



More recently, “participants of G7 members recognised that according to the World Bank’s most recent assessment, the global cost of the health effects of lead exposure is estimated to be 4.6% of global GDP” ([G7 Environment Ministers 2022](#)) (see Addendum 5, below).

Wherever this Model National Policy calls for research to be funded by government, it assumes that the government will also encourage philanthropic funding of said research.

It is beyond the scope of this Model National Lead Safety Policy Proposal to thoroughly detail proper protection of wildlife and the environment from lead. This is a human health focused policy and there are significantly more environmental impacts apply than what have been included here. Although, for instance, banning leaded ammunition (see 1.4, below) to protect shooters from lead exposure will also protect wildlife and the environment, and legislation that will result in protecting the environment from lead is specifically proposed (see xvi, below).

### **Initial Steps to Prevent Lead Exposure and Lead Poisoning**

There is a clear role in global and regional lead-safety policy development, and guidance in development of national lead-safety policy for bodies such as the World Bank, the World Health Organisation (WHO), United Nations Environment Programme, and the World Medical Association (WMA), WHO Regional Offices, and for multilateral bodies such as the G7, and the OECD. The US government has a special role to play in assisting national governments to develop lead-safety policy because of their history of creating lead laws and consequently significantly reducing blood lead levels since 1970, see Figure 4 (below).



2023 Volcano Art Prize Entry. Artist: Edison Nguyen

Title: Cherries

Lead-Safety Message: Grapes grown on a trellis and tree fruits like cherries generally don't uptake lead from the soil, but dust or soil that gets on the fruit should be washed off before using. Eating cherries is way better than interacting with lead!

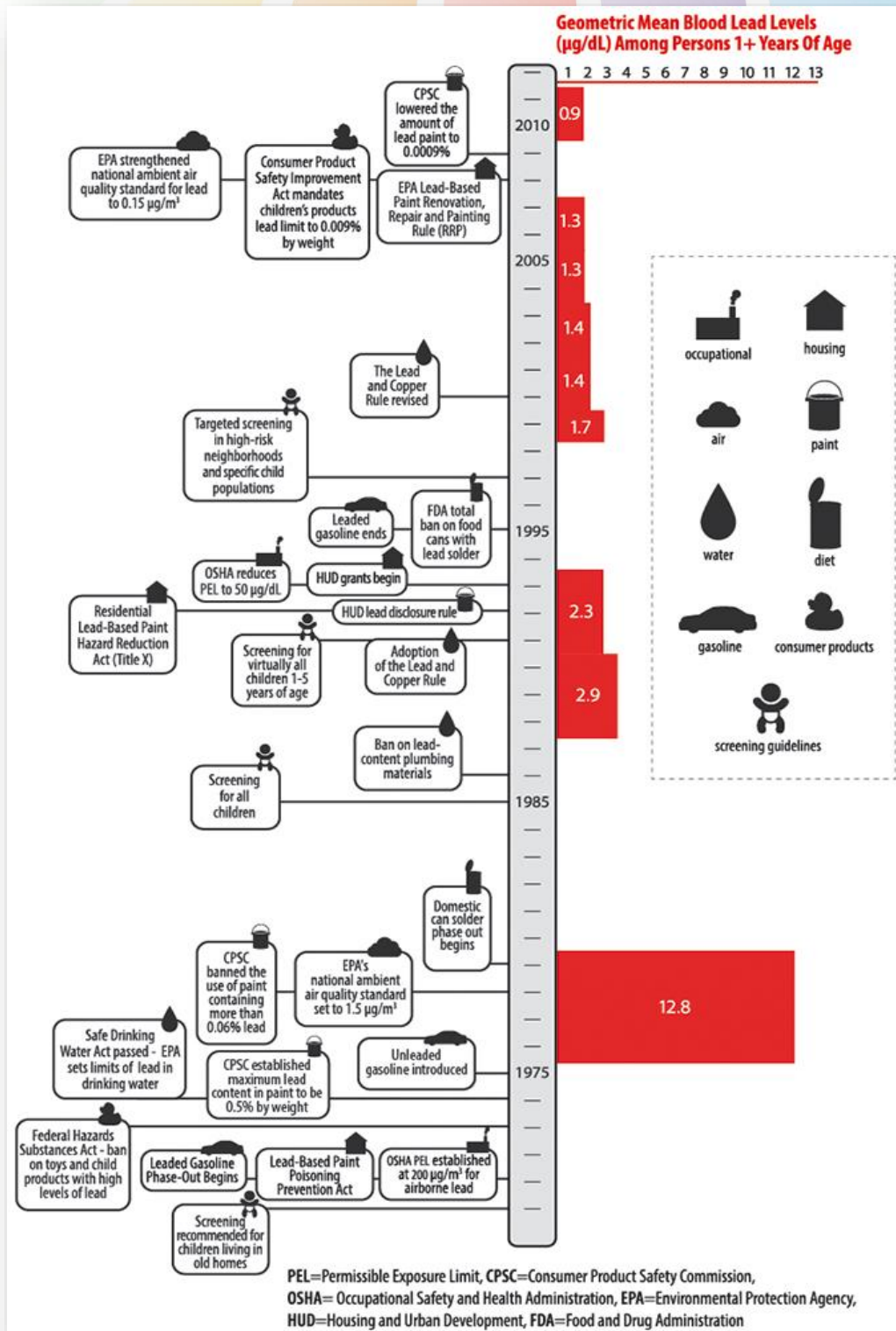
School: Creative Einstein

Age: 11

Description of Work: Colouring pencils on paper

[https://volcanoartprize.com/portfolio-item/cherries-](https://volcanoartprize.com/portfolio-item/cherries-2/)

[2/](#)



**Figure 4:** Selected Lead Control Measures, United States, 1970-2012 (Dignam et al 2019)

The initial step in any national lead policy is to require that all of the following, and more, have a role to play.



Prime Ministers and Opposition Leaders, Ministers and Shadow Ministers, including but not limited to:

- Ageing and Health
- Agriculture
- Alcohol, Drug and Gaming
- Aviation
- Building, Construction and Demolition
- Child Poverty Reduction
- Children and Youth
- Climate Change
- Commerce and Consumer Affairs
- Consumer Protection
- Defence
- Economic and Regional Development
- Education
- Environment, Water and Conservation
- Fair Trading
- Fisheries
- Housing
- Indigenous Peoples
- Industry
- International Trade and Export Growth
- Justice and Corrections
- Marine Environments
- Medical Research
- Mining and Manufacturing
- Police
- Revenue
- Science and Innovation
- Shooters and Hunters
- Social and Gender Equity
- Social, Environmental and Intergenerational Justice
- Telecommunications
- The Arts
- Transport
- Workplace Relations and Safety



2023 Volcano Art Prize Entry. Artist: Gordon Ma

Title: Christmas Decorations and Candles

Lead-Safety Message: Be sure to only buy lead-free Christmas decorations and non-metal-wick candles. The LEAD Group got lead candle wicks banned in Australia but not globally yet.

School: Creative Einstein

Age: 10

Description of Work: Colouring pencils on paper.

<https://volcanoartprize.com/portfolio-item/christmas-decorations-and-candles/>



### **i) Establish a National Blood Lead Surveillance System, the data from which feeds government Lead Education and Awareness Campaigns**

A National Blood Lead Surveillance System is a database into which pathology laboratories and/or health professionals/agencies are required to enter blood lead results and associated data. It is designed to aid government, health professionals and researchers to see trends and make decisions on lead safety policy and lead exposure and poisoning prevention research.

If a National Blood Lead Surveillance System is not already in place, the national government's first responsibility in Primary and Secondary Lead Exposure Prevention, and Tertiary Lead Poisoning Prevention, is to set up such a Surveillance System to collect ALL blood lead testing results (not just those results which exceed the target blood lead limit at any one time). This surveillance will include active blood lead screening of individuals (and communities) identified through lead risk questionnaire screening, not just passive reporting of those cases identified by health care professionals.

Then to collate, analyse, and raise awareness of the conclusions of the analysis of the collected data.

Data collected for the National Blood Lead Surveillance System and entered by the pathology laboratory to include:

- Name
- Address
- National health identifier (such as Medicare/NIH, patient number, NHS number)
- Date and time of day of blood draw
- Time of day
- Date of birth
- Gender
- Ethnicity and/or race
- Blood lead result
- COVID-19 incidence (in the patient)

The doctor and/or local health agency is also required to enter data pertaining to interventions taken to reduce blood lead levels, and any information gleaned from particular case histories as to the sources of lead exposure in the individual/community, as stated below at v. As the National Blood Lead Surveillance System gains more data, an inventory of sources of lead exposure in the population (see Addendum 5, below) and a list of successful interventions will be generated.



