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RISK ASSESSMENT STUDY

**Mine Tailings Site at
Mount Egerton, Victoria**

for
**Environment Protection Authority
Department of Health & Community Services
Department of Agriculture, Energy & Minerals
Department of Conservation and Natural Resources**

ADDENDUM

The report was reviewed by

- Department of Human Services,
- Department of Natural Resources and Environment and
- Environment Protection Authority.

The report recommends a number of options be considered to minimise the risk to young children and animals of contacting mine tailings. These options are based on a number of assumptions. These assumptions are based on limited scientific evidence of the relationship between arsenic, animals and humans.

The report concludes that levels above the accepted daily intake are possible for young children if they are exposed to some areas of tailings.

The report also makes the same conclusion for animals if they eat grass and soil containing high levels of arsenic. However, it is the assessment of the reviewers, that the report's assumptions for stock are sufficiently conservative, to allow these conclusions to be considered to represent the worst case.

The following significant limitations of the report have been recognised by the reviewers and must be taken into account when considering the report's findings.

1. There is limited accurate information stating the bioavailability of arsenic to animals but the Department of Natural Resources and Environment expert advice indicates that the bioavailability factor is unlikely to be as high as indicated in the report.
2. An understanding of speciation of arsenic at this site would enable a better assessment of any risks.
3. The report assumes total access to the tailings over 100 % of the grazing land. This is not the case in the majority of land holdings because much of the material is covered by or mixed with top soil. In addition, it should be noted that the original samples were taken preferentially from material identified as tailings and therefore may represent the most contaminated material to be found on the site, rather than the average across the affected area.
4. Chronic arsenic toxicity (due to long term exposure below acute toxicity levels) has not been well documented in animals. The observed animal health effects may be related to deficiencies in trace elements, related to arsenic consumption, rather than by arsenic poisoning. For example selenium excretion is promoted by absorbed arsenic and may lead to deficiencies in selenium and vitamin E. These deficiencies can be reversed by injectable selenium and vitamins.
5. In some animal cases the report's conclusions are affected significantly by the conservative nature of assumptions. As the report states, if for example, the estimate for

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**RISK ASSESSMENT STUDY
MINE TAILINGS SITE AT
MOUNT EGERTON, VICTORIA**

for

*Environment Protection Authority
Department of Health & Community Services
Department of Agriculture, Energy & Minerals
Department of Conservation and Natural Resources*

EXECUTIVE SUMMARY

A risk assessment has been undertaken at Mount Egerton, Victoria on behalf of four Victorian Government agencies including the Environment Protection Authority (EPA); Department of Health and Community Services (H&CS); Department of Agriculture, Energy and Minerals (DAEM); and Department of Conservation and Natural Resources (DCNR). The study site covers part of the course of the Paddock Creek from the township of Mount Egerton northwards in an area approximately 20km south east of Ballarat. The study addressed human health and animal health risks in relation to the presence of concentrations of arsenic and mercury associated with former mine tailings located on land downstream of the Mount Egerton mining lease and proposes management measures to minimise or eliminate unacceptable risks where identified by the study.

The study is based study on information provided by Victorian Government agencies, including the results of analyses on soil and water contaminant concentrations, concentrations of arsenic and mercury in fish and animal samples; on information available from the literature and from the public record; together with site inspections, interview of affected residents and review of aerial photographs of the subject area conducted by Dames & Moore. No further sampling or analysis was conducted for this study.

Review of the airphotos and the site inspections confirmed that mine tailings material is present over large parts of the residential lots downstream of the mining lease. Review of local history indicated that there is potential for a number of contaminants to be present as a result of historic mining activities principally arsenic, from naturally occurring arseno-pyrites, and mercury from the gold extraction process.

Human Health Risk Assessment

The human health risk assessment methodology applied generally follows the Australia and New Zealand Environment and Conservation Council (ANZECC) and Australian National Health and Medical Research council (NHMRC) approach. Chemical concentrations have been assessed from sampling results where available from a variety of sources. The EPA samples are judged to be most representative of the range of conditions in the residential area and the arithmetic mean concentration of arsenic and mercury in tailings material used for the risk assessment were 495mg/kg of arsenic and 4.3mg/kg of mercury.

In assessing the contribution of drinking water and consumption of local fish or yabbies, the concentrations utilised in the risk assessment for water were 0.002mg/L of arsenic and 0.0005mg/L of mercury, and for the fish and yabbies were 0.3mg/kg of arsenic (inorganic) and 0.5mg/kg of mercury.

It is concluded that the average arsenic and mercury contamination in tailings material is unlikely to present health risks to adults or children and that arsenic hot spots (if any) with concentrations exceeding 650mg/kg could present health risks to children.

The assessment is subject to a degree of uncertainty with respect to the variability in arsenic concentrations in the tailings; bioavailability factors; and the limited information available on arsenic concentrations in fish and yabbies

Animal Health Risk Assessment

The animal health risk assessment generally follows a similar methodology to the human health risk assessment and is based on a range of international references with emphasis on the USA and Australasia. The chemical concentrations in soil adopted for animal health risk assessment are the same as those used for the human health risk assessment. However, due to the relatively small data base and the higher probability of farm animals drinking from the dams on the properties, peak concentrations were used to represent potential water sources for farm animals of 0.58mg/L of arsenic and 0.0012mg/L of mercury.

Ingestion of arsenic and mercury in the normal diet of grass and other natural or cultivated vegetation due to uptake of heavy metals from the soil, in the vegetation is taken into account, but possible other exposure pathways, including inhalation of contaminated dust, and absorption of arsenic and mercury through the skin are considered likely to be of minor influence in comparison to the other pathways and have not been quantified.

The results show that there exist health risks to horses, cattle and sheep in respect of arsenic, for which estimated intakes typically exceed tolerable values by between 40 and 50%. For the parameters selected for this assessment, no significant health risks to animals are indicated for mercury. The threshold concentrations of arsenic and mercury in soil acceptable for horses are estimated to be 317mg/kg of Arsenic and 8.4mg/kg of mercury.

It is concluded that this assessment indicates that arsenic contamination in tailings affected soil is likely to affect the health of farm animals due to a combination of soil ingestion and the uptake of arsenic in local vegetation.

As for the human health risk assessment, assessment of the animal health risks is subject to a high degree of uncertainty with respect to several key parameters which are not reliably defined. These include: soil ingestion rates; bioavailability factors; plant uptake factors; and toxicity parameters.

Management Measures

In assessing appropriate management measures for the site, it must be appreciated that there are still a large number of assumptions that have been incorporated into the risk assessments and these could change if more information is obtained or made available. Possible management options relate to measures that secure reduction or removal of the potential for exposure by interrupting the exposure pathway. This may include any of the following objectives:

- *Remove the sources of contamination (contaminated tailings, water etc).*
- *Prevent access to the contaminated soils/water.*
- *Remove affected people/animals from the area.*

Review of the cost effectiveness of management options has indicated that a number of measures could be considered. It would appear that community consultation should be high on the list of priorities for together with further studies of the extent of the contamination in the affected media, including in the shallow soils, the vegetation accessible to the grazing animals, the surface waters in dams and Paddock Creek, and in the local biota.

Simple and cheap measures to improve physical protection of residents such as fencing and warning signs need to be considered as a high priority. The more expensive options to either improve the properties by covering or removal of affected soils, filling in of the dams, or the interception or improvement of the quality of the surface run-off or underground leachate can also be considered.

Removal of the residents would appear to be relatively low on the list of priorities unless if it was selective. A 'do nothing' option is not seen to be feasible, both from effectiveness and from a community acceptance point of view.