



Quality of incombustible dust, sampling and analysis of roadway dust in underground coal mines

Coal Mining Safety and Health Act 1999
Recognised Standard – 05



This document is issued in accordance with PART 5—RECOGNISED STANDARDS and Section 37(3) of the Coal Mining Safety and Health Act 1999.

“PART 5—RECOGNISED STANDARDS

Purpose of recognised standards

71. A standard may be made for safety and health (a “recognised standard”) stating ways to achieve an acceptable level of risk to persons arising out of coal mining operations.

Recognised standards

72.(1) The Minister may make recognised standards.

(2) The Minister must notify the making of a recognised standard by gazette notice.

(3) The chief executive must keep a copy of each recognised standard and any document applied, adopted or incorporated by the recognised standard available for inspection, without charge, during normal business hours at each department office dealing with safety and health.

(4) The chief executive, on payment by a person of a reasonable fee decided by the chief executive, must give a copy of a recognised standard to the person.

Use of recognised standards in proceedings

73. A recognised standard is admissible in evidence in a proceeding if—

(a) the proceeding relates to a contravention of a safety and health obligation imposed on a person under part 3; and

(b) it is claimed that the person contravened the obligation by failing to achieve an acceptable level of risk; and

(c) the recognised standard is about achieving an acceptable level of risk.

37.(3)....if a recognised standard states a way or ways of achieving an acceptable level of risk, a person discharges the person’s safety and health obligation in relation to the risk only by—

(a) adopting and following a stated way; or

(b) adopting and following another way that achieves a level of risk that is equal to or better than the acceptable level.”

Where a part of a Recognised Standard or other normative document referred to therein conflicts with the Coal Mining Safety and Health Act 1999 or the Coal Mining Safety and Health Regulation 2001, the Act or Regulation take precedence.

This recognised standard is issued under the authority of the Minister for Natural Resources and the Minister for Mines

[Gazetted 18 July 2003]

ISBN

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Version No	Date
1	18 July 2003

RECOGNISED STANDARD No 05
QUALITY OF INCOMBUSTIBLE DUST, SAMPLING AND ANALYSIS OF
ROADWAY DUST IN UNDERGROUND COAL MINES

CONTENTS

1. PURPOSE.....	4
2. SCOPE.....	4
3. APPLICATION FRAMEWORK.....	4
4. TECHNICAL GUIDANCE	5
4.1. INCOMBUSTIBLE DUST PROPERTIES	5
4.1.2. PHYSICAL PROPERTIES	5
4.1.3. SIZE RANGE LIMITATIONS	5
4.1.4. COMPLIANCE WITH SPECIFICATION IN STANDARD	5
5. SAMPLING.....	5
5.1. SAMPLE COLLECTION	5
5.2. SAMPLING ZONES AND SAMPLING WITHIN ZONES	6
5.3. SUB ZONES	6
5.4. SAMPLE POINTS IN SUB-ZONES.....	7
6. ROADWAY DUST ANALYSIS.....	8
6.2. ANALYSIS BY LABORATORY METHOD	8
6.3. ANALYSIS BY PORTABLE INSTRUMENT METHOD.....	8
6.4. ANALYSIS BY COLORIMETRIC METHOD	9
7. DEFINITIONS.....	10
8. ACCOUNTABILITIES/COMPETENCIES	11
9. REFERENCES	11
9.1. NORMATIVE STANDARDS.....	11
9.2. INFORMATIVE STANDARDS	11

RECOGNISED STANDARD No 05

QUALITY OF INCOMBUSTIBLE DUST, SAMPLING AND ANALYSIS OF ROADWAY DUST IN UNDERGROUND COAL MINES

1. Purpose

The purpose of this standard is to *provide a technical standard for the application and monitoring of use of Stonedust or other explosion inhibitors in underground mine roadways, to assist in reducing the risk of dust explosion to an acceptable level, and includes;*

Incombustible stonedust properties
Sampling methods for roadway dust; and
Methods of analysis of roadway dust.

2. Scope

This standard applies to underground coal mines.

3. Application Framework

Accumulations of fine coal dust within underground mine roadways have the potential to propagate explosions or ignitions *in underground workings where there is potential for an ignition source capable of igniting the dust and causing the dust to be suspended in the atmosphere. The dust when suspended by the prime ignition continues to ignite and force further roadway dust into suspension creating a chain reaction.* To lower the probability of such a disaster occurring, it is necessary to maintain a high level of incombustible content within roadway dust. *Stonedust or other explosion inhibitors can act as both a dilutant for potentially combustible levels of coal dust, and adsorbent of available heat, and obstruction to oxygen and other gases from participating in the event of an explosion.*

The probability of propagation of an explosion increases exponentially with a corresponding decrease in the Stonedust or explosion *inhibitor* present, and it is thus important to constantly monitor incombustible levels within roadways. This standard outlines a method of representative sampling and testing roadway dust samples to ensure that the required level of suitable incombustible material as specified in the regulations is maintained in the mine workings.

