Barry Noller Report 23 February 2023

Statement from Barry N Noller BSc, MChem, PhD FRACI, FRSC, FFACS, FIUPAC on behalf of the Lue Action Group regarding the 'Proposed Bowden's silver mine at Lue'

Dear Commissioners,

I am an independent expert on contamination of metals and metalloids and other substances arising from mining activities practices utilising skills in environmental chemistry and toxicology and applications of risk assessment processes to human health and environment including ecological issues (Slide 1). I have over 40 years' experience in assessing contamination matters and have given advice to the Lue Action Group since 2012.

Based on my examination of EIS documents including the HHRA I have proposed key areas to discuss today, considering the limited time to do this.

1.The review of the HHRA

The HHRA has been conducted and independently reviewed (Slide 2). A key feature of the reviewing process is that most detail raised about HHRA issues have not survived the review processes. This implies that the community should have confidence in the process applied. What has emerged is the key reliance on modelling to estimate environmental impacts and health effects in relation to air quality (including heavy metals) and noise regarding any specific impacts on the health of the local community.

Monitoring and management measures for HHRA need to be in place to reduce risk to human health with sufficient reliable monitoring occurring as the project moves through its different stages of development.
The Air modelling and HHRA in Appendices 6 and 7 claim to show no risk from lead to the community before or during mining activities based on blending of ore and waste rock to estimate dispersed lead penetrations in air, and therefore there is no reason for them to test ore and concentrate levels for effects of lead on the population. With these details the conclusion stated a number of times is that there is no problem. Dr Roger Drew in his review identifies that a comprehensive monitoring program is required so that exposure pathways can be demonstrated in practice. With modelling there is no validation of the data by other experimental means and only external review.

The LAG and community believe that IPC approval cannot be granted without all SEARs having been addressed. Monitoring risks to human health by measure baseline and ongoing blood lead levels in the community is a key item noting that 'Human Health – including a Human Health Risk Assessment address how the project development and environmental impacts in relation to air quality and monitoring and management measures to reduce risk to human health.

The example of Cadia's poor performance is a relevant example of how operating projects can get out of control. Cadia is a much bigger project than Bowden's but

emphasises that there needs to be on going review of a mine's operation to steer the monitoring and not have it locked in concrete before project commencement.

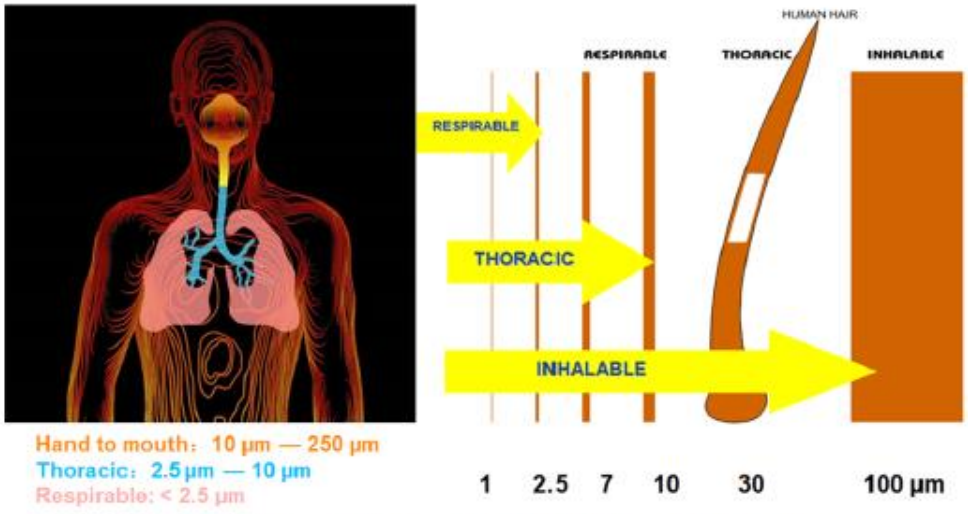
Monitoring and management measures need to be in place to reduce risk to human health with sufficient reliable monitoring in place to occur as the project moves through its different stages of development. The SEARs need to address that the principal role of monitoring following commencement of mining is to ensure that the community is protected from exposure to contaminants from mining activities with intentional validation of the modelling as an independent measuring activity rather than solely relying on predictions from modelling.

