Interactions Between Climate and Lead Contamination, Exposure and Detox

How climate change amplifies lead exposure - and what The LEAD Group's Model National Lead Safety Policy recommends

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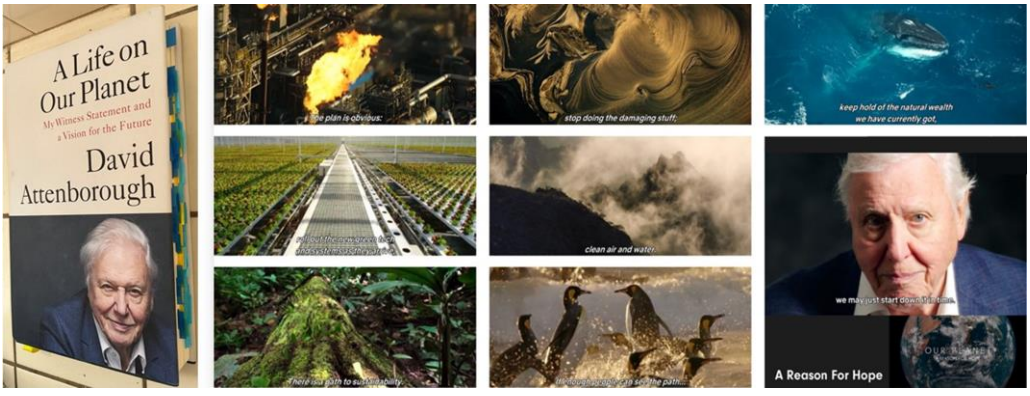
Photo: David Attenborough 100th Birthday on Planet Earth, BBC, UK, as reported on ABC World News Tonight USA

Abstract

Climate change and lead contamination are deeply intertwined. Lead is released whenever any type of fuel, including all fossil fuels, is mined, transported, refined, burned, or permitted to enter any environmental medium / waste-stream. Warmer temperatures mobilise lead dust, floods spread contaminated sediments, bushfires release lead stored in vegetation and infrastructure, and the global shift to renewable energy is driving demand for lead-acid batteries. Meanwhile, lead poisoning reduces the cognitive capacity humanity needs to solve the climate crisis. Drawing on three decades of research published by The LEAD Group, this article traces the interactions between climate and lead across three domains: contamination, exposure, and detox. It concludes with policy recommendations from The LEAD Group's Model National Lead Safety Policy.



2024 Volcano Art Prize (VAP) Entry. Artist: Elizabeth O'Brien. Title: Stop Doing the Damaging Stuff. Lead-Safety Message: Eliminate fossil fuel combustion, particularly leaded aviation gasoline, to prevent lead poisoning in children and preserve cognitive capacity needed to address climate challenges. Description of Work: iPhone photograph of 'A Life on Our Planet' annotated to highlight connections between lead safety and climate protection. URL: https://volcanoartprize.com/portfolio-item/stop-doing-the-damaging-stuff/ [LID 28173]

Introduction: Two Crises Walk Into a Bar

You're standing in your backyard, watching the kids play on the grass. The news on the radio is about climate targets. You're thinking about solar panels, maybe an electric car. Noble thoughts. Green thoughts. What you're probably not thinking about is that the dust your toddler just wiped off the outdoor table and put in her mouth contains lead from petrol your grandfather's car burned in 1973. Or that the solar panels you're considering will need electronics and batteries. Or that the heatwave-induced dust storm making everyone cranky this week is mobilising more of that old lead out of your soil and into the air your family is breathing.

Welcome to the intersection of climate change and lead contamination - two crises that, as it turns out, have been sharing a cab for decades.

In 2009, Elizabeth O'Brien and Robert Taylor wrote a paper that was presented by Dr Thuppil Venkatesh in Islamabad with a deceptively simple thesis: climate change abatement actions must also reduce exposure to lead, the most common industrial contaminant (O'Brien and Taylor 2009). Nearly two decades later, the proposition has only grown more urgent. The mechanisms linking climate and lead are not speculative; they are documented, measurable and inconveniently accelerating.