NOTE: RECOGNISED STANDARDS ARE NOT MANDATORY

Recognised Standards are not mandatory; but when followed provide a way of meeting safety and health obligations. A person may adopt another way of managing that risk, however, in the event of an incident the person may be required to show that the method adopted was equivalent to the method in the recognised standard.

4. Technical Guidance

4.1. Incombustible Dust Properties

4.1.1. *If stonedust (limestone dust) is used for explosion suppression it shall conform to the following specifications*

4.1.2. Physical Properties

Stonedust used for explosion suppression in mines must be light in colour, contain not more than 3 per cent by mass of free silica, as determined by the Method for Free Silica in Limestone Dust in 'Guidelines for Coal Dust Explosion, Prevention and Suppression' publication MDG3006 MRT5, published by the NSW Department of Mineral Resources.

4.1.3. Size Range Limitations

The limestone dust must be of such fineness as determined by the Method for Size Analysis of Limestone Dust in 'Guidelines for Coal Dust Explosion, Prevention and Suppression' publication MDG3006 MRT5, published by the NSW Department of Mineral Resources, that

(i) not less than 95% by mass must pass through a 250 micrometre sieve, and

(ii) of the dry dust which passes through a 250 micrometre sieve, not less than 60% and not more than 80% by mass must pass through a 75 micrometre sieve

4.1.4. Compliance with Specification in Standard

The manufacturer or supplier of *Stonedust* intended for use in the suppression of coal dust explosions must be able to provide if so requested, acceptable evidence of compliance with the specifications contained in this Standard.

5. Sampling

5.1. Sample Collection

5.1.1. *Sample collection can be either by the strip sampling method or the spot sampling method*

5.1.2. *Strip samples of the deposited dust layer should be collected from a transverse strip around the periphery of the roadway of such width so as to obtain sufficient sample material to test. The width of sampling should be kept consistent throughout the sampling process.*

5.1.3. *The strip sample should be taken around the perimeter of the roadway to a height that is safely practicable*

5.1.4. *Spot samples of the deposited dust layer should be collected from a series of spots each comprising an area not less than 0.1 m² of the roadway floor or sidewalls.*

- 5.1.5. Samples of the roadway dust layers in a mine roadway *should be* collected from the roof, floor and ribs *to obtain a representative sample of dust deposited and applied in the roadway.*
- 5.1.6. *If the roadway has obstructions eg belt structure, samples shall be taken from the surfaces of such structures when sampling the respective roadway*
- 5.1.7. Each sample of the deposited dust layer collected from the mine roadway should be taken from the layer to a depth not greater than 5 mm.
- 5.1.8. Spot samples should be taken from the floor, roof and ribs in an evenly distributed alternating fashion. *Consistency of sampling needs to be ensured.* A predetermined plan of alternating the spot samples should be drawn up and used throughout the sampling process.
- 5.1.9. If the sample material *from any sampling zone or sub zone* is so wet that water can be squeezed from it, the sample should be discarded but a record of the sample location and the fact that it was too wet should be kept.

5.2. Sampling Zones and sampling within zones

- 5.2.1. The mine should be divided up into zones according to the percentage of incombustible dust required in each zone. Example: 85% zone, 80% zone, 70% zone.
- 5.2.2. A representative sample for the incombustibles in each roadway in each zone or sub-zone is required to be obtained at a frequency as determined by the regulations.
- 85%- weekly,
80%- monthly,
70% -three monthly.

5.3. Sub zones

- 5.3.1. A sub zone is a smaller division of a zone, which is used to increase the representativeness of the sampling process.
- 5.3.2. In every sub zone that consists of more than one roadway each roadway must be sampled, analysed and reported on separately.
- 5.3.3. The 85% zone must be divided into sub zones not longer than 100 metres each.
- 5.3.4. All other zones in the mine that are longer than 200m should be divided into sub zones of not longer than 200 metre lengths for sampling purposes. Where the sub zone is less than the maximum length the amount of sample points per sub zone can be reduced proportionately.

