



**MOUNT ISA  
MINES**

## **COMMUNITY BRIEFING PAPER**

**28 November 2007**

### **Whole of Emissions Study Phase 1 – Emissions to Land Study of Lead in the Leichhardt River and Surrounding Locations**

#### **Background**

The Whole of Emissions Study was initiated by Xstrata Mount Isa Mines in late 2006 to assess and determine whether there were any potential significant risks to human and ecological health in the Mount Isa community from current or previous mining operations in the city.

The study is designed around three material phases to investigate and assess:

1. Emissions to Land,
2. Emissions to Air, and
3. Emissions to Water.

The Centre for Mined Land Rehabilitation (CMLR), which is part of the University of Queensland's highly regarded Sustainable Minerals Institute, was contacted in late 2006 to develop the scope for the project. Xstrata Mount Isa Mines commissioned the CMLR to commence the Whole of Emissions Study in 2007.

World renowned toxicologist, Associate Professor Barry Noller, was appointed by the CMLR to undertake the study in April 2007. His team is currently completing the initial study into Phase 1 – Emissions to Land.

The following overview summarises the results to date of Phase 1 of the Whole of Emissions Study. This plain English summary is endorsed by the CMLR, however, it does not contain all the comprehensive scientific details.

#### **Overview**

An initial study of Phase 1 - Emissions to Land in the Mount Isa and Leichhardt River area was undertaken by CMLR between April and August 2007. The purpose of Phase 1 was to assess the performance and effectiveness of remedial works completed by MIM Holdings in cooperation with the Mount Isa City Council and the Queensland Government CHEM Unit, between 1991 and 1994, on historical contamination in the river. This occurred from mining activities and practices during the 1940s and 1950s.

The additional purpose of Phase 1 of the study was to investigate and assess geographical areas in Mount Isa and the Leichhardt River which have been the subject of various academic research and papers, and recent media attention. This will assist Xstrata Mount Isa Mines and

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key regulatory stakeholders to determine whether there are any areas that may cause concern about potential community health impacts.

During the initial Phase 1 study, 21 representative soil and sediment samples were collected from upstream and downstream of the Leichhardt River, including samples taken from the vicinity of the velodrome (Wellington Oval), the swimming pool (Splashez), Kruttschnitt Oval, and the Skate Park. These samples comprised 13 soils, 6 sediments and 2 samples for acid generation properties and are indicated in Figure 1.

