Submission No 118

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

Organisation: Environmental Risk Sciences Pty Ltd

Date Received: 5 September 2023

Environmental Risk Sciences Pty Ltd

5 September 2023

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
NSW Parliament

Submission – 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

1 Introduction

Environmental Risk Sciences Pty Ltd (enRiskS) has prepared the following submission to assist the *"Inquiry into current and potential impacts of gold, silver, lead and zinc mining on human health, land, air and water quality in NSW"*.

2 Inquiry Terms of Reference

The terms of reference for this inquiry have been provided as follows:

That Portfolio Committee No. 2 inquire into and report on current and potential impacts of gold, silver, lead and zinc mining on human health, land, air and water quality in New South Wales, in particular:

(a) the impact on the health of local residents and mine workers, including through biomagnification and bioaccumulation

(b) the impact on catchments and waterways, affecting both surface and groundwater destined for, local and town water supplies, including rainwater tanks, and on aquatic biodiversity

(c) the impact on land and soil, crops and livestock, including through biomagnification and bioaccumulation

(d) the adequacy of the response and any compliance action taken by the regulatory authorities in response to complaints and concerns from communities affected by mining activities

(e) the effectiveness of the current regulatory framework in terms of monitoring, compliance, risk management and harm reduction from mining activities

(f) the effectiveness of current decommissioning and rehabilitation practices in safeguarding human health and the environment,

(g) the effectiveness of New South Wales Government agencies to regulate and improve outcomes including:

(i) the measurement, reporting and public awareness

(ii) the provision of various protective materials

(iii) the ability to ensure the health of at-risk groups

(iv) the suitability of work health and safety regulations, and

(v) the capacity to respond within existing resources

(vi) the adequacy of existing work, health and safety standards for workers

(h) whether the regulatory framework for heavy metals and critical minerals mining is fit for purpose and able to ensure that the positive and negative impacts of heavy metals and critical minerals mining on local communities, economies (including job creation) and the environment are appropriately balanced

(i) any other related matters.

3 Background information on Environmental Risk Sciences

Environmental Risk Sciences Pty Ltd (enRiskS) is a boutique dedicated toxicology / risk assessment consulting company. Based in Sydney, with key staff located in Melbourne, we have a long-standing track record in providing cost-effective human health and environmental toxicology and risk assessment services to identify the most appropriate approaches for sound environmental decision making. Our client base is broad and major clients include:

- Government Departments such as Australian Pesticides and Veterinary Medicines Authority (APVMA), Commonwealth Department of Environment – Office of Water Science, Commonwealth Department of Health – Office of Chemical Safety, NSW Health, SA Health, WA Health, NSW Planning and NSW EPA, EPA Victoria and EPA Tasmania.
- Research facilities including CSIRO and CRC CARE.
- Local councils including Cardinia and Casey (Victoria), Adelaide (South Australia) and Bayside (NSW).
- Industry including Northconnex, Westconnex, AGL, AMP, Cleanaway, Endeavour Energy, Orica and a wide range of private developers.
- Environmental (including contaminated land) consulting firms including numerous Environmental Auditors.

enRiskS is committed to problem solving in the most appropriate and realistic manner possible using state-of-the-art / best practice principles, current regulatory guidance (national and international), and information from the scientific literature. enRiskS has particular expertise in distilling high level technical issues into information that can be easily understood by different target audiences.

enRiskS has extensive experience in assessing environmental risks and developing risk based criteria for the protection of human or ecological health for a wide range of chemicals that may be present in the environment.

enRiskS staff have extensive experience in preparing guidance documents on behalf of government agencies including development of guidelines for contamination assessments, including:

- Schedule B4 and Schedule B7 National Environmental Protection (Assessment of Site Contamination) Measure.
- CRC CARE Technical Reports on petroleum vapour intrusion:
  - CRC CARE TR9 (Field assessment of vapours).
  - CRC CARE TR23 (Petroleum hydrocarbon vapour intrusion: Australian Guidance)
  - CRC CARE TR40 (Weathered petroleum hydrocarbons).
- NSW EPA Approved methods for the modelling and assessment of air pollutants (contributed detailed review of specific guidelines for individual chemicals that were considered in this update - https://www.epa.nsw.gov.au/your-environment/air/industrial-emissions/approved-methods-for-the-modelling-and-assessment-of-air-pollutants)

enRiskS staff have also undertaken work in regard to assessing the risks posed by chemicals in water such as:

- Human health and ecological risk assessments for a range of water authorities in regard to PFAS in recycled water, sewage effluent and biosolids.
- Human health risk assessment in regard to development of a new sewage treatment plant (EIS).
- Peer review services for the Commonwealth Department of Environment for water quality guidelines during the current updating process.
- Human health and ecological risk assessments to develop water reuse guidelines for industrial water reuse – particularly in regard to dust suppression.
- Human health and ecological risk assessments to evaluate potential uptake of chemicals into plants and livestock from use of recycled water for irrigation in regard to PFAS and persistent organic pollutants.