Lead enters the environment through the combustion of coal, petrol, and aviation fuel; through mining and smelting; through deteriorating paint and plumbing; and through the manufacture and recycling of lead-acid batteries. Climate change acts as a force multiplier across every single one of these pathways. Heat mobilises dust. Drought concentrates contamination in shrinking water sources. Floods redistribute lead-laden sediments across communities. Bushfires release lead stored in vegetation and painted infrastructure. And the green energy transition, while essential for the climate, is increasing global demand for the very lead acid batteries that poison the communities where the lead is mined, smelted and refined and where the batteries are informally recycled.

Let's take this pathway by pathway. Bring your LEAD Group lead test sampling kit.

Contamination: The Many Ways Climate Spreads Lead Around

Coal: still dirty after all these years

You'd think we'd have sorted coal by now. We have not. CSIRO data show lead concentrations in coal range from under 1 to 22 parts per million, averaging 7 ppm. That doesn't sound like much until you do the maths: based on 1991 global consumption, approximately 35,700 tonnes of lead were released from coal combustion alone (O'Brien and Roberts 2009). Coal consumption has increased by 2–3 per cent annually since. The black carbon produced by burning coal and biomass is the second or third most potent greenhouse pollutant after CO_2, responsible for up to 30 per cent of Arctic warming (O'Brien and Roberts 2009). So every tonne of coal burned is a climate problem AND a lead problem. Two for one, and not the good kind.

The legacy lives in your ceiling. Van Alphen (1999) documented how ceiling dust preserves a complete pollution history of your neighbourhood, from horse-drawn carts and ubiquitous coal and wood burning through to the motor car era. In Broken Hill, geometric mean lead concentrations in ceiling dust reached approximately 6,000 mg/kg. Your ceiling cavity is basically a museum of everything your suburb has ever mined or burned. Except nobody charges admission and the exhibits are toxic.

2016 Volcano Art Prize (VAP) Entry. Artist: Arindam Bala. Title: Dust and smoke in Rajasthan India. Lead-Safety Message: Every time you burn something it adds more lead into the air. That's why The LEAD Group is part of the Global Alliance for Clean Cookstoves. Description of Work: Canon EOS500D photo. URL: https://volcanoartprize.com/portfolio-item/dust-and-smoke-in-rajasthan-india/ [LID 18241]

AvGas: the leaded fuel we forgot to ban

We banned leaded petrol for cars worldwide in 2021. Job done, right? So close. Leaded aviation gasoline, AvGas, is still being pumped into piston-engine aircraft across the globe. Blum (2021) reports that AvGas now accounts for approximately 70 per cent of airborne lead emissions in the United States. **Seventy. Per cent.** Blood lead level increases in children living downwind of airports using AvGas are comparable to those documented during the Flint, Michigan water crisis. And the sole global manufacturer of tetra-ethyl lead, the additive that makes fuel leaded? A company called Innospec that pleaded guilty to defrauding the United Nations and violating anti-corruption laws (Roberts and O'Brien 2011). You genuinely could not make this up or hallucinate it.

2024 Volcano Art Prize (VAP) Entry. Artist: Zoe Lu. Age: 7, School Name: Creative Einstein, Lead-safety Message: In the 1920s when tetra ethyl lead (TEL) was first made, the factory became known as the House of the Butterflies as lead poisoned workers had hallucinations and went insane or died. When will we stop using TEL in aviation fuel (AvGas)? Description of Work: Coloured pencil drawing collaged in Paint and Powerpoint. Lead Safety Message from *The House of the Butterflies: Lead Poisoning among Workers and Consumers*. [LID 29362]. URL: https://volcanoartprize.com/portfolio-item/butterflies-and-tulips/ [LID 28182]

Leaded aviation fuel does not confine itself to the fuel tank. In Australia's Northern Territory, children have broken into remote airstrips to sniff AvGas, recording blood lead levels up to 17 times the acceptable limit. The NT Centre for Disease Control's acting director Charles Douglas stated that the Northern Territory has the highest levels of lead detected in blood of anywhere in the developed world (Daily 2017). And it is the lead that mostly kills. As O'Brien (2002) wrote: "The higher the blood lead level on admission to hospital of a petrol sniffer, the more likely the person is to leave in a box." Every year, Aboriginal children and adolescents die from sniffing leaded petrol - deaths rarely attributed to lead at autopsy, instead recorded as accidents, blood loss, self-immolation, kidney failure, or heart attack. The case histories documented by Mosman (1996) are harrowing. We couldn't make those up either. You'd wish they would be.

