Introduction

CB3 Mine Services Pty Ltd (CB3) provides a range of advanced laboratory tests that are leading practice in quantifying the spontaneous combustion propensity of coal and other materials. This site specific data is then used to develop effective mitigation and Principal Hazard Management Plans for Spontaneous Combustion across the spectrum of operations including, at the mine, in transit or in stockpiles.

Staff Experience & Expertise

CB3 staff members have extensive experience within the mining and minerals sector and have a sound knowledge of the industrial process and regulatory context present in different mine operation and locations worldwide. Staff have provided consulting services on spontaneous combustion for projects in Australia (Queensland's Bowen Basin, Galilee Basin, and Surat Basin; New South Wales' Sydney Basin and Gunnedah Basin), New Zealand (North Island and South Island Coal Regions), The United States, India, Indonesia, South Africa and Colombia.

With laboratory testing facilities in both Australia and New Zealand including in house coal quality analysis completed in a Telarc ISO9001 Registered laboratory we can carry out the complete scope of works from start to finish, at which point you will be supplied with a comprehensive report signed off by Basil Beamish, a registered professional engineer with over 30 years of experience in coal principal hazard issues and a world leader in spontaneous combustion assessment. In total CB3 personnel have over 90 years of experience within the mining industry.

Testing Capabilities and Services

Spontaneous combustion is a significant hazard for coal mine operations with the occurrence of spontaneous combustion events often leading to severe outcomes and major disruptions to production. It is therefore essential for coal mines to produce detailed and reliable Principal Hazard Management Plans for Spontaneous Combustion based on accurate measurements of spontaneous combustion behaviour including the propensity of coal to self-heat under in-mine conditions and the associated gas evolution pattern of the heating.

All testing programs are tailored to suit, as each mine and coal seam occur in different settings, both geographically and geologically. These factors need to be recognised in deciding on testing parameters that are designed to simulate the site specific conditions. As such, each project is developed in consultation with the client to provide the best outcome for management planning. CB3 offer the following spontaneous combustion tests:

- R_{70} testing
- SponComSIM™ testing
- SponComGAS™ testing
- SponComBULK™ testing

R_{70} testing

The R_{70} test provides a quick and accurate measure of the intrinsic reactivity of coal to oxygen and is backed by an extensive database of results from locations around the world that can enable a direct comparison to be made between coals of similar spontaneous combustion propensity. The R_{70} values obtained are strongly coal rank dependent and are affected by the intrinsic properties of the coal such as mineral matter content (acting as a heat sink) and maceral composition. A value for the Relative Ignition Temperature (RIT) of each sample (a high temperature index value obtained from the R_{70} test as it reaches thermal runaway), is also used to confirm the intrinsic spontaneous combustion reactivity of the coal. As such the adiabatic R_{70} self-heating rate test is now two tests in one.

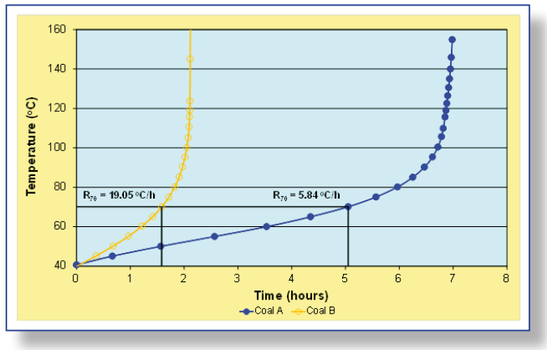
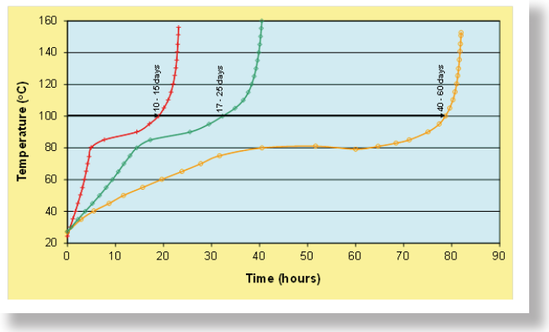


Figure 1: Typical adiabatic R_{70} self-heating rate results for high volatile bituminous (Coal A) and sub-bituminous (Coal B) coals.

SponComSIM™ testing

SponComSIM™ is designed to simulate coal self-heating for any set of boundary conditions that may exist at a mine, port or in transit. This test takes into consideration the moisture present in the coal and the surrounding environment, the presence of reactive pyrite and issues associated with seasonal variation. In essence, the test provides a realistic quantification of the spontaneous combustion propensity of coal by accounting for both the intrinsic and extrinsic influences on coal self-heating.

Figure 2: SponComSIM™ test results showing typical coal self-heating behaviour from low mine ambient temperature to thermal runaway, where moisture evaporation moderates the coal self-heating. The x-axis shows laboratory hours for the test and a scaled equivalent in days is shown for spontaneous combustion issues in a loose coal pile on site as documented by Beamish and Beamish (2012).



SponComGAS™ testing

The gas evolution pattern that occurs in response to coal self-heating can be used as a signature for the early detection of a self-heating event. CB3 can determine the unique gas evolution trends for your situation which can be vital to define and support the alarm limits set in the Trigger Action Response Plans (TARPs) developed as part of the Spontaneous Combustion Principal Hazard Management Plan for an underground coal mine or any form of transportation and stockpiling.

SponComBULK™ testing

Bulk self-heating tests provide an opportunity to monitor hot spot development in a coal pile in terms of location of the initial hot spot and subsequent migration within the pile. These tests can be conducted using a 2-metre column apparatus that is designed to minimise heat losses and thus simulate coal in a large stockpile environment.

Analysis, Interpretation and Reporting of Results

All test results are analysed, interpreted and compiled into a comprehensive report by Chartered Professionals who are members of the Australasian Institute of Mining and Metallurgy. The final report includes a separate chapter on Preliminary Risk Assessment that evaluates the impact of site specific factors on spontaneous combustion risks, this chapter can be incorporated directly into the Principal Hazard Management Plan for Spontaneous Combustion. Depending on the number of samples provided for testing, a model may also be developed for contouring the intrinsic spontaneous combustion reactivity of the seam(s) or specific coal plies (for example coal left in the goaf) across the mine plan. Reports are certified by Registered Professional Engineers who are registered under the terms of the Professional Engineers Act 2002 (Queensland) and have appropriate knowledge and experience.

Contact Us

At CB3 Mine Services we are always happy to discuss your spontaneous combustion needs and work towards developing an appropriate management plan with you.

For more information or to arrange a confidential discussion please contact Basil Beamish (b.beamish@cb3mineservices.com) or:

Australia (Brisbane Laboratory):
CB3 Mine Services Pty Ltd
Unit 3/20 Archerfield Road, Darra Qld 4076, Australia
T +61 7 3375 4100 F +61 7 3375 3777
info@cb3mineservices.com
www.cb3mineservices.com

New Zealand (Wellington Laboratory):
CRL Energy Ltd
68 Gracefield Road, Lower Hutt 5040, New Zealand
T +64 4 570 3700 F +64 4 570 3701
crl@crl.co.nz
www.crl.co.nz

References

Beamish, B and Beamish, R, 2012. Testing and sampling requirements for input to spontaneous combustion risk assessment, in Proceedings of the Australian Mine Ventilation Conference (eds: B Beamish and D Chalmers), pp 15-21 (The Australasian Institute of Mining and Metallurgy: Melbourne).

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Spontaneous Combustion Services