Health Officers to the home to collect all likely lead sources relevant to the 3 year old, they found that there were "none" apart from the Ayurvedic medication, and soil. NSW Health's testing of the Ayurvedic medication confirmed the initial test result of high lead, and found that the soil lead content was below the "Investigation" level, thus NSW Health was satisfied that the Ayurvedic medication was responsible for the elevated blood lead level in the 3 year old.

Do all Ayurvedic medications have the same amount of lead, mercury and arsenic?

No. When reading journal articles on cases of lead poisoning from Ayurvedic medications, it quickly becomes apparent that a very wide range of concentrations of a very long list of

toxic heavy metals are found in various Ayurvedic medications, but typically lead is the most likely element to be found at alarming levels.

Tait et al (2002) found the following lead levels (and mercury levels in brackets) in four different Ayurvedic medications prescribed by a doctor in India and taken daily for 9 years prior to the 24 year old pregnant woman in Australia developing a blood lead level of 108 ug/dL, or nearly 11 times higher than the notifiable level at the time (10 ug/dL). When the child was born, the neonatal blood lead level (245 ug/dL or 49 times the notifiable level of today) was the highest recorded for a surviving infant:
The lead (and mercury) levels found in the Ayurvedic medications which caused the most severe congenital lead poisoning in a surviving infant (Tait et al 2002) were:

Brown tablet, called "HSY-15" – 89,000 mg/kg or **8.9% lead** (0.003% mercury)
Red tablet – 45,000 mg/kg or **4.5% lead** (mercury not analysed)
Pink tablet – 2,000 mg/kg or **0.2% lead** (0.08% mercury)
Green tablet – 30 mg/kg or 0.003% lead (0.002% mercury)

That is, 100% of the four Ayurvedic medications contained lead in the range 30 mg/kg to 89,000 mg/kg and the median concentration of lead was 34,007.5 mg/kg.

Mikulski et al (2018) wrote:

> Two hundred and fifty-two samples of Ayurvedic products and herbal supplements [purchased from one Indian clinic by the cluster of US lead poisoning cases in Breeher et al (2015)] were analysed.... Lead was the most common element found in 65% (*N* = 164) of all samples with maximum level of 43,200 mg/kg [**4.32% lead** and minimum level of 0.46 mg/kg].... Lead and arsenic in doses per pill exceeding those recommended by the [United States Pharmacopeia Convention] USP (0.005 and 0.015 mg/day, respectively) were found in over one-third of the products analyzed in this study... *Indukantham* tablets contained the highest levels of lead of all the samples with lead detected in the study.

Mikulski et al (2018) also found that the median lead content of the 252 Ayurvedic medications purchased by US residents from India, was 4.9 mg/kg which is lower than the lowest soil lead concentration I've ever seen (5mg/kg) because lead naturally occurs in soil.

Saper et al (2004) found that: a total of 14 (20%) of 70 Ayurvedic medications purchased at stores in Boston in 2003 contained heavy metals: The median lead concentration in 13 (18.6%) of the medications was 40 µg/g (40 mg/kg); and the range was 5-37,000 mg/kg or **3.7% lead.** Mercury was found in 6 of the medications with the median concentration being 20,225 mg/kg; and the range from 28 to a massive 104,000 mg/kg or **10.4% mercury**; and arsenic was also found in 6 of the medications; median concentration, 430 mg/kg; range, 37-8130 mg/kg or 0.8% arsenic.

So the meta-analysis for lead in Ayurvedic medications just from those three journal articles above is:

Lead was found in 18.6% to 100% of samples tested in the three studies, the minimum concentration of lead was 0.46 mg/kg and the maximum was 89,000 mg/kg, (**8.9%**) and the median lead concentration ranged from 4.9 mg/kg to 34,007.5 mg/kg (**3.4%**).

Why are lead and other heavy metals found in most Ayurvedic medications and at extremely high concentrations in some?

In an interview for *The Health Report* on ABC Radio National, broadcast on 24/1/2005, Dr Norman Swan asked Dr Robert Saper, Director of Integrative Medicine in the Department of Family Medicine at Boston University USA (Swan and Saper, 2005):

Why was the lead there [in the 13 leaded Ayurvedic medications out of 70 Ayurvedic medications purchased at stores in Boston in 2003 (Saper et al 2004)] in the first place, do you think?

Robert Saper: I think three possibilities emerged. One is that the products could have simply been contaminated during the process of manufacturing. Another possibility is that the raw materials for the products could have lead or other heavy metals in them because of being exposed to these heavy metals in the environment, such as from contaminated soil or groundwater. But perhaps most provocative is that if you study the text books of Ayurveda, both published thousands of years ago and in the modern era in the last 25 years, and speak with traditional Ayurvedic physicians, all these sources will describe a very clear role for metals such as mercury and lead in Ayurveda. Some of these metals are purported to carry certain therapeutic qualities and may be added to the medicine to for example, increase the potential of the medicine to give vitality or longevity. So it's possible in particular, for example, that medicines where we found tens of thousands parts per million of some of these metals, the metals may have been intentionally added."

Professor Venkatesh Thuppil referred me to a paper he co-wrote with Robert Saper and others (2008) which concludes:

One-fifth of both US-manufactured and Indian-manufactured Ayurvedic medicines purchased via the Internet contain detectable lead, mercury, or arsenic.

Saper et al (2008) also state:

Ayurvedic medicines are divided into 2 major types: herbal only and *rasa shastra*. Rasa shastra is an ancient practice of deliberately combining herbs with metals (eg, mercury, lead, iron, zinc), minerals (eg, mica), and gems (eg, pearl). Rasa Shastra experts claim that these medicines, if properly prepared and administered, are safe and therapeutic. [Satpute (2003), Shastri (1979)]

Saper et al (2008) go on to comment:

Metals identified in our sample of Ayurvedic medicines are likely a result of the practice of rasa shastra [(combining herbs with metals, minerals, and gems)] or contamination. Many rasa shastra medicines are made with *bhasmas*, which are elaborately prepared with various forms of metals including cinnabar (mercuric sulfide), galena (lead sulfide), realgar (arsenic sulfide), and white arsenic (arsenic trioxide). [Satpute (2003), Shastri (1979)] Ekangvir Ras is an example of a rasa shastra medicine made with *naga* (lead) bhasma and *parada* (mercury). Ayurveda experts in India believe that if bhasmas are properly prepared according to ancient protocols, the metals undergo *shodhana* ("purification"), rendering them nontoxic and therapeutic. Case reports in the literature, however, have documented significant toxicity with the use of some of these products. [Ernst (2002), CDC (2004)] The prevalence of metals in non–rasa Shastra medicines was still substantial (17% [heavy metals were found in 27 medicines out of a total of 158 non-rasa Shastra medicines]) and could be a consequence of environmental contamination of the herbs or incidental contamination during manufacturing.

By the time Robert Saper was a co-author with Koch et al (in 2011), the hypothesis of the "Ayurveda experts in India" that in making bhasmas, the heavy metals undergo purification rendering them non-toxic, was firmly disproven and the opposite, increased toxicity, found for the most common Ayurvedic medicine in lead poisoning cases, Mahayograj Guggulu:

Lead bioaccessibility was high (close to 100%) in a medicine (Mahayograj Guggulu) that had been compounded with bhasmas (calcined minerals), including naga (lead) bhasma…

In the current study, sample 11 (Mahayograj Guggulu) contains a high concentration of lead, around 5% by weight (50,000 mg/kg), which was likely added as naga bhasma (lead ash) (Raza, 1975). Bhasmas are calcined or ashed minerals or gems; in chemical terms, the bhasma process is mainly oxidative roasting. The lead species in the sample could not be detected by X-ray diffraction analysis, likely because only amorphous forms were present, but the lead form was nearly 100% bioaccessible in the final product. This suggests that the bhasma process may actually increase the bioaccessibility of the lead starting material, most likely elemental lead, which is insoluble in water. Of note, Mahayograj Guggulu is the traditional Indian medicine most frequently associated with reported lead poisoning cases (Ernst, 2002; Centers for Disease Control and Prevention, 2004; Saper et al., 2008).

Is it in any way possible that lead, mercury, arsenic and other toxic heavy metals from any source are actually therapeutic?

In my view the answer is no. Devesh Thakur and Thuppil Venkatesh (better known as Venkatesh Thuppil) concur and have stated as much categorically, in *Ubiquity of Lead in Our Lives - Lead in Food* (2015):

Researchers and the entire medical profession are now convinced that this toxic heavy metal and its salts have no known beneficiary biological function. Hence everyone is convinced that lead and its salts have deleterious effects.

Could low life expectancy in India compared to in Australia make claims of Ayurvedic physicians more likely to be believed?

Nearly 40 years ago when I was studying Epidemiology in my post-graduate Health Education course, I distinctly remember being shocked when the lecturer told us that the life expectancy at birth of females in India was 46, and that of males, 54. In Australia, the figures were something like 75 (women) and 68 (men) respectively. The internet didn't exist back then but Wikipedia (2020a) confirms that in the past, life expectancy at birth in the years 1970-1975 for both genders in India was 49.39 and in Australia was 71.75 years.

More recently, according to Wikipedia (2020b), the *Human Development Report 2019* by the United Nations Development Programme, (based on 2018 data), ranks India as country number 130 (out of 186 countries) in terms of life expectancy at birth, compared to Australia at number 7, (number 1-ranked Hong Kong females had the highest life expectancy at birth, at 87.6).

Within that context of relatively low life expectancy at birth, I guess people in India are more open to believing traditional Ayurvedic physicians who purport that metals such as mercury and lead carry therapeutic qualities and increase the potential of the medicine to give vitality or longevity – they want to believe that something they can afford to buy can help make them live a healthier and longer life. The only belief change that's needed for Ayurveda medicines to continue to be used safely, is to now know that whilst the bhasmas of metals are toxic, the herbs and other non-bhasmas in Ayurvedic medications can indeed be therapeutic.

Research showing lead poisoning causes the opposite of vitality and longevity – lead causes life-long health impacts and early death

The LEAD Group has created two lists citing dozens of research articles which demonstrate that lead poisoning - whether from Ayurvedic medicines or any other source – once in the blood, has life-long impacts including early death, and a fact sheet made up of quotes from media articles regarding the Lanphear et al (2018) article in *The Lancet*, which concludes that lead poisoning causes almost as many deaths annually in the US as cigarette smoking – another hugely popular behaviour in India, and one which, coincidentally raises the blood lead level of the smoker and those around them. See web addresses in the Reference list below for The LEAD Group's three fact sheets:

Health Impacts of Lead Poisoning (Vella et al 2020);

Health effects of a blood lead level below 10 µg/dL in both adults and children and even below 1 µg/dL in pregnancy (Roberts et al 2020);

Lead is an issue beyond childhood: A fact sheet by LEAD Group volunteer Emily Choong, using extracts of media articles about the landmark Lancet lead article by Lanphear et al, March 2018 (Choong 2020).

What is the name of the Ayurvedic medication which lead poisoned an Australian 3 year old child in 2020?

The particular Ayurvedic medication in this index case in Australia in 2020, has been found under 5 different spellings for the name of the medication, just between the prescribing doctor, the importer and the manufacturer:

Manasamitram Pills - in the prescription written by the man calling himself an "Ayurveda doctor" in Sydney

Manasamitravatakam Pills - in the prescription written by the unregistered Ayurveda health practitioner calling himself a "doctor" in Sydney

Manasmithra Vatika 100 Capsules – on the label of the plastic bottle that the "Senior Ayurveda doctor" in Sydney sold to the mother, and in the photo of the same bottle on the website of the Australian-based importer www.medcure.com.au (before the website info was removed while the site was "under maintenance" as at 27th September 2020).

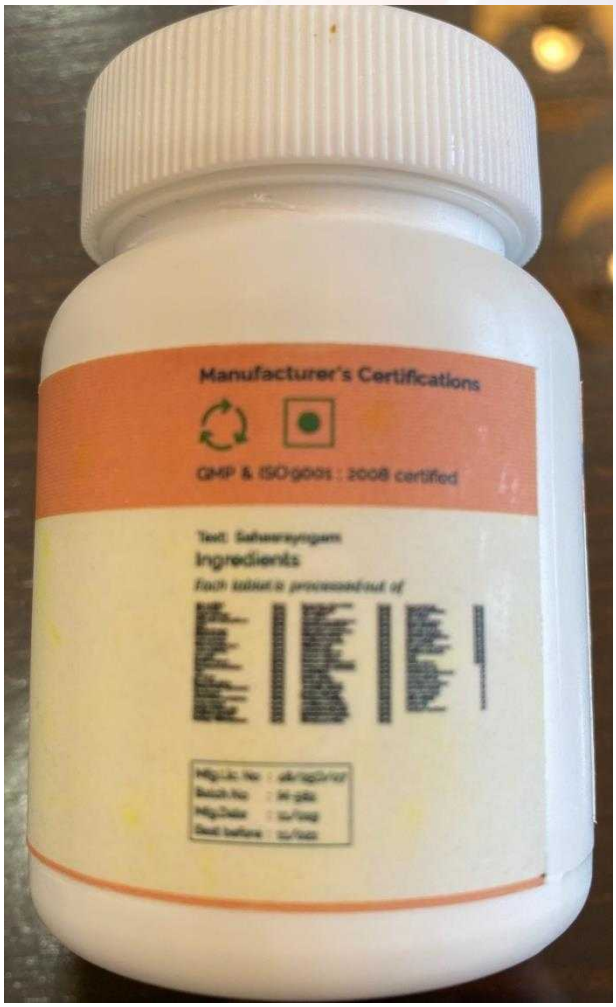
Manasamithra vatika – on the Australian importer's website www.medcure.com.au (previously); and on the online store VVMart of the manufacturer named on the Medcure capsule bottle label as: *Manufactured by Vasudeva Vilasam Herbal Remedies P. Ltd. Made in India* - https://vvmart.in/products/manasamitra-vatika-100-nos?_pos=1&_sid=5b94294d4&_ss=r - where it is still for sale as at 28th September 2020.

Manasamitra vatika – for sale online globally (and exported to 20 countries), at VVMart, the online store of Vasudeva Vilasam, https://vvmart.in/products/manasamitra-vatika-100-nos?_pos=1&_sid=5b94294d4&_ss=r

Just one other website (AyurMedInfo 2020) revealed sixteen more names/spellings for this medication:

Manasa mitra vatakam, Manasa mithra vataka, Manas Mitra vatakam, Manasamitra vattakam, Manamitra vataka, Manasamitra Gulika, manas mitran vati, manasamitravatkam, mmvatakam, MMV, MMVati, Maanasamitra, Maanasamithra vatakam, Manasamitra gulki and Manasamitra vati – at https://www.ayurmedinfo.com/2012/06/29/manasamitra-vatakam-benefits-dosage-ingredients-and-side-effects/#Manufacturers

Which of the Ingredients of Medcure Manasamithra vatika are most likely the source of the heavy metals?



The Ingredients of Manasamithra vatika appear on the Medcure capsule bottle purchased from the Sydney-based Ayurveda doctor, but are so small as to be illegible, but fortunately the Ingredients were listed (before "site maintenance") on the Australian importer's website: https://www.medcure.com.au/collections/capsules/products/manasamithra-vatika ; though are not listed on either the manufacturer's website: www.Vasudeva.com or the manufacturer's online store website: www.VVMart.in

As at 27th September 2020, the only text at www.medcure.com.au is:

MEDCURE - SITE UNDER MAINTENANCE. WE'LL BE BACK SOON. You can write to us at connect@medcure.com.au

But of the Ingredients previously listed for Manasamithra vatika on the Medcure website (accessed on the 8th September 2020), the first 58 ingredients are listed as being present in the same amount (6.3mg), presumably per pill or per batch. The "amount per pill or per batch" for the remaining 9 ingredients is listed as Q.S.

According to The Free Dictionary online (2020), the acronym QS has 43 definitions, but among the 12 Science & Medicine uses of the acronym QS, the following two seem most likely to be what is meant in the Ingredients lists for Ayurvedic medications:

Q.S. = Quantum Sufficit *(Latin: as much as suffices)*

Q.S. = Quantum Sufficiat *(Latin: sufficient quantity; on a prescription, indicates quantity is left to the dispenser's discretion)*

One ingredient of Medcure Manasamithra vatika, *Sida cordifolia* is listed twice for the amount 6.3mg, and once for the amount Q.S., so in effect there are 65 different ingredients listed.

Four of the 65 ingredients in Medcure Manasamithra vatika are Ashes of metals. Six of the 65 ingredients are other non-plant ingredients and the remaining 56 ingredients are from 56 different plants.

According to Prpic-Majic et al (1996), "The metal and mineral contents in some Ayurvedic remedies are in a powdered ash form produced by the repetitive, temperature controlled burning of metals such as gold, silver, copper, zinc, iron, lead, tin, mercury, etc. and precious stones."

The Medcure website lists the following Ingredients-of-concern in Manasamithra vatika, with the translation of Swarna bhasma being "sacred ash of gold":

Bhasmas or Ashes of Metals:

Swarna bhasma(6.3mg),

Ash of silver(6.3mg),

Ash of Iron(6.3mg).

Professor Venkatesh Thuppil advises that if Manasamithra vatika were to contain ash of lead, then the lead content could be even higher than the 1.08% found in the Medcure Manasamithra vatika.

He advised in an email dated 15th September 2020: "Medicines containing heavy metals and pure lead bhasma called Naga Bhasma which is 100% lead, is also sold in India at Ayurvedic pharmacies."

My guess is that the second most likely group of heavy-metal containing ingredients in Manasamithra vatika are the Other non-plant ingredients, but especially the mineral (iron pyrite) and bhasma (ash of deer horn) ingredients:

Iron pyrite(6.3mg),

Bhasma of deer horn(6.3mg),

Coral(6.3mg),

Pearl(6.3mg),

Musk(6.3mg),

Cow's milk(Q.S).

Which of the Ingredients of Manasamitra Vatakam (listed by AyurMedInfo.com) most likely add heaps of heavy metals to the product?

Adjunct Professor Brian Priestly referred me to the AyurMedInfo.com website (2012) list of 71 ingredients of Manasamitra Vatakam, 60 ingredients at 10 g of each (perhaps per batch?), and 11 ingredients at Quantity Sufficient.

The following five bhasmas (ashes of four metals and ash of deer horn) are ingredients for Manasamitra Vatakam listed on the AyurMedInfo.com website (2012):

Swarna Bhasma;

Tapya – Makshika Bhasma – Bhasma of Copper-Iron Pyrite

Loha Bhasma – Bhasma prepared from Iron

Rajata Bhasma – Bhasma of silver

Mrigashringa Bhasma – Bhasma made of deer horn.

indiaabundance.com (2020) in New Delhi, India, sells Manasamitra Vatakam Gulika – I could not find the name of the manufacturer – listing 72 ingredients including four metal bhasmas and deer horn bhasma. These five ingredients are exactly the same as the ingredients for Manasamitra Vatakam listed on the AyurMedInfo.com website (2012):

Swarna Bhasma

Tapya – Makshika Bhasma – Bhasma of Copper-Iron Pyrite

Loha Bhasma – Bhasma prepared from Iron

Rajata Bhasma – Bhasma of silver

Mrigashringa Bhasma - Bhasma made of deer horn.

Aside from Vasudeva Vilasam, which other companies make Manasamitra Vatakam in India and does the product always contain bhasmas?

The answer to this question could involve months of research but over a few days I have found that The AyurMedInfo site (2012) page about Manasamitra Vatakam reveals four manufacturers of that medication to be:

Kottakkal – Arya Vaidya Sala

Amruta Drugs, Vaidyaratnam

IMIS

Nagarjuna – Maanasamithra vatakam

Arya Vaidya Sala (AVS 2020), in Kottakkal does not list bhasmas amongst the 70 Ingredients for its Manasamithra Vatakam, but it does list the following metals:

Gold (Sanskrit name: Hema),

Iron Pyrite (Tapya),

Iron (Kalaloha) and

Silver (Rajata), as well as

Buffalo's Horn (Mrigasringa).

Which organisation is best placed to start purchasing Manasamitra vatika and Mahayograj Guggulu and other bhasma-containing Ayurvedic medicines and analysing them for heavy metals?

The LEAD Group would love to do it but could not do so without substantial financial backing. InSLAR may be in the same situation. Robert Saper and his colleagues could be asked. The World Health Organization (WHO) could have a role to play. A ground-swell of citizens who have already purchased such products could perhaps be convinced to pay for laboratory analysis, especially if they have already had blood testing for heavy metals and found elevated levels. Health departments that follow-up notifiable blood lead levels could be asked to ask every case whether Ayurvedic medications were a possible source of the lead, and if so, test them at a certified lab for at least lead, mercury and arsenic, recording results, the practitioner, medication supplier, manufacturer, ingredients if provided, and identifying if possible whether bhasmas were among the ingredients. National health departments could then draw together the data from local health departments, and WHO could draw it all together to create a global picture, allowing national governments to recall unsafe Ayurvedic medications, and ban ingredients which result in unsafe Ayurvedic medications.

If not all Ayurvedic medications include Metals or Bhasmas, why are so many contaminated with heavy metals?

I believe it's possible that the reason so many Ayurvedic medications contain much smaller amounts of heavy metals than Medcure Manasamithra vatika made by Vasudeva Vilasam in India (which contains 1.08% lead), is that the same equipment is used (without thorough cleaning) to make a batch of a different medication, following the making of the high heavy-metal medications, despite the Vasudeva Vilasam factory where the Medcure Manasamithra vatika is made, in Kerala, India, being certified as GMP (Good Manufacturing Practice) and ISO 9001 (which sadly allows companies to set their own quality goals, in this case, clearly Vasudeva Vilasam's goals do not include providing safe heavy-metal-free products).

What does ISO 9001 Certification and GMP mean in relation to products like Ayurvedic medications?

Regarding ISO (International Organization for Standardization) 9001, The 9000 Store (2020) states:

The standard is used by organizations to demonstrate their ability to consistently provide products and services that meet customer and regulatory requirements and to demonstrate continuous improvement…

- It is NOT a standard for products. It does not define product quality. This is a process-based standard: you use it to control your processes, then your end product should meet the desired results.

At least one manufacturer of Ayurveda products in India believes that Good Manufacturing Practices entail creating safe products. On the MAPI (Maharishi Ayurveda Products International) website (2017) vpk by Maharishi Ayurveda demonstrate that they've combined the "science of life" which is the Sanskrit meaning of Ayurveda, with the western science of product safety testing:

- ISO-9001 Certification - The ISO (International Organization for Standardization) - ISO is the world's largest developer and publisher of International Standards. Maharishi Ayurveda Products International meets the ISO's stringent requirements for quality in the design, production, and export of herbal products.
- Good Manufacturing Practices (GMP & cGMP) Certification - Conducted by an independent panel of experts; certifies that Maharishi Ayurveda Products International products are "fault-free, safe and have consistent quality."

And in their article *Tested and Safe: Our Commitment to Purity - Maharishi Ayurveda Products International* specifically state that:

> ...tests include examination for: Heavy metals (lead, arsenic, cadmium and mercury).

Can anything be done to force Vasudeva Vilasam and other ISO 9001 Certified Ayurveda medicine manufacturers to remove unsafe ingredients like metal bhasmas from their formulations?

Apparently the answer is yes. Email your complaints to info@vasudeva.com or md@vasudeva.com or phone on +91 471 409 1000.

According to Yehuda Dror (1995), one of the Common Myths about "the ISO 9000 (namely 9001, 9002 and 9003)" is that:

> It doesn't foster continuous improvement or improve product quality. One common criticism of the standard is all that a company needs to receive and maintain compliance is paperwork and a bureaucracy to guard it, while the product quality remains unimportant.

In defence of the ISO 9000 series of international standards, Dror goes on to respond to this myth:

> This is far from correct. Though the standard does not explicitly require continuous improvement, it does require a system for review and correction, and implementation of corrective and preventive actions, which in essence form the Deming plan-do-check-act continuous-improvement loop. Thus, companies making bad product will undoubtedly hear about it either from their customers (customer complaints), or their own process (nonconformities and corrective actions) or from problems related to suppliers through the purchasing system. A company should be able to use its review-and-correction system, consisting of corrective actions, internal audits and management reviews, to ensure that its system weeds out the problems and can assure consistency in producing those products or services it deemed of good quality.

My reading of what Dror has said is that both customer complaints (eg that a product is unsafe) and problems identified by suppliers (eg that employees at manufacturing operations where bhasmas or metals of ashes ingredients are made are being poisoned by the heavy metals in these raw ingredients of Ayurvedic medications) should lead to Vasudeva Vilasam and other ISO 9001 certified Ayurvedic medications manufacturers changing their formulations to remove toxic ingredients.

What are the names and manufacturers of other Ayurvedic medications that have been found to contain lead, mercury and arsenic?

Saper et al (2004) compiled the following data (first presented here as a screenshot and then as searchable text, minus the data on % of stores selling HMP):

Table 2. Ayurvedic Herbal Medicine Products Containing Lead, Mercury, and/or Arsenic*

Ayurvedic HMP	Manufacturer	Formulation	% Stores Selling HMP	Metal, µg/g		
				Lead	Mercury	Arsenic
Bal Chamcha†	Jalaram	Powder	3.3	10	ND	ND
Bala Guti†	Zandu	Tablet	3.3	5	ND	ND
Bala Sogathi†	Navjeevan	Powder	3.3	43	28	ND
Balguti Kesaria†	Kesari Ayurvedic Pharmacy	Tablet	3.3	7	17600	37
Gesari†	Harinarayan Pharmacy	Tablet	3.3	7	ND	ND
Karela	Himalaya	Capsule	6.7	7	ND	ND
Maha Sudarshan Chuma	Dabur	Powder	3.3	17	ND	ND
Maha Sudarshan Chuma	Zandu	Tablet	6.7	40	ND	ND
Mahalakshmi Vilas Ras with gold	Baidyanath	Tablet	3.3	300	72100	2800
Mahayograj Guggulu with silver and Makardhwaj	Baidyanath	Tablet	3.3	37000	22800	8100
Navratna Rasa†	Unjha Ayurvedic Pharmacy	Tablet	3.3	600	104000	60
Safi†	Hamdard Pakistan	Liquid	70.0	ND	ND	54‡
Shilajit	Syncom	Capsule	6.7	8	ND	ND
Swarna Mahayograj Guggulu with gold	Baidyanath	Tablet	3.3	7870	4380	800

Abbreviations: HMPs, herbal medicine products; ND, not detected (heavy metal assay reporting levels: lead ≥5 µg/g, mercury ≥20 µg/g, and arsenic ≥10 µg/g).
*A list of HMPs without detectable heavy metals is available from the authors.
†Label specifically recommended pediatric use.
‡Concentration of metals in aqueous liquid herbal medicine products expressed as µg/mL.

Table 2. Ayurvedic Herbal Medicine Products Containing Lead, Mercury, and/or Arsenic*

Ayurvedic HMP	Manufacturer	Formulation	Metal, µg/g		
			Lead	Mercury	Arsenic
Bal Chamcha†	Jalaram	Powder	10	ND	ND
Bala Guti†	Zandu	Tablet	5	ND	ND
Bala Sogathi†	Navjeevan	Powder	43	28	ND
Balguti Kesaria†	Kesari Ayurvedic Pharmacy	Tablet	7	17,600	37
Gesari†	Harinarayan Pharmacy	Tablet	7	ND	ND
Karela	Himalaya	Capsule	7	ND	ND
Maha Sudarshan Churna	Dabur	Powder	17	ND	ND
Maha Sudarshan Churna	Zandu	Tablet	40	ND	ND
Mahalakshmi Vilas Ras with gold	Baidyanath	Tablet	300	72,100	2800
Mahayograj Guggulu with silver and Makardhwaj	Baidyanath	Tablet	37,000	22,800	8100
Navratna Rasa†	Unjha Ayurvedic Pharmacy	Tablet	600	104,000	60
Safi†	Hamdard Pakistan	Liquid	ND	ND	54‡
Shilajit	Syncom	Capsule	8	ND	ND
Swarna Mahayograj Guggulu with gold	Baidyanath	Tablet	7870	4380	800

Abbreviations: HMPs, herbal medicine products; ND, not detected (heavy metal assay reporting levels: lead _5 µg/g, mercury _20 µg/g, and arsenic _10 µg/g).
*A list of HMPs without detectable heavy metals is available from the authors.
†Label specifically recommended pediatric use.
‡Concentration of metals in aqueous liquid herbal medicine products expressed as µg/mL.

Could researchers supply the World Health Organization (WHO) with the company names of manufacturers of toxic Ayurvedic medications?

Theoretically, yes. The WHO could request this information from researchers such as Robert Saper and Marek Mikulski and the research teams of, for starters, the 96 journal articles about heavy metal poisoning from Ayurvedic medicines on the PubMed website (2020), and put it together with the known Vasudeva Vilasam manufacturer from this index case in Australia, and the four manufacturers of Manasamitra vatakam listed on the AyurMedInfo site (2012), to generate a list of manufacturers of likely-to-be-toxic Ayurvedic medications, which could then be analysed as to which of the manufacturers are, as Professor Thuppil suggests “back yard traditional and folk medicine producers that are difficult to track”, and which manufacturers have ISO 9001 certification, like Vasudeva

Vilasam. Complaints could then be made to each manufacturer that has ISO 9001:2015 certification.

What could get the ball rolling to remove toxic ingredients from Ayurvedic medications?

If ISO 9001 certification is worth the paper it is written on, then complaints by WHO to every ISO 9001 certified Ayurvedic medicine manufacturer which has products identified by researchers as containing heavy metal-containing ingredients, could be the beginning of re-formulation of Ayurvedic medications without toxic ingredients. With the toxic ingredients no longer being added, based on my hypothesis that non-bhasma-containing Ayurvedic medications are likely mixed in the same vats following the mixing of bhasma-containing medications, without proper cleaning of the vat in between, I predict that the percentage of Ayurvedic medications containing heavy metals will fall drastically.

Why aren't there millions of cases of lead poisoning from Ayurvedic medications documented in India?

There probably are hundreds of millions of lead poisoned people in India, but as in Australia, blood lead testing is extremely rare so how would anyone know? And without elevated blood lead levels being notifiable, no one in India is going to be lucky enough to have a Public Health Officer come to their home to check out whether they're taking Ayurvedic medications which contain heavy metals or whether they have a myriad of other possible lead sources. Because Ayurvedic medicine has been an accepted therapeutic part of Indian traditional medicine for so long, it is very likely to be overlooked – it has become part of the fabric of life. People probably read ingredients lists which include metals and deer horn and pearl and milk etc and then read:

100% Herbal Product - Made with the Wisdom of Ayurveda - Safe and Effective

at the bottom of the page, such as on the indiaabundance.com website (2020) *Manasamitra Vatakam Gulika* page, and don't even think "False advertising?" let alone, think: "is this product going to poison me?"

A woman prepares *bhasma* ingredients for an Ayurvedic treatment in India. Ayurveda is also used in the United States. *Photo: Luca Tettoni/Corbis, from Chen (2015)*

For those who've been working tirelessly in India and the United States for years on this issue, frustration and a sense of urgency are evident, as Angus Chen writes (2015):

In his own practice, [Professor Venkatesh Thuppil] says he sees people suffering from heavy metal toxicity because of Ayurvedic *bhasma* medicines almost every day. "Children have died. People have lost their lives," he says. Others have suffered permanent brain damage. "It must be stopped."

So far, stabs at effective policies in India and the United States to stop the production or distribution of contaminated Ayurvedics have fallen flat, according to Nancy Clark, the assistant commissioner for the New York Bureau of Environmental Hazards and Health.

For years, health departments like hers have routinely issued cease-and-desist orders to shops from selling specific Ayurvedic or other traditional remedies, but only once a laboratory test confirms the product is dangerous. "And believe me, we also notify the Indian government," Clark says. "There are attempts on the Indian side to regulate products. Obviously, it's not working."

Is it possible some ingredients in Ayurvedic medications naturally chelate heavy metals?

Yes it is. As noted in *Treating Lead Toxicity: Possibilities beyond Synthetic Chelation* by Thuppil and Tannir (2013) there are numerous natural chelators (chelating agents remove lead and other heavy metals from the body), including Vitamin C, Alpha-lipoic acid (ALA), coriander or cilantro (*Coriandum sativum*), tea, garlic (*Allium sativum*), turmeric (*Curcuma longa*), ginger (*Zingiber officinale*), Indian gooseberry or amla (*Emblica officinalis* Gaertn or *Phyllanthus emblica* Linn), ascorbic acid, allicin, flavonoids and catechins.

Many of these naturally occurring plant-based chelators are ingredients in Ayurvedic cooking and in numerous Ayurvedic medicines, even including Medcure Manasamithra vatika which contains turmeric (*Curcuma longa*) and Indian gooseberry (*Emblica officinalis*).

As Professor Thuppil was quoted as saying in Chen (2015):

"Every Indian kitchen is like an Ayurvedic pharmacy. We have pepper, ginger, turmeric," says Venkatesh. "It's a great medicine, but one has to be very cautious."

Are there any relevant regulations or litigation over lead poisoning from Ayurvedic medicines in India?

If this metal bhasma-containing medication was being produced in Australia, the manufacturing workers would be required to wear Personal Protective Equipment to reduce their exposure to the heavy metals, and to have bio-monitoring (blood tests for heavy metals) before they started their employment and then within one month of starting employment, and then regularly, depending on the levels of heavy metals found in their blood (SafeWork Australia 2018).

Mikulski et al (2018) have described the heavy metal-related belief of Ayurveda practitioners and users as follows:

Ayurvedic formulations are based on herbal products but often include toxic metals and other elements as part of the *Rasa Shastra* practice. These elements are used intentionally, as Ayurvedic tradition holds that lead, mercury, copper, gold, iron, silver, tin, and zinc may help restore good health and normal function to the human body. Arsenic, aluminum, cadmium, chromium, and nickel may be found in Ayurvedic products as well. It is estimated that over 20% of the Ayurvedic medications manufactured and distributed by U.S. and Indian companies contain toxic metals such as lead, mercury, and/or arsenic.

I asked Professor Venkatesh Thuppil:

Does India have any similar Occupational Health & Safety regulation? Do you know whether any workers at Ayurvedic medication manufacturing plants have ever actually had their blood tested for heavy metals? Or, given the tradition of intentionally adding heavy metals to Ayurvedic medications (see above paragraph by Mikulski et al 2018), is it legal to sell medications containing heavy metals in India? Has any heavy-metal containing Ayurvedic medication ever been recalled in

India? Can you send me any documents about any Indian regulations, legal action or litigation in relation to Ayurvedic medication please?

Professor Thuppil replied:

To date there are no mandatory regulations in India in spite of the AYUSH [Ayurveda, Yoga & Naturopathy, Unani, Siddha & Sowa Rigpa and Homeopathy] Ministry - recently formed – which is looking at the safety of various alternative medicines including Ayurveda and Unani. However there were a couple of litigations. With regard to good manufacturing practices I am unable to comment as old traditional methods are adopted for the preparation of Ayurvedic medicines and varies from manufacturer to manufacturer. Testing of blood lead level (BLL) of the workers at the manufacturing unit is not in practice or not known as there is no mandatory regulation. Any person can sell medications containing heavy metals in India and there is no legal requirement. Most of the time the Ayurvedic practitioner will prepare and sell or advocate to his patients. The entire process is based on mere trust and faith. Kindly log on to the AYUSH web site for the regulations and safety aspects and with reference to the documents about any Indian regulations, legal action or litigation in relation to Ayurvedic medication.

I did spend an hour searching the AYUSH Ministry website www.ayush.gov.in but found nothing relating to litigation against Ayurveda medications manufacturers for heavy metals in products; or blood testing of customers or workers; or regulation or even analysis of Ayurvedic medications for heavy metals. I concluded that the "Ministry of AYUSH, Government of India was established to ensure the development and propagation of AYUSH systems of medicine" - apparently not to regulate them or protect the health and safety of workers exposed to heavy metals during manufacture of bhasmas of metals etc, though some concern was evident for the treatment of experimental animals used in drug trials, and guidance given on keeping heavy metals out of their diet, then feeding them Ayurvedic medications and testing their blood for heavy metals. All this within the seemingly unshakeable paradigm of heavy metals being therapeutic if properly processed, as demonstrated by the following (Ministry of AYUSH 2018):

It was known to ancient Ayurvedic scholars that metals, minerals and some plants are toxic and harmful to the body and therefore, it was advocated to process them properly so as to render them therapeutically safe. Ayurveda pharmaceutics strongly recommend various other safety aspects, which are known for their contemporary relevance, like Good Agricultural Practices (GAP), Good Field Collection Practices (GFCP) of medicinal plants and Good Manufacturing Practices (GMP) for preparation of quality assured drugs.

It doesn't matter how you process it or how much you describe it as safe, it is illegal in Australia to supply unsafe products, although there is no particular lead level or mercury level or arsenic level etc that is deemed safe or unsafe, so an argument has to be made on a case-by-case basis that the product is unsafe. And to demonstrate that a workplace where heavy metals are used is safe, you have to present the blood lead and other blood heavy

metal results of the workers. It is not the same in India and the Ministry of AYUSH is clearly not going to accept the science on this anytime soon.

Breeher et al (2015) described a cluster of lead and mercury toxicity cases in 2011 among a community of adherents of traditional medical practice of Ayurveda [who all purchased their medications from one clinic in India – sadly, the clinic is not named].... Adherents of Ayurveda were offered heavy metals screening following the identification of the index case. Forty-six of 115 participants (40%) had elevated blood lead levels (BLLs) of 10 ug/dl or above, with 9.6% of BLLs at or above 50 ug/dl.

How many people in India have likely been lead poisoned by Ayurvedic medicines?

In 2005 on *The Health Report*, Dr Robert Saper told Dr Norman Swan that:

In India, it is estimated that up to 80% of their population of 1-billion uses Ayurvedic medicine, and in fact there are over one-half-million registered Ayurvedic physicians in India, as well as over 2500 hospitals, and 22,000 clinics that are solely dedicated to Ayurvedic medicine.

The following Results and Conclusions come from the *Abstract* of Mikulski et al (2018) in which the researchers analysed Ayurvedic medications that US residents purchased from one clinic in India:

Results: Lead was found in 65% of 252 Ayurvedic medicine samples with mercury and arsenic found in 38 and 32% of samples, respectively. Almost half of samples containing mercury, 36% of samples containing lead and 39% of samples containing arsenic had concentrations of those metals per pill that exceeded, up to several thousand times, the recommended daily intake values for pharmaceutical impurities.

Conclusions: Lack of regulations regarding manufacturing and content or purity of Ayurvedic and other herbal formulations poses a significant global public health problem.

Whilst Mikulski et al (2018) also found that the median lead content of the Ayurvedic pills purchased from India was 4.9 mg/kg and thus half the products had a lead content below 4.9 mg/kg, until someone does a survey of the heavy metal content and sales figures for each Ayurvedic medication sold in India, to find out whether Ayurvedic doctors generally favour prescribing the heavy metal-containing Ayurvedic medications (because they believe the heavy metals are therapeutic) or users of Ayurvedic medications prefer to purchase the heavy metal-containing Ayurvedic medications (because they believe the Ayurvedic doctors when they say the heavy metals-based ingredients – the ashes of metals and other Bhasmas - are therapeutic) it's not possible to estimate how many people in India have been lead poisoned by Ayurvedic medications, but the figure is surely in the order of hundreds of millions.

When I asked Professor Thuppil any actions InSLAR (or National Referral Centre for Lead Poisoning in India (NRCLPI) before it) have taken regarding lead poisoning related to Ayurvedic medications which would potentially bring an end to the practice of intentionally adding toxic heavy metals to Ayurvedic medications globally, he answered:

We at InSLAR during the recently concluded International Lead Conference discussed the presence of toxic heavy metals in Ayurvedic preparations. We had some of the top Ayurvedic experts and we are moving in the right direction and due to COVID the progress is hindered. We will arrive at some mutually agreed recommendations to the Government of India. Hopefully we in India should be able to tackle this issue in a diplomatic way. My recommendation is to stop using all medicines containing toxic heavy metals including lead to all age groups till regulatory authorities come out with legislation in any part of the globe in the interest of the health of people.

What actions initially need to be taken to ensure this case leads to massive change?

The customers of Ayurveda "doctor" Rama Prasad (including the mother of the 3-yr-old girl) need to write to him to ask what he tested for and to request a copy of the test results he claims to have had done on Manasamithra vatika before taking it himself and **prescribing** it (or more correctly, as this is a case of a person who is not actually registered to practice as a Health Practitioner in Australia, **selling** it) and if he provides test results demonstrating that lead was in the product, to then complain that he knowingly sold an unsafe product. If he didn't have the product tested for lead prior to selling it, then the complaint is that he recommended an unsafe untested product and the request should be made that he should make a complaint to his supplier, Medcure.

If Mr Rama Prasad did have the product tested for lead (and other heavy metals) before selling it in Australia, and therefore recommended the product knowing that it contained over 1% lead, then the complaint from the parents should be that he not be allowed to practice until he is registered with AHPRA and that AHPRA be advised that Mr Prasad as at May 2020 believed that lead (and other heavy metals like mercury and arsenic) were therapeutic, and that unless he recants, he never be allowed to register and practice in Australia.

Until more blood lead testing is done in people taking bhasma-containing Ayurvedic medications as a priority, and more credible laboratory analysis results are obtained on both bhasma-containing Ayurvedic medications AND the metal bhasma ingredients themselves, this will remain an isolated case, but the difference is: we now know the name of one manufacturer of one toxic medication and we know the names of the ingredients (the bhasmas) that are the likely source of the heavy metal concentrations, and the manufacturer has ISO 9001 certification. A complaint to Vasudeva Vilasam requesting that the metal bhasmas are analysed for lead and other heavy metals, should, according to the ISO 9001 quality assurance system, lead to a change in the ingredients so that heavy

metals are not found in the end product - or a cessation of manufacturing Manasamithra Vatika by this one company.

Next step – ask purchasers of this and other known metal bhasma-containing Ayurvedic medicines to have them tested for heavy metals at an accredited lab. If heavy metals are found, purchasers should undergo blood lead and other heavy metal testing and complain to the supplier/importer/manufacturer, especially those with ISO 9001 Certification... and so on... one case at a time... building to critical mass... and ending with only heavy-metal-free Ayurvedic medications on the market.

Who needs to take which steps to make Ayurvedic medications safe globally?