2020 Volcano Art Prize (VAP) Entry. 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: Watercolour artwork. URL: https://volcanoartprize.com/portfolio-item/lighter-and-lighter-losing-the-lead-weight/ [LID 19826]

Bushfire: when the trees give back what they took

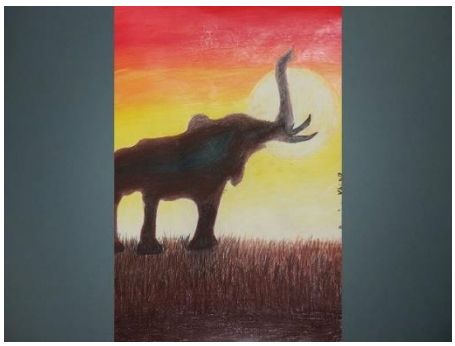
Trees absorb lead from contaminated soil. This is generally considered a good thing - phytoremediation, the scientists call it. Until the trees burn. When they do, the stored lead is released as smoke and ash. O'Brien and Taylor (2009) observed that when lead-painted buildings and infrastructure burn, lead pollution becomes a serious issue, and global warming is predicted to increase the length of the annual fire season. Gee (2014) contended that burnt bark in inner-city bushland carries higher-than-background lead levels, particularly in areas historically impacted by leaded petrol emissions. O'Brien (2004) warns that burning lead-painted wood releases lead fumes that can contaminate rainwater tanks within 100 metres. A hundred metres. That's your neighbour's bonfire and your drinking water.

2023 Volcano Art Prize (VAP) Entry (as printed on the Pictureproducts mug prize). Artist: Suvana Parajuli (Age 11, Creative Einstein). Title: Burnt Bush. Lead-Safety Message: Trees take up lead from the soil which is why oil, coal, and gas contain lead. If we stop burning fossil fuels to stop climate change, we'll have fewer bushfires releasing that lead as smoke and ash! Description of Work: Colouring pencils on paper. URL: https://volcanoartprize.com/portfolio-item/burnt-bush/ [LID 27698]

Flood and drought: too much water, too little water, same problem

If you're starting to sense a theme here - that lead is everywhere and climate just moves it around - you're paying attention. Flooding redistributes lead-contaminated sediments across communities. The Islamabad speech describes a 'perfect storm' for regions with glacier-fed rivers, heavy precipitation, and seasonal flooding combined with arid dusty lowlands (O'Brien and Taylor 2009). Post-hurricane sediment analysis in New Orleans found elevated concentrations of lead reworked from older, highly contaminated urban soils (O'Brien and Roberts 2009). The water didn't bring the lead; it moved the lead that was already there.

Drought concentrates the problem differently. In the drought year of 2007, Broken Hill children experienced the first increase in blood lead levels since 1992. Soil resuspension can contribute 40–75 per cent of atmospheric lead after leaded petrol phase-out (O'Brien and Roberts 2009). And then there's Esperance. Nine thousand five hundred native birds died from lead poisoning during port handling operations, with deaths peaking on the hottest days - 42.5°C and 38.5°C (Crisp 2008). Heat, wind, and lead dust. A lethal trifecta, and one that climate change is making more frequent.



2026 Volcano Art Prize (VAP) Entry. Artist: Devrim Yasar (Age 11, Creative Einstein). Title: Elephants, Droughts and Lead. Lead-Safety Message: During droughts, shrinking water holes can concentrate heavy metals like lead. As water levels fall, elephants are forced to consume sediment, mud, and water with high concentrations of contaminants. Description of Work: Coloured pencil drawing with side panels created using Paint and PowerPoint. URL: https://volcanoartprize.com/portfolio-item/elephants-droughts-and-lead/ [LID 29363]

Mining: the deeper you dig, the worse it gets

Here's an irony that would make T.S. Eliot reach for his pen. The extraction of lead is becoming more carbon-intensive at precisely the moment we need less carbon. Mudd (2010) documents long-term declines in lead ore grades, meaning that extracting one tonne of lead now requires processing ever greater volumes of material. More energy. More greenhouse gas emissions. More water. More waste. And 77 per cent of world lead production goes into lead-acid batteries (O'Brien et al. 2005) - the same batteries needed for storing renewable energy. The green energy transition is increasing demand for a toxic metal whose extraction contributes to the very problem it's supposed to solve. Eliot would have called it a hollow endeavour. I'd call it a policy failure we can fix.

