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Comments on Responses to Review of HHRA for Bowdens Silver Mine (SSD 5765)

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Prepared for:
NSW Department of Planning Industry and Environment

Prepared by:
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Background

Drew Toxicology Consulting (DTC) was engaged by NSW Department of Planning Industry and Environment (DPIE) to undertake a comprehensive review of the human health risk assessment (HHRA) completed for the proposed Bowdens Silver Mine environmental impact assessment (EIS). The review is entitled "*Review of HHRA for Bowdens Silver Mine (SSD 5765)"* , it has document number DTC270720-RF and is dated11th September 2020. Although the HHRA also dealt with water-borne risks and noise associated health impacts the review was confined to the assessment of dust-borne health risks.

The scope of the review included:

a) Whether the assumptions used are reasonable, appropriate and suitably justified.
b) Adequacy of the HHRA methodology, analysis and assessment.
c) Identification of any areas of deficiency and recommendations to improve or resolve these issues.
d) Any recommendations (if required) for additional information to inform the assessment of the project.

In response to the review, the authors of the HHRA have produced a revised HHRA which is included in the EIS as "*Appendix 7 Human Health Risk Assessment – Updated prepared by Environmental Risk Sciences Pty Ltd"*. In addition detailed responses to the review of the original HHRA have been provided by Environmental Risk Sciences (enRisk). These responses are in a document identified as "*Proposal: Response to Drew Toxicology Consulting's Peer Review of the Bowdens Silver Project Human Health Risk Assessment"* dated 12 April 2021.

Herein are comments on the revised HHRA and the individual responses provided by enRisk. To facilitate reading of these latest comments also provided to DPIE is a pdf document of the supplied enRisk responses with comments to each item embedded as a 'sticky note'.

Overview

Since the HHRA will likely be read without continuous consultation of other technical appendices to the EIS, the original HHRA was reviewed as if it were a 'stand-alone' document, i.e. as a community member may read the HHRA. Consequently many of the review comments were in relation to improving transparency and appreciation of the assessment. While the revised HHRA has addressed a good number of these, the authors have declined to include requested precises of some of the technical information in other reports, arguing the material, with detail, is in those reports and there is no need for it to be repeated. In this reviewer's opinion this is unfortunate as it detracts from readily understanding the HHRA and appreciation of the results. Notwithstanding this

opinion it is acknowledged the technical workings of the HHRA are not compromised by the omissions.

In some of their responses to specific review comments the authors indicate they have held discussions with NSW Health, this reviewer is not aware of the exact nature of the discussions and their outcome is not provided. Consequently comments on those particular responses from the authors cannot be provided.

Health risks posed by potential exposures to lead in particulate emissions from the proposed mine is a major focus of the HHRA. There were a large number of comments made in relation to the lead assessment. These have been adequately addressed in the revised HHRA. However the method for characterising the risk is, as far as this reviewer is aware, novel for HHRA's conducted in Australia. While additional information has been provided regarding the rationale and workings of the lead risk assessment there are aspects of the derivation of the lead inhalation and ingestion toxicity reference values that, in this reviewer's opinion, require regulatory imprimatur. Specific aspects are provided in the detailed comments below. Notwithstanding, this reviewer acknowledges heath risk from lead exposure from mine emissions is very low.

Overall, the HHRA follows the standard process for conducting such assessments in Australia. The HHRA concentrates on incremental health risks that the mine proposal may present. The revised HHRA adequately documents the methodology and important assumptions are supported. The calculations indicate health risks due to the proposed mine are very low. I agree with these conclusions.

Specific comments on responses to the HHRA review

Item 1.
The reviewer commented on data transparency in the HHRA. The enRisk response argues the information relied upon is in other technical reports and does not need to be reproduced in the HHRA.

Standard style requirements do not inhibit, limit or forbid producing a report that does not require numerous forays into other documents. While Section 1.7 lists the titles of four documents relied upon, throughout the HHRA the details of where to find the data in those reports is not provided. The reader has to integrate various technical reports to find it - indeed difficult for some members of the community.