2023 Volcano Art Prize Entry. Artist: Tim Pye  
Title: Peebee The Elephant  
Lead-Safety Message: Lead: The big, grey, dangerous, heavy element in the room. It could be your room.  
Description of Work: Microsoft Powerpoint

<https://volcanoartprize.com/portfolio-item/peebee-the-elephant/>



Excellent examples of collation and analysis of blood lead data can be seen at the US Centers for Disease Control and Prevention ([CDC 2019](#)) website in the National Health and Nutrition Examination Survey (NHANES) ([CDC 2021](#)) Healthy Homes and Lead Poisoning Surveillance System (HHLPPSS) and summary data is included in the *National Report on Human Exposure to Environmental Chemicals* ([CDC 2022b](#)). CDC have also written and published over 100 lead poisoning case histories and meta-analyses in *Morbidity and Mortality Weekly Report* (MMWR) ([CDC 2023](#)) some examples are:

- [Elevated Blood Lead Levels Associated with Retained Bullet Fragments United States, 2003–2012 \(Weiss et al 2017\)](#)
- [Lead in Spices, Herbal Remedies, and Ceremonial Powders Sampled from Home Investigations for Children with Elevated Blood Lead Levels — North Carolina, 2011–2018 \(Angelon-Gaetz et al 2018\)](#)
- [Elevated Blood Lead Levels Among Employed Adults — United States, 1994–2013 \(Alarcon 2016\)](#)

## ii) Set national blood lead action levels for sub-populations and the environmental and



2023 Volcano Art Prize Entry. Artist: Elizabeth O'Brien  
Title: Invest Sustainably

Lead Safety Message: In *A Life on our Planet* (2020), my hero David Attenborough's vision of humans cooperating to achieve the rewilding of the world and avert climate disaster includes encouraging every individual to ensure their wealth is invested sustainably. If your bank or super fund isn't aiming to help end climate change, commit today to switch to one that does!

Description of Work: Powerpoint collage of screenshots from [Future Super and Pension Funds](#); [Count Us In website - Make Your Money Count commitment page](#); [Teachers Mutual Bank \(TMB\)](#); [Bank Australia](#); [A Life on our Planet \(Audible book\)](#)

<https://volcanoartprize.com/portfolio-item/invest-sustainably/>



## consumer standards designed to lower blood lead levels, and to prevent and address environmental lead contamination

Blood lead testing is the gold standard for biomonitoring to assess recent exposure to lead. Repeated blood lead monitoring provides invaluable information as to lead exposure over time. Blood lead testing is also a useful tool in gauging the impact of actions intended to reduce the blood lead level as well as tracking the biokinetics of lead, that is, to assess how much lead from the bone (and other organ) stores has moved back into the bloodstream either due to treatment, extreme changes in activity levels (for example, becoming bedridden, or training for a marathon), hormonal changes such as during growth and pregnancy, or the demineralisation of the bones.

**A blood lead action level is** the level at which the government requires action to assist the blood lead level of the individual from a certain sub-population or leaded community to fall as quickly as possible below that level (see also 2.3, below).

*Because research into the health effects of lead has demonstrated over many decades that the action level will always need to be lowered further on the basis of the findings of ongoing health effects research, it is vital to **acknowledge** that the blood lead action level/s set by any government will be chosen on political and economic grounds. On health grounds alone, there is no threshold of safety in lead exposure, but less lead means less damage.*

*It is irresponsible for a government to set the level/s very low in a country which has no hope of achieving it, especially if it still permits the addition of lead to paint, and the use of Ayurvedic medicines containing metal bhasmas, leaded AvGas for general aviation aircraft, the use of human sewage on food crops, etcetera - and even more irresponsible to set the level very high.*

We have seen that what was considered to be an elevated blood lead level is NOT fixed. Initially, below 80 µg/dL was the "acceptable level" and this was progressively reduced (to 60, 50, 40, 25, 10, 5 and most recently 3.5 µg/dL) in the light of research revealing connections between blood lead levels and serious health risks. In [2009, WHO](#) wrote, "The ideal exposure level for lead is less than 1 µg/dl". Many of the world's leading lead researchers have since recommended lead levels of no greater than 1 µg/dL of blood as the action level.

In Germany, the [Wilhelm et al \(2010\)](#) policy paper written on behalf of the Human Biomonitoring Commission of the German Federal Environment



2023 Volcano Art Prize Entry. Artist: Jennifer Chuah

Title: Pearl Oyster

Lead-Safety Message: Pearls are made by oysters around a parasite that enters their shell. Lead is similarly encased in our bones but sadly can leach back into our blood stream later in life and cause early death.

School: Creative Einstein

Age: 12

Description of Work: Colouring pencils on paper

<https://volcanoartprize.com/portfolio-item/pearl-oyster/>



Agency set a global precedent in lead policy by replacing health-based blood lead levels of concern with individual action levels (called "reference values") which differ for each sub-population, and were based on the 95th percentile blood lead result in a blood lead survey for that sub-population.

This meant that because 95% of German children (3–14 years of age) in the survey had a blood lead result below 3.5 µg/dL, the reference value became 3.5 µg/dL. Interventions were required from doctors and public health professionals for all child blood lead results 3.5 µg/dL and above.

The reference values for adults ([Schulz et al 2007](#)), which are based on data from the German Environmental Survey of 1998, are:

- Men 9 µg/dL
- Women 7 µg/dL

In 2012, the US CDC followed suit by choosing the 97.5 percentile reference value for children up to 72 months. Due to the NHANES ongoing national blood lead survey data, the 97.5 percentile reference value for children was further lowered to 3.5 µg/dL in 2021 ([CDC 2022c](#)).

As at early 2023, the widely used action level is a blood lead level no greater than 3.5 µg/dL, based on US NHANES blood lead national survey data from 2011-2014 which determined that 97.5% of young children in the US had a blood lead level below 3.5 µg/dL. The CDC policy is to reduce this "reference" [or action] blood lead level each four years, in line with the NHANES survey (repeated every two years) falling 97.5<sup>th</sup> percentile result ([Caldwell et al 2017](#)).

The combination of the US model of lowering the reference level periodically and the German model of having reference levels for sub-populations, provides the best existing model for other nations.

In 2012, as a result of a forum held by members of The LEAD Group's Technical Advisory Board and others (including Professor Bruce Lanphear) ([Taylor et al 2012](#)), The LEAD Group set its action blood lead level to be 1 µg/dL.

The LEAD Group proposes that blood lead action levels be set and periodically lowered, and intervention actions determined by sub-population, including:

- Birth cord blood lead levels
- Children up to the age of 60 months
- Children 5-12 years old
- Children 13-20 years old



2023 Volcano Art Prize Entry. Artist: Joshua Fatsea

Title: Mountain Lake

Lead-Safety Message: Protect our beautiful planet by banning lead in aviation fuel, fishing sinkers, bullets, paint and everything else that causes lead pollution!

School: Creative Einstein, Age: 10

<https://volcanoartprize.com/portfolio-item/mountain-lake/>



- Adults 21-60 years old
- Adults 61-70 years old
- Adults 71-80 years old
- Adults 81-90 years old
- Adults 91-100 years old
- Adults over 100 years old
- Occupationally exposed sub-groups, for example, ship-breakers, gold assayers, metal and bone *bhasma* makers, plumbers, mine and smelters workers working with lead and lead-containing ores (zinc, copper, tin, silver or gold), fossil fuel burning facility workers, lead-acid battery manufacturing and recycling plant workers, vehicle recycling plant workers, painting contractors, remediators and restorers, shooters, leadlighters
- Community members by age sub-population in highly leaded communities
- Wildlife (aquatic and terrestrial)
- Domestic animals
- Farm animals (aquatic and terrestrial)

Occupational lead health and safety regulations will be updated to set more stringent blood lead action levels (for instance, removal from lead-risk work and return levels) by occupation. Enforcement of these up-to-date lead workers' regulations is an essential component of Primary Lead Exposure Prevention. Policing of occupational lead health and safety regulations is vital and enforcement must include financial penalties for non-compliance.

Occupational lead health and safety regulations will be set based upon the percentile blood lead level determined by government for that particular occupation and regularly reduced through continuous surveying, implementation of the Hierarchy of Control for Managing Risk of Materials (the highest level of control is to eliminate lead from the process), and resultant reduction in blood lead levels.

