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GUIDELINES

MDG 1006

Spontaneous Combustion Management Guideline

Produced by Mine Safety Operations Branch

Industry and Investment NSW

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INTRODUCTION

1.1 Overview

The intent of this guideline is to provide assistance to mines in the development and implementation of management systems to control risk arising from spontaneous combustion.

In order to achieve this aim the guideline provides a set of mandatory management elements which be addressed to manage spontaneous combustion risks in a disciplined and controlled manner.

The importance of effective management approaches, in addition to technical measures, is recognised as is the need for reliable and durable means of managing spontaneous combustion.

The nature of risk arising from spontaneous combustion is that it may be continuously variable not only between mines but also within an individual colliery's workings.

A degree of discipline is also warranted as a means to detect, and effectively act upon, the often subtle changes in a mines operating environment which may be associated with the potential for spontaneous combustion.

It is the intention of this document to detail an outline of what elements should be considered in the development of a managed approach to that risk. That managed approach is based on the development, implementation and maintenance of a Spontaneous Combustion Management Plan (SCMP) for an affected mine.

The SCMP is the collection of measures to be undertaken to assess, detect and control spontaneous combustion risks at a particular mine and it is intended that working SCMP's are tailored to suit the situation at any individual mine.

There is a need for durable systems which retain their integrity over periods of time and with changes of personnel and increasing complexity of mining systems.

Stakeholders in coal mines are increasingly seeking assurance that risks to the workforce and the mines themselves are being effectively managed, since it is those stakeholders who carry the burden of the consequences of ineffective management. It is considered that any mine complying with the letter and intent of this guideline will be in an excellent position to provide such assurance, that risk arising from spontaneous combustion is being effectively managed.

1.2 Scope

The requirements of this document apply to all underground coal mining operations.

All underground coal mines are subject to some risk of spontaneous combustion. The likelihood will vary from mine to mine and operators should have in place an appropriate level of awareness and response to that hazard.

This document is intended to support the development of an appropriate response to the spontaneous combustion risk faced by any mine.

The Elements of this SCMP provide the broad management framework. They are consistent with ISO 9000 and AS/NZ 4801 series standards together with the legislative requirements of the OHS and the CMH&S Acts and Regulations.

1.3 Technical Reference Literature

A technical reference document (MDG1006 – Technical Reference) supplements this guideline for those preparing risk assessments relating to spontaneous combustion and its subsequent management controls. The technical reference should be read in conjunction when using this guideline.

1.4 Definitions

For the purposes of this document the following definitions apply:

spontaneous combustion - Oxidisation of coal is a normal process and this produces heat and certain gases. (All coal oxidizes). Spontaneous combustion is the process by which certain materials can ignite as a result of internal heat which arises spontaneously due to reactions liberating heat faster than it can be lost to the environment

spontaneous combustion risk - the set of risks to people and/or property which may arise from spontaneous combustion where the rate of oxidation is, or is likely to, increase and result in undesirable temperature increase.

heating - situation where the dissipation of heat energy resulting from spontaneous combustion is insufficient to restrain coal oxidation from becoming self sustaining and for an ongoing temperature rise of the surroundings to occur (this is analogous to the term ‘spontaneous heating’ which may be found in the literature). i.e., the uncontrolled progression of spontaneous combustion

1.5 Policy

The SCMP should contain or refer to a policy statement on the management of risk, health and safety, endorsed by the most senior officer of the operation.

2. CONSULTATION

Workforce involvement is required during the spontaneous combustion risk assessment process, development of controls, and review of the SCMP.

Matters relating to any spontaneous combustion event or significant changes to the SCMP are to be effectively communicated to the workforce and other stakeholders.

3. RISK IDENTIFICATION

The mine must conduct an evaluation of the spontaneous combustion risk to be managed at the mine site in accordance to MDG1010 and ISO31000.

This evaluation should include spontaneous combustion propensity testing & other relevant data for coal seams impacted upon by mining.

4. RISK ANALYSIS and EVALUATION

The mine should have in place processes for the timely collection of appropriate information related to spontaneous combustion risk. The aim is to gather information to predict the risk arising from spontaneous combustion related events.

