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SUMMARY REPORT

A RAPID ASSESSMENT OF ANTIMONY LEVELS AT COSTERFIELD VICTORIA

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Golder Associates Pty Ltd declares that they have no conflicts of interest in relation to this work.

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REPORT

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Summary Report

Summary of Findings

This rapid assessment is based on data collected in a two week period. Samples were collected from shallow soils and tank water and ambient air monitoring was undertaken from one measuring station. This included analysis of 149 samples (58 tank water, 91 surface soils (including 15 road samples) for antimony and other metals. It also included ambient air monitoring program (PM₁₀, metals, PM_{2.5}).

The key findings of environmental monitoring:

- Regional soil antimony levels are naturally elevated. This is the reason antimony is mined in Costerfield. At present this rapid assessment does not attribute antimony concentrations in urine, soil, water or any other media to any source natural, historical or current.
- Antimony was the key metal measured above guideline levels. At 33 of 34 residential properties antimony concentrations in tank water were greater than the Australian Drinking Water Guideline. For soil, 13 of 34 residential properties reporting an exceedance of the provisional antimony investigation level.
- *Preliminary air monitoring results* - indicate low particulate levels (PM₁₀ and PM_{2.5}).

What do these findings mean for Health?

- Using conservative assumptions the rapid assessment finds that for both adults and children **adverse health effects are unlikely.**
- **Further investigations and a comprehensive risk assessment are warranted** to inform ways to reduce antimony exposures to residents.

Context

The Costerfield Community has expressed to the State Government concerns regarding antimony exposure. Golder Associates was engaged as an independent expert by a Reference Group of State Government Agencies to conduct an environmental monitoring program and a human health risk assessment.

Health risk assessment requires data on environmental levels and potential sources of exposure as well as robust toxicological data. The collection of data and information to support a comprehensive risk assessment is underway.

Recognising the need for a rapid assessment addressing imminent health concerns, a rapid monitoring program was conducted. The rapid monitoring program focussed on important sources for human exposure; drinking water obtained from tanks, surface soils and ambient air particulates. Within a two week period, 149 samples (58 tank water, 91 soil) were collected from 34 residences most of which were within 1.5 kilometres of the Mandalay Resources ore processing operations in Costerfield. Properties between 1.5 kilometres and 3 kilometres of the ore processing and one property located in Heathcote (approximately eight kilometres away) were also tested. The soil samples include 15 surface soil samples collected from road sides in Costerfield. Air monitoring was conducted at a single neighbourhood location, with three PM₁₀/metals and three PM_{2.5} results reported to date. The monitoring continues with further results available in coming weeks.

The water and surface soil monitoring program analysed samples for antimony and another seven metals. Ambient air sampling was conducted for PM₁₀, with filter samples analysed for 12 metals, including antimony. The program also involves PM_{2.5}, deposited dust, analysed for insoluble solids and metals, and continuous PM₁₀ measured using an indicative instrument. The monitoring program was conducted in a manner consistent with relevant Australian Sampling and Analysis guidelines and National Association of Testing Authorities (NATA) requirements.

The rapid monitoring program identified antimony as the key metal measured above guideline levels.



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Antimony in tank water exceeded the Australian Drinking Water Guideline at all of the tested residences within Costerfield (33 properties). The property outside of Costerfield did not exceed the antimony Drinking Water Guideline. Of the 91 soil samples (surface soils, sub-surface soils and roadside), 22 exceeded a provisional health based soil investigation level for antimony for a residential setting, and 17 of the 66 samples collected from shallow surface soils of residential properties exceeding the provisional antimony investigation level.

The air monitoring program is ongoing, with particulate (PM₁₀ and PM_{2.5}) levels reported to date relatively low. Measurable concentrations of antimony were detected in the reported PM₁₀ samples, and these were below health based guideline levels.

The rapid risk assessment sought to address two fundamental questions.

Question 1: Is there concern for adverse health effects due to antimony exposure in Costerfield?

