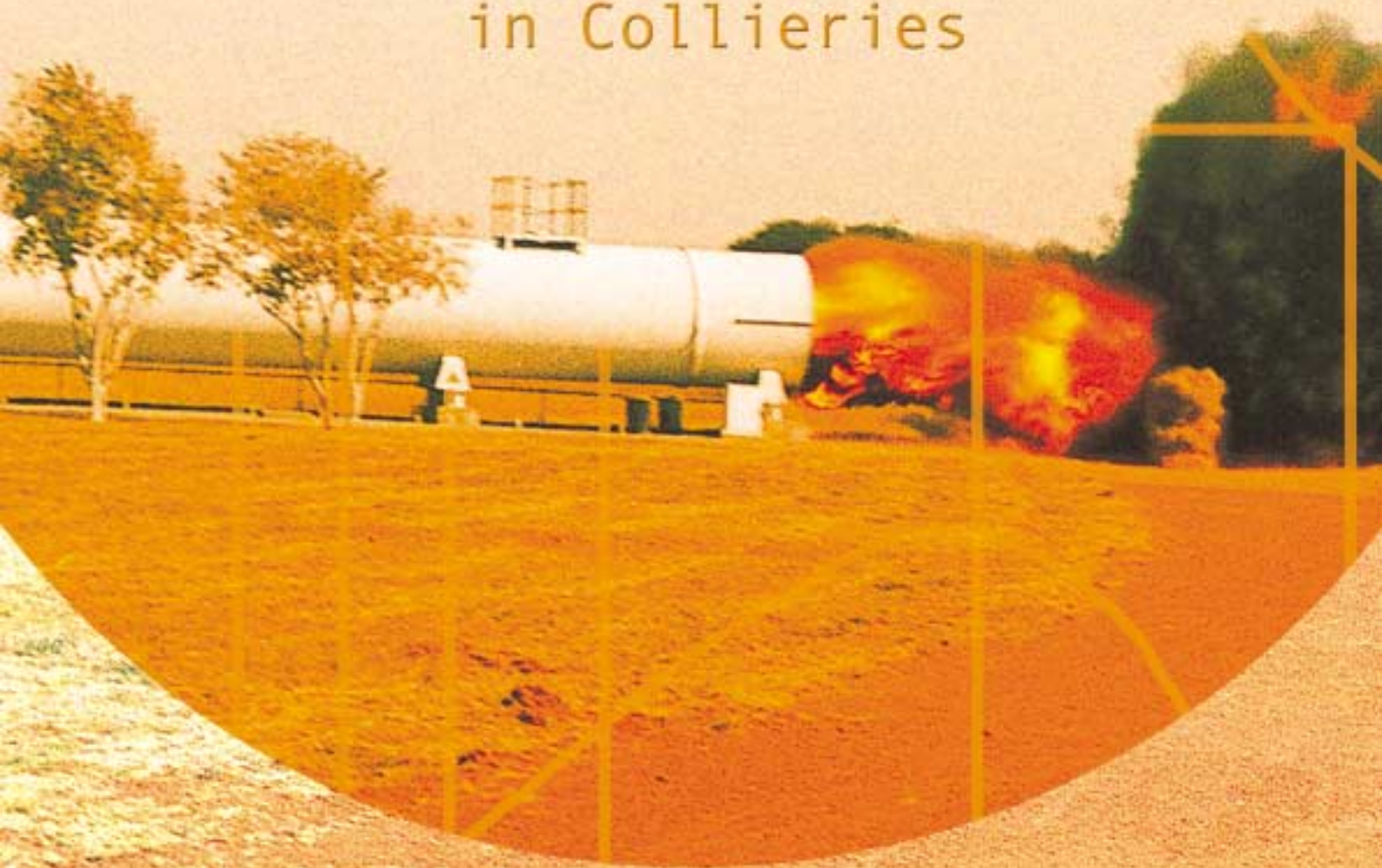
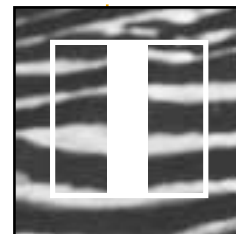
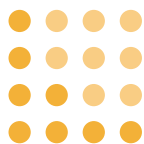


Guideline for the Compilation of a Mandatory Code of Practice for

the Prevention of Flammable Gas
and Coal Dust Explosions
in Collieries



DEPARTMENT OF MINERALS AND ENERGY



REFERENCE NUMBER: DME16/3/2/1-A1



DEPARTMENT OF MINERALS AND ENERGY
REPUBLIC OF SOUTH AFRICA

MINE HEALTH AND SAFETY INSPECTORATE

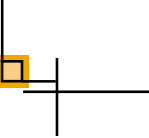
GUIDELINE FOR THE COMPILATION OF A MANDATORY
CODE OF PRACTICE FOR THE PREVENTION OF FLAMMABLE
GAS AND COAL DUST EXPLOSIONS IN COLLIERIES