4 Submission

4.1 Term (a)

(the impact on the health of local residents and mine workers, including through biomagnification and bioaccumulation)

4.1.1 Regulation

There is a regulatory system in place in relation to mining in NSW that requires a range of approvals, compliance with strict conditions and ongoing monitoring. Taking time to consider whether such systems are working well enough to protect the health of people and the environment is an excellent idea.

Historical practices may have not always been adequate to manage potential for people at a mine or in the area surrounding the mine to be exposed to unreasonable levels, but this was only identified after exposure had been occurring for some time. Concerns have also arisen at times because companies have not always done the right thing.

It is absolutely appropriate to require mining activities to be undertaken appropriately and that government requirements be in place to ensure this is the case via environment protection licences for existing facilities and consent conditions and environment protection licences for new developments. Activities like mining should be undertaken using best practice approaches and in a way that does not change normal exposures of people as much as is possible. It is also appropriate for people to be able to ask questions and be provided with relevant information. There is no doubt that health effects (and effects on the environment) are possible if activities are not undertaken appropriately.

What we need to do when undertaking such a review is put all the relevant information in context – to consider whether or not it is possible local residents around an operating or proposed mine will be exposed to levels higher than is considered normal not whether people will be exposed at all. We all need to work together to gather the right sort of information about a particular mine and what is and is not happening at that site. That information then needs to be provided in an accessible way so that local communities can make informed decisions about activities in their area without the stress (extreme in some cases) being induced by current processes.

The following discussion highlights some ways relevant information around the basic science in regard to mining (or other industrial processes) is not being provided to communities in context.

4.1.2 Impact vs exposure

This term of reference refers to whether there is potential for impact on people as a result of a mine being located nearby.

There are a number of terminology aspects that are important to consider:

- before there can be an impact there must be a way people can be exposed to the metals of interest where they arise from the mining operations
- just because a person is exposed does not mean that impacts will necessarily follow – as has been recognised for centuries – the dose makes the poison – people need to be exposed to a sufficient amount to cause impacts

The following discussion points address the potential for people to be exposed to metals arising from a mining operation. These points are summarised as:

- Normal exposures
    - people are always exposed to metals, they are naturally occurring and regularly present in our food, water and air
    - often exposures around a mine are not different to those experienced in cities or towns or other locations
    - background concentrations in soil can be elevated around an ore body due to the geology and so exposure to metals can occur due to these background concentrations from a whole area rather than just arising from the works at a mine site
    - there are many sources of metals (other than the geology or a mining operation) around homes and farms

Other matters are also addressed in the following discussion – the concepts around bioaccumulation and biomagnification as well as issues in regard to the confusing nature of communication in the media or in social media.

4.1.3 Normal exposures

There are a number of foundational aspects about how people (or the environment) may be exposed that are important to consider when looking at the potential for risks to health on local residents and mine workers from mining of ore bodies rich in gold, silver, lead and zinc (and other metals/metalloids).

These include that:

- metals are elements – the fundamental building blocks for the entire planet

Chemicals are the fundamental building blocks for the entire planet and the elements in the Periodic Table are the fundamental building blocks of all chemicals.

Everything is made of some mix of chemicals – the water we drink, the air we breathe, the food we eat, the ground we walk on, the houses we live in, the things we have inside our houses or workplaces or what we ourselves are made of.

Some chemical substances we need to keep us alive or to let plants or other animals live – like water, oxygen and nutrients. Other chemical substances are naturally occurring, but they can negatively impact us – like spider and snake venoms or well-known poisons like arsenic or mercury. The same applies to the chemical substances we make – some are quite benign and some are quite toxic.