Independent facilitation for the conduct of a risk assessment can contribute to the objectivity of the results. The risk assessment team should include workforce representation and external person(s) experienced in spontaneous combustion management. This evaluation should include:

- evaluating the spontaneous combustion related history of both the mine and any adjacent or prior operations in the same seam and/or coal measures;
- evaluating external information including review of other's experience, regular review of available information, and regular review of emerging technology
- developing particular indicators of spontaneous combustion risk for the mine based on the previous evaluations and to provide input into the mine's evaluation/decision processes related to spontaneous combustion. Those indicators developed for the mine should be maintained as an internal standard.

Indicators of spontaneous combustion should include both gas analysis based indicators and other sensory or observation based indicators used as input to the mine's evaluation/decision process in the development of trigger levels.

5. RISK MANAGEMENT - CONTROLS

The mine should develop controls to reduce or eliminate the risk of spontaneous combustion.

5.1 Design Parameters

The Technical Reference Document outlines the criteria relating to mine design, prediction, prevention, detection, response and methods of control for spontaneous combustion hazard.

5.2 External Resources

The SCMP should include provision for accessing external resources. Such resources may include off-site or mobile gas analysis services, Mines Rescue response, inertisation unit, or external expertise.

The mine should establish and maintain a register of external resources which should include a listing of personnel and service providers who may need to be contacted in response to demands of the SCMP.

5.3 Spontaneous Combustion Treatment

The mine should develop and implement processes for the treatment of spontaneous combustion, including inertisation, flooding, sealing, etc.

5.4 Goods/Services Acquisition Control

There should be processes in place for:

- equipment used for the management of a spontaneous combustion event to be fit for purpose,
- contracted services to be provided to be consistent with the SCMP.

5.5 Mine Standards and Procedures

The mine should develop, document and implement standards which define the following:

- Seal Standards & Maintenance
- Sealed Area Monitoring
- Ventilation Monitoring
- Gas Monitoring System & Locations
- Gas Sampling and Analysis
- Physical Indicator Observation & Reporting
- Inspection

6. MONITORING

Early detection of the onset of spontaneous combustion most often will provide time for action to be taken to control the heating before people need to be withdrawn from the mine. Specific detail on the following monitoring provisions can be found in MDG1006 - Technical Reference.

6.1 Inspections

Criteria for the inspection of spontaneous combustion control should be detailed in the Mines Inspection Program.

6.2 Gas Sampling and Analysis

The mine should have in place processes for gas sampling and analysis including bag sampling, and continuous monitoring from boreholes or seals, or within mine airways and goaves.

6.3 Continuous Gas Monitoring

The mine should have in place processes for continuous gas monitoring to provide information related to spontaneous combustion for evaluation/decision processes.

6.4 Trend Analysis

The SCMP should include processes for the monitoring of conditions and detection of changes in the mining environment of spontaneous combustion indicators, inclusive of the collection and retention of relevant records or other information.

Historical information should be retained to allow analysis of information over time. There should be means for the timely transfer of information of change detection into the mine's evaluation/decision processes.

6.5 Calibration

The SCMP should reference the calibration requirements for gas monitoring instrumentation used for spontaneous combustion management.

6.6 Response

The mine should have in place response plans for the mitigation of the effects of spontaneous combustion, including means for the protection of personnel and the mine.

6.6.1 Trigger Action Response Plans (TARP's)

The mine should determine indicators for the earliest detection of spontaneous combustion, including gaseous & physical indicators (such as smell, haze, etc).

TARP's should be developed with responses to indicators with levels ranging from early detection through to evacuation of the mine.

6.6.2 Incident Management Team

The TARP's should define the trigger which will invoke the operation of the incident management team (IMT) to manage spontaneous combustion events. The IMT should include persons with sufficient authority to implement decisions, together with appropriate expertise and representation of stakeholders.

The IMT should maintain an event log to record issues, decisions, actions and resulting events. The IMT should not be disbanded until a controlled and stable condition exists at the mine with respect to spontaneous combustion risk.

6.6.3 Withdrawal of Persons

The mine should develop and implement a process for the withdrawal of persons from the mine in the event of a potentially life threatening situation arising from a spontaneous combustion event in accordance with MDG1020.

6.6.4 Emergency Sealing

The mine should develop and implement processes for the rapid sealing of specific areas of risk in response to TARP's supported by sealing procedures and seal design together with a minimum inventory of materials to be maintained on-site, or to have guaranteed ready availability, at all times.