Chief Inspector of Mines

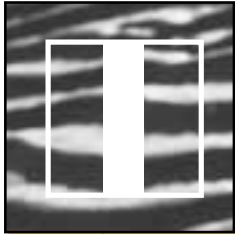
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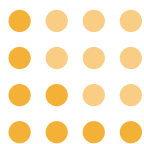
EFFECTIVE DATE: 1 AUGUST 2002





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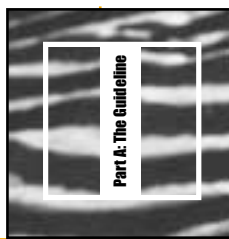
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PART A: THE GUIDELINE

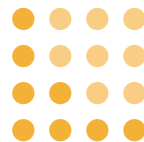
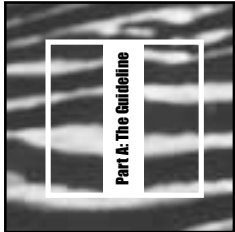
1. FOREWORD

- 1.1 Throughout the history of coal mining, ignitions of flammable gas and coal dust have been major causes of death. Investigations following explosions have shaped the legislation for mines and have influenced the development of equipment and mining techniques. Despite improved standards of ventilation, technical developments and a greater awareness, ignitions are probably the most feared hazard underground. Most coal dust explosions are preceded by an ignition of flammable gas.
- 1.2 Due to the increased use of mechanical miners, which increases the risk of ignitions, the extent of the hazard has increased in recent years, since these machines open up large areas of virgin ground in a short time period.
- 1.3 Following the Report of the Leon Commission of Inquiry into Safety and Health in the Mining Industry, MRAC appointed a task group to advise on measures to be taken to minimize the risk of flammable gas and coal dust ignition and/or explosions at collieries in South Africa. This guideline is a result of the work of that task group.
- 1.4 This Guideline and the COP to which it refers, will deal with good ventilation practices and the prevention of ignitions and explosions of flammable gas as well as the inertisation of coal dust to prevent the ignition and/or propagation of coal dust explosions. This guideline is applicable to all coal mines. However, the measures to be taken for the prevention of coal dust explosions are only applicable to mines mining bituminous coal.

2. LEGAL STATUS OF GUIDELINES AND COPs

- 2.1 In accordance with section 9(2) of the MHSA, an employer must prepare and implement a mandatory COP on any matter affecting the health and safety of employees and other persons who may be directly affected by activities at the mine if the Chief Inspector of Mines requires it. These COPs must comply with any relevant guidelines issued by the Chief Inspector of Mines (section 9 (3)).
- 2.2 Failure by the employer to prepare or implement a COP in compliance with this guideline is a breach of the MHSA. Any contravention of, or failure to comply with, a COP is not, in itself, a breach of MHSA, except a contravention or failure by an employer that also constitutes a failure to implement the COP. Since the DME does not approve COPs, its focus is not to enforce them either. The focus of the DME is to ensure that employers provide healthy and safe working environments at mines, i.e. focusing on system failures and compliance with the MHSA, rather than enforcing compliance with the COP.
- 2.3 The fact that a contravention of or failure to comply with a COP is not a breach of the MHSA does not mean that such breaches will have no legal implications. As far as the employer is concerned, there are numerous specific and general obligations on the employer in the MHSA aimed at ensuring the health and safety of all employees and all persons who are not employees but who may be directly affected by the activities at the mine. Where any failure to comply with a COP also constitutes a breach of any of the employer's obligations under the MHSA, the employer could be liable to an administrative fine for such breach. An inspector could also issue various instructions to the employer and employees in terms of section 54 to protect the health or safety of persons at the mine. Failure by an employer to comply with such an instruction could render the employer liable to an administrative fine.





- 2.4 As far as employees are concerned, section 22 places a number of obligations on employees, including that they must take reasonable care to protect their own health and safety and the health and safety of other persons who may be affected by their conduct. Where a failure by an employee to comply with a COP would also constitute a breach of the employee's duties in terms of section 22 (or a breach of section 84, 86(1) or 88), the employee could be criminally charged for such breach. As is the case with employers, the Inspectorate could issue instructions to employees in terms of section 54 and failure to comply with such an instruction constitutes a criminal offence.
- 2.5 Employers should deal with breaches by employees of a COP in terms of the mine's standard instructions and the employer's disciplinary procedures. This is not the responsibility of the State.

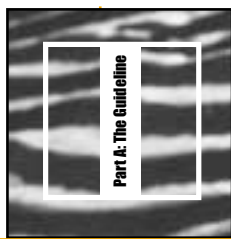
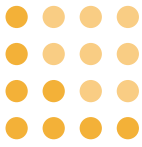
3. OBJECTIVE OF THE GUIDELINE

The objective of this guideline is to assist the employer of every coal mine to compile a COP, which, if properly implemented and complied with, would considerably reduce the risk of an ignition of flammable gas and will ensure the inertisation of coal dust to prevent the ignition and/or propagation of a coal dust explosion.