2. Dust deposition measurement

The current techniques to measure dust deposition need to be proposed and confirmed to become part of mine site monitoring of lead dispersion in dust included with other air monitoring in the mine management plan if mining commences (Slide 3). The important detail is to ensure that measurements are performed for lead dust dispersion assessment and that lead deposition in fallout is not based solely on modelling calculations.

Dr Roger Drew raised earlier about the input data being used for lead deposition in dust giving an underestimate of lead exposure to adults and children at Lue from ingestion. The conclusion for lead exposure is primarily based on calculated exposures being less than health-based guidelines. However, issues were raised in in Dr Drew's report regarding the selectivity of using data for PM10 (for dust deposition) and PM2.5 (for exposure to metals).

Slide 4 shows Figure 1 and the size ranges of dust particles for human ingestion and inhalation.



Source: Modified from SKC (2009) (used with permission from SKC)

Figure 1 Size of dust particles for ingestion and inhalation.

For some pathways and substances exposure to TSP apart from PM10 is also relevant. Dust size based on PM10 is finer than collected with TSP from mine sites. Exposure of metals including lead has been potentially under estimated when PM 10 alone is used.

NSW defines TSP as ≥ 50µm while Qld defines TSP as ≤ 100 µm. TSP as the surrogate of dust deposition is chosen because it is readily available measurement data and avoids having to perform dust fallout measurements. TSP does not include particles from 50µm or 100µm up to ≤ 250µm, the size cut off for dust ingestion by children. Thus using TSP data for dust fallout is an approximation. Bioaccessibility of lead in soil also uses a size cut off of <250 µm all samples for soil.

Slide 5 shows Figure 2 giving the example of particle size analysis of collected mine dust by Malvern Mastersizer 2000 from Mt Isa (Lead Pathways Study, 2017). Closer examinations of plots in Figure 2 of % volume vs particle size (µm) shows that TSP < 50 µm only may exclude the complete range of particles in the size range >50 µm to <250 µm that is relevant to human exposure via ingestion to lead from dust fallout.