A wide range of chemical substances form the things we use every day like food, clothes, computers, kitchen appliances, cars, houses, roads, trains, planes, hair dyes, beauty products, toothpaste, shampoo, flea rinse for our pets and many other things.

Governments have established a range of legal requirements about how chemicals are approved for use, handling, transport and disposal as well as what to do in emergency situations so that chemicals are managed well. Such requirements include consideration of the characteristics of the chemical substances, how much will be used, how they might be released into the environment and a range of other matters.

People are always exposed to chemicals so when assessing projects or activities, the benefits and risks of how people will be exposed to specific chemicals and if that exposure might be the same or different to normal daily life are considered. Such assessments are not based on considering how to eliminate exposure to all chemicals because that cannot occur. Instead, these assessments target whether there are any chemicals being used in a way that might be different from normal situations and/or cause an impact. Management actions are then proposed to ensure those key chemicals are controlled.

- metals are normally present:
    - at low concentrations in most soils in NSW
    - at somewhat higher concentrations in areas around an ore body
    - at much higher concentrations actually within the ore body.

The concentrations of metals that arise in the environment due to natural processes like weathering, rainfall washing soil particles into waterways or windblown dust are termed background or ambient concentrations.

Information on background or ambient concentrations can be obtained from sources such as Olszowy, H, Torr, P & Imray, P 1995, *Trace Element Concentrations in Soil from Rural and Urban Areas of Australia*, South Australian Health Commission or Soil Explorer Database (Victoria) https://soilexplorer.org.au/ .

Data on naturally occurring/background/ambient concentrations of metals in soil in NSW are not routinely collected by Government or collated by Government or academia from sources such as contaminated land investigations (for data from parts of a site which are not contaminated) or environmental impact assessments for large developments (i.e. EIS), so a database similar to the Victorian Soil Explorer Database is not available in NSW. As an example, however, the Victorian database lists zinc as being present at concentrations in soil ranging from <5 mg/kg to 150 mg/kg for locations that can be considered background as defined in Victoria for the purposes of that database.

- metals are naturally occurring and present in most soil and water at detectable concentrations, so people are always exposed to them.

People are exposed every day to metals in the water they drink, the food they eat and the air they breathe.

The NHMRC Drinking Water Guidelines provide the following information about background concentrations of some metals in the water used for drinking in Australia (NHMRC 2011 updated 2022).

- Zinc – Concentration of zinc ranges up to 0.26 mg/L with a typical concentration of 0.05 mg/L.
- Copper – Concentration of copper ranges up to 0.8 mg/L with a typical concentration of 0.05 mg/L.
- Aluminium – concentration of aluminium varies from 0.01 mg/L to 0.9 mg/L with typical concentrations of 0.1 mg/L for fully treated supplies.

Residues of pesticides and naturally occurring chemicals of interest are measured in the food supply by the Commonwealth Department of Agriculture, Fisheries and Forestry (https://www.agriculture.gov.au/agriculture-land/farm-food-drought/food/nrs/nrs-results-publications). Not all metals are tested in these surveys for all food types. Information about the overall levels of metals in the food supply is also provided by Food Standards Australia and New Zealand (FSANZ) in their Total Diet Studies (https://www.foodstandards.gov.au/publications/Pages/Default.aspx?k=total+diet+). Aluminium is discussed in the 24th Total Diet Study. Arsenic, cadmium, lead and mercury are covered in the 25th Total Diet Study. A wide range of elements including aluminium, arsenic, cadmium, lead, mercury, chromium, cobalt, copper and zinc are covered in the 23rd Total Diet Study. In the most recent study that looked at zinc (23rd Total Diet Study), it was estimated that the average intake of zinc each day from consumption of food ranged from 0.2-0.7 mg/kg body weight (i.e. 3-50 mg/day depending on age) and that the main foods that contributed zinc were meat (beef in particular), flours/grains and milk/cream.

The NSW EPA undertook an ambient air research project in the late 1990s that included measurement of metals in air (https://www.environment.nsw.gov.au/topics/air/research/previous-research/air-toxics) . Samples of air were collected in 5 locations in Sydney, 2 in Wollongong and 1 in Newcastle. The average concentration of zinc in air was around 30 ng/m^3 while copper was present at an average of 8 ng/m^3. These are quite low concentrations – ng/m^3 equals nanograms per cubic metre of air – but these results indicate that these common metals were at measurable concentrations in the air we breathe.

It is not possible to avoid being exposed to most metals.

