

DOC16/121931-37

The Senior Planner
Resource and Energy Assessments
Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

By email: elle.donnelley@planning.nsw.gov.au

Dear Ms Donnelley

Re Broken Hill North Mine recommencement project – Response to Submissions

I refer to your electronic mail dated 7 September 2017 to the Environment Protection Authority (EPA) about the Response to Submissions (RTS) prepared by Perilya Broken Hill Limited for their proposed recommencement of mining at the North Mine in Broken Hill.

As foreshadowed to you in our correspondence dated 29 September 2017 we have now completed our review of the revised Human Health Risk Assessment (HHRA) presented in the RTS. The review has concluded that we require further additional information to enable an adequate assessment the risk to human health from the proposed recommencement of mining at the North Mine.

We have detailed the further additional information required in relation to the HHRA, together with our justification for seeking this information, at Attachment 'A'.

We request the applicant provides a further revised HHRA to refine assumptions or implement additional mitigation measures and demonstrate that blood lead levels in surrounding residential occupants are not increased as a result of the recommencement of mining at the North Mine.

If you have any further enquiries about this matter please contact Jason Price by telephoning 02 6969 0700.

Yours sincerely



5.10.2017

CRAIG BRETHERTON
Manager Regional Operations South West
Environment Protection Authority

ATTACHMENT 'A'

Background

On 8 March 2017 the Environment Protection Authority (EPA) provided a submission to the Department of Planning and Environment (DPE) about the proposal to recommence mining at the Perilya Broken Hill Limited (Perilya) North Mine in Broken Hill (the Proposal). The submission included comments in relation to the Human Health Risk Assessment (HHRA) and a request for additional information in relation to the HHRA.

The DPE provided Perilya's Response to Submissions (RTS) to the EPA on 7 September 2017 which included a new health risk assessment titled '*Perilya Broken Hill North Mine HHRA*' (the revised HHRA) dated 4 September 2017 and prepared by ToxConsult Pty Ltd (Toxconsult). The revised HHRA is based on the previous HHRA and a revised air quality assessment titled '*Perilya Broken Hill North Mine – Air Quality Assessment Update*' dated 21 August 2017 and prepared by Pacific Environment Limited (PEL, 2017b).

As this is a new HHRA for the Proposal some further additional information is required to be provided to the EPA so a complete review of the risks to human health can be assessed. PEL, 2017b has not been considered in detail in this review and it should be noted that any errors or inconsistencies in the PEL, 2017b that need to be addressed might require consideration in any further revised HHRA.

Overview of the revised Human Health Risk Assessment

The revised HHRA assessed risks of lead and other metals to sensitive receptors within districts/areas throughout Broken Hill. Generally, one receptor was assessed within each district/area, which represented the receptor with the highest predicted exposure due to the Proposal (as determined by PEL, 2017b). For districts/areas that were expected to have to highest exposure, the receptors with the maximum and minimum exposure were assessed along with the median to determine a range within those locations.

For the lead risk assessment, blood lead levels (BLLs) in children were modelled for three scenarios:

- (i) the existing situation (ie no active mining) including background exposures;
- (ii) the Proposal only (ie active mining) not including background exposures; and,
- (iii) the Proposal (ie active mining) including background exposures.

Modelling was undertaken using the US EPA Integrated Exposure Biokinetic and Uptake (IEUBK) model. The assessment predicted that in all but two districts/areas assessed the estimated increase in BLLs of children was $\leq 0.001 \mu\text{g/dL}$, which equates to 0.02% of the National Health and Medical Research Council (NHMRC) investigation level of $5 \mu\text{g/dL}$.

For two districts/areas, the predicted increase due to the Proposal was greater than this, up to $0.558 \mu\text{g/dL}$ at a residence owned by Perilya on the North Mine site. The other location was district D5a, which is located adjacent to the proposed mine site. Due to the already elevated BLLs in children of Broken Hill (measured geometric means are already above the investigation level of $5 \mu\text{g/dL}$), Perilya have proposed that they will actively monitor BLLs in children living in residences within the North Mine site and take measures to reduce exposure if levels exceed $5 \mu\text{g/dL}$.