1. Anyone who has tested and found heavy metals in Ayurvedic medications should make a complaint to the supplier and manufacturer demanding that the manufacturer (or an independent auditor) analyse each of the ingredients of the medication, to determine which ingredients provided the heavy metals in the final product, and to also test other products they make containing those ingredients;
2. WHO should coordinate this complaint process (so complaints cannot be ignored by the manufacturers) and build a database of toxic ingredients and names of suppliers and manufacturers' names of formulations which include those toxic ingredients;
3. Anyone who has taken those Ayurvedic medications which have been identified as containing heavy metals, should ask their doctor for blood testing for lead, mercury, arsenic and antimony;
4. If blood lead testing occurs in countries where blood lead notification by the pathology lab to the health department is mandatory, these countries would then be motivated to analyse the particular Ayurvedic medications taken and identify more manufacturers, and feed more data into Step 1 and Step 2 in this list;
5. Anyone working in bhasma-manufacturing should ask their doctor for blood testing for lead, mercury, arsenic and antimony (to begin with, more heavy metals could be tested if any of the first 4 heavy metal results are elevated);
6. Anyone working in bhasma-utilising Ayurvedic medicine manufacturing should ask their doctor for blood testing for lead, mercury, arsenic and antimony (to begin, more heavy metals could be tested if the first results are high);
7. If blood lead testing of bhasma-manufacturing workers and bhasma-utilising Ayurvedic medicine manufacturing workers occurs in countries where blood lead notification by the pathology lab to the occupational health and safety department is mandatory, these countries would then be motivated to analyse the particular Ayurvedic ingredients or medications manufactured where workers are lead poisoned, and identify more manufacturers, and feed more data into Step 1 and 2 in this list;
8. If a respected body such as InSLAR (Indian Society for Lead Awareness and Research) were to raise awareness of the need for blood heavy metal testing and

laboratory analysis of the heavy metal contents of both Ayurvedic ingredients like bhasmas and the final products, then critical mass could be reached in India;

9. When a critical mass of poisoning cases and data about particular heavy metal-containing Ayurvedic ingredients, medications and manufacturers has been reached, manufacturers, firstly those with ISO 9001 certification, and then those without it, will be forced to reformulate Ayurvedic medications leaving out lead and other heavy metal-containing ingredients;
10. As lead is associated with early death, life expectancy in India and other countries where Ayurvedic medications are taken by a majority of the population should rise and this rise may even show up in the next United Nations Development Programme *Human Development Report*.

Why is this Australian 3 year old's lead poisoning from an Ayurvedic medicine so special?

What gives me so much hope that this case can improve the lives of perhaps a billion or more people? What's special about this case, is that Vasudeva Vilasam has made one (that we know of until further testing is done) Ayurvedic medicine – Manasamithra vatika – that contains 1.08% lead (plus mercury and arsenic) and the company claims on their website that with nearly 140 years experience in manufacturing Ayurvedic medicines, and with ISO 9001 Certification, they are truly Ayurvedic – quality assured.

Vasudeva Vilasam is not just some unscrupulous backyard Ayurvedic medicine manufacturer.

I've identified the Customer Complaint process of ISO 9001 Certification as the key ingredient which has not been tried by any other proponents of heavy-metal-free Ayurvedic medications.

If you had tested an Ayurvedic medicine because a little girl with no other lead sources had been lead poisoned by it, wouldn't you also be willing to try this novel approach? Sure, it may only go as far as this one medicine being reformulated without the toxic metals or just removed from the Vasudeva Vilasam VVMart online shop, but the approach has the potential to go much further… to acceptance by Indian manufacturers wishing to maintain their ISO 9001 certification, of Western science that says heavy metals in medications are toxic no matter how they're prepared, and they don't belong in medications.

I am happy to recommend Ayurvedic medicines - those that contain no heavy metals but do contain the natural chelating plants (like coriander) identified by Thuppil and Tannir (2013) - for detoxing lead and other heavy metals. Once more Ayurveda medicine manufacturers aim to keep heavy metals out of their products, wouldn't that fuel a resurgence of Ayurveda and an acceptance in Western countries of the safety of Ayurvedic medications, and their therapeutic value, that would potentially benefit billions of people both outside and inside India?

Coriander in flower. Photo: Elizabeth O'Brien

References:

Australian Government (2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended - NEPM Volume 2 Schedule B1 GUIDELINE ON Investigation Levels for Soil & Groundwater, in force 16/5/13* at http://www.comlaw.gov.au/Details/F2013C00288/f31af886-6051-47b6-9eb5-6009a9f6a1c4

AVS (Arya Vaidya Sala) website (2020) *Manasamithra Vatakam Dosage Usage Ingredients Indications Caution*, undated, accessed 28th September 2020 https://www.aryavaidyasala.com/products.php?cate=All&cate_product=manasamithra

AyurMedInfo.com website (2012) *Manasamitra Vatakam Benefits Dosage Ingredients Side Effects & Manufacturers,* 29th June 2012 https://www.ayurmedinfo.com/2012/06/29/manasamitra-vatakam-benefits-dosage-ingredients-and-side-effects/

Breeher, Laura; Mikulski, Marek A.; Czeczok, Thomas; Leinenkugel, Kathy; and Fuortes, Laurence J. (2015) *A cluster of lead poisoning among consumers of Ayurvedic medicine,* Int J Occup Environ Health. October, 2015; 21(4): 303307. doi: 10.1179/2049396715Y.0000000009, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4727589/

CDC (Centers for Disease Control and Prevention, USA) (2004) *Lead poisoning associated with use of Ayurvedic medications — five states, 2000-2003*. MMWR Morb Mortal Wkly Rep. 2004;53(26):582-584. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5326a3.htm

Chen, Angus (2015) *Toxic Lead Contaminates Some Traditional Ayurvedic Medicines,* npr Health Shots, 31st July 2015, https://www.npr.org/sections/health-shots/2015/07/31/428016419/toxic-lead-contaminates-some-traditional-ayurvedic-medicines

Choong, Emily (2018) *Lead is an issue beyond childhood: A fact sheet by LEAD Group volunteer Emily Choong, using extracts of media articles about the landmark Lancet lead article by*

Lanphear et al, March 2018. 5th September 2018. https://www.lead.org.au/fs/Lead-is-an-issue-beyond-Childhood-20180905.pdf

Dror, Yehuda (1995), *The Reality of ISO 9000 - Misinformation about ISO 9000 is leading many companies down the wrong path*, Quality Digest, September 1995, https://www.qualitydigest.com/sep/iso9000.html

Ernst E. *Heavy metals in traditional Indian remedies*. Eur J Clin Pharmacol. 2002;57(12):891-896. doi: 10.1007/s00228-001-0400-y. https://pubmed.ncbi.nlm.nih.gov/11936709/

HCCC (Health Care Complaints Commission) NSW (2020a) *Public Warning under s94A of the Health Care Complaints Act - Concerning levels of heavy metals in Ayurvedic medication ["Manasamithra Vatika", (Manasamitram Pills)]*, 18 September 2020. https://www.hccc.nsw.gov.au/decisions-orders/public-statements-and-warnings/public-warning-under-s94a-of-the-health-care-complaints-act-concerning-levels-of-heavy-metals-in-ayurvedic-medication

HCCC (Health Care Complaints Commission) NSW (2020b) *Mr Rama Prasad ("Ayurveda Doctor Rama Prasad") - Interim Prohibition Order [due to his prescribing of the Ayurvedic Medication "Manasamithra Vatika" (Manasamitram Pills) to both children and adults]*, 18 September 2020. https://www.hccc.nsw.gov.au/decisions-orders/media-releases/2020/mr-rama-prasad-ayurveda-doctor-rama-prasad-interim-prohibition-order

indiaabundance.com website (2020) *Manasamitra Vatakam Gulika page*. Indian Herbal Store Pvt. Ltd., New Delhi, India, undated, accessed 28th September 2020. https://www.indiaabundance.com/shopping/sp49_pr8542/Manasamitra_Vatakam_Gulika.html

Koch, Iris; Moriarty, Maeve; House, Kim; Sui, Jie; Cullen, William R.; Saper, Robert B. and Reimer, Kenneth J. (2011) *Bioaccessibility of lead and arsenic in traditional Indian medicines,* Sci Total Environ. 2011 Oct 1; 409(21): 4545-4552. Published online 2011 Aug 23. doi: 10.1016/j.scitotenv.2011.07.059. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3224858/

Lanphear B, Rauch S, Auinger P, Allen R, Hornung R, *Low-level lead exposure and mortality in US adults: a population-based cohort study*. Lancet Public Health 2018 http://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(18)30025-2/fulltext

MAPI (Maharishi Ayurveda Products International) (2017) vpk by Maharishi Ayurveda: The First Ayurveda Company in the U.S.; Tested and Safe: Our Commitment to Purity - Maharishi Ayurveda Products International, © 2017. https://www.mapi.com/about-us.html#:~:text=Originating%20in%20India%2C%20vpk%20by,dating%20back%20thousands%20of%20years ; https://www.mapi.com/our-story/safety.html

Mikulski, Marek A; Wichman, Michael D; Simmons, Donald L; Pham, Anthony N; Clottey, Valentina and Fuortes, Laurence J. (2018) *Toxic metals in ayurvedic preparations from a public health lead poisoning cluster investigation,* International Journal of Occupational and Environmental Health, 2017, VOL. 23, NO. 3, 187-192, https://doi.org/10.1080/10773525.2018.1447880. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6060866/

Ministry of AYUSH, Government of India (2018) *GENERAL GUIDELINES FOR SAFETY/TOXICITY EVALUATION OF AYURVEDIC FORMULATIONS Volume – II*, 2018 https://www.ayush.gov.in/docs/guideline_safety_toxicity.pdf

Prpic-Majic, Danica; Pizent, Alica; Jurasovic, Jasna; Pongracic; Jadranka; and Restek-Samarzija, Nada (1996) *Lead poisoning associated with the use of Ayurvedic metal-mineral tonics*, in Journal of Toxicology - Clinical Toxicology. 34(4):417-23, 1996. Abstract only, or, for subscribers, full article: http://informahealthcare.com/doi/abs/10.3109/15563659609013812?journalCode=ctx

PubMed (2020) *96 PubMed articles on lead & other heavy metal poisoning from Ayurvedic medicines,* accessed 27th September 2020 https://pubmed.ncbi.nlm.nih.gov/?linkname=pubmed_pubmed&from_uid=11936709

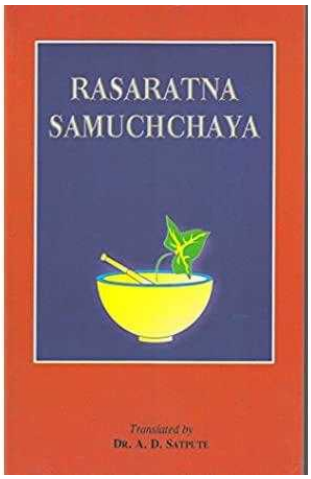
Roberts, Anne; O'Brien, Elizabeth; Taylor, Robert; and JustOne Lead Soldier (2020) *Health effects of a blood lead level below 10 µg/dL in both adults and children and even below 1 µg/dL in pregnancy*, The LEAD Group Inc, 22nd September 2020. https://www.lead.org.au/fs/Health_Effects_of_PbB_Level_Below_10_ug_per_dL_&_Even_Below_1_ug_per_dL_20200922.pdf

SafeWork Australia (2018) *Safe Work Australia, Safety by Topic: Lead - Managing risks associated with lead; Change to allowable blood lead levels; Lead processes and lead risk work; Health monitoring; Biological monitoring; Monitoring for airborne contaminants; Recent changes,* April 2018, https://www.safeworkaustralia.gov.au/topic/lead

Saper, Robert B; Kales, Stefanos N; Paquin, Janet; Burns, MJ; Eisenberg, David M; Davis, RB; Phillips, RS (2004) *Heavy Metal Content of Ayurvedic Herbal Medicine Products*, Journal of the American Medical Association (JAMA). Vol 292 No 23. pp 2868-2873 December 15 2004, http://jama.ama-assn.org/cgi/content/abstract/292/23/2868

Saper, Robert B; Phillips, Russell S; Sehgal, Anusha; Khouri, Nadia; Davis, Roger B; Paquin, Janet; Thuppil, Venkatesh; Kales, Stefanos N (2008) *Lead, Mercury, and Arsenic in US- and Indian-Manufactured Ayurvedic Medicines Sold via the Internet*, The Journal of The American Medical Association, Vol. 300 No. 8, August 27, 2008. https://jamanetwork.com/journals/jama/fullarticle/182460?alert=article#_=_ ; http://jama.ama-assn.org/cgi/content/short/300/8/915

Satpute, AD (2003) *Rasa Ratna Samuchaya of Vagbhatta, trans*, Chaukhamba Sanskrit Pratishtana, Varanasi, India, 2003.



Shastri K. *Rasa Tarangini of Sadananda Sharma.* trans. New Delhi, India: Motilal Banarsidas; 1979.

Swan, Dr Norman, interview of Dr Robert Saper, Director, Integrative Medicine, Dept Family Med., Boston University, USA (2005), *Heavy Metal Content of Ayurvedic Herbal Medicine Products*, on *The Health Report* on ABC Radio

National, broadcast on 24/1/2005, transcript at www.abc.net.au/rn/talks/8.30/helthrpt/stories/s1288483.htm

Tait, Paul A; Vora; Amish; James; Simon; Fitzgerald, Dr James; Pester, Beverly A (2002) *NOTABLE CASES: Severe congenital lead poisoning in a preterm infant due to a herbal remedy,* Medical Journal of Australia (MJA) Vol 177 19 August 2002 195, www.mja.com.au/public/issues/177_04_190802/tai10010_fm.pdf

TGA (Therapeutic Goods Administration) (2020) *Manasmithra Vatika (Manasamitram Pills) Ayurvedic medicine - Safety advisory - contains dangerous levels of lead and other heavy metals*, 25th September 2020. https://www.tga.gov.au/alert/manasmithra-vatika-manasamitram-pills-ayurvedic-medicine

Thakur, Devesh and Venkatesh, Thuppil (2015) *Ubiquity of Lead in Our Lives - Lead in Food*, JKIMSU, Vol. 4, No. 3, July-September, 2015, https://www.researchgate.net/publication/282299441_Ubiquity_of_Lead_in_Our_Lives-Lead_in_Food

Thuppil, Venkatesh and Tannir, Shambhavi (2013) *Treating Lead Toxicity: Possibilities beyond Synthetic Chelation*, JKIMSU, Vol. 2, No. 1, Jan-June 2013, https://www.researchgate.net/publication/287412980_Treating_Lead_Toxicity_Possibilities_beyond_Synthetic_Chelation

The 9000 Store (2020) *What is ISO 9001? The current version of the ISO 9001 standard is 9001:2015. ISO 9001 is the international standard for a quality management system ("QMS").* https://the9000store.com/what-are-iso-9000-standards/what-is-iso-9001/#:~:text=ISO%209001%20is%20the%20international%20standard%20for%20a,requirements%20set%20forth%20in%20the%20ISO%209001%20Standard – undated but © 2020, accessed 27/9/2020

The Free Dictionary online (2020) *43 Definitions of the Acronym QS* https://acronyms.thefreedictionary.com/QS , accessed 18/9/2020.

UNDP (United Nations Development Programme) (2019) *Human Development Report 2019 - Beyond income, beyond averages, beyond today: Inequalities in human development in the 21st century,* Copyright @ 2019 By the United Nations Development Programme 1 UN Plaza, New York, NY 10017 USA, http://hdr.undp.org/sites/default/files/hdr2019.pdf

Vella, Vance; O'Brien, Elizabeth; Idris, Elisa; Wibowo, Erik; Zhu, Hugh Xin Xi; & Choong, Emily (2020) *Health Impacts of Lead Poisoning - A preliminary listing of the health effects & symptoms of lead poisoning*, The LEAD Group Inc, 27th September 2020. https://www.lead.org.au/fs/The_LEAD_Group_Fact_Sheet-Health_Impacts_of_Lead_Poisoning_202009.pdf

Wikipedia (2020a) *List of countries by past life expectancy: ranging from 1950 to 2015 in five-year periods,* https://en.wikipedia.org/wiki/List_of_countries_by_past_life_expectancy - page last edited on 6 August 2020, at 00:30 (UTC).

Wikipedia (2020b) *List of countries by life expectancy: The article documents lists of countries by average life expectancy at birth by various sources of estimates.* https://en.wikipedia.org/wiki/List_of_countries_by_life_expectancy#UNDP_(2018) - page last edited on 20 September 2020, at 16:53 (UTC)

Mr Rama Prasad ("Ayurveda Doctor Rama Prasad") - Interim Prohibition Order

18 September 2020

[https://www.hccc.nsw.gov.au/decisions-orders/media-releases/2020/mr-rama-prasad-ayurveda-doctor-rama-prasad-interim-prohibition-order]

The NSW Health Care Complaints Commission ("the Commission") is currently investigating Mr Rama Prasad in relation to his prescribing of the Ayurvedic Medication "Manasamithra Vatika" (Manasamitram Pills) to both children and adults and about his claims that his treatments can reverse several aspects of autism in children.

The Ayurvedic Medication "Manasmithra Vatika" (Manasamitram Pills) was found to contain elevated levels of lead and other heavy metals.

One case with mildly elevated blood level was notified to the South Eastern Sydney Public Health Unit after consuming this product.

Clients residing in NSW who are considered to have been placed at possible risk have now been contacted by NSW Health public health personnel.

The Commission has issued an interim prohibition order in relation to Mr Rama Prasad, under section 41AA of the *Health Care Complaints Act 1993* ('The Act'). Mr Prasad is currently prohibited from providing any health services, either in paid employment or voluntarily, to any member of the public.

This interim prohibition order will remain in force for a period of eight weeks and may be renewed where appropriate in order to protect the health or safety of the public.

The Commission is also issuing a public warning about the risks associated with Ayurvedic Medication.

There is also close liaison with NSW Health, the Therapeutic Goods Administration (TGA) and the Australian Health Practitioner Regulation Agency (AHPRA) who also have regulatory responsibilities

relating to this matter.

What should consumers do to protect themselves?

The Commission strongly urges those individuals seeking alternative therapies to be vigilant in their research prior to proceeding with any natural therapy medications or medicines and to discuss any such proposed therapies with their treating registered health practitioner.

Individuals can check to see if a practitioner is registered in Australia through the Australian Health Practitioner Regulation Agency (AHPRA) website at www.ahpra.gov.au

Individuals can also check the website at https://www.tga.gov.au/ to see whether medications or medicines have been approved by the TGA.

Further Information

The full interim prohibition order can be found here.

For further information, contact the Executive Officer of the Health Care Complaints Commission, on 9219 7444 or send an email to media@hccc.nsw.gov.au.

If you think you may have consumed this medication, please contact your local Public Health Unit on 1300 066 055.

The information in this media release is correct at the time of publication. Orders may change; for example, conditions may no longer apply. For current information regarding the status of a registered health practitioner, including any conditions that currently apply, please check the National Register at www.ahpra.gov.au.

Still need more information

If you would like to speak to someone at the Commission for more information before you lodge a written complaint you can contact the Inquiry Line during business hours, Monday to Friday from 9am – 5pm on 1800 043 159 or submit an online inquiry.

Online inquiry

Ready to lodge your complaint

All complaints must be made in writing and we aim to assess complaints within 60 days. Your complaint will be allocated to an assessment officer and we will write to you to explain the outcome of your complaint.

Click here to make a complaint

Track my complaint

You can track the progress of your complaint online.

Click here to track your complaint

Page last updated 18 Sep 2020

Contact Us

Ph: (02) 9219 7444
Toll free (NSW) 1800 043 159
Email: hccc@hccc.nsw.gov.au

We acknowledge the Traditional Custodians of the land on which we work and live, the Gadigal people of the Eora Nation, and recognise their continuing connection to land, water and community. We pay respect to Aboriginal and Torres Strait Islander Elder

Public Warning under s94A of the Health Care Complaints Act – Concerning levels of heavy metals in Ayurvedic medication

18 September 2020

Public Warning under s94a of the Health Care Complaints Act 1993: concerning levels of heavy metals in Ayurvedic Medication.

[https://www.hccc.nsw.gov.au/decisions-orders/public-statements-and-warnings/public-warning-under-s94a-of-the-health-care-complaints-act-concerning-levels-of-heavy-metals-in-ayurvedic-medication]

The NSW Health Care Complaints Commission is concerned about a complaint received regarding the prescription of "Manasamithra Vatika," (Manasamitram Pills) an Ayurvedic medication.

The complaint related to prescription of this medication to a child for treatment of autism.

This medication was found to contain concerning levels of lead and other heavy metals.

Clients who are considered to have been placed at risk have now been contacted by NSW Health public health personnel.

If you think you may have consumed this medication please contact your local Public Health Unit on 1300 066 055.

There is also close liaison with NSW Health, the Therapeutic Goods Administration (TGA) and the Australian Health Practitioner Regulation Agency (AHPRA) who also have regulatory responsibilities relating to this matter.

What should consumers do to protect themselves?

The Commission strongly urges those individuals seeking alternative therapies to be vigilant in their research prior to proceeding with any natural therapy medications or medicines and to discuss any such proposed therapies with their treating registered health practitioner.

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For further information, contact the Executive Officer of the Health Care Complaints Commission, on 9219 7444 or send an email to media@hccc.nsw.gov.au

The information in this media release is correct at the time of publication. Orders may change; for example, conditions may no longer apply. For current information regarding the status of a registered health practitioner, including any conditions that currently apply, please check the National Register.

Manasmithra Vatika (Manasamitram Pills) Ayurvedic medicine: Safety advisory - contains dangerous levels of lead and other heavy metals

https://www.tga.gov.au/alert/manasmithra-vatika-manasamitram-pills-ayurvedic-medicine

Home » Safety information » Alerts » All alerts

Related information

Video: Buying medicines and medical devices online

Counterfeit medicines and devices

25 September 2020

The Therapeutic Goods Administration (TGA), in conjunction with state health authorities, is investigating a report of the presence of dangerous levels of lead and other heavy metals in the Ayurvedic medicine Manasmithra Vatika (Manasamitram Pills).

Ayurvedic medicines are a type of complementary medicine (sometimes known as 'traditional medicine') originating from India.

The TGA is aware that Manasmithra Vatika was supplied to practitioners and patients in NSW and Victoria, but there may have been further product distribution to other states.

If high levels of lead are present in these products, taking them could result in lead poisoning. Lead poisoning is a serious condition that can cause long-term health effects up to and including organ damage and death. Pregnant women and children are at a greater level of risk of lead poisoning.

Further information on symptoms can be found on the Victoria Health website alert.(link is external) Information on the health risks of lead exposure is available at the Better Health website.(link is external)

Information for consumers

If you, or someone you care for, has Manasmithra Vatika (Manasamitram Pills), do not use them. If you have already taken some of these pills, you should seek medical advice from your doctor or call the Poisons Information Centre on 13 11 26.

If you suspect you have had a side effect (also known as an adverse event) to this product, please report it to the TGA. In addition, if you have concerns about this or other products, you can make a report to the TGA on 1800 020 653 or through our website.

You can identify if a medicine has been included on the Australian Register of Therapeutic Goods (ARTG) by checking to see if it has an AUST R or AUST L number. For further information on how we regulate registered and listed medicines, see the TGA's website.

The benefits of purchasing complementary medicines that are regulated by the TGA include that you have assurances that those products are safe and contain the ingredients identified on the label.

If you buy unregulated medicines, either from a local retailer or online, you may be wasting your money and/or risking your health.

Information for health professionals

Please be aware of the above issue and advise patients accordingly if they seek advice.

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96 PubMed articles on lead & other heavy metal poisoning from Ayurvedic medicines

Similar Articles for PMID: 11936709

1. Heavy metals in traditional Indian remedies.

Ernst E.Eur J Clin Pharmacol. 2002 Feb;57(12):891-6. doi: 10.1007/s00228-001-0400-y.PMID: 11936709

URL: https://pubmed.ncbi.nlm.nih.gov/11936709/

2. Heavy metal content of ayurvedic herbal medicine products.

Saper RB, Kales SN, Paquin J, Burns MJ, Eisenberg DM, Davis RB, Phillips RS.JAMA. 2004 Dec 15;292(23):2868-73. doi: 10.1001/jama.292.23.2868.PMID: 15598918

URL: https://pubmed.ncbi.nlm.nih.gov/15598918/

3. A review of the clinical and toxicological aspects of 'traditional' (herbal) medicines adulterated with heavy metals.

Lynch E, Braithwaite R.Expert Opin Drug Saf. 2005 Jul;4(4):769-78. doi: 10.1517/14740338.4.4.769.PMID: 16011453 Review.

URL: https://pubmed.ncbi.nlm.nih.gov/16011453/

4. A cluster of lead poisoning among consumers of Ayurvedic medicine.

Breeher L, Mikulski MA, Czeczok T, Leinenkugel K, Fuortes LJ.Int J Occup Environ Health. 2015;21(4):303-7. doi: 10.1179/2049396715Y.0000000009. Epub 2015 Apr 6.PMID: 25843124 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/25843124/

5. Ayurvedic herbal medicine and lead poisoning.

Gunturu KS, Nagarajan P, McPhedran P, Goodman TR, Hodsdon ME, Strout MP.J Hematol Oncol. 2011 Dec 20;4:51. doi: 10.1186/1756-8722-4-51.PMID: 22185092 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/22185092/

6. Simultaneous exposure to lead, arsenic and mercury from Indian ethnic remedies.

Sheerin NS, Monk PN, Aslam M, Thurston H.Br J Clin Pract. 1994 Nov-Dec;48(6):332-3.PMID: 7848800

URL: https://pubmed.ncbi.nlm.nih.gov/7848800/

7. Indian herbal remedies for diabetes as a cause of lead poisoning.

Keen RW, Deacon AC, Delves HT, Moreton JA, Frost PG.Postgrad Med J. 1994 Feb;70(820):113-4.

doi: 10.1136/pgmj.70.820.113.PMID: 8170881 **Free PMC article.**
URL: https://pubmed.ncbi.nlm.nih.gov/8170881/

8. [Lead poisoning from traditional Indian medicines].

Garnier R, Poupon J.Presse Med. 2006 Jul-Aug;35(7-8):1177-80. doi: 10.1016/s0755-4982(06)74776-5.PMID: 16840895 French.
URL: https://pubmed.ncbi.nlm.nih.gov/16840895/

9. Lead, mercury, and arsenic in US- and Indian-manufactured Ayurvedic medicines sold via the Internet.

Saper RB, Phillips RS, Sehgal A, Khouri N, Davis RB, Paquin J, Thuppil V, Kales SN.JAMA. 2008 Aug 27;300(8):915-23. doi: 10.1001/jama.300.8.915.PMID: 18728265 **Free PMC article.**
URL: https://pubmed.ncbi.nlm.nih.gov/18728265/

10. Monitoring of mercury, arsenic, cadmium and lead in Ayurvedic formulations marketed in Delhi by flame AAS and confirmation by ICP-MS.

Kumar G, Gupta YK.Food Addit Contam Part B Surveill. 2012;5(2):140-4. doi: 10.1080/19393210.2012.680612. Epub 2012 May 9.PMID: 24779744
URL: https://pubmed.ncbi.nlm.nih.gov/24779744/

11. Lead poisoning caused by Indian ethnic remedies in Italy.

Muzi G, Dell'Omo M, Murgia N, Curina A, Ciabatta S, Abbritti G.Med Lav. 2005 Mar-Apr;96(2):126-33.PMID: 16001512 Review.
URL: https://pubmed.ncbi.nlm.nih.gov/16001512/

12. Heavy metal hazards of Nigerian herbal remedies.

Obi E, Akunyili DN, Ekpo B, Orisakwe OE.Sci Total Environ. 2006 Oct 1;369(1-3):35-41. doi: 10.1016/j.scitotenv.2006.04.024. Epub 2006 Jun 6.PMID: 16759683
URL: https://pubmed.ncbi.nlm.nih.gov/16759683/

13. Lead poisoning due to ingestion of Indian herbal remedies.

Roche A, Florkowski C, Walmsley T.N Z Med J. 2005 Jul 29;118(1219):U1587.PMID: 16059407
URL: https://pubmed.ncbi.nlm.nih.gov/16059407/

14. Heavy Metals in Indigenous Preparations Used for Sex Selection During Pregnancy in India.

Ganguli A, Rai P, Balachandran S, Gupta R, Sharma R, Neogi SB.Biol Trace Elem Res. 2019 Apr;188(2):239-244. doi: 10.1007/s12011-018-1411-1. Epub 2018 Jun 16.PMID: 29909490
URL: https://pubmed.ncbi.nlm.nih.gov/29909490/

15. Lead poisoning from Indian herbal medicine (Ayurveda).

Dunbabin DW, Tallis GA, Popplewell PY, Lee RA.Med J Aust. 1992 Dec 7-21;157(11-12):835-6.PMID: 1454025

URL: https://pubmed.ncbi.nlm.nih.gov/1454025/

16. Lead poisoning due to ingestion of Indian herbal remedies: a response to the case report by Roche et al.

Beasley M.N Z Med J. 2005 Aug 26;118(1221):U1637.PMID: 16138175 No abstract available.

URL: https://pubmed.ncbi.nlm.nih.gov/16138175/

17. A case of mistaken identity: herbal medicine as a cause of lead toxicity.

Smitherman J, Harber P.Am J Ind Med. 1991;20(6):795-8. doi: 10.1002/ajim.4700200611.PMID: 1805616

URL: https://pubmed.ncbi.nlm.nih.gov/1805616/

18. Lead poisoning associated with ayurvedic medications--five states, 2000-2003.

Centers for Disease Control and Prevention (CDC).MMWR Morb Mortal Wkly Rep. 2004 Jul 9;53(26):582-4.PMID: 15241300 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/15241300/

19. Toxic metals in ayurvedic preparations from a public health lead poisoning cluster investigation.

Mikulski MA, Wichman MD, Simmons DL, Pham AN, Clottey V, Fuortes LJ.Int J Occup Environ Health. 2017 Jul;23(3):187-192. doi: 10.1080/10773525.2018.1447880. Epub 2018 Mar 12.PMID: 29528276 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/29528276/

20. How natural are 'natural herbal remedies'? A Saudi perspective.

Bogusz MJ, al Tufail M, Hassan H.Adverse Drug React Toxicol Rev. 2002;21(4):219-29. doi: 10.1007/BF03256198.PMID: 12503255

URL: https://pubmed.ncbi.nlm.nih.gov/12503255/

21. EVALUATION OF TOXIC HEAVY METALS IN AYURVEDIC SYRUPS SOLD IN LOCAL MARKETS OF HAZARA, PAKISTAN.

Hajra B, Qayum I, Orakzai S, Hussain F, Faryal U, Aurangzeb.J Ayub Med Coll Abbottabad. 2015 Jan-Mar;27(1):183-6.PMID: 26182772

URL: https://pubmed.ncbi.nlm.nih.gov/26182772/

22. Lead poisoning in pregnant women who used Ayurvedic medications from India--New York City, 2011-2012.

Centers for Disease Control and Prevention (CDC).MMWR Morb Mortal Wkly Rep. 2012 Aug 24;61(33):641-6.PMID: 22914225

URL: https://pubmed.ncbi.nlm.nih.gov/22914225/

23. Heavy metal hazards of Asian traditional remedies.

Garvey GJ, Hahn G, Lee RV, Harbison RD.Int J Environ Health Res. 2001 Mar;11(1):63-71. doi: 10.1080/09603120020019656.PMID: 11260788

URL: https://pubmed.ncbi.nlm.nih.gov/11260788/

24. Traditional remedies and food supplements. A 5-year toxicological study (1991-1995).

Shaw D, Leon C, Kolev S, Murray V.Drug Saf. 1997 Nov;17(5):342-56. doi: 10.2165/00002018-199717050-00006.PMID: 9391777

URL: https://pubmed.ncbi.nlm.nih.gov/9391777/

25. Adverse events associated with metal contamination of traditional chinese medicines in Korea: a clinical review.

Kim H, Hughes PJ, Hawes EM.Yonsei Med J. 2014 Sep;55(5):1177-86. doi: 10.3349/ymj.2014.55.5.1177.PMID: 25048473 **Free PMC article.** Review.

URL: https://pubmed.ncbi.nlm.nih.gov/25048473/

26. Lead poisoning associated with Ayurvedic drug presenting as intestinal obstruction: a case report.

Gupta N, Goswami B, Singh N, B C Koner, Garg R.Clin Chim Acta. 2011 Jan 14;412(1-2):213-4. doi: 10.1016/j.cca.2010.10.007. Epub 2010 Oct 13.PMID: 20950594

URL: https://pubmed.ncbi.nlm.nih.gov/20950594/

27. Toxic metals and organochlorine pesticides residue in single herbal drugs used in important ayurvedic formulation - 'Dashmoola'.

Rai V, Kakkar P, Singh J, Misra C, Kumar S, Mehrotra S.Environ Monit Assess. 2008 Aug;143(1-3):273-7. doi: 10.1007/s10661-007-9976-8. Epub 2007 Oct 7.PMID: 17922233

URL: https://pubmed.ncbi.nlm.nih.gov/17922233/

28. [Two poisoning case reports on heavy metal medicinal herb preparation (author's transl)].

Gao ZJ.Zhonghua Yu Fang Yi Xue Za Zhi. 1980 May;14(2):117-8.PMID: 7215031 Chinese. No abstract available.

URL: https://pubmed.ncbi.nlm.nih.gov/7215031/

29. Metal concentrations in plants and urine from patients treated with traditional remedies.

Steenkamp V, von Arb M, Stewart MJ.Forensic Sci Int. 2000 Nov 13;114(2):89-95. doi: 10.1016/s0379-0738(00)00291-7.PMID: 10967249

URL: https://pubmed.ncbi.nlm.nih.gov/10967249/

30. Lead poisoning from Ayurvedic medicines.

Tsutsui RS, Van Schalkwyk J, Spriggs D.N Z Med J. 2013 May 10;126(1374):80-3.PMID: 23799386

URL: https://pubmed.ncbi.nlm.nih.gov/23799386/

31. Determination of trace and heavy metals in some commonly used medicinal herbs in Ayurveda.

Nema NK, Maity N, Sarkar BK, Mukherjee PK.Toxicol Ind Health. 2014 Nov;30(10):964-8. doi: 10.1177/0748233712468015. Epub 2012 Dec 6.PMID: 23222691

URL: https://pubmed.ncbi.nlm.nih.gov/23222691/

32. Study of heavy metal poisoning in frequent users of Chinese medicines in Hong Kong and Macau.

Chui SH, Wong YH, Chio HI, Fong MY, Chiu YM, Szeto YT, Vong WT, Lam CW.Phytother Res. 2013 Jun;27(6):859-63. doi: 10.1002/ptr.4816. Epub 2012 Aug 16.PMID: 22899484

URL: https://pubmed.ncbi.nlm.nih.gov/22899484/

33. Ayurvedic plumbism.

Sadler M, Bell S.Intern Med J. 2017 Jul;47(7):823-825. doi: 10.1111/imj.13478.PMID: 28677317

URL: https://pubmed.ncbi.nlm.nih.gov/28677317/

34. Metals and metalloids in traditional medicines (Ayurvedic medicines, nutraceuticals and traditional Chinese medicines).

Gyamfi ET.Environ Sci Pollut Res Int. 2019 Jun;26(16):15767-15778. doi: 10.1007/s11356-019-05023-2. Epub 2019 Apr 19.PMID: 31004267

URL: https://pubmed.ncbi.nlm.nih.gov/31004267/

35. Toxic heavy metals and undeclared drugs in Asian herbal medicines.

Ernst E.Trends Pharmacol Sci. 2002 Mar;23(3):136-9. doi: 10.1016/S0165-6147(00)01972-6.PMID: 11879681 Review.

URL: https://pubmed.ncbi.nlm.nih.gov/11879681/

36. Analytical methods for heavy metals in herbal medicines.

Yuan X, Chapman RL, Wu Z.Phytochem Anal. 2011 May-Jun;22(3):189-98. doi: 10.1002/pca.1287. Epub 2011 Feb 21.PMID: 21341339 Review.

URL: https://pubmed.ncbi.nlm.nih.gov/21341339/

37. Childhood lead poisoning associated with traditional Chinese medicine: a case report and the subsequent lead source inquiry.

Lin GZ, Wu F, Yan CH, Li K, Liu XY.Clin Chim Acta. 2012 Jul 11;413(13-14):1156-9. doi: 10.1016/j.cca.2012.03.010. Epub 2012 Mar 20.PMID: 22564879

URL: https://pubmed.ncbi.nlm.nih.gov/22564879/

38. Contributions of Indian Council of Medical Research (ICMR) in the area of Medicinal plants/Traditional medicine.

Tandon N, Yadav SS.J Ethnopharmacol. 2017 Feb 2;197:39-45. doi: 10.1016/j.jep.2016.07.064. Epub 2016 Jul 22.PMID: 27452657 Review.

URL: https://pubmed.ncbi.nlm.nih.gov/27452657/

39. Chronic arsenic poisoning following ayurvedic medication.

Pinto B, Goyal P, Flora SJ, Gill KD, Singh S.J Med Toxicol. 2014 Dec;10(4):395-8. doi: 10.1007/s13181-014-0389-0.PMID: 24696169 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/24696169/

40. Metals in herbal drugs from Himalayan region.

Pakade YB, Kumari A, Singh S, Sharma R, Tewary DK.Bull Environ Contam Toxicol. 2011 Jan;86(1):133-6. doi: 10.1007/s00128-010-0161-3. Epub 2010 Dec 17.PMID: 21165599

URL: https://pubmed.ncbi.nlm.nih.gov/21165599/

41. Buyers beware: lead poisoning due to Ayurvedic medicine.

Pierce JM, Estrada CA, Mathews RE Jr.J Gen Intern Med. 2012 Oct;27(10):1384-6. doi: 10.1007/s11606-012-2048-y. Epub 2012 Apr 3.PMID: 22476953 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/22476953/

42. [Lead poisoning after ingestion of ayurvedic drugs].

Schilling U, Mück R, Heidemann E.Med Klin (Munich). 2004 Aug 15;99(8):476-80. doi: 10.1007/s00063-004-1072-2.PMID: 15309279 German.

URL: https://pubmed.ncbi.nlm.nih.gov/15309279/

43. Hematopoietic toxicity from lead-containing Ayurvedic medications.

Kales SN, Christophi CA, Saper RB.Med Sci Monit. 2007 Jul;13(7):CR295-8.PMID: 17599022 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/17599022/

44. Heavy metal contaminants in yerberia shop products.

Levine M, Mihalic J, Ruha AM, French RN, Brooks DE.J Med Toxicol. 2013 Mar;9(1):21-4. doi: 10.1007/s13181-012-0231-5.PMID: 22562238 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/22562238/

45. Evaluation of mercury contamination in Smilax myosotiflora herbal preparations.

Ang HH, Lee KL.Int J Toxicol. 2007 Sep-Oct;26(5):433-9. doi: 10.1080/10915810701583036.PMID: 17963130

URL: https://pubmed.ncbi.nlm.nih.gov/17963130/

46. Lead poisoning-associated death from Asian Indian folk remedies--Florida.

Centers for Disease Control (CDC).MMWR Morb Mortal Wkly Rep. 1984 Nov 16;33(45):638, 643-5.PMID: 6436668 No abstract available.

URL: https://pubmed.ncbi.nlm.nih.gov/6436668/

47. Leads from the MMWR. Lead poisoning-associated death from Asian Indian folk remedies--Florida.

PMID: 6502873

URL: https://pubmed.ncbi.nlm.nih.gov/6502873/

48. Combined DNA, toxicological and heavy metal analyses provides an auditing toolkit to improve pharmacovigilance of traditional Chinese medicine (TCM).

Coghlan ML, Maker G, Crighton E, Haile J, Murray DC, White NE, Byard RW, Bellgard MI, Mullaney I, Trengove R, Allcock RJ, Nash C, Hoban C, Jarrett K, Edwards R, Musgrave IF, Bunce M.Sci Rep. 2015 Dec 10;5:17475. doi: 10.1038/srep17475.PMID: 26658160 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/26658160/

49. Penicillamine in metal poisoning.

Lyle WH.J Rheumatol Suppl. 1981 Jan-Feb;7:96-9.PMID: 6939892

URL: https://pubmed.ncbi.nlm.nih.gov/6939892/

50. Evaluation of Ubtan - A traditional indian skin care formulation.

Biswas R, Mukherjee PK, Kar A, Bahadur S, Harwansh RK, Biswas S, Al-Dhabi NA, Duraipandiyan V.J Ethnopharmacol. 2016 Nov 4;192:283-291. doi: 10.1016/j.jep.2016.07.034. Epub 2016 Jul 11.PMID: 27416804

URL: https://pubmed.ncbi.nlm.nih.gov/27416804/

51. Safety and toxicity issues associated with lead-based traditional herbo-metallic preparations.

Nagarajan S, Sivaji K, Krishnaswamy S, Pemiah B, Rajan KS, Krishnan UM, Sethuraman S.J Ethnopharmacol. 2014;151(1):1-11. doi: 10.1016/j.jep.2013.10.037. Epub 2013 Nov 9.PMID: 24216165 Review.

URL: https://pubmed.ncbi.nlm.nih.gov/24216165/

52. [Correlation between toxicity of heavy metals and various food components].

Szczepański Z, Król J.Pediatr Pol. 1979 Sep;54(9):1077-80.PMID: 228237 Polish. No abstract available.

URL: https://pubmed.ncbi.nlm.nih.gov/228237/

53. Case of acute lead toxicity associated with Ayurvedic supplements.

Breyre A, Green-McKenzie J.BMJ Case Rep. 2016 Jun 30;2016:bcr2016215041. doi: 10.1136/bcr-2016-215041.PMID: 27364782 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/27364782/

54. A severe case of multiple metal poisoning in a child treated with a traditional medicine.

Steenkamp V, Stewart MJ, Curowska E, Zuckerman M.Forensic Sci Int. 2002 Aug 28;128(3):123-6. doi: 10.1016/s0379-0738(02)00184-6.PMID: 12175791

URL: https://pubmed.ncbi.nlm.nih.gov/12175791/

55. [Chronic lead intoxication associated with Ayurvedic medication].

Kanen BL, Perenboom RM.Ned Tijdschr Geneeskd. 2005 Dec 24;149(52):2893-6.PMID: 16402516 Dutch.

URL: https://pubmed.ncbi.nlm.nih.gov/16402516/

56. Lead poisoning associated with use of traditional ethnic remedies--California, 1991-1992.

Centers for Disease Control and Prevention (CDC).MMWR Morb Mortal Wkly Rep. 1993 Jul 16;42(27):521-4.PMID: 8321177

URL: https://pubmed.ncbi.nlm.nih.gov/8321177/

57. Lead intoxication due to ayurvedic medications as a cause of abdominal pain in adults.

Mehta V, Midha V, Mahajan R, Narang V, Wander P, Sood R, Sood A.Clin Toxicol (Phila). 2017 Feb;55(2):97-101. doi: 10.1080/15563650.2016.1259474. Epub 2016 Dec 13.PMID: 27957879 Clinical Trial.

URL: https://pubmed.ncbi.nlm.nih.gov/27957879/

58. Lead, mercury, and arsenic poisoning due to topical use of traditional Chinese medicines.

Wu ML, Deng JF, Lin KP, Tsai WJ.Am J Med. 2013 May;126(5):451-4. doi: 10.1016/j.amjmed.2013.01.001.PMID: 23582936

URL: https://pubmed.ncbi.nlm.nih.gov/23582936/

59. Lead content of some traditional preparations--"Kushtas".

Haq I, Asghar M.J Ethnopharmacol. 1989 Oct;26(3):287-91. doi: 10.1016/0378-8741(89)90101-3.PMID: 2615409

URL: https://pubmed.ncbi.nlm.nih.gov/2615409/

60. Lead induced anaemia due to traditional Indian medicine: a case report.

Spriewald BM, Rascu A, Schaller KH, Angerer J, Kalden JR, Harrer T.Occup Environ Med. 1999 Apr;56(4):282-3. doi: 10.1136/oem.56.4.282.PMID: 10450247 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/10450247/

61. Speciation and bioavailability of lead in complementary medicines.

Bolan S, Naidu R, Kunhikrishnan A, Seshadri B, Ok YS, Palanisami T, Dong M, Clark I.Sci Total Environ. 2016 Jan 1;539:304-312. doi: 10.1016/j.scitotenv.2015.08.124. Epub 2015 Sep 11.PMID: 26363725

URL: https://pubmed.ncbi.nlm.nih.gov/26363725/

62. Hazards of heavy metal contamination.

Järup L.Br Med Bull. 2003;68:167-82. doi: 10.1093/bmb/ldg032.PMID: 14757716 Review.