- many metals are actually essential micronutrients – i.e. they are essential to life

This means not only will the body cope with being exposed to relevant, common levels, the body actually needs to be exposed to function properly. Not all elements fit into this category – e.g. lead and cadmium are not essential to life – but many are. In fact, one issue of concern from drinking water that has been subject to treatment via reverse osmosis is that the levels of essential micronutrients that people normally receive in their drinking water are no longer present and people may become deficient which has its own range of health impacts.

- other sources of metals around homes

Common building materials used in homes contribute metals into the water collected in rainwater tanks. Materials used in roofing include lead flashing and galvanised metal roofing panels which contain zinc. These materials contribute lead and zinc into water collected in rainwater tanks. The presence of such materials as well as fall out of particles from urban air are the reason that NSW Health provides guidance about how to look after rainwater tanks to ensure the water is appropriate to drink. That guidance includes the need to clean out the particles/sediment from the bottom of a tank regularly (e.g. yearly).

- other sources of metals on farms

The use of fertilisers on cropping land can be a source of metals to soil. Commonly, fertilisers like superphosphate are taken from naturally occurring deposits (e.g. bird guano from large colonies of birds). Such materials contain small amounts of chemicals such birds normally excrete including a range of metals that the birds have taken up from the food they eat, the water they drink and the air they breathe (https://publications.csiro.au/publications/publication/PIprocite:66d7d05d-24cc-473e-b0c7-a2f5fbdc1ac6/SQcontaminants%20in%20fertilisers/RP1/RS25/RORECENT/STsearch-by-keyword/LISEA/RI3/RT4). Application of this material to cropping areas then introduces these chemicals including metals to the soil.

4.1.4 Bioaccumulation/biomagnification

This term of reference makes particular mention of considering the potential for impacts to people from the bioaccumulation or biomagnification of metals. However, most metals do not biomagnify nor do they really bioaccumulate.

A large proportion of chemicals can get absorbed by the body but also can be readily excreted from the body. This means they do not accumulate within the body.

Chemicals that bioaccumulate or biomagnify are ones that can get into the body (i.e. cross the membranes in the lungs or stomach or skin so that they enter the blood and get moved around the body) but are not easy for the body to remove. If exposure continues, then the levels can build up.

Chemicals that biomagnify are ones that build up inside an organism and then also accumulate through the food chain – i.e. the various organisms in the food chain all have great difficulty in removing even small amounts of the chemical from their systems so the concentration within higher organisms magnify due to uptake from water, soil and food. Biomagnification is more a term applied when assessing the potential for risks in ecosystems rather than in relation to people.

Some chemicals bioaccumulate but do not biomagnify as, although removal of the chemical is slow, it is still occurring. Chemicals that biomagnify are ones where it almost impossible for the body to remove the chemical of interest.

Metals that are essential micronutrients could be considered to accumulate because some of what is absorbed from food or water is retained within the body. These metals, however, usually have specific systems within the body to hold onto levels of the metal that are needed, i.e active management systems. These systems make sure to hold onto enough of the metal to meet the body's needs and also make sure to get rid of any excess. This means the levels cannot continue to build up over time indefinitely – the body has systems to keep levels at the optimum amount. Such systems may be overwhelmed by a large acute or short term exposure, but it would have to be very large and would result in immediate effects not ones related to accumulation.

Metals that are not essential micronutrients could potentially be considered to bioaccumulate, but they are not considered to be chemicals that biomagnify. They can be absorbed by the body and they can be excreted by the body. Depending on how much people are exposed to, excretion may take some time and so low levels may be found in the body, however, ongoing build up to large levels does not occur.

Metals are generally considered to not be chemicals that biomagnify for a number of reasons:

- chemicals that biomagnify are mostly ones that are stored in fatty tissue (i.e. lipids) and metals do not have this tendency.
- general mechanisms present in the body can remove metals – even the ones that are not essential micronutrients (e.g. metallothionein proteins).
- many metal salts (the form that would be present in the body) are water soluble and water soluble chemicals can be removed from the body.

Chemicals like methylmercury – where mercury atoms have been joined to organic molecules by bacteria – do have more of the characteristics of chemicals that biomagnify so there are a few exceptions to the general outline here but such exceptions are not relevant to mines in NSW as chemicals like methylmercury form in deeper sediments in surface waters where oxygen is low.