In communities near lead mines and smelters, the contamination is anything but abstract. In Broken Hill, open-cut mining within city limits since 1991 has sent dust spilling across the city, with workers recording blood lead levels up to 80 µg/dL (Rowbotham 1999). At Port Kembla, roof dust near the copper smelter contained 2,471 ppm of lead (Mosman 1997). Taylor et al. (2013) estimate that if the pre-2021 US CDC's 5 µg/dL reference were applied in Broken Hill, Mt Isa, and Port Pirie, more than 50 per cent of young children would need intervention. Half the kids. Let that land.

2023 Volcano Art Prize (VAP) Entry. Artist: Elizabeth O'Brien. Title: Stop New NSW Lead Mines. Lead-Safety Message: The artist envisions the NSW Parliamentary Inquiry will halt proposed lead mines like Bowdens. She advocates using recycled lead instead, with government rebates to remove and recycle lead roof flashing. Description of Work: PowerPoint collage of screenshots from ABC TV broadcast. URL: https://volcanoartprize.com/portfolio-item/stop-new-nsw-lead-mines/ [LID 27683]

Rainwater tanks: the climate adaptation that bites back

This one's particularly cruel. You install a rainwater tank because you're a responsible citizen adapting to water scarcity. Except your roof has lead flashing. Or lead-based paint on the guttering. Or lead solder. A Monash University study found excessive lead in 33 per cent of Melbourne rainwater tanks. Griffith University found 10–20 per cent of Brisbane tanks exceeded the 0.01 mg/L guideline (O'Brien 2012). In June 2025 the guideline was halved to 0.005 mg/L but still most rainwater tank owners are completely oblivious to the fact that they are responsible if their tankwater exceeds this guideline or that The LEAD Group actually recommends that all drinking water should contain less than 0.001 mg/L. Lead flashing expands thermally by 3 mm per 2 metres of length (Brackaflash n.d.), so temperature extremes progressively crack and degrade it. Hailstorms do the rest. Your climate adaptation strategy may be slowly poisoning your drinking water. Test your tank water. If you have a new brass tap, test your water before you drink it. In Australia, you can buy a LEAD Group Posted Kit to test for lead in drinking water (and surface dust wipes).

2019 Volcano Art Prize (VAP) Entry. Artist: Elizabeth O'Brien. Title: Rainwater should always be lead tested. Lead-Safety Message: The original rainwater tank on my childhood Kingaroy post-war home was almost certainly lead-contaminated but even the new tank water on the shed should be tested for lead. Description of Work: iPhone 5S Photographs collaged using Word and Paint. URL: https://volcanoartprize.com/portfolio-item/rainwater-should-always-be-lead-tested/ [LID 20253]

Exposure: Climate Turns Up the Dose

The Summer Disease

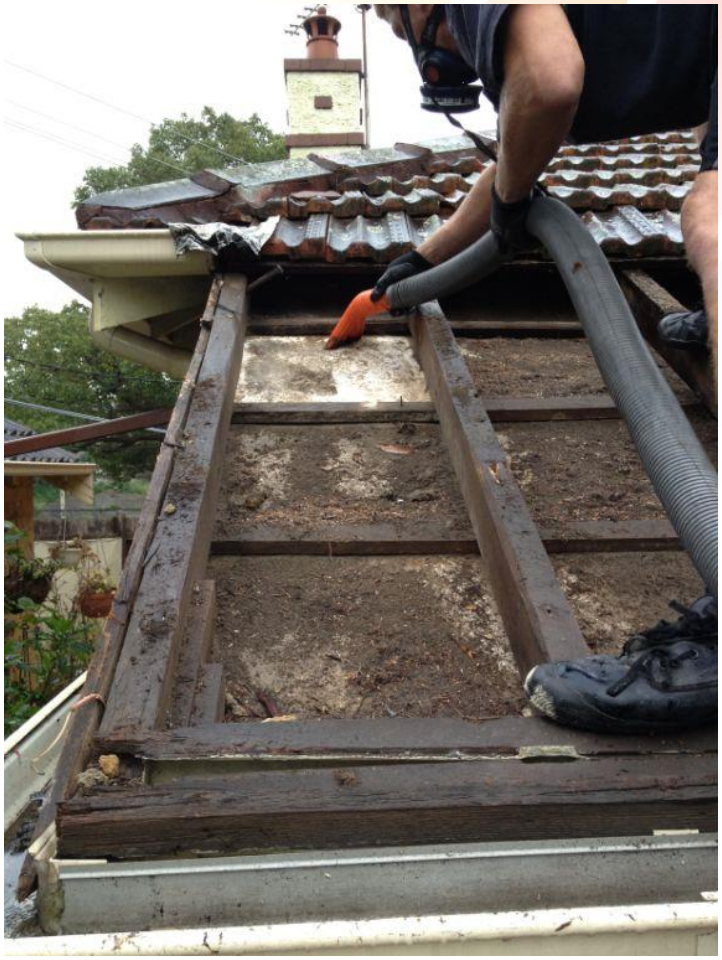
Lead poisoning has been called the 'Summer Disease' since the 1920s, when researchers first documented elevated hospital admissions for childhood lead poisoning during warmer months (O'Brien 1996). Freeman's 1970 study of Sydney cases noted that most children presented in the hot summer months of December to February. The mechanisms are multiple and mutually reinforcing: solar radiation enhances vitamin D synthesis, which paradoxically aids lead absorption; heat-induced dehydration and acidosis mobilise lead from bone storage; and warm, dry conditions generate more airborne dust.