When products or processes which cause occupational lead exposure have been identified, policy on producer responsibility will protect the environment from lead and further decrease lead exposure in industrial scale, backyard, black-market and hobby lead processes, such as in the collection and recycling of used lead-acid batteries (ULABs)



2023 Volcano Art Prize Entry. Artist: Jordan Ma  
Title: Frog on Grass  
Lead-Safety Message: Many frogs are endangered. Make the world lead-safe so frogs can be safe too!  
School: Creative Einstein  
Age: 7  
Description of Work: Colouring Pencils on paper

<https://volcanoartprize.com/portfolio-item/frog-on-grass/>





(see xvii, below), spent leaded ammunition and the management of lead paint (see also 1.6, below).

### iii) Set target blood lead levels and reduce them over time

**A target blood lead level is** the blood lead level to be achieved by everyone who has a blood lead test in the entire population or a sub-population by a certain date.

The decision to not include adults in public health policy on lead poisoning prevention was a common mistake of past programs based on inadequate information about health effects of lead exposure in adults.

It is important to **acknowledge** that, if, in current regulations, a certain group of people, such as workers, are permitted to exceed the national target blood lead level, that this was a political and economic decision (often based on industry-funded misinformation) made in the past (or at best, one made in ignorance), not a health-based decision.

Australian, New Zealand and United Kingdom governments need to consider political and economic factors in order to determine staged reductions of the target levels set out below:

- All lead workers blood lead levels to be below 12 µg/dL by 2024,
- All adults, children and cord blood lead levels to be below 10 µg/dL by 2025,
- All children under 6 years of age and cord blood lead levels to be below 3.5 µg/dL by 2027,
- All adults, children and cord blood lead levels to be below 5 µg/dL by 2028, and
- All adults, children and cord blood lead levels to be below 1 µg/dL by 2031.

Each country's government will have to decide on what is politically and economically viable, but stepped targets will enable the development of specific strategies so that lead safety can be achieved over a set timeframe.

Any province, state or other level of government (which for instance is dependent on the income of a large lead facility) within the country, can set its own target blood lead levels, as long as the economic



2023 Volcano Art Prize Entry. Artist: Shitemi Owen

Title: Anti Lead in Paint Campaign Cake

Lead-Safety Message: This cake symbolises the successful work of University of Nairobi Chemistry Students Association and Basco Paints of raising lead poisoning awareness and introducing lead-free paints to Kenya.

School: University of Nairobi

Description of Work: The cake has logos of the sponsors of International Lead Poisoning Prevention Week of Action (ILPPWA) 2022 that included the

University of Nairobi, University of Nairobi Chemistry Students Association

and Basco Paints. It was 10 years anniversary icon from World Health Organization and a symbol of Ban Lead Paints.

<https://volcanoartprize.com/portfolio-item/anti-lead-in-paint-campaign-cake/>



and political factors for choosing the targets are acknowledged.

Define "success" in achieving a particular target as being no incidence of a blood lead level exceeding the target level by the target date, as revealed by follow-up national surveys and blood lead surveillance data. By setting both targets for blood lead levels and of zero incidence of cases above the sub-population's blood lead target, a country has something by which to measure its progress in reducing the incidence of lead poisoning in its national or regional population or sub-population. The blood lead monitoring data is vital for re-evaluating the strategies needed to meet the targets (see 2.3, below).

Conduct follow-up national, lead-town and leaded community blood lead surveys to see if the blood lead target was met and to motivate and inform increased development or implementation of programs to achieve the next target. Just as with blood lead target of individuals, the formula is:

- Survey
- Respond
- Re-survey
- Respond afresh
- Repeat until lead-safety is achieved

#### **iv) Promote blood lead testing of individuals and inclusion in blood lead surveys of categories of people at risk of historical, current or future lead exposure**

It is vitally important to identify individuals and populations at risk of historical, current or future lead exposure and ensure that they receive access to blood lead testing as soon as they have been identified and that they are informed of the results.

Targets will be set for the screening of at-risk sub-populations will ensure that blood lead testing is adequate. In the US, the target is that 100% of young children are screened via questionnaire and that 50% of children below 2 years of age are screened via blood lead testing. In Australia, the target is that 100% of lead-exposed workers are blood lead tested.

Once the National Lead Policy is finalised and adopted, the first round of media activity to raise awareness of the new policy will publicise the list of categories of individuals at risk of lead exposure and advise them to seek medical advice and referral for



2023 Volcano Art Prize Entry. Artist:

Suvana Parajuli

Title: Flamingo

Lead-Safety Message: [How many more flamingos must we lose before we do something about lead pollution?](#)

School: Creative Einstein

Age: 11

Description of Work: Colouring pencils on paper

<https://volcanoartprize.com/portfolio-item/flamingo-2/>



blood lead testing. Contemporaneously, researchers will be funded to carry out blood lead surveys of the following categories of people.

This list is a good starting point for identifying individuals who could benefit from a blood lead test and categories of people who are at risk of current or past lead exposure and who require a blood lead test.

Any child or adult who presents for a or medical check-up or with any of the following signs or symptoms associated with lead exposure, or occupations, hobbies, behaviours or beliefs which result in lead exposure:

- Medical check-ups for pre-employment, pre-insurance, annual health check
- Vomiting, diarrhoea, constipation, abdominal pain
- Foreign body ingestion
- Anaemia or iron-deficiency
- Seizures
- Pica
- Behavioural problems
- Aggression and/or contrariness, including in the elderly
- Delinquency
- Violent crime (including homicide and domestic violence)
- Possible Autism Spectrum Disorder (ASD)
- Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder (ADHD)
- Speech and other developmental delays
- IQ less than expected or less than 80
- Learning or development problems
- Depression, anxiety, and panic disorder
- Dementia, including Alzheimer's Disease
- Parkinson's Disease
- Essential tremor
- Amyotrophic Lateral Sclerosis (ALS)
- Multiple Sclerosis (MS)
- Motor Neurone Disease (MND)
- Hypertension, stroke, heart attack, heart disease
- Unexplained hearing loss and/or balance problems



2023 Volcano Art Prize Entry. Artist: Alex Jewson

Title: #GrandmaLead and Grandson

Lead Safety Message: Children look to us to invest in what's important: Children's intelligence, lead-safety, climate-safety, time together meditating while on your favourite "whale rock".

Description of work: Mobile phone photo.

<https://volcanoartprize.com/portfolio-item/grandmalead-and-grandson/>



- Cataracts
- Any person planning to conceive
- Pregnancy (blood lead testing will be carried out on anyone who is pregnant, in the first and third trimesters, and cord blood will be tested for lead at the birth)
- Lactation
- Preeclampsia
- Pre-term birth and low birth weight babies (test cord blood for lead at the birth)
- Babies born with unexplained birth defects (test cord blood for lead at the birth)
- Delayed achievement of developmental milestones (crawling, walking, speech, and others)
- Delayed puberty
- Loss of libido, reduced sperm count, sub-fertility, or miscarriage (spontaneous abortion)
- Menopause (including perimenopause)
- Joint pain
- Bone fractures, loss of bone density, or osteoporosis
- Dental caries
- Kidney disease
- Reduced kidney function
- Tobacco smokers, given that lead is found in tobacco and that smoking interferes with vitamin C metabolism which has lead removal/chelation role
- Possible alcoholism, given that lead can be found in alcohol and consumption of alcoholic beverages will increase the rate of absorption of lead from the gut
- People with occupation or hobby lead exposure, such as plumbers, radiator repairers, ship breakers, DIY renovators, bullet- or fishing sinker makers, scrap metal merchants, leadlighters
- A belief that lead and other toxic metals are therapeutic, for example, people who take Ayurvedic medication containing metal *bhasmas*
- Anyone who has been shot and has retained lodged lead shot, bullets, or shrapnel – these people require at least annual blood lead



2023 Volcano Art Prize Entry. Artist: Leo Manttan

Title: Fighting Kangaroos

Lead-Safety Message: Kangaroos shot but not killed by hunters can become aggressive due to lead poisoning from the lodged bullet fragments.

Age: 4

Description of Work: Non-toxic children's texta drawing

<https://volcanoartprize.com/portfolio-item/fighting-kangaroos/>



monitoring until the lead is removed from the body

This would mean a very high proportion of the population will be tested for blood lead. The reality is that all these symptoms may be exacerbated by lead and it is important to begin to track down those who may have a link that is caused by environmental lead.