URL: https://pubmed.ncbi.nlm.nih.gov/14757716/

63. Ayurvedic medicine: patients in peril from plumbism.

van Schalkwyk J, Davidson J, Palmer B, Hope V.N Z Med J. 2006 May 5;119(1233):U1958.PMID: 16680175

URL: https://pubmed.ncbi.nlm.nih.gov/16680175/

64. Contamination and adulteration of herbal medicinal products (HMPs): an overview of systematic reviews.

Posadzki P, Watson L, Ernst E.Eur J Clin Pharmacol. 2013 Mar;69(3):295-307. doi: 10.1007/s00228-012-1353-z. Epub 2012 Jul 29.PMID: 22843016 Review.

URL: https://pubmed.ncbi.nlm.nih.gov/22843016/

65. [The toxicology of some heavy metals].

Hansen JC.Ugeskr Laeger. 1974 Apr 15;136(16):853-8.PMID: 4825558 Danish. No abstract available.

URL: https://pubmed.ncbi.nlm.nih.gov/4825558/

66. Traditional medicinal plants in Nigeria--remedies or risks.

Awodele O, Popoola TD, Amadi KC, Coker HA, Akintonwa A.J Ethnopharmacol. 2013 Nov 25;150(2):614-8. doi: 10.1016/j.jep.2013.09.015. Epub 2013 Oct 3.PMID: 24095699

URL: https://pubmed.ncbi.nlm.nih.gov/24095699/

67. [Heavy metals in traditional Chinese medicine: ba-pao-neu-hwang-san].

Chi YW, Chen SL, Yang MH, Hwang RC, Chu ML.Zhonghua Min Guo Xiao Er Ke Yi Xue Hui Za Zhi. 1993 May-Jun;34(3):181-90.PMID: 8368065 Chinese.

URL: https://pubmed.ncbi.nlm.nih.gov/8368065/

68. Toxic heavy metals in human blood in relation to certain food and environmental samples in Kerala, South India.

Jose A, Ray JG.Environ Sci Pollut Res Int. 2018 Mar;25(8):7946-7953. doi: 10.1007/s11356-017-1112-x. Epub 2018 Jan 4.PMID: 29302906

URL: https://pubmed.ncbi.nlm.nih.gov/29302906/

69. Adulteration of South African traditional herbal remedies.

Snyman T, Stewart MJ, Grove A, Steenkamp V.Ther Drug Monit. 2005 Feb;27(1):86-9. doi: 10.1097/00007691-200502000-00015.PMID: 15665751

URL: https://pubmed.ncbi.nlm.nih.gov/15665751/

70. Heavy metal and pesticide content in commonly prescribed individual raw Chinese Herbal Medicines.

Harris ES, Cao S, Littlefield BA, Craycroft JA, Scholten R, Kaptchuk T, Fu Y, Wang W, Liu Y, Chen H, Zhao Z, Clardy J, Woolf AD, Eisenberg DM.Sci Total Environ. 2011 Sep 15;409(20):4297-305. doi: 10.1016/j.scitotenv.2011.07.032. Epub 2011 Aug 6.PMID: 21824641 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/21824641/

71. Analysis of heavy metals in marine fish from Mumbai Docks.

Deshpande A, Bhendigeri S, Shirsekar T, Dhaware D, Khandekar RN.Environ Monit Assess. 2009 Dec;159(1-4):493-500. doi: 10.1007/s10661-008-0645-3. Epub 2008 Dec 17.PMID: 19089595

URL: https://pubmed.ncbi.nlm.nih.gov/19089595/

72. Monitoring heavy metals, residual agricultural chemicals and sulfites in traditional herbal decoctions.

Yu IS, Lee JS, Kim SD, Kim YH, Park HW, Ryu HJ, Lee JH, Lee JM, Jung K, Na C, Joung JY, Son CG.BMC Complement Altern Med. 2017 Mar 14;17(1):154. doi: 10.1186/s12906-017-1646-y.PMID: 28288606 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/28288606/

73. Severe lead poisoning caused by use of health supplements presenting as acute abdominal pain during pregnancy.

Shamshirsaz AA, Yankowitz J, Rijhsinghani A, Greiner A, Holstein SA, Niebyl JR.Obstet Gynecol. 2009 Aug;114(2 Pt 2):448-50. doi: 10.1097/AOG.0b013e31818f55d9.PMID: 19622956

URL: https://pubmed.ncbi.nlm.nih.gov/19622956/

74. Lead encephalopathy due to traditional medicines.

Karri SK, Saper RB, Kales SN.Curr Drug Saf. 2008 Jan;3(1):54-9. doi: 10.2174/157488608783333907.PMID: 18690981 **Free PMC article.** Review.

URL: https://pubmed.ncbi.nlm.nih.gov/18690981/

75. Volatile (As and Hg) and non-volatile (Pb and Cd) toxic heavy metals analysis in rhizome of Zingiber officinale collected from different locations of North Western Himalayas by Atomic Absorption Spectroscopy.

Gupta S, Pandotra P, Gupta AP, Dhar JK, Sharma G, Ram G, Husain MK, Bedi YS.Food Chem Toxicol. 2010 Oct;48(10):2966-71. doi: 10.1016/j.fct.2010.07.034. Epub 2010 Jul 30.PMID: 20732845

URL: https://pubmed.ncbi.nlm.nih.gov/20732845/

76. Lead Poisoning Due to Herbal Medications.

Sakharkar P.Indian J Clin Biochem. 2017 Oct;32(4):500-501. doi: 10.1007/s12291-017-0678-x. Epub 2017 Jul 22.PMID: 29062186 **Free PMC article.**

URL: https://pubmed.ncbi.nlm.nih.gov/29062186/

77. Herbal vitamins: lead toxicity and developmental delay.

Moore C, Adler R.Pediatrics. 2000 Sep;106(3):600-2. doi: 10.1542/peds.106.3.600.PMID: 10969109

URL: https://pubmed.ncbi.nlm.nih.gov/10969109/

78. Lead poisoning from an Asian Indian folk remedy.

Pontifex AH, Garg AK.CMAJ. 1985 Dec 15;133(12):1227-8.PMID: 4063934 **Free PMC article.** No abstract available.

URL: https://pubmed.ncbi.nlm.nih.gov/4063934/

79. Nutritional factors in relation to heavy metal toxicants.

Levander OA.Fed Proc. 1977 Apr;36(5):1683-7.PMID: 191297

URL: https://pubmed.ncbi.nlm.nih.gov/191297/

80. Heavy metal pollution and potential health risks of commercially available Chinese herbal medicines.

Wang Z, Wang H, Wang H, Li Q, Li Y.Sci Total Environ. 2019 Feb 25;653:748-757. doi: 10.1016/j.scitotenv.2018.10.388. Epub 2018 Oct 30.PMID: 30759600

URL: https://pubmed.ncbi.nlm.nih.gov/30759600/

81. Chinese proprietary medicine in Singapore: regulatory control of toxic heavy metals and undeclared drugs.

Koh HL, Woo SO.Drug Saf. 2000 Nov;23(5):351-62. doi: 10.2165/00002018-200023050-00001.PMID: 11085343

URL: https://pubmed.ncbi.nlm.nih.gov/11085343/

82. Studies on metals and pesticide content in some Ayurvedic formulations containing Bacopa monnieri L.

Mishra A, Mishra AK, Tiwari OP, Jha S.J Integr Med. 2016 Jan;14(1):44-50. doi: 10.1016/S2095-4964(16)60241-8.PMID: 26778228

URL: https://pubmed.ncbi.nlm.nih.gov/26778228/

83. The analysis of heavy metals in Chinese herbal medicine by flow injection-mercury hydride system and graphite furnace atomic absorption spectrometry.

Yuan X, Koh HL, Chui WK.Phytochem Anal. 2009 Jul-Aug;20(4):293-7. doi: 10.1002/pca.1126.PMID: 19402186

URL: https://pubmed.ncbi.nlm.nih.gov/19402186/

84. Study of the content of heavy metals related to environmental load in urban areas in Slovakia.

Kozak M, Kralova E, Sviatko P, Bilek J, Bugarsky A.Bratisl Lek Listy. 2002;103(7-8):231-7.PMID: 12518994

URL: https://pubmed.ncbi.nlm.nih.gov/12518994/

85. [What do we know about occupational metal poisoning?].

Grandjean P.Ugeskr Laeger. 1983 Sep 26;145(39):3026-9.PMID: 6649119 Danish. No abstract available.

URL: https://pubmed.ncbi.nlm.nih.gov/6649119/

86. Monitoring of mercury, arsenic, and lead in traditional Asian herbal preparations on the Dutch market and estimation of associated risks.

Martena MJ, Van Der Wielen JC, Rietjens IM, Klerx WN, De Groot HN, Konings EJ.Food Addit Contam Part A Chem Anal Control Expo Risk Assess. 2010 Feb;27(2):190-205. doi: 10.1080/02652030903207235.PMID: 19890755

URL: https://pubmed.ncbi.nlm.nih.gov/19890755/

87. Herbal medicine induced Stevens-Johnson syndrome: a case report.

Chowdhury AD, Oda M, Markus AF, Kirita T, Choudhury CR.Int J Paediatr Dent. 2004 May;14(3):204-7. doi: 10.1111/j.1365-263X.2004.00515.x.PMID: 15139956

URL: https://pubmed.ncbi.nlm.nih.gov/15139956/

88. [Study on the baseline contents and reference maximum limit standard of heavy metals and harmful element of 23 Chinese herbs in Northern China].

Li XW, Gao JQ, Zhao JL, Chen JM.Wei Sheng Yan Jiu. 2006 Jul;35(4):459-63, 467.PMID: 16986524 Chinese.

URL: https://pubmed.ncbi.nlm.nih.gov/16986524/

89. [Chronic lead poisoning caused by Ayurvedic health pills].

Linke S.Dtsch Med Wochenschr. 2004 Apr 16;129(16):910; author reply 910. doi: 10.1055/s-2004-823057.PMID: 15083415 German. No abstract available.

URL: https://pubmed.ncbi.nlm.nih.gov/15083415/

90. Occult lead poisoning from Ayurvedic medicine produced, prescribed and purchased in India.

Wijeratne NG, Doery JC, Graudins A.Med J Aust. 2011 Feb 21;194(4):205-6.PMID: 21401464 No abstract available.
URL: https://pubmed.ncbi.nlm.nih.gov/21401464/

91. Analysis and Regulation of Traditional Indian Medicines (TIM).

Pundarikakshudu K, Kanaki NS.J AOAC Int. 2019 Jul 1;102(4):977-978. doi: 10.5740/jaoacint.18-0376. Epub 2018 Dec 17.PMID: 30558694 **Free article.** No abstract available.
URL: https://pubmed.ncbi.nlm.nih.gov/30558694/

92. Therapeutic potentials of metals in ancient India: A review through Charaka Samhita.

Galib, Barve M, Mashru M, Jagtap C, Patgiri BJ, Prajapati PK.J Ayurveda Integr Med. 2011 Apr;2(2):55-63. doi: 10.4103/0975-9476.82523.PMID: 21760689 **Free PMC article.**
URL: https://pubmed.ncbi.nlm.nih.gov/21760689/

93. Ayurvedic lead poisoning: an under-recognized, international problem.

Kales SN, Saper RB.Indian J Med Sci. 2009 Sep;63(9):379-81. doi: 10.4103/0019-5359.56108.PMID: 19805916 No abstract available.
URL: https://pubmed.ncbi.nlm.nih.gov/19805916/

94. Membranous Nephropathy Associated With Indigenous Indian Medications Containing Heavy Metals.

Kumar MN, Priyamvada PS, Chellappan A, Sunooj KV, Srinivas BH, Nachiappa Ganesh R, Sampath E, Parameswaran S.Kidney Int Rep. 2020 Jun 29;5(9):1510-1514. doi: 10.1016/j.ekir.2020.06.015. eCollection 2020 Sep.PMID: 32954075 **Free PMC article.** No abstract available.
URL: https://pubmed.ncbi.nlm.nih.gov/32954075/

95. Toxicological risks of herbal remedies.

[No authors listed]Paediatr Child Health. 1999 Nov;4(8):536-8. doi: 10.1093/pch/4.8.536.PMID: 20213001 **Free PMC article.** No abstract available.
URL: https://pubmed.ncbi.nlm.nih.gov/20213001/

96. Traditional cauterisation in an infant.

Lowe T, Jilani N, Al Ansari K, Powell C.Arch Dis Child. 2020 Oct;105(10):998. doi: 10.1136/archdischild-2019-317266. Epub 2019 Jun 13.PMID: 31196910 No abstract available.
URL: https://pubmed.ncbi.nlm.nih.gov/31196910/

Health Impacts of Lead Poisoning

A preliminary listing of the health effects & symptoms of lead poisoning

by Vance Vella, Elizabeth O'Brien, Elisa Idris, Erik Wibowo, Dr Hugh Xin Xi Zhu and others - a work in progress by The LEAD Group Inc, Australia

Updated by Emily Choong (Actuarial Intern) 11/04/18 and Elizabeth O'Brien (Lead Scientist) – 27/09/2020

The following list of the symptoms and effects of lead poisoning has been compiled to raise awareness that more blood lead assessments must be done in time for further poisoning to be prevented. After each symptom or effect, the numbers indicate the publications which refer to that effect. So far, only 64 publications have been examined of the thousands published. More will be reviewed and this list updated as time permits.

However, remember that <u>most</u> people who are lead poisoned present with no symptoms at all.

Children

Nervous system

- Encephalopathy [brain disease] (1,2,3,4,20,35)
- Acute encephalopathy (11)
- Alters function of developing brain (16)
- Alters electroencephalogram [EEG] (16)
- Convulsions (1, 2, 3, 4)
- Cerebral Palsy (1)
- Neurotransmitter release disrupted (11)

Peripheral nervous system

- Peripheral nerve disturbances [reduced touch sensitivity] (2, 3, 4, 5, 6,18)
- Slowed nerve conduction velocity [decreased reaction times] (2,14,18,35,39,58)
- Foot/ hand drop (1,3)
- Proprioreceptive pathways involved in balance altered (2)
- Dizziness (1,4,38)

Growth & development

- Delayed neurodevelopment [e.g. in sitting up, walking, talking] (2,58)
- Stature and growth rate reduction (1,2,3,18,35,39)
- Impaired pituitary-thyroid endocrine system (18,21)
- Osteoporosis in later years (43)
- Weight loss (58. 60)
- Delayed Puberty (60)
- Reduced postnatal growth (60)

Cognitive development

- I.Q. levels decrease (1,2,3,4,5,6,15,24,35,36,39,41,58, 60)

- Cognitive function deficits (2,26,33)
- Verbal function / linguistic deficits (2,14,15)
- Learning difficulties (11,15,35)
- Decreased educational performance (35, 60)
- Decreased reading, maths, non-verbal reasoning ability & short term memory, even at blood lead levels less than 10ug/dL (41)
- Autism (7) in genetically predisposed individuals with metallothionein dysfunction (42)

Behaviour

- Aggression, violence, hostility, anti-social or delinquent behaviour (8,26, 60)
- Attention problems; distractibility, restlessness (8,12,15,21,38,58, 60)
- Externalising and internalising behaviours (8)
- Hyperactive behaviours, difficult to manage (1,2,8)
- Inappropriate / uncontrolled behaviours similar to ADD behaviours, increased frequency (2,11)
- Irritability (1,38)
- Lethargy (1)
- Increased school absenteeism (35)

Hearing

- Hearing impairment; auditory sensitivity decreased (2,3,5,10,14,18,21,26,32,35,39,58, 60)
- Auditory evoked response patterns altered (2)
- Auditory processing altered (2,10)

Sight

- Retinal degeneration (6,10)
- Depressed sensitivity of rod photoreceptors (10)
- Perceptual function deficits (2,21)
- Visio-spatial skills deficit [eg difficulty doing jigsaws] (15)
- Cataract (63)

Movement and muscular

- Visual-motor skills deficits [hand-eye coordination] (2,3,15,26)
- Fine motor dysfunction (1, 2, 3)
- Motor function deficits (2)
- Impaired muscular strength and endurance (26)
- Paralysis (3)
- Somatic complaints [aches and pains] (8,38)

Digestive system

- Impaired Vitamin D metabolism [affecting bone remodelling, mineral absorption and calcium uptake] (2,3,6,18,24,35,38,39,58)
- Colic (3,25,35)
- Loss of appetite (1,2)
- Vomiting (1,4)
- Constipation, diarrhoea, anorexia (38,58)
- Abdominal cramps (39,58)

Renal (kidneys), blood and circulation

- Renal disease – acute nephropathy (14,21,35,38,58)
- Queensland nephritis (14)
- Anaemia (1,2,3,4,5,6,35,38,58)

Death (1,2, 3, 4,19,35,46,58)

Perinatal Development and Reproductive Health Effects

Foetal

- Preimplantation loss (3)
- Miscarriage, still birth, neonatal death (2,3,4,5,18,20,24,31,47)
- Reduced gestational age, preterm birth (1,2,3,5,18,24,62)
- Reduced birth weight (1,2,3,4,5,6,18,19, 60,62)
- Minor congenital / chromosomal anomalies (2,3,4,18,31)
- Reproductive abnormalities; disorders (5,13,38)
- Decreased placental functioning (19)
- Lead passed via placenta to foetus from mother (39,58)
- Reduced foetal growth (60,62)

Maternal

- Pre-eclampsia (64)
- Increased risk of maternal death (due to preeclampsia) (64)

Adults

- Altered testicular functioning (24)
- Hypospermia [low sperm count] (3,5,19,47, 60)
- Asthenospermia [sperm weakness] (3,5,20, 60)
- Teratospermia [sperm abnormalities] (3,5,31)
- Erectile dysfunction, impotence (3,40)
- Decreased serum testosterone (3)
- Lead presence in seminal fluid (31)
- Pituitary effects (31)
- Sterility, infertility (5,31,35,39,58)
- Effects on ovaries (19)
- Decreased libido / sex drive (2,21,31)
- Impotence (31)
- Delayed conception time (60)

Adults

Kidneys

- Renal damage (2,3,5,13,14,21,23,24,28,30,34,39,58)
- Chronic lead nephropathy [kidney disease] (2,3,14,21,22,24,38,58, 60)
- Death from nephritis [kidney inflammation] (29,30)
- Fanconi Syndrome (14)
- Gout (2,3,14)
- Renal hypertension (17)
- Decrease in glomerular filtration rate and Increase in creatinine concentration (23, 60)

Nervous system

- Encephalopathy [brain disease] (2,4,20,24,25,34)
- Cerebrovascular diseases, stroke, cerebral haemorrhage (2,27,28,29,30)
- Psychomotor impairment (13,34)
- Peripheral nervous system (13,24,40,47)
- Peripheral Arterial Disease [PAD](53,54)
- Slowed nerve conduction velocity [slowed reaction time] (2,34,58)
- Tremor (25,26,38,40,55, 60)
- Paresthesia, paralysis (25)

Cardiovascular and circulation

- Hypertension, elevated blood pressure (2,14,17,22,35,38,40,58, 60)
- Increased systolic blood pressure in men (35)
- Cardio-toxic effects (14)
- Increased risk of cardiovascular disease (17, 61)
- Coronary artery disease (2)
- Anaemia; falling haemoglobin levels (2,3,5,13,24,35,38,39,47,58)
- Platelet dysfunction (2)
- Increased erythrocyte [red blood cell] protoporphyrin (35)
- Increased ALA in urine (34)
- Increased protoporphyrin in urine (34)
- Increased risk of early death from heart attack or stroke (46,61)
- Left-ventricular hypertrophy (61)
- Peripheral arterial disease (61)
- Electrocardiographic abnormalities (61)
- Promotes development of atherosclerosis (plaque build-up in arteries) and thrombosis (formation of blood clots) (61)
- Ischaemic heart disease (61)

Intellectual and mental

- Depression (2,13,38)
- Anxiety (38)
- Personality changes (34)
- Death from violence, suicide, accidents (29)
- Impaired concentration (19,25,34,38)
- Deficits in short term memory (2,13,19,34,38)
- Cognitive function deficit (58)
- Oxidative stress (61)

Behaviour

- Fatigue, muscular exhaustion (2,19,25,34,38, 47)
- Sleep disturbance, insomnia (19)
- Irritability, agitation, restlessness, aggression (2,13,24,34,19, 47,58)

Sensory

- Abnormalities in visuomotor coordination (2)
- Abnormalities in fine motor control (2)

- Deficits in visual acuity (2)
- Hearing loss (18,35,39,47,58)
- Somatosensory dysfunction [eg deficits in detection of vibration, changes in temperature] (2,23)

Gastrointestinal / Digestive

- Effects on gastrointestinal tract (24)
- Loss of appetite (19,40)
- Nausea (19)
- Constipation, diarrhoea (25,38)
- Abdominal pain, cramps (25,34,40,47)
- Weight loss, anorexia (25,38)

Bone, muscle and joint

- Bone marrow alterations (21)
- Myalgia [muscle pain] (25,38,40,58)
- Pain in buttocks and cramps in the legs as early stages of peripheral arterial diseases [PAD](53,54)
- Muscular weakness (34,38,39,40,47)
- Arthralgia [joint pain] (25,38,40,47)
- Bone lead mobilisation during menopause leads to decreased neurocognitive performance and increased systolic blood pressure in post-menopausal women (44)
- Wrist drop [the inability to hold the hand extended] (47)
- Long term effect: linked to osteoporosis which has symptoms of decline in bone density and increase risk in fractures, also inhibit normal fracture healing (48,49,50,51,52)

Other

- Headaches (2,19,21,40, 47)
- Decreased longevity (35,39)
- Adrenal dysfunction (38)
- Teeth with blue black-lines near gum base (38,40)
- Pallor (40)
- Cell damage (at blood lead level between 20 to 30 μg/dL for men and between 10 to 20 μg/dL for women) (39)
- Probable human carcinogen (56,57)

Death (2,4,19,39,46,61)

- Increased risk of early death from cancer and all other causes (46)

Effects of lead from animal studies

- Impaired attention, learning and short-term memory in primates (12)
- Behavioural impairment; inflexibility in behavioural change in primates (12)
- Elevated blood pressure at moderate levels (17)
- Impaired immune system in new-borns of rats fed lead [greater susceptibility to asthma] (37,45)
- Increased incidence of tumors (cancer) in rats born to mothers fed lead (45)
- Altered response to stimulant drugs; attenuation of drug induced hyperactivity in rats (2)
- Teratogenic effect causing birth deformities (4)

- Low bone density in lab animals such as mice and fractures due to lead-induced osteoporosis do not heal properly (52)

References

[LID = Library identification number in Global Lead Advice & Support Service (GLASS) Library]

1. Smith, M. A., Grant, L. D. & Sors, A. (1989). **Lead exposure and child development: an international assessment**. Kleeven Academic Publishers. [LID 5279]
2. Silbergeld, E. K. (1992). **Neurological perspective on lead toxicity. In Human Lead Exposure**, ed H. L. Needleman, CRC Press. [LID 756]
3. National Research Council (US). (1993). **Measuring lead exposure in infants children and other sensitive populations**. National Academy Press, Washington DC. [LID 5042]
4. Chemwatch Database. (1996) **Lead Arsenate**. http://www.chemsw.com/ [LID 73]
5. Alperstein, G., Reznik, R. & Duggin, G. (1991). **Lead: Subtle forms and new modes of poisoning**. The Medical Journal of Australia Vol 155 Sept 16. [LID 208]
6. Berry, M., Garrard, J. & Greene, D. (1994). **Reducing Lead Exposure in Australia**. Commonwealth Department of Human Services and Health, Canberra. [LID 1208]
7. Clark, H. R. (1995). **The cure for all diseases**. Pro Motion Publishing, San Diego California. http://drclarkia.com/books/The_Cure_For_All_Diseases.html . [LID 673]
8. Needleman, H. L., Riess, J. A., Tobin, M., Biesecker, G. & Greenhouse, J.B. (1996). **Bone Lead Levels and Delinquent Behavior**. vol 275 No 5 JAMA. February 7. pp 363-369. http://jama.jamanetwork.com/article.aspx?articleid=395592 Abstract. [LID 54]
9. F. Gil, A. Facio, E. Villanueva, M.L. Pérez, R. Tojo, A. Gil, **The association of tooth lead content with dental health factors, The science of the total environment**. Volume 192, Issue 2, 2 December 1996, Pages 183–191. http://www.sciencedirect.com/science/article/pii/S0048969796053132 Abstract.
10. Fox, D. A. (1992). **Visual and Auditory System Alterations following Developmental or Adult Lead Exposure: a critical review**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4820]
11. Goldstein, G. W. (1992). **Developmental neurobiology of lead toxicity**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 1563]
12. Rice, D. C., (1992). **Behavioural Impairment produced by developmental lead exposure: Evidence from primate research**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4822]
13. Matte, T. D., Landrigan P. J. & Baker E. L. (1992). **Occupational Lead Exposure**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4806]
14. Wedeen R. P. (1992). **Lead, the kidneys and hypertension**. In Human Lead Exposure, ed H. L. Needleman, CRC Press
15. Bellinger, D. & Needleman, H. L. (1992). **Neurodevelopmental effects of low-level lead exposure in children**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4824]
16. Burchfile, J. L., Duffy, F. H., Bartels P. H., & Needleman, H. L. (1992). **Low-level lead exposure: Effect on quantitative electroencephalography and correlation with neuropsychologic measures**. In Human Lead Exposure, ed H. L. Needleman, CRC Press
17. Schwartz, J. (1992). **Lead, blood pressure and cardio-vascular disease** In Human Lead Exposure, ed H. L. Needleman, CRC Press
18. Schwartz, J. (1992). **Low level health effects of lead: Growth, developmental and neurological disturbances**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4827]
19. Rutter, M. & Jones, R. (ed) **Lead versus health: Sources and effects of low level lead exposure**. Wiley medical Publications
20. National Academy of Sciences. (1980). **Lead in the Human Environment**. Washington DC.
21. Castellino, N., Castellino, P. & Sannolo, N. (ed). (1995). **Inorganic lead exposure**. Lewis Publishers
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.
23. Rokho Kim, MD, DrPH; Andrea Rotnitzky, PhD; David Sparrow, DSc; Scott T. Weiss, MD, MSc; Carrie Wager, BSc; Howard Hu, MD, ScD . (1996). **A Longitudinal Study of Low level lead exposure and**

impairment of renal function. JAMA Vol 275 No 15 April 1996. p. *1177-1181*. http://jama.jamanetwork.com/article.aspx?articleid=400546 Abstract.
24. Fischbein, A. (1992). **Occupational and environmental lead exposure**. In Environmental and Occupational Medicine, 2nd edn. Ed W.N. Rom. Little, Brown & Co. [LID 5136]
25. Rempel, D. MD. **The Lead-Exposed Worker** California occupational health program JAMA. 1989; 262(4): 532-534. http://jama.jamanetwork.com/article.aspx?articleid=378115 Abstract.
26. Repko, J. (1976). **Behavioural toxicology of inorganic Lead. In Health Effects of Occupational Lead and Arsenic Exposure** - a symposium, ed.B. W. Carnow, US Dept of Health, Education and Welfare Public Health Service Divn of Surveillance Hazard Evaluation and Field Studies, Feb.
27. Fanning, D. (1988). **A mortality study of lead workers 1926 - 1985**. In Archives of Environmental Health, Vol 43 No 3 May/June. pp. 247-251. http://www.ncbi.nlm.nih.gov/pubmed/3382250 Abstract.
28. D Malcolm, H A Barnett. (1982). **A mortality study of lead workers 1925 - 76**. In British Journal of Industrial Medicine 1982; Vol 39. pp. 404-410 http://oem.bmj.com/content/39/4/404.abstract
29. Davies, J. M. (1984). **Long-term mortality study of chromate pigment workers who suffered lead poisoning**. In British Journal of Industrial Medicine, Vol 41. pp. 170-178 http://oem.bmj.com/content/41/2/170.abstract?sid=7a6b24e7-2419-4a15-ab25-5d78f48d25f8
30. McMichael, A. J. & Johnson, H. M. **Long term mortality profile of heavily exposed lead smelter workers**. In Journal of Occupational Health, Vol 24 No 5 May 1982. http://journals.lww.com/joem/Abstract/1982/24050/Long_term_Mortality_Profile_of_Heavily_Exposed.8.aspx
31. Winder, C. (1989). **Reproductive and chromosomal effects of occupational exposure to lead in the male**. In Reproductive Toxicology Review. Vol 7. pp. 221-233. [LID 1479]
32. Schwartz, J. & Otto, D. (1987). **Blood lead, hearing thresholds, and neurobehavioral development in children and youth**. In Archives of Environmental Health Vol 42, No. 21 pp 153-160, 1st May 1987. http://hero.epa.gov/index.cfm?action=reference.details&reference_id=57538 http://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryID=48404
33. Fergusson, D. M., Hurwood, L. J. & Lynskey, M. T. (1997). **Early dentine lead levels and educational outcomes at 18 years**. In Journal of Child Psychology and Psychiatry, Vol 38 No 4. pp. 471-478. http://onlinelibrary.wiley.com/doi/10.1111/j.1469-7610.1997.tb01532.x/abstract;jsessionid=4E242DD9F8439BE0BB0A53981CAEB7B4.d03t02
34. NSW Workcover Authority. **Occupational Medicine Handbook** Ch 5 "Lead" p. 58
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
36. Gatsonis, C. A.. & Needleman, H. L. (1992). **Recent epidemological studies of low-level lead exposure and the IQ of children: a meta-analytic review** In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4828]
37. Day, M. (1998) **Lead in the womb**. New Scientist Magazine. 23 May 1998 p.7
38. Werbach, M. F. (1997). **Foundations of nutritional medicine**. Third Line press, Tarzana California.
39. Agency for Toxic Substances Disease Registrar. (1989). **Toxicological profile of lead**. US ATSDR. http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=96&tid=22
40. Salome, F. & Gulson, B. (1996). **Lead paint management**. Grad School of the Environment, Macquarie University
41. Lanphear, Bruce P; Dietrich, Kim; Auinger, Peggy; Cox, Christopher. (2000) **Cognitive Deficits Associated with Blood Lead Concentrations <10 µg/dL in US Children and Adolescents**, Public Health Reports Nov 2000, Volume 115, 521-529; http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1308622/pdf/pubhealthrep00019-0027.pdf
42. Walsh, William J; Usman, Anju; Tarpey, Jeffrey; and Kelly, Tanika. (2001) **Metallothionein And Autism** Pfeiffer Treatment Center, Health Research Institute, Naperville, Illinois USA. The booklet can be ordered from info@HRIPTC.org or via the website www.hriptc.org for US$20 + postage but is not web-published. October 2001
43. Wentzel, Michael, Democrat & Chronicle, 25/2/02, **UR [University of Rochester] links childhood lead to osteoporosis**: http://www.mindfully.org/Health/Folder%20Settings/2002/Lead-Exposure-Osteoporosis25feb02.htm

44. Silbergeld, Ellen, **Menopause and Lead: Consequences and Determinants of Bone Lead Mobilization**, Women's Environments & Women's Health Conference, Baltimore, Maryland, October 22, 1999.
45. NBC News, **Lead in Pregnancy Linked to Asthma**, July 29 [1998?] re: study by Dr. Rodney R. Dietert, Cornell University in Ithaca, N.Y published in journal Toxicological Sciences. See http://www.cyber-nook.com/water/tbl_cont.html [LID 6728]
46. Lustberg, M; Silbergeld, E, **Blood Lead Levels And Mortality**, in Arch Intern Med 2002 Nov 25;162(21):2443-9, http://archinte.jamanetwork.com/article.aspx?articleid=214370 [LID 6921]
47. Government of Ontario, Canada, Ministry of Labour, Health and Safety, "**Lead on Construction Projects - The Health Effects of Lead**", http://www.labour.gov.on.ca/english/hs/pdf/gl_lead.pdf
48. Escribano, A., M. Revilla, E.R. Hernandez, C. Seco, J. Gonzalez-Riola, L.F. Villa, H. Rico. (1997), **Effect of lead on bone development and bone mass: A morphometric, densitometric, and histomorphometric study in growing rats**. Calcified Tissue International. 60(2): 200-203. http://www.springerlink.com/content/81u4pc2002ecgx54/ http://www.ncbi.nlm.nih.gov/pubmed/9056171
49. Gruber, H.E., H.C. Gonick, F. Khalil-Manesh, T.V. Sanchez, S. Motsinger, M. Meyer, C.F. Sharp. (1997). **Osteopenia induced by long-term, low- and high-level exposure of the adult rat to lead**. Mineral & Electrolyte Metabolism. 23(2): 645-73. http://www.ncbi.nlm.nih.gov/pubmed/9252971; http://cat.inist.fr/?aModele=afficheN&cpsidt=2781185
50. Katrina Smith Korfmacher, PhD, **Long Term Costs of Lead Poisoning. How much can New York save by stopping lead?** Environmental Health Sciences Center, University of Rochester. http://www.sehn.org/tccpdf/lead%20costs%20NY.pdf
51. Professor Brian Gulson, Macquarie University News, **Good News for aging Bones**, No longer online.
52. St. Louis Lead Prevention Coalition - **University of Rochester study links osteoporosis to childhood lead exposure**, http://www.leadprevention.org/web/uploads/childhood_lead_&_osteoporosis.doc
53. AHA Journal News report (2004),"**Safe' levels of lead, cadmium may raise risk of peripheral artery disease**", 08/06/04. http://www.charitywire.com/charity8/05787.html [LID 7385]
54. Ana Navas-Acien, MD, MPH; Elizabeth Selvin, MPH; A. Richey Sharrett, MD, DrPH; Emma Calderon-Aranda, PhD, MD; Ellen Silbergeld, PhD; Eliseo Guallar, MD, DrPH. **Lead, Cadmium, Smoking, and Increased Risk of Peripheral Arterial Disease** (Circulation. 2004;109:3196-3201.) © 2004 American Heart Association, Inc. http://circ.ahajournals.org/content/109/25/3196.full [LID 7392]
55. Louis, ED, EC Jurewicz, LK Applegate, P Factor-Litvak, M Parides, L Andrews, V Slavkovich, JH Graziano, S Carroll and A Todd. (2003). "**Association Between Essential Tremor and Blood Lead Concentration** Environmental Health Perspectives", 3 July 2003 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241711/pdf/ehp0111-001707.pdf [LID 7330]
56. International Agency for Research on Cancer (IARC), **IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 87 (2006) Inorganic and Organic Lead Compounds** http://monographs.iarc.fr/ENG/Monographs/vol87/index.php [LID 7420]
57. National Toxicology Program (of the US department of Health and Human Services) **Report on Carcinogens** Twelfth Edition 2011 http://ntp-server.niehs.nih.gov/ntp/roc/twelfth/roc12.pdf [LID 7352]
58. Dr. Ben Balzer, **Lead Poisoning Slide Show**, 6 September 2000 www.lead.org.au/bblp/bblp.html [LID 4598]
59. Menke, A, Muntner, P, Batuman, V, Silbergeld, EK, and Guallar, E. 2004. **Blood Lead Below 0.48 µmol/L (10 µg/dL) and Mortality Among US Adults.** Circulation - Journal of the American Heart Association 114:1388. http://circ.ahajournals.org/cgi/reprint/CIRCULATIONAHA.106.628321v1 [LID 8599]
60. National Toxicology Program (NTP). **NTP Monograph on Health Effects of Low-Level Lead**. U.S Department of Health and Services 2012 [LID 15884]
61. Lanphear B, Rauch S, Auinger P, Allen R, Hornung R, **Low-level lead exposure and mortality in US adults: a population-based cohort study.** Lancet Public Health 2018 http://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(18)30025-2/fulltext [LID 18948]
62. Felicia A. Rabito, Mehmet Kocak, Derek W. Werthmann, Frances A. Tylavsky, Christopher D. Palmer, Patrick J. Parsons, **Changes in low levels of lead over the course of**

pregnancy and the association with birth outcomes. Reproductive Toxicology Volume 50, December 2014, Pages 138-144, published online 22 Oct 2014, at https://www.sciencedirect.com/science/article/abs/pii/S0890623814002597?via%3Dihub

63. Schaumberg DA, Mendes F, Balaram M, Dana MR, Sparrow D, Hu H. **Accumulated lead exposure and risk of age-related cataract in men.** JAMA. 2004;292(22):2750-2754 - JAMA, December 8, 2004 - Vol 292, No. 22. http://www.rima.org/web/medline_pdf/Jama_2750.pdf
64. Arthur E. Poropat, Mark A. S. Laidlaw, Bruce Lanphear, Andrew Ball, Howard W. Mielke **Blood lead and preeclampsia: A meta-analysis and review of implications.** Environmental Research Volume 160, January 2018, Pages 12-19, at https://doi.org/10.1016/j.envres.2017.09.014

Health Impacts of Lead Poisoning (Chinese)

铅中毒对健康的影响

A preliminary listing of the health effects & symptoms of lead poisoning

初步列出铅中毒对健康的影响和症状

Written in English by Vance Vella, Elizabeth O'Brien, Elisa Idris, Erik Wibowo, Dr Hugh Xin Xi Zhu and others - a work in progress by The LEAD Group Inc, Australia

英语由Vance Vella, Elizabeth O'Brien, Elisa Idris, Erik Wibowo, Hugh Xin Xi Zhu 医生和其他人编写-- 一项进展的工作 由铅小组公司，澳大利亚编写

Updated by Emily Choong (Actuarial Intern) 11/04/18 and Elizabeth O'Brien (Lead Scientist) – 27/09/2020；translated into Chinese by Dr Hugh Xin Xi Zhu 2020

由Emily Choong (Actuarial Intern)澳大利亚实习医生更新于11/04/2018和ElizabethOBrien（铅科学家）-27/09/2020。奥伯良. 由Hugh Xinxi Zhu 医生翻译成中文2020。

以下列出的铅中毒的症状和作用已经被编辑用来提醒人们为了防止进一步的铅中毒，更多的血铅检测必须及时做完。在每个症状或**者作用出**现以后，数字提示涉及该作用的出版物。在几千个已经发表的出版物的至今只有**61个出版物被**检查过。 **更多的将被复**查。 这个列表更新是在时间许可下完成。

然而， 请记住大多数铅中毒的人表现出没有一点症状。

儿童

神经系统：

脑病(1,2,3,4,20,35)

急性脑病(11)

改变发育中的大脑的功能(16)

改变的脑电图表现(16)

惊厥（1，2，3，4）

脑瘫(1)

神经传导递质的释放受阻（11）

周围神经系统

周围神经紊乱【减低的触觉敏感性】（2，3，4，5，6，18）

减慢的神经传导速度【减**慢的**传到时间】（2，14，18，35，39，58）

脚/手下垂（1，3）

涉及平衡的本体感受通路改变（2）

头晕（1，4，38）

生长和发育

延迟的神经发育[**如坐立**， **走步**， 讲话]（2，58）

身材和成长率下降（1，2，3，18，35，39）

脑垂体-**甲状腺内分泌系**统障碍（18，21）

晚年的骨质疏松（43）

体重下降（58，60）

青春期延迟（60）

减少新生儿的生长发育（60）

认知的发育

智商水平下降(1,2,3,4,5,6,15,24,35,36,39,41,58, 60)

认知功能缺失（2，26，33）

口头功能/语言功能缺失（2，14，15）

学习困难（11，15，35）

减低的教育表现（35，60）

减低的阅读， **数学**， **非口**头推理的能力和短期记忆，
甚至出现在在血铅水平小于10ug/dL（41）

自闭症（7），
出现在具有基因遗传倾向的儿童同伴有金属硫蛋白功能障碍症(42)

行为

侵略性，**暴力**，敌意，反社会或犯罪行为。（8，26，60）

注意问题，注意力分散， 烦躁不安。(8,12,15,21,38,58, 60)

外向和内向行为（8）

多动行为，难以管理（1，2，8）

不适当的/无法控制的行为类似注意力缺失功能障碍行为，
增加的发生率（2，11）

易激（1，38）

嗜睡（1）

增加的学校旷课（35）

听力

听力障碍，**听**觉敏感性减低(2,3,5,10,14,18,21,26,32,35,39,58, 60)

听觉诱发反应模式改变（2）

听觉处理改变（2，10）

视力

视网膜变性（6，10）

杆状细胞光感受器敏感性降低（10）

感知功能缺失（2，21）

视-**空**间技能不足[**如拼**图]（15）

运动和肌肉

视-**运**动技能缺失【手-**眼**协调功能】（2，3，15，26）

精细运动障碍（1，2，3）

运动功能缺失（2）

肌肉力量和耐力受损(26)

瘫痪(3)

躯体疼痛【酸痛】(8,38)

消化系统

维生素D**代**谢障碍【影响骨重塑，
矿物质吸收和钙摄取。(2,3,6,18,24,35,38,39,58)

绞痛(3,25,35)

食欲丧失(1,2)

呕吐(1,4)

便秘， 腹泻，厌食(38,58)

腹部痉挛(39,58)

肾的（肾脏）血液和循环

肾脏疾病-急性肾病(14,21,35,38,58)

昆士兰肾炎(14)

贫血(1,2,3,4,5,6,35,38,58)

死亡(1,2, 3, 4,19,35,46,58)

围产期发育和生殖健康的影响

胎儿

植入前损失(3)

流产，死产，新生儿死亡(2,3,4,5,18,20,24,31,47)

胎龄缩小，早产(1,2,3,5,18,24,62)

降低胎儿体重(1,2,3,4,5,6,18,19, 60,62)

轻度先天性/染色体异常（2,3,4,18,31）

生殖异常; 障碍（5,13,38）

胎盘功能降低（19）

铅通过胎盘传递给母亲的胎儿（39,58）

- 减少胎儿生长（60,62）

产妇

•先兆子痫（64

•产妇死亡的风险增加（由于先兆子痫）（64

成人

改变睾丸功能(24)

低精液量【低精子数量】(3,5,19,47, 60)

无精子症【精子无力】(3,5,20, 60)

畸胎精症[精子异常](3,5,31)

勃起功能障碍，阳痿(3,40)

血清睾酮降低(3)

精液中含有铅的存在(31)

对垂体的影响(31)

绝育， 不育(5,31,35,39,58)

对卵巢的影响(19)

性欲减退/性行为减少(2,21,31)

阳痿(31)

延迟受孕时间(60)

成人

肾脏

肾脏损伤(2,3,5,13,14,21,23,24,28,30,34,39,58)

慢性铅性肾病[肾脏病](2,3,14,21,22,24,38,58, 60)

死于肾小球肾炎[肾脏炎症]（29，30）

Fanconi综合征（14）

痛风（2，3，14）

肾性高血压（17）

减低的肾小球滤过率和增加的肌酐血浓度（23，60）

神经系统

脑病【脑的疾病】(2,4,20,24,25,34)

脑血管病， **中**风， 脑出血（2,27,28,29,30)