- 5.3.5. In an 80% zone where four composite samples, show compliance for four consecutive months throughout a sequence of sub zones the length of the sub zones in the sequence can be increased to 500 metres.
- 5.3.6. In a 70% zone where a conveyor belt is operating, where four composite samples, show compliance over 12 consecutive months throughout a sequence of sub zones the length of the sub zones in the sequence can be increased to 500 metres.
- 5.3.7. In other the rest of the 70% zones where two composite samples, taken consecutively, show compliance over 6 consecutive months throughout a sequence of sub zones the length of the sub zones in the sequence can be increased to 1000 metres providing the samples taken are representative of that section of roadway.
- 5.3.8. In the event that non-compliance in any sub zone occurs more than once consecutively, the length of the sub zone will revert back to 200m until consistent compliance is proven again.

5.4. Sample points in sub-zones

- 5.4.1. In zones requiring an incombustible content of 85 percent, samples of dust should be collected from 10 equally spaced sample points in the sub zone per roadway to *make a composite sample*. At least sample should be taken from each open cut-through adjacent to a heading in the zone. The samples out of each individual roadway *and cut-through* in a sub zone can be combined to form one composite representative sample. The location of weekly samples shall be varied from week to week to better cover the sub zone.
- 5.4.2. Where an in-situ analysis like the portable or colorimetric method is used, no more that two sample points can be combined into one sample for evaluation.
- 5.4.3. In zones requiring an incombustible content of 80 percent, the samples of dust shall be collected for a composite sample from 10 equally spaced sample points throughout the sub zone per roadway and from at least one point in a open cut through adjacent to headings in the sub zone. Only samples taken from one roadway in the sub-zone can be combined to form one sample for analysis. The location of monthly strip samples shall be varied from month to month to better cover the zone.
- 5.4.4. Where an in-situ analysis like the portable or colorimetric method is used, no more that two sample points can be combined into one sample for evaluation.
- 5.4.5. In mine location zones requiring an incombustible content of 70 per cent, samples of dust shall be collected for a composite sample from 10 equally spaced sample points per roadway in the sub zone as well as from a sample point in each open cut through adjacent to the sampling location. Only samples taken from one roadway in the sub-

zone can be combined to form one sample for analyses. The location of 3-monthly strip samples shall be varied to better cover the zone.

- 5.4.6. Where an in-situ analysis like the portable or colorimetric method is used, no more than two sample points can be combined into one sample for evaluation.

6. Roadway Dust Analysis

- 6.1. Samples of dust collected from mine roadways shall be analysed by one or a combination of the following methods:

Laboratory method;
Portable instrument method;
Colorimetric method.

- 6.1.1. Each sample of dust *shall* be analysed as soon as practicable after collection.

6.2. Analysis by Laboratory Method

- 6.2.1. The purpose of the laboratory method is to accurately determine the fraction of incombustible material.
- 6.2.2. Each dust sample to be assessed by the laboratory method shall be prepared and evaluated by the following method or an equivalent method.
- 6.2.3. A weighed quantity of the sample shall be dried at a temperature not exceeding 140 degrees Celsius and the loss of mass attributable to moisture determined. The residue shall then be heated in an open vessel to a temperature not less than 480 degrees Celsius and not more than 520 degrees Celsius until the coal is completely burned away. The incinerated residue shall be weighed.
- 6.2.4. The incombustible content is taken as the sum of the moisture and the incinerated residue and is expressed as a percentage of the total mass of the sample.
- 6.2.5. Where roadway dust samples were air-dried before analysis by the laboratory method, a correction shall be made to the incombustible matter content of the dust sample analysed by the laboratory method. The corrected total incombustible content is given by the equation
- $$I_c = M + I(100 - M / 100)$$
- where IC is the corrected total incombustible content
where M is the percentage loss of mass during air drying
where I is the percentage of total incombustible matter in the sample

6.3. Analysis by Portable Instrument Method

- 6.3.1. A portable instrument may be used for the analysis of stonedust provided the instrument gives the same accuracy as would be obtained using the Laboratory

Method. Each dust sample to be assessed by the use of a portable instrument shall be prepared and evaluated by the method specified with the instrument.

- 6.3.2. The performance of each portable instrument shall be checked by the recommended testing and calibration procedures as frequently as necessary to ensure that results are acceptable.