All of these individuals will be monitored for blood lead and iron levels, have their environment tested and nutrition assessed, and be retested for blood lead following abatement measures. The awareness that lead may be involved in many of the underlying conditions outlined above will begin by making a blood lead test part of routine testing for annual check-ups and other testing regimes, such as in pregnancy and via up-to-date and enforced occupational lead health and safety regulations, prior to, and during, occupational exposure to lead (see ii, above).

#### **v) Ensure that all blood lead results and patients' details are uploaded to the National Blood Lead Surveillance System**

National governments will require pathology laboratories to upload ALL blood lead results with the patient's health system number, name, address, date of birth, gender and lead-risk occupation to the National Blood Lead Surveillance System (see i, above).

Further, the doctor who receives subsequent blood lead results of one of their patients, will be required to upload information on any efforts to made to reduce the blood lead level, the date of changes, and so on, and whether that resulted in a reduction or rise in the subsequent blood lead results, to the National Blood Lead Surveillance System.

The initial benefits of uploading ALL blood lead results to the System is that when an individual's reduction in blood lead level is observed in conjunction with doctor-documented interventions uploaded to the system, and when the government's target blood lead level is reduced and government interventions implemented, longitudinal analysis in the Blood Lead Surveillance data over time will demonstrate:

- Trends within different lead-risk groups
- Trends in those individuals who have further or ongoing blood lead monitoring
- The success or otherwise of the implemented interventions.



2023 Volcano Art Prize Entry. Artist: Gordon Ma

Title: Apple, Pineapple, Pear, Cherries, Orange and Watermelon

Lead-Safety Message: All these fruits will help to keep you safe from lead.

School: Creative Einstein

Age: 10

Description of Work: Colouring pencils on paper.

<https://volcanoartprize.com/portfolio-item/apple-pineapple-pear-cherries-orange-and-watermelon/>



The other major benefit is that the National Blood Lead Surveillance System data can be de-identified and made available to researchers to form the basis of cohorts to examine lead-associated health, behavioural and longevity outcomes in longitudinal studies, as well as cohorts to examine the synergistic effects of exposure to lead and other toxicants, such as other heavy metals, and conditions, such as COVID-19 (see xiv, 3.0, 3.1 and 3.2, below).

The cost-benefit analysis of the blood lead research findings will justify increased expenditure in prevention of lead exposure and tertiary lead poisoning, as all previous lead longitudinal studies have done.

#### **vi) Use pathology reports to re-educate lead-workers, employers, trade unions and health professionals as to current blood lead target and blood lead action levels, and new levels as revised**

Many doctors are reliant on statements provided by laboratories on the pathology report of blood lead levels when interpreting the results to the patient, rather than to continuing medical education.

Employers and health professionals will be re-educated if their current understanding is that 20 or 30 or 50 µg/dL is the appropriate blood lead action level for workers or that an elevated blood lead level above the national target level is only of concern in young children.

Currently in Australia and New Zealand, pathology reports state the blood lead result and a range, e.g., 3.5 µg/dL (0-5 µg/dL). Unlike other pathology parameters, such as iron or cholesterol, where the range provided on the report is actually the healthy range, **there is no healthy range for blood lead levels.** The LEAD Group advises

that all blood lead results above 1µg/dL will be followed-up by actions/interventions which aim to bring the blood lead level to below 1µg/dL.

However, many patients receive the message from their doctor that their blood lead level is “normal” or “average” when it is below the government’s “action blood lead level” or “notifiable blood lead level”, for instance, in Australia of 5 µg/dL.

It has always been wrong to report blood lead results together with a range that can be misinterpreted as being “healthy”, “average” or “acceptable”. Blood lead results will only be reported by pathology laboratories in such a way that they can be compared to the recommended levels and action levels, and for the sake of the patient (or their parent/caregiver) to the average blood lead level



2023 Volcano Art Prize Entry. Artist: Claire Leight  
Title: Not Just a Kid From Kingaroy  
Lead-Safety Message: Not Just a Kid from Kingaroy - A Force to be Reckoned With  
Description of Work: Photograph – Iphone

<https://volcanoartprize.com/portfoli>

[o-item/not-just-a-kid-from-kingaroy/](https://volcanoartprize.com/portfoli/o-item/not-just-a-kid-from-kingaroy/)



for their age range.

In the United States in the 2017-2018 national blood lead survey, the average blood lead levels are below 1 µg/dL in all age ranges and for all races, except Asians ([CDC n.d.](#)). Perhaps this is due to the continued use of Ayurvedic medicines containing metal *bhasmas* by some Asians in the US. As reported in [Angelon-Gaetz et al \(2018\)](#), in the period 2011-2018, close to 70% of 61 lead-poisoned children averaging 17 µg/dL in North Carolina were identified as Asian, including from India and Pakistan. In the Indian subcontinent, over 80% of the population use Ayurvedic medicines and 20% of Ayurvedic medicines contain lead and other heavy metals ([O'Brien 2020](#)).

One microgram per decilitre is about 60 times higher than pre-industrial humans whose blood lead levels were 0.016 µg/dL ([Flegal and Smith 1992](#)) (see Figure 2, above).

Using the statements on this laboratory report well becomes the challenge for good public health policy.

The following are example statements that could be included on a report:

*There is no threshold below which lead exposure causes no harm, however, less lead exposure means less damage. Pre-industrial blood lead levels of humans were 0.016 µg/dL.*

*This laboratory has a limit of detection of 0.2 µg/dL.*

*The national target blood lead level is to be below 3.5 µg/dL.*

*The national blood lead "action level" is above 5 µg/dL – this is the level at which the government recommends that action be taken to reduce the blood lead level.*

*Laboratory lead testing of paint, soil, surface dust wipes, ceiling dust, water, backyard eggs, food, traditional and complementary medicines, traditional cosmetics and other consumer products provide the most accurate guidance to potential current sources of lead. (See vii, below)*

In most countries, the average blood lead level is unknown. This will remain the case until national blood lead surveys are conducted. Once averages are known by age range, pathology reports will include the average relevant to the age range of the patient. This will prevent the assumption being made by the doctor or patient that any ranges are "averages", as noted above.

Governments also have a role in requiring pathology laboratories to continually upgrade their equipment if the limit of detection of blood lead results is higher than, say, half the average blood lead result as determined



2023 Volcano Art Prize Entry. Artist: Justine Cooney

Title: I Want a Lead Safe Future

Lead-Safety Message: I want a future in which people care about each other, and as a society regulate to protect people, particularly the vulnerable like children, from known and preventable dangers such as lead poisoning.

Description of Work: iPhone photo.

<https://volcanoartprize.com/portfo>

[lio-item/i-want-a-lead-safe-future/](https://volcanoartprize.com/portfo)



by the national survey.

For example, blood lead levels in all age groups in the United States currently average <1 µg/dL, yet numerous Australian laboratories have a limit of detection of 2.1 µg/dL resulting in most patients being told that they have non-detectable lead in their blood, when they could in fact have more than twice the US average.

In some countries, blood lead levels are reported in micromoles per litre (µmol/L) or micrograms per litre (µg/L) rather than the international units of micrograms per decilitre (µg/dL). This leads to confusion among doctors and patients and makes it difficult to compare results to international guidelines and literature. It's recommended that these countries shift to the international reporting units (as used by WHO) as soon as possible, until the international community agrees to shift entirely to µg/L (this has been recommended by [Taylor and Lanphear 2020](#)). When people see a blood lead result of 10 µg/L (equivalent to 1 µg/dL), it's easier to conceptualise that they have a long way to go to get to a non-detectable blood lead level.

**vii) Use pathology reports to advise doctors and their patients as to options for accurate and reliable testing for the likely environmental lead sources that may have elevated their blood lead level**

In some countries, government advice cautions about the lack of sensitivity and potential false results from hardware stores) for lead in paint, dust wipes, ceramics, and so on.

As noted above (in vi), blood lead pathology reports provide an indirect and consistent opportunity to advise of the accuracy of laboratory lead testing of paint, soil, surface dust wipes, ceiling dust, water, backyard eggs, food, traditional and complementary medicines, traditional cosmetics and other consumer products.

Chemical analysis laboratories which test for lead in all these sample types are generally not permitted to provide interpretation, advice or recommendations on how to respond to the lead results. As well, most laboratories don't provide advice or information on sample for lead analysis, and don't supply laboratory-grade sampling equipment for lead sample collection.

Given these limitations, it is prudent of the pathology laboratories to provide information on laboratory testing for environmental lead.