4.1.5 Confusing communication

Over the last few years, it has been become clear that concerns in the community about exposure to chemicals are increasing in part due to confusing information provided in the media and in social media. This has resulted in significant concern in the community which can lead to health effects due to stress alone. Addressing these misunderstandings is critical to assist the community to properly understand the risks posed by chemicals and to ensure that unacceptable stress is not occurring.

This difficulty in communication is one of the reasons concerns arise in communities around an operating mine or around a proposed new mine.

The most confusing aspects of information provided in the media or social media seem to be the ideas around:

- chemicals are bad and to be avoided in all circumstances
- exposure to chemicals is bad regardless of which chemicals or how a person is exposed
- exposure to chemicals can only come from the proposed development not from every day life.

These ideas are not correct and communication that puts chemicals into their proper context is required. Ideas like:

- the world is built from chemicals whether it be our cars, our food, our homes, our roads or ourselves
- we are exposed to many chemicals all the time
- many chemicals are essential to life

- our bodies have systems that can manage exposure to chemicals that we do not need, especially for low levels of exposure
- it is not possible to avoid being exposed to chemicals
- activities like driving our cars or using a wood fired heater put out the same types of chemicals as a power station or a waste to energy facility – it is the amounts that are different
- our food is made of chemicals that we use to generate energy and we excrete the chemicals we do not need.

It is difficult to address these confusing aspects when a community becomes concerned due to information in the media or social media.

Once people have been provided with information from a source they trust or which they feel is on their side/looking after their best interests, it is extremely difficult to provide the basic science in a way that can be trusted as it is seen as standing up for the proponent of the mine or implying that the community is not well informed. Often trying to provide the basic science can inflame the situation so these issues continue to occur and potentially get worse in the general population every time one occurs.

A critical need in this communication space is the provision of these basic concepts by trusted sources in accessible ways and over a sufficient period of time to embed them in the community understanding. If that was possible, then the community could focus on specific questions about a development that actually relate to exposures or impacts where things will differ from normal.

4.2 Term (b)

(b) the impact on catchments and waterways, affecting both surface and groundwater destined for, local and town water supplies, including rainwater tanks, and on aquatic biodiversity

4.2.1 Background

This term of reference appears to refer to the potential for metals present in soil/ore to wash off a mine site and reach off-site locations including waterways where they may cause impacts or for the potential for such materials to be spread around the local area as windblown dust. Once the metals have reached a specific off-site location, the term of reference is considering the potential for there to be impacts on people and the environment.

4.2.2 Stormwater runoff

The current regulatory framework in place for controlling mining activities in NSW includes requirements to ensure rainfall runoff from a mine site is managed appropriately. Whether such requirements are sufficient is appropriate to check. These requirements are in place for all industrial developments in NSW and include:

- collecting stormwater from parts of the site where activities occur and contamination might be present (i.e. dirty stormwater) separate from rain that falls onto undisturbed areas of a site (i.e. clean stormwater)
- having systems that can hold sufficient dirty stormwater (based on expected rainfall in an area) so that it can be treated if required
- clean stormwater and stormwater that has been treated appropriately is discharged into local stormwater systems or local creeks.

Environment protection licences specify these requirements. There is also a strict requirement built into NSW legislation – s120 Protection of the Environment (Operations) Act. This specifies that it is an offence to put anything in a waterway other than water (based on the definition of water pollution). This means, if a stormwater management system was not operating effectively, there is existing legislation that is quite clear.

It is not possible to prevent rain from falling onto a particular site, so it is important that appropriate systems are in place to ensure it is managed appropriately.

It is also noted that, if the existing management controls were to fail, runoff from such sites would be quite visible as it is likely that it would contain a lot of mud/particles that wash off areas without vegetation. This means people in the community or on the site would notice such a failure and it would then be able to be repaired/resolved.

4.2.3 Windblown dust

In regard to deposition of dust particles from air onto water surfaces (whether waterways, reservoirs or rainwater tanks), the current regulatory framework that applies to mining and, in addition, the current regulatory framework that applies to all workplaces can contain or already does contain controls on the amount of dust that can be generated at a site or allowed to leave a site.

Safework Australia has a workplace exposure standard of 10 mg/m^3 of dust in air. This means that all workplaces must control airborne dust at a site to make sure workers are not exposed to excessive levels. This value applies to the average level across a day so, as with any average, there could be times in the day where concentrations are a little higher than this value while other times in the day where concentrations are a little lower than this value and a site will still comply with the standard. This standard applies to dust in general.

