Submission No 70

INQUIRY INTO CURRENT AND POTENTIAL IMPACTS OF GOLD, SILVER, LEAD AND ZINC MINING ON HUMAN HEALTH, LAND, AIR AND WATER QUALITY IN NEW SOUTH WALES

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Submission to Port Folio Committee No. 2 – Health

Inquiry into current and potential impacts of gold, silver, lead and zinc mining on human health, land, air and water quality in New South Wales

Response to Terms of Reference 1 (a) the impact on the health of local residents and mine workers, including through biomagnification and bioaccumulation

Dr Rachael Martin and Dr Dora Pearce

4 September 2023

Dear Inquiry and Committee Members,

We make this submission to the **NSW Inquiry into Current and Potential Impacts of Gold, Silver, Lead and Zinc Mining on Human Health, Land, Air and Water Quality in New South Wales** (the Inquiry) to express our support of the Inquiry, and to provide our opinion on key issues that we consider warrant consideration, based on our collective research efforts completed during our Honours (Dr Martin) and Doctoral research (Dr Pearce and Dr Martin).

Dr Rachael Martin completed her PhD in Regional Victoria where she investigated the properties of historical mining wastes in terms of their geochemistry and particle size distribution. She has worked for various NSW Government departments in technical and advisory positions, and more recently, in contaminated land auditing. While working for NSW EPA, she was the lead author of the NSW EPA Lead Expert Working Group Report on Managing Residual Lead Contamination in North Lake Macquarie and was a member of the Derelict Mines Program committee. Rachael has an interest in occupational dust diseases and co-authored the Case Finding Study - Respirable crystalline silica exposure in the NSW manufactured stone industry, for SafeWork NSW. She has prepared numerous toxicological profiles for heavy metals and other contaminants in support of human health risk assessments.

Dr Martin is willing to give evidence at a hearing.

Dr Dora Pearce, retired environmental epidemiologist, completed her PhD at the University of Ballarat, investigating the association between soil arsenic concentration and cancer incidence across Victoria's goldfields region, and childhood exposures to arsenic by applying synchrotron-based X-ray microprobe techniques to toenail clippings. Application of spatial statistical modelling to influenza epidemiological research at the Centre for Epidemiology and Biostatistics, School of Population and Global Health, University of Melbourne, provided insights into pandemic spread of infectious diseases. While holding Honorary affiliations with the University of Melbourne and Federation University, she responded to the environmental health concerns of the Cadia Community Sustainability Network after the tailings dam collapse at Newcrest's Cadia gold mine. Now an Honorary with the Future Regions Research Centre, Federation University, she continues to advocate for the protection of community health from environmental degradation while acknowledging the need for critical minerals to underpin renewable energy sources.

Dr Pearce is willing to give evidence at a hearing.

In making this submission, we acknowledge that NSW mining regulators are faced with the difficult task of balancing the need for ongoing economic growth with ensuring the protection of human health and the environment. We also acknowledge that regulators play a critical role in ensuring mining activities comply with set licence conditions. However, we consider that *pro-active* regulation is needed to (i) ensure that regulators have a firm understanding of how well mining operators comply with their conditions; and (ii) allow the timely and effective response to non-compliances to better manage and deter future licence breaches.

Introduction and Recommendations

Our published research and literature reviews have focussed on actual and potential human health issues and risks facing people in gold mining impacted communities in regional Victoria, with a focus on arsenic as the contaminant of potential concern.

This submission outlines key findings from this research and provides some context in which health impacts and risks may arise in NSW as a result of metalliferous mining operations.

Based on our findings and experience, we recommend the following:

- Offsite PM_{10} and $PM_{2.5}$ monitoring be routinely conducted in communities surrounding metalliferous mining operations in NSW.
- Offsite PM_{10} and $PM_{2.5}$ samples be routinely analysed for arsenic, respirable crystalline silica, and heavy metals, and results compared against current national or international guidelines.
- Residential soil, external and internal dust, and rainwater tanks be analysed to determine the extent of the emissions fallout zone, and potential human exposure pathways.
- Potentially exposed communities have biomedical testing of blood, hair or urine samples as appropriate to detect heavy metal exposures.
- Human Health Risk Assessments be undertaken at baseline and follow-up to detect adverse health consequences of environmental exposures.
- Mental health impacts associated with environmental health concerns, and environmental degradation, be considered.

Metalliferous Mining as a Potential Source of Airborne Emissions

As reviewed in Martin et al. (2014) mining operations may entail ore extraction, mechanical and/or high temperature processing, transportation, storage of mining by-products, and disposal of mine waste products. During each activity, there is potential for the release of heavy metal-enriched media to the environment. For example, the mechanical action of ore extraction and processing activities may release dust into the environment via wind-borne dispersal of emissions. Similarly, active and abandoned tailings storage facilities and mine waste stockpiles, if not adequately contained and managed, are potential sources of fugitive dust emissions.

