X

Appendix X – Spontaneous Combustion Forward Work Program

MINING SERVICES
AUSTRALIA'S LEADER IN SPONCOM RISK ASSESSMENT AND MANAGEMENT PLANNING

B3 Mining Services Pty Ltd
PO Box 1565, TOOWONG BC QLD 4066
Telephone: 0488 708 949
basil@b3miningservices.com
ABN 36 122 684 584

PROPOSAL

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Pyramo Marianelli
Geochemistry
Environmental Projects
McArthur River Mine
Zinc Assets Australia
Pyramo.marianelli@glencore.com.au

Spontaneous Combustion Hazard Assessment of McArthur River Mine Waste Rock

Beamish (2016) highlighted that there is a need to for better understanding of waste rock spontaneous combustion behaviour for improved environmental planning of dumps. Consequently, a new development in spontaneous combustion testing of waste rock for metalliferous mines has been used to identify and quantify the difference between reactive and unreactive waste rock (Beamish and Theiler, 2016). To date two samples from McArthur River Mine, representing both reactive and unreactive waste rock, have been tested for spontaneous combustion propensity as part of research and development at the CB3 Mine Services Pty Ltd laboratory in Darra (Brisbane) using the newly developed Incubation test method (Figure 1). These results clearly show the incubation behaviour of the reactive waste rock in response to reactive pyrite initiated self-heating at low ambient temperatures and self-heating of organic carbon at elevated temperatures above 120°C.

Beamish (2017) has proposed a simple and cost effective means of classifying the spontaneous combustion propensity of waste rock based on analytical data for Total Organic Carbon (TOC) and Total Sulphur (TS). An example of this classification chart for metalliferous waste rock is shown in Figure 2. The chart can be used as a filter to identify waste rock units that require Incubation testing to quantify their spontaneous combustion behaviour and minimum incubation period. It can also be used to develop a site-specific Spontaneous Combustion Hazard Likelihood Chart.

To confirm the relationship between TOC/TS and incubation behaviour for McArthur River waste rock units requires samples to be tested to cover a range of TOC/TS values. It is proposed that initially ten (10) core samples be supplied from the McArthur River Mine waste rock profile to help develop a more robust spontaneous combustion likelihood chart for hazard assessment. This would need to be followed-up with an additional ten (10) core samples to build a sound database for future mine planning of the waste removal and emplacement at McArthur River Mine.

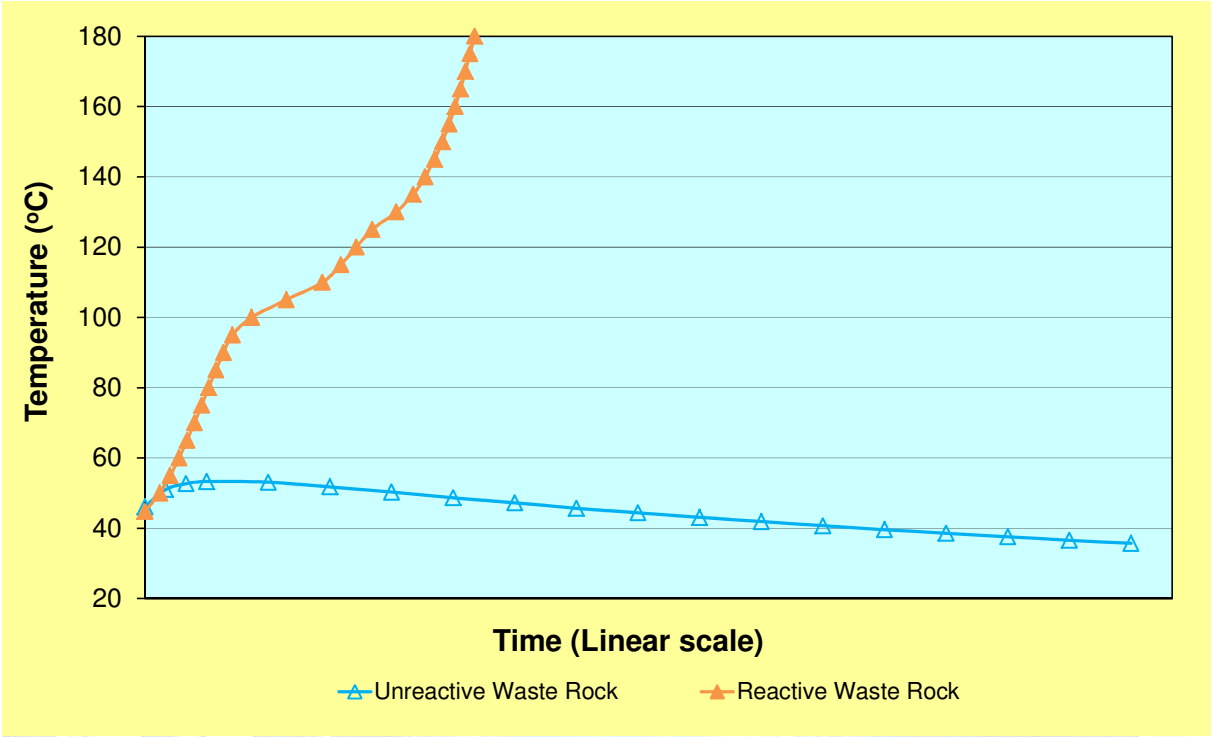

Figure 1. Examples of Incubation test results for unreactive and reactive waste rock from McArthur River Mine.