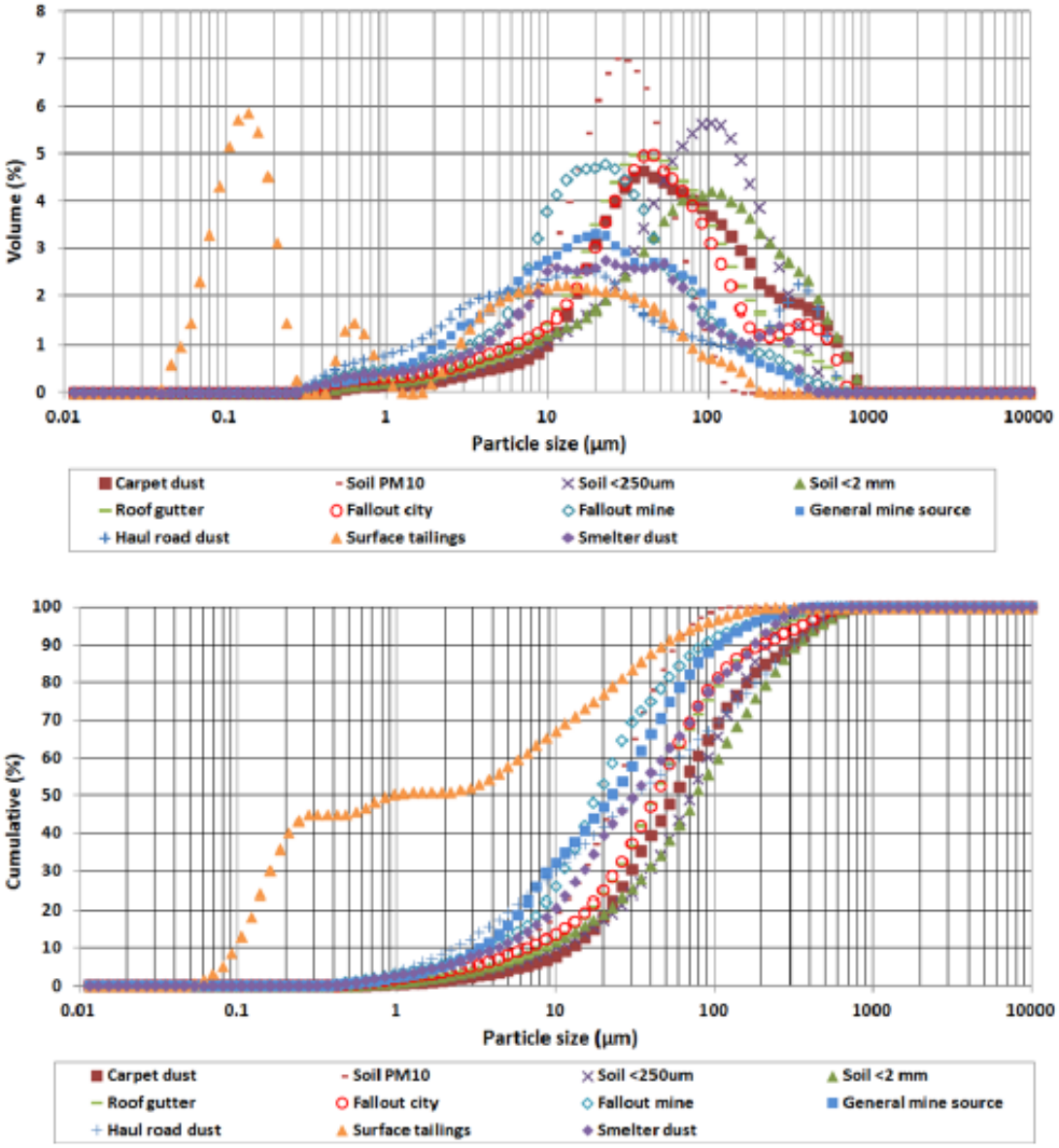


Figure 62 Summary of particle size distribution of samples from the mine site and the city's residential area as volume (%) and cumulative (%)

Figure 2 Example of particle size analysis of mine dust by Malvern Mastersizer 2000 from Mt Isa. TSP < 50 µm only excludes >50 µm to <250 µm.

Whilst Mt Isa, like Broken Hill and Port Pirie have both mining/mineral processing and smelting activities that generate dust fallout containing lead, the smelter at Mt Isa is only a partial smelter. This means that most lead at Mt Isa has occurred via dust fallout pathways. An example of a lead mining/mineral processing activity without smelter is the former Woodcutters lead zinc mine operated by Newmont Mining in the Northern Territory. The on-site lead/zinc mineral processing activity at Woodcutters created a distinct plume in of lead in surface soil extending 1-2 km in the direction of the prevailing winds and details are given in historical reports (add reference).

During drier episodes as happened during the drought period 2017 – 2019 there is more potential to have dust generated for dry surface materials (Slide 6). Evidence for an accompanying reduction is stored water for dust suppression and dispersion of dry surface dust with non-availability of sufficient stored water for dust suppression may result in increased dust dispersion increasing lead as given in Shireen Baguley's report for LAG, entitled “Proposed Bowdens Mine SSD 5765 Surface Water Submission Report to the Independent Planning Commission”. In such a case non-availability of sufficient stored water for dust suppression may result in increased dust dispersion increasing lead. This warrants attention to have enhanced monitoring of lead in dust fallout during drier climatic episodes.

Attention is therefore required in the SEARS with selecting dust monitoring methods including for lead and other metals, and particle size distribution that provide sufficient detail about dust properties to enable management measures to be put in place to assess lead exposure at Lue based on dust distribution patterns and actual particle size data.

Attention in the SEARS is also required to put in place appropriate guidelines for lead in dust fallout to protect both the local population in the surrounding area of Lue together with terrestrial species and cultivated plants. In the absence of NSW or other Australian guidelines for lead and other metals in dust fallout , the German Luft Air guidelines for dust fallout can be used.