In Australia, LEAD Group Kits, ([Australian Government Department of the Environment 2014](#)), sold by the not-



2023 Volcano Art Prize Entry. Artist: Jennifer Chuah  
Title: Wild Blueberries  
Lead-Safety Message: Medical Medium Anthony William calls Wild Blueberries both a heavy metal detox food and one of his top 10 Super Healing Foods. Excellent in smoothies!  
School: Creative Einstein  
Age: 12  
Description of Work: Colouring pencils on paper

<https://volcanoartprize.com/portfolio-item/wild-blueberries/>





for-profit LEAD Group charity, are unique in the world for providing sampling instructions, advice and laboratory-grade sampling equipment, plus interpretation and individually tailored comments on the laboratory results with guidance as to priority mitigation measures. Clients can include individuals, government departments, shooting ranges, and environmental assessors, contractors, and public health officers (who collect the samples for the client). The advice provided on how to sample, what to sample, interpretation of results, and how to reduce blood levels in humans, animals (pets, backyard poultry and livestock, including "paddock pets") is enormously advantageous compared to standalone laboratory test results or environmental sample x-ray fluorescence (XRF) screening results.

All environmental and consumer product sample types are covered by LEAD Group Kits within Australia. Outside Australia, USA and Canada, all other countries can currently access LEAD Group Kits if they are not testing the sample types which will not pass through Australian customs due to biosecurity risks, such as soil, water, eggs, breast milk.

If any country were to locate chemical and food/medicine laboratories which have the capacity to test for the presence of lead at low levels then the above sample types could be analysed in that country with a LEAD Group Kit, and this would bypass the biosecurity issue.

Where possible, within-country laboratory testing of lead, in all sample types via LEAD Group Kits will be sourced to avoid the need for international transportation of any samples. Such laboratories will need to possess the capabilities to detect lead at low levels across multiple sample types.

With local community group involvement that is already, or is prepared to, collaborate with a knowledgeable and experienced charity, such as The LEAD Group, the rest of the services could be provided in-country - namely the provision of laboratory-grade sampling equipment, instructions, interpretation and advice to the client on the laboratory results and how to reduce their blood lead levels. This would in-effect be an Australian lead-safety intellectual property export to help to offset the burden of Australia's more than 120-year history of exporting lead.

Where DIY sampling kits which involve laboratory analysis and guidance, such as LEAD Group Kits, are available it would be beneficial for all patients to be advised of their availability (along with any government subsidy) within the blood lead pathology report.

viii) National governments will budget for the provision



2023 Volcano Art Prize Entry. Artist:

Joshua Fatsea

Title: Pet Rabbit

Lead-Safety Message: Protect pets by testing your soil for lead at a lab. In Australia, you can test at a lab via a LEAD Group Kit from

[www.lead safeworld.com/shop](http://www.lead safeworld.com/shop)

School: Creative Einstein

Age: 10

Description of Work: Colouring pencils on paper.

<https://volcanoartprize.com/portfolio-item/pet-rabbit/>

[o-item/pet-rabbit/](https://volcanoartprize.com/portfolio-item/pet-rabbit/)



of affordable laboratory testing and guidance on lead results in potential environmental, food, and other sources of lead to individuals (of all ages)

Governments can also provide community-based lead testing DIY sampling kits, such as The LEAD Group's Kits (described in vii, above) which come with guidance based on laboratory lead results in environmental, food, traditional and complementary medicine, and other samples as to how to reduce blood lead levels.

When national governments budget for the provision of this type of testing (including advice) on a means-tested basis, not only will blood lead levels fall but community not-for-profit organisations providing such services will be financially supported to carry out other lead safety programs.

### ix) Determine and allocate responsibility for prevention of lead exposure and lead poisoning

Prevention of lead exposure and poisoning is commonly divided, in health literature, as consisting of Primary, Secondary and Tertiary Prevention.

**Primary Prevention** is concerned with preventing public/individual lead poisoning and/or exposure in the first place.

Predominantly, it is the responsibility of intergovernmental organisations and national governments.

Individuals can also take action to prevent lead exposure in their homes, workplaces, or leisure activity venues, such as shooting ranges. For example, prior to purchase or rental of residential properties, individuals may test for lead and decide to carry out abatement prior to moving in or elect not to purchase or rent the property.

### Secondary Prevention



2023 Volcano Art Prize Entry. Artist: Elizabeth O'Brien

Title: Stop New NSW Lead Mines

Lead Safety Message: I have a vision that the [2023 NSW Parliamentary Inquiry into whether the NSW regulatory framework for heavy metals and critical minerals mining is fit for purpose](#), will not only stop Bowdens and other proposed lead mines, but will find that no new lead mines in NSW can be justified! Let's use recycled lead (eg using government rebates to remove and recycle lead roof flashing so lead-safe rainwater can be collected) instead for our renewable energy projects!

Description of Work: Powerpoint collage of screenshots from [Communities anxious as NSW government spruiks mining, The 7.30 Report, 20 Sept 2023, ABC TV \(on Youtube\)](#)

<https://volcanoartprize.com/portfolio-item/stop-new-nsw-lead-mines/>



follows the finding of an elevated blood lead level and is concerned with preventing further lead exposure in individuals by environmental testing and removing the individual from the source of lead exposure or removing the source from the individual.

The state or local health authorities have a significant role to play either in lead testing and/or support for the removal of the lead source or the person from the source of exposure.

A typical example would be removal of lead contaminated soil from a backyard, or laying geotextile on top of it, then providing clean topsoil and grass to prevent soil exposure of children, pets and backyard poultry.

Another example would be a person changing their occupation or place of residence to prevent being exposed to lead.

Secondary Prevention is more diversified and therefore it is not entirely possible to designate in advance whose responsibility it is. The responsibility for collecting, collating, analysing and raising awareness of the results of blood lead testing (and possibly environmental lead testing) rests with governments.

**Tertiary Prevention** is concerned with preventing the lead already in a person's body from doing further harm (further than the harm done on the way into the organs and bone and teeth storage), including causing early morbidity and mortality.

Responsibility for Tertiary Lead Poisoning Prevention is also diversified from the individual experimenting with what reduces their own blood lead level to governments sponsoring long-term studies of the effects of certain treatment or intervention protocols.

There must be strategies for carrying out or encouraging all three forms of Lead Exposure and Lead Poisoning Prevention. These strategies need to be tailored to the specific circumstances of the particular country, but public awareness campaigns regarding the health effects of lead, possible sources and pathways of exposure, as well as what can be done to prevent exposure, cut off pathways, or reduce blood lead levels are essential.

Each country will establish both a national taskforce, like the President's Task Force on Environmental Health Risks and Safety Risks to Children (US), and an advisory group similar to the Lead Exposure and Prevention Advisory Committee (US).



2023 Volcano Art Prize Entry. Artist:

Christopher Nguyen

Title: Striped Kittens

Lead-Safety Message: Lead poisoning in cats often only shows as a loss of appetite and only sometimes vomiting and diarrhoea. Cats with lead toxicity are usually adult although occasionally kittens may be lead poisoned too.

School: Creative Einstein

Age: 11

Description of Work: Non-toxic colour pencils on paper. Lead Safety Message from <https://lead.org.au/fs/fst9.html>

<https://volcanoartprize.com/portfolio-item/striped-kittens/>



x) Carry out a National Blood Lead Survey of All Ages within 6 months of endorsing the National Lead Safety Policy on the Prevention and Management of Lead Exposure, Poisoning and Contamination

The first step in implementing a National Lead Safety Policy for preventing lead poisoning in a population is to do a baseline study - a National Blood Lead Survey of All Ages (across all age brackets).

Excellent examples of collation and analysis of national blood lead data collected since 1976 can be seen in the US Centers for Disease Control and Prevention ([CDC 2021](#)) *National Health and Nutrition Examination Survey (NHANES)*, although children who receive Medicaid in the US are only required to have their first blood lead test at 12 months of age, thus missing potentially 6-months' of lead exposure while crawling.

It is not a question of doing a survey to find out if anyone in the population of a particular country has lead in their blood because exposure to lead in some form or another is genuinely universal. A National Blood Lead Survey of All Ages is needed to develop specific strategies focused on sub-populations most at risk and then resurvey the population once the strategies have been implemented to evaluate their efficacy.

A National Blood Lead Survey of All Ages must include babies and children from at least age 6 months, as this is the age when crawling begins and therefore environmental lead exposure increases. The exception would be in lead mining and smelting (including lead-acid battery recycling/secondary smelting) towns, and near general aviation airports, where children as young as 4 months will be included due to the lead inhalation pathway.

Children 6-48 months old are at highest risk for lead exposure due to mouthing behaviours, pica, more efficient absorption, smaller size, and larger body burden.