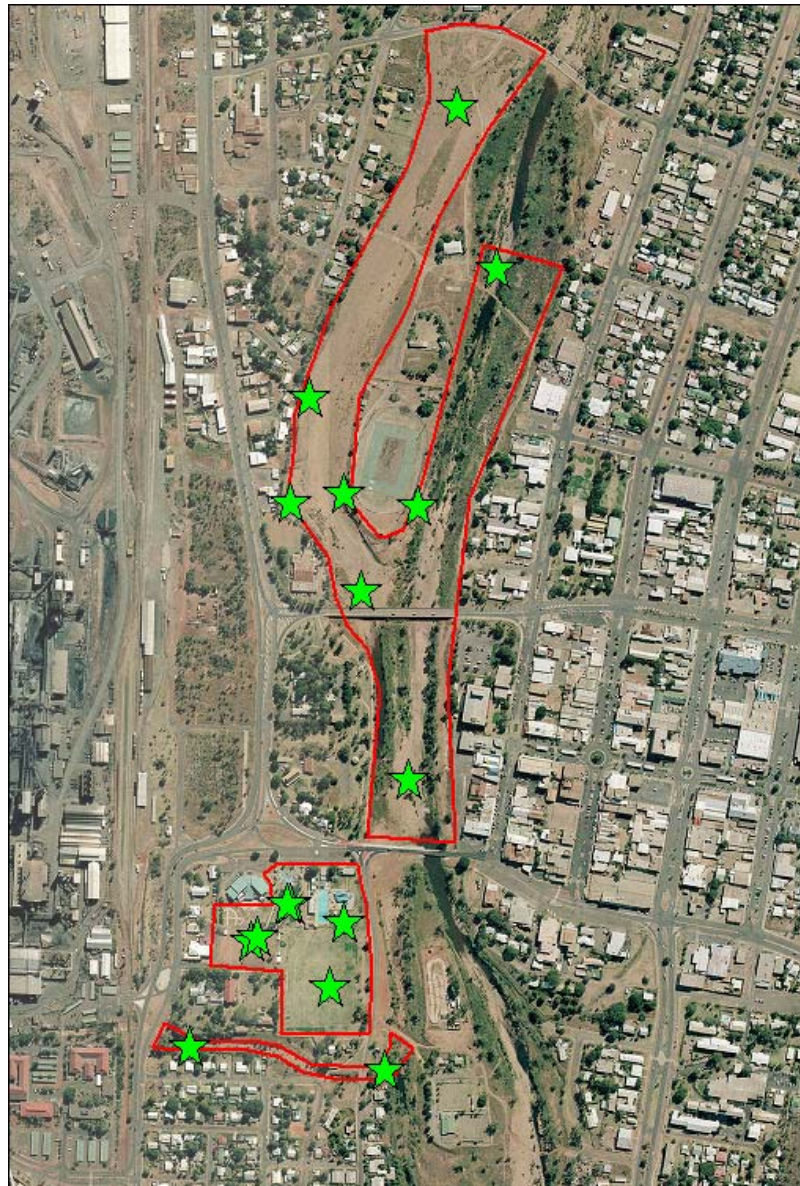


Figure 1: Soil/sediment sampling locations (Does not include upstream / downstream control sampling points)

The aims of the Phase 1 Emissions to Land study, as one of the three material phases being assessed in the Whole of Emissions study, are to:

1. Establish the bio-accessible levels of lead based on the Physiologically-Based Extraction Technique (PBET) compared with total concentrations and National Environment Protection Measure (NEPM) guidelines for soil in the Leichhardt River and the swimming pool area;
2. Use the bio-accessible levels as indicators of bio-availability of heavy metals to human beings; and

3. Assess impact on the aquatic ecosystem by comparison with the Australian and New Zealand Environment Conservation Council Interim Sediment Quality Guidelines (ANZECC - ISQG).

'Total lead' is a direct measurement of its concentration in a soil sample. The 'bio-availability' of this lead represents the proportion that a person can potentially absorb from the total lead in the sample. The 'bio-accessibility' represents a proportion of the bio-available lead that could reasonably be absorbed by a person if the sample was ingested.

With bio-accessibility, a time component is considered that reflects the time ingested material could stay in a person's gastro-intestinal tract before it is passed out of the body. This will vary based on body mass, however, in setting allowable intake limits the World Health Organisation (WHO) adopts a body mass average of 14 kilograms for a child and 70 kilograms for an adult.

Laboratory analysis of the 21 representative samples of soil and sediment was completed using the Physiologically-Based Extraction Technique (PBET) that simulates transfer through the gastro-intestinal tract of a human being. This method provides a good estimate of bioavailability of lead. Application of the percentage of bio-accessibility as a factor to total concentration is then applied to the National Environment Protection Measure (NEPM) soil guidelines as a means of giving a more accurate estimate of bioavailability.

Comparison of the total concentrations of lead in soils and sediments were then made against the NEPM Level A Health Investigation Levels (HILs) – which sets limits for highly sensitive land use including vegetable gardens with less than 10 per cent of vegetable and fruit intake as well as child care centres, and, NEPM Level E Health Investigation levels (HILs) – which sets limits for parks, recreational open space and playing fields, including secondary schools.

Initially, results of the analysis showed exceedances of total concentrations for seven sites, assuming 100 per cent bioavailability. Comparison of the measured bio-accessibility from the PBET results, when applied as a factor against total concentration, gave site specific bio-accessibility concentrations and showed that only a small number of sample site/element combinations could be considered to be a potential risk to human health, requiring further investigation.

However, it is important to note that these geographical areas are areas of low public activity. Samples at the Skate Park, Kruttschnitt Oval, and swimming pool, as well as downstream in the Leichhardt River, showed only low levels of lead. These areas were emphatically ruled out as being potential areas of risk to the community.

The Leichhardt River historical mine sediments between the Grace Street Bridge and downstream of the velodrome showed exceedances for lead. The average concentration of lead at locations where exceedances were recorded was 4,250mg/kg or seven times the limit when including the factor for bio-accessibility against a limit of 600mg/kg (Health Investigation Level E). Again, these areas are also considered to be areas of low public activity.