Furthermore, it is noted a swag of information listed in Table 4.2 is cited as derived from four reports written by JBS, the data in that table is not matched to a particular report. In addition the JBS reports listed in the HHRA bibliography (under project related references) do not indicate where these reports are archived, it is therefore not possible for the reader to easily access the raw data.

Contrary to the response made by the HHRA author, contour maps are readily interpreted by the public and in this reviewers experience are often included in HHRA's to enable extrapolation of risks calculated at point locations (called receptors) to other areas of the modelling domain that may be of interest to the community.

While it may be argued the above concerns may be a matter of 'style', HHRA transparency and ability of the community to interpret the HHRA suffers. This reviewer concedes his remarks do not impinge of the technical workings of the HHRA.

Item2:
It remains the opinion of this reviewer that exclusion of 'project related' residences from the HHRA is a deficiency of the assessment. The 'usual limitations' related to occupancy of project related dwellings cited in the authors' response are not in the HHRA, and in the reviewers opinion the assumed vacancy of 'project related' residences over the life of the project cannot be relied upon. At the very least there should be some discussion of this point in the HHRA. However inclusion of 'project related' residences in the HHRA and guarantees of non-occupancy are matters for the Agency to address.

Item 3:
The authors have provided additional information in Annexure A on the calculation of risk of death from $PM_{2.5}$. With respect to exposure response relationships for other health endpoints the HHRA author indicates discussions with NSW health have been undertaken. This reviewer has not been party to those discussions and their outcome is not included in the revised HHRA.

Item 4:
See reviewer's comments to Item 2.

Item 5:
The comment from the HHRA reviewer was regarding number and location of media samples with existing exceedances of guidelines. The response from the HHRA authors does not address this. However in the revised HHRA additional footnotes to Table 4.4 indicate exceedances of drinking water quality criteria is not wide spread and water analysis was prior to cleaning tanks. It is not

indicated whether tanks with exceedances are the ones subsequently cleaned, an impression is created that all tanks were cleaned.

While the new footnotes are welcome they indicate:

- There were just two 2 exceedances for lead; however the data in the table shows at least one exceedance for each of three different types of tank.
- Text indicates there were 84 tanks sampled but the new footnotes cite the data is for 42 tanks.

It also has been noticed the average tank water concentration for lead in Table 4.4 is 5.9 µg/L but it appears 4.9 µg/L has been used in calculations for existing lead exposure via ingestion of water (p7-276 of revised HHRA).

Item 6:
See comment to Item 24.

Item 7:
See comment to Item 8.

Item 8:
Additional information has been included in Annexure B5 which clarifies the issue.

Item 9:
See comment to Item 24.

Item 10:
Additional information to Annexure E (Table E3) clarifies that dust deposition to roofs is TSP and not PM10.

Item 11:
See comments to responses Items 47 - 52.

Item 12:
OK

Item 13:

The reviewer suggested health effects to particulates greater than $PM_{2.5}$ should be considered in the HHRA. The authors call up their response to Item 3 above. See comment on this.

Item 14:

The reviewer's suggestion has been addressed in the authors' response.

Item 15:

This reviewer agrees ingestion of soil and dust has been included in the HHRA and that inhalation of particles from soil or dust does not need to be dealt with separately. However the reviewer's comment was meant to elicit a response in relation to ingestion of particulates from the mine after they had been inhaled. On reflection the reviewer's comment was poorly worded and it is not surprising the HHRA authors responded in the manner they have.

Item 16:

See comment to Item 3.

Item 17:

See comment to Item 2.

Item 18:

The reviewer's comment has multiple parts. The HHRA revision indicates an annual average but there is no indication the cited value is the maximum modelled for any scenario. It is acknowledged the comments relate to HHRA clarity and its appreciation, and do not impinge on the HHRA workings.