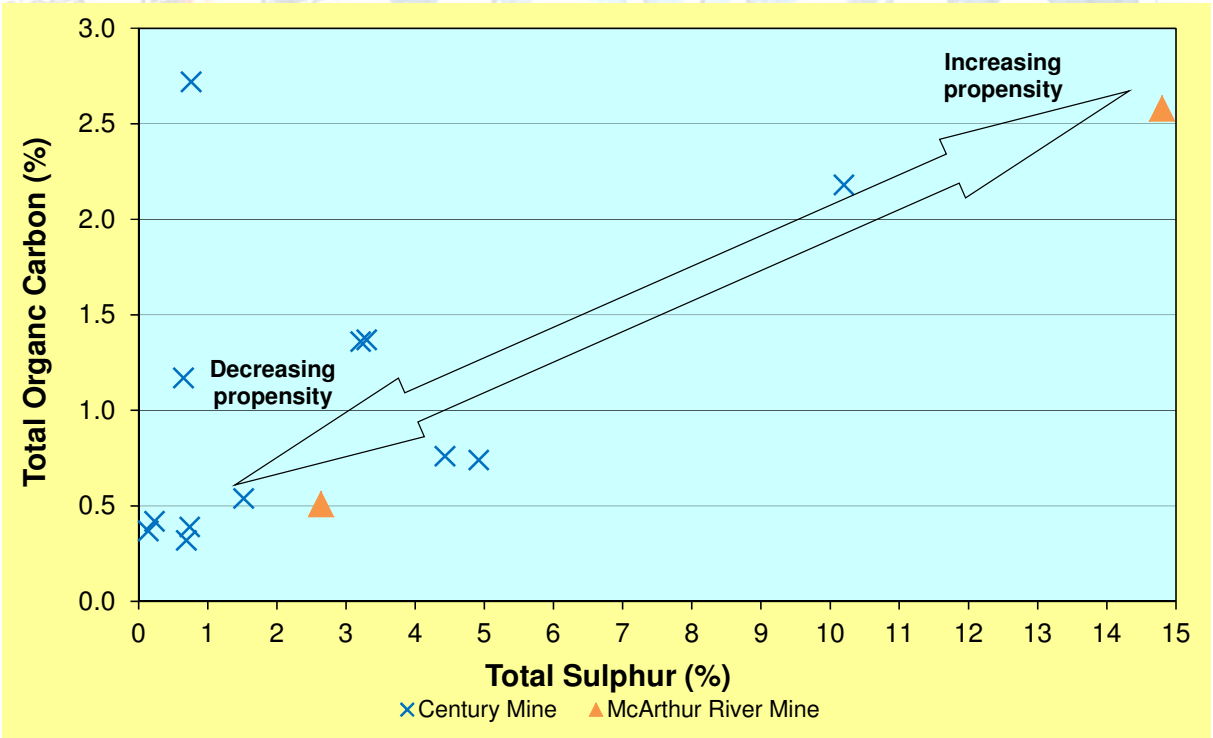

Figure 2. Relationship between total sulphur and total organic carbon for waste rock samples from Century Mine and McArthur River Mine. Note this same chart can be used to identify waste rocks that pose a potential carbon fuel source if placed in contact with more reactive rock units.

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Scope of Work

The scope of work for the initial and follow-up batch of samples is to be conducted in two concurrent phases and includes the following:

Phase 1

- Collection of core samples from McArthur River Mine covering a range of waste rock units with varying TOC and TS values.
- Delivery of the samples to Brisbane for analysis (TOC, TS, M, Ash, CV) by ALS Laboratories. If additional geochemical testing is being done on the core samples it is suggested that half cores be supplied to the CB3 Mine Services laboratory at Darra and these can be homogenised for the spontaneous combustion assessment work.
- Replicate samples sent to UNSW, School of Biological, Earth and Environmental Sciences for XRD analysis and Microscopic/SEM analysis.

Phase 2

- Conduct Incubation tests on the waste rock samples to assess propensity for thermal runaway and the subsequent minimum incubation period for a spontaneous combustion event. It is recommended that a start temperature of 45 °C be used for these tests to reflect the high ambient temperature at McArthur River Mine in summer.

Deliverables from the project will be as follows:

- Provision of interim results and on-going interpretation as results become available.
- Provision of a comprehensive technical report signed off by a Registered Professional Engineer of Queensland on the analysis and interpretation of the Phase 1 and Phase 2 test results. This will include identification of any relationships between the analytical parameters that can be used on-site for future environmental planning and the development of a Spontaneous Combustion Hazard Likelihood Chart.

The timing of the work will be dependent on the receipt of each batch of samples (initial batch early 2018, follow-up batch mid 2018) and the spontaneous combustion testing performance of the samples as there is no way of predicting the actual incubation testing time. A nominal timeframe of four weeks is possible for each of the two batches of samples once testing commences. However, staged reporting of the results will be provided as they become available.

All samples are to be dispatched to the following laboratory street address:

Dr B Basil Beamish
CB3 Mine Services Pty Ltd
3/20 Archerfield Road
Darra QLD 4076

References

Beamish, B, 2017. Cost-effective spontaneous combustion hazard assessment of coal mine overburden, AusIMM Bulletin Online. Available at https://www.ausimmbulletin.com/feature/cost-effective-spontaneous-combustion-hazard-assessment-coal-mine-overburden-rocks/.

Beamish, B, 2016. Understanding waste rock spontaneous combustion, AusIMM Bulletin Online. Available at https://www.ausimmbulletin.com/feature/understanding-waste-rock-spontaneous-combustion/.

Beamish, B and Theiler, J, 2016. Characterising the spontaneous combustion propensity of waste rock, in *Proceedings Life of Mine 2016 Conference*, pp 93-96 (The Australasian Institute of Mining and Metallurgy: Melbourne).

Dr B Basil Beamish MAusIMM CP(Min) RPEQ
Managing Director