Metals other than lead were also assessed in the revised HHRA for both acute and chronic risks. In both cases, the conclusion was that the risk from the Proposal was low as all hazard indices (HIs) were less than the criteria of 1. Inhalation cancer risk was also assessed for arsenic and cadmium and the conclusion was that the Proposal did not pose an unacceptable risk.

Review of the new HHRA provided in the Response to Submissions

The comments in this section relate to the additional information requested by the EPA arising out of the original HHRA and the adequacy of the RTS provided by Perilya. The detailed previous EPA request for additional information has not been repeated here and the original EPA submission should be referred to for further detail on the information requested.

1. The Human Health Risk Assessment lacks a conceptual site model (CSM) and other essential elements that are required to demonstrate health risks associated with the Project have been comprehensively assessed.

1.1. Receptors not clearly identified or assessed

Applicant response – PEL, 2017b and revised HHRA assessed 86 non-proposal related receptors within the assessment district (including private residences, child-care centres, health care facilities, business premises and play grounds/playing fields). In the case of private residences, care was taken to assess the residence within each district that would most likely be impacted by the Proposal. In addition, 16 Applicant-owned residences were also assessed. The Applicant contends that all receptors that would likely be impacted by the proposal have been assessed.

EPA response – this issue has been resolved

The revised HHRA assesses the risk posed to residences outside North Mine as well as a number of residences located within North Mine, referred to as the 'PBH residences'. In the revised HHRA, the minimum, maximum and median exposure for the PBH residences were considered. For the other locations, the receptors assessed were clearly identified (see Table 3.5.1 of the revised HHRA) and captured the receptors within each district/area predicted to have the highest exposure from the Proposal determined in PEL, 2017b.

1.2. The HHRA lacks a conceptual site model (CSM)

Applicant response – A conceptual site model has been included in Section 3.2 of the revised HHRA.

EPA response – this issue has been partially resolved

The revised HHRA contains a site-specific conceptual site model for the risk assessment, which is discussed in Section 3.2 and shown diagrammatically in Figures 3.2.1 and 3.2.2. It appears that most of the relevant and complete exposure pathways have been considered in the assessment except for ingestion of home grown vegetables/fruits (see further additional information request on revised HHRA #3).

1.3. Potential impacts associated with exposure to other contaminants, in particular, persistent and bioaccumulative contaminants have not been considered. All contaminants of potential concern should be considered.

Applicant response – Section 4 of the revised HHRA and Section 3.5.3.6 of the RTS document provide an assessment for metals other than lead.

EPA response – this issue has been resolved

Section 4 of the revised HHRA includes a risk assessment for metals other than lead. This includes an assessment of both acute and chronic (non-cancer and cancer) risks. These assessments were done for the existing Mine (not active) and the proposed Mine (active). As no background data (soil and air) were available for these metals these data were not included. This means that the assessment does not incorporate intake factors from existing sources around Broken Hill.

The EPA notes however that the chronic assessment compared exposure concentrations to tolerable daily intakes (TDIs). In this assessment, the TDIs were background-adjusted for high-end background exposures (eg dietary exposures etc). Note that the further additional information requests on the revised HHRA includes comments requesting additional information in relation to the assessment of metals other than lead (additional information requests #6 and #7).

1.4. It is unclear how conservative and representative values are derived from the updated AQA.
Applicant response – PEL, 2017b and the revised HHRA both state that the assumptions used are representative and conservative.

EPA response – this issue has not been resolved

Although the applicant response states that ‘the assumptions used are representative and conservative’, this has not been demonstrated by showing all the measured and predicted air quality data that the HHRA relies on. The revised HHRA refers regularly to PEL, 2017b and spreadsheets provided to ToxConsult by Pacific Environment Limited (PEL). The spreadsheet was not presented in the HHRA and it is not possible to confirm that the information used in the revised HHRA is representative and conservative (see further additional information request on revised HHRA #2).

1.5. The input information for the assessment of health risks requires PEL, 2017b to be accurate.
Applicant response – a new HHRA was prepared based on the substantial revisions made to PEL, 2017b (from the original Air Quality Assessment – PEL, 2017a).