The size of the particle that may be generated at a site is also important to consider.

Particles that are visible in air are ones that are larger – 10-100 micron in size (i.e. µm or 1 millionth of a metre). These particles don't travel long distances from the point of generation. The sorts of particles that travel long distances from where they are generated are the very fine particles – 2.5 micron or less.

When the wind blows across a site with bare soil such as a mine site, the sorts of particles present to be swept up are larger ones. Very fine particles tend to be generated during combustion processes like those that occur in car engines, power stations, wood fired heaters, bushfires or other fires. There will be some fine particles mixed in with the larger ones from bare earth, but they will not form the majority of the particles.

When a dust plume is visible at any type of site, it will mostly be made up of larger particles and these will not travel kilometres from the site where they are generated.

A calculation can be undertaken using a range of assumptions to show that windblown dust is not likely to result in significant movement of metals.

If material at a site contains 100 mg/kg of zinc and a plume of this dust is blown into the air, the following can be estimated:

Windblown dust

- Size of dust plume is assumed to be 5 m high, 10 m wide, 10 m long – i.e. a box of air of 500 m^3
- Dust within that box is present at 10 mg/m^3 (i.e. workplace exposure standard)
- This results in 5,000 mg of dust being present in the box of air (i.e. 500 x 10) which is equal to 5 g or 0.005 kg of dust
- If there is 10 mg/kg of zinc in the dust, this means there is 0.5 mg of zinc in the box of air (i.e. 10 mg/kg x 0.005 kg)

Wash off into rainwater tank

- If that box of air moves across and settles out onto a nearby roof without any dilution due to wind or loss of particles prior to reaching the roof, then this means 0.5 mg of zinc settles out onto the roof
- If that is washed into a 5,000 L rainwater tank, then that gives a concentration in the water of 0.0001 mg/L assuming all the zinc can dissolve out of the particle into the water – most particles at a mine site contain ore as their source of the relevant metal and ore is usually not readily soluble so it is more likely most of the zinc will remain stuck in the particles as they settle to the bottom of the tank
- The NHMRC Australian drinking water guideline for zinc is 3 mg/L. This gives a margin of 30,000. This guideline is actually based on impacts on taste. Impacts on health do not occur until concentrations are much higher.

Settling out onto soil in a backyard

- If that amount of dust containing zinc settles out onto a backyard instead of a roof, then that would mean 0.5 mg of zinc could be present across a backyard of 10 m wide and 20 m long and that dust would mix into the top 10 cm of soil. It is noted that zinc will already be present in this soil, but this dust would result in an extra amount of zinc of 0.000025 mg/kg.
- The national guidelines for zinc in backyard soils is 7,400 mg/kg. This gives a margin of more than 1 million.

It is acknowledged that these calculations are based on a single dust plume moving to a single house, but they show very large gaps between national guidelines and the maximum amount of additional metal that could be contributed to a single house.

In relation to rainwater tanks, these fill up and then get used up over time so there is always water going in and out and this will potentially dilute the metal concentrations to much lower concentrations than estimated here.

In relation to backyards, dust can settle onto the backyard and be reswept up into the air to be moved elsewhere. Every time gardening occurs, the dust that has settled gets mixed into the deeper soil diluting it further.

Other matters that are important to consider when considering the potential for windblown dust to contribute significant levels of relevant metals to rivers, creeks, reservoirs, lakes, rainwater tanks etc:

- windblown dust comes from all locations around a single house (or creek/lake etc) so at times dust from a mine may reach a house but, on other days, the dust that reaches a house will come from a different direction.
- dust/soil in areas around an area where there is an ore body sufficient for mining will also have higher levels of the relevant metal (and those commonly found with it) than in areas far away from a mine.
- this means that, even if the mine is not operating (i.e. never starts), there will be dust being blown around that contains the relevant metals and which will settle onto a roof or backyard and get into rainwater tanks or waterways.
- even in areas well away from mines/ore bodies (such as cities or towns), the material that will settle onto a roof or backyard will contain metals like zinc and lead (from paint, vehicle emissions etc etc) due to the wide range of sources of these metals in our everyday lives.
- in addition to material settling out on roofs and buildings, the materials from which a building or a roof are made also result in the movement of metals with stormwater into rainwater tanks etc.