精神运动性障碍（13,34）

周围神经系统（13,24,40,47）

周围动脉疾病[PAD]（53,54）

神经传导速度减慢[**反**应时间减慢]（2,34,58）

震颤（25,26,38,40,55,60）

感觉异常，瘫痪（25）

心脏血管和血液循环

•**高血**压，血压升高（2,14,17,22,35,38,40,58,60）

•**男性收**缩压增加（35）

•**心**脏毒性效应（14）

•**心血管疾病的**风险增加（17,61）

•冠状动脉疾病（2）

•贫血; 血红蛋白浓度下降（2,3,5,13,24,35,38,39,47,58）

•血小板功能障碍（2）

•增加红细胞[红细胞]原卟啉（35）

•尿中ALA增加（34）

•尿中原卟啉增加（34）

•心脏病发作或中风早期死亡的风险增加（46,61）

•左心室肥大（61）

•外周动脉疾病（61）

•心电图异常（61）

•促进动脉粥样硬化（动脉斑块积聚）和血栓形成（形成血凝块）(61)

•缺血性心脏病（61）

智力和精神

•抑郁症（2,13,38）

•焦虑（38）

•个性改变（34）

•死于暴力，自杀，事故（29）

•注意力集中障碍（19,25,34,38）

•短期记忆力缺失（2,13,19,34,38）

•认知功能缺陷（58）

•氧化应激（61）

行为

•疲劳，肌肉疲劳（2,19,25,34,38,47）

•睡眠障碍，失眠（19）

•烦躁不安，激动，不安，侵略性（2,13,24,34,19,47,58）

感觉

•视觉运动协调异常（2）

•精细运动控制异常（2）

•视力不足（2）

•听力损失（18,35,39,47,58）

•躯体感觉能障碍[例如检测振动，温度变化的缺陷]（2,23）

胃肠道/消化道

•对胃肠道的影响（24）

•食欲不振（19,40）

•恶心（19）

•便秘，腹泻（25,38）

•腹痛，痉挛（25,34,40,47）

•体重减轻，厌食（25,38）

骨骼，肌肉和关节

•骨髓改建（21）

•肌痛[肌肉疼痛]（25,38,40,58）

•臀部疼痛和腿部抽筋作为外周动脉疾病[PAD]的早期阶段的症状(53,54)

•肌无力（34,38,39,40,47）

•关节痛[关节疼痛]（25,38,40,47）

•妇女更年期期间的骨铅动员导致神经认知表现下降，和收缩压增高在经绝期的妇女(44)

•手腕下垂[无法握住手伸展]（47）

•长期效应：与骨质疏松症相关，骨密度下降症状和骨折风险增加，也会抑制正常骨折愈合（48,49,50,51,52）

其他

•头痛（2,19,21,40,47）

•减少寿命（35,39）

•肾上腺功能障碍（38）

•牙龈附近有蓝黑线（38,40）

•苍白（40）

•细胞损伤（男性血铅水平介于20至30µg/ dL之间，女性介于10至20µg/ dL之间）（39）

•可能的人类致癌物（56,57）

死亡(2,4,19,39,46,61)

增加早期死亡于癌症和所有其他疾病的风险(46)

从动物研究中得到的铅的影响

•灵长类动物的注意力，学习和短期记忆受损（12）

•行为障碍; 灵长类动物行为改变的不灵活性（12）

•中等水平的血压升高（17）

•喂食铅的大鼠新生儿的免疫系统受损[对哮喘的易感性更大]（37,45）

•喂养铅的母亲所生的大鼠肿瘤（癌症）的发病率增加（45）

•改变对兴奋剂药物的反应; 药物诱导的大鼠高活动度减弱（2）

•致畸效应引起的出生畸形（4）

•低骨密度在实验室动物如小鼠，
和铅诱导的骨质疏松症导致的骨折不能适当的愈合[52]

References

[LID = Library identification number in Global Lead Advice & Support Service (GLASS) Library]

1. Smith, M. A., Grant, L. D. & Sors, A. (1989). **Lead exposure and child development: an international assessment**. Kleeven Academic Publishers. [LID 5279]
2. Silbergeld, E. K. (1992). **Neurological perspective on lead toxicity. In Human Lead Exposure**, ed H. L. Needleman, CRC Press. [LID 756]
3. National Research Council (US). (1993). **Measuring lead exposure in infants children and other sensitive populations**. National Academy Press, Washington DC. [LID 5042]
4. Chemwatch Database. (1996) **Lead Arsenate**. http://www.chemsw.com/ [LID 73]
5. Alperstein, G., Reznik, R. & Duggin, G. (1991). **Lead: Subtle forms and new modes of poisoning**. The Medical Journal of Australia Vol 155 Sept 16. [LID 208]
6. Berry, M., Garrard, J. & Greene, D. (1994). **Reducing Lead Exposure in Australia**. Commonwealth Department of Human Services and Health, Canberra. [LID 1208]
7. Clark, H. R. (1995). **The cure for all diseases**. Pro Motion Publishing, San Diego California. http://drclarkia.com/books/The_Cure_For_All_Diseases.html . [LID 673]
8. Needleman, H. L., Riess, J. A., Tobin, M., Biesecker, G. & Greenhouse, J.B. (1996). **Bone Lead Levels and Delinquent Behavior**. vol 275 No 5 JAMA. February 7. pp 363-369. http://jama.jamanetwork.com/article.aspx?articleid=395592 Abstract. [LID 54]
9. F. Gil, A. Facio, E. Villanueva, M.L. Pérez, R. Tojo, A. Gil, **The association of tooth lead content with dental health factors, The science of the total environment**. Volume 192, Issue 2, 2 December 1996, Pages 183–191. http://www.sciencedirect.com/science/article/pii/S0048969796053132 Abstract.
10. Fox, D. A. (1992). **Visual and Auditory System Alterations following Developmental or Adult Lead Exposure: a critical review**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4820]
11. Goldstein, G. W. (1992). **Developmental neurobiology of lead toxicity**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 1563]

12. Rice, D. C., (1992). **Behavioural Impairment produced by developmental lead exposure: Evidence from primate research**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4822]
13. Matte, T. D., Landrigan P. J. & Baker E. L. (1992). **Occupational Lead Exposure**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4806]
14. Wedeen R. P. (1992). **Lead, the kidneys and hypertension**. In Human Lead Exposure, ed H. L. Needleman, CRC Press
15. Bellinger, D. & Needleman, H. L. (1992). **Neurodevelopmental effects of low-level lead exposure in children**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4824]
16. Burchfile, J. L., Duffy, F. H., Bartels P. H., & Needleman, H. L. (1992). **Low-level lead exposure: Effect on quantitative electroencephalography and correlation with neuropsychologic measures**. In Human Lead Exposure, ed H. L. Needleman, CRC Press
17. Schwartz, J. (1992). **Lead, blood pressure and cardio-vascular disease** In Human Lead Exposure, ed H. L. Needleman, CRC Press
18. Schwartz, J. (1992). **Low level health effects of lead: Growth, developmental and neurological disturbances**. In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4827]
19. Rutter, M. & Jones, R. (ed) **Lead versus health: Sources and effects of low level lead exposure**. Wiley medical Publications
20. National Academy of Sciences. (1980). **Lead in the Human Environment**. Washington DC.
21. Castellino, N., Castellino, P. & Sannolo, N. (ed). (1995). **Inorganic lead exposure**. Lewis Publishers
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.
23. Rokho Kim, MD, DrPH; Andrea Rotnitzky, PhD; David Sparrow, DSc; Scott T. Weiss, MD, MSc; Carrie Wager, BSc; Howard Hu, MD, ScD . (1996). **A Longitudinal Study of Low level lead exposure and impairment of renal function**. JAMA Vol 275 No 15 April 1996. p. *1177-1181*. http://jama.jamanetwork.com/article.aspx?articleid=400546 Abstract.
24. Fischbein, A. (1992). **Occupational and environmental lead exposure**. In Environmental and Occupational Medicine, 2nd edn. Ed W.N. Rom. Little, Brown & Co. [LID 5136]
25. Rempel, D. MD. **The Lead-Exposed Worker** California occupational health program JAMA. 1989; 262(4): 532-534. http://jama.jamanetwork.com/article.aspx?articleid=378115 Abstract.
26. Repko, J. (1976). **Behavioural toxicology of inorganic Lead. In Health Effects of Occupational Lead and Arsenic Exposure** - a symposium, ed.B. W. Carnow, US Dept of Health, Education and Welfare Public Health Service Divn of Surveillance Hazard Evaluation and Field Studies, Feb.
27. Fanning, D. (1988). **A mortality study of lead workers 1926 - 1985**. In Archives of Environmental Health, Vol 43 No 3 May/June. pp. 247-251. http://www.ncbi.nlm.nih.gov/pubmed/3382250 Abstract.
28. D Malcolm, H A Barnett. (1982). **A mortality study of lead workers 1925 - 76**. In British Journal of Industrial Medicine 1982; Vol 39. pp. 404-410 http://oem.bmj.com/content/39/4/404.abstract
29. Davies, J. M. (1984). **Long-term mortality study of chromate pigment workers who suffered lead poisoning**. In British Journal of Industrial Medicine, Vol 41. pp. 170-178 http://oem.bmj.com/content/41/2/170.abstract?sid=7a6b24e7-2419-4a15-ab25-5d78f48d25f8
30. McMichael, A. J. & Johnson, H. M. **Long term mortality profile of heavily exposed lead smelter workers**. In Journal of Occupational Health, Vol 24 No 5 May 1982.

http://journals.lww.com/joem/Abstract/1982/24050/Long_term_Mortality_Profile_of_Heavily_Exposed.8.aspx
31. Winder, C. (1989). **Reproductive and chromosomal effects of occupational exposure to lead in the male**. In Reproductive Toxicology Review. Vol 7. pp. 221-233. [LID 1479]
32. Schwartz, J. & Otto, D. (1987). **Blood lead, hearing thresholds, and neurobehavioral development in children and youth**. In Archives of Environmental Health Vol 42, No. 21 pp 153-160, 1st May 1987. http://hero.epa.gov/index.cfm?action=reference.details&reference_id=57538 http://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryID=48404
33. Fergusson, D. M., Hurwood, L. J. & Lynskey, M. T. (1997). **Early dentine lead levels and educational outcomes at 18 years**. In Journal of Child Psychology and Psychiatry, Vol 38 No 4. pp. 471-478. http://onlinelibrary.wiley.com/doi/10.1111/j.1469-7610.1997.tb01532.x/abstract;jsessionid=4E242DD9F8439BE0BB0A53981CAEB7B4.d03t02
34. NSW Workcover Authority. **Occupational Medicine Handbook** Ch 5 "Lead" p. 58
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
36. Gatsonis, C. A.. & Needleman, H. L. (1992). **Recent epidemological studies of low-level lead exposure and the IQ of children: a meta-analytic review** In Human Lead Exposure, ed H. L. Needleman, CRC Press. [LID 4828]
37. Day, M. (1998) **Lead in the womb**. New Scientist Magazine. 23 May 1998 p.7
38. Werbach, M. F. (1997). **Foundations of nutritional medicine**. Third Line press, Tarzana California.
39. Agency for Toxic Substances Disease Registrar. (1989). **Toxicological profile of lead**. US ATSDR. http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=96&tid=22
40. Salome, F. & Gulson, B. (1996). **Lead paint management**. Grad School of the Environment, Macquarie University
41. Lanphear, Bruce P; Dietrich, Kim; Auinger, Peggy; Cox, Christopher. (2000) **Cognitive Deficits Associated with Blood Lead Concentrations <10 µg/dL in US Children and Adolescents**, Public Health Reports Nov 2000, Volume 115, 521-529; http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1308622/pdf/pubhealthrep00019-0027.pdf
42. Walsh, William J; Usman, Anju; Tarpey, Jeffrey; and Kelly, Tanika. (2001) **Metallothionein And Autism** Pfeiffer Treatment Center, Health Research Institute, Naperville, Illinois USA. The booklet can be ordered from info@HRIPTC.org or via the website www.hriptc.org for US$20 + postage but is not web-published. October 2001
43. Wentzel, Michael, Democrat & Chronicle, 25/2/02, **UR [University of Rochester] links childhood lead to osteoporosis**: http://www.mindfully.org/Health/Folder%20Settings/2002/Lead-Exposure-Osteoporosis25feb02.htm
44. Silbergeld, Ellen, **Menopause and Lead: Consequences and Determinants of Bone Lead Mobilization**, Women's Environments & Women's Health Conference, Baltimore, Maryland, October 22, 1999.
45. NBC News, **Lead in Pregnancy Linked to Asthma**, July 29 [1998?] re: study by Dr. Rodney R. Dietert, Cornell University in Ithaca, N.Y published in journal Toxicological Sciences. See http://www.cyber-nook.com/water/tbl_cont.html [LID 6728]
46. Lustberg, M; Silbergeld, E, **Blood Lead Levels And Mortality**, in Arch Intern Med 2002 Nov 25;162(21):2443-9, http://archinte.jamanetwork.com/article.aspx?articleid=214370 [LID 6921]

47. Government of Ontario, Canada, Ministry of Labour, Health and Safety, "**Lead on Construction Projects - The Health Effects of Lead**", http://www.labour.gov.on.ca/english/hs/pdf/gl_lead.pdf
48. Escribano, A., M. Revilla, E.R. Hernandez, C. Seco, J. Gonzalez-Riola, L.F. Villa, H. Rico. (1997), **Effect of lead on bone development and bone mass: A morphometric, densitometric, and histomorphometric study in growing rats**. Calcified Tissue International. 60(2): 200-203. http://www.springerlink.com/content/81u4pc2002ecgx54/ http://www.ncbi.nlm.nih.gov/pubmed/9056171
49. Gruber, H.E., H.C. Gonick, F. Khalil-Manesh, T.V. Sanchez, S. Motsinger, M. Meyer, C.F. Sharp. (1997). **Osteopenia induced by long-term, low- and high-level exposure of the adult rat to lead**. Mineral & Electrolyte Metabolism. 23(2): 645-73. http://www.ncbi.nlm.nih.gov/pubmed/9252971; http://cat.inist.fr/?aModele=afficheN&cpsidt=2781185
50. Katrina Smith Korfmacher, PhD, **Long Term Costs of Lead Poisoning. How much can New York save by stopping lead?** Environmental Health Sciences Center, University of Rochester. http://www.sehn.org/tccpdf/lead%20costs%20NY.pdf
51. Professor Brian Gulson, Macquarie University News, **Good News for aging Bones**, No longer online.
52. St. Louis Lead Prevention Coalition - **University of Rochester study links osteoporosis to childhood lead exposure**, http://www.leadprevention.org/web/uploads/childhood_lead_&_osteoporosis.doc
53. AHA Journal News report (2004),"**Safe' levels of lead, cadmium may raise risk of peripheral artery disease**", 08/06/04. http://www.charitywire.com/charity8/05787.html [LID 7385]
54. Ana Navas-Acien, MD, MPH; Elizabeth Selvin, MPH; A. Richey Sharrett, MD, DrPH; Emma Calderon-Aranda, PhD, MD; Ellen Silbergeld, PhD; Eliseo Guallar, MD, DrPH. **Lead, Cadmium, Smoking, and Increased Risk of Peripheral Arterial Disease** (Circulation. 2004;109:3196-3201.) © 2004 American Heart Association, Inc. http://circ.ahajournals.org/content/109/25/3196.full [LID 7392]
55. Louis, ED, EC Jurewicz, LK Applegate, P Factor-Litvak, M Parides, L Andrews, V Slavkovich, JH Graziano, S Carroll and A Todd. (2003). "**Association Between Essential Tremor and Blood Lead Concentration** Environmental Health Perspectives", 3 July 2003 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241711/pdf/ehp0111-001707.pdf [LID 7330]
56. International Agency for Research on Cancer (IARC), **IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 87 (2006) Inorganic and Organic Lead Compounds** http://monographs.iarc.fr/ENG/Monographs/vol87/index.php [LID 7420]
57. National Toxicology Program (of the US department of Health and Human Services) **Report on Carcinogens** Twelfth Edition 2011 http://ntp-server.niehs.nih.gov/ntp/roc/twelfth/roc12.pdf [LID 7352]
58. Dr. Ben Balzer, **Lead Poisoning Slide Show**, 6 September 2000 www.lead.org.au/bblp/bblp.html [LID 4598]
59. Menke, A, Muntner, P, Batuman, V, Silbergeld, EK, and Guallar, E. 2004. **Blood Lead Below 0.48 µmol/L (10 µg/dL) and Mortality Among US Adults.** Circulation - Journal of the American Heart Association 114:1388. http://circ.ahajournals.org/cgi/reprint/CIRCULATIONAHA.106.628321v1 [LID 8599]
60. National Toxicology Program (NTP). **NTP Monograph on Health Effects of Low-Level Lead**. U.S Department of Health and Services 2012 [LID 15884]
61. Lanphear B, Rauch S, Auinger P, Allen R, Hornung R, **Low-level lead exposure and mortality in US adults: a population-based cohort study.** Lancet Public Health

2018 http://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(18)30025-2/fulltext [LID 18948]
62. Felicia A. Rabito, Mehmet Kocak, Derek W. Werthmann, Frances A. Tylavsky, Christopher D. Palmer, Patrick J. Parsons, **Changes in low levels of lead over the course of pregnancy and the association with birth outcomes.** Reproductive Toxicology Volume 50, December 2014, Pages 138-144, published online 22 Oct 2014, at https://www.sciencedirect.com/science/article/abs/pii/S0890623814002597?via%3Dihub
63. Schaumberg DA, Mendes F, Balaram M, Dana MR, Sparrow D, Hu H. **Accumulated lead exposure and risk of age-related cataract in men.** JAMA. 2004;292(22):2750-2754 - JAMA, December 8, 2004 - Vol 292, No. 22. http://www.rima.org/web/medline_pdf/Jama_2750.pdf
64. Arthur E. Poropat, Mark A. S. Laidlaw, Bruce Lanphear, Andrew Ball, Howard W. Mielke **Blood lead and preeclampsia: A meta-analysis and review of implications.** Environmental Research Volume 160, January 2018, Pages 12-19, at https://doi.org/10.1016/j.envres.2017.09.014

Health effects of a blood lead level below 10 µg/dL in both adults and children and even below 1 µg/dL in pregnancy

Health effects of a blood lead level below 10 µg/dL in both adults and children and even below 1 µg/dL in pregnancy

Researched, collated and summary statements chosen by Anne Roberts, Elizabeth O'Brien and Robert Taylor, The LEAD Group Inc, Australia, 17th August 2009; last amended 8th September 2020, by JustOne Lead Soldier.

NB µg/dL (often written as ug/dL) = micrograms per decilitre, and µmol/L (or umol/L) = micromoles per litre, are the usual units used for lead in blood results. Also see "Blood lead testing: who to test, when, and how to respond to the result" at https://lead.org.au/fs/fst46.html

Research into the health effects of a blood lead level below 10 µg/dL in adults

1. **"Blood Lead Below 0.48 µmol/L (10 µg/dL) and Mortality Among US Adults"** by Andy Menke, Paul

Muntner, Vecihi Batuman, Ellen K. Silbergeld and Eliseo Guallar, in Circulation - Journal of the American Heart

Association, September 26, 2006 published online Sep 18, 2006; http://circ.ahajournals.org/cgi/content/short/114/13/1388

"Conclusions—The association between blood lead levels and increased all-cause and cardiovascular mortality was observed at substantially lower blood lead levels than previously reported. Despite the marked decrease in blood lead levels over the past 3 decades, environmental lead exposures remain a significant determinant of cardiovascular mortality in the general population, constituting a major public health problem."

2. **" 'Safe' levels of lead may not be that safe after all"** by Melissa Healy, Times Staff Writer, The Los Angeles Times 2/10/06 at http://articles.latimes.com/2006/oct/02/health/he-lead2

RE: the above Menke et al study published in the American Heart Association Journal "Circulation", Sep 18, 2006:

"Researchers used a comprehensive national health survey of American adults to track 13,946 subjects for 12 years and looked at the relationship of blood lead levels and cause of death. They found that compared with adults with very low levels of lead in their blood [less than 1.94 micrograms per

decilitre], those with blood lead levels of 3.6 to 10 micrograms of lead per deciliter of blood were two and half times more likely to die of a heart attack, 89% more likely to die of stroke and 55% more likely to die of cardiovascular disease. The higher the blood lead levels, the greater the risk of death by stroke or heart attack.

"The dangers of lead held steady across all socioeconomic classes and ethnic and racial groups, and between men and women."

3. **"Lead in Blood: 'Safe' Levels Too High? Average Americans Tested Had Level High Enough for Increased**

Heart Disease Death Risk" by Miranda Hitti, Medical Writer, WebMD Medical News, Reviewed By Louise Chang, MD Medical Editor, WebMD Medical News, Sept. 18, 2006 at http://www.webmd.com/news/20060918/lead-in-blood-safe-levels-too-high

"The average blood level of lead found among Americans is high enough to increase the likelihood of heart attack and stroke, according to a new study.

"In fact, people with only a fifth the level of lead in their blood now considered 'high' are more likely to die of heart attack or stroke, the study shows.

"These findings suggest the threshold for 'high' blood levels of lead may not fully take into account lead's heart risks, according to the study.

"The study appears in Circulation's rapid access online edition."

"A 'high' blood level is now defined as more than 10 micrograms of lead per deciliter of blood (10 mcg/dL).

"Most Americans -- 99% -- fall below that threshold, write the researchers, who include Andy Menke, MPH, of Tulane University School of Public Health.

"But an increased likelihood of death from heart attack or stroke has started to be seen in people with blood levels greater than 2 mcg/dL, according to Menke and colleagues."

4. **"Lead, Cadmium, Smoking, and Increased Risk of Peripheral Arterial Disease"** by A Navas-Acien, E Selvin, R Sharrett, E Calderon-Aranda, E Silbergeld, E Guallar in Circulation Issue 109, American Heart Association (AHA) Inc. June 7th 2004. http://circ.ahajournals.org/cgi/content/full/109/25/3196

"This study concluded that blood lead and cadmium, at levels well below current safety standards, were associated with an increased prevalence of peripheral arterial disease in the general US population. Cadmium may partially mediate the effect of smoking on peripheral arterial disease."

5. **"'Safe' levels of lead, cadmium"** by Carole Bullock 'Safe' levels of lead, cadmium AHA Journal News report, 8th June 2004, at www.eurekalert.org/pub_releases/2004-06/aha-lo060304.php

"The general public can be exposed to lead and cadmium through cigarette smoke, in ambient air near industrial and combustion sources, in certain foods and sometimes in drinking water. Peripheral artery disease or PAD affects 8 to 12 million Americans, according to the American Heart Association. It is a condition similar to coronary artery disease and carotid artery disease. In PAD, fatty deposits build up in artery walls and reduce blood circulation, mainly in arteries to the legs and feet. In its early stages a common symptom is cramping or fatigue in the legs and buttocks during activity. Such cramping subsides when the person stands still.

"In a study of 2,125 adults, those with the highest blood concentrations of lead or cadmium were almost three times more likely to develop PAD than those with the lowest levels of the two metals. Yet

the highest levels were well within what is currently considered safe levels, said senior author Eliseo Guallar, M.D., DrPH, an assistant professor of epidemiology at the Johns Hopkins University Bloomberg School of Public Health in Baltimore. "

6. **"Blood Lead Levels and Death from All Causes, Cardiovascular Disease, and Cancer: Results from the NHANES III Mortality Study"** by Susan E. Schober, Lisa B. Mirel, Barry I. Graubard, Debra J. Brody, Katherine M.

Flegal in Environmental Health Perspectives Online 6th July 2006, The National Institute of Environmental Health Sciences, National Institutes of Health, U.S. Department of Health and Human Services, 1st Oct 2006, at www.ncbi.nlm.nih.gov/pmc/articles/PMC1626441/

"CONCLUSION: In a nationally representative sample of the U.S. population, blood lead levels as low as 5–9 μg/dL were associated with an increased risk of death from all causes, cardiovascular disease, and cancer."

7. **"Research Indicates that Low Blood Lead Levels Contribute to Early Death from Cardiovascular Disease and Cancer"** by Courtney Hinton, Intern at the Alliance for Healthy Housing, & Student, University of Maryland, published in Alliance Alert, August 2006, published by the Alliance for Health Housing (AFHH) at www.afhh.org/res/res_alert_archives_aug06.htm#lowbllearlydeath

This is a summary of item 6, above (The 3rd US National Health and Nutrition Examination Survey, NHANES 3)

"Previous surveys, conducted in 1976-1980, indicated a higher risk of death with blood lead levels higher than 20 μg/dL. Blood lead levels have significantly decreased since 1970, however, and the third survey, conducted from 1988-1994, reflect that even low blood lead levels, between 5-9 μg/dL, carry an increased risk of death.

"The current NHANES, with data from 1999-2002, suggests an elevated risk of peripheral arterial disease, hypertension, and renal dysfunction in a population with blood lead levels averaging approximately 2 μg/dL.

"The analysis of the third NHANES study supports other evidence of adverse health consequences related to blood levels that are lower than current levels of concern."

8. **"Association of blood lead concentrations [greater than 8 μg/dL] with mortality in older women: a prospective cohort study"** by Naila Khalil , John W Wilson , Evelyn O Talbott , Lisa A Morrow , Marc C Hochberg , Teresa A Hillier , Susan B Muldoon , Steven R Cummings and Jane A Cauley (2009) at www.ehjournal.net/content/8/1/15

"Methods

Prospective cohort study of 533 women aged 65–87 years enrolled in the Study of Osteoporotic Fractures at two US research centers (Baltimore, MD; Monongahela Valley, PA) from 1986–1988. Blood lead concentrations were determined by atomic absorption spectrometry. Using blood lead concentration categorized as < 8 μg/dL, and ≥ 8 μg/dL, we determined the relative risk of mortality from all cause, and cause-specific mortality, through Cox proportional hazards regression analysis.

"Conclusion

Women with blood lead concentrations of ≥ 8 μg/dL (0.384 μmol/L), experienced increased mortality, in particular from CHD as compared to those with lower blood lead concentrations."

9. **"Association Between Essential Tremor and Blood Lead Concentration"** by ED Louis, EC Jurewicz, LK Applegate, P Factor-Litvak, M Parides, L Andrews, V Slavkovich, JH Graziano, S Carroll, and Todd, at www.ncbi.nlm.nih.gov/pmc/articles/PMC1241711/pdf/ehp0111-001707.pdf

"Essential tremor (ET) is a neurologic disease that is characterized by an action tremor of the hands and/or head. ET is considered to be distinct from age-related enhanced physiologic tremor."

"There was a correlation between the total tremor score and BPb concentration (Spearman's r = 0.14; p = 0.03) in the 243 study subjects."

"BPb concentrations were higher in ET patients than in controls (mean ± SD, 3.3 ± 2.4 and 2.6 ± 1.6 µg/dL, respectively; median, 2.7 and 2.3 µg/dL; p = 0.038)."

"In this case–control study, we found that the BPb concentration was higher in ET patients than in controls. This association between higher BPb concentration and the diagnosis of ET persisted after adjusting for confounding variables. The association was strongest in patients with sporadic ET, that is, those with no family history of tremor, suggesting that lead as a toxicant might be of more relevance in ET patients without a genetic susceptibility for ET."

"Although our data demonstrate an association between ET and higher BPb concentrations, one must be cautious about the interpretation of these data. It is unlikely that a BPb concentration of 3.3 µg/dL alone is sufficient to cause ET."

10. **"Maternal Blood Lead Levels and the Risk of Pregnancy Induced Hypertension. The "EDEN" Cohort Study"** by Chadi Yazbeck, Olivier Thiebaugeorges, Thierry Moreau, Valérie Goua, Ginette Debotte, Josiane Sahuquillo, Anne Forhan, Bernard Foliguet, Guillaume Magnin, Rémy Slama, Marie-Aline Charles, Guy Huel. Environmental

Health Perspectives, online 26 June 2009,

http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info:doi/10.1289/ehp.0800488

Results: pregnancy-induced hypertension (PIH) was diagnosed in 106 subjects (10.9%). Age, parity, weight gain, alcohol, smoking habits and calcium supplementation were comparable between hypertensive and non hypertensive women. Lead levels were significantly higher in PIH cases (2.2 µg/dL [0.11 µmol/L] SD 1.4 µg/dL) than in normotensive patients (1.9 µg/dL [0.09 µmol/L] SD 1.2 µg/dL); p=0.02.

Discussion: We found that the adjusted risk of PIH was associated with maternal blood lead levels in midpregnancy. This risk was doubled in the highest quartile as compared to the lowest quartile of lead distribution… Our findings that lead may have an etiologic role in PIH, even at low levels of environmental exposure, suggest that it may be appropriate for public health organizations to consider lowering the upper limit of "acceptable" blood lead levels in pregnant women, which is currently at 10 µg/dL.

11. **"Blood lead and preeclampsia: A meta-analysis and review of implications"** by Arthur E. Poropat, Mark A. S. Laidlaw, Bruce Lanphear, Andrew Ball, Howard W. Mielke in Environmental Research Volume 160, January 2018, Pages 12-19, at https://doi.org/10.1016/j.envres.2017.09.014

[According to the Mayo Clinic, at https://www.mayoclinic.org/diseases-conditions/preeclampsia/symptoms-causes/syc-20355745 : "***Preeclampsia*** is a pregnancy complication characterized by high blood pressure and signs of damage to another organ system, most often the liver and kidneys."

A 4th Sept 2017 Griffith University media release at
https://lead.org.au/Durack_Lead_poisoning_is_the_top_risk_factor_for_pre-

eclampsia_says_Griffith_study_20171004.pdf - about this Poropat et al (2018) study - states:

Pre-eclampsia is a disease which kills over 75,000 women internationally each year and is responsible for 9% of all fetal deaths.

"We found that the link between high blood lead levels and pre-eclampsia is twice as strong as the risk from diabetes and is as big a risk as chronic high blood pressure," says Dr Poropat.

"There is a clear dose-response relationship between maternal blood lead and pre-eclampsia: doubling the blood lead level results also doubles the risk of pre-eclampsia. Even relatively low levels of lead increase the risk of the condition."]

"Increase of 1 μg/dL in BPb results in a 1.6% increase in likelihood of preeclampsia."

"Odds ratio for BPb and preeclampsia = 9.81 (95% CI = 8.01–12.02)."

" Women with concentrations higher than 5 μg/dL should be actively monitored"

"95% of lead absorbed into the body is stored in human bones in place of calcium. During pregnancy (especially the third trimester) and lactation, as maternal bones release calcium to the mother's blood to support fetal development, maternal bones also release lead, thereby exposing the women and the fetus to an even greater exposure risk (Gulson et al., 2016)."

"studies have shown that lead exposure is associated with gestational hypertension"

"The picture that emerges is that BPb is a major risk factor for preeclampsia"

"calcium supplementation may ameliorate maternal hypertension and preeclampsia by suppressing mobilisation of skeletal lead."

"tests of BPb should be routine when there is suspected environmental or occupational exposure to lead"

"All pregnant women should be encouraged to limit potential exposure to lead contamination, such as by only consuming lead-free water and suppressing household dust."

Research into the health effects of a blood lead level above 1 µg/dL and below 10 µg/dL in children

12. "Cognitive Deficits Associated with Blood Lead Concentrations <10 microg/dL in US Children and Adolescents" by Lanphear BP, Dietrich K, Auinger P, Cox C. Public Health Rep. 2000;115:521–529, www.ncbi.nlm.nih.gov/pmc/articles/PMC1308622/pdf/pubhealthrep00019-0027.pdf

"Results:: For every 1 µg/dL increase in blood lead concentration, there was a 0.7-point decrement in mean arithmetic scores, an approximately 1-point decrement in mean reading scores, a 0.1-point decrement in mean scores on a measure of nonverbal reasoning, and a 0.5-point decrement in mean scores on a measure of shortterm memory. An inverse relationship between blood lead concentration and arithmetic and reading scores was observed for children with blood lead concentrations lower than 5.0 µg/dL.

"Conclusion. Deficits in cognitive and academic skills associated with lead exposure occur at blood lead concentrations lower than 5 µg/dL.

13."Intellectual impairment in children with blood lead concentrations below 10 µg per deciliter" by Canfield RL, Henderson CR Jr, Cory-Slechta DA, Cox C, Jusko TA, Lanphear BP, N Engl J Med. 2003;348:1517–1526. AVAILABLE TO SUBSCRIBERS AND PURCHASERS AT http://content.nejm.org/cgi/content/full/348/16/1517

The findings of this study are startling and counter-intuitive: at lower concentrations of lead in the blood – below 10µg/dL - children tested for IQ at ages three and five, showed greater decline in IQ than those with higher concentrations- over 10 µg/dL.

"The blood lead concentration was inversely and significantly associated with IQ. In the linear model, each increase of 10 µg per deciliter in the lifetime average blood lead concentration was associated with a 4.6-point decrease in IQ (P=0.004), whereas for the subsample of 101 children whose maximal lead concentrations remained below 10 µg per deciliter, the change in IQ associated with a given change in lead concentration was greater. When estimated in a nonlinear model with the full sample, IQ declined by 7.4 points as lifetime average blood lead concentrations increased from 1 to 10 µg per deciliter."

14. "Even Low Lead Levels Pose Perils for Children", by Jane E Brody, New York Times, 5th August 2003, www.nytimes.com/2003/08/05/health/nutrition/05BROD.html This is an interview about the Canfield et al study above.

Since 1923 it has been known that lead damages the brain. Progressively, it has been shown that lower blood lead levels than first thought, causes significant damage to the developing brain.

"Repeatedly over 30 years, follow-up studies of lead-exposed children have demonstrated I.Q. reductions and other memory and learning disturbances associated with successively lower blood lead levels…

"Dr. Needleman and Dr. David C. Bellinger of Boston Children's Hospital and the Harvard Medical School studied 249 mostly middle-class children in the Boston metropolitan region, measuring blood levels levels seven times from birth to age 10.

"Prompted by the Canfield study, they reanalyzed findings among the children whose blood levels never rose above 10 micrograms and found the same effects — proportionately greater harm at the lowest levels.

"Dr. Canfield said in an interview: "Our research suggests that nontrivial damage is occurring below the C.D.C. level of concern. Both the C.D.C. and the World Health Organization need to reassess their policies in light of this research."

Brody also refers to studies linking early childhood exposure to lead and subsequent delinquent behaviour.

15. **"Bellinger DC, Needleman HL. Intellectual impairment and blood lead levels".** N Engl J Med. 2003; 349:502. www.nejm.org/doi/full/10.1056/NEJM200307313490515

"In the light of the report on intellectual impairment and blood lead levels by Canfield et al... we reanalyzed data from our prospective cohort study, focusing on 48 children whose blood lead levels never exceeded 10 µg per deciliter at birth or at 6, 12, 18, 24, 57, or 120 months. The IQ at 120 months was inversely related to the lead level at 24 months with adjustment for covariates ...[and] analyses suggested that the inverse association persisted at blood lead levels below 5 µg per deciliter."

16. **"Blood Lead Concentrations < 10 µg/dL and Child Intelligence at 6 Years of Age"** by Todd A. Jusko, Charles R. Henderson Jr., Bruce P. Lanphear, Deborah A. Cory-Slechta, Patrick J. Parsons, and Richard L. Canfield, Environmental Health Perspectives - VOLUME 116, NUMBER 2, February 2008,
http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info:doi/10.1289/ehp.10424

"Compared with children who had lifetime average blood lead concentrations < 5 µg/dL, children with lifetime average concentrations between 5 and 9.9 µg/dL scored 4.9 points lower on Full-Scale IQ."

17. **"Exposures to Environmental Toxicants and Attention Deficit Hyperactivity Disorder in US Children"** by Joe Braun, Robert S. Kahn, Tanya Froehlich, Peggy Auinger and Bruce P. Lanphear in Environmental Health Perspectives - ehp online.org at
http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info:doi/10.1289/ehp.9478

The study found that prenatal exposure to environmental tobacco smoke (ETS – also known as "passive smoking") and environmental lead was found to be a risk factor for attention deficit hyperactivity disorder (ADHD).

18. **"Study: ADHD cases linked to lead, smoking"** by LINDSEY TANNER, Associated Press Medical Writer,
www.letsmakeleadhistory.org/LinkClick.aspx?link=News%2fADHDCases.pdf&tabid=71

This is a newspaper report on the preceding item.

"About one-third of attention deficit cases among U.S. children may be linked with tobacco smoke before birth or to lead exposure afterward, according to provocative new research.

"Even levels of lead the government considers acceptable appeared to increase a child's risk of having attention deficit hyperactivity disorder, the study found.

"It builds on previous research linking attention problems, including ADHD, with childhood lead exposure and smoking during pregnancy, and offers one of the first estimates for how much those environmental factors might contribute.

"'It's a landmark paper that quantifies the number of cases of ADHD that can be attributed to very important environmental exposures,' said Dr. Leo Trasande, assistant director of the Center for

Children's Health and the Environment at Mount Sinai School of Medicine in New York.

"More importantly, the study bolsters suspicions that low-level lead exposure previously linked to behavior problems "is in fact associated with ADHD," said Trasande, who was not involved in the research."

19. **"Exposure Assessment: Lead Neurotoxicity - Is the Center for Disease Control's goal to reduce lead below 10µg/dL blood in all children younger than 72 months by 2010, good enough?"** by Thomas F. Schrager, Ph.D., Toxicology Source published by Cambridge Toxicology Group Inc. at www.toxicologysource.com/toxmed/lead/braininjury.html

Summarises various research papers. Concludes, amongst other things, that "additional data and new analysis of existing data support a growing scientific consensus that a threshold for lead neurotoxicity in fetuses and young children does not exist (WHO 1995; CDC (US Center for Disease Control) 2003); CDC stated in a consensus report that 'a threshold for harmful effects of lead remains unknown' (Myer et al 2003). And following the release of the comprehensive 'Third National Report on Exposure to Chemicals in Humans' (CDC 2005), Jim Pirkle, deputy director of CDC's Environmental Health Lab, stated unequivocally that a safe blood lead level in children simply does not exist. "

20. **"No "safe" lead level seen for fetal brain"** by Amy Norton, Reuters, originally published January 19, 2006 www.health.state.nm.us/eheb/rep/lead/fetal%20lead.pdf

This is a news report on Schnaas et al (2006), below.

"NEW YORK (Reuters Health) – Exposure to even small amounts of lead through a mother's blood may harm the brain development of unborn babies, a new study suggests.

"The Centers for Disease Control and Prevention (CDC) currently considers 10 micrograms per deciliter (µg/dL) the "level of concern" for lead in the bloodstream, but researchers in Mexico found that maternal blood lead levels well below 10 µg/dL appeared to have a lasting impact on their children's IQ, at least up to the age of 10."

21. **"Reduced Intellectual Development in Children with Prenatal Lead Exposure"** by L Schnaas, SJ Rothenberg, M-F Flores, S Martinez, C Hernandez, E Osorio, S Ruiz Velasco & E Perroni, EHP 114(5) May 2006, at http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info:doi/10.1289/ehp.8552

"The fetal brain seems susceptible to lower lead concentrations than those established by the official Mexican standard and current CDC guidelines, and the effects are obvious at least until 10 years of age. Although these findings should be replicated, our data suggest that we should establish lower action limits for lead exposure of reproductively active women."

22. **"Association Of Dental Caries And Blood Lead Levels"** by Moss, Mark E; Lanphear, Bruce P; and Auinger, Peggy, at www.lead.org.au/lanv7n4/L74-12.html

"Results The log of blood lead level was significantly associated with the number of affected surfaces for both deciduous and permanent teeth in all age groups, even after adjusting for socio-demographic characteristics, diet, and dental care. Among children aged 5 to 17 years, a 0.24 µmol/L (5 µg/dL) change in blood lead level was associated with an elevated risk of dental caries (odds ratio, 1.8; 95% confidence interval, 1.3-2.5). Differences in blood lead level explained some of the differences in caries prevalence in different income levels and regions of the United States..."

"Conclusions: Environmental lead exposure is associated with an increased prevalence of dental caries in the US population. Findings may help explain the distribution of caries by income and region of the United States."

23. **"The Relationship between Early Childhood Blood Lead Levels and Performance on End-of-Grade Tests"** by Marie Lynn Miranda, Dohyeong Kim, M. Alicia Overstreet Galeano, Christopher J. Paul, Andrew P. Hull, and S. Philip Morgan at http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info:doi/10.1289/ehp.9994

Conclusions: "using a variety of modeling approaches, blood lead levels in early childhood are related to educational achievement in early elementary school as measured by performance on end of-grade testing. According to 2003–2004 NHANES data, 50% of children 1–5 years old nationwide are estimated to have blood lead levels of ≥ 3 μg/dL (National Center for Health Statistics 2006). Thus as many as half the children in the United States are experiencing negative effects associated with lead exposure—a significantly higher proportion than the 2.3% estimated using the CDC's current blood lead action level of 10 μg/dL. In addition, early childhood lead exposures appear to have more impact on performance on the reading than on the mathematics portions of the EOG, although the differences may not be statistically significant. This differential impact on reading versus mathematics is consistent with previous studies (Fulton et al.1987; Lanphear et al.

2000)."

24. **"Low Blood Lead Levels Associated with Clinically Diagnosed Attention-Deficit/Hyperactivity Disorder and Mediated by Weak Cognitive Control"** by Joel T. Nigg , G. Mark Knottnerus, Michelle M. Martel, Molly Nikolas, Kevin Cavanagh, Wilfried Karmaus, Marsha D. Rappley Biological Psychiatry Vol 63, Is 3,1st February 2008 at www.journals.elsevierhealth.com/periodicals/bps/article/PIIS0006322307006750/abstract

"Blood lead levels in this sample closely matched US population exposure averages, with a maximum level of 3.4 μg/dL. Blood lead levels were statistically significantly higher in ADHD-combined type than in non-ADHD control ($p < .05$) children. Blood lead was associated with symptoms of hyperactivity-impulsivity but not inattention-disorganization, after control of covariates. Blood lead levels were linked with a lower IQ ($p < .05$), but IQ did not account for effects on hyperactivity. Instead, hyperactivity mediated effects of lead on IQ. Effects of blood lead on hyperactivity-impulsivity were mediated by poor performance on the stop task. This mediation effect was independent of effects of lead on IQ.

Conclusions

"Low-level lead exposure might be an important contributor to ADHD. Its effects seem to be mediated by less effective cognitive control, consistent with a route of influence via striatal-frontal neural circuits."

25. **"Low-Level Environmental Lead Exposure and Children's Intellectual Function: An International Pooled Analysis"** BP. Lanphear, R Hornung, J Khoury, K Yolton, P Baghurst, DC. Bellinger, RL. Canfield, KN. Dietrich, R Bornschein, T Greene, SJ. Rothenberg, HL. Needleman, L Schnaas, G Wasserman, J Graziano, R Roberts Environ Health Perspect. 2005 July; 113(7): 894–899. at www.ncbi.nlm.nih.gov/pmc/articles/PMC1257652/

"For a given increase in blood lead, the lead-associated intellectual decrement for children with a maximal blood lead level < 7.5 μg/dL was significantly greater than that observed for those with a maximal blood lead level ≥7.5 μg/dL ($p = 0.015$). We conclude that environmental lead exposure in children who have maximal blood lead levels < 7.5 μg/dL is associated with intellectual deficits."