Climate change is extending the 'summer' of lead exposure. Over 50 per cent of seasonal blood lead changes are predictable from weather patterns (O'Brien 1996). As heatwaves become more frequent and more intense, the seasonal peak in lead exposure is becoming broader and nastier. A firearms instructor with elevated blood lead described heat-triggered symptoms as feeling like 'spontaneously combusting from inside' (O'Brien 1996). That's not a metaphor anyone would choose lightly.

2023 Volcano Art Prize (VAP) Entry. Artist: Rishab Vohra (Age 9, Creative Einstein). Title: Moon High Tide Flooding. Lead-Safety Message: By age 21, NASA forecasts the moon's tilt cycle will worsen coastal flooding if climate change continues raising sea levels. Make the world lead-safe now to increase brainpower so we can avert the climate crisis. Description of Work: Coloured pencils on paper. URL: https://volcanoartprize.com/portfolio-item/moon-high-tide-flooding/ [LID 27694]

Ceiling dust: the insulation trap

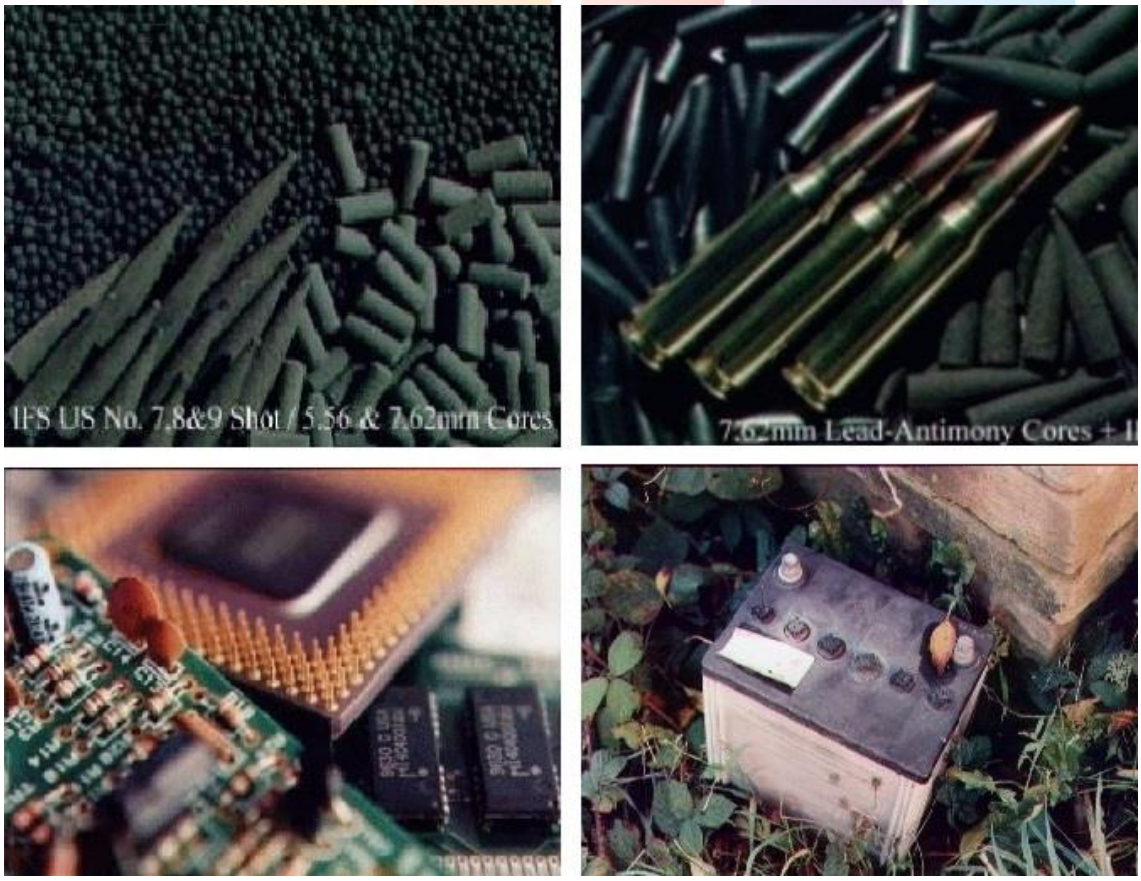
Here's a scenario that plays out every time a government launches an energy efficiency rebate program. Householder gets excited about free insulation. Installer goes into the ceiling cavity. Installer disturbs decades of accumulated lead-contaminated dust, breathing it in. Dust enters living spaces when installer exits manhole. Family gets exposed. The LEAD Group has been banging on about this for years: ceiling dust removal contractors who are members of the Australian Dust Removalists Association should remove ceiling dust before insulation is installed (O'Brien 2009). Van Alphen (1999) showed that ceiling dust preserves the complete pollution history of your neighbourhood. In homes built before 1970, the dust should be assumed guilty until proven innocent (LRC 1998). Even hail damage can trigger the problem - the NSW Department of Housing conducted ceiling dust removal in Glebe and in south-eastern Sydney after hailstorms (O'Brien 1999). The well-intentioned climate fix becomes the lead exposure pathway nobody saw coming. Except The LEAD Group, who saw it coming and published the fact sheet.