EPA response – this issue has been resolved

We note however that if further additional changes are made to PEL 2017b, the HHRA will likely also likely need revisions.

2. Soil, air and bioavailability input data into the exposure model requires further justification and clarification to ensure Project impacts have been robustly assessed.

Applicant response - Sections 3.4 and 3.9 of the revised HHRA justify the relevant inputs to the IEUBK model.

EPA response – this issue has been partially resolved (see EPA comments 3-6 below).

3. The soil and dust data used in the assessment appears conservative and not well justified

3.1. Measured site data

Applicant response – section 3.4 of the revised HHRA provides justification of the soil and lead dust concentrations.

EPA response – this issue has been partially resolved

In the revised HHRA, ToxConsult present lead soil data from two studies (Taylor et al., 2014 and Yang & Cattle, 2015). The Yang & Cattle (2015) data were selected for this assessment, as there was more clarity about the measured concentrations compared to Taylor et al., (2014). There are some limitations with using this data as it is not specific to individual districts/areas assessed but the EPA acknowledges it is probably the best use of the available data.

3.2. Estimated data from deposition modelling

Applicant response – Section 2.6 of the revised HHRA describes how metal concentrations in soil were derived from the modelled deposition information.

EPA response – this issue has been resolved

Section 2.6 of the revised HHRA outlines the calculations to convert the deposition data from PEL into soil concentrations. This was done for both the measured deposition (existing situation) and predicted deposition (from the proposal). The resulting values for all areas and/or receptors are shown in Tables 3.4.3 and 3.5.1 of the revised HHRA.

3.3. It is unclear how the predicted incremental lead concentration in soil was derived

Applicant response – Section 2.6 of the revised HHRA describes how metal concentrations in soil were derived from the modelled deposition data.

EPA response – this issue has been partially resolved

The revised HHRA, lists the measured and predicted lead deposition for all areas and/or receptors in Tables 3.4.3 and 3.5.1. The conversion of these data into soil concentrations is described in Section 2.6. The EPA notes that the source for the metal depositions is a spreadsheet provided to ToxConsult by PEL, which was not been presented as part of the HHRA. Considering this, the data could not be checked against the source (see further additional information request on the revised HHRA #2).

4. The outdoor air lead concentrations used in the HHRA are not clearly justified

Applicant response – Section 3.5 and Appendix D of the revised HHRA justifies the outdoor lead concentrations used in the HHRA.

EPA response – this issue has been partially resolved

The revised HHRA lists the modelled and measured outdoor air lead concentrations in Appendix D for all receptors assessed and for the three scenarios. The footnote to the table references the spreadsheet provided to ToxConsult by PEL. As this spreadsheet was not made available, these data could not be checked against the source (see further additional information request on the revised HHRA #2).

5. The HHRA does not adequately justify the bioaccessibility values used.

Applicant response – Section 3.6 of the revised HHRA presents a review of the available bioaccessibility data for Broken Hill ores and soils and, as differences in available bioaccessibility values could not be adequately resolved, the most conservative value has been adopted. This value coincides with the default value recommended by US EPA for predictive blood lead modelling using IEUBK.

EPA response – this issue has been resolved

The EPA notes that the revised HHRA presented lead bioaccessibility data from two studies undertaken in Broken Hill. The samples tested and the methods used were different in the two studies and there were large differences in the results. Considering this, the revised HHRA uses the average bioaccessibility value from the study with the highest result. This is the most conservative approach, which is suitable when dealing with the uncertainty in the data

6. The use of the maternal blood lead levels (BLL) value should be justified.

Applicant response – Section 3.8 of the revised HHRA provides additional information in relation to maternal blood lead levels in Broken Hill.

EPA response – this issue has been resolved

The EPA notes that the maternal BLL used in the HHRA was 1.2 µg/dL, which is the geometric mean concentration measured in umbilical cord blood from 2008 to 2014 in the Broken Hill area (data from NSW Health).

7. The National Health and Medical Research Council (NHMRC) recommended BLL investigation level of 5 µg/dL should be used.

Applicant response – the recommended criterion has been used in the revised HHRA.