Item 19:

The reviewer appreciates the AQA has dealt with cumulative exposures by comparison with air quality guidelines/objectives. However this is not the same as risk of death which is what the HHRA appropriately calculates for incremental particulate exposures. The reviewer is asking that the health risks also be considered/calculated for the cumulative particulate exposure. See also comments at Item 3.

Item 20:

This is satisfactorily addressed in the revised HHRA.

Item 21:
The author's response and inclusions in the revised HHRA satisfactorily address the reviewer's comment.

Item 22:
See comment at Item 1.

Item 23:
While Annexure D (the laboratory report on bioaccessibility) provides information on the methodology, it does not address the potential conservatism embedded when using the gastric phase for bioaccessibility of lead in soil. The reviewer was hoping to prompt the author's in providing an additional line of evidence for conservatism in the HHRA. Its absence does not impinge on the workings of the HHRA.

Item 24:
The reviewer appreciates the detailed response and also notes additions to Annexure B provide useful additional information regarding the adopted guidelines used in the HHRA.

Additions to the HHRA indicate the target blood lead levels adopted are based on the central tendency of the benchmark dose modelling for 1% response (i.e. BMD01) rather than the lower confidence limit (BMDL01) which is more usual.

With respect to the choice of target blood lead levels for child and adult offered by DEFRA, this has been made by the authors of the HHRA apparently because a lower value was considered to be overly conservative (no reasoning why over conservative). Given it is now recognised there is no safe level of lead exposure and the Australian policy is to limit as far as possible any exposure over and above background (which is primarily dietary) a cogent argument can be made for adopting the lowest of the options offered by DEFRA rather than the mid value for the target blood lead level chosen by the authors. It is noted a lower target will not alter the conclusions of the HHRA.

This reviewer agrees that different scientists may have different opinions, which is why it was suggested Agency advice be sought. The HHRA authors have held discussions with NSW Health re particulate exposure response but there is no indication similar discussions have occurred on what is an appropriate blood lead target against which IUBEK modelling for the corresponding lead intake can be done. It would be best for such discussions to be documented in the HHRA.

At debate is not whether the proposed mine places the community at unacceptable health risk from lead emissions in dust, but rather the methodology for arriving at the conclusion of low risk. This reviewer is also cognisant that when the HHRA for Bowdens Mine is approved by the Regulator it may set precedence for other consultants less knowledgeable than the HHRA authors.

Text at p7-144 (last paragraph original HHRA, p7-134 revised HHRA) implies a blood lead criteria of 10 µg/dL was used for benchmarking the HHRA, in fact as discussed in the enRisk response at Item 24 and clarified in the revised HHRA a target blood lead level of 3.5 µg/L was applied for calculation of toxicity reference values that were concentrations in water and air that could yield this blood level. So as not to confuse the community it is suggested text at p7-134 be revised to be consistent with calculations.

Item 25:
The reviewer suggested blood lead modelling for the calculated exposures could be done. The HHRA authors do not present reasons for not undertaking modelling to estimate the resultant blood lead concentration(s) from the estimated lead intake calculated in the HHRA.

Item 26:
See comment at Item 24.

Item 27:
The change is acknowledged.

The resulting risk indices (Table 5.5) are somewhat different than in the original HHRA. The RI for lead has decreased approximately 4 fold, while the calculated RI for all metals has increased approximately 5 - 10 fold. Furthermore the contribution of lead to the total risk decreased from 40 - 60% in the original HHRA to just 2% in the revised version where manganese now accounts for more than 90%. The new RI's are all less than unity indicating low risk so the HHRA conclusions are unchanged.

Item 28:
The clarification is acknowledged.

Item 29:
The reviewer's comment was intended just for lead (poorly worded). It is agreed the addition of specific inhalation and ingestion TRVs is common. The comment was prompted by uncertainty in

the first HHRA whether the oral and inhalation TRVs for lead were based on different target blood lead levels. Additions made to Annexure B have clarified this.