A desktop risk assessment for human health shows that an amount of two kilograms (2 kgs) of the highest level of total lead found would need to be consumed daily by an adult, and 400 grams daily by a child, to induce poisoning from lead.

A comparison of results with the Australian and New Zealand Environment Conservation Council (ANZECC) (which is now part of the National Water Quality Management Strategy) Interim Sediment Quality Guidelines - low and high trigger values - show exceedances for

historical lead in river sediments adjacent to and below the mine lease. These sites require further investigation and include downstream Leichhardt River. This investigation, called the *Leichhardt River Remediation Project*, will commence in April 2008 after the wet season and will continue for several months.

The following additional activities are proposed as a result of the findings of the Phase 1 study:

1. Confirm the performance and effectiveness of remediation of the Leichhardt River undertaken between 1991 and 1994 by undertaking a more detailed assessment of bioavailability of lead, using animal uptake studies (approved by an ethics committee at the University of Queensland) to give a more extensive understanding of potential human health risks and to re-verify the reliability of the bio-accessibility technique.
2. An assessment of potential effects on flora and fauna (ecological toxicity) of Leichhardt River sediment to determine the significance of the exceedances of the ANZECC-ISQG high trigger levels.
3. A preliminary study into potential pathways for lead from current Xstrata Mount Isa Mines operations into the community, what forms the pathways are in and whether there are any potential or specific health risks. This will provide an accurate basis to design a comprehensive pathway study, and
4. Initiate and commission a PhD level study (between two to three years) into potential pathways of lead into the community to identify further long term risk to human and ecological health as a continuation of the study described in point 3 (above).

## Glossary of Terms

ADI *Allowable Daily Intake.*

This refers to the amount of lead that can be ingested without seeing an effect on human health. In this case, levels of Allowable Daily Intake were compared to acute and sub-chronic thresholds recommended by the World Health Organisation (WHO) (1989) being:

- for an Adult (70 kg) with Allowable daily intake (ADI) of 0.25 mg of lead, and
- a Child (14 kg) subject with Allowable daily intake (ADI) of 0.05 mg of lead.

The lethal dose of lead is 500 mg for an adult and 100 mg for a child.

At the highest measured level of in Leichhardt River soil/sediment and assuming 2 per cent bioavailability, an adult would have to eat 2,000 grams (2 kgs) of the soil/sediment per day to induce poisoning and a child 400 grams soil/sediment per day.

Bio-available Lead – Is the portion (mg/kg) of total lead in a sample that could be potentially absorbed by a human. This will vary based on body mass – Child 14 kg, and Adult 70 kg

Bio-accessibility – portion (mg/kg) is a measure of bio-available lead in a sample that could be absorbed given that it would have a limited time before it is passed through the body.

Direct Measurement of Lead – concentration (mg/kg) of all (total) lead in a sample.

ANZECC *Australian and New Zealand Conservation Council*  
<http://www.environment.gov.au/about/councils/anzecc/>

ISQG *Interim Sediment Quality Guidelines- related websites guide and guideline*

<http://www.environment.gov.au/water/quality/nwqms/index.html>

<http://www.environment.gov.au/water/publications/quality/index.html#nwqmsguidelines>

[http://www.mincos.gov.au/\\_data/assets/pdf\\_file/0003/316137/gfmwq-guidelines-vol2-8-4.pdf](http://www.mincos.gov.au/_data/assets/pdf_file/0003/316137/gfmwq-guidelines-vol2-8-4.pdf) (specifically the sediment guideline background)

WHO *World Health Organisation*

<http://www.who.int/en/>

NEPM *National Environment Protection Measure*

<http://www.ephc.gov.au/>

PBET *Physiologically-Based Extraction Technique*

Previous papers can be found in the:

Journal of Toxicology and Environmental Health, Part A - Current Issues;

In Vitro Physiologically Based Extraction Test (PBET) and Bioaccessibility of Arsenic and Lead from Various Mine Waste Materials - 1 January 2007 – Scott Bruce, Barry Noller, Vitukawalu Matanitobua, and Jack Ng, National Research Centre for Environmental Toxicology (ENTOX), University of Queensland, Coppers Plains, Queensland, Australia