Mine Wastes are a Source of Human Exposure to Heavy Metals

Our investigations into historical gold mining wastes in Victoria show that notable proportions of historical mine waste materials occur in particle size fractions relevant to human exposure and dust mobilisation: up to 75% of particles in the readily ingestible size fraction (≤250 μm); and up to 46% in the dust size fraction (≤100 μm) (Martin et al., 2015). These investigations also revealed that historical mining wastes can also contain up to around 26% of particles in the inhalable size fraction (≤10 μm, or PM_{10}), and within the inhalable size fraction, between 15% and 50% of particles occur in the respirable size fraction (≤2.5 μm, or $PM_{2.5}$) (Martin et al., 2017). Concentrations of arsenic and other heavy metals (cobalt, iron, manganese, antimony and zinc) in historical gold mine wastes increased with decreasing particle size.

Based on these findings human receptors residing in the vicinity of a mine waste deposit may be at risk of exposure to elevated concentrations of arsenic (and other heavy metals) via inhalation and/or ingestion pathways.

Human Exposure to Arsenic in Mining Impacted Communities

There exists overwhelming epidemiological evidence suggesting an increased risk of arsenic exposure for populations living in the vicinity of active or abandoned gold mining operations (reviewed in Martin et al., 2014). Our epidemiological investigations show a positive correlation between the arsenic content in school-aged children's toenails and the arsenic content in residential soil, in an historical gold mining area in regional Victoria (Martin et al., 2013; Pearce et al., 2010), and this correlation was found to persist over time (Martin et al., 2013). Younger children had a higher risk of arsenic exposure, as were children who spent more times outdoors, and those who spent more time in bushland areas.

Based on these findings arsenic in soil is an important source of exposure for children living in mining impacted communities.

Human Health Risk Assessment

While regulatory enforcement of compliance with environmental monitoring criteria is essential to protect the environmental health of communities living in close proximity to mining operations, a critical next step is to dispel, or confirm, community concerns by conducting baseline health assessments and ongoing evaluation of human health impacts due to offsite contamination. This necessitates identifying and delineating the precise geographic extent of the exposed population in order to fully evaluate:

a) impacts of one or more environmental contaminants or hazards.
b) frequency and duration of exposures.
c) possibility of multiple exposure pathways.
d) population susceptibility and vulnerability (ATSDR, 2022; enHealth, 2012).

Importantly, childhood exposures must be specifically elucidated, since their developmental stage may influence their rate of absorption and ability to detoxify environmental toxins, and hence increase their susceptibility (Au, 2002). Pollutant data, whether sampled on a grid or at residential locations, may be analysed in association with biomedical monitoring of blood, hair or urine samples of potentially exposed or concerned community members. An alternative approach to investigate community concerns about disease clusters or adverse environmental health impacts over time and space is to utilise NSW Cancer Registry data (NSWCR, 2022) and NSW Healthstats data (NSWH, 2022), accessible with Human Research Ethics Committee approval. Spatial and space-time statistical software options, such as SaTScan™ may readily be applied to evaluate suspected clustering of cancer diagnoses and deaths, or hospital admissions for respiratory and cardiovascular diseases, while adjusting for the confounding effects of socioeconomic status (ABS 2023).

Although the long latency period of arsenic-induced cancers can delay diagnoses (Smith et al., 2018), increased cancer risk associated with soil arsenic concentration has been detected in socio-economically disadvantaged areas of Victoria's goldfields region (Pearce et al., 2012).

Based on the outcomes of such human health risk assessments, additional regulatory requirements for dust mitigation strategies and monitoring, or more stringent enforcement of compliance with relevant environmental criteria, must be initiated.

Mental Health Impacts

Based on our collective experience working more broadly with contamination impacted communities during our research and professional work, we have encountered people in various states of distress. Issues regarding human health, social inequities including uncertainty of future mining activities and impacts on their land, and the potential additional burdens associated with contamination at their property (or within their community) have been the key drivers of concern, and these issues can persist for many years. We therefore consider mental health to be an important element for consideration as part of the Inquiry.

Universal Human Right to a Safe, Clean, Healthy, and Sustainable Environment

Rural and regional communities living in close proximity to mineral resources have a human right to a safe, clean, healthy, and sustainable environment (Parliament of Australia 2023, UNDP 2022)

Yours sincerely,

Dr Rachael Martin and Dr Dora Pearce

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