6.7 Document and Data Control

The SCMP should be managed by the mine's document control system and be in a form which is durable, communicable and able to be updated. All obsolete documents are to be removed from circulation and destroyed. The documented history for this Guideline is referred to in Appendix 1.

6.8 Record Keeping

Records related to SCMP that should be retained include:

- Spontaneous combustion training
- Spontaneous combustion events
- Mine specific spontaneous combustion characteristics
- TARP's
- Non-conformances - corrective action
- Audits
- Review

6.9 Corrective Action

Means should be established and maintained for all personnel involved in the operation of the plan to report non-conformities where:

- the SCMP is not followed; and
- spontaneous combustion control is not adequately catered for in the plan;

Reports of such non-conformities should be made to persons with sufficient authority to initiate action. Causes of non-conformances with the SCMP should be investigated and recorded.

7. INFORMATION

Information which adequately describes the mine and defines the “mine characteristics” as they relate to the control of spontaneous combustion should be recorded & effectively communicated to stakeholders.

Information in this context includes both paper and computer based information. This includes, but may not be limited to, procedures, standards and plans.

A minimum set of information should be collected and recorded for each spontaneous combustion event at a mine. This information is to be recorded on the form detailed in Appendix 2 – Recording of Spontaneous Combustion Event. The information should be retained in a form which will allow its use in subsequent re-assessment of the spontaneous combustion risk at the mine and review of the adequacy of the SCMP for the mine.

8. TRAINING

Persons with responsibilities under the SCMP shall undergo training including:

- the relevant sections of the SCMP and the importance of compliance
- roles and responsibilities of persons in relation to the operation of the SCMP
- spontaneous combustion indicators
- reporting and recording the observation of spontaneous combustion related indicators
- relevant standards & procedures associated with the SCMP
- conduct of internal & external audits.
- persons new to the mine should be trained in relevant aspects of the SCMP

9. ROLES & RESPONSIBILITIES

The SCMP shall define the authorities and duties of all persons who have responsibilities under the Plan.

In fulfilling these requirements such devices as organisation charts, job or position descriptions in relation to the SCMP, or statements of duties with respect to the SCMP may be useful.

The SCMP should be adequately resourced in terms of resources for plan development, implementation and ongoing maintenance.

10. SUPERVISORS

Supervisors shall:

- maintain an up to date knowledge of spontaneous combustion prevention, detection and control through attendance of refresher training
- be familiar with their accountabilities under the mine’s spon comb management plan
- conduct inspections and take recordings as required in the SCMP
- make written report on findings
- provide instruction to workers to maintain standards which may impact on potential spon comb heatings

11. AUDIT

Effective, and timely, audits are a valuable means to give management, and others, assurance that requirements of the SCMP are being adhered to in practice.

A schedule of both internal and external audit should be prepared to ensure the effective verification of SCMP operation.

Internal audits should be conducted by persons independent of those with direct responsibility for the aspect of SCMP which is the audit subject.

External audits should be conducted by persons independent of the mine's operations, and may be conducted by those external to a mine but still within the corporate entity owning or operating the mine.

Records of all audits should be maintained.

12. REVIEW

The timely and effective review of the content and operation of the SCMP will assess the plan's continued suitability and effectiveness in managing spontaneous combustion related risks at the mine.

The mine should prepare a review protocol conforming to the following requirements:

- a re-evaluation of the spontaneous combustion related risks and all aspects of the SCMP;
- identify persons to participate in reviews (indicate who should decide if significant change has occurred, and to what criteria that decision is to be made);
- define time based and event based review triggers. Event based review triggers should include, as a minimum requirement:
    - failure of the SCMP to control spontaneous combustion,
    - significant change in mining systems,
    - change of equipment,
    - change of management structure;

Where the conduct of any review indicates that the SCMP is no longer suitable and effective in managing spontaneous combustion related risks present then management should implement corrective action to amend the plan to make it suitable and effective for this purpose.

13. REFERENCES

[To include reference to developed guidance material or other material which may be cited]

Spontaneous Combustion in Australian Underground Coal Mines Reprinted 2004

Emergency Preparedness and Mines Rescue – Mines Rescue Board NSW

MDG 1006 - Technical Reference

14. APPENDICES

14.1 Appendix 1 - Document History

First Draft Issue - SCMP02.DOC dated 31 October 1995.