Anybody seeking to conceive, those who are pregnant and women giving birth also need to be included in the National Blood Lead Survey of All Ages - cord blood can be collected during the birth and can be analysed for lead concentration.

Participants in the National Blood Lead Level Survey of All Ages will need to complete (or have their parent/guardian complete) a lead risk factor questionnaire



2023 Volcano Art Prize Entry. Artist: Gordon Ma

Title: Orcas Porpoising

Lead-Safety Message: Being an apex predator puts orcas at risk of severe population losses from lead in their prey and from crude oil spills and air pollution from the exhaust of tour boats – all fuel contains some lead.

School: Creative Einstein

Age: 10

Description of Work: Colouring pencils on paper

<https://volcanoartprize.com/portfolio-item/orcas-porpoising/>



and a general health questionnaire that specifically includes incidence of lead-related health outcomes in the person (and their family health history), such as all the at-risk individuals, listed at iv (above).

The lead risk factor questionnaire would include –

➤ **For children and adults:**

- Race, given that darker skinned people on average have higher blood lead levels than lighter skinned people in similar circumstances
- Gender, given that males typically have higher blood lead levels than females
- Date of birth (in preparation for being resurveyed, when the individual may have gone up an age bracket)
- Pica behaviour
- Year of construction and description of home (including condition of paint and presence of lead lighting or leaded windows, and lead flashing when rainwater runoff is allowed to empty onto soil, rather than being directed to a stormwater drainage system)
- Presence during or following renovation/s
- Home in a leaded community such as:
  - Inner city
  - Communities with lead, zinc, copper, tin, silver or gold mining or smelting operations
  - Aluminium smelter communities (due to the use of leaded coal tar pitch in smelting aluminium)
  - Communities around fossil fuel facilities or close to petrol stations
  - Proximity to a general aviation airport
- Use of Ayurvedic medicine, given that if metal *bhasmas* are included the medicine is likely to contain lead (and other heavy metals)
- Whether anyone smokes in the household
- Consumption of backyard chicken eggs
- Consumption of homegrown root vegetables
- Consumption of locally sourced fish or seafood
- Consumption of water from:



2023 Volcano Art Prize Entry. Artist: Rohan Calvert

Title: Lead Safe Rooftop

Lead-Safety Message: [Men in White](http://www.meninwhite.com.au) organised degraded lead-painted fascia component replacement, then lead-safely stripped red lead paint from the gable end and painted all with non-lead paint. Next step: plumber to replace lead flashing with non-lead Colorbond flashing. Description of Work: Powerpoint collage of 7 photos & logo from [www.meninwhite.com.au](http://www.meninwhite.com.au)

<https://volcanoartprize.com/portfolio-item/lead-safe-rooftop/>



- A tank (including whether there is lead flashing in the rainwater collection area and whether the rainwater is collected in a lead mining and smelting community or near general aviation flightpaths), dam, river, bore, or well
  - Lead pipes
  - Lead-soldered pipes
  - A new brass tap installed within the previous three years
  - Whether anyone living in the house has occupational and/or hobby exposure to lead, for example, in paint (including artists' paints for adults), glazes, alloys, solders, leadlighting
  - Whether anyone living in the house is a shooter, fisher or hunter, or makes bullets or fishing sinkers at home
  - If the home is carpeted
  - Use of ceramicware that is in poor condition (chipped, crazed glazing, dishwasher-damaged, microwave oven-damaged and so on) particularly if antique and/or used to hold acidic, alcoholic or hot foods or beverages, or to heat food or beverages
  - Use of leaded crystal glassware for acidic, alcohol or hot food or beverages, or to heat food or beverages
  - Use of turmeric, especially if sourced from India, Bangladesh or Georgia
  - Use of cosmetics, such as kohl
  - The presence of exposed soil (non-grassed, mulched or paved)
- **For children:**
- Chewing or mouthing of potentially leaded items (such as painted toys, jewellery),
  - Year of construction of any other building/s where the child spends a significant amount of time and the renovation history of the building
  - Regular use of lead-painted playground equipment or play areas made from either tyre crumb or leaded PVC artificial turf
- **For adults:**
- Consumption of alcohol and/or cigarettes



2023 Volcano Art Prize Entry. Artist: Edison Nguyen  
Title: Plastic shoe

Lead-Safety Message: Beware! Lead and other toxics have been found in cheap plastic shoes so never let a child or pet chew them! Australia and every other country needs a ban on children's consumer products that contain more than 90 ppm lead, as in the USA!

School: Creative Einstein

Age: 11

Description of Work: "Lead" (actually lead-free graphite) coloured pencils on paper. Lead Safety Message from <https://arnika.org/en/news/children-summer-shoes-they-often-contain-toxic-lead-and-hazardous-phthalates>

<https://volcanoartprize.com/portfolio-item/plastic-shoe/>



- Pregnant or breastfeeding
- Perimenopausal or menopausal
- Occupational and/or hobby exposure to lead
- Tattooed

This health history combined with data collection about lead exposure risk factors will enable the results to be immediately useful across a variety of research areas.

A National Blood Lead Survey of All Ages will also include testing for levels of iron, zinc and iodine, as these trace elements have a connection with lead and its effects, noting that both serum iron and ferritin are acute phase reactants and can vary significantly due to other factors. Low levels of iron and zinc in the blood increase the rate of uptake of lead. Iron and iodine deficiency can be mistaken for problems with brain development, one of the effects of lead poisoning.

Because of the negative impacts of both COVID-19 infection/s on heart health ([Raisi-Estabragh 2022](#)) and lead exposure, and the increased risk of all-cause mortality of both COVID-19 and lead, a National Blood Lead Survey of All Ages will include all known incidences of COVID-19 in the person and parameters of heart health in order to determine whether there is a relationship whereby people who have a higher blood lead level are more likely to die from heart attack or stroke following COVID-19 infection/s.

**xi) Further research the lead sources and pathways for National Blood Lead Survey of All Ages participants who have blood lead levels above the current action level**

Those participants of the National Blood Lead Level Survey of All Ages who have a blood lead level which exceeds the national action level will be offered government-funded laboratory testing of their likely sources of lead, starting with the usual soil, surface dust wipe, degraded paint, and water sources. Cases will be followed up until the blood lead level falls below the action level.

The likely lead sources and pathways for an individual can also be determined by using "isotopic fingerprinting" and other research techniques on blood, environmental samples, food, drink, cigarettes, ceramicware and so on.

This method is described in a paper presented at Standards Australia Conference "Lead in Blood" in



2023 Volcano Art Prize Entry. Artist: Elizabeth O'Brien  
Title: Vaping and Smoking Both Lead Your Health to the Gutter.

Lead Safety Message: #Grandma Lead says protect your health from lead and radioactive polonium-210 which decays to lead plus multiple other toxics by neither smoking nor vaping. Read <https://leadsafeworld.com/vaping-lead-poisoning>  
Description of Work: iPhone 8 photos collaged in Powerpoint

<https://volcanoartprize.com/portfolio-o-item/vaping-and-smoking-both-lead-your-health-to-the-gutter/>



1993 by Emeritus Professor Brian Gulson (founding head of The LEAD Group's Technical Advisory Board) and Karen Mizon, CSIRO, "Lead Isotope Method – Lead in Blood":

*The lead isotope fingerprinting method makes use of the fact that the abundance of the isotopes of Pb [lead] from one geological source can be quite different to the abundance of the isotopes from another geological source. For example, Pb in Australia generally has a totally different profile (a  $^{206}\text{Pb}/^{204}\text{Pb}$  of 16.0 –16.5) to that of Pb from Europe ( $^{206}\text{Pb}/^{204}\text{Pb} > 18.0$ ). The profiles or abundances of the Pb ores are also usually quite different from those of Pb in the common rocks which surround the mineral deposits.*

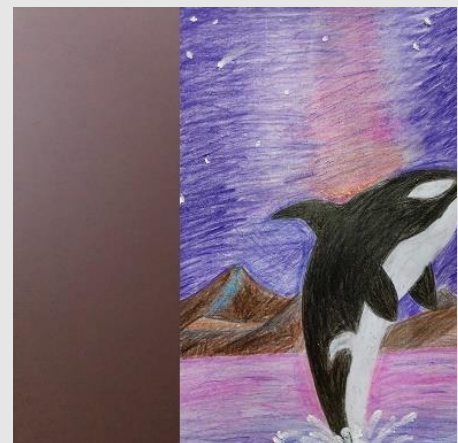
*In using the fingerprinting method for determining the source of Pb in, for example, people, the researchers compare the Pb isotope profiles in blood and/or urine (but can also use nails and teeth) with those found in the potential environmental sources such as air, food, water and dust. In simple terms, the closer the similarity in isotope profiles between that in blood and an environmental source or sources indicates that the environmental sources may be a significant contributor to the Pb in blood.*

Doing isotopic fingerprinting and analysis on the blood and relevant samples for each individual whose result was above the current action level is an essential follow-up to the national blood lead survey.