Item 30:
OK.

Item 31:
Additional footnotes made to Table 4.4 address the reviewer's comment.

Item 32:
The clarification and amendments are acknowledged.

Item 33:
The changes are acknowledged.

Item 34:
The changes are acknowledged. See also comment to response at Item 27.

Item 35:
The changes are acknowledged.

Item 36:
OK.

Item 37:
It is noted the acute inhalation assessment has been discussed and accepted by NSW Health. This does not negate the possibility of sensory effects being potentially experienced by persons, e.g. farm hands exposed to peaks within the 1 hour modelled average concentration. It is however acknowledged the assessment has been done using the maximum average and therefore there is low likelihood a person would experience sensory effects since there is a requirement that such a person would need to be at the spot and time the rare peak concentration would occur.

Item 38:
Yes, the terminology is that articulated in the US reference, however this reviewer still struggles understanding the phrase "asymptomatic, non-sensory effects".

Item 39:

Agreed the information does not alter the numerical value. While public information describing how an overseas guideline may be established is not always available, for TCEQ and PAC guidelines there is usually documentation. The value for including at least the health endpoint is to provide indication whether additivity of HI's is biologically/toxicologically feasible. It is acknowledged the information does not impact the HHRA workings.

Item 40:

It appears this information has not been inserted to Table 5.1 footnotes. The explanation in the authors' response argues for a description for how TCEQ sets acute TRVs for metals to be included in the HHRA (see Item 39), and why $PM_{2.5}$ is more appropriate than PM_{10} recommended by TCEQ.

Item 41:

It is noted the approach has been discussed with and accepted by NSW Health. The author's response does not address the mismatch between their definition of acute and what the HHRA assesses, nor the absence of assessing intermediate exposures.

Item 42:

OK.

Item 43:

Clarification is acknowledged.

Item 44:

OK the information is deduced from equation parameter values in Table E3 rather than from text.

Item 45:

The changes are acknowledged. See also comment to response at Item 27.

Item 46:

The authors are expecting a lot from a community reader, indeed any reader, that they remember every detail of what was previously read. It is still recommended that BAc be incorporated into equations where bioavailability is part of the equation. Nevertheless it is acknowledged this does not affect the workings of the HHRA.

Item 47:
As previously indicated it is unfortunate that the authors have decided not to include a brief sentence on the determination. See also comment to Item 1.

Item 48:
Inclusion is acknowledged.

Item 49:
Inclusion is acknowledged.

Item 50:
Inclusion and clarification is acknowledged.

Item 51:
Inclusion and discussion in the HHRA is acknowledged.

Item 52:
The additional information is welcomed and it is acknowledged the conclusion of the HHRA has not changed.

Item 53:
The additional information on HCN is appreciated. The HHRA conclusions are not changed.

Item 54:
OK.

Item 55:
See comment at Item 5.
Not sure why the data is "essentially in line with the NHMRC guidance".
It is agreed the predicted contribution of lead to tank water is very small.

Item 56:
The new text in Section 5.5 (Uncertainties) provides the requested clarification.

Item 57:
The new text provides clarification.

It is also noted Table 4.2 contains revised guidelines that were either not in the previous HHRA (ceiling spaces) or are lower (window sills, floors).

The adopted guideline for ceiling dust has been derived by the authors by lowering the USEPA (2020) guideline for window sills by 10x. The assumption that children will be exposed to dust in the ceiling space is very unlikely, unless ceiling dust falls through ceiling cracks (e.g. at wall joints).

Item 58:
While it is appreciated that lead in existing soil was <50 mg/kg, the absence of the actual data (or descriptive statistics) in the HHRA means the choice of the numerical value of 50 is a mystery. A number of 60 or 100 mg/kg would equally fit the reasoning provided.