EPA response – this issue has been resolved

EPA notes that only 5 µg/dL has been used as the criterion throughout the revised HHRA.

8. The HHRA should assess lead impacts against 95% of the population

Applicant response – the revised HHRA presents modelled BLLs for the percentage of the population that are predicted to be above 5 µg/dL, as well as comparing the estimated population distributions for children for the existing and proposed situation. In addition, when comparing a population distribution, this includes information for 95% of the population.

EPA response – this issue has been resolved

The EPA notes that the percentile distributions of predicted BLLs for children living in the districts/areas most impacted by the Proposal are presented in Figures 3.10.2, 3.10.3, 3.10.4 and 3.10.5 of the revised HHRA. For these distributions, it is predicted that considerably greater than 5% of a population will have a BLL greater than the NHMRC investigation level of 5 µg/dL.

9. Approximately 5% of children are at the recommended investigation level, therefore additional exposure should be prevented.

Applicant response – the applicant contends that it has committed to best practice dust and lead management practice and the consultant's report states that such measures have been incorporated into the assessment. Notwithstanding this, the applicant notes that blood lead levels of children in Broken Hill are higher than the NEPM guideline and that it is contributing to a range of programs to manage this issue. However, the revised HHRA identifies that the proposal would result in a negligible change in blood lead level concentrations in children in Broken Hill.

EPA response – this issue has not been resolved

The EPA notes that the revised proposal outlines some additional management practices to minimise emissions from the site, including enclosing the crusher under negative pressure. Despite this, unacceptable increases in exposure are predicted at some residential receptors located within the site of the North Mine (owned by Perilya) and some residential receptors located adjacent to the mine (district D5a). Although the applicant has stated that they will undertake blood lead monitoring of children living in the residences they own, this is not possible for the external residences at D5a. Considering this, Perilya needs to incorporate additional mitigation measures to ensure nearby receptors are not exposed to lead emissions from the mine (see further additional information request on the revised HHRA #1).

10. The origin of the geometric mean BLL data presented in Table 5-6 of the HHRA is unclear.

Applicant response – this comment is no longer relevant as the revised HHRA includes a new Human Health Risk Assessment.

EPA response – this issue has been resolved

11. Table 5-8 of the HHRA should present values greater than 5 µg/dL rather than values greater than 10 µg/dL.

Applicant response – the revised HHRA presents an assessment of blood lead levels greater than 5 µg/dL.

EPA response – this issue has been resolved

The EPA notes that the revised HHRA compares all blood lead data to a 5 µg/dL criterion.

12. The total suspended particulate (TSP) data used to estimate outdoor air lead concentrations is not justified as representative or conservative.

Applicant response – Section 7.1.1 of the revised AQA and Section 3.11 of the revised HHRA state that the TSP data used to support the HHRA is conservative.

EPA response – this issue has been partially resolved

The EPA notes that in the revised HHRA, PM₁₀-lead is used as the air concentrations rather than TSP-lead as used in the previous assessment. There are two monitors near the site that measure PM₁₀ and PM₁₀-lead, HVAS1 and HVAS2. Appendix D states that after subtracting the contribution from the North Mine, the 2016 annual average concentration of PM₁₀-lead for these two monitors was 0.0692 and 0.0798 µg/m³, respectively.

The data from the monitoring station closest to each of the assessed receptors was used as the background. This is a limitation of the assessment as it assumes that air quality for the whole Broken Hill area is explained by these two monitors, which are both located within close proximity to the Rasp Mine. However, considering the annual average lead concentrations are not that

different between these two locations, it suggests that there is not that much variability in the area. The EPA also notes that the HVAS data shown in Appendix D of the revised HHRA is sourced to PEL, which is the spreadsheet not presented, therefore these data could not be checked with the source (see further additional information request of the revised HHRA #2).

13. Dust and lead emissions must be prevented or minimised to the maximum extent achievable through the implementation of best practice.

Applicant response – Section 4 of PEL, 2017b states that the recommendations contained in the document *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* have been used to inform the management and mitigation measures used in the updated AQA and committed to by the Applicant.