Even older participants' sources of lead exposure from earlier in their lives may be able to be identified and thus provide information to help identify patterns of lead exposure over time where that person grew up (see 2.4, below).

### **xii) Incorporate all National Blood Lead Survey of All Ages results and individual findings from isotopic research into the National Blood Lead Surveillance System**

Integrate all results from the National Blood Lead Survey of All Ages and include individual findings derived from isotopic research into the National Blood Lead Surveillance System, so that the conclusions and trends can feed back into the lead awareness media campaigns (see xiii, below).



2023 Volcano Art Prize Entry. Artist: Devrim Yasar

Title: Moonlit Killer Whale

Lead-Safety Message: Keep lead out of the ocean and stop global sea temperature rising by switching from burning fuel – even unleaded fuel contains trace amounts of lead – to renewable energy so apex predators like killer whales can continue to thrive.

School: Creative Einstein

Age: 9

Description of Work: Colouring pencils on paper

<https://volcanoartprize.com/portfolio/o-item/moonlit-killer-whale/>





### **xiii) Fund the implementation of campaigns to increase public awareness of lead and manufacturers, distributors and consumer of alternatives**

Government-run and government-funded lead education and media campaigns will inform actions taken by the public and professionals in creating a lead-safe product or service, lead-safe home, workplace, educational setting, childcare facility, places of leisure and hobbies (for example, shooting ranges, hunting and fishing locations, leadlighting, ceramics and jewellery studios/workshops), communities, regions and nations, and finally, the world.

For example, government funding will be provided to NGOs along with government-developed information (which in some cases may have been derived by an NGO or research organisation) about all the measures above so that this information can be disseminated via relevant websites, for example, The LEAD Group, Heart Foundation, and similar (see the full list at Addendum 1, below).

Learnings from the National Blood Lead Surveillance System (see i, above) and the National Blood Lead Survey of All Ages (see x, above) need to be incorporated into lead education and media (including social media) campaigns funded by government and carried out by government and a range of NGOs.

Excellent examples of lead poisoning case studies and trends in sources and pathways of lead exposure, often based on NHANES data, can be seen at the US Centers for Disease Control and Prevention (CDC) website in *Morbidity and Mortality Weekly Report (MMWR)* ([CDC 2023](#)).

Education and awareness campaigns to both consumers and manufacturers, distributors, and importers will include the existence of lead-free alternative products and ingredients. Some examples include:

- Tin or tungsten as alternatives for radiation shielding from x-rays and radioactive materials in items such as leaded vests, walls, boxes, cubicles, nuclear reactors and so on
- Artists paints for adults that are free from heavy metals
- Stainless steel to replace brass or bronze plumbing products, lead weights, lead bookmarks, lead curtain weights, lead shot inside teddy bears and other posable soft toys, lead soldiers and other game models, and galvanized products
- Non-leaded aviation fuels for general aviation (propellor-driven) planes and helicopters

As this National Lead Safety Policy is rolled out, the



2023 Volcano Art Prize Entry. Artist: Edison Nguyen  
Title: Dragon

Lead-Safety Message: If you ever buy a metal miniature Dragon to paint, make sure the paints and the metal are lead-free.

School: Creative Einstein  
Age: 11

Description of Work: "Lead" (actually lead-free graphite) coloured pencils on paper. Lead Safety Message from <https://lead.org.au/q&a/2006/20061102001.html>

<https://volcanoartprize.com/portfoli>



national government will be responsible for letting relevant non-government organisations (NGOs) know about all learnings that are discovered and their will be incorporated into outreach programs of these other organisations.

Lead education vitally extends to the provision of information on lead safety, exposure, poisoning and lead contamination prevention and management in training course material (including lectures and practical sessions).

This training information will help medical and health practitioners to identify potentially lead-exposed and lead-poisoned individuals and manage them appropriately; trades and building professionals to carry out lead-safe work, and all other professionals where lead exposure or lead contamination is a possibility to reduce lead exposure or lead contamination.

**The public lead education and media campaigns might include, for example:**

- Podcasts, video and social media platforms
- More traditional avenues, such as radio, television, newspapers, magazines, posters and art competitions
- Industry publications
- Online platforms to share fact sheets, articles and training courses (such as for D.I.Y. renovators)
- Information including lead-risk questionnaires at doctors and veterinary clinics
- Handouts at childcare and early learning centres, hardware stores (in the paint and plumbing sections), at shooting ranges, ammunition stores, at leadlighting, ceramics and jewellery studios/workshops, at local government offices and libraries
- Online shops where leaded- and potentially leaded-products are sold
- Mandatory labelling of products capable of causing lead exposure or contamination, for example:
  - "This heat gun/sander is not safe for use on leaded paint. Test the paint for lead at a laboratory before proceeding"
  - "This leaded solder must not be used in plumbing"
  - "This leaded PVC hose does not supply lead-safe water if left lying in the sun. Humans, pets, poultry and livestock should not drink water from this hose"
  - In any country where the WHO lead paint ban has not yet been legislated for **all** paint types, the paint types which contain more than 90 ppm lead or



2023 Volcano Art Prize Entry. Artist: Leo Manttan  
Title: Lion

Lead-Safety Message: Wild carnivores can ingest lodged lead bullets and shot in their prey. We need a global ban on lead ammunition to protect wildlife from lead poisoning.

Age: 4

Description of Work: Non-toxic children's texta drawing



indeed have added other heavy metals, will be labelled. For example, artists paints for adults will list the concentrations of specific heavy metals in each tube/colour and general warning labels regarding the hazards of all the heavy metal ingredients, as well as the synergistic effects of exposure to combinations of heavy metals (see 3.2, below)

The World Health Organisation (WHO) and the United Nations (UN) have created the Lead Paint Alliance and, at the suggestion of The LEAD Group, have declared the last full Sunday-Saturday week of October each year to be International Lead Poisoning Prevention Week of Action (ILPPWA).

The WHO/UN "Lead Week of Action", or ILPPWA, is an opportunity for governments, NGOs and individuals to run annual lead events (at home, overseas or online) to increase public awareness of lead and inform relevant professionals of appropriate testing and actions towards lead-safety. All levels of government should consider their own ILPPWA events and funding for other organisations to run such campaigns.

Public awareness campaigns will be evaluated to ensure return on investment, including by repeat blood lead surveys after education/awareness campaigns in targeted sub-populations and, where relevant, the provision of lead testing kits with instructions for environmental sampling, comments and interpretation of the results (see vii, above).

**xiv) Examine and utilise research into health and environmental impacts of lead and deficits caused by past lead exposure and their effect on the gross domestic product (GDP), in order to justify budgetary allocations to both a National Lead Safety Policy**

As mentioned above, [McFarland et al \(2022\)](#) estimated that in the US alone, over 824 million IQ points were lost during the 100-year era of leaded gasoline use. The study recommends:

*Such lead loss estimation efforts should be repeated across other domains believed to be influenced by lead exposure (including criminal behavior, personality, psychopathology, social mobility, cardiovascular disease, kidney function, and pathological brain aging). Doing so would generate a more complete understanding of the contributions lead exposures may have made to these important outcomes, the ultimate benefits to society from lead's removal from gasoline (including, potentially, recent improvements in many of these*



2023 Volcano Art Prize Entry. Artist: Gordon Ma

Title: Wave Cresting at Sunset

Lead-Safety Message: Let's catch the wave of renewable energy as the sun sets on fossil fuel burning.

School: Creative Einstein

Age: 10

Description of Work: Colouring pencils on paper

<https://volcanoartprize.com/portfolio-item/wave-cresting-at-sunset/>



outcomes) and the costs of ignoring existing lead hazards, including lead's continued use in aviation fuel... and its wide underregulated use in commercial and industrial processes internationally.