This question was judged by calculating a margin (called the margin of exposure) between the amount of antimony known to cause adverse health effects and an estimate of amount of antimony potentially taken up by a person (adult or child) from tank water, soil and air. Concern was judged as a margin of less than 100 fold.

- The margin of exposure for adults ranged between 1650 to 300,000 fold.
- The margin of exposure for children ranged between 196 to >100,000 fold.

Answer 1: Health effects are not expected.

The margin between the levels known to cause toxicity and antimony exposure in Costerfield are sufficient to conclude that adverse health effects are not expected.

Question 2: Is there a need to further investigate and assess the significance of elevated concentrations of antimony in Costerfield?

This question was objectively assessed by comparing an estimate of intake of antimony per kilogram of body weight from tank water, soil and air and comparing the estimated intake to a regulatory value known as the 'tolerable daily intake' (TDI – also expressed as an intake per

kilogram of body weight). The TDI has large, in-built safety factors and is intended as a safe level of exposure over a lifetime for the general population from all sources of exposure. In a rapid assessment if the estimated intake is greater than the TDI it is judged that further investigation is needed.

Answer 2: Further investigations are needed to assess the significance of elevated concentrations of antimony in Costerfield.

- The estimated intakes for adults are all below the TDI.
- At up to 9 residences if young children (1 year old) are present the estimated intake **exceeds the TDI.**

What do the results of this Rapid Assessment mean for urine levels?

Antimony levels in urine are a measure of the levels of antimony in the body. If antimony levels in the environment are elevated then the amount of antimony taken into the body will be elevated and the levels in urine will also be elevated.

Elevated concentrations in urine are a marker of exposure and not human health impact. Urine levels can be elevated and still not result in human health effects.

Conservative Aspects of this Rapid Assessment

The Costerfield area has a geology containing naturally high antimony. That is why antimony mining occurs in Costerfield. Mining activities over 150 years will have added to the antimony in the soil. The rapid assessment does not consider the origin of the elevated concentrations of antimony in soil. The antimony could be of natural origin, historical mining related or due to current mining operations.

The rapid assessment assumes:

- Children eat 100 milligrams of soil each day while they play at the residence. Children play in the area where the maximum soil concentration was measured. In addition there is no averaging period assigned to this exposure. For instance a child may only play outside on a proportion of the number of days per year and live at the residence for certain number of years. The exposure



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frequency and duration have not been considered.

- People (both adults and children) drink tank water as their sole source of drinking water. Once again no averaging period is assigned to the exposure. This is conservative because the intake has been compared to the tolerable daily intake (TDI). The TDI is a lifetime average daily dose. That is a safe concentration for the general population who may be exposed 24 hours a day, 365 days per year for a lifetime.

Data Gaps

- The levels and sources of antimony in the local airshed are not well understood.
- Antimony in ambient air (and therefore tank water) may be elevated due to elevated levels in soil (a major contributor to the elevated intakes in Costerfield). Further investigation is needed to characterise ambient soil background concentrations not affected by mining occurrence and with depth.
- There is a need to consider all sources of exposure including diet.
- The rapid assessment does not consider impacts on stock, pets or wildlife.
- Some of the toxicological aspects of antimony need further assessment. For instance:
 - The current assessment assumes 70% of the antimony in soil is available for uptake by the human body. This could be considerably different in practice (likely to be a lower value).
 - The latest revision of the Australian Drinking Water Guideline for Antimony (3 micrograms per litre) was in 1996. In 2003 the World Health Organisation, based on a review of more recent toxicology studies set a drinking water guideline value at 20 micrograms per litre. A review of the drinking water guideline could inform this assessment.

Strategies to Reduce Exposure

Most residences within Costerfield are likely to have low intakes to antimony. There are a number of residences that if children were present every day there would be a need to reduce exposure levels. Measures to reduce exposure include:

- drinking water that complies with the drinking water standard,
- reducing indoor dust, and
- reducing soil exposures (e.g. replace soil in play areas and garden beds).

A Golder technical report has been issued together with this summary report Golder Report 147613051-001-R-Rev3.



Report Signature Page

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