3. Blood lead of Lue community

I am aware that NSW EPA uses an outdated guideline for assessing building contamination from lead and does not have a current floor contamination method for lead that meets a blood lead level of 5 ug/dL, as does the USEPA lead floor standard (Slide 7). Whether the latter standard can be applied to monitoring floor surface lead in homes and the school at Lue but is not stipulated by the NSW EPA. In addition, NSW Health has the measurement of blood lead as the gold standard for lead exposure. However, NSW Heath does not advise blood lead monitoring as a routine monitoring tool for assessing lead exposure in child or adult, unless a medical doctor advises that an exposed individual has been diagnosed with effects from lead exposure. These shortcomings with the NSW Government agencies need to be brought to the attention of the enquiry, as they connect with the kind of lead exposure monitoring that may be allowed in NSW. It is therefore important to get all residents and particularly children tested for blood lead. The HHRA claims from air modelling and HHRA show no risk from lead to the community before or during mining activities. I am summarising all these details as they keep on saying there is no problem. It remains important to get all residents and particularly children tested for blood lead.

4. Crystalline silica in air

One of the most important contaminants in air at Bowdens silver project is crystalline silica (Slide 8). This needs to be measured in the PM2.5 fraction to follow international best practice. Because PM2.5 particulate matter is ultrafine particles it can be dispersed far more widely than larger size particles in dust deposition. Figure 1 shows that the size of dust particles for inhalation and penetrates the deep lung. Dispersion of respirable crystalline silica (as PM2.5 annual average) derived from mine project operations current require regular monitoring to meet the standard of 50 $\mu g/m^3$ at the mine site.

Thus, crystalline silica has a great potential to affect the wider community than lead in fall out dust within 2-3 km from the project boundary as the dispersion of PM2.5 covers a longer distance and will go way beyond Lue and Mudgee.

In the community the Victoria (EPA Victoria 2007) applies 3 $\mu g/m^3$ as the guideline based on the California EPA Office. This is measured in the PM2.5 fraction and follows international best practice.

Evidence from coal mining in the Hunter Valley also shows that heavy vehicles on mine sites creates PM2.5 particulates by action of tyres driving over sedimentary rock and releases silica particles.

It is recommended in the SEARS to apply 3 $\mu g/m^3$ in the PM2.5 fraction in SEARS as the guideline to assess respirable crystalline silica exposure of the population at Lue and follow international best practice as crystalline silica is produced on a continuous basis from the mine production activities.

5. Consequences of Acid Mine Drainage

Acid mine drainage (AMD) prediction and control requires the highest level of testing for acid generation properties before reliable monitoring can be undertaken. There can be no flexibility with data requirements for ensuring no risk of AMD generation.

Representative sampling for AMD testing rather than averaging is imperative to predict reliably if AMD generation will occur. Any shortcoming to the scope of the monitoring program risks creating acid drainage in the future. In addition, any attempt to delay resolving adequate sampling issues before the project commences is asking for trouble arising from inadequate capability to predict acid generation.

Surface water coupled with any generation of AMD is likely to severely impact tributary creeks such as Lawson's Creek. The risk of AMD getting into Lawson's Creek and the Cudgegong River is that it may lead to damage to the isolated aquatic ecosystems beyond the point of restoration.

Discharge strategies will need to be developed in the future but should not be allowed when surface runoff is in contact with PAF waste rock. Water discharge has to meet NSWEPA requirements.

TSF material is not immune to acid generation and requires detailed kinetic testing to establish whether or not acid formation will occur in the future when breakthrough in acid neutralisation ceases.

Pit void water treatment and potential for overflow of acid water requires critical management and must be prevented. Increased pit water volume is exacerbated by enlargement of the final void to increase pit volume for store excess water and may lead to a requirement for continuous water treatment into the future, to avoid damage to creeks like Lawson's Creek and the Cudgegong River.