4. DEFINITIONS AND ACRONYMS

In this guideline for a COP or any amendment thereof, unless the context otherwise indicates -

- "abandoned area" means an area where coal mining or stonework has, temporarily or permanently, been stopped but which has not been sealed off.
- "accessible workings" means all workings other than -
- (i) goafed areas, the limits of which must be defined by the employer; and
 - (ii) abandoned workings that have had all entrances sealed off;
- "active workings" means workings of any kind which are primarily in use for travel or work in connection with the production operations of a mine;
- "bituminous coal" means coal in which the percentage by mass of volatile matter content calculated on a dry ash-free basis, exceeds 14%;
- "containment wall" means a seal which is designed to withstand a static pressure of 140 kPa;
- "continuous monitoring" means continuous electronic monitoring or regular monitoring with handheld gas testing or other instruments;
- "contraband" means any match or appliance of any kind for the intentional striking of a light or spark, including any contrivance or material for smoking and aluminium foil and cans, but excluding any device used for the intentional creation of a spark for the lighting of welding or cutting torches taken underground with the written permission of the employer;
- "COP" means Code of Practice;
- "DME" means Department of Minerals and Energy;
- "explosion proof seals" means a seal which is designed to withstand a static pressure of 400 kPa;



“explosive range”	means the range between Lower Explosive Limit and Upper Explosive Limit which is determined by an appropriate methodology which is fit for purpose such as United States Bureau of Mines and/or Coward triangle;
“face area”	means an area within 180 m from the coal face being worked;
“float coal”	means coal dust consisting of particles of coal that can pass through a sieve having an aperture of 100 micrometres;
“inaccessible workings”	means workings that are unsafe to enter;
“last through road”	means the closest holing to the working faces between two companions, which carry a unidirectional flow of air from the intake to the return of the section;
“MHSA”	means Mine Health and Safety Act, 1996 (Act No. 29 of 1996);
“MRAC”	means Mining Regulation Advisory Committee;
“SANAS”	means South African National Accreditation System;
“sealed off”	means an area which is sealed off with explosion proof seals or containment walls in accordance with this mandatory COP; and
“too wet”	in relation to a coal dust sample, is when that sample is placed on a 2 mm aperture sieve for at least one minute, to permit the drainage of excess water, and the resultant material when squeezed in the hand exudes water.

5. SCOPE

This Guideline for mandatory COP covers -

- (a) the significant risks associated with flammable gas;
- (b) ventilation arrangements;
- (c) ventilation methods;
- (d) ventilation design;
- (e) application of ventilation methods and design;
- (f) the significant risks associated with coal dust (apancam and explosives).
- (g) limiting the formation and dispersion of coal dust;
- (h) inertisation of coal dust;
- (i) application of barriers to prevent the propagation of explosions;
- (j) abandoned areas;

This guideline supersedes previously issued directives and/ or instructions by the DME dealing with -

- 1. Mechanical Miner Ventilation;
- 2. Guideline for the compilation of a mandatory code of practice for the Prevention of Coal Dust Explosions in Underground Coal Mines. [GME 7/4/118-AC1].





6. MEMBERS OF TASK GROUP

6.1 This guideline was prepared by the MRAC Task Group on Flammable Gas.

6.2 The members originally appointed were the following-

Messrs:	MF du Plessis	-	State (Chairperson)
	BA Doyle	-	State
	NJ von Rönge	-	Employers
	J Guthrie	-	Employers
	TC Muntingh	-	Labour
	MJ Martinson	-	Labour
	J du Plessis	-	CSIR.

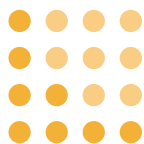
6.3 The task group proceeded with the following members who attended until the completion of the guideline -

Messrs:	K Hewitson	-	State (Chairperson)
	PR Kritzingen	-	State
	MF du Plessis	-	State
	KM du Plessis	-	State
	MA Mosia	-	State
	D Msiza	-	State
	HES Moorcroft	-	Employers
	DJ van Niekerk	-	Employers
	PLJ Viljoen	-	Employers
	CC Hulley	-	Employers
	PA Shand	-	Employers
	CAS Thompson	-	Employers
	TC Muntingh	-	Labour.

6.4 Relevant topics, identified on a fault tree, were sourced out and the following members of sub groups gave input:

Messrs:	BA Doyle	-	State
	PD Wessels	-	Employers
	A Tatton	-	Employers
	MCC Barnard	-	Employers
	SE Bubb	-	Employers.

6.5 The Guideline for the Prevention of Coal Dust Explosions in Underground Coal Mines [GME 7/4/118-AC1] and the Guideline for the Prevention of Flammable Gas Explosions in Coal Mines were amalgamated into this document by Mr. J Visser of employers.



PART B: AUTHOR'S GUIDE

- 1.1 The COP must, where possible, follow the sequence laid out in Part C "Format and Content of the Mandatory COP". The pages as well as the chapters and sections must be numbered to facilitate cross-referencing. Wording must be