2015 Volcano Art Prize (VAP) Entry. Artist: Richard Jones (Licensed Builder, Kaleidoscope NSW). Title: Ceiling dust removal by Insulvac in Sydney (slide show). Lead-Safety Message: Vacuuming of ceiling dust by an Australian Dust Removalists Association (ADRA) Member Company is a must before ceiling demolition. Description of Work: Photographic slideshow documenting five stages of ceiling dust removal. URL: https://volcanoartprize.com/portfolio-item/ceiling-dust-removal-by-insulvac-in-sydney-slide-show/ [LID 17878]

Battery recycling: the dark side of the green revolution

Lead-acid batteries consume 77 per cent of world lead production (O'Brien et al. 2005), and demand is growing as renewable energy storage expands. In developed nations, formal recycling achieves recovery rates above 90 per cent. In developing countries, it's a different story entirely. In Bangladesh, rural entrepreneurs extract lead by breaking battery shells with hammers and melting plates over open fires, generating 3–5 tonnes of recycled lead daily with no environmental controls (LEAD Group 2007). In Shanghai, only 1.5 per cent of consumed batteries were actually collected between 1998 and 2002 (O'Brien et al. 2005). One-point-five per cent. As O'Brien and Taylor (2009) warned, more lead-acid batteries will hit the recycling black market where lead poisoning rates are already deeply concerning. The green revolution runs on batteries. Batteries contain lead. And the people who dismantle them are the ones who can least afford to be poisoned.



2016 Volcano Art Prize (VAP) Entry. Artist: Peter Hurley. Title: Leaded ammo, ewaste and used lead acid battery. Lead-Safety Message: Recycle toxic lead waste safely! Never let it contaminate soil or be licked or ingested by animals – especially if it also contains toxic antimony like the bullets shown here. Description of Work: Collaged photos using MS Word and Paint, enlarged with AlSee software. URL: https://volcanoartprize.com/portfolio-item/leaded-ammo-ewaste-and-used-lead-acid-battery/ [LID 18252]

Detox: Eating Your Way Out (Sort Of)