SEARS are not being met with respect to AMD in identified key 'mine viability-determining' areas and there is no documented plan for developing site specific water quality guidelines for effects of contaminants in Lawson's Creek being a special category of alpine creek system. There can be no flexibility in the SEARS with data requirements for ensuring no risk of AMD generation.

6. Conclusions regarding EIS

- The principal role of monitoring is to validate modelling as an independent measuring activity rather than place reliance on modelling alone.
- Dust monitoring methods need sufficient detail to enable management measures to be put in place to assess lead exposure at Lue.
- Deficiencies in lead contamination monitoring of the community that meets a blood lead level of 5 ug/dL need to be overcome and include testing for blood lead.
- Monitoring of dispersion of respirable crystalline silica (as PM2.5 annual average) to the community is required to meet a suitable guideline such as that used in Victoria.
- SEARS are not being met with respect to AMD in identified key 'mine viability-determining' areas and there is no documented plan for developing site specific water quality guidelines for effects of contaminants in Lawson's Creek being a special category of alpine creek system. There can be no flexibility with data requirements for ensuring no risk of AMD generation.
- The IPC Commissioners have not been provided with insufficient evidence to make a fully-informed decision and the project is not approval-ready.
- Key unanswered questions remain regarding conditions of Consent.
- It would be a failure of due process for the IPC proceed without seeing revised management plans and confirming that SEARS have been met.

Yours Sincerely,

Barry N Noller

BSc, MChem, PhD FRACI, FRSC, FFACS, FIUPAC

References

Bruce, S.L., Ng, J.C. & Noller, B.N. (2004) A desktop Human Health Risk Assessment of Arsenic and lead in Soil at Woodcutters Mine Site. Prepared for EWL Sciences Pty Ltd. pp1-60.

Diacomanolis, Violet, Ng, Jack C., and Noller, Barry N. (2006). Site Specific Health Risk Assessment of Arsenic, Lead and other Metals at Woodcutters Mine site. National Research Centre for Environmental Toxicology, Newmont Australia Ltd.

Diacomanolis, V., Ng, J.C., Haymont, R. and Noller, B.N. (2010) (Poster and Invited Oral). Division Symposium 4.2. 19th World Congress of Soil Science, Soil Solutions for a Changing World 1 – 6 August 2010, Brisbane, Australia. Paper 1331 Published on DVD. pp 1-3.

Ng, J.C. and Noller, B.N. (2006) Site Specific Health Risk Assessment of arsenic, lead and other metals at Woodcutters Mine site. Report for Newmont Asia Pacific October 2006. pp 1- 91.

Ng, J., Diacomanolis, V., Noller, B. and Alarcón León, E. (2008) Soil Contamination Investigation of Heavy Metals in Soils at Woodcutters. Report for Newmont Asia Pacific by GHD- EnTox April 2008. pp 1 - 61.

Noller, B., Zheng, Jiajia., Huynh, T., Ng, J., Diacomanolis, V., Taga, R. and Harris, H. (2017). Lead Pathways Study – Air. Health Risk Assessment of Contaminants to Mount Isa City. 7 February 2017 Mount Isa Mines Limited, Mount Isa. pp 1-414 plus appendices.

http://www.mountisamines.com.au/EN/sustainability/Pages/LEADPATHWAYSSTUDYPORTAL.aspx

Appendix

Slides supporting presentation to IPC 15 February 2023
Statement on 'Proposed Bowden's silver mine at Lue'