26. **"Longitudinal Associations Between Blood Lead Concentrations Lower Than 10 μg/dL and Neurobehavioral Development in Environmentally Exposed Children**

in Mexico City" Martha M. Te´llez-Rojo, ScDa, David C. Bellinger, PhDb,c, Carmen Arroyo-Quiroz, BSca, He´ctor Lamadrid-Figueroa, MDa Adriana

Mercado-Garcı´a, MD, MPHa, Lourdes Schnaas-Arrieta, MScd, Robert O. Wright, MD, MPHe, Mauricio Herna´ndez-Avila, MD, ScDa, Howard Hu, MD, MPH, ScDc,e PEDIATRICS Volume 118, Number 2, August 2006 e323-e332 http://pediatrics.aappublications.org/cgi/reprint/118/2/e323

"RESULTS. Adjusting for covariates, children's blood lead levels at 24 months were significantly associated, in an inverse direction, with both Mental Development Index and Psychomotor Development Index scores at 24 months. Blood lead level at 12 months of age was not associated with concurrent Mental Development Index or Psychomotor Development Index scores or with Mental Development Index at 24 months of age but was significantly associated with Psychomotor Development Index score at 24 months. The relationships were not altered by adjustment for cord blood lead level or, in the analyses of 24-month MentalDevelopment Index and Psychomotor Development Index scores, for the 12- month Mental Development Index and Psychomotor Development Index scores. For both Mental Development Index and Psychomotor Development Index at 24 months of age, the coefficients that were associated with concurrent blood lead level were significantly larger among children with blood lead levels <10 µg/dL than it was among children with levels >10 µg/dL.

CONCLUSIONS. These analyses indicate that children's neurodevelopment is inversely related to their blood lead levels even in the range of <10 µg/dL. Our findings were consistent with a supralinear relationship between blood lead levels and neurobehavioral outcomes.

27. **"Deficits in cognitive function and achievement in Mexican first-graders with low blood lead concentrations"** [Abstract Only] Katarzyna Kordas, Richard L. Canfield, Patricia López, Jorge L. Rosado, Gonzalo

García Vargas, Mariano E. Cebrián, Javier Alatorre Rico, Dolores Ronquillo and Rebecca J. Stoltzfus

Environmental Research Volume 100, Issue 3, Pages 295-442 (March 2006)

"Elevated blood lead levels in children are associated with lower scores on tests of cognitive functioning. Recent studies have reported inverse relations between lifetime exposure and intellectual functioning at blood lead concentrations below 10 µg/dL, the Centers for Disease Control and Prevention's (CDC) level of concern. We report associations between blood lead and cognitive performance for first-grade Mexican children living near a metal foundry…

" One implication of [our] findings is that at the age of 7 years, even in the absence of information on lead exposure in infancy and early childhood, a test result with blood lead <10 µg/dL should not be considered safe. Together with other recent findings, these results add to the empirical base of support available for evaluating the adequacy of current screening guidelines and for motivating efforts at primary prevention of childhood lead exposure"

28. "Lead Exposure and Cardiovascular Dysregulation in Children" [Abstract only] James A. MacKenzie,

Brooks B. Gump, Kristen Roosa, Kestas Bendinskas, Amy Dumas, Robert Morgan and Patrick Parsons The FASAB Journal paper presented to The American Physiological Society at the Experimental Biology 2009 conference, New Orleans 18-22 April, 2009 at

www.fasebj.org/cgi/content/meeting_abstract/23/1_MeetingAbstracts/786.13

"Increasing lead (Pb) exposure is associated with increased blood pressure in humans and animal studies suggest this is due to increased vascular resistance."

"The authors looked at cardiovascular reactions to acute stress in 9-11 year old children with low blood levels – below 3.76 µg/dL

"Pb levels were significantly associated with increased total peripheral resistance (TPR) responses and diminished stroke volume and cardiac output responses to AS. This vascular pattern of response to AS tasks may predict future hypertension."

"The effects described here were significant for Pb levels considered well below the 10 µg/dL threshold set by the CDC (Centers for Disease Control) for deleterious effects."

29. "Low Lead Levels In Children Can Affect Cardiovascular Responses To Stress" The American Physiological Society press release about the Mackenzie paper above www.the-aps.org/press/releases/09/18.htm

"Even low levels of lead found in the blood during early childhood can adversely affect how the child's cardiovascular system responds to stress and could possibly lead to hypertension later in life, according to a study from the State University of New York (SUNY) at Oswego.

"Lead exposure was associated with an increase in vascular resistance when the children worked on a stressful computer task. Vascular resistance is a measure of tension within the blood vessels. Increased vascular resistance may lead to hypertension if it continues over time.

"The study also found that lead exposure was associated with a decrease in circulating aldosterone levels. Aldosterone is a hormone that helps regulate blood pressure.

"One of the study's most important findings is that all of the participants had very low lead levels, well below the 10 micrograms per deciliter that the CDC defines as a level of concern. The highest lead level for the children in this study was 3.8 micrograms per deciliter.

"'The interesting thing was that the levels of lead were all pretty low in the children who participated,' Dr. MacKenzie said. "We're seeing the negative effects at these low levels."

30. "Gender specific differences in neurodevelopmental effects of prenatal exposure to very low-lead levels: The prospective cohort study in three-year olds" {abstract only} Wieslaw Jedrychowski, Frederica Perera,

Jeffery Jankowski, Dorota Mrozek-Budzyn, Elzbieta Mroz, Elzbieta Flak, Susan Edwards, Anita Skarupa, Ilona Lisowska-Miszczyk Early Human Development Vol 85, Is 8 Pages 503-510 (August 2009) at www.earlyhumandevelopment.com/article/S0378-3782(09)00077-2/abstract

"Conclusion: the study suggests that there might be no threshold for lead toxicity in children and provides evidence that 3-year old boys are more susceptible than girls to prenatal very low lead exposure. The results of the study should persuade policy makers to consider gender-related susceptibility to lead and possibly to other toxic hazards in setting environmental protection guidelines. To determine whether the cognitive deficit documented in this study persists to older ages, the follow-up of the children over the next several years is to be carried out."

31. Childhood Lead Poisoning Prevention Too Little, Too Late Bruce P. Lanphear, MD, MPH at http://jama.ama-assn.org/content/293/18/2274.extract

"Despite the dramatic decline in children's blood lead concentrations, lead toxicity remains a major public health problem. Environmental lead exposure in children—typically measured using lead in whole blood or teeth—has been associated with an increased risk for reading problems, school failure, delinquency, and criminal behavior.9-14 Moreover, there is no evidence of a threshold for the adverse consequences of lead exposure.15,16 Indeed, studies show that the decrements in intellectual function are, for a given increase in blood lead concentration, greater at blood lead levels lower than 10

µg/dL,15,16 the level considered acceptable by the CDC."

32. **"Neuropsychological function in children with blood lead levels < 10 µg/dL"** by Pamela J. Surkan, Annie

Zhang, Felicia Trachtenberg, David B. Daniel, Sonja McKinlay, David C. Bellinger, in NeuroToxicology 28 (2007) 1170-1177published online 25 July 2007; www.nchh.org/Portals/0/Contents/Article0822.pdf

"Among participants in the NECAT [New England Children's Amalgam Trial], children with blood lead levels of 5-10 µg/dL had significantly lower scores on IQ, achievement, attention, and working memory than did children in the referent group, who had levels of 1-2 µg/dL."

"It appeared to be within the domain of executive functioning that the children with lead levels of 5-10 µg/dL showed their most consistent deficits….These findings suggest that working memory, cognitive flexibility, and ability to formulate, test, and adapt hypotheses might contribute to impaired scores on apical tests"

"In summary, we found that blood lead levels of 5-10 µg/dL in school-age children are associated with deficits in intelligence, visual–spatial skills, executive function, and IQ adjusted academic achievement."

33. **"In kids, even a low blood lead level is a concern"** By Patricia Many NEW YORK NURSE: July/August

2008 at www.nysna.org/publications/newyorknurse/2008/jul_aug/research.htm

"The study [Surkan and colleagues (2007)] assessed the impact that a BLL ≤10µg/dL had on mental and behavioral development of 534 English-speaking children ages 6-10 from the New England area."

"[The] battery of tests examines …. vocabulary, comprehension, picture arrangement, block design, and maze completion… reading, math, and spelling…. fine motor skills, memory, attention, verbal tests, finger tapping, and reaction time."

"Children with a BLL of 1-2 µg/dL were compared to children with a BLL of 3-4 µg/dL and 5-10 µg/dL. The results indicate that children with a BLL of 5-10 µg/dl scored lower, especially in vocabulary, math, reading, attention span, and working memory."

34. **"Blood lead levels and specific attention effects in young children"** by Lisa M. Chiodo, Chandice

Covington, Robert J. Sokol, John H. Hannigan, James Jannise, Joel Ager, Mark Greenwald and Virginia DelaneyBlack in Neurotoxicology and Teratology Volume 29, Issue 5, September-October 2007, Pages 538-546 published online 21 April 2007

"Importantly, the present study documents a significant negative impact of blood lead levels on attention, but not impulsivity, in early elementary age children, further delineating the specific aspects of attention related to blood lead concentrations. Analyses were also conducted to identify a "safe" blood lead level threshold. Visual inspection of non-parametric regression plots suggested a gradual linear dose-response relationship for each endpoint. None of the neurobehavioral outcomes assessed showed evidence of a threshold under which lead levels appear to "safe". In light of the consistency of these findings with those of several other groups, it is advisable to consider whether the threshold for an acceptable blood lead level should be reduced."

35. **"Effects of early childhood lead exposure on academic performance and behaviour of school age children"** by K Chandramouli, C D Steer, M Ellis, A M Emond (2009)

"After adjustment for confounders, blood lead levels at 30 months showed significant associations with educational attainment, antisocial behaviour and hyperactivity scores at age 7–8 years..."

"Blood lead levels >5 µg/dL were associated with reduced Standard Assessment Tests scores, and levels >10 µg/dL with increased scores for antisocial activities and hyperactivity..."

"**Conclusions:** Exposure to lead early in childhood has effects on subsequent educational attainment, even at blood levels below 10 µg/dL**. These data suggest that the threshold for clinical concern should be reduced to 5 µg/dL."**

36. **" Blood Lead Levels Well Below "Safe" Threshold Harm Children's Development"** from Medical News Today 18 Sep 2009, at www.medicalnewstoday.com/articles/164336.php

"The higher the level of lead in the blood at the age of 30 months, the poorer were reading, writing, and spelling grades on the Standard Assessment Tests (SATS), and the greater were the chances of antisocial behaviour [at 7 and 8 years of age]."

"But lead levels of between 5 and 10 µg/dL were associated with significantly poorer scores for reading (49% lower) and writing (51% lower). A doubling in lead level from 5 to 10 µg/dL was associated with a 0.3 point fall in SAT scores."

According to **"Cognitive Tests: Interpretation for Neurotoxicity? (Workshop Summary)"** by William Slikker, Jr., Barbara D. Beck, Deborah A. Cory-Slechta, Merle G. Paule, W. Kent Anger and David Bellinger (2000) at http://toxsci.oxfordjournals.org/content/58/2/222.full.pdf+html - "**Apical Test Scores Represent Final Common Pathways for the Expression of Diverse Cognitive Patterns:** The assessment battery typically used in a neurotoxicant study consists of a global or apical test, supplemented by tests thought to assess particular aspects of cognition (e.g., language, visual-spatial skills, memory, and fine motor function). Historically, however, it is apical test scores (e.g., full-scale IQ) rather than domain-specific test scores that have received the most attention, most likely because they can more readily be incorporated into risk assessment and cost benefit analyses."

Health effects of a blood lead level even below 1 µg/dL in pregnancy

37. **"Changes in low levels of lead over the course of pregnancy and the association with birth outcomes"** by Felicia A. Rabito, Mehmet Kocak, Derek W. Werthmann, Frances A. Tylavsky, Christopher D. Palmer, Patrick J. Parsons in Reproductive Toxicology Volume 50, December 2014, Pages 138-144, published online 22 Oct 2014, at https://www.sciencedirect.com/science/article/abs/pii/S0890623814002597?via%3Dihub

"A 0.1 µg/dL increase in second trimester lead was associated with lower birth weight and pre-term birth."

"Maternal blood lead below 1 µg/dL behaves in a manner similar to lead at higher levels and is associated with a small decrease in birth weight and gestational age."

"We found that a 0.1µg/dL increase in second trimester lead resulted in a 43 g decrease in birth

weight"

"We found that increasing lead in both the second and third trimester was associated with pre-term birth"

"Our results show a statistically significant rise in maternal blood lead from the second trimester to delivery"

"Sample blood lead, µg/dL: n/ Mean(Range)/Geometric Mean(Standard deviation)

- Second trimester 98/ 0.43 (0.19–1.22)/ 0.42 (0.20)
- Third trimester 88/ 0.43 (0.19–2.10)/ 0.45 (0.28)
- Delivery 69/ 0.50 (0.21–2.47)/ 0.50 (0.35)"

"results from this study suggest that prenatal lead exposure may impact birth outcomes at levels previously considered safe"

"Further research on larger population-based cohorts is needed to confirm these findings and to investigate the level at which clinically relevant decrements in birth outcomes occurs."

Lead is an issue beyond childhood (re: Lanphear et al 2018, The Lancet)

A fact sheet by LEAD Group volunteer Emily Choong, using extracts of media articles about the landmark Lancet *lead article by Lanphear et al, March 2018*

"The population attributable fraction of the concentration of lead in blood for all-cause mortality was 18·0% (95% CI 10·9–26·1), which is equivalent to 412,000 deaths annually [in the US alone]. Respective fractions were 28·7% (15·5–39·5) for cardiovascular disease mortality and 37·4% (23·4–48·6) for ischaemic heart disease mortality, which correspond to 256,000 deaths a year from cardiovascular disease and 185,000 deaths a year from ischaemic heart disease." [Lanphear et al, 2018]

Lanphear and his team reviewed two decades of health data for more than 14,000 adults in the US, covering the period 1990-2011. The participants all had blood tests at the outset to measure past and current exposure to lead, as well as a urine test for the metal cadmium. [Hood, 2018]

"There's no safe threshold," Lanphear said. "Once we found that there was a risk across the entire range of exposures, we could estimate the number of attributable deaths. And instead of it being 40,000 deaths, which is what had previously been estimated, we found that it was about 10 times that." [Lieber, 2018]

'Overall, people who had high lead levels (6.7 µg/dL) were at 37% greater risk of premature death from any cause, 70% times greater risk of cardiovascular death, and double the risk of death from ischemic heart disease, compared with people with lower levels (1 µg/dL). [Lancet, 2018]

They also concluded the estimated number of deaths attributable to lead were

comparable to the number of deaths from tobacco smoke exposure. [Lardieri, 2018]

The new Lancet study estimates that deaths from lead exposure approach the levels attributable to smoking, which kills 483,000 Americans each year. People are still far more likely to suffer complications from smoking. But only 20% of Americans now smoke, while lead exposure is more common, affecting 90% of people in the study. [Glenza, 2018]

REFERENCES

Glenza J, 2018, 'Lead exposure may be linked to 412,000 premature US deaths yearly, study says', *The Guardian*, Accessed: 1st August 2018 < https://www.theguardian.com/us-news/2018/mar/12/lead-exposure-premature-deaths-us>

Hood M, 2018 'Lead poisoning may hasten death for millions in US: study', *Medical Xpress*, Accessed: 1st August 2018 < https://medicalxpress.com/news/2018-03-poisoning-hasten-death-millions.html

Lanphear B, Rauch S, Auinger P, Allen R, Hornung R. 2018 'Low-level lead exposure and mortality in US adults: a population-based cohort study'. *The Lancet Public Health*, Accessed: 1st August 2018

Lardieri A, 2018, 'Study: Lead Exposure Linked to 10 Times More Deaths Than Reported', *US News*, Accessed: 1st August 2018 < https://www.usnews.com/news/health-care-news/articles/2018-03-13/study-lead-exposure-linked-to-10-times-more-deaths-than-reported>

Lieber M, 2018 'US deaths from lead exposure 10 times higher than thought, study suggests' *CNN*, Accessed: 1st August 2018 < https://edition.cnn.com/2018/03/12/health/lead-exposure-cardiovascular-disease-study/index.html>

The Lancet, 2018, 'Historical lead exposure may be linked to 256,000 premature deaths from cardiovascular disease in adults in United States each year.' *ScienceDaily*, Accessed: 1st August 2018 www.sciencedaily.com/releases/2018/03/180312201739.htm

Lead in Literature: The World Below the Brine

BY WALT WHITMAN

[© THE POETRY FOUNDATION. URL: https://www.poetryfoundation.org/poems/45481/the-world-below-the-brine]

The world below the brine,

Forests at the bottom of the sea, the branches and leaves,

Sea-lettuce, vast lichens, strange flowers and seeds, the thick tangle, openings, and pink turf,

Different colors, pale gray and green, purple, white, and gold, the play of light through the water,

Dumb swimmers there among the rocks, coral, gluten, grass, rushes, and the aliment of the swimmers,

Sluggish existences grazing there suspended, or slowly crawling close to the bottom,

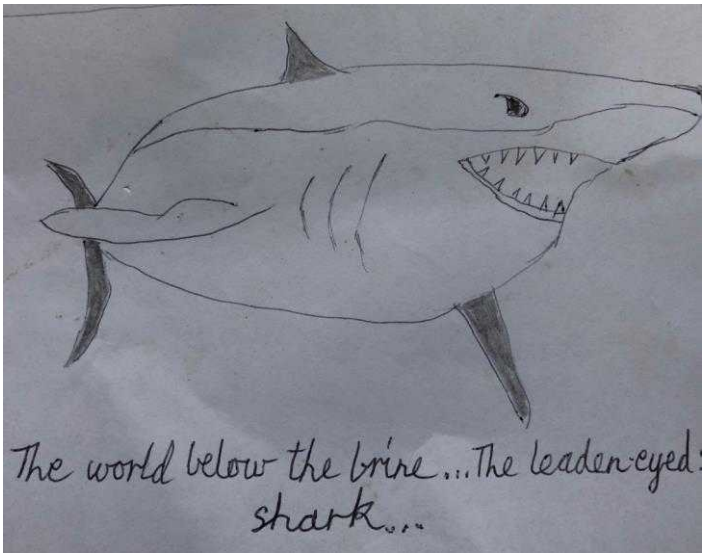
The sperm-whale at the surface blowing air and spray, or disporting with his flukes,

The leaden-eyed shark, the walrus, the turtle, the hairy sea-leopard, and the sting-ray,

Passions there, wars, pursuits, tribes, sight in those ocean-depths, breathing that thick-breathing air, as so many do,

The change thence to the sight here, and to the subtle air breathed by beings like us who walk this sphere,

The change onward from ours to that of beings who walk other spheres.



2020 Volcano Art Prize (VAP) Entry.
Title: The world below the brine...The leaden-eyed shark....

Lead-Safety Message: Great White Sharks Have Toxic Levels of Mercury, Arsenic and Lead In Their Blood- it's likely if we eat the same fish that sharks eat, we'll be poisoned too!

Artist: Elizabeth O'Brien

Description of Work: Title from a poem in Walt Whitman's "Leaves of Grass" book of poems. Lead pencil and pen drawing.

URL: https://volcanoartprize.com/portfolio-item/the-world-below-the-brine-the-leaden-eyed-shark/

The Scafell Project - Screen Children At-risk For Elevated Lead Levels

By Tim Pye, 25th September 2020

This article introduces "The Scafell Project".

Mission

The mission of the Scafell Project is to convince the UK National Screening Committee (NSC) that screening children at-risk for elevated lead levels is:

- Necessary
- Achievable
- Effective

The next NSC review is scheduled for 2021/22. Keep up to date with progress on these web pages.

Introduction

Logic

A lead poisoning prevention (LPP) stakeholder observed that screening children for lead would be pivotal in the UK. If even limited screening can be introduced, parents would become aware of lead toxicity. They will then start asking questions about the source of the lead exposure which, hopefully, would lead to more action and information from relevant government agencies, trade organisations and businesses.

There may be concerns about a panic response. To prepare for this we should encourage the introduction of a web site and help line, as is provided in the USA, and repeat the message that lead poisoning is entirely preventable.

Timing

There may be additional difficulties in progressing this project during the COVID-19 pandemic. Public Health England (PHE) staff have been reallocated from lead related initiatives to work on COVID-19 and the PHE is to be re-organised into a new agency called National Institute for Health Protection (NIHP). This could perhaps result in the next review by the NSC being pushed back, but there is no news about this yet.

Scope

Health Services in the UK are devolved to the individual countries. This scope of this project will be England, initially.

The initial age group focus would be from 1-4 years, inclusive, because this is where most elevated BLCs were reported by the passive Lead Exposure in Children Surveillance System (LEICSS).

Project Naming

Scafell Pike is the highest mountain in England. There is a mountain to climb to achieve the project mission, but Scafell Pike is not inaccessible.

The name "Scafell Project" has been used previously for an initiative regarding prolific and priority offenders. This is nothing to do with screening, except that there is evidence that lead exposure can lead to crime (Boutwell et al, 2017, Dietrich et al, 2001, Taylor et al, 2016).

Background

In 2018 the NSC recommended against screening for lead poisoning. The reasons given were:

- the number of children affected in the UK is currently not known
- the test was not reliable enough
- treatments in children with mild symptoms have not been proven and may also be harmful

The three parts of the mission of the Scafell Project address each of these reasons.

A detailed submission was presented to the NSC in 2018 by associates of Lead Safe World dealing with these questions in some detail. However, this was not effective in persuading the NSC to change their recommendation. The evidence presented at that time can be found on the NSC web site.

The NSC had also commissioned an external review from Bazian Limited. Unless there are personnel changes, it would be likely that Bazian would not want to change their recommendation, so we should ask the NSC to use another organisation to perform the next review. The Scafell Project could look for alternatives, perhaps from the USA, where there is more experience.

The Parliamentary Under Secretary of State for Prevention, Public Health and Primary Care, Jo Churchill MP, has stated that "prevalence is likely to be a higher concern in at-risk populations, in whom lead exposure may be a public health concern". This statement could be used to support the project's submission to the NSC.

Objectives

The objectives required to meet the project mission are as follows:

Necessary

The Scafell Project aims to acquire up-to-date data on the prevalence of elevated BLC in the child population as a whole, but focus this in areas where lead exposure may be more frequent. This probably means former industrial areas which are now deprived and include older housing. If these data show that lead exposure is still a problem in England then they should be presented to the NSC to show that testing for elevated BLCs is necessary.

There has been no study of the prevalence of elevated lead levels in the UK since the middle of the 1990s. At that time it was found that, of those sampled, 14.5% of pregnant women (Taylor et al, 2013) and 27% of toddlers (Chandramouli et al, 2008) had blood lead concentrations (BLC) above 5 µg Pb/dL. This is the action level currently recommended by the Lead Exposure in Children Surveillance System.

To show that screening is necessary, more up-to-date data on the prevalence of elevated BLCs is needed. One way to achieve this could be to exploit existing stocks of blood samples. UK Biobank have been contacted about this and information about costs is awaited.

Another approach could be to collect new samples for analysis. This could be done using a finger prick method analysed by a device such as LeadCare II. A current study on COVID-19 antigens uses participant self-administered sample collection showing that a trained nurse may not be needed. The ethical constraints around this would have to be examined and a cohort of volunteers would be needed – perhaps from the children of the ALSPAC 'Children of the Nineties' cohort.

Achievable

The NSC asserted that existing tests are not reliable enough. However, according to the Centre for Disease Control (CDC), in the USA in 2017, 2,014,208 tests were performed on children younger than 72 months. This represents 18.7% of this age group. Of these, 3% were found to have BLCs ≥ 5 µg/dL. It should be noted that these data may not include all tests performed where these do not meet the CDC standardisation criteria. The CDC also warn that these data do not represent population-based estimates. In UK terms, the same percentages would result in around 540,000 children being tested and 115,000 children being found to have elevated blood lead levels.

What this shows is that screening children for elevated blood lead levels is clearly achievable in the USA so this should also apply in England. Blood lead concentrations are already measured in England for children with recognised lead toxicity and in workers handling lead. Does the NSC believe these existing tests are not accurate?

The Scafell project should collate this, and other, information, seek endorsement from UK professionals and present this to the NSC showing that testing for elevated lead levels can be simple, cheap and effective.

Effective

The NSC state that treatments are not proven and possibly harmful. They seem to limit their definition of treatment to clinical or medical interventions. In the USA the Environmental Protection Agency (EPA) provide considerable information about how to reduce the lead loading in homes and other locations frequented by children. The Scafell Project will use this, and other collated evidence, to

create a compelling case to explain how lead exposure can be reduced.

Stakeholders

The stakeholders, from whom endorsement of the project will be sought, may include:

- Academics
- Clinicians
- Service providers
- Activists
- Parents

Approach

Branding

The project is hosted under the Lead Safe World project created by The LEAD Group in Australia. This includes using the Lead Safe World branding, web site and emails.

Costs and Funding

The main, and perhaps only, cost involved with the project could be acquisition of BLC data. Further work would be needed to establish the options, feasibility and costs. Following this, and depending on how much it would be, funding could be sought. Perhaps from the National Institute for Health Research.

Steps

At this time, the steps envisioned to progress the Scafell Project include:

- Seek endorsements.
- Seek people to help progress the project.
- Seek assurances that the replacement of Public Health England will not mean that the Lead Exposure in Children Surveillance System (LEICSS) is abandoned and that the new National Institute for Health Protection will include protecting children from lead in its remit.
- Inform the NSC about the mission of the Scafell Project and ask them
  - to seek an alternative organisation to provide the next external review.
  - To indicate what evidence of the prevalence of elevated blood lead levels they would accept
- Investigate ways to find out the prevalence of elevated blood lead levels in England.
- Collect information on the accuracy of BLC screening.
- Collect information on the efficacy of interventions in children's environments.
- Prepare a submission to the NSC.

Personal Note to Lead-Using Businesses

My name is Tim Pye and I am the instigator of this project. If you represent a lead-using business and feel threatened by it, there is no need to take legal, or illegal, action against me. Just let me know and we'll talk.

I do not believe it would be helpful to seek to blame, or hold responsible, any individual or organisation for lead exposure. Everyone has benefited from the use of lead, so there should be collective responsibility for resolving the consequential health issues. This is best addressed through

government agencies.

I have no wish to be a martyr for this cause, but feel I am well placed to help in a small way to improve the health and wealth of the country through this campaign. Your help would be welcomed. I can be contacted at uk1@leadsafeworld.com.

"***Let us not seek to fix the blame for the past. Let us accept our own responsibility for the future***" John F Kennedy

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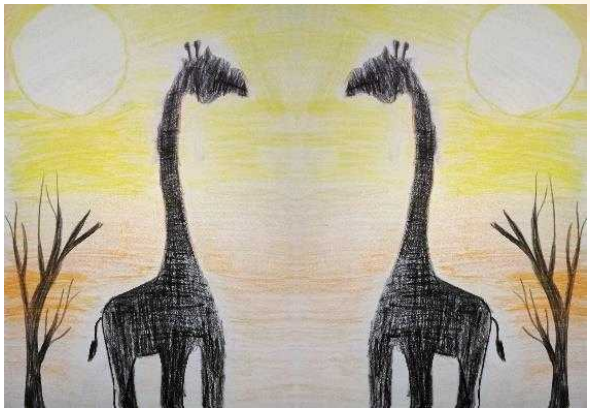
Vote for the People's Choice Prize in Volcano Art Prize 2020

Just click on the link below any VAP 2020 entry you like, and vote via Facebook Like for each of them (there's no limit on how many entries you can vote for) so that The LEAD Group can give the $200 cash prize to the entrant with the most Facebook Likes!! Or go to https://volcanoartprize.com/peoples-choice/ to vote.

Artist: Rose Lennon
Title: Mother mops up lead dust while baby plays in high chair.
LEAD-Safety Message: When babies are crawling, floors in old houses should be wet-cleaned every other day.
Description of Work: Pen drawing
Age: 7
URL: https://volcanoartprize.com/portfolio-item/mother-mops-up-lead-dust-while-baby-plays-in-high-chair/

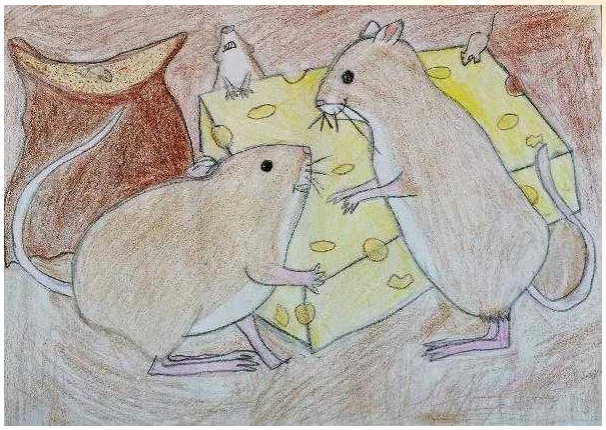
Artist: Celeste Chen
Title: Hoppity Hop Bunny
LEAD-Safety Message: Pet bunny rabbits can easily be lead poisoned if you let them eat leaded PVC cabling under your house.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 13

URL: https://volcanoartprize.com/celeste-chen-hoppity-hop-bunny/



Artist: Kelvin Guo
Title: Giraffes
LEAD-Safety Message: Being wild and lead-free is how we live!!
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/giraffes/

Artist: Amanda Han
Title: Orange Pumpkin
LEAD-Safety Message: Pumpkin and lead do not go hand in hand.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/orange-pumpkin/

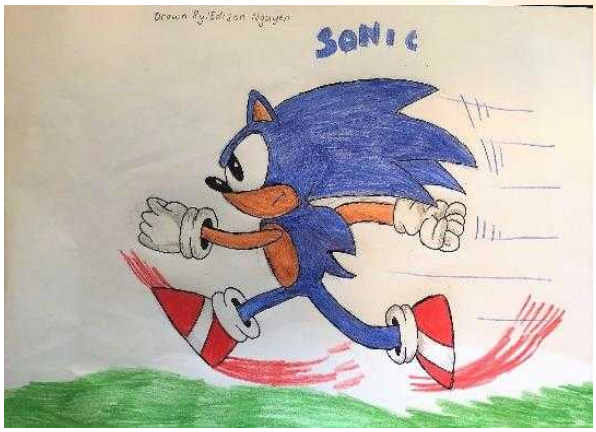


Artist: Michelle Meng
Title: Mouse's treat
LEAD-Safety Message: Having lead-free treat is a right of every creature on earth.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/mouses-treat/

Artist: Si Yu Chen
Title: Mickey and Minnie
LEAD-Safety Message: Be healthy and eat healthy to have a healthy and lead free happily ever after.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 13 years
URL: https://volcanoartprize.com/portfolio-item/mickey-and-minnie/

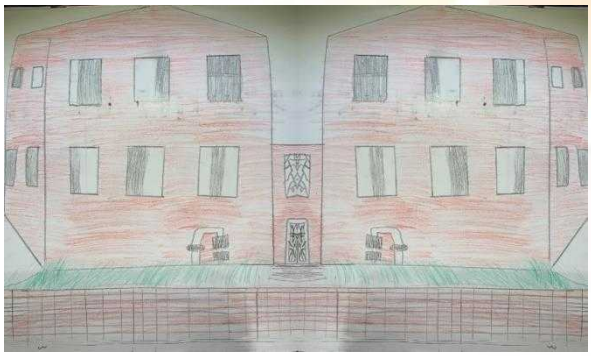
Artist: Emidori Lum
Title: Pigeon
LEAD-Safety Message: Lead is a common household hazard for birds. Due to their curious, explorative nature, house birds can be exposed to lead around the house. Lead causes heavy metal toxicity, affecting the blood, nervous system and gastrointestinal system. Lead poisoning can be fatal if not treated.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 12 years
URL: https://volcanoartprize.com/portfolio-item/pigeon/

Artist: Liza Tripathi
Title: Stay at home
LEAD-Safety Message: Before repainting while children are in the home, watch the very short video Lockdown, DIY and Lead and test using a LEAD Group Kit.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/stay-at-home/

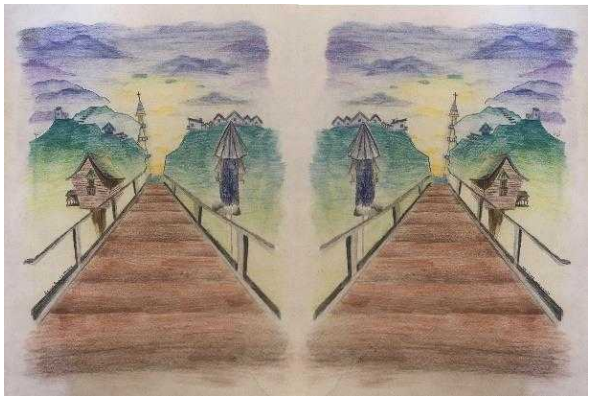


Artist: Edison Nguyen
Title: Sonic
LEAD-Safety Message: To run fast like Sonic stay away from lead.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 7 years
URL: https://volcanoartprize.com/portfolio-item/sonic/

Artist: Karina Guo
Title: Flamingo
LEAD-Safety Message: Waterbirds are exposed to many contaminants, including lead from ingestion of shot and fishing sinkers. It's our duty to protect earth and all its lifeforms.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
URL: https://volcanoartprize.com/portfolio-item/flamingo/

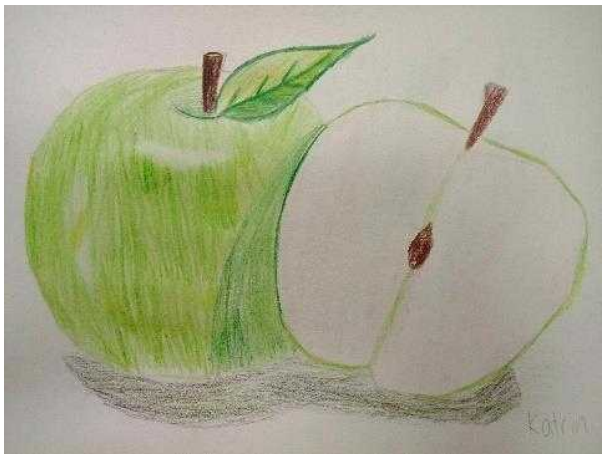


Artist: Liza Tripathi
Title: Building
LEAD-Safety Message: Living in a lead free house improves your health and longevity. Make sure to test your house for traces of lead.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/building/



Artist: Karina Guo
Title: Bridge
LEAD-Safety Message: Watching a sun rise everyday is a blessing. Please lead a lead free life to enjoy it.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 11 years
URL: https://volcanoartprize.com/portfolio-item/bridge/

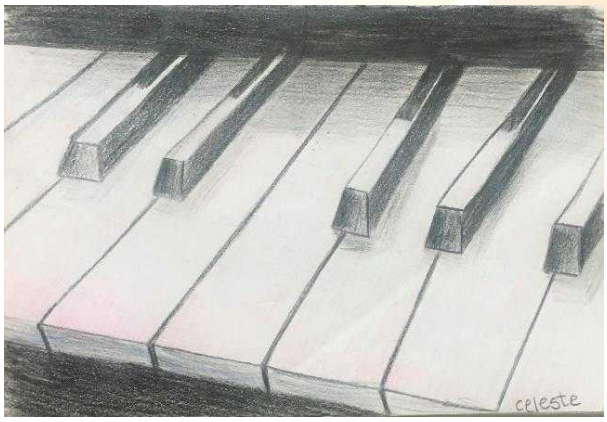
Artist: Liza Tripathi
Title: Volcano Eruption
LEAD-Safety Message: Volcano's hot eruption contains lava, rocks and dust. They might also contain heavy metals like lead and mercury. Stay safe and practise caution where ever you are.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/volcano-eruption/



Artist: Katrin Nam
Title: A lead-free apple keeps diseases away
LEAD-Safety Message: Apples contain pectin, which removes lead from the body.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 6 years
URL: https://volcanoartprize.com/portfolio-item/a-lead-free-apple-keeps-diseases-away/

Artist: Leo Manttan
Title: Crayon art
LEAD-Safety Message: Lead-free crayons are a must for babies who might eat them!!
School: Creative Einstein
Description of work: Crayon drawing
Age: 16 months
URL: https://volcanoartprize.com/portfolio-item/crayon-art/

Artist: Alina Xin
Title: Christmas time
LEAD-Safety Message: Christmas trees and candles do contain small amounts of lead. Be aware of the risks and take appropriate actions to celebrate safely. After all, washing your hands after handling your lights is a pretty insignificant price to pay for all of the joy those lights provide every single holiday season.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 7 years
URL: https://volcanoartprize.com/portfolio-item/christmas-time/

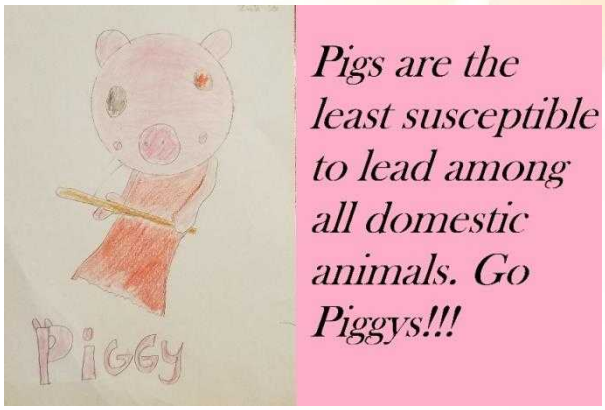


Artist: Celeste Chen
Title: Piano keys
LEAD-Safety Message: As the piano developed, the weight of the hammers increased in order to produce more volume. To keep the touch weight of the keys the same as it was in the instrument with light hammers, lead weights, were inserted into the piano keys which are placed in the front end of the key when the touch weight is too large and in the rear end of the key, if the touch weight is too small. There may be exposure when key leads are changed or piano keys are levelled using these weights.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 13 years
URL: https://volcanoartprize.com/portfolio-item/piano-keys/

Artist: Celeste Chen
Title: Lotus
LEAD-Safety Message: Lead toxicity causes a range of damages to plants from germination to yield formation; however, its toxicity is both time and concentration dependent. Its exposure at higher rates disturbs the plant water and nutritional relations and causes oxidative damages to plants.
School: Creative Einstein.
Description of work: Colour pencil drawing / lead pencil drawing
Age: 13 years
URL: https://volcanoartprize.com/portfolio-item/lotus-2/

Artist: Daniel Ho
Title: Portrait
LEAD-Safety Message: Painting a portrait using lead free paint is satisfying.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 10 years
URL: https://volcanoartprize.com/portfolio-item/portrait/

Artist: Zubin Sen
Title: Love what you have
LEAD-Safety Message:
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/love-what-you-have/



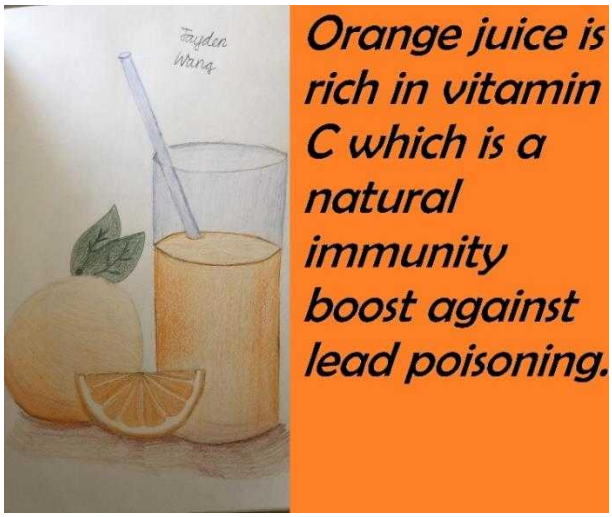
Artist: Zubin Sen
Title: Piggy
LEAD-Safety Message: Pigs are the least susceptible to lead among all domestic animals. Go Piggys!!!
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/piggy/

Artist: Zubin Sen
Title: Dad &Mom
LEAD-Safety Message: Keep your family safe by being lead safe.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/dad-mom/

Artist: Jenna Freed
Title: Beach waves
LEAD-Safety Message: Keep our beaches safe by not dumping industrial waste into the oceans.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 12 years
URL: https://volcanoartprize.com/portfolio-item/beach-waves/

Artist: Jenna Freed
Title: Cats having wine
LEAD-Safety Message: Lead poisoning in cats is a medical condition caused by increased levels of metal lead in the blood. Lead has the ability to disrupt and damage normal cell functions and may affect multiple systems throughout the body. Keep them safe and playful.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 12 years
URL: https://volcanoartprize.com/portfolio-item/cats-having-wine/

Artist: Jenna Freed
Title: Zebra
LEAD-Safety Message: Help wildlife thrive by being lead safe.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 12 years
URL: https://volcanoartprize.com/portfolio-item/zebra/



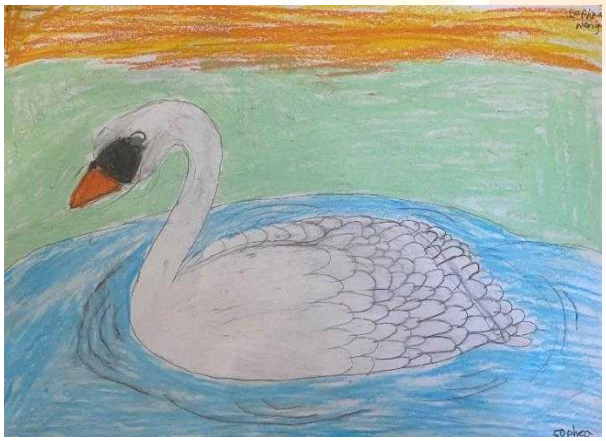
Artist: Jayden Wang
Title: Orange juice
LEAD-Safety Message: Orange juice is rich in vitamin C which is a natural immunity boost against lead poisoning.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/mickey-and-minnie/

Artist: Justone Lead-Soldier

Title: Lockdown, DIY and Lead.