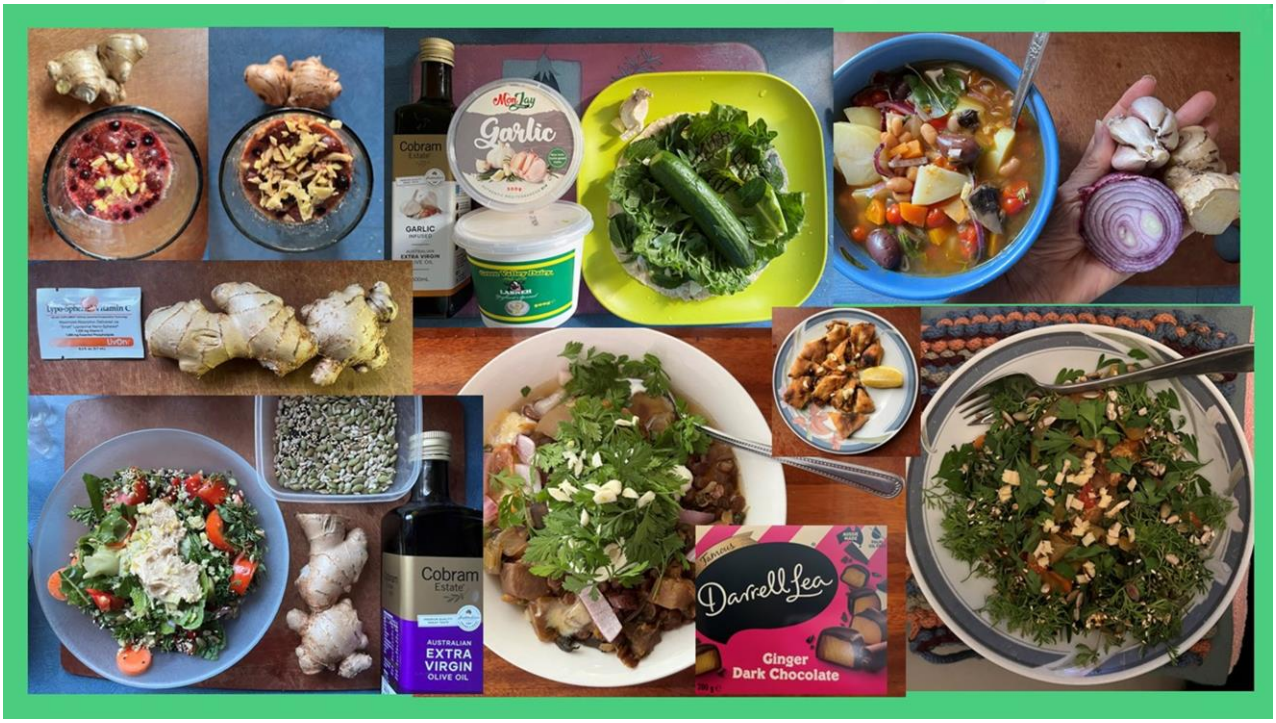
So. The climate is spreading lead around, heating it up, washing it into new places, and shaking it loose from where it's been stored. Can we at least eat something helpful? As it happens, yes. With caveats.

The LEAD Group's comprehensive guide to foods that fight lead poisoning (O'Brien 2015) identifies key nutrients that reduce lead absorption and support detoxification. Vitamin C is consistently linked to lower blood lead levels. Iron deficiency is particularly dangerous: iron-deficient individuals absorb up to seven times more lead (Taylor 2010). Calcium supplementation reduces blood lead during pregnancy, protecting mother and child from lead released from bone stores during foetal development. Pectin, found abundantly in citrus peel and apples, binds lead in the digestive system and increases urinary excretion while preserving essential minerals (Srikaran 2010). Garlic, turmeric, and rosemary support liver function and toxic substances clearance.

Here's the climate sting, though. Drought reduces crop yields. Flooding destroys harvests. Rising temperatures affect nutrient content in staple foods. Food price volatility hits the poorest hardest, the

same communities most likely to live near lead contamination sources and least likely to afford the broccoli, kale, and salmon that fight it. When the nutritional safety net frays, lead absorption increases. The climate-lead interaction is not merely environmental; it is metabolic. Your body's ability to defend itself against lead depends on a food system that climate change is destabilising.

A hard-rocking metallurgist in the kitchen this morning might start with a citrus-heavy breakfast. Pectin in the lemon zest and pith. Iron in the eggs cooked in a cast-iron pan. Vitamin C in the capsicum. Calcium in the yoghurt. It's not chelation therapy, but it's not nothing, either.