6.4. Analysis by Colorimetric Method

- 6.4.1. *Dust samples may be analysed by the colorimetric method either on the mine surface or underground. When analysis by this method is carried out underground, sample drying facilities and adequate lighting shall be available at a suitable location. (It should be noted that any moisture contained in the sample is considered a factor of safety.)*
- 6.4.2. *The colour of each dust sample is compared with a scientifically prepared reference colour sample of a known incombustible matter content. When using the visual method reference colour samples shall be prepared with an incombustible matter content of 70 per cent, 80 per cent and 85 per cent.*
- 6.4.3. *In the colorimetric method the colour of each dust sample, only containing material that is smaller than 250 micrometres, is compared with a scientifically prepared reference colour sample of a known incombustible matter content.*
- 6.4.4. *When on such comparison, the colour of the sample is found to be the same colour or lighter than that of the reference sample, the incombustible content in the sample is taken to comply with the required percentage of the total incombustible matter content.*
- 6.4.5. *When on such comparison, the colour of the sample is found to be darker than that of the reference colour sample, it shall be assumed that the sample does not comply with the required percentage and the sample shall be referred to a laboratory for analysis.*
- 6.4.6. *A random sample of 10 per cent of the dust samples found satisfactory by the colorimetric method shall also be analysed by the laboratory method.*
- 6.4.7. *A documented and standardised method of preparing the samples and reference samples shall be used. The reference samples shall be prepared from each mining unit at the mine from which regular samples are to be taken or from a representative sample of the seam from main roadways from which regular samples are to be taken. Regular samples will be compared against reference samples made from that part of the mine.*
- 6.4.8. *Reference samples shall be changed if significant changes in the coal or mining characteristics are evident.*

7. Definitions

“**Colorimetric method**” means the system of sample analysis where the incombustible content is determined by a visual comparison of the sample with that of a prepared standard.

“**Laboratory method**” means the system of sample analysis where the incombustible content is determined by a laboratory assessment technique.

“**Portable instrument method**” means the system of sample analysis where the incombustible content is determined by means of the instrument itself.

Sample- an amount of dust, including limestone and coal dust that has been collected from where it occurs in the mine and which is to be used for the determination of the incombustible content.

Sampling- the taking of these samples, either by means of the strip sample method or by means of a spot sample method.

Sample point is the point at which a single sample is taken either by means of a strip sample or by means of spot sampling.

A **strip sample** means a sample collected from a transverse strip around the periphery of the roadway of such width so as to obtain sufficient sample material to test.

A **spot sample** means a sample collected from a series of spots from the roadway floor, roof and sides.

Composite Sample means in the case of strip samples a single sample derived from combining a series of strip samples in a roadway. In the case of a spot samples the composite sample is derived from a series of spot samples in a roadway. The value of a composite sample is deemed to represent the whole area from which it was taken for compliance and rectification purposes.

Heading means a tunnel driven in a coal seam in the main direction of the mining operation

Open cut-throughs. A cut-through that has a flow of ventilation *passing* through it.

Roadway means any *tunnel* in a mine and includes open cut-throughs.

Zone means any roadway, or combinations of roadways including cut-throughs that are contained in a continuous part of the mine requiring a certain percentage of incombustible matter to be maintained. Example: 70% zone, 80% zone, 85% zone

Sub zones are smaller divisions of a zone, the sizes of which are determined by mine management but cannot exceed the sizes as specified in section 5.3.

Risk assessment – An assessment of the risks associated with an activity and it *shall be* undertaken in accordance with the principles contained in **AS/NZ 4360: 1999 Risk management**.

Normative – Refers to a standard or document that forms an integral part of the recognised standard in which it is mentioned.

Informative – Refers to a standard or document that is only for information and guidance.

8. Accountabilities/Competencies

- 8.1. The Underground Mine Manager *shall* appoint one or more persons with responsibilities for the collection and analysis of roadway dust samples and for reporting of the results, as required by this Standard.
- 8.2. The person carrying out the duties of dust sampler in the case of colorimetric analysis *shall* be able to distinguish between the colour ranges and *shall* be adequately trained to prepare the samples and conduct the colorimetric tests.
- 8.3. The person carrying out the duties of dust sampler in the case of portable instrument *shall* be adequately trained to prepare the samples and conduct the test with the instrument in accordance with the manufacturers specifications.

9. REFERENCES

9.1. NORMATIVE STANDARDS

- 9.1.1. *The following documents are referred to, directly or indirectly, in this standard:*
- 9.1.2. *'Guidelines for Coal Dust Explosion, Prevention and Suppression' publication MDG3006 MRT5, published by the NSW Department of Mineral Resources. Coal Mining Safety and Health Regulation 2001*
- 9.1.3. *Coal Mining Safety and Health Regulation 2001*

9.2. INFORMATIVE STANDARDS

The following documents may be of assistance in determining the best practice for sampling of roadway dust in mines.