Item 59:
OK. However it is strange that dust wipe samples from within 20 buildings could be obtained but not soil samples. Although the Macquarie University data is not formally published it is contained in the LAG submission and therefore is (will be) publicly available. It is recommended this be included in Table 4.2 and discussed in the text of this section.

Item 60:
It is suggested text such as this be included in the HHRA. See also comment to authors' response at Item 1.

Item 61:
OK. See also comment at Item 1.

Item 62:
It is appreciated that the objective was not to identify lead paint and that it would likely be a 'hot spot' issue in the town. It is this reviewer’s opinion the 'lead paint' problem could/should be raised in the uncertainty section flagging the overall lead risks for individual residences may be different than for the community at large. But also reiterate mine contribution is low.

Item 63:
See comments to Item 1.

Item 64:
See comment at Item 21. It is not within the remit of this reviewer to critic the intricacies of the AQA. The comment was made from perception created by wording in the HHRA supporting conservatism.

Item 65:

Additional information provided in the revised HHRA, and the Macquarie University address the reviewer's comment.

Item 66:

Noted.

Item 67:

See comment to Item 2.

Item 68:

The changes are acknowledged.

Item 69:

Acknowledged, but Annexure B has not been further checked in this regard by this reviewer.

Item 70:

Acknowledged.

Item 71:

The change is acknowledged.

Item 72:

Agreed. It seems the particular comment from the reviewer was ill founded.

Item 73:

The changes address the reviewers comment. It is noted Figure B1 is not mentioned in the text and it is recommended a source attribution be provided for the figure.

Item 74:

Acknowledged and agreed.

Item 75:

The change is acknowledged and that it does not change the assessment outcome.

Item 76:

The additional clarification is acknowledged.

Item 77:
Acknowledged.

Item 78:
The updated information addresses the comment.

Item 79:
The number of dust samples taken within Leu is now included. However this reviewer sees no reason for not including descriptive statistics for the lead information. The authors' reason for not doing so means the information in Table 4.2 is incomplete, regardless of whether it is critical for the HHRA. See also comment to Item 1.

Item 80:
See response to Item 79.

Item 81:
The only mention of diesel emissions in the HHRA is at dot point 2 on p7-64 (original HHRA) or p7-67 (revised). The AQA was not interrogated by the reviewer (see comment to Item 1). Additional mention of the inclusion of diesel particulates elsewhere in the HHRA would reinforce the fact the particulate assessment was not just about airborne crustal dust. It is acknowledged this does not affect the working of the HHRA.

Item 82:
OK.

Item 83:
OK.

Item 84:
Yes agreed, but for the sake of community communication inclusion of this response in the HHRA would be beneficial.

Item 85:
OK.

About the author:

Dr Roger Drew is the principal consultant of Drew Toxicology Consulting. He has primary degrees in biochemistry and pharmacology and postgraduate degrees in toxicology. Postdoctoral training was undertaken at the National Institutes of Health, National Cancer Institute in the USA. He has more than 40 years of toxicological and risk assessment experience in academia, industry and consulting. For 12 years he taught medical students at Flinders Medical Centre while undertaking research on the toxicology of chemicals and medicines. He then joined ICI Australia for 10 years as corporate toxicologist managing the Toxicology Unit and responsible for providing advice to the executive team, strategic business units and customers. For the last 20 years he has been an independent consultant servicing a range of industries and Government authorities. He has significantly participated in developing health based risk assessment practice in Australia. Dr Drew is one of just a few toxicologists in Australia certified by the American Board of Toxicology.

While employed in the above roles Dr Drew was also Adjunct Professor in Biochemical Toxicology at RMIT University and is currently Adjunct Associate Professor in the Department of Epidemiology and Preventive Medicine, Monash University. He teaches various aspects of toxicology and risk assessment to undergraduate and postgraduate students at local Universities. He is a member of professional toxicology societies and is a recognised national and international expert in toxicology and risk assessment. He has served on the editorial board of the international scientific journal “Regulatory Toxicology and Pharmacology".