Barry N Noller
BSc, MChem, PhD FRACI, FRSC, FFACS, FIUPAC

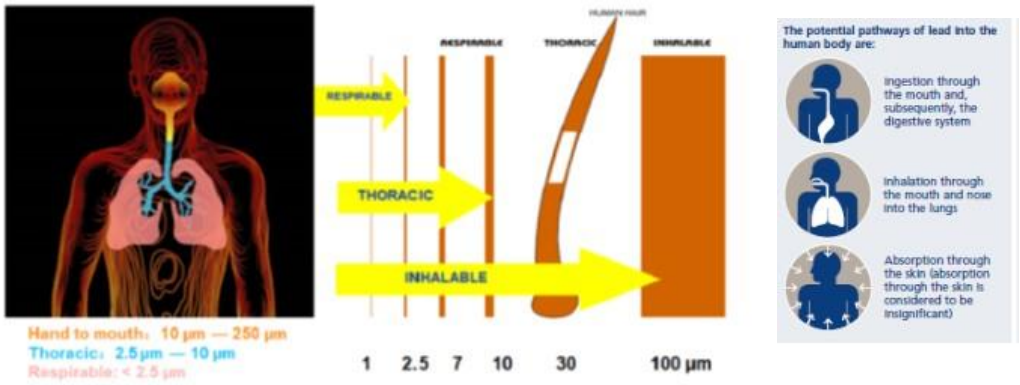
on behalf of the Lue Action Group

1. The review of the HHRA

- The HHRA has been conducted and independently reviewed but most detail raised about issues have not survived the review processes. This implies that the community should have confidence in the process applied.
- Monitoring and management measures for HHRA need to be in place to reduce risk to human health with sufficient reliable monitoring occurring as the project moves through its different stages of development .
- The LAG believes that IPC approval cannot be granted without all SEARs having been addressed. Monitoring risks to human health by refusing to measure baseline and ongoing blood lead levels in the community is a key item noting that HHRA address how the project development and environmental impacts in relation to air quality and monitoring and management measures to reduce risk to human health.
- This is the principal role of monitoring rather than solely relying on modelling, and intended to validate the modelling as an independent measuring activity.

2. Dust deposition measurement

- Attention will be required with selecting dust monitoring methods to provide sufficient detail to enable management measures to be put in place to assess lead exposure at Lue.
- Figure 1 shows size of dust particles for ingestion and inhalation exposure.
- TSP in air used in modelling is measured to <50 µm diameter in NSW or 100 µm in QLD.
- Ingestion pathway up to <250 µm (Figure 1) is applicable for lead. Therefore TSP underestimates dust particle size in the fraction >50 µm to <250 µm for lead ingestion.
- Figure 2 shows examples of particle size distribution of mine dust from Mt Isa and shows the proportion of dust particles.



Source: Modified from SKC (2009) (used with permission from SKC)

Figure 1 Size of dust particles for ingestion and inhalation.

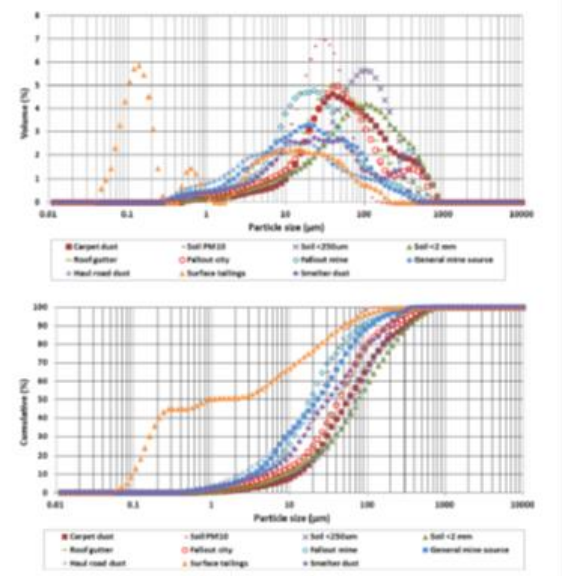


Figure 62 Summary of particle size distribution of samples from the mine site and the city's residential area as volume (%) and cumulative (%)

Figure 2
Example of particle size analysis of mine dust by Malvern Mastersizer 2000 from Mt Isa.
TSP < 50 µm only excludes >50 µm to <250 µm

2. Dust deposition measurement cont

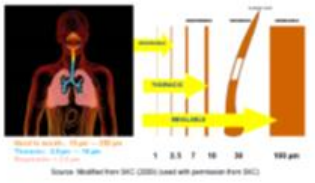
- During drier episodes such as the drought period 2017 – 2019 there is more potential to have dust generated for dry surface materials. Evidence for an accompanying reduction is stored water for dust suppression and dispersion of dry surface dust with non-availability of sufficient stored water for dust suppression may result in increased dust dispersion increasing lead. Evidence for this is given in Shireen Baguley's report for LAG.