2024 Volcano Art Prize (VAP) Entry. Artist: Elizabeth O'Brien. Title: Daily Lead Detox Foods. Lead-Safety Message: The artist describes consuming 30 different plants plus mushrooms daily along with various supplements and fresh ginger and garlic, experimenting to lower blood lead levels. Description of Work: iPhone 13 photos collaged in Powerpoint. URL: https://volcanoartprize.com/portfolio-item/daily-lead-detox-foods/ [LID 28166]

Policy: What Should Actually Be Done

The LEAD Group's Model National Public Health Policy on the Prevention of Lead Poisoning (O'Brien and Roberts 2008), updated in 2023 (O'Brien 2023), provides a framework that, if governments bothered to adopt it, would address every interaction documented in this article. It operates across three tiers:

Primary Prevention - preventing exposure in the first place. Ban leaded AvGas. Mandate ceiling dust removal before insulation installation in every energy efficiency program. Require lead testing of rainwater tanks. Regulate lead flashing on roofs. Ensure that renewable energy battery supply chains don't create new exposure pathways in developing nations. The only safe level of lead is zero (O'Brien and Roberts 2008). Every policy should start from that premise.

Secondary Prevention - finding and fixing exposure that's already occurring. Establish national blood lead surveillance systems. Test at-risk populations. Implement nutritional intervention programs. The updated Policy proposes blood lead action levels by sub-population, from birth cord blood through to adults over 100, and explicitly covers fossil fuel burning facility workers, lead-acid battery workers, and mining and smelter workers (O'Brien 2023).

Tertiary Prevention - preventing lead already in the body from causing further harm. Fund research into links between elevated blood lead and conditions including heart attack, stroke, dementia, Alzheimer's disease, depression and even diabetes. Require independent research into detox claims - because the supplement industry will sell you colloidal silver and zeolite all day long, and somebody should probably check if any of it works (O'Brien and Roberts 2008).

Critically, the updated Policy addresses Climate Change as a ministerial responsibility, alongside Public and Occupational Health, Environment, Education, Agriculture, Aviation, Mining, Housing, Police, Defence and Transport (O'Brien 2023). Lead safety is not a single-portfolio problem. It is a whole-of-government problem that intersects with climate policy at every level. Any Minister who thinks lead isn't their problem hasn't read the evidence.

Conclusion: Same Solutions, Same Fight

The interactions between climate and lead are pervasive, bidirectional, and intensifying. Climate change mobilises stored lead through heat, drought, flood, and fire. It drives demand for lead through lead acid battery production. It undermines nutritional defences through food insecurity. And lead poisoning, by reducing cognitive capacity across populations, diminishes humanity's ability to respond to the climate crisis itself. It's a feedback loop that would impress even the most pessimistic systems analyst.

But here's the thing. Every action that reduces fossil fuel combustion simultaneously reduces lead emissions. Every ceiling dust removal before insulation installation is a win for both energy efficiency and lead safety. Every lead-free roof flashing protects both rainwater quality and human health. Every battery recycled formally rather than by a man or child with a hammer in Bangladesh prevents both lead poisoning and environmental contamination. The solutions are not in competition. They are the same solutions.

The LEAD Group's Model National Lead Safety Policy provides the framework. Three decades of *LEAD Action News* provides the evidence. The Volcano Art Prize entries illustrating this article - many created by children whose responsible adults understand the problem better than most parliamentarians - provide the vision.

What remains is the political will. And perhaps, on a warm Tuesday evening, the awareness that the dust on the outdoor table, the solar panels on the roof, the tank water in the glass, and the broccoli on the plate are all connected by a single element with an atomic number of 82.

A lead-safe world and a climate-safe world are not two goals. They are one.

Next time I pass a community garden in Sydney's inner west, I'll bring a LEAD Group sampling kit. And maybe some lemon peel to share.

2025 Volcano Art Prize (VAP) Entry. Artist: Grandma Lead. Title: Solar Electrifying. Lead-Safety Message: I actually feel joyful now that I've had solar panels and a battery installed and replaced my gas hot water and stove with an electric heat pump and electric stove. Description of Work: iPhone 13 photographs collaged in PowerPoint and Paint. URL: https://volcanoartprize.com/portfolio-item/solar-electrifying/ [LID 28956]

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[Note that the LID number refers to the Library ID from The LEAD Group's Library Database]

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