Working Revision - SCMP03-1.DOC dated 2 July 1996

Working Revision - SCMP03-2.DOC dated 23 July 1996

First Issue - SCMP033A.DOC dated 26 August 1996

Second Issue SCMP03B. DOC dated 01 April 2010

14.2 Appendix 2 - Recording of Spontaneous Combustion Event.

Mine:	Date:
Seam (s):	
Raw or washed coal:	
Attach a Proximate analysis if possible:	
Area and Depth of origin:	
Size of the event:	
Location of the event, (geographic):	
Location of the event with respect to the seam, roof, floor or elsewhere:	
Description of the surrounding mine and mine conditions:	
Environmental conditions leading to the event:	

Time since material affected has been first exposed:
Description of the event:
Method of controlling the event:
Ventilation, ventilation appliances and seals, attach plans diagrams, ventilation appliance status reports, ventilation flows and pressures:

Rank the impact of each of the following factors on the event. The ranking is from 'Very Low' to 'Very High'. N/A denotes not applicable to the event. If information is not available indicate 'Don't Know'.

	Very Low	Low	Med	High	Very High		N/A	Don't Know
Mining System:								
Broken coal in waste or goaf								
From:								
Roof - roof coal								
Roof - rider seam								
Floor - floor coal								
Floor - rider seam								
Worked Seam -remnant pillars/stooks								
Worked Seam - rib spall								
Worked Seam - working method (ramping, poor coal recovery)								
Panel design:								
Panel dimensions (width, length)								
Caving - closed/open goaf								
Working time for panel								
Rate of retreat								

	Very Low	Low	Med	High	Very High		N/A	Don't Know

Panel Design contd.	Very Low	Low	Med	High	Very High		N/A	Don't Know
Standing/Interuption time(s)								
Face startup/finish delays								
Roadway design - dimenensions								
Roof/Rib support								
Mining method (longwall, bord & pillar)								
Stability of pillars (abutment, roadway) and adjacent areas								

Ventilation:

Design - single, flanking, bleeders								
Nature of goaf ventilation and migration paths								
Pressure and flow magnitude								
Variation to pressure and flow								
Ventilation stability								
Seam gases (need to dilute or as goaf inerting medium)								
Leakage from surface								

	Very Low	Low	Med	High	Very High		N/A	Don't Know

Pressure differential (drop):	Very Low	Low	Med	High	Very High	N/A	Don't Know
Across stoppings/ seals/regulators							
Across goaf/waste							
Across pillars (roadway, abutment, interpanel)							
Across/along balance roadway/chamber							

Ventilation Appliances/Airways:							
Stoppings/Seals - location, design, construction, timing with respect to mining schedule,							
Regulators - location, design, construction, interference with/ overuse							
Failure - collapse							
Airway constriction (falls, flooding)							

Effect of Gas Capture/Drainage:							
Capture from goaf							
Pre drainage							
Post drainage							
Air ingress							
Water removal							

	Very Low	Low	Med	High	Very High	N/A	Don't Know

Geological/Seam Factors:	Very Low	Low	Med	High	Very High		N/A	Don't Know
Nature of roof and floor strata								
Faulting/Structures								
Strength of coal - friability								
Cleat/Jointing								
Previous oxidation								
Impurities (Pyrite)								
Seam gas (as preventer of oxygen ingress)								
Water (effect of dewatering via gas drainage)								

Intrinsic (Coal) Factors:

How would you rate the accuracy of any testing conducted of the coal involved in predicting the ultimate propensity for spontaneous combustion?

Very Low	Low	Med	High	Very High		N/A	Don't Know

Method of first detection:

Attach the Results of monitoring or other detection data:
Attach a Diary of events and decisions:
Investigating person(s):

Feedback sheet

Your comments on **MDG1006 Spontaneous Combustion Management Guideline** and **MDG 1006 Technical Reference** will be very helpful in reviewing and improving these documents.

Please copy and complete the feedback sheet and return it to:

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How did you use, or intend to use, these guidelines?

What do you find most useful about these guidelines?

What do you find least useful?

Do you have any suggested changes to these guidelines?

Thank you for completing and returning this feedback sheet