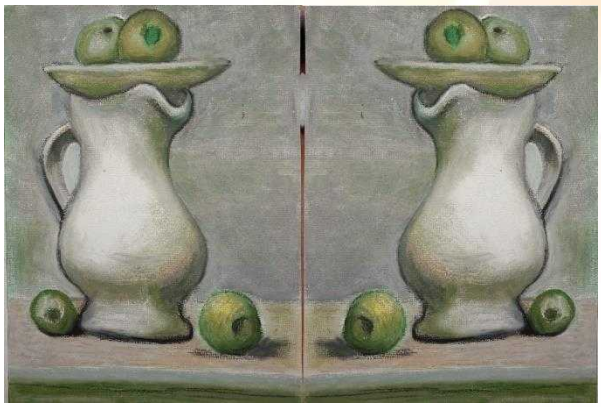
Lead-Safety Message: DIY can poison you and your family
Description of work: Powtoon video
URL: https://volcanoartprize.com/portfolio-item/lockdown-diy-and-lead/ https://volcanoartprize.com/wp-content/uploads/2020/05/lockdown-diy-and-lead-v1.2.mp4

Artist: Kiara Nguyen
Title: Lotus
LEAD-Safety Message: Lotus are beautiful and serene flowers which do not absorb water from the lakes. But the human body isn't so lucky when it comes to lead and so we need to protect ourselves in every way to avoid it.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/lotus-3/



Artist: Sophea Wang
Title: Swan
LEAD-Safety Message: Thousands of swans die every year due to lead poisoning from bullets. Save swans by not shooting but protecting these magnificent birds.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 9 years
URL: https://volcanoartprize.com/portfolio-item/swan-2/

Artist: Mark Ju
Title: Coffee Mug
LEAD-Safety Message: DTU FOOD has estimated that approximately 40% of the lead exposure from beverages is from coffee. Based on this data, the intake of lead from coffee thus corresponds to approximately 20% of the total dietary intake of lead. Please be aware of what you eat and drink.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 15 years
URL: https://volcanoartprize.com/portfolio-item/coffee-mug/

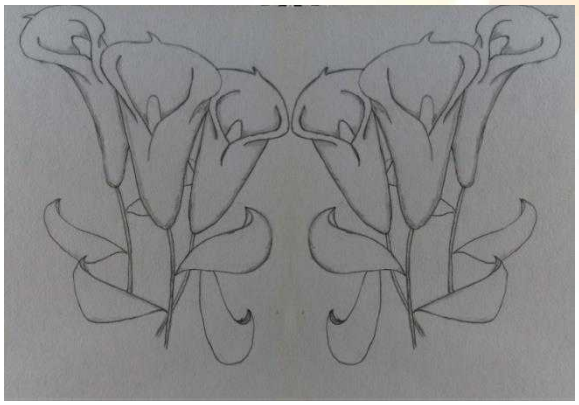


Artist: Mark Ju
Title: Water Jug
LEAD-Safety Message: Use lead free paint to have a beautiful and safe painting.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 15 years
URL: https://volcanoartprize.com/portfolio-item/water-jug/

Artist: Mark Ju
Title: Flower vase
LEAD-Safety Message: From oils to acrylics to watercolors, some paints contain toxic chemicals that are potentially harmful to humans and the environment.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 15 years
URL: https://volcanoartprize.com/portfolio-item/flower-vase/

Artist: Dheeran Nagesh
Title: Handprints.
Lead-Safety Message: Use lead-free water colour to have a safe and fun filled childhood. Thank you Lead Group for making everyone's lives safer.
Description of work: Watercolour
Age: 21 months
URL: https://volcanoartprize.com/portfolio-item/handprints/

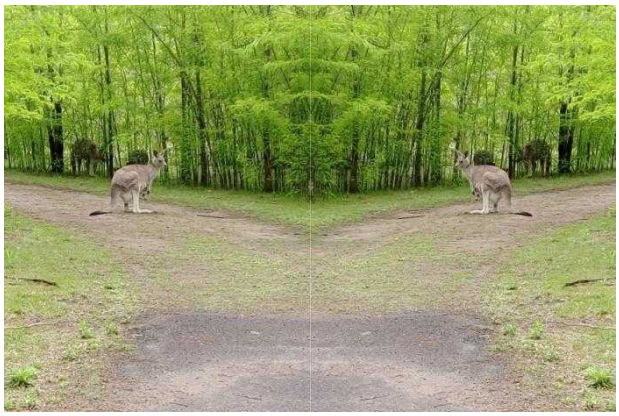
Artist: Poornima Murthy
Title: White Tulips.
Lead-Safety Message: With more than 100 species, the tulip contains several glycosides that can lead to toxicity in your horse when a portion of the plant and/or the bulb is ingested.
Description of work: HTC Phone
URL: https://volcanoartprize.com/portfolio-item/white-tulips/



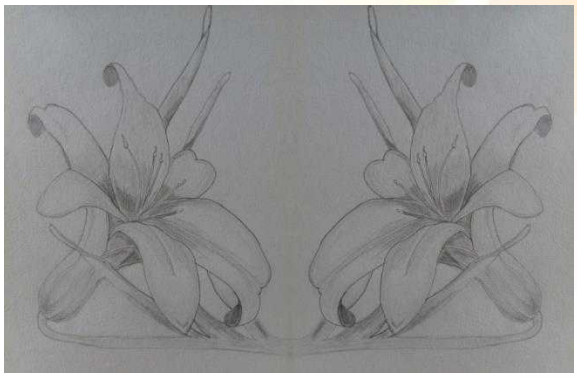
Artist: Poornima Murthy
Title: Tulips.
Lead-Safety Message: Make sure to draw using lead free pencils to have a safer world.
Description of work: Pencil
URL: https://volcanoartprize.com/portfolio-item/poornima-murthy-tulips/

Artist: Poornima Murthy
Title: Stairs to a lead free world.
Lead-Safety Message: The path to a lead free world is in our hands. Embrace it.
Description of work: HTC Phone
URL: https://volcanoartprize.com/portfolio-item/stairs-to-a-lead-free-world/

Artist: Poornima Murthy
Title: Rainbow.
Lead-Safety Message: Make the world as safe and beautiful as you want it to be.
Description of work: HTC Phone
URL: https://volcanoartprize.com/portfolio-item/rainbow/



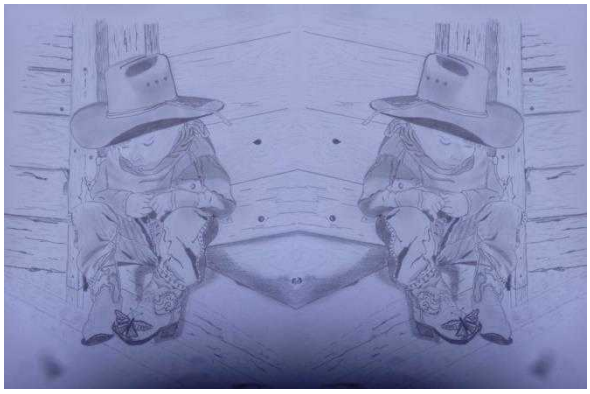
Artist: Poornima Murthy
Title: Kangaroos.
Lead-Safety Message: Wild kangaroos ought to roam free without fear of being poisoned by lead. Protect them to protect yourself.
Description of work: HTC Phone
URL: https://volcanoartprize.com/portfolio-item/kangaroos/



Artist: Poornima Murthy
Title: Flower.
Lead-Safety Message: Using lead safe pencils protects you for ages to come.
Description of work: Pencil
URL: https://volcanoartprize.com/portfolio-item/flower/

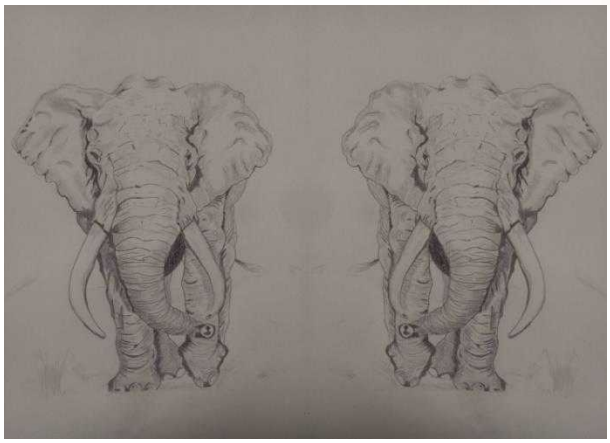
Artist: Poornima Murthy
Title: Cycling path.
Lead-Safety Message: The path to having a lead free world is long and beyond our line of sight. But if we work together and work hard, we can achieve it sooner than we think.
Description of work: HTC Phone
URL: https://volcanoartprize.com/portfolio-item/poornima-murthy-cycling-path/

Artist: Poornima Murthy
Title: Australia Day Hot Air Balloons.
Lead-Safety Message: Lead a free life up in the skies by being safe from lead and other poisons.
Description of work: HTC Phone
URL: https://volcanoartprize.com/portfolio-item/australia-day-hot-air-balloons/

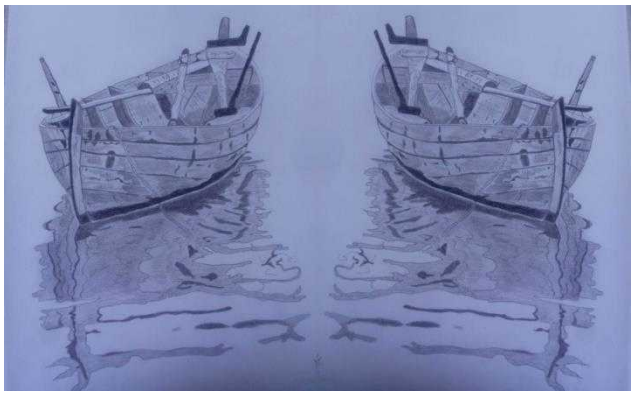


Artist: Nagesh Bala
Title: Sad boy.
Lead-Safety Message: Don't be sad. Being healthy and being safe is in our hands. Be lead free.
Description of work: Pencil
URL: https://volcanoartprize.com/portfolio-item/sad-boy/

Artist: Nagesh Bala
Title: Parrots.
Lead-Safety Message: Keep birds safe and free from lead poisoning by taking an oath to protect them.
Description of work: Pencil
URL: https://volcanoartprize.com/portfolio-item/parrots/



Artist: Nagesh Bala
Title: Elephant.
Lead-Safety Message: Several cases were observed when drought conditions enabled elephants to access grasslands adjacent to Fothergill Island. Lead poisoning has also been suggested as a cause.
Description of work: Pencil drawing
URL: https://volcanoartprize.com/portfolio-item/elephant-2/



Artist: Nagesh Bala
Title: Boat.
Lead-Safety Message: Lead dust and fumes can be generated from boats with paint containing lead that is disturbed from repairs and maintenance.
Description of work: Pencil
URL: https://volcanoartprize.com/portfolio-item/boat/

Artists: Kim Cole and Korey Nicholas

Title: Sunflowers.
Lead-Safety Message: Stand Up for Environmental Racism and victims of Lead Poisoning.

Description of work: Photograph

URL: https://volcanoartprize.com/portfolio-item/sunflowers-3/

Artists: Kim Cole and Korey Nicholas

Title: We Lead The Way Lead Poisoning Awareness Cause.
Lead-Safety Message: Black Lives Matter and How do we trust Johns Hopkins to provide America with Covid-19 research when they poisoned children of color with Lead?

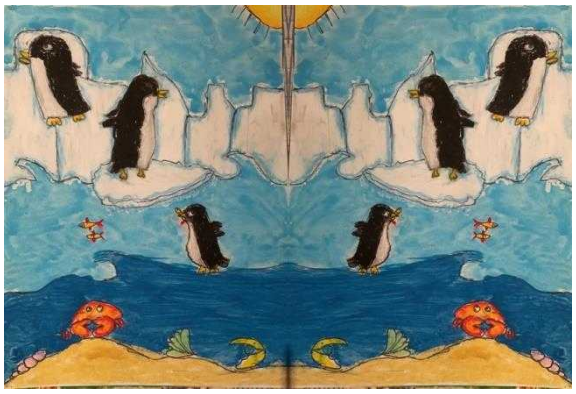
Description of Work: Photograph and Alliance For Human Research Protection

URL: https://volcanoartprize.com/portfolio-item/we-lead-the-way-lead-poisoning-awareness-cause/

Artist: Shraddha Shankar
Title: Rainbow in the Countryside
LEAD-Safety Message: Used chemical free colors
School: Homebush West Public School
Description of work: Crayons
Age: 5
URL: https://volcanoartprize.com/portfolio-item/rainbow-in-the-countryside/

Artist: Manasa Ramesh
Title: Po the Panda
LEAD-Safety Message: We don’t want to be dead, so don’t use lead.
School: Merryhill Elementary and Middle School
Description of work: Watercolour
Age: 7
URL: https://volcanoartprize.com/portfolio-item/po-the-panda/

Artist: Manasa Ramesh
Title: Birds at Sunset.
Lead-Safety Message: Birds are very sensitive to lead toxicity. Please be aware of what you give back to our planet.
School: Merryhill Elementary and Middle School
Description of work: Oil pastels and Watercolour
Age: 7
URL: https://volcanoartprize.com/portfolio-item/birds-at-sunset/



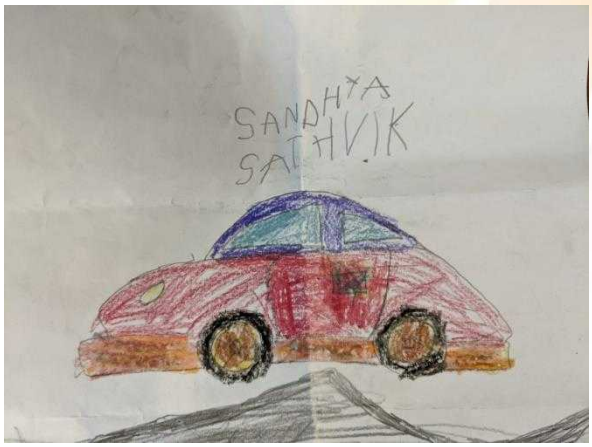
Artist: Manasa Ramesh
Title: Penguins.
Lead-Safety Message: In Omaha, Ten penguins have died of lead poisoning at the Henry Doorly Zoo, not from bullets but from eating lead pellets they confused with food.
School: Merryhill Elementary and Middle School
Description of work: Oil pastels and Watercolour
Age: 7
URL: https://volcanoartprize.com/portfolio-item/penguins/

Artist: Manasa Ramesh
Title: Seal's life.
Lead-Safety Message: Lead can harm production of blood cells and the absorption of calcium needed for strong bones and teeth, muscle movements, and the work of nerves and blood vessels.
School: Merryhill Elementary and Middle School
Description of work: Oil pastels and Watercolour
Age: 7
URL: https://volcanoartprize.com/portfolio-item/seals-life/

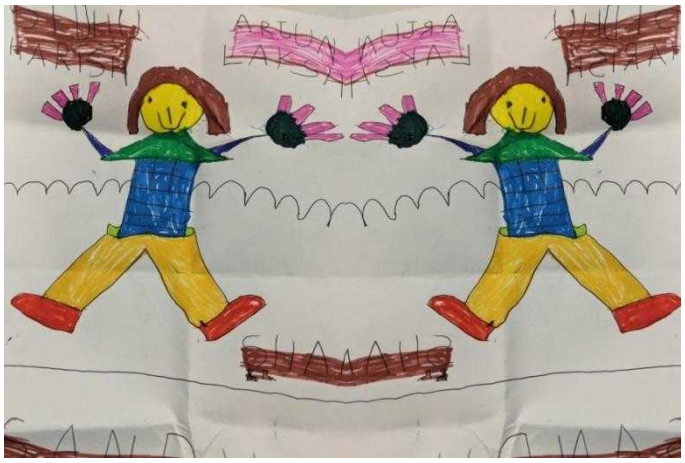
Artist: Medha Ramesh
Title: Beautiful Ducks.
Lead-Safety Message: Lead poisoning is one of the most commonly reported toxic conditions in both wild and domestic ducks. In wild ducks, it is often caused by lead shotgun pellets. Live and let live.
School: Merryhill Elementary and Middle School
Description of work: Oil pastels and Watercolour
Age: 10
URL: https://volcanoartprize.com/portfolio-item/beautiful-ducks/

Artist: Medha Ramesh
Title: Blue bird.
Lead-Safety Message: High-grade exposure is from ingestion of lead and often affects waterfowl, granivorous birds, and raptors. Unfortunately, the toxic effects of lead may be passed through the egg, resulting in chick mortality.
School: Merryhill Elementary and Middle School
Description of work: Oil pastels and Watercolour
Age: 10
URL: https://volcanoartprize.com/portfolio-item/blue-bird-2/

Artist: Medha Ramesh
Title: Lake.
Lead-Safety Message: Water does not naturally contain much lead. But untreated water can damage lead pipes, causing the toxic element to seep into a water source. It can then pick up lead as it travels elsewhere.
School: Merryhill Elementary and Middle School
Description of work: Oil pastels and Watercolour
Age: 10
URL: https://volcanoartprize.com/portfolio-item/lake/

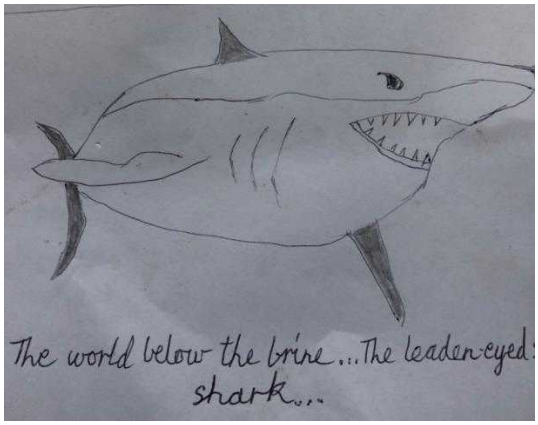


Artist: Sathvik Deepak
Title: Red Car
Lead-Safety Message: Old cars paint are high in lead and can be a health hazard. There have been cases of children suffering lead poisoning from playing in soil contaminated by auto paint dust. Please don't use lead.
School: Jollyfrog Kindergarden
Description of work: Crayon
Age: 4
URL: https://volcanoartprize.com/portfolio-item/red-car/



Artist: Sathvik Deepak
Title: Little boy.
Lead-Safety Message: Lead free boys lead a healthy life.
School: Jollyfrog Kindergarden
Description of work: Crayon
Age: 4
URL: https://volcanoartprize.com/portfolio-item/little-boy/

Artist: Siobhan Hannigan
Title: Be prepared.
Lead-Safety Message: Be aware of Pb blood levels
Description of work: Ink and mixed media
URL: https://volcanoartprize.com/portfolio-item/be-prepared/

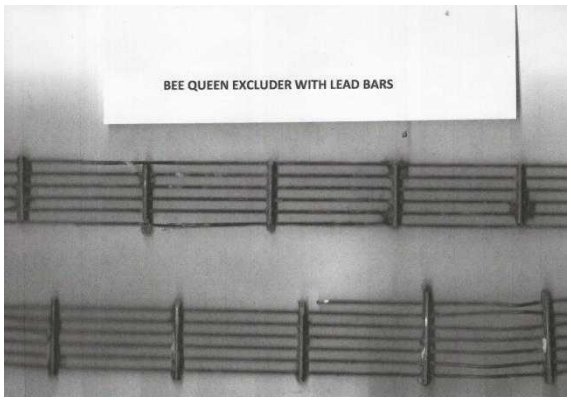


Artist: Elizabeth O'Brien
Title: The world below the brine...The leaden-eyed shark....
Lead-Safety Message: Great White Sharks Have Toxic Levels Of Mercury, Arsenic And Lead In Their Blood- it's likely if we eat the same fish that sharks eat, we'll be poisoned too!
Description of Work: Title from Walt Whitman's "Leaves of Grass" poem. Lead pencil and pen drawing.
URL: https://volcanoartprize.com/portfolio-item/the-world-below-the-brine-the-leaden-eyed-shark/

Artist: Nandini Tilak
Title: Fruit picking
Lead-Safety Message: You too can go fruit picking with your best friend if you lead a lead free and healthy life.
School: Westmead Christian Grammar School
Description of work: Colour pencils
Age: 5
URL: https://volcanoartprize.com/portfolio-item/fruit-picking/

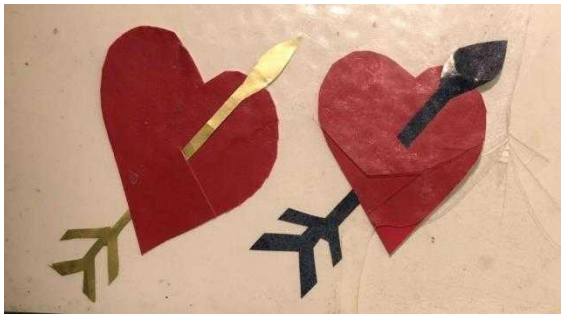
Artist: Angela Kozaitis
Title: For the children
Lead-Safety Message: Keep the place clean from dust containing lead.
Description of work: Photo
Age: 7
URL: https://volcanoartprize.com/portfolio-item/for-the-children/

Artist: Elizabeth O'Brien
Title: Bondi Beach sewage-free but what about the sea? .
Lead-Safety Message: Between 1990 and 1992, deep ocean outfalls were built to discharge potentially lead-contaminated sewage several kilometres off shore.
Description of Work: IPhone 8 panorama
URL: https://volcanoartprize.com/portfolio-item/bondi-beach-sewage-free-but-what-about-the-sea/



Artist: Dr Michael Hindmarsh
Title: Bee Queen Excluder with Lead Bars.
Lead-Safety Message: This Excluder enables the worker bees to enter the Hive but forces the Queen Bee to remain @ Home & Not Allow the colony to Swarm Away WITH HER HIGHNESS! But who wants LEAD FLAVOURED HONEY????
Description of Work: The Queen Bee Excluder goes on the front of the bee hive where the guard bees loiter and the worker bees come and go through the bars. Like cattle or children, bees may develop a taste for lead and lick it
URL: https://volcanoartprize.com/portfolio-item/bee-queen-excluder-with-lead-bars/

Artist: Emidori Lum
Title: Lum Toucan
LEAD-Safety Message: Wildlife being wild and free from lead as it's meant to be.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 12 years
URL: https://volcanoartprize.com/portfolio-item/toucans/



Artist: Elizabeth O'Brien
Title: Cupid's gold and lead arrows.
Lead-Safety Message: Bronwen Wickkiser says that in Ovid's version of the myth, Cupid's shiny, sharp, golden arrow arouses desire, but his dull lead arrow blunts desire and slows the limbs to prevent pregnancy, in magical bindings, and the metal of choice for curse tablets and sling bullets is lead
Description of Work: Cut paper and alfoil snack wraps on cardboard under clear plastic.
URL: https://volcanoartprize.com/portfolio-item/cupids-gold-and-lead-arrows/

Artist: Elizabeth O'Brien
Title: Mojave Desert Aircraft Graveyard.
Lead-Safety Message: Leaded aviation paint falls from old planes onto this California desert, including from Australian Boeing 747s. Why aren't planes made to be recycled?
Description of Work: Google Earth Image from Google Earth
URL: https://volcanoartprize.com/portfolio-item/mojave-desert-aircraft-graveyard/

Artist: Chelsea Woollett
Title: Plants can deal with lead, but animals can't.
LEAD-Safety Message: Plants can deal with lead, but animals and humans cannot!
School: Burwood Public School
Description of work: Watercolour on canvas
Age: 10
URL: https://volcanoartprize.com/portfolio-item/plants-can-deal-with-lead-but-animals-cant/

Artist: Chelsea Woollett
Title: Lead kills fish.
Lead-Safety Message: Lead kills fish
School: Burwood Public School
Description of work: Crayon on paper
Age: 10
URL: https://volcanoartprize.com/portfolio-item/lead-kills-fish/

Artist: Claire Leight
Title: Future Perfect.
Lead-Safety Message: The "best" being a lead FREE world!
Description of Work: Photograph of Window Display
URL: https://volcanoartprize.com/portfolio-item/future-perfect/

Artist: Noela Whitton and Claire Leight

Title: Lost in the Woods.

Lead-Safety Message: I'm in the dark no longer. I see a lead safe world in the light.

Description of Work: Photo collage and oil on canvas

URL: https://volcanoartprize.com/portfolio-item/lost-in-the-woods/

Artist: Elizabeth O'Brien

Title: Is 2020 the End of Leaded Petrol?

Lead-Safety Message: The PCFV said in 2019, only Algeria still sells Leaded Petrol. Innospec in Feb 2020 still "believes" they're the only TEL producer and they expect TEL revenues to conclude in early 2020.

Description of Work: Collage of PCFV map etc from United Nations website, made using Powerpoint and Paint

URL: https://volcanoartprize.com/portfolio-item/is-2020-the-end-of-leaded-petrol/

Artist: Elizabeth O'Brien
Title: The world is cursed until TEL is banned,
Lead-Safety Message: When Tetra Ethyl Lead (TEL) is banned in Aviation Fuel as well as Motor Fuel, Earthlings will have a fighting chance of fulfilling our potential.
Description of Work: Text created in Powerpoint, on Photo of Roman curse tablet (made of lead) © Marie-Lan Nguyen / Wikimedia Commons, from
https://upload.wikimedia.org/wikipedia/commons/a/a0/Curse_tablet_BM_1934.11-5.1.jpg
URL: https://volcanoartprize.com/portfolio-item/the-world-is-cursed-until-tel-is-banned/

Artist: Elizabeth O'Brien
Title: First 3 Steps to a Lead Safe World,
Lead-Safety Message: Step 1. Ban leaded fuel. Step 2. Ban leaded paint. Step 3. Ban leaded batteries & collect & safely recycle every used lead acid battery.
Description of Work: Iphone photo
URL: https://volcanoartprize.com/portfolio-item/first-3-steps-to-a-lead-safe-world/

Artist: Dr Michael Hindmarsh

Title: Lead in AVGAS,
Lead-Safety Message: It's too late for concern about me being a Vet and a Bush Pilot over Northern Queensland spreading Tetra Ethyl Lead with gay abandonment – but we MUST ban lead in aviation fuel ASAP.

Description of Work: Annotated results of websearch and image from https://everipedia-storage.s3-accelerate.amazonaws.com/NewlinkFiles/5168783/28096363.jpg?nocache=7689a5

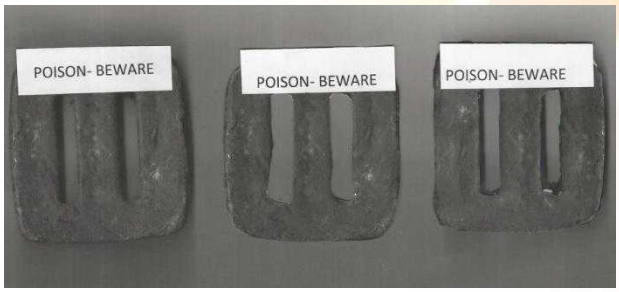
URL: https://volcanoartprize.com/portfolio-item/lead-in-avgas/

Artist: Alice Ju

Title: Cherries,
Lead-Safety Message: Cherries reduce the recycling of toxics in the body.

Description of Work: Oil on canvas. Lead Safety Message from https://lead.org.au/fs/Foods_for_Lead_Detox_A-Z_20150214.pdf

URL: https://volcanoartprize.com/portfolio-item/cherries/



Artist: Dr Michael Hindmarsh

Title: Lead Diving Belt Weights,
Lead-Safety Message: The human Body in a wet suit is buoyant therefore LEAD is a vital necessity needed for the owner to DIVE! Therefore the Management of the LEAD IS CRITICAL! Where is the Warning?

Description of Work: Photo of Lead Diving Weights with "Poison-Beware" warning labels.

URL: https://volcanoartprize.com/portfolio-item/lead-diving-belt-weights/

Artist: James Scotman

Title: Three boats at sunset,
Lead-Safety Message: The boats in the painting have been painted with Lead paint.

Description of Work: Acrylic paint on canvas board

URL: https://volcanoartprize.com/portfolio-item/three-boats-at-sunset/

Artist: Theresa Gordon

Title: Lighter and lighter. Losing the lead weight,
Lead-Safety Message: This is my feeling about what the LEAD Group has done for generations of Australian children.

Description of Work: "Balloons Spring Nature" Watercolour by Silvio Z from https://pixabay.com/illustrations/balloons-spring-nature-watercolour-1615032/

URL: https://volcanoartprize.com/portfolio-item/lighter-and-lighter-losing-the-lead-weight/

Artist: Claire Leight

Title: Lead in Limoges?
Lead-Safety Message: Don't eat off just anything, check the possibility of lead content first.

Description of Work: photo collage

URL: https://volcanoartprize.com/portfolio-item/lead-in-limoges/

Artist: Elizabeth O'Brien

Title: Is my breakfast lead poisoning me?
Lead-Safety Message: Is there too much lead in my breakfast or is the lead leaching out of my bones now that I'm 64, or both?

Description of Work: iPhone 8 photos collaged in Powerpoint

URL: https://volcanoartprize.com/portfolio-item/is-my-breakfast-lead-poisoning-me/

Before LEAD Group Kit result After LEAD Group Kit result

Artist: Jodie Arnold

Title: Through the looking glass.
Lead-Safety Message: Children are the future and they may be at risk of lead poisoning from common household objects and furniture. This beautiful rose coloured leadlight glass door on the left Through a simple dust wipe it was determined that this glass door was unsafe. The LEAD Group recommended to get the lead dust down to 12ug/m2

Description of Work: smart phone photos collaged in Powerpoint

URL: https://volcanoartprize.com/portfolio-item/through-the-looking-glass/

Artist: Michael Musenga

Title: Working to eliminate lead paint in Zambia,
Lead-Safety Message: Lead Safe Zambia by 2020

Description of Work: photo

URL: https://volcanoartprize.com/portfolio-item/working-to-eliminate-lead-paint-in-zambia/

Artist: Isla MacGregor

Title: Get the L out of K Wing,
Lead-Safety Message: New K Wing at Royal Hobart Hospital to be renamed the L Wing?? Entrance to K Block alerts about COVID-19 but not Lead in the water. What other university accommodation or tourism developments in Hobart currently under construction are using the same leaded brass plumbing

Description of Work: Smart phone photos collaged in Powerpoint

URL: https://volcanoartprize.com/portfolio-item/get-the-l-out-of-k-wing/

Artist: Manli Chen

Title: Leadlight lamp and lead vase,
Lead-Safety Message: We just found out our lead light lamp and lead vase are producing lead dust, and poisoning us. We need to have a lead blood test.

Description of Work: photo

URL: https://volcanoartprize.com/portfolio-item/leadlight-lamp-and-lead-vase/

Artists: Natalia, Jeremiah, Juan

Title: Lead Neurological Damage

LEAD-Safety Message: Lead in our soil is a big issue, and can cause neurological damage

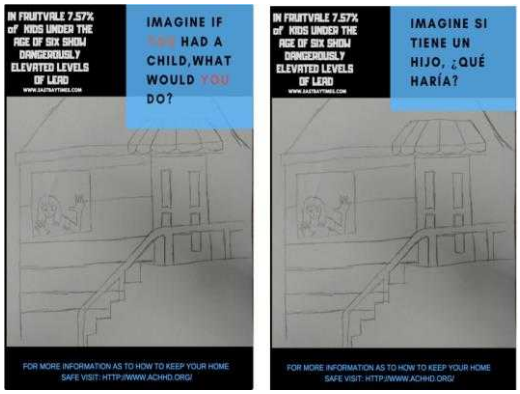
School: ASCEND TK-8 School in Oakland's Fruitvale District, California, USA

Description of work: brochure

Age: 15

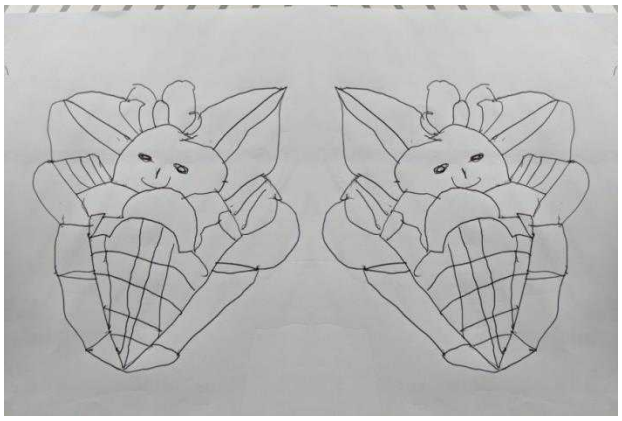
URL: https://volcanoartprize.com/portfolio-item/lead-neurological-damage/

Artists: Ramses, Dahiana, Jamie
Title: Lead = Dead / Plomo = Muerto.
Lead-Safety Message: Lead is prevalent in the soil of Oakland neighborhoods
School: ASCEND TK-8 School in Oakland's Fruitvale District, California, USA
Description of work: brochure
Age: 15
URL: https://volcanoartprize.com/portfolio-item/lead-dead-plomo-muerto/

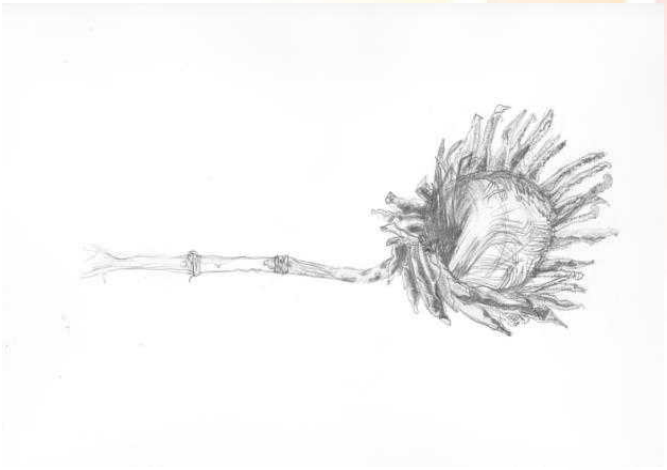


Artists: Yurayma, Chris, Brian
Title: In Fruitvale 7.57% of Kids under 6 Show Elevated Blood Lead.
Lead-Safety Message: The incidence of elevated levels of lead is very high in our neighbourhood, and we made this poster to teach people about this issue
School: ASCEND TK-8 School in Oakland's Fruitvale District, California, USA
Description of work: brochure
Age: 15
URL: https://volcanoartprize.com/portfolio-item/in-fruitvale-7-57-of-kids-under-6-show-elevated-blood-lead/

Artists: Jenny, Edgar, Melanie
Title: These Candies May Have Lead
Lead-Safety Message: Many candies that we all enjoy actually have been found to have lead in them, we learned this from Alameda County Healthy Homes, and thought more people should know
School: ASCEND TK-8 School in Oakland's Fruitvale District, California, USA
Description of work: brochure
Age: 15
URL: https://volcanoartprize.com/portfolio-item/these-candies-may-have-lead/



Artists: Sathvik Deepak
Title: Caterpillar
Lead-Safety Message: Lead can affect the smallest of creatures. Please don't use lead.
School: Jollyfrog Kindergarden
Description of work: pencil
Age: 4
URL: https://volcanoartprize.com/portfolio-item/caterpillar/



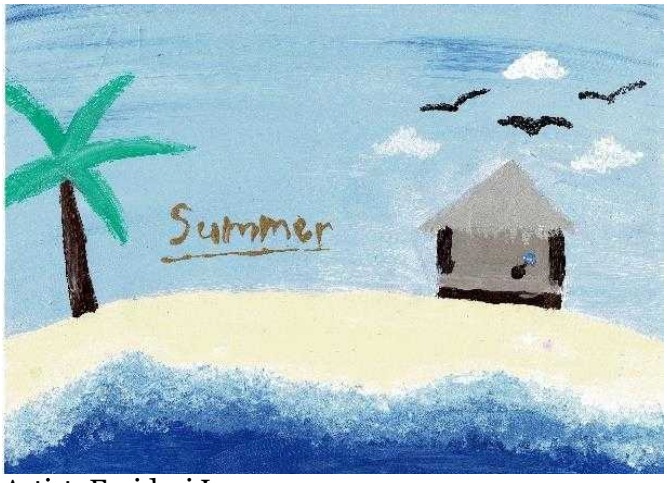
Artist: April-Kaye Ikinci

Title: Covid 19 slow drawing: protea.

Lead-Safety Message: This drawing was interrupted because Lead disrupted my life and put my whole life's work at risk.

Description of work: pencil drawing on paper

URL: https://volcanoartprize.com/portfolio-item/covid-19-slow-drawing-protea/



Artist: Emidori Lum
Title: Summer Sun Shine
LEAD-Safety Message: A safe and lead-free beach is perfect for our earth. Take an oath to keep our beaches and nature safe.
School: Creative Einstein
Description of work: Colour pencil drawing / lead pencil drawing
Age: 12 years
URL: https://volcanoartprize.com/portfolio-item/summer-sun-shine/

Citizen Science Project - LeadSafe Vs Sugarsoap for Cleanup after Lead Paint Removal

By Elizabeth O'Brien, Lead Scientist and Lead Advisor, The LEAD Group Inc, Australia

A LEAD Group Kit customer kindly agreed to become a "citizen scientist" during the COVID-19 lockdown in Australia, by using dust wipes from his LEAD Group Kits to sample dust from surfaces in his vacant 1940's home after paint stripping (by a contractor using Heritage No. 1 stripper), in order to determine the cleaning solution which makes surfaces most lead-safe for a baby to move in. I have summarised the tentative findings below.

Disclaimer: this project was not carried out in a lab where one could have controlled the lead loading (micrograms of lead per metre squared of surface, or ug/m2) for all areas cleaned, so there's no way for sure we can know that the 30cm x 30cm wipe areas (despite being chosen for looking similar and even alongside one another) actually had the same lead loading before cleaning.

Aim: to determine at before and during cleanup (following lead paint stripping with a chemical stripper), whether detergent was more effective than water alone, and which of two detergents being trialled was more effective at reducing the lead loading, so that that detergent could be used for the remainder of the cleanup.

Method: noting that LeadSafe detergent costs (by volume) approximately 4 times more than Liquid Sugarsoap, and that the recommended lead cleanup method is the Three Bucket Cleaning System*, the citizen scientist followed the LEAD Group Kit dust wipe sampling instructions (which are based on the Australian New Zealand Standard AS/NZS 4361.2:1998 "Guide to Lead Paint Management) to collect dust wipe samples (wearing the lead-free gloves and using the Ghost Wipes and laboratory-grade sampling containers that come in the Kit) from an area that was consistently 900cm² (either 30 cm x 30 cm or 15 cm x 60 cm). He first sampled dust wipes on some stained or oiled reclaimed timber which looked in quite variable condition, post paint stripping and pre- and post-wipe down by the paint removal contractor, but before cleaning, to get a baseline lead loading, and sent these off to the lab for urgent analysis before the cleaning contractors arrived to start the HEPA vacuuming and wet-cleaning. A dust wipe from one wall was sampled because it was made of the same reclaimed stained or oiled timber as the lounge floor, but of course would have had no track-in or fall-out dust.

Baseline Results:

Timber feature wall made from reclaimed wood.	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition (wiped down)	25ug/m2

Lounge room Timber floor (reclaimed wood) Centre of room, under metalwork with lead paint (post paint stripping)	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition (wiped down)	63ug/m2
Lounge room Timber floor (reclaimed wood) Centre of room, under metalwork with lead paint (post paint stripping)	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition (not wiped down)	190ug/m2

Method (continued): Then two similar areas of the lounge timber floor and corridor polished concrete floor were cleaned by first HEPA vacuuming then following the Three Bucket Cleaning System and using the concentration recommended on the container for both Fiberlock Lead Safe Lead Dust Cleaner ("Leadsafe") and Selley's Liquid Sugarsoap ("Sugarsoap").

Results:

Lounge Timber floor cleaned with "Leadsafe"	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition	64ug/m2
Lounge Timber floor cleaned with "Sugarsoap"	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition	170ug/m2
Corridor Concrete floor cleaned with "Leadsafe"	30cmx30cm wipe. Polished concrete	72ug/m2
Corridor Concrete floor cleaned with "Sugarsoap"	30cmx30cm wipe. Polished concrete	145ug/m2

Method (Modification One): The following day, realizing that water alone may be doing a lot of the lead removal, our citizen scientist collected three dust wipe samples in each area of the home, one cleaned only with water in the Three Buckets, one with Leadsafe and one with Liquid Sugarsoap, but having found online that the Australian federal Environment department recommended Sugarsoap be used at four times the concentration listed on the Selley's Liquid Sugarsoap detergent container, for lead paint cleanup, he used the Sugarsoap this time at the "correct concentration" for lead cleanup. Noting the wide variation in lead dust loading results, he also began testing similar-looking surfaces within an area. Then knowing that once the family was in residence they would be using the ceiling fans that had both winter and summer modes, he thought to also test the unconventional non-child accessible surface of the "ceiling", specifically, the underside of metal roofing in areas without a ceiling void.

Results:

Dining Concrete floor cleaned with Water	30cmx30cm wipe. Polished concrete	8.0ug/m2
Dining Concrete floor cleaned with "Leadsafe"	30cmx30cm wipe. Polished concrete	7.5ug/m2
Dining Concrete floor cleaned with "Sugarsoap correct concentration"	30cmx30cm wipe. Polished concrete	0.5ug/m2

Lounge 1 Timber floor cleaned with Water	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition	160ug/m2
Lounge 1 Timber floor cleaned with "Leadsafe"	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition	210ug/m2
Lounge 1 Timber floor cleaned with "Sugarsoap correct concentration"	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition	265ug/m2

Lounge 2 Timber floor cleaned with Water	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition	100ug/m2
Lounge 2 Timber floor cleaned with "Leadsafe"	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition	68ug/m2
Lounge 2 Timber floor cleaned with "Sugarsoap correct concentration"	30cmx30cm wipe. Timber appears to be stained or oiled in past with variable condition	63ug/m2

Corridor A Concrete floor cleaned with Water	15cmx60cm wipe. Polished concrete floor	260ug/m2
Corridor A Concrete floor cleaned with "Leadsafe"	15cmx60cm wipe. Polished concrete floor	95ug/m2
Corridor A Concrete floor cleaned with "Sugarsoap correct concentration"	15cmx60cm wipe. Polished concrete floor	350ug/m2
[202003037J 09/04/2020] Corridor A Concrete floor. Near wood, floor cleaned with "Leadsafe"	15cmx60cm wipe. Polished concrete floor	510ug/m2
[202003037K 09/04/2020] Corridor A Concrete floor. Centre, floor cleaned with "Leadsafe"	30cmx30cm wipe. Polished concrete floor	2.5ug/m2
[202003037L 09/04/2020] Corridor A Concrete floor near beam, kitchen side, floor cleaned with "Leadsafe"	15cmx60cm wipe. Polished concrete floor	44ug/m2
[202003037M 09/04/2020] Corridor A Underside of Metal roof (near metal beam) "ceiling" cleaned with "Leadsafe"	15cmx60cm wipe. Sheet metal "ceiling"	320ug/m2

Method (Modification Two): Having decided to aim for his baby's blood lead level never to exceed 1 microgram per decilitre (1 ug/dl), and despite the one floor dust wipe result after cleaning with Sugarsoap where the result was the lowest that The LEAD Group has ever seen (0.5 ug/m^2) our citizen scientist collected a dust wipe after a second clean using the generally more lead-reducing Leadsafe detergent (and the Three Bucket System) and collected one floor dust wipe sample for urgent analysis at the lab before the cleaning contractor finished up, to see whether cleaning twice with Leadsafe would achieve clearance (a lead-safe home in which the family could reside), ie bring the floor dust wipe lead loading to below The LEAD Group's recommended 12ug/m^2 which is aimed at keeping a blood lead level below 1 ug/dl.

Results:

Corridor A after 2nd clean with "Leadsafe"	15cmx60cm wipe. Polished concrete	21ug/m2
Lounge Ceiling right of centre 4 after 2nd	15x60cm wipe. Underside of Zincaluminum roof	3.5ug/m2

clean with "Leadsafe"	above ceiling fan that has both Summer and Winter modes	

Method (Modification Three): Having not achieved the target lead loading of less than 12 ug/m2 with **two** Three Bucket cleans using Leadsafe on the floor, our citizen scientist collected more dust wipe samples after **three** Three Bucket cleans with Leadsafe detergent, and ensured that brushing or scouring with a soft (non-metal) scourer was vigorous enough for the detergent to form a lather.