There are crossovers in the benefits to be gained through lead safety and climate crisis aversion policies due to:

- Lead naturally occurring in soil, rocks and volcanic emissions and thus in all organisms, and therefore in all fossil fuels, coal tar pitch, dung and plants, especially within trees
- Lead-exposed organisms displaying more lead-related symptoms at increased temperatures
- Fires, floods, droughts, storms and other extreme weather events releasing and spreading lead contamination

National governments will take the following steps to both avert the climate crisis and reduce lead emissions:

- Disallow new coal, gas and oil mines
- Cease the export of all fossil fuels
- End fossil fuel subsidies
- Stop forest burning to create agricultural land
- Promote vehicles, marine vessels and aircraft that are fuelled by renewable energy sources, and
- Subsidise individuals and companies to reduce their carbon footprint, switch to renewable energy and minimise the burning of fossil fuels.

See The LEAD Group's LEAD Action News *Lead Poisoning and Climate Change* ([Whitton 2009](#)) and fact sheet: *What can I do about climate change AND lead?* ([O'Brien and Taylor 2009](#)).

Refer to policy proposals on research at xvi, xviii, 2.6, 3.1, 3.2 and 3.3 (below).

#### **xv) Fund posthumous blood and/or bone lead testing**

Posthumous blood and/or bone lead testing will be carried out to determine the role that lead might have played in:

- Severe air pollution mortality
- Heatwave event mortality
- Premature deaths, especially regarding its interactions with other morbidities
- COVID-19 deaths



2023 Volcano Art Prize Entry. Artist:

Jennifer Chuah

Title: Pink Daisy

Lead-Safety Message: When lead dust pollution falls on flowers, bees collect it with the nectar and keep it in their bodies. Using renewable energy will help lower lead in air and in bees!

School: Creative Einstein

Age: 12

Description of Work: Colouring pencils on paper

<https://volcanoartprize.com/portfolio>

[o-item/pink-daisy/](https://volcanoartprize.com/portfolio/o-item/pink-daisy/)



Taking this a step further, posthumous testing of all individuals will illuminate lead's role in all-cause mortality and provide valuable incentive for preventing all lead exposure.

**xvi) Utilise research on the effects of lead on fauna, flora, microbes and the environment to create environmental protection legislation**

Research has already determined that lead harms wildlife and that plants stop growing in highly lead-contaminated soil and water, and that although soil biodiversity is generally depleted by lead contamination, some microbes and fungi can be utilised in bioremediation.

Every use of lead affects living organisms and their environment, whether it be exposure of farm animals, backyard chickens and aquatic life which allows lead to enter the human food chain; or the use of leaded ammunition and fishing sinkers which eventually harm wildlife; or allowing historical uses of lead, such as in paint and petrol and current uses of lead such as lead-acid batteries and AvGas, to be further distributed in the environment through poor management of demolition, paint on surfaces, storm water run-off, rainwater, dredged sediments, human sewage, and so on.

Legislation will be developed to:

- Prevent the addition of rainwater tanks to buildings without first removing lead flashing and leaded paint, lead spouting, and other sources of lead and requiring a first flush diverter to eliminate freshly fallen lead dust from the tank water
- Clean up shooting ranges and waterways where leaded ammunition and sinkers have been used and recycle the lead safely
- Require product stewardship on lead-acid batteries so as to ensure that all used lead-acid batteries (ULABs) are collected and recycled lead-safely and to research the potential for a circular economy with lead-acid batteries such that new lead-acid batteries are made entirely from the lead in ULABs
- Phase out lead mining, including setting policy to disallow the opening of new lead mines
- Require environmental clean-up be funded by companies that have profited from lead-related activities
- Lead mines will be phased out in favour of using recycled lead. New lead mines should not be necessary with the enormous amount of lead that is already in the world.



2023 Volcano Art Prize Entry. Artist: Jordan Ma

Title: Clownfish and Anemone

Lead-Safety Message: Clownfish rely on anemones for protection from predators, while anemones rely on clownfish waste for food. Every organism now relies on humans to protect them from our leaded waste.

School: Creative Einstein

Age: 8

Description of Work: Colouring pencils on paper

<https://volcanoartprize.com/portfolio>



**xvii) Legislate to ensure that the recycling of the biggest use of lead complies with the requirements of a circular economy**

A circular economy is defined by the United Nations Conference on Trade and Development (UNCTAD) as:

*A circular economy entails markets that give incentives to reusing products, rather than scrapping them and then extracting new resources. In such an economy, all forms of waste, such as clothes, scrap metal and obsolete electronics, are returned to the economy or used more efficiently (UNCTAD n.d.).*

The G7 acknowledged that “circular economy policies to improve design, reuse and safe recycling can contribute in addressing this issue [of lead and leaded waste management and reducing lead exposure in developing countries]” ([G7 Environment Ministers 2022](#), see full Communiqué in Addendum 5, below).

“Approximately 86% of the total global consumption of lead is for the production of lead-acid batteries mainly used in motorized vehicles, storage of energy generated by photovoltaic cells and wind turbines, and for back-up power supplies” ([UNEP n.d.](#)). “Nearly 99 million wet-cell lead-acid car batteries are manufactured each year [in the US alone]” ([US EPA 2011](#)).

Recycling rates for lead-acid batteries and the safety of recycling vary enormously from country to country. “Battery manufacturing accounts for greater than 85% of lead consumption in the world and recycling rate of lead–acid batteries in the USA is about 99%” ([Prengaman & Mirza 2017](#)).

Although the figure is similar in India, “A study found that 90 percent of lead batteries in India end up being recycled by unregulated small-scale operators.... There are many more [lead] contaminated sites than plants... [In] Bangladesh, where there are hundreds of informal companies, often breaking batteries and smelting their lead on vacant land... They keep getting chased off by the locals, but just move elsewhere, leaving behind thousands of contaminated sites” ([Pearce 2020](#)).

When new lead-acid batteries are made, 35% of the lead in them is freshly mined lead. Governments will need to legislate to transform the lead-acid battery manufacturing and recycling industries requiring them to create 100% recyclable lead-acid batteries in order to achieve a circular economy for lead-acid batteries. As Peter Hurley ([O'Brien et al 2005](#)) states:

*[Lead-acid] battery makers can only use 65% of what [the recyclers] recover... [this is due to the use of lead-antimony alloy which is too*



2023 Volcano Art Prize Entry. Artist: Percy Chau  
Title: Favourite Fresh Foods  
Lead-Safety Message: Whether you're a panda who just eats bamboo or a kid who loves sweet cherries and cake, we all need a lead-safe and climate-safe environment to keep growing our favourite fresh foods.  
School: Creative Einstein  
Age: 11  
Description of Work: Colouring pencils on paper

<https://volcanoartprize.com/portfolio-item/favourite-fresh-foods/>



corrosive to recycle into the anode plate].

If they used lead-tin alloys then they could reuse nearly all the material they recovered/recycled, provided they could keep it separate from the lead-antimony... A lead-tin battery will last up to five times longer than a conventional lead-antimony battery, and [yet] the battery maker can't get 5 times the profit from the better battery.

As can be seen, lead as used today in lead-acid batteries (ULABs) is not yet a green eternally recyclable metal, so producer responsibility is essential to the management of ULABs.

*Extended Producer Responsibility (EPR), also known as Product Stewardship, is a strategy to place a shared responsibility for end-of-life product management on producers, and other entities involved in the product chain, instead of the general public; while encouraging product design changes that minimize negative impacts on human health and the environment at every stage of the product's lifecycle. This allows the costs of processing and disposal to be incorporated into the total cost of a product. (CalRecycle 2023)*

Governments will need to legislate for producer responsibility which mandates the use of 100% recyclable metal alloy in lead-acid batteries and the collection and lead-safe recycling of all the used lead-acid batteries that are already in the world (refer to see ii, above; Figure 5 in Addendum 2, below; and Addendum 5, below).

An example of lead-safe ULAB recycling certification is the Better Environmental Sustainability Targets (BEST) Certification for Lead Battery Manufacturers ([OK International 2007](#)).

### **xviii) Contribute to a global database of research of world's best practice on Lead Exposure and Lead Poisoning Prevention**

Governments will contribute all their success stories in terms of legislation and reductions in blood lead levels in their country to a global database of research of world's best practise on Lead Poisoning Prevention, possibly to be developed by the World Bank, WHO or the UN, and promoted during International Lead Poisoning Prevention Week of Action (ILPPWA).



2023 Volcano Art Prize Entry. Artist: Joshua Quarters  
Title: Shark

Lead-Safety Message: Apex predators like sharks biomagnify all the heavy metals like lead that their prey have bioaccumulated. Protect our oceans from leaded waste and stormwater and ban all leaded products like sinkers which might contaminate the sea.

School: Creative Einstein

Age: 10

Description of Work: Colouring pencils on paper

<https://volcanoartprize.com/portfolio-item/shark-3/>