Recognising and responding to the obvious: the source of lead pollution at Mount Isa and the likely health impacts

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Blood lead levels in children in Mount Isa are substantially elevated, and a purported lack of knowledge of the lead source is no longer tenable

Environmental lead levels and blood lead concentrations in children at Mount Isa, in north-western Queensland, are substantially elevated compared with background values[1-3] and, as a consequence, there is a public health risk. This problem is exacerbated by the reluctance of stakeholders, including Xstrata Mount Isa Mines Ltd, operator of Mount Isa Mines (MIM), and Queensland environmental and health authorities to acknowledge and respond effectively to the fact that the main environmental lead source is mining and smelting activity.[1,2] It is frequently claimed that the lead source is natural surface mineralisation;[4-6] this is not the case.

Mount Isa city, located immediately adjacent to MIM, is a major lead, zinc and copper producer, and Australia's largest atmospheric emitter of sulfur dioxide, lead and other metals.[7] The emissions are likely to have had an impact on the blood lead level (BLL) of a significant proportion of the city's population of about 21 000. The causal link between smelter lead emissions and an increased risk of adverse health effects has been convincingly documented elsewhere,[8] and responded to, albeit with varying degrees of urgency, at smelting sites around Australia (Box).[9] In Mount Isa, the link has been routinely questioned and remedial action delayed.

In recent decades, considerable evidence has emerged showing lifelong negative health, intellectual and sociobehavioural effects associated with childhood BLLs above 10 μg/dL, the level widely regarded as the threshold above which intervention is necessary. However, there is emerging evidence of adverse effects occurring at 5–10 μg/dL, and even at levels as low as 2 μg/dL.[8-11] In 2008, Queensland Health reported that Mount Isa children aged 1–4 years had a mean BLL of 5 μg/dL, with 37% having levels > 6 μg/dL and 11.3% having levels > 10 μg/dL.[3]

Recent data from Fremantle, Western Australia, an urban centre with no major industrial lead source, showed a mean BLL in children of 1.8 μg/dL, with no individual readings exceeding 10 μg/dL.[12] This is similar to the mean BLL of 1.9 μg/dL (with only 1.6% of readings ⩾ 10 μg/dL) for children aged 1–5 years in the United States in 1999–2002.[10] Compared with these figures, BLLs remain substantially elevated in many of Mount Isa's children and, as shown by numerous studies elsewhere, the level of lead exposure is likely to correlate with neurocognitive impairments.[8-11] Lead exposure places children on an abnormal developmental trajectory that may result in reduced social and educational achievement and unmet life potential. Assuming that the Mount Isa BLL data are representative of all 1–4-year-olds in the city (of whom 27% were sampled),[3] then, on average, every nine days a child will exceed the BLL threshhold of > 10 μg/dL.

Research commissioned during a Queensland government-led inquiry a decade ago,[1] as well as subsequent peer-reviewed studies,[2] have unequivocally demonstrated widespread contamination of soil and airborne dust in and around Mount Isa, as a result of both historic and ongoing mining and smelting activity by MIM. Contaminants include lead, copper and other metals and metalloids. Frequent claims that natural mineralisation of soils is the main cause of increased lead levels[4-6] are incorrect, and have stymied an appropriate response to the Mount Isa lead problem. The "gossans" (ridges of lead-bearing surface rocks) initially discovered west of Mount Isa are now largely covered by mining operations, and cannot be a major source of environmental lead.

Furthermore, there is *no* substantial natural exposure of copper ore, which was discovered "accidentally" during deep drilling. These observations are supported by data published by several of MIM's own geologists over the past 60 years.[13] Numerous soil profiles in and around Mount Isa show that it is usually only the surface layers that are contaminated with lead and copper.[1,2] Concentrations of these metals correlate signifi-

Australian mining- and smelting-related blood lead levels and government and industry responses[9]

Port Pirie, South Australia

- Early 1980s: high blood lead levels (BLLs) confirmed
- 1984 onwards: decontamination and demolition of residences, slag dumps covered, emissions controlled
- 2004: BLLs decreased but remain elevated

Broken Hill, New South Wales

- Early 1990s: high BLLs confirmed
- 1994 onwards: land and home evaluation and remediation
- 2006: BLLs decreased but remain elevated

Boolaroo, NSW

- Early 1990s: high BLLs confirmed
- 1991 onwards: emissions controlled
- 1997: lead abatement of homes
- 2003: smelting operations ceased
- 2005: BLLs decreased substantially after smelter closure

Mount Isa Mines, Queensland

- 1994: high BLLs confirmed
- 1997: Mount Isa lead emission limits set above Australian national limits (national limits written into law in 2009, to apply in Mount Isa from 2012)
- 2000: partial emission capture
- 2007: Xstrata Mount Isa Mines "lead pathways" study initiated (not completed June 2010)
- 2008: BLLs lower than in 1994 but remain elevated
- 2009: Queensland government lead management report
- 2010: highest lead emissions in Australia ◆

cantly with each other and are up to 20 times higher at 0–2 cm depth than at 10–20 cm depth. This shows that (1) soil contamination with *both* lead and copper can only have come from particles emitted into the atmosphere from MIM, as there is no other common source for *both* metals, and (2) that the surface soil metal enrichment can only have come from aerial deposition of contaminated particles. Lead isotope fingerprinting, used as a tracer, shows that surface soil — but in most cases not deeper soil — contains lead from the Mount Isa lead ore body due to aerial deposition.[1]

The capture by MIM of smelter fumes (sulfur dioxide and associated metal-bearing particles) is inefficient, as shown by the ongoing high emission levels that, for some compounds, have been rising in recent years.[7] The Queensland Government's air quality data for Mount Isa[14] show 10 breaches of the guideline level for sulfur dioxide between September 2009 and February 2010, and that lead concentrations in air increased substantially during these breaches. However, the current legal standard for lead concentrations in air in Mount Isa is higher than the Australian national lead-in-air standard of 0.5 µg/m3, and therefore was not breached.[15,16] More importantly, the current Mount Isa standard is an order of magnitude greater than the recently revised US lead-in-air standard,[8] which was lowered by the US Environmental Protection Agency after assessing about 6000 studies related to the health impacts of lead exposure.[8] The lower standard was deemed necessary to properly protect the health and wellbeing of children.[8]

The evidence is clear. There is a single primary source of environmental lead in Mount Isa: the historic and ongoing mining and smelting *activity*. Acceptance of this patent fact by all stakeholders will lead to a more targeted remedy to the lead problem, and better health and environmental outcomes for the community of Mount Isa. A purported lack of knowledge of the lead source is no longer a tenable response and provides no long-term resolution for Xstrata, the government or the children of Mount Isa whose futures are at risk.

Competing interests

Niels Munksgaard produced some of the analytical data referred to as a consultant. He has publicly commented on related matters in conflict with the views of the Queensland Government. Mark Taylor has received payments from Slater and Gordon, solicitors, to support sampling at Mount Isa. Alana Mackay's PhD research is partially funded by Mount Isa Water.

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