Result:

Corridor A Ceiling Wipe near metal after 3rd clean with "Leadsafe"	15x60cm Zincaluminum roof	**2.0ug/m2**

Conclusions: Different dust wipe areas, even those that look exactly alike, can have widely variable lead dust loadings. The substrate (reclaimed oiled timber, Zincaluminum roofing, polished concrete) being sampled makes a large difference. Some (perhaps significant amount of) lead dust can be removed by repeated wiping down with water. If "Leadsafe" is used with a non-metal scourer and forms a lather, extraordinarily low lead loadings can be achieved, though several cleans may be necessary for this "clearance.

* Three Bucket Cleaning System (see below) - Reference: *Lead Safe - A Renovator's Guide To The Dangers Of Lead* (1998) - Part available online at http://web.archive.org/web/20070830233627/www.epa.nsw.gov.au/leadsafe/leadinf4.htm by the Lead Reference Centre (LRC) - a now defunct part of NSW Environment Protection Authority (EPA)

Three bucket cleaning system

You will need:

- three buckets (1 - for detergent, 2 - for clean water, 3 - for emptying used water into)
- two mops or rags, one for clean and one for dirty
- a lead specific cleaning detergent (e.g. liquid sugar soap).

Method:

1. Place mop into detergent solution, wipe area
2. Squeeze into empty bucket
3. Place second mop into clean water and wipe area and squeeze into empty bucket
4. Replace water every room or every half hour whichever comes first
5. Pour water down toilet
6. Start at top and furthest corner from door

2020 Volcano Art Prize (VAP) Entry. Title: Mother mops up lead dust while baby plays in high chair. Lead-Safety Message: When babies are crawling, floors in old houses should be wet-cleaned every other day. Artist: Rose Lennon. Aged 7. Description of Work: Pen drawing. https://volcanoartprize.com/portfolio-item/mother-mops-up-lead-dust-while-baby-plays-in-high-chair/

Is what Tamara Rubin reports on her blog "fear-mongering"?

By Justone Lead-Soldier, 27th September 2020

Background

A recent edition of LEAD Action News (v20n3, May 2020) included an article titled 'What I Have Learned About Lead - Part 1 Plumbophobia'. This elicited a "rebuttal" from Tamara Rubin titled "I don't do what I do to instill fear. I do what I do to educate, so YOU can make informed choices for your family.'

Tamara kindly gave permission for her blog post to be reprinted in LEAD Action News (v20n4, June 2020) titled (as in the original) Is the work of Lead Safe Mama Fear-Mongering? The reprint concluded (at the bottom) with a LEAD Action News Editor's Note titled: *Elizabeth O'Brien's question about negative and positive blood lead results* suggesting that blood test results would be better quantified with an actual values rather than a positive or a negative.

Tamara's response to that included ""Negative" = zero (no Lead detected) and "positive" = some amount of Lead present (some Lead detected.)" and "The outcome of encouraging testing with those "absolutes" is that likely everyone will test positive if they have an accurate test (or - unfortunately - negative if their doctor uses a test with a low threshold of 3.3 or 2.0 or 5.0 or whatever) - and accordingly everyone should be incentivized to take on the inquiry of the impact of Lead in their homes (lives, and communities)."

The reprint of Tamara's blog post in LEAD Action News (v20n4, June 2020), was followed by a short letter - initial Response to Tamara Rubin from JustOne Lead Soldier.

The rest of this article is a more complete response to Tamara's blog post.

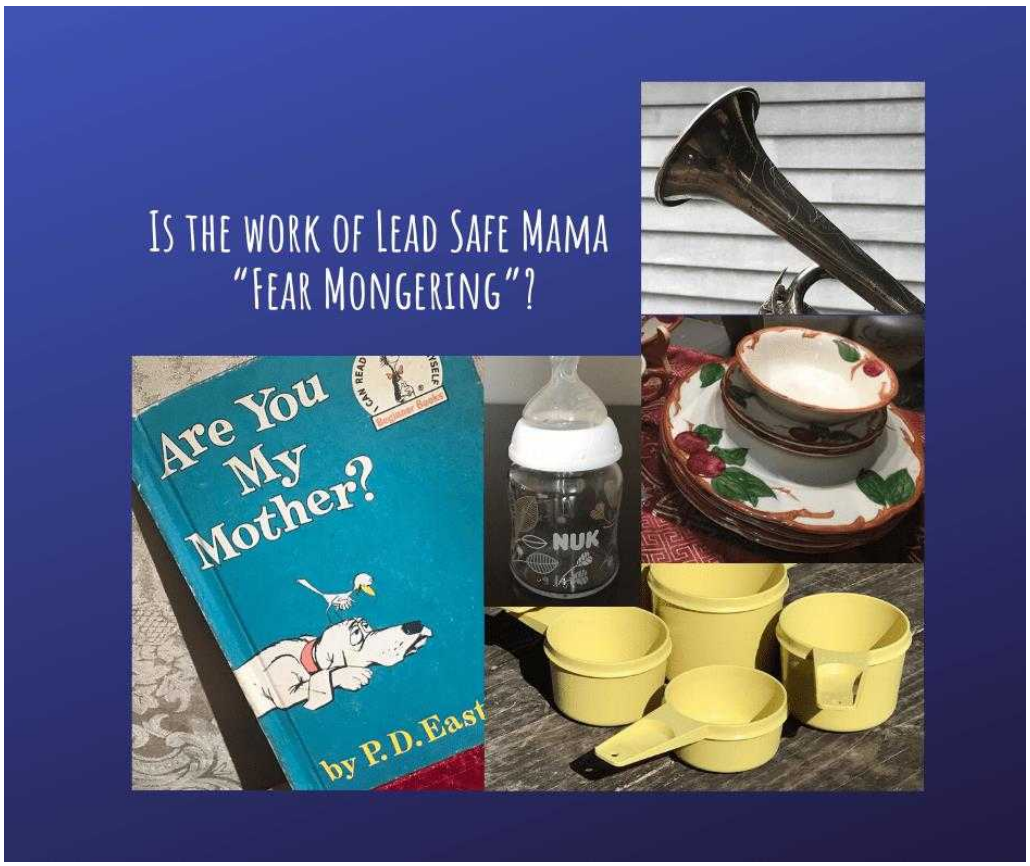
Volcano Art Prize 2018 Entry, Artist: Mark Ju. School: Creative Einstein. Title: Kitchen Still Life. Lead-Safety Message: Let's make sure our kitchen things like glass, ceramic ware and cutlery are free of lead. Description of Work: Colour pencil, age: 12. http://volcanoartprize.com/portfolio-item/kitchen-still-life/

Introduction

Anyone who is involved in lead poisoning prevention (LPP) is likely to be aware of the fantastic work done by Tamara. Since two of her sons were tragically poisoned by lead, she has been a tireless advocate despite extreme financial and legal challenges. Her work includes testing consumer items for lead and providing personal consultations for families experiencing lead threats. She also shares her findings via her blog and on Facebook creating an extremely valuable resource for those concerned with lead exposure through household objects.

This article provides opinions on the content of Tamara's "rebuttal" blog entry. If Tamara reads this I hope she takes it as respectful feedback with honest and humble suggestions on how she might improve the incredible work she does. The content of her blog is copyright and the content below us provided with the kind permission of Tamara.

The blog entry text is shown below in black with headings in ***pink***. Opinions are in green.



Is what I report on this blog "fear-mongering"?

Yesterday an article was shared with me that mentioned me and my advocacy work. This blog post here, today – on my website, is by way of a rebuttal – addressing not only a few misconceptions articulated in that particular piece, but also comments and critical reactions to my work that have appeared (and reappeared) over the years.

The only mention of Tamara in the article was actually regarding harassment of lead poisoning prevention activists. This subject is not discussed in the blog entry which is a pity. It is also a pity that a link to the LEAD Action News (LAN) article is not provided to help her blog readers judge for themselves.

It seems likely that the paragraph that drew Tamara's attention is this:

"The point being that, as lead poisoning prevention advocates, we have to realise that simply warning people about lead is not good enough. We have to assess whether there really is a risk to physical health before we tell people there is lead in something and therefore imply it is dangerous. It is not whether lead is in something that matters, but whether it comes out or comes off the surface. Lead that stays where it is, is safe. For example, the battery in your car ".

Some of the responses to the article were as follows (paraphrased because they are from a private group):

Very interesting! Thank you for sharing

I have needed to read this article for years, thank you. We should know more about living with lead rather than just living in fear.

There are relative risks from various sources that we need to think about so that we are not making ourselves and our kids fearful.

I appreciate The Lead (Pb) Group. I am one of those who hear the whisper, but the scream terrifies me.

I loved reading your article.

While, as I said, this post was not written only in response to that piece from yesterday, in the piece the author contends that it is relatively useless to simply know whether or not something contains Lead. The allegation sounds reasonable enough at first glance: that simply *knowing* that any particular example of a consumer good – even a plate, mug, bowl or other dishware – "merely" *contains* Lead serves no function; that only if something has *confirmed currently leachable / bioavailable* Lead is that information of any value.

I emphatically disagree.

I actually believe the opposite. Simply knowing if something has Lead (or Mercury, or Arsenic, etc.) puts consumers in a position of power in making choices for their family and for the health of our environment.

For a new product, of a known brand, this is true. If something has no detectable lead in it, then no detectable lead can come out. What needs to be considered is that, although many items have been tested by Tamara, it is still a tiny proportion of items that have ever been made. It may also be suggested that saying that one example, or a few examples, of a type of item contains lead, puts the

consumer in a position of doubt, not power. Owners may ask:

Is my item the same?

Are older, or newer, examples OK?

Do all things of this type contain lead?

It must surely be true that if lead does not come out of a material in dangerous amounts then there is no health risk. How can Tamara disagree with that? The example given in LAN was car batteries. Would any LPP advocate recommending that everyone in the world stops getting into a car, or bus, or train, or plane because of the large amount of lead they contain? Perhaps the lead is a concern in terms of safe recycling, but not because of health concerns while in a vehicle in normal use. I should add that there could be some exceptional circumstances which cause damage or corrosion when the lead could be released and there are many strong concerns about the management of waste batteries.

Another example is a piece by Tamara titled "Could bombillas (decorated metal straws for drinking yerba mate) cause undiagnosed heavy metal poisoning in users?". Immediately that is a question, so implies there is doubt. Her sample is of two bombillas of very similar design. Readers may not feel informed about bombillas in general. There is a lot that is still not known. A much larger sample set needs to be tested before any conclusions can be made.

Above is a picture of a different bombilla and mate cup. It looks like stainless steel, but perhaps it is soldered with lead. If a reader owns a bombilla of this, or a different design, then it might be helpful if Tamara included a suggestion about what they should do? It would be great if there was some commentary about how to identify lead in a bombilla –would a LeadCheck swab be enough? Perhaps Tamara would recommend that all owners throw away all their bombillas and suggest to their family and friends that they do the same. As Tamara says there are hundreds, if not thousands, of variations available. Clearly it is not going to be possible to test them all so that consumers are fully informed. We will be left with doubt, fear and guilt.

The data that Tamara has collected about bombillas, and many other types of items, is very useful ammunition to present to governmental agencies in a campaign for tests, reports and an information scheme. I am not aware of Tamara being involved with campaigning for government action. This could multiply her findings so that many more products could be tested and many more families protected. An example is the petition launched by the Environmental Working Group.

Lead is everywhere. We cannot avoid it. It is how much, how often and for how long we are exposed that counts. Somethings contain lead, but it is released at a rate that is not dangerous. For example, decorative horse brasses on a pub wall – unless there is evidence to the contrary.

Consumers have a right to know what they are buying — particularly if the items include neurotoxic elements.

I think all consumers have a right to know if the products they buy for their home (or use every day) "merely" contain Lead (or Mercury, Arsenic, Cadmium, Antimony or any other toxic heavy metals)! Moreover, leach-testing on every single item ever made would obviously be wildly cost-prohibitive, and as a practical matter would also be impossible – but knowing if a manufactured consumer item contains (or is likely to contain) Lead or other highly neurotoxic metals (using high-precision XRF technology) is a very important piece of information that families can use to make informed choices for their household.

The word "merely" was not used in the LAN article. We may agree that leach testing every single item ever made would be impossible, but then so would XRF testing. How much would it cost to have a trained professional such as Tamara test every item in the average home? She charges a minimum of $600 for a two hour house visit. How many items could be tested in that time?

Furthermore, people will not be fully informed unless they are told of the actual risk of lead migrating from a surface into their bodies. Surely full information comes from further analysis of the rate of release of lead from a surface as well as which compounds of lead are present. Some compounds, e.g. lead phosphate, lead sulphate, (Sauve et al, 1998) are less soluble and so less bioavailable (Yan et al, 2017).

A paper by Cotter-Howell, 1996 describes how a lead phosphate (pyromorphite ($Pb_5(PO_4)_3Cl$)), which is not bioavailable, is formed in soils contaminated with lead if sufficient phosphorus is available. However, it was also found that "Pyromorphite accounted for less than 2% of the total Pb in these soils." The other 98% will be formed of other lead compounds which may, or may not, be more or less bioavailable.

Analysis by Guardian Industries Goole Ltd explains how the surface of pure lead oxidises to form lead sulphite and lead sulphate, but still retains about 10% lead carbonate which is bioavailable. This is still

a dangerous ppm, but less than would be detected by XRF analysis.

The FDA, with greater resources than Tamara, have provided the following list of ceramic items of concern, but the emphasise is that what is important is leachable lead:

https://www.accessdata.fda.gov/cms_ia/importalert_122.html

It could be said that Tamara does what she can with the tools she has. That is great and every test result she shares adds to our accumulated knowledge about the prevalence of lead in the home environment. Perhaps Tamara could consider adopting additional tools to further enhance the available data. For Tamara's speciality, this would seem to be leach testing.

Would it not be possible to do a simple leach test by exposing a suspect item to an acidic food then measuring the lead content of the food with the XRF scanner? If an XRF cannot be used in this way then it is not the right too for the job and is not providing all the information consumers need to make fully informed decisions. However, perhaps the XRF could be used for initial screening followed by leach testing.

The fact of the matter is that if we had advance knowledge that something contained 20,000 or 50,0000 — or even "only" 10,000 ppm Lead, most of us would likely *choose* to not purchase (or otherwise acquire) that particular item for use in our home. This is especially true if the item in question is something intended for *food use*, in our kitchens or dining rooms. That we (as humans) are likely to choose non-toxic options (over items with heavy metals) is even more likely when you consider how many *non*-toxic / Lead-*free* options are out there [and surprisingly, that in most cases the Lead-free options are also often the *least-expensive options*!]

Tamara should be congratulated for the work does to identify as many new branded items that contain toxins as possible. There is no good reason why toxic substances are used so we must all hope that Tamara is willing and able to continue to do this with the same fervour for many years to come.

What may need to be considered is what message Tamara's reports send to people who already own an item that has been tested – or perhaps a similar item. They may infer that they have been poisoning themselves, their family and friends. This could cause considerable anxiety even when there is actually no risk of lead migrating from the item in dangerous amounts, in normal use.

Tamara addresses this question in her article "What should I do with my Lead-contaminated dishes? To Toss or Not To Toss?"

Here she talks about bio-available lead, but does not make this distinction in her product reports - which would be useful. However, the article contains the statement "I don't have a definitive answer for you".

Would others agree that number that really matters is whether any member of the household has an elevated lead level? If children, in particular, are screened for lead then the services Tamara provides can be very useful in identifying which items in the home could be causing the exposure. This could be supplemented by dust tests to give more information about the lead loading in the home. It might possible for Tamara to analyse dust wipe samples using her XRF scanner as described in this EPA report.

Giving people ***access to information*** regarding the historic (or current) use of toxicants in the manufacture of particular consumer goods does not, by default, automatically incite or encourage ***fear***. I do acknowledge that ***some*** people are fearful – over many things. Some people are ignorant, misinformed, confused or overwhelmed; others have been traumatized, and may have developed [diagnosed or un-diagnosed] *OCD* over their fear of the toxicants in our world. That does not – ***must not*** – trump the importance of disclosing toxicants [***still***] widely used in the manufacturing of consumer products (or prevalent in family heirlooms we may use daily.)

Readers must agree that disclosing toxins used in currently available goods is really valuable. What could extend this value is some understanding of the prevalence of contaminated items. Everything untested may contain dangerous levels of lead, but if we had some idea of the likelihood of encountering the items, then Tamara's readers could feel even more informed.

Few people are doing this work

Given *no public agency* is looking at many categories of these currently -manufactured products commonly found in our homes [not to mention, *vintage* products] I contend the work I do *is* of value — because it provides specific information to families that no one else is providing (again – so they can make their own *informed choices, based on scientifically replicable accurate data*).

It should be possible to take an additional point of view. Tamara seems to work bottom up, whereas there can also be a top down approach. At a micro level it is true that a family can informed about the objects they own, or are considering buying. This is very valuable to them. However, it does not help other readers to decide whether all the dishes in their cupboard are safe or not. Or all the other items that they use. Or all the other items used by everyone in the world. Proving data about specific items or to specific family about their home is a great service, but Tamara can only do a limited amount of this work. Everyone else is left in doubt.

It is also important to focus on persuading governments to invest in the public agencies to do more testing, more screening as well as improve regulations and enforce them. That way we protect many more people from many more possibly dangerous products.

I am very careful with language in all of my posts and work hard at *not* indulging in *sensational* posts *or click-bait headlines*, nor any *needlessly alarming, or exaggerated statements* on my blog. It is very important to me that the information I share is *simple*, *factual* and consistently

science-based (and that all consumer goods test results reported are replicable.)

It could be agreed that Tamara's reporting is factual, but perhaps in the style of a magazine rather than of a scientific research journal. The reports are of case studies rather than statistical sampling. This is excellent if it makes the information more accessible. However, we may observe that Tamara's headlines and content are often questions, e.g."Does vintage and new functional pottery and dishware have unsafe levels of lead? Why is that a problem?". That sounds alarming and the article continue to ask more questions and gives anecdotal information. More questions mean more doubt and doubt leads to fear. Perhaps it is not responsible to ask a question of the general public unless an answer is available.

There are only a few specific types (or *brands*) of products that I consider *inherently very unsafe* [because of their function and usage in a typical home, and risk of consequent (possibly *chronic)* exposure to the toxicants used]. In those few cases, I endeavor to be clear and explicit about my concerns with these products. [Some examples of more concerning products: *all Franciscan Potteries china*, *colorful vintage Pyrex bowls, and pre-2010* Tupperware.]

This a good start and perhaps all that can be said, but the reader may still be left with doubt. How colourful, how old is vintage, how can I tell the age?

I am not fear-mongering

Most of my readers (this includes more than 1,948,000 readers in 2019 alone – in more than 200 countries) do *not* react to what I write with *fear*. *Most* read the words without "reading between the lines" (*looking* for – i.e. *making up* – some kind of "tacit" meaning beyond my words) and most use the information provided to make informed choices.

How does Tamara know this? What is seen in "The Lead(Pb) Group" on Facebook is many people asking questions. Tamara provides a fantastically valuable service to those families she visits and to those considering buying specific products. For the rest there is just doubt.

Here are some recent sample comments from The Lead (Pb) Group on Facebook:

"Do I need to worry if it is leaded?"

"How do you home test broken tile and jewelry?"

"Am I crazy for freaking out?!"

"I sometimes feel like I am failing my daughter"

"What does this equate to in ppb leaching? "

"This is so overwhelming!"

"feel like I've lived reckless life"

"so I've poisoned my family."

"so where are the issues? if it breaks ? or more ?? is it the color? or the entire exterior? to what degree does it come off? or is it encased?"

"Holy crap."

"Hmmmm nothing is safe ?"

"It is every where."

"How nervous should I be? "

Also, on Tarama's web site is a dialogue titled "Stop using your vintage Tupperware NOW. These measuring cups are positive for 2,103 ppm Lead + 250 ppm Arsenic."

Tamara speaks from a position of apparent authority and tells us to stop using Tupperware now, but without evidence that Tupperware can actually cause harm in normal use. Some of the comments reflect the uncertainty and fear this generates:

you have no idea how upset I am.

If it's vintage, it's likely to be leaded

so how do these metals get shed from the plastic and in what amounts over what period of time? Unless we know this, we know nothing is dangerous yet

I just don't see the extreme caution this has been made

The levels of various heavy metals in plastic mean little or nothing on their own. You need to know what RELEASES those metals into food and at what levels.

Where would you dispose of these things?

Please do not forget the Green, Red, Blue as well. Please provide lech rates for each as well If it does not come out of suspension it is not a hazard.

Before we scare people maybe we should suggest they get themselves tested for lead first.

She is monetizing fear.

Ok, I want to know…if I measure out 1 cup of sugar from one of these Tupperware measuring cups, how much of the lead and how much of the arsenic is transferred to that cup of sugar?

So here you are posting this huge post putting the fear of God into everybody who has any Tupperware

What do you consider vintage? Is it from 20 years ago? Is it from 40 years ago? Is it from 30 years ago? You don't specify so now everybody is panicking and doesn't know what to do.

Um, I dont cook with my measuring cups? So wheres the harm??

If they're hazardous where are we supposed to dispose of them??

Could you allow various liquids like water and vinegar to sit in the cup for 5 or 10 minutes and see if the liquid leaches?

It may not be going too far to suggest those comments represent doubt, fear or guilt. That is not to say that this information should not be shared. It is frightening, lead exposure is definitely something to be feared, but it also needs to be qualified when it is not known how much lead comes out of these items in question in normal use. The point being that some of these people are in fear of lead in their lives when there may actually be no dangerous levels of lead exposure.

Anxiety is a useful response, but when information is not complete, anxiety can be uncontrolled and cause lots of problems in itself as described in the LAN article. The fear of lead can be worse than the lead itself.

Beyond any possible direct health risks or concerns (for the end user of any given product), there are also legitimate environmental issues surrounding the mining, refining, and use of toxic heavy metals in consumer products. But any "*fear*" / *hysteria* around this information is counter-productive – and arises in the individual reader – in that person's unintended *interpretation or inappropriate response* to the posting of the simple routine *factual scientific test results* I publish [*normally* shared intentionally *devoid of any emotional charge* and always shared without *baseless allegations or assertions*.]

With so many readers of Tamara's work it might be suggested there is some responsibility on her, as the author, to manage the response to ensure that it is not unintended. Asking emotive questions such as "How toxic is YOUR 2019 Starbucks Christmas mug?" could cause anxiety. The 40 ppm Cd limit mentioned refers to products intended for children. Whether 40 ppm is safe or dangerous for any one product is not known. What is safe must surely vary by material and usage.

Lead is incontrovertibly toxic – in extremely small amounts / at very low exposure levels. This is a fact.

If the presence of Lead were not *inherently problematic at even very low levels,* the information shared on this blog might arguably *not* be valuable or relevant information. However, the mere *presence of any Lead in a child's environment* has been well-documented to be inherently problematic — at *remarkably* low levels [so low that after researchers reached the consensus that there is *no known "low threshold of toxicity" for Lead,* our public health agencies in the U.S. and internationally eventually acknowledged this fact, *and officially and universally moved to include the language that "there is no safe level of Lead exposure"*].

Many sources do use the "no safe level" wording. Others make it clear that there is no known safe level. For example,

"No safe blood lead level in children has been identified." CDC

"According to the WHO, there is no known safe level of lead exposure." UNICEF

Even in pre-industrial times, the background blood lead concentration was 0.016 ug/dL. The earth's crust is 14ppm lead. If there is no safe level then we have never been safe, and can never be safe. "No safe level" may be interpreted as "only dangerous levels". Lead-free is unachievable, so it may be said we should promote an acceptable level of lead exposure. It could be that this is where the health impacts are so rare or slight that they are less prevalent than other threats. Deal with the worst first and the least last.

Perhaps there should be some reassurance in Tamara's work that it is possible to survive and thrive in a world contaminated by lead, and many other things.

If you are blasé about newly-manufactured consumer goods that contain *high* levels of Lead (Leaded brass, Lead fishing weights, Lead crystal) then *your focus is too narrow*. If you don't have any concern for Lead in products of these types at the levels typically found (because as-of-yet no one has "proven to *you*" the impact to the end user for these products), then you are obviously *not looking at the bigger picture.*

It could be said that biggest picture is the population impact of lead exposure. The geometric mean in the USA in 2015/16 was 0.82 µg/dL. By Tamara's definition, all blood lead results are positive (ie above zero), because a negative result (=zero) is impossible to receive from any pathology lab in the world. The best result you can ever get is <0.17 µg/dL from the best US laboratory. So, everyone in the world has a positive blood lead result or is lead poisoned according to Tamara – yet a good public health campaign really needs to focus and give priority to those people with the highest blood lead levels and those lead sources which are poisoning the most people or the most sensitive people in the population.

Lead fishing weights and ammunition aside (which are a risk to wildlife), if commonplace items such as leaded brass and lead crystal are dangerous in normal use then they should be banned. An explanation as to why they have not been banned could be that although items such as these have an unacceptable amount of lead ppm this is not released in sufficient amounts to cause widespread elevation of blood lead concentration. Knowing the numerator is informative, but the denominator also matters. 90ppm is 90 µg in a g, but suppose we only have one mg of lead containing material released from a surface, perhaps in dust. Then there is only .09 µg of lead present. Is that enough to be dangerous?

Consider lead in keys as reported on Tamara's web site (Typical American house key: 12,800 ppm Lead. Don't let kids (especially babies) play with real keys!)

An average key weighs around 10g. There are a million µg in a g, so at 12,800 ppm, as found by Tamara, or 1.28%, the key would contain 128,000µg of lead.

Keys last a long time and only show little wear over time. It could be assumed that in 10 years a key might loose 5% of its weight. Based on that, we can estimate the maximum lead exposure as follows - assuming all the released lead was available to be ingested or inhaled and not lost in locks, pockets, purses, etc.

Assumption	Value	Units	Result
Weight of a key	10	g	10g
Percentage lead	1.28	%	128,000 µg Pb
Loss over 10 years	5	%	6,400 µg Pb
Days in 10 years	3653	Days	1.75 µg Pb day^{-1}
Ingested and absorbed	20	%	0.25 µg Pb day^{-1}

It seems that children can excrete 30 µg lead per day (Winecker et al, 2002). The FDA also set a daily Interim Reference Level limit of 3 µg for children (FDA, 2020) which is "set nearly ten-times less than the actual amount of lead intake from food that would be required to reach the CDC's blood reference level".

We may not feel comfortable giving a toddler brass keys to play with, but could we question if this would really be too cautious. It seems unlikely that a child would be sucking on a key all the time, but, on the other hand, it could be several keys at once.

We need some actual facts about how much lead is released from keys before we raise the alarm and make people guilty about their prior behaviour.

There's a bigger picture here, the planet.

The bigger picture is the concern for the *entire lifecycle* of any product that incorporates high amounts of Lead — and the very real risks to many people all along *the supply chain.* This includes risks to the miners that mine the Lead (and other toxicants) for the raw materials for these products, risk to the workers that make the products, and perhaps most important – the impact on the human habitat. The larger environmental impacts range from the *highly toxic waste* produced in mining and refining of Lead; to global pollution from emissions generated through manufacturing Leaded products; and ultimately including the issues created at the end-of-life for Lead-containing products with disposal (and even the potential contamination of the manufacturing chain for recycled goods.)

The world does not revolve simply around any one of us. If the air we breathe and the water we drink and the soil we grow our crops in are *fundamentally contaminated* with Lead from manufacturing, mining, refining, use, and reclaiming or disposal of Leaded products – we – as stewards of the Earth – bear *responsibility* for those contaminations, too.

Of course, we should use non-toxic substances or employ safe practices for their acquisition, manufacture, use and disposal. That is unless, the cost of those practices causes more damage than they solve. Right now we could not simply dispose of and replace all the lead containing material in the human world without causing an environmental, social and economic catastrophe. What we need to is manage and mitigate the risk focussing on where the biggest benefit can be found for the costs incurred – as stated in the next section regarding lead paint in older housing.

"OCD" or not?

While the biggest human impact problem (when it comes to Lead) is, first-and-foremost *Lead-contaminated dust in older housing and other buildings that were historically painted with Lead paint*, being concerned about the very real additional presence and impact of Lead in *consumer goods* is not "OCD".

If the still-largely-unstudied/undetermined specific impact of *lower and lower* levels of exposure were not a concern, public health agencies across the globe would *not* have set the toxicity level for Lead in consumer goods at *90 to 100 parts per million*. Consumer goods have the potential to cause harm at very low levels. This is why these government standards have been set. However it is well beyond the capacity of any government to test all things for safety.

In the absence of the government testing of all things – just because something has not yet been proven to be harmful, does not mean it is safe. And thus people like me play a role in nudging scientific research and public policy along in the right direction, shifting public concern in a way that encourages scientists to do further study. To wit – years after activists (including me) began testing and reporting unsafe levels of Lead in *coffee mugs*, a formal study was done concluding that this was actually a problem. Years after activists (including me) began reporting unsafe levels of Lead in *vintage plastic toys*, two formal study were undertaken, concluding this was actually a problem. Years after activists (including me) began reporting unsafe levels of Lead in the *painted decorations of functional (relatively modern) glassware*, a study was done (in England), concluding this was actually a problem. I am actually just about to publish some new groundbreaking findings about Lead in vintage books and I expect these findings (which are scientifically replicable) will likely precipitate further study by a scientific body. (*I will post that link here as soon as it is published.*)

It is very important to keep nudging. Governments will need to be given examples with hard evidence. To label this as "OCD" would seem to be quite wrong.

What may need to be considered is what impact incomplete information will have one those suffering with OCD or other mental health conditions such as panic attacks, anxiety and depression. It is ironic that lead is associated with these conditions (Bouchard et all, 2009, Rueben et al 2018). It seems that lead gets at us in two ways. It makes us susceptible to worry, then gives us something to worry about.

Surely, we should only worry people when we are sure that normal use of a lead containing item will cause harm, because the harm from the damage to mental health could be worse than the harm from the lead itself.

Someone has to start the conversation

To those cynics who may be resistant to accepting "new" scientific information — tending to remain *highly skeptical* until such information is *widely acknowledged at a cultural level:* in every field there must be early pioneers.

Just because someone is a pioneer in reporting seemingly "*new*" facts or "*new*" concerns does not *invalidate* those concerns (just be patient…there's always a lag between a first discovery, subsequent related *scientific findings* and *popular knowledge*). [*Let's see how the timeline plays out with my new findings around vintage books!]*

It might said that Tamara's "rebuttal" suggests that she is also not receptive to conversations on new ideas and responds as though alternative views are an attack on her work. We might hope that Tamara can accept that no one knows it all and no one can do it all. Those campaigning for more action on lead poisoning prevention should be willing to learn from each other.

Learning about Lead in household goods is a great introduction (to the larger Lead issue) for new moms

In addition to all of the above considerations, some conversations (like the concern for Lead in dishware) happen to be a great introduction to the subject of the concerns for Lead in our environment (overall). *Everyone* has *dishes*. *Everyone* also has (or had) a *mother* and a *grandmother* — and therefore *everyone* (or nearly everyone) has had interaction with potentially high-Lead *dishes from past generations*.

While I have worked with many families who were actually *poisoned* by their toxic *dishes,* in the scope of things, I don't in fact see this as a *primary* threat (statistically, relative to other sources of Lead exposure), but I do see the topic of Lead in consumer goods as a impactful "*gateway* " / *introduction, introducing young families* to the concerns for Lead exposure as it relates to them and their lives (especially impactful for young parents who have not previously thought of Lead-poisoning as potentially "*their*" problem.)

If parents become aware about the potential for Lead in their dishes (whether or not their dishes might contribute to a child's specific blood lead level) they may get their child tested. If their child is tested and is negative for Lead – great! If their child gets tested and is positive for Lead in their blood the parents will likely start looking around their home for other exposure sources (including sources of Lead dust from deteriorating paint.) With the limited resources available today to combat childhood Lead poisoning, anything encouraging an increase in childhood blood Lead testing is a step forward.

This make sense and seems like a good approach. Tamara has developed the credibility to be listened to. Perhaps she could have a much greater impact if she spoke to governments as well as individuals.

Tamara should also consider that she has an international readership. While blood test for appears to be routine in the USA, and in some states mandatory, this is not the same here in the UK. The rest of the world can look to the USA to be the leader in LPP.

Young parents don't want to think of their house as toxic. It is too confronting.

Most families are reluctant to explore the potential concern of Lead paint in their homes. The financial liability of that inquiry is too much to bear, both in the short and long term. However examining the

concern for Lead in consumer goods is a manageable task (dishes, to continue the example above – are inexpensive and easy to replace with modern Lead-free alternatives.) Exploring the concern for Lead in consumer goods is a path to helping families discover an issue (and learn how it may or may not relate to their family) in a way that is less confronting (and less expensive) than testing their entire home – and therefore it has value.

Lead is *everyone's* problem — and the age-old conundrum is: how do we get everyone to see this? We are fighting against *more than a century* of marketing efforts by the Lead industry – marketing efforts designed to make us numb to the concern for Lead; marketing efforts specifically designed to make us think "this is not *my* problem, this is *someone else's* problem." By introducing people to the FACT that there is *Lead* in *their* dishware – you are opening their minds to the FACT that this is everyone's problem, and that we all should consider the value of getting Lead out of our homes and environments.

It is true that lead in dishware is everyone's problem, but when an owner wonders about the items in their cupboard it is their problem. Most people do not have access to an XRF scanner. Sodium rhodizonate swabs can detect lead in ceramics, but may not have the sensitivity required. In normal use, both XRF and swab tests detect lead that is in an item, not whether that lead comes out. However, in both cases, a wipe sample could be taken from the surface of items and analysed.

Where Tamara's point has influence in the power of the crowd. The more people there are that realise lead is still a problem in the modern world, even in developed countries, then the more likely it is that governments will listen and will take then action. If the route to action is through dishware then that is worth pursuing.

But some Lead is useful in consumer products, right?

I disagree with this assertion 100%.

As Dr. Mark Pokras says in my film, I wish we could create legislation that says "Thou shalt not use Lead in *anything, period*!". It is 2020; today we have alternatives for every application in which Lead was previously used. Uses like Lead in *car-batteries* are now roughly 100-years-old, and there is no reason we should continue this practice. Car batteries absolutely DO poison the planet – the Lead in car batteries in neither unavoidable nor safe. While it is oft-cited as the most "recyclable" source of Lead (and I understand the *Lead mining industry* considers the recoverability/reusability of the Lead in car batteries to be a *problem* that needs to be *addressed!*) it is not ultimately a *necessary* use of Lead — and there are still grave environmental implications with the use of Lead in this way.

If it was not poisonous, lead would be a very useful substance - as has been demonstrated for centuries. I don't think we would find anyone in the readership of LEAD Action News who would not want all new use of lead to be replaced by other materials.

In conclusion

In the meantime, (to those who are dismissing / mischaracterizing my work – as "fear-mongering"), *please stop trying to invalidate the work of honest, hard-working advocates simply trying to inform families so they can make intelligent choices for their families – choices not based on double-speak and marketing language provided by manufactures, but choices based on data and facts and numbers*.

Tamara does not make it clear whether she includes the LAN article in her accusations. At no point

does the article suggest that Tamara mongers fear. The article does not dismiss, mischaracterise or invalidate Tamara's work and only mentions her in relation to harassment of LPP campaigners.

As described above, the data and facts and numbers that Tamara presents, while very valuable and helpful, leave a lot of questions unanswered. These unanswered questions may lead to anxiety so should be presented carefully.

Instead of taking on all comers, perhaps Tamara could listen to her friends, accept help and advice from them, work with them and help us all to reduce the damage from lead poisoning around the world.

Just because the longterm human implications of something has not yet been well-studied — like what happens to someone's body if they "only drink out of Leaded crystal *every now and then",* or if they drink "*really quickly* when they do" [*two actual "objections" to my recommendation to avoid ever drinking from Leaded crystal*] — why would you risk putting one of the most neurotoxic substances known to man up against your lips – when *you can buy a Lead-free alternative for one dollar?!* *

The obvious answer to the question posed here by Tamara is that use of lead crystal glasses is considered safe by the authorities in California, Canada and Australia.

Again, we are left in doubt. Have we been poisoning our guests for years? Do we believe Tamara, who can test how much lead is in a glass, but not how much comes out; or the government agencies who may be lagging behind the latest science?

What does some science say? Here are quotes from two studies:

Guadagnino et al, 2000

"significant health risks resulting from the ingestion of beverages in contact with crystalware can be excluded."

Height, 1996

"Lead release at 1440 min was .. 358 ng/ml in wine". "Lead release at 1 min was equal to approximately 30% of cumulative lead release measured at 1440 min."

Based on this, there would be 13µg lead in a 125ml glass of wine. ThIs would be a good reason to not drink too much wine too often from lead crystal glasses.

It may be worth repeating the last line of the LAN article. There are no black and white answers.

Everything about lead is grey.

Thank you for reading.

Tamara Rubin
#LeadSafeMama

What I Have Learned About Lead - Part 2a Lead Balloon

Justone Lead-Soldier, 27th September 2020

What is a "lead balloon"?

I don't know if the saying is used only in the UK or also elsewhere, but 'This will go down like a lead balloon' means that something is going to be really unpopular - as portrayed in Jack Dee's series of the same name featuring annoyances, disappointments and embarrassments.

"Lead balloon" particularly applies when you tell people that what they are doing risks releasing lead dust – especially tradesmen.

I asked one decorator how they dealt with dust from lead paint sanding outside. Their reply was "we let the wind deal with that". A window installer said the best way to clean lead cames was with wire wool. He had had a heart attack!

Not everyone is ignorant, as I was, about the risks of lead, but often their responses can be described as one or more of:

Laziness

Excuses

Apathy

Denial

This article describes tips, tricks and techniques that I have discovered while DIY decorating and renovation in our lead-rich house. I have not commented on products that did not work well for me because of fear of defamation claims against me or The LEAD Group.

I must acknowledge the help provided by Hesaan Sheridan of Heritage Testing for analysing many of my dust test samples. The results of some of these appear in this article.

Lead Safe Ish

In general, what I have found is that, lead free is impossible. Lead safe maybe achievable, but there is often some doubt left. Accidents will happen – containment will fall down, steps will be taken outside the work area, tests may not collect all the lead.

It has been said that "Certainty is a luxury you cannot afford". The time, money, effort and anxiety involved in getting to lead safe begins to realise diminishing returns. In many cases, I have found that there is only judgement left to determine if there is a dangerous contamination problem or not.

In writing this account I am not recommending anyone else does the same and I do not provide any guarantees these techniques will work for others. I am just sharing ideas of what I believe has worked for me.

Guidance

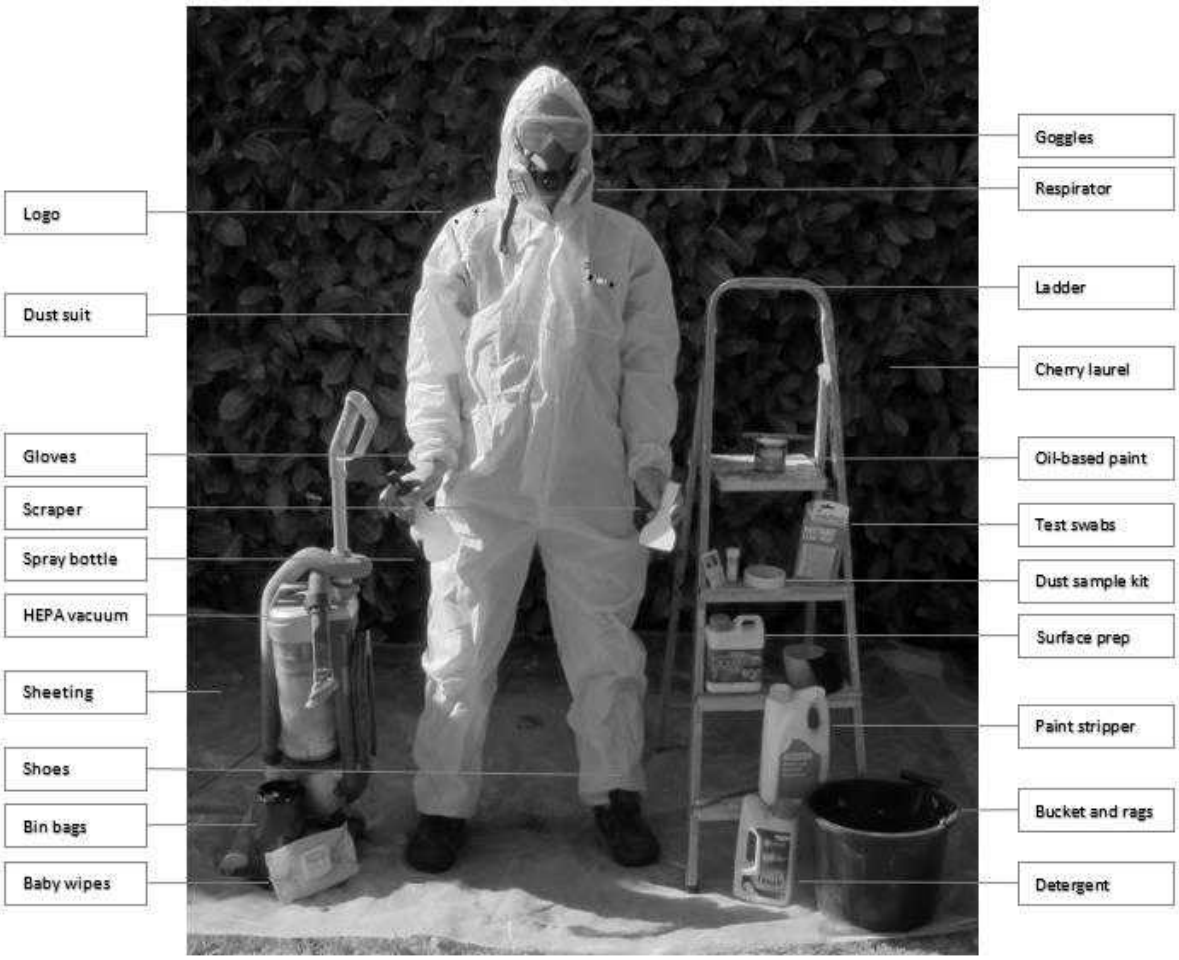
I have used several resources to guide my DIY work. I most often try to be compliant with the Renovation, Repair and Painting Program (RRP) from the Environmental Protection Agency in the USA. I mostly refer to the contents of a training course student manual. One difference is that I do not apply the 6 sq ft applicability minimum. I apply RRP to any sized area of work.

One part of the guidance in the RRP is to hire a certified lead-safe contractor. There is no such thing in the UK. There is training, but no certification scheme so, to be sure of compliance to lead safe practices, I need to do the work myself or persuade a tradesman that I am not mad and get them to do their work they way I believe is safe.

From the UK, I refer to the Department for Environment, Food & Rural Affairs (DEFRA) leaflet "Advice on lead paint in older homes" and the; British Coatings Federation, Painters and Decorators' Association and Scottish Decorators' Federation; "PaintSafe" initiative - particularly their tri-fold leaflet.