3. Blood lead of Lue community

- NSW EPA uses an outdated guideline for assessing building contamination from lead and does not have a current floor contamination method for lead that meets a blood lead level of 5 ug/dL, as does the USEPA lead floor standard.
- The USEPA lead floor standard. needs to be applied to monitoring floor surface lead in homes and the school at Lue but is not stipulated by the NSW EPA.
- NSW Health has the measurement of blood lead as the gold standard for lead exposure. However, NSW Heath but does not advise blood lead monitoring as a routine monitoring tool for assessing lead exposure in child or adult, unless a medical doctor advises that an exposed individual has been diagnosed with effects from lead exposure.
- These shortcomings with the NSW Government agencies need the attention of the IPC to monitor lead exposure of all residents and particularly children tested for blood lead.
- The HHRA claims from air modelling to show no risk from lead to the community before or during mining activities.
- The principal role of monitoring is to validate the modelling as an independent measuring activity rather than rely solely relying on modelling. It remains important to get all residents and particularly children tested for blood lead.

4. Crystalline silica in air

- One of the most important potential contaminants in air at Bowden's silver project is crystalline silica. Dispersion of respirable crystalline silica (as PM2.5 annual average) derived from Project operations current require regular monitoring to meet the standard of 50 µg/m^3 at the mine site.
- In the community the Victoria (EPA Victoria 2007) applies 3 µg/m3 as the guideline based on the California EPA Office. This is measured in the PM2.5 fraction and follows international best practice.
- Evidence from coal mining in the Hunter Valley also shows that heavy vehicles on mine sites creates PM2.5 particulates by action of tyres driving over sedimentary rock and releases silica particles.
- It is appropriate to apply 3 µg/m3 in the PM2.5 fraction as the guideline to assess respirable crystalline silica exposure at Lue and follow international best practice.



See Figure 1 Size of dust particles for ingestion and inhalation.

5. Consequences of Acid Mine Drainage

- Acid mine drainage (AMD) prediction and control requires the highest level of testing for acid generation properties before reliable monitoring can be undertaken. There can be no flexibility with data requirements for ensuring no risk of AMD generation.
- Representative sampling for AMD testing rather than averaging is imperative in order to predict reliably if AMD generation will occur and create acid drainage in the future.
- Surface water coupled with any generation of AMD is likely to severely impact tributary creeks such as Lawson's Creek. The risk of AMD getting into Lawson's Creek and the Cudgegong River is that it may lead to damage to the isolated aquatic ecosystems beyond the point of restoration.
- Discharge strategies will need to be developed in the future but should not be allowed when surface runoff is in contact with PAF waste rock. Water discharge has to meet NSW EPA requirements.
- TSF material requires detailed kinetic testing to establish if acid formation will occur in the future when breakthrough in acid neutralisation ceases.
- Pit void water treatment and potential for overflow of acid water requires critical management. Increased pit water volume and enlargement of the final void to increase pit volume for store excess water and may lead to a requirement for continuous water treatment into the future, to avoid damage to creeks like Lawson's Creek and the Cudgegong River.
- SEARS are not being met with respect to AMD in identified key 'mine viability-determining' areas.

6. Conclusions

- The principal role of monitoring is to validate modelling as an independent measuring activity rather than place reliance on modelling alone.
- Dust monitoring methods need sufficient detail to enable management measures to be put in place to assess lead exposure at Lue.
- Deficiencies in lead contamination monitoring of the community that meets a blood lead level of 5 ug/dL need to be overcome and include testing for blood lead.
- Monitoring of dispersion of respirable crystalline silica (as PM2.5 annual average) to the community is required to meet a suitable guideline such as that used in Victoria.
- The IPC Commissioners have not been provided with insufficient evidence to make a fully-informed decision and the project is not approval-ready.
- Key unanswered questions remain regarding conditions of Consent.
- It would be a failure of due process for the IPC proceed without seeing revised management plans and confirming that SEARS have been met.