These matters limit the potential for windblown dust to significantly change the concentration of metals in soil or on a roof. This is especially the case at increasing distances from the mining operations.

4.3 Term (c)

(c) the impact on land and soil, crops and livestock, including through biomagnification and bioaccumulation

This term of reference covers the potential for food to become contaminated by metals due to the movement of metals from a mine site into surrounding agricultural areas.

Australia has a system to regulate the potential presence of contaminants in the food supply – the Food Standards Code and related guidance. There are also state based requirements that apply in some situations.

The Food Standards Code includes maximum limits for metals like lead and cadmium. It is illegal to sell food containing concentrations above these limits (Schedule 19 of the Code). The Food Standards Code does not include maximum limits for zinc as it is not considered that it could be present at levels of concern using normal agronomic and horticultural practices (https://www.foodstandards.gov.au/code/userguide/Pages/generallyexpectedlev1412.aspx).

As noted above, the potential for bioaccumulation or biomagnification of metals to occur is not straightforward.

- Crops and livestock are not at the top of any food chain so the potential for biomagnification is unlikely.
- Metals present in ore type materials are not going to be readily accessible for crops or livestock – such chemicals are chemically bound up in the particles and do not readily dissolve into soil water so they can be taken up through the roots of a crop plant and do not readily dissolve in the stomach of livestock so they can be taken up across the gut.
- For metals like zinc and other essential micronutrients, they will always be present in crops and livestock as such organisms require a certain amount to live and they have systems that control the amount present in their systems, so they accumulate to a certain extent but not indefinitely.
- For metals that are not essential micronutrients:
    - livestock have metabolic pathways that enable them to remove them from their system albeit slowly in some cases
    - chemicals need to be able to dissolve into the water within soil for crops to be able to take them up via the roots so, for many ore type sources, little will transfer from the dust into an accessible form that can be taken up by plants.

These matters will limit the potential for metal containing materials from a mine site (and from all of the area that is considered mineralised around an ore body) to have significant impacts on food grown in areas close to a mine.

4.4 Term (d)

(d) the adequacy of the response and any compliance action taken by the regulatory authorities in response to complaints and concerns from communities affected by mining activities

No comment provided.

4.5 Term (e)

(e) the effectiveness of the current regulatory framework in terms of monitoring, compliance, risk management and harm reduction from mining activities

No comment provided.

4.6 Term (f)

(f) the effectiveness of current decommissioning and rehabilitation practices in safeguarding human health and the environment

No comment provided.

4.7 Term (g)

(g) the effectiveness of New South Wales Government agencies to regulate and improve outcomes including:

(i) the measurement, reporting and public awareness
(ii) the provision of various protective materials
(iii) the ability to ensure the health of at-risk groups
(iv) the suitability of work health and safety regulations, and
(v) the capacity to respond within existing resources
(vi) the adequacy of existing work, health and safety standards for workers

No comment provided.

4.8 Term (h)

(h) whether the regulatory framework for heavy metals and critical minerals mining is fit for purpose and able to ensure that the positive and negative impacts of heavy metals and critical minerals mining on local communities, economies (including job creation) and the environment are appropriately balanced

No comment provided.

5 Conclusions

This submission has provided a range of background basic scientific information to assist the Inquiry. enRiskS would be very happy to appear before the Inquiry to answer questions in relation to this information, if required.

As noted in our comments, prior to determining whether metals from a mine may cause impacts on people or the environment, it is critical to determine if those people or the relevant part of the environment can actually be exposed to metals arising from the mining operation in excess of normally expected levels.

6 Limitations

Environmental Risk Sciences Pty Ltd has prepared these comments in accordance with the usual care and thoroughness of the consulting profession. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

It is prepared in accordance with the scope of work and for the purpose outlined in this report.

This report was prepared in August/September 2023. The report is based on the information provided and reviewed at that time. Environmental Risk Sciences disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

7 References

NHMRC 2011 updated 2022, *Australian Drinking Water Guidelines 6, Version 3.8 Updated September 2022, National Water Quality Management Strategy*, National Health and Medical Research Council, National Resource Management Ministerial Council.

8 Closure

Thank you for the opportunity to provide a submission to this inquiry. If you require any additional information or if you wish to discuss any aspect of this submission, please do not hesitate to contact

Yours sincerely

Environmental Risk Sciences Pty Ltd