Tools

This picture, previously presented in Lead Action News, shows most of the tools that I use when working with lead contaminated materials:

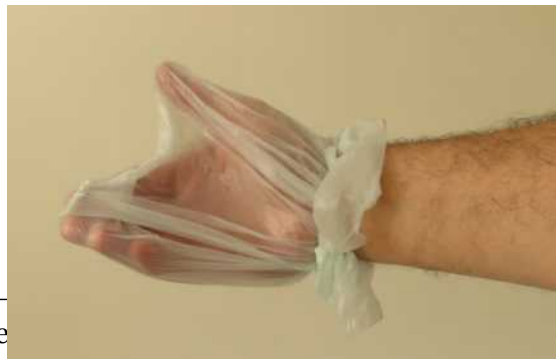


I point out cherry laurel in this picture because this is another toxic hazard. The plant contains cyanide which is released if the leaves are crushed or the wood is burned. Even water that drips off the leaves is poisonous.

Testing

The main tools I use for testing for lead are 3M LeadCheck swabs and dust samples sent to a laboratory for analysis.

When taking dust samples for analysis for lead I use the EPA Lead Dust Sampling Technician Field Guide. One exception is that I use nappy bags secured with rubber bands instead of gloves. These allow me to turn them inside out and limit one source of possible sample contamination. It should be noted that the clearance



levels mentioned in the EPA guide have now been superseded by the US Department of Housing and Urban Development.

The current HUD action levels are:

• Interior Floors: < 10 µg/ft2
• Porch Floors: < 40 µg/ft2
• Window Sills: < 100 µg/ft2
• Window Troughs: < 100 µg/ft2

These are the levels that I refer to and aim to meet.

Cleaning

Baby wipes

Cleaning follows the RRP or DEFRA advice, but usually utilising baby wipes and/or HEPA filter equipped vacuum. Evaluation of different methods by Heritage Testing found that baby wipes were the most effective of the methods tried. The best way is one directional wiping, not backwards and forwards, but by starting each swipe from the same edge of the area being cleaned.

More details of the method described by Heritage Testing include:

How many wipes to use:

Depends on the roughness of the surface. Generally, 1 ft x 1 ft for carpets and rough or areas that are not visually clean, 1 m x 1 m for smooth or visually spotless surfaces. For heavily contaminated areas, use up to three wipes.

When to use:

The 'baby wipe' method was effective as a 'finishing clean' for areas that had been repeatedly cleaned, but are still not below acceptable levels. This method is not good for cleaning of previously un-cleaned areas - it would probably take many more baby wipes (and a smaller grid).

How to use:

Wipe in one direction or sweep in an 'S' or 'double S' shape, you can fold the wipe inwards halfway through if necessary. The technique is to push everything the wipe collects in one direction, rather than scrub. At the end, of the sweep, fold inwards again and collect any dust pushed towards the bottom of the 'S' or 'double S'. Then discard the wipe.

Effectiveness:

One wipe was usually enough for lightly contaminated surfaces, and resulted in a dramatic (more than 90%) reduction in lead content on floor and window sill surfaces, and more than 50% reduction on carpet or rough wood upper surfaces (after using HEPA vacuum cleaners to remove lead dust from deep within the pile or cracks).

Materials

Containment and cleaning in lead rich renovation requires a lot of use of plastics. There could be concerns about the use of a non-biodegradable plastic products. I take the view that it is waste management that is the problem with plastics so I always ensure that used wipes and sheeting go into my domestic rubbish, as advised by DEFRA. Once in land fill the hydrocarbons are back underground, where they came from, where they will decompose slowly. This seems better than degradable plastics

which will release greenhouse gasses such as methane and carbon dioxide more quickly. I would be happy to be told if this is wrong.

HEPA

I use vacuum cleaners equipped with HEPA (High Efficiency Particulate Arrestance/Air) filters. However, I have learned that some HEPA filters are higher than others.

Under European normalization standards EN 779, the following filter classes were recognized until 2018 when they were replaced by ISO 16890. The details of this standard are not publicly available for free. The test standard for HEPA filters is BS EN1822.

Usage	Class	Performance	Performance test	Particulate size approaching 100% retention
Semi HEPA	E10	85%	Minimum value	>1 µm
	E11	95%	Minimum value	>0.5 µm
	E12	99.5%	Minimum value	>0.5 µm
HEPA	H13	99.95%	Minimum value	>0.3 µm
	H14	99.995%	Minimum value	>0.3 µm

Some filters I have used are actually marked 'H12' which is confusing, but I assume means that they are 99.5% efficient.

The highest lead loadings that I have found in our house are in the 100s of µg Pb/ft². I assume that 99.5% efficiency means that 1 in 200 particles gets through the filter. Based on that, my logic is that a loading of 500 µg Pb/ft² would be reduced to 2.5 µg Pb/ft² which is well below the HUD clearance level and not even detectable in the laboratory analyses that I use. Most recent dust tests around the house have met the HUD clearance levels so there does not seem to be a general problem with distribution of lead contaminated dust via the vacuum cleaner. I am satisfied that this level of filtration is adequate.

I actually have three vacuum cleaners which I use for different purposes and keep them for that purpose.

Removing lead paint flakes.

Cleaning up dirty areas possibly contaminated with lead.

Normal house cleaning.

This means I reduce cross-contamination between areas of different lead loading.

I have seen it said that vacuums leak. I have found that all my vacuum cleaners leak, but inwards. That is, upstream of the post-motor filter. I therefore think that this is not a problem.

Cleaning the cleaner

One technique with vacuum cleaners I can mention is what I call back-sucking. If I am using a brush attachment and it is getting dirty, I will take it off and simply vacuum the bristles to remove the dirt.

If I feel the vacuum cleaner has become contaminated I will wash the non-electrical parts in a solution of dishwasher detergent, rinse and then leave it to dry. This may also require disassembly before washing. I found that washing without disassembly resulted in any fluff remaining in the parts getting damp and becoming smelly. I found a YouTube video that explains how to disassemble on one example vacuum cleaner.

Cleaning contaminated objects

All detritus, tools and clothes are put into plastic bags before being removed from the work area. The tools are scrubbed and washed in dishwasher detergent. The clothes are thrown away, or washed separately, and hung out to dry outside. This is rather than allowing the tumble dryer to blow any residual lead contaminated dust around inside the house. The clothes are then used only for future lead risk work and not brought back into normal use.

Door Dipping

If you have an old door with many layers of paint then the general advice is to get them dipped by a professional company. You then probably need to sand them as described in this conversation (Money Saving Expert, 2006). The advice given is 'let them air dry (totally - or you'll damage the surface) and then sand them really well'.

The problem I have found is that when the doors come back from the dipping process they are leaded. This is easily checked with a 3m LeadCheck swab. The surface may be rough with many loose wood fibres. Sanding this is very likely to release lead contaminated dust onto the worker, their clothes and the surrounding area.

The thing is, that the lead on the doors may have come from other doors. My understanding is that the vat of caustic solution for door dipping is used repeatedly. It would seem obvious that this may become a leaded soup which will soak into other doors even if they were not already covered in lead paint.

In a test I found the level of lead on a door to be 428 µg Pb/sq ft without sanding.

I have found that covering with water based varnish does not solve this problem. Lead can still be detected with LeadCheck swabs even after two coats. I have found that two or three coats of polyurethane varnish are needed. Then no lead was detected with LeadCheck. Also, recent dust samples in the area analysed for lead have been sub-detects.

Leaded Internal Display Cabinets

Our house was built in the 1920s and has several original features. These include display cabinets with glass doors and lead cames (Cames are the strips of lead used to hold the glass together. The pieces of glass are called quarries). A dust sample from inside one of these cabinets showed a disturbing level of 731 µg Pb/sq ft.

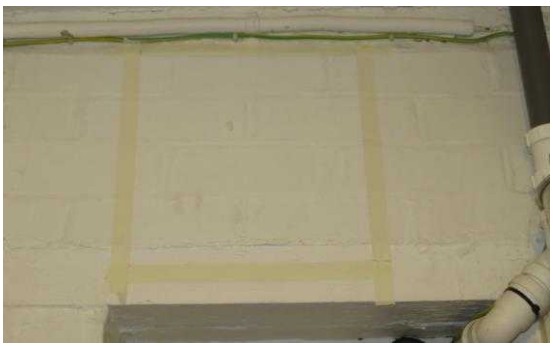
My solution was to encapsulate the glass panes between two sheets of acrylic. The encapsulated panes were sealed with 40mm PVC tape and held in place with spring clips. Work on the windows was done away from the cabinets, with the windows placed in a cardboard box, while I was wearing PPE. The resultant encapsulation is almost invisible.

The doors and interior of the cabinet were also thoroughly cleaned and painted with oil-based gloss paint and varnish. Care was taken to ensure that the doors are not rubbing against their frames as this could lead to abrasion of the new paint through to the original lead paint.

Sometime after the work, a dust sample taken from the floor near the display cabinet was analysed and the result was a no-detect.

Lead Painted Walls

I have not been able to detect lead in the paint on the walls of the house with LeadCheck except in the pantry. This appeared to have been painted with a grey, leaded gloss paint. Unfortunately, a previous roof leak had caused the paint to fail. This was probably the nastiest problem in the house that I needed to deal with. Dust sample analysis showed the following levels of lead:

Location	Picture	µg Pb/sq ft
Shelf – before cleaning Shelf – after cleaning with baby wipes, one directional		352 Paint and grit contaminated with lead is present <2.85 Baby wipes work
Wall – note the lead pipe with an electric cable in it! However, all water pipes in the house have been replaced with copper.		19.25 A little lead being released from the surface despite being over painted.
Floor		< 2.85 Lead paint flakes are not reaching the floor in a detectable quantity

My approach to deal with this issue was to remove as many paint flakes as possible, while keeping the surface wet. I also put up a containment sheet on the doorway and covered the floor with thick plastic sheeting held down with sticky tape. After getting to a sound surface two layers of emulsion paint, known as latex in some countries, was applied. A test with LeadCheck still detected lead. Two further coats of oil based gloss were applied, after which, LeadCheck did not detect any lead.

Some may say that it is not appropriate to leave lead paint in place, even when covered with layers of non-lead paint, because this leaves a toxic hazard for the future. My judgement was that, in this case, attempting to remove the paint from the rough brick surface would have been very difficult and could have spread contamination. I could have used a product such as EcoBond, but this is not available in

the UK.

A recent dust analysis found no detectable lead.

Shoes

I wondered whether lead contaminated dust was being brought into the house from outside. I calculated the area of the sole of my shoes, took a wipe sample and sent it off for analysis.

The result was 24 µg Pb/sq ft. And, no, I do not have square feet!

Even if all the lead on the shoes was transferred from the shoes to the floor it would soon be distributed widely enough to be below the HUD clearance level. However, over time, without cleaning, that lead could build up and become more dangerous especially if children played on the floor. A sample from a doorway that had not been cleaned for a few weeks was analysed and found to have 21 µg Pb/sq ft which is above the HUD clearance level for floors, but not for porches.

These results were lower than I expected, but still enough to show that removing shoes when coming indoors will help to reduce overall lead loading.

Soil

I have had two soil samples analysed from our garden. These showed:

83ppm in an old raised bed, top 50mm of soil

97ppm in cultivated soil, between 50mm and 150m depth

The background level in soil in England (Environmental Protection Act 1990) was found to be 180mg/kg (180 ppm by weight). Thornton et al, 1990, found a geometric mean on 266 µg/g.

The EPA standard for lead in soil in play areas does not apply here, but is higher than the levels I found at 400ppm.

I am, therefore, not very worried about lead in most of our soil, but still grow vegetables in raised beds with new soil. I say most, because this is one drain from a lead covered flat roof that discharges on to a flowed bed. I treat that with extreme caution including not putting material from there into compost.

Carpets

Most analyses of dust samples from carpets have not found detectable lead. One location persistently would not go below the HUD clearance level of 10 µg Pb/sq ft. This was even after two rounds of professional carpet cleaning. The levels found were not alarmingly high at 25, 28, 28, 59, 59 and 68 µg Pb/sq ft, but we decided to replace the carpet anyway before any children played on it.

Lead Painted Wood And Metal

Preparation

The RRP guidelines explain how to deal with flaking lead paint. I follow those guidelines so there is no need to repeat here.

If the paint surface is sound, but needs a new top coat there needs to be a way to help the new paint adhere. If the paint is not leaded then the normal practice would be to sand it. I don't want to do that if there is lead paint present, even in lower layers of the surface.

What I have found works well is a "chemical sander". This may also be described as an adhesion enhancer. I have used a product called 'Easy Surface Preparation' made by Owatrol.

I have found this to provide a good surface for gloss paint, with no flaking, even outside and exposed to direct, all-day sunlight. The sale assistant in the DIY shop said it would not last five minutes which makes me wonder why they sell it. However, it seems to work very well. It looks expensive at around £25 a litre, but it does a long way and maybe turns out cheaper than abrasive and is certainly less effort.

Encapsulation

If a lead painted surface is at-risk of being knocked and chipped then I have sometimes encapsulated it to cover up the surface and eliminate the risk. Sometimes this is no more than sticking white PVC tape over the vulnerable edge. Some times it required more substantial encapsulation.

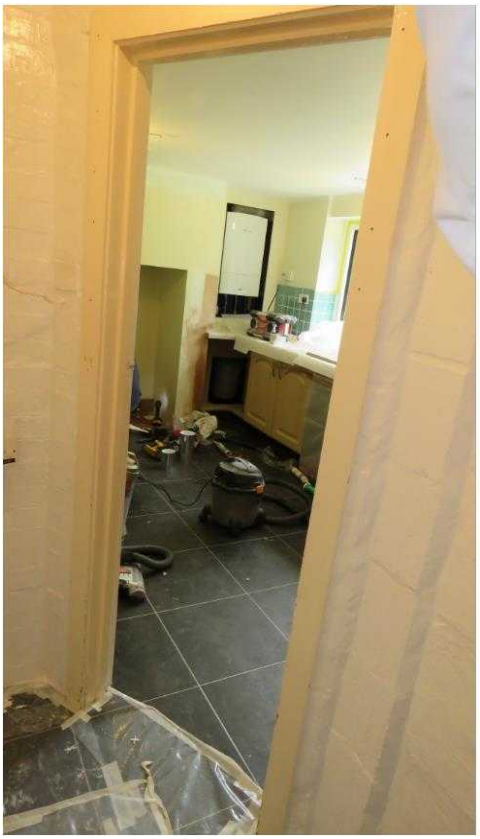
Larder

One edge of our larder door was especially vulnerable to being chipped as shown in this picture.

Our solution was to encapsulate the door frame and architrave in MDF board and paint it. This was done while the area was contained. It was also cleaned thoroughly afterwards in case any lead paint was disturbed in the process.

The door hinges and stricker plates were replaced as the old ones were covered in leadpaint.

Before



After

Airing cupboard

The airing cupboard had an old door that was warped as well as being painted, under the top layers, with lead paint. The door frame also had original lead paint.

The approach we took was to stop any contamination going into the cupboard with plastic sheeting as well as putting sheeting on the floor. We then taped over the old leaded door frame to stop any leaded dust being released during the work and then screwed in a new frame within a frame. The was made the right size to accommodate some replacement doors. The old architrave was retained and overpainted, but was not now vulnerable to chipping.

Shaving Foam

Just one last point in this edition. If there is a situation where a small amount of lead paint may be disturbed, e.g. removing old screws, drilling into lead painted wood, I have found a way to stop lead contaminated dust being distributed is to use shaving foam. Put a blob of shaving foam over the point of contact. This traps paint chips or dust so that they easily be collected on a piece of kitchen paper or baby wipe for safe disposal.

Another method is to smear over some silicon sealer.

Future Articles

Other planned articles in the 'What I Have Learned About Lead' series:

Window replacement – lead paint, lead cames, lead nightmare

Whole Lotta Lead – Things with lead, things that release lead

Pb or not Pb – Experience with different testing methods

Plumbing the Depths – A review of the health impacts of lead exposure

Chapter Review: *Industrial-Strength Denial* Chapter on Leaded Gasoline

Book: Industrial-Strength Denial: Eight Stories of Corporations Defending the Indefensible, from the Slave Trade to Climate Change

Book written by Barbara Freese; Chapter 4 reviewed by Theresa Gordon, Member of The LEAD Group's Technical Advisory Board

Chapter 4 "How Wrong One Can Be" Bias, Tribalism, and Leaded Gasoline.

For those of us that understand the health and environmental damage caused by lead, the sorry tale in Chapter 4 of this book is especially confronting.

In 1921, when tetraethyl lead (TEL) was put forward by Thomas Midgley as the answer to stopping the annoying knocking in motor car engines, the dangers of lead were well known. To quote the book, "*In the 1920s, lead was perhaps the world's single most well-recognised, indeed conspicuous, occupational and environmental toxin*".

So what went wrong? At the suggestion of lead being added to petrol, appropriate bureaucratic protective measures using the science were convened to prevent a possible public health threat. However, Barbara Freese explains how these protective processes failed miserably against economic pressures, vested interests, scientific bias and tribal type industry attacks on any scientists offering an anti-lead perspective.

Indeed, alerts from the US Surgeon General, together with Midgley's own acute lead poisoning from TEL and multiple deaths and incidences of TEL workers going horribly and violently insane, were not enough to stop the reckless use of this toxin. Fighting negative press, the Industry embarked on a campaign of denial, reframing themselves as an industry serving the greater good. There appeared to be no limits to the absurdity of the industry's claims. Media questions about the incidence of TEL workers suffering insanity were met with an industry statement that the workers *"probably went insane because they worked too hard*". Charles Kettering, Midgley's boss, was often quoted as saying *"the price of progress is trouble, and I don't think the price is too high*". The book uncovers years of industry sponsored research denying lead as a hazard. Between 1920 and 1960 virtually all research into lead's effect on the human body was conducted at the Kettering Laboratories. Research was conducted by those who least wanted to find the harm.

On a brighter note, we are introduced to an anti-lead hero. In the late 1940's and early 1950s a geochemist named Clair Patterson, challenged the TEL industry's consistent reassuring perspective on lead. Patterson became the nemesis of a popular young physician named Robert Kehoe who assured critics that the industry would stop selling TEL, if the facts showed TEL as an actual hazard. Despite the petroleum industry offering Patterson bribes not to publish and then threats to block his funding, Patterson published his research showing a dramatic rise in lead contamination to the

environment. He concluded the source of lead was probably petrol. In 1965, pushing through the constant threats and intimidation Patterson presented findings that Americans probably had one hundred times (later changed to six hundred times) more lead in their bodies than prehistoric humans. Attacks on Patterson's credibility increased but he persevered and his work can be credited with starting to turn the tide on the wanton use of lead. Over the years Patterson's research continued to gather damning evidence against lead and its threat to human health. He continued to challenge the industry's assertions and argued that Americans where "*being subjected to severe chronic lead insult*".

In 1970 GM announced its intention to introduce the catalytic converter which needs unleaded petrol to function. This together with America's new Clean Air Act was the beginning of the end of leaded petrol in the US. Sadly, I must point out that leaded petrol was not fully phased out in Australia until 2002; an impressive achievement of The LEAD Group as the main driving force behind this major public health and environmental improvement.

Over the years the industry continued to attempt to confuse the science on lead, even trying at one point to produce a study that claimed lead was actually an essential micronutrient (only debunked by a US EPA panel of experts in 1983). In the mid 1980s the lead industry focused on character assignation and manufacturing uncertainty about emerging scientific consensus. The main target of their attacks was the paediatrician Herbert Needleman, a man well known to those of us concerned about lead. Needleman was a pioneer in the discovery of the effects on children of low levels of lead. Not only were Needleman's findings attacked but they accused him of professional misconduct.

An unfathomable revelation in the book is that Algeria is the last country in the world to continue the use of TEL in petrol, with production scheduled to cease in 2020. How has this been justified and allowed for so long?

It's also disconcerting to read that Midgely and GM had successfully experimented with ethanol in 1920 but ethanol couldn't be patented and therefore didn't offer the revenue stream promised by TEL. The book leaves us to ponder the resulting lead burden to the public at large, and asks, *"what sort of people might we have been if we had all developed to our full potential and been a little smarter, more attentive, less anxious, and less impulsive than we have been".* What a sobering thought to end on.

Volcano Art Prize (VAP) 2020 Entrant: Theresa Gordon

Title: Lighter and lighter. Losing the lead weight. Lead-Safety Message: This is my feeling about what the LEAD Group has done for generations of Australian children.

Description of Work: "Balloons Spring Nature" Watercolour by Silvio Z from https://pixabay.com/illustrations/balloons-spring-nature-watercolour-1615032/

URL: https://volcanoartprize.com/portfolio-item/lighter-and-lighter-losing-the-lead-weight/

Chapter 4 on Leaded Gasoline, in "Industrial-Strength Denial" (extracts)

Extracts from Chapter 4: "How Wrong One Can Be": Bias, Tribalism, and Leaded Gasoline, in ***Industrial-Strength Denial: Eight Stories of Corporations Defending the Indefensible, from the Slave Trade to Climate Change***

Author: Barbara Freese, published by University of California Press, May 2020

Chapter 4: "How Wrong One Can Be": Bias, Tribalism, and Leaded Gasoline [page 97]

"The whole proceeding against an industry that has made invaluable contributions to the American economy for more than fifty years is the worst example of fanaticism since the New England witch hunts in the Seventeenth Century."

-Lawrence Blanchard, vice president of Ethyl Corporation, on rules phasing lead out of gasoline, 1976

In 1921, Thomas Midgley was a young engineer at General Motors.

…

On December 9 [1921], Midgely and his colleagues tried yet another [gasoline anti-knock] additive… it was cheap and patentable…. The magic ingredient was a substance called tetraethyl lead (TEL), and it was soon clear that this breakthrough – the invention of "leaded" gasoline – was worth a staggering amount of money.

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An inauspicious start: "Insanity Gas" and a Delusional corporate response [page 100]

…

In February 1923, leaded gas went on sale in Ohio.

…

And then the deaths began. In the summer of 1924, two workers under Midgley's close direction at a GM plant in Dayton, Ohio, died from TEL Poisoning, and dozens were hospitalized.

…

But in October 1924, men at a third facility – a Standard Oil refinery in Bayway, New Jersey – started falling ill. Because the plant was located just across the river from New York

City, several of the city's papers got wind of the story and covered it with alarming headlines like "Odd Gas Kills One, Makes Four Insane," "Another Man Dies From Insanity Gas," and "Gas Madness Stalks Plant; 2 Die, 3 Crazed."

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[Page 101]

In one week, five workers died and another thirty-six were hospitalized. Their doctor soon reported they were "doing nicely,"

...

One of the first responses to the disaster made on behalf of Standard Oil came from a physician who had been consulting for the company. Not realizing that the horse had already left the barn, he told a newspaper reporter that "nothing ought to be said about this matter in the public interest."

Small-town papers have a long history of agreeing to ignore spectacularly violent workplace accidents upon the request of locally dominant employers.

...

[Page 102]

A subsequent response issued the first day of the crisis came from the chief chemist at the plant, Dr Matthew D. Mann. When asked by journalists to comment, he left the room for several minutes and returned with a written statement saying that "these men probably went insane because they worked too hard." While major corporations were not as good at presenting plausible denials in the 1920s as they are today, their denials were hardly ever this preposterous. However, Dr. Mann was himself later named among the victims of TEL poisoning, and William Kovarik, a communication historian who has researched the 1920s controversy in depth, concluded that Mann "had probably made the statement while in a delirious state of mind." If so, this would be a rare example of a corporate denial caused by the very product whose dangers were being denied.

What was not rare was for employers to blame workers for getting poisoned. When the story did not go away, that is what Ethyl and Standard Oil tried next (though at least they admitted that the symptoms were caused by workplace exposure, unlike US Radium which a few months later would blame its workers' poisoning symptoms on their inherent Weaknesses). Midgley raced to New York for a press conference at the Standard Oil headquarters on Broadway, where he said that despite warnings, the Bayway workers "had filed to appreciate the dangers of constant absorption of the fluid by their hands and arms." Other company officials at the press conference insisted that they had constantly admonished workers to wear rubber gloves and gas masks, and said the workers had plenty of reason to know they were engaged in "a man's undertaking." A few moths later the company would employ a stricter worker-protection protocol, which Midgley described like this: "The minute a man show signs of exhilaration he is laid off. If he spills the stuff on himself he is fired.

Because he doesn't want to lose his job, he doesn't spill it."

...

Viewing Risk through a tribal lens: shaping the science [page 105]

...

...those backing leaded gas played their cards close to their chest, including initially suppressing the news of the deaths at the Dayton and Deepwater facilities - news that might have prevented the poisonings at Bayway if the health authorities and workers had known it.

...

Exalting the in-group: and industry with the "interests of the public at heart" selling a "gift of god" [page 106]

...

One of the attendees at the conference was Yale physiology professor Yandell Henderson, a nationally recognized expert on the effects of gases on the body. Henderson had become a widely quoted thorn in industry's side since the Bayway poisonings. He had prophetically warned in an April 1925 speech of the likelihood that "conditions will grow worse so gradually and the development of lead poisoning will come on so insidiously (for this is the nature of the disease) that leaded gasoline will be in nearly universal use and large numbers of cars will have been sold that can run only on that fuel before the public and the Government awaken to the situation."

...

[Page 108 to 109]

Frank Howard, of Standard Oil, but speaking on behalf of its corporate partners too, went further. He stated that "our continued development of motor fuels is essential in our civilization," and by letting a gallon of gas go further, TEL was a "gift of God." A scientist who consulted for Ethyl expressed a similar view in a letter to a federal official; while acknowledging the health risks of leaded gasoline, he was "afraid human progress cannot go on under such restrictions and that where things can be handled safely by proper supervision and regulation they must be allowed to proceed if we are to survive among the nations."

Reframing a harmful action as serving a greater good is another psychological mechanism Albert Bandura identified that enables people to more easily violate their own moral codes. The industry's defenders may well have convinced themselves they were serving the larger good when they made their statements, but there is evidence that the larger good was not the dominant motive.

For example, the first nation with which this gift of God would be shared was Hitler's Germany. In 1936, a TEL plant would be built in Germany and jointly owned by an Ethyl affiliate and IG Farben, a powerful German chemical trust that was crucial to the rising Nazi war machine. The deal would be negotiated by the same Frank Howard, and as a congressional investigation would later reveal, the TEL technology was shared despite

warnings that Germany was secretly rearming and TEL would help it. Indeed, an IG Farben official wrote during the war that "without lead-tetraethyl the present method of warfare would be unthinkable," and the Nazis' ability to produce TEL was entirely because "the Americans had presented us with the production plants, complete with experimental knowledge."

Moreover, the indispensability of lead as an antiknock compound had been challenged even in the 1920s. Gasoline could have been blended with ethanol (grain alcohol), as Midgley and others at GM knew because they had successfully experimented with it. But ethanol could be made by "any idiot with a still," in the words of journalist and automotive historian Jamie Lincoln Kitman. Ethanol could not be patented and did not offer a revenue stream the way TEL did. In his award-wining article in 2000 about the history of leaded gas for *The Nation,* Kitman would write that the benefits of leaded gasoline "were wildly and knowingly overstated in the beginning, and continue to be."

…

Attacking the out-group critic: a naïve, ignorant, brash, passionate, dogmatic, absurd zealot [page 110]

Robert Kehoe - the young physician who in 1925 assured critics that the industry would stop selling TEL if the facts showed an actual hazard - would utterly dominate the search for such a hazard for the next forty years and never spot one. In the meantime, his career would become a symbol of the intimate ties between business and academia, as he simultaneously worked for the University of Cincinnati as head of its industry funded Kettering Laboratory and as medical director of the Ethyl Corporation. Industry not only built his lab and financed most of his research, but it paid his salary (except for the one dollar per year he received from the University of Cincinnati).

While Kehoe's prominence extended to the field of occupational medicine generally, about lead he was the long-unquestioned authority. To an astonishing degree, virtually all research into lead's effect on the human body between the 1920s and 1960s was conducted at the Kettering Laboratory under Kehoe's direction. After he sent colleagues a compilation of his lectures on the subject in 1960, one colleague wrote back, "You are God in the field,' and another wrote, "The last word has been said on lead."

Kehoe's data largely came from studying workers, and he helped develop protocols for greatly reducing worker exposures to TEL, surely saving lives by reducing acute occupational poisonings. He also conducted experiments where he had young men eat lead salts and breathe the exhaust of engines burning leaded gasoline, and then measured how much lead was excreted in their waste and how much was left in their blood. He championed two particularly important conclusions drawn from this work. First, he concluded that relatively high levels of lead were naturally present in both the environment and people's bodies. Second, he argued that as long as blood lead levels stayed below the threshold associated with clinical symptoms of classical lead poisoning, lead posed no harm. The threshold Kehoe

identified was 80 micrograms of lead per deciliter of blood (µg/dL), because he had never seen symptoms of lead poisoning below that level. For decades, these basic principles limited the scope of the discussion about lead poisoning, to the extent there was any discussion.

…

An Industry under siege: "The worst example of fanaticism since the witch hunts" [page 117]

…

The year 1970 was a particularly rough one for the Ethyl Corporation. Just a few days into the new decade, the president of GM announced that to cut smog-creating emissions, GM was turning to catalytic converters. Since catalytic converters were ruined by lead, new cars would have to burn unleaded gasoline. Both GM and Standard Oil of New Jersey, who had been there at the birth of Ethyl, had sold their shares in the early 1960s; one Ethyl executive compared GM's announcement to being disowned by your father.

The Ethyl Corporation reacted to the announcement with a flurry of denial. It argued the plan would backfire: unleaded gasoline would actually increase smog and had more cancer-producing agents. It argued impossibility, with one official opining that "lead is going to be in gasoline until they stop using gas in internal combustion engines" (an ironic expression of technological pessimism from a company launched by Charles Kettering, the prophet of progress).

…

[Page 121]

Almost all the industries profiled in this book complain about being victimized by unfair processeS and irrational critics. This seems to be a highly effective way for them, or probably members of any tribe facing criticism, to minimize any feelings of remorse about the harms their tribe has caused. Focusing instead on the wrongs they perceive to have been done to them (and those in the bunker with them) lets an energizing anger obliterate any emerging guilt that might otherwise threaten to demoralize them.

Lead Burden: The gift that keeps on giving [page 124]

…

In 1940, at the age of 51, Midgley developed polio. He devised a rope and pulley system to lift himself from bed, and one morning in 1944 his wife found him strangled to death in the ropes. The newspapers were told it was a freak accident, but cemetery records called it suicide.

Volcano Art Prize (VAP) 2020
Artist: Elizabeth O'Brien
Title: The world is cursed until TEL is banned,
Lead-Safety Message: When Tetra Ethyl Lead (TEL) is banned in Aviation Fuel as well as Motor Fuel, Earthlings will have a fighting chance of fulfilling our potential.
Description of Work: Text created in Powerpoint, on Photo of Roman curse tablet (made of lead) © Marie-Lan Nguyen / Wikimedia Commons, from

https://upload.wikimedia.org/wikipedia/commons/a/a0/Curse_tablet_BM_1934.11-5.1.jpg

URL: https://volcanoartprize.com/portfolio-item/the-world-is-cursed-until-tel-is-banned/

Mt Isa Resident 11th October 2019 Letter to The LEAD Group

Anonymous Mt Isa Resident
Mt Isa, QLD, 4825
11th October, 2019

Dear Elizabeth,

Good news regarding changes to limit, further, human exposure to lead.

On SBS TV today, the regular PBS news hour program on the US office of the EPA proposing changes to how communities test for lead in the water. This is the first change in 30 years.

These changes, that have been proposed, are because of the Flint, Michigan trouble. Some of the changes include the water testing of water to schools and day care centres.

Enclosed is my latest collection of items to do with lead.

Regards,

Anonymous Mt Isa Resident

Mt Isa Resident 11th October 2019 Letter Enclosures to The LEAD Group (summarised)

LEAD news from Mount Isa

Articles Collated and Some Summarised by Anonymous Mt Isa Resident.
Found if Online by James Scotman, Other Articles Summarised by Lily D'Adam,
Lead Archives Digitisation Project (LADP) Team, The LEAD Group Inc

Author	Title	Source	SUMMARY/URL
Northwest Star	Glencore Sweeper	Northwest star Glencore Sweeper 20190228	Glencore Mt Isa Mines invested in another D6000 sweeper which is used to sweep the roadways to minimise the lead and copper dust levels. https://www.northweststar.com.au/story/5918882/glencore-purchase-another-sweeper-to-keep-dust-levels-low/
Derek Barry	Five parties working on rail	Northwest Star Five parties working on rail 20190216	Five different parties are working together in response to a Pacific National freight train containing zinc concentrate, lead concentrate and copper anodes which continues to be impacted by unprecedented flood waters in North West Queensland. https://www.northweststar.com.au/story/5901286/five-parties-working-on-fix-for-nelia-derailment/
Melissa North	AQC access new data	Northwest Star AQC access new data 20190124	Glencore's Air Quality Control Centre recently purchased and commissioned an Attex MTP-5 atmospheric temperature profiler which provides data and insights into atmospheric conditions around Mt Isa.
Anonymous	Channel 9 TV Series	Anonymous Mt Isa Resident	Discussing the use of lead in ceiling decorations by the Tudors, in cosmetics and lead shot in a cat & how that led to lead poisoning.
Queensland Government	Position Vacant	Queensland Government position vacant 20190112	A job advertisement for leading and managing the Living with Lead Alliance's community education campaign, information activities and services within Mt Isa.
Chris McLennan	NLC has objected to McArthur River	Northwest Star NLC has objected to	The Northern Land Council has objected to the approval of an amendment to the existing mine management plan for the McArthur River Mine.

Author	Title	Source	SUMMARY/URL
	Plans	McArthur River Plans 20190827	https://www.northweststar.com.au/story/6342258/northern-land-council-objects-to-mcarthur-river-mine-plans/
Derek Barry	NW Qld to drive green state	Northwest star NW Qld to drive green state 20190813	Mount Isa has the potential to supply the clean energy economy, a report from the Climate Council has found. https://www.northweststar.com.au/story/6316737/climate-change-council-says-north-west-qld-can-drive-green-economy/
Anonymous	Channel 70 Megastructures 20199227	Anonymous Mt Isa Resident	Renovations on the Golden gate Bridge will include footings intended to protect the bridge from earthquakes that are made from rubber on the outside and lead on the inside.
Anonymous	Channel 72 Sydney Weekender	Anonymous Mt Isa Resident	At a recreated pioneer village in the Hawkesbury region, a man was showing tourists how to melt and pour pewter, so he and tourists were breathing in the fumes.
Anonymous	Channel 7 Better homes and gardens 20190317	Anonymous Mt Isa Resident	The garden behind number 10 Downing Street, London, where the UK Prime Minister resides, has two huge sinks from 1666 made of lead. Reportedly these sinks have plants growing in them.
Anonymous	TV News late February 2019	Anonymous Mt Isa Resident	Story Bridge in Brisbane to be renovated. Like the Sydney Harbour Bridge, it is covered in grey paint containing lead. If a repaint is included in the renovations, then new lead paint will go over the old lead paint.

Mt Isa Resident 11th April 2020 Letter Enclosures to The LEAD Group (summarised)

Articles Collated and Some Summarised by Anonymous Mt Isa Resident.
Found if Online by James Scotman, Other Articles Summarised by Lily D'Adam,
Lead Archives Digitisation Project (LADP) Team, The LEAD Group Inc

Author	Title	Source	SUMMARY/URL
Northwest Star	Mining checker to hit region	Northwest Star Mining checker to hit region 20200123	A new mine and quarry inspector has been hired to ensure the health and safety of the sites & employees.
Courier Mail	20 years ago End of the line for leaded fuel	Courier Mail End of the line for leaded fuel 20200207	Leaded fuel will be phased out in Queensland under tough new regulations.
Aidan Green	Clearing lead in your yard	Northwest Star Clearing lead in your yard 20191116	A competition was run to help improve and spread awareness on lead levels in your yard.
Scientific American	More Features Podcast	Scientific American More Features Podcast 200710	Lead smelter workers who read more suffered less brain insult from lead exposure.
Anonymous	Health Check on BBC radio	Anonymous Mt Isa Resident	A study was done in Beijing testing for 4 pollutant substances. All substances were found in the air.
Anonymous	Channel 7 Autopsy USA	Channel 7 Autopsy USA 20191130	If left in, bullets can expand and leak lead, leading to lead poisoning. The bullet left in Bob Marley's arm was investigated to see if lead poisoning caused his collapse in New York.
Samantha Walton	Glencore launches online newsletter	Northwest Star Glencore launches online newsletter 20191022	Glencore's communications team launched an online newsletter on 17/10, named 'Resourceful'. https://www.northweststar.com.au/story/6443177/glencore-launches-its-digital-newsletter-resourceful/
Chris Mc Lennan	River Health in focus	Northwest Star River Health in focus 20191105	The NT Government has amended the Mine Management Plan for Glencore's McArthur River Mine to allow all 30 recommendations made by the Environmental Protection

Author	Title	Source	SUMMARY/URL
			Authority to be implemented.
Derek Barry	Rare Earths hunt is on	Northwest Star Rare Earths hunt is on 20191126	The John Campbell Miles drill core storage facility in Mt Isa will play a key part in a new state government funded initiative to find the minerals of the future needed for things such as wind turbines and electric cars. https://www.northweststar.com.au/story/6504958/government-puts-138m-into-the-hunt-for-rare-earth-minerals/
Anonymous	DW TV News on SBS TV 12/10/19	SBS TV DW TV News 20191012	400 tonnes of lead was vaporised by the Notre Dame Cathedral fire in Paris.
Derek Barry	Lady Loretta helps out	Northwest Star Lady Loretta helps out 20200213	Mt Isa Mine's restart of the Lady Loretta zinc-lead mine has helped improve production for both zinc and lead. There was a 21% increase in lead production. https://www.northweststar.com.au/story/6619705/lady-loretta-improves-glencore-production-numbers/
Living with Lead Alliance	Lead and your Mob	Living with Lead Alliance Lead and your Mob Version 3	A guide to protecting your mob from lead poisoning. http://www.leadalliance.com.au/wp-content/uploads/2013/06/LWLA-Lead-and-Your-Mob.pdf
Mt Isa Council	Living safely with lead	Mt Isa council living safely with lead 20200101	Information and a guide on reducing the absorption of lead in your everyday life. http://www.leadalliance.com.au/wp-content/uploads/2013/06/LivingSafelyWithLead-2013.pdf
Mt Isa Council	Wet Wipe, Wash & Eat Well	Mt Isa Council Wet Wipe, Wash & Eat Well 20200101	A guide to help protect your child from lead poisoning. http://www.leadalliance.com.au/wp-content/uploads/2016/09/Squeaky-Brochure-V2-2013.pdf
Living with lead alliance	Wet Wipe, Wash and Eat Well	living with lead alliance Wet Wipe, Wash and Eat Well 20200101	A short guide to keeping your house safe from lead poisoning and information on what the Xstrata Mt Isa Mine is doing to keep their employees safe from lead exposure. http://www.leadalliance.com.au/wp-content/uploads/2013/04/wetwipebrochure.pdf
Mt Isa Council	Lead and your Mob V3	Mt Isa Council Lead and your Mob V3 20200101	A guide to protecting your mob from lead poisoning. http://www.leadalliance.com.au/wp-content/uploads/2019/03/Lead-and-Your-Mob-v4.pdf

Mt Isa Living with Lead Alliance - Lead and Your Mob (flyer) 2020

Voluntary battery stewardship scheme granted authorisation

4 September 2020

[https://www.accc.gov.au/media-release/voluntary-battery-stewardship-scheme-granted-authorisation]

The Battery Stewardship Council (BSC) will be able to establish and operate a national scheme for managing expired batteries under an authorisation granted by the ACCC.

BSC was formed in 2018 with the primary goal of establishing a battery stewardship scheme in Australia that would see a significant increase in battery collections and recycling.

Batteries imported by members of the scheme would attract a levy of four cents per 24 grams (the weight of a AA battery). Rebates would then be paid to recyclers to help offset the cost of collecting, sorting and processing expired batteries. Members of the scheme must agree to only deal with other members along the supply chain, with limited exceptions such as for pre-existing arrangements.

The BSC estimates that only about 3 per cent of handheld batteries in Australia are recycled. Most batteries go to landfill.

“This battery stewardship scheme has the potential to be an important tool for encouraging businesses across the battery supply chain to take responsibility for treating batteries in an environmentally responsible way,” ACCC Deputy Chair Delia Rickard said.

“The ACCC believes the scheme can achieve significant environmental benefits by increasing the number of batteries that get recycled rather than going to landfill.”

“There are also benefits from increased public awareness around battery disposal and re-use, and supporting increased research and development,” Ms Rickard said.

The ACCC notes that by encouraging consumers to hold onto button batteries for subsequent collection and recycling, there is a risk the scheme may inadvertently

increase the safety hazard of young children ingesting batteries or the risk of house fires.

The ACCC's current advice is for consumers to dispose of used button batteries immediately given the safety risk of serious injury or death if they are swallowed or inserted into the body. Young children are at the greatest risk due to their narrower oesophagus and tendency to place small objects into their mouths, ears and noses.

In order to address this issue of consumers potentially storing button batteries for later recycling, the ACCC has imposed a condition requiring BSC to develop a button battery safety strategy within 12 months. The strategy is to be guided by an advisory group involving the ACCC, relevant industry bodies and medical and child safety experts.

The ACCC has granted authorisation until 26 September 2025.

The ACCC considers it important that BSC is able to demonstrate strong take-up of the scheme, and effective administration and risk management before applying for re-authorisation in 2025.

More information, including the ACCC's reason for decision is available online on the ACCC's public register at Battery Stewardship Council.

The scheme is intended to manage all types of end of life batteries except for automotive lead-acid batteries and batteries that are currently included in a stewardship or recycling scheme (such as the embedded batteries covered by the National Television and Computer Recycling Scheme; or the mobile phone batteries covered by MobileMuster).

BSC proposes to offer the following rebates to recyclers:

- $2.50/kg for battery collection in metropolitan areas,
- $3.50/kg in regional and remote areas (to account for increased costs and logistics),
- $1/kg for sorting, and
- $1/kg for processing.

BSC was established as a not-for-profit company limited by guarantee with the purpose of designing and administering a battery stewardship scheme in Australia.

Authorisation provides statutory protection from court action for conduct that might otherwise raise concerns under the competition provisions of the *Competition and Consumer Act 2010*.

Broadly, the ACCC may grant an authorisation when it is satisfied that the public benefit from the conduct outweighs any public detriment.

Without authorisation, the imposition of the levy and the obligation on scheme members to only deal with other scheme members would risk breaching the Act.

Background

Product Stewardship is an environmental management strategy that means whoever designs, produces, sells or uses a product takes responsibility for minimising that product's environmental impact through all of the stages of its life-cycle.

The Product Stewardship Act 2011 identifies batteries (of all types) as 'priority products' for Stewardship.

The 2019 National Waste Policy Action Plan has indicated an intention for all Governments to develop a common approach to restrict the disposal of priority products and materials in landfill, starting with lithium ion batteries and e-waste by 2021. The Victorian government banned all e-waste, including all batteries, from landfill from 1 July 2019.

The Australian Battery Recycling Initiative (ABRI) has published guidelines on the safe and responsible use of button batteries. These guidelines are specific to button batteries and include the following tips when recycling expired button batteries:

- As soon as you have finished using a button battery put sticky tape around them to:
  - make them less attractive to children
  - prevent short-circuiting, and
  - avoid the low risk of having them catch fire.
- Once taped, store batteries in a child-proof container.
- Take batteries to a designated battery recycling drop-off location.

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