EPA response – this issue has not been resolved

See the EPA response to comment #9 above.

14. Justification for the use of the selected chronic exposure criteria for lead is required.

Applicant response – the revised HHRA fully justifies the assumptions used in the HHRA

EPA response – this issue has been resolved

The EPA notes that detailed justification is provided in the revised HHRA for all assumptions and criteria. Any issues that were identified have been listed in the further additional information request on the revised HHRA below.

15. The HHRA lacks a detailed evaluation of uncertainties and the effect on the HHRA outcomes.

Applicant response – Section 3.11 and 4.6 of the revised HHRA provide an assessment of the uncertainties associated with the original Human Health Risk Assessment.

EPA response – this issue has been resolved

An uncertainty analysis for the lead assessment is provided in Section 3.11 and in Section 4.6 for the assessment of other metals. For most assumptions, the uncertainty analysis is qualitative, which means that the impact of varying assumptions on the outcome of the assessment is unknown. The EPA notes that for this proposal, the uncertainty in the modelled emissions data is likely to pose the greatest uncertainty in relation to the risk from the proposed mine.

Both PEL and ToxConsult state that conservative assumptions have been used, however if approved, the applicant should be required to revise the HHRA with measured data during operation of the mine. This is to ensure that the risk to human health is negligible based on measured data.

16. Proposal related emissions generated at Southern Operations and fugitive emissions from exposure areas should be included in the assessment.

Applicant response – PEL, 2017b takes into account wind erosion from exposed areas within the Mine Site as well as all other significant emission sources. The Applicant notes that emissions from the Southern Operations are included in the background monitoring and therefore there is no requirement to separately model those emissions.

EPA response – this issue has not been resolved

The EPA notes that the Proposal includes additional processing of the ore at the Southern Operations. Considering this, there may be increased emissions from the Southern Operations due to the operation of the North Mine. The current 'background' does not account for this, as it doesn't consider the potential increased emissions from the Southern Operations (see further additional information requests on the revised HHRA #4).

17. It is unclear if the monitoring data adequately characterises existing air quality.

Applicant response – Section 3 and Appendix C of PEL, 2017b provides a description of the monitoring network throughout Broken Hill that has been relied upon to characterise the existing air quality environment. In summary, long-term 16 deposited dust gauges, 2 TEOMs and 6 HVAS samplers have been used to determine the existing dust environment and differential background concentrations have been used for different receptors based on the proximity of each monitoring point. The Applicant notes that this level of background data is far in excess of that previously accepted as adequate for other air quality assessments.

EPA response – this issue has been resolved

The EPA notes that the monitoring network considered for PEL, 2017b, which provided data for the revised HHRA was more extensive than that used in the previous assessment. In addition, Table 3.4.3 of the revised HHRA outlines that for each of the receptors assessed, data from the monitoring location in the closest proximity was used. This information was provided to ToxConsult by PEL.

Further additional information request on the revised Human Health Risk Assessment

1. The revised HHRA concluded that there would potentially be increased exposure to lead for children living adjacent to North Mine in district D5a. This is unacceptable to the EPA particularly as the predicted geometric mean BLLs in this area under existing conditions (Scenario 1) is already above the NHMRC investigation level of 5 µg/dL. Perilya are unable to restrict people living in these properties or require that children undergo regular blood lead monitoring.

Based on these elevated BLLs Perilya must ensure that there are no predicted increase in lead emissions from the site. The applicant should consider additional dust mitigation measures to ensure that residence at D5a are not exposed to concentrations of lead above background.

The applicant must refine assumptions (with robust justification) or propose additional mitigation measures to ensure that there are no increases in exposure to lead at any locations.

2. The revised HHRA refers regularly to data from spreadsheets provided to ToxConsult by PEL. Much of this data is not presented in PEL, 2017b. As these spreadsheets were not provided as part of the proposal, it was not possible to crosscheck the data to ensure that it was accurate and conservative. The EPA has undertaken the review of the revised HHRA assuming that all data referenced to PEL & PEL, 2017b is accurate and correct. The EPA also notes that ToxConsult state that *'The information from PEL has been used at face value'* (p. 14 of the revised HHRA). Considering this, it would be useful to sight the data that was provided to ToxConsult by PEL.

The applicant must provide all data used in the HHRA, including the spreadsheets provided to ToxConsult by PEL.

3. Section 3.2 outlines in detail the reasons why plant uptake of lead was not considered a complete exposure pathway in the revised HHRA. These reasons include, limited uptake of lead into edible parts of plants and that there is a low likelihood of people growing vegetables and fruits at home in the Broken Hill area due to the low rainfall. Due to these reasons, ToxConsult outline that this pathway is accounted for in the blood lead modelling by including dietary background intakes of lead as no additional exposure is expected in Broken Hill compared to other locations.

The EPA notes that there is the possibility of ingestion of dust which may settle on the edible parts of plants. In addition, ToxConsult state that *'plants can absorb and accumulate some forms of lead through their leaves from atmospheric fallout'* (p. 27). Considering this and that lead exposure from this proposal is primarily by air, it is not well justified that this pathway is incomplete.

The applicant must include ingestion of homegrown vegetables and fruit in the HHRA or provide sufficient justification for the exclusion of this pathway.

4. Section 3.4 states that in addition to the existing soil lead concentrations *'lead depositing from sources other than the existing or proposed mine has been included in BPb (blood lead) modelling for Scenarios 1 and 3'*. It is unclear if the additional emissions from the Southern Operations due to an increase in activity directly from the Proposal have been considered in Scenario 3.

The EPA notes that it is proposed that crushed ore from the North Mine will be transported to the Southern Operations for further processing. Any potential increases in emissions from the Southern Operations should therefore be considered in Scenario 3.

The applicant must justify why unloading, stockpiling and milling activities of ore from the North Mine at the Southern Operations will not increase emissions from the Southern Operations existing mining and processing activities.

5. Table 3.10.2 summarises the modelled geometric mean blood lead concentrations for Scenario 1 (existing North Mine) and Scenario 3 (proposed North Mine). These data show that in some cases there is a predicted decrease in the geometric means of the blood lead concentration with the proposed North Mine in operation compared to the current situation (ie not in operation).

It is not clear how decreases in blood lead concentrations can occur, considering the TSP, PM₁₀ and PM_{2.5} annual average concentrations at sensitive receptors are almost always higher for the Proposal compared to the non-active mine (see Tables 20, 21 and 22, respectively in PEL, 2017b). In addition, Appendix C of the revised HHRA, Tables C.1.1 and C.1.2, show that for Scenario 2 (ie the proposed North Mine without background) there are positive values for lead deposition in TSP, estimated lead in soil and lead in indoor dust.

The applicant must clarify how the modelling predicts that there will be a decrease in the geometric mean of blood lead concentrations at some receptors, despite notable impacts on airborne and deposited lead being predicted for the Proposal.

6. Section 4.1 of the HHRA outlines that for the chronic assessment of the metals other than lead, exposure pathways of inhalation and ingestion were considered for threshold risks (non-cancer) and inhalation was considered for non-threshold risks (cancer). It is unclear from the revised HHRA why dermal contact was not also considered for threshold risks and ingestion and dermal were not considered for non-threshold risks.

The applicant must outline clearly and justify why all potential exposure pathways (inhalation, ingestion and dermal) were not considered in the assessment of the metals others than lead for threshold and non-threshold risks.

7. The EPA notes that in the description to equation 4.1, the bioaccessibility used in the assessment of the metals was 100%, except for arsenic. For arsenic, a bioaccessibility of 4% was used, which is referenced to Toxikos (2010) from testing undertaken in Broken Hill using the PBET (physiologically based extraction test) method.

No additional information is provided about this, for example, the number and type of samples that were tested. It is unclear if a bioaccessibility of 4% for arsenic is suitable and conservative. The EPA also notes that highly variable bioaccessibility values were reported in the revised HHRA for lead using different methods (reported in Section 3.6) and that the PBET method provided the lowest values. Considering this, it is unclear why in the case of arsenic, data from this one method was considered suitable.

The applicant must provide justification for use of 4% bioavailability for arsenic or consider a more suitable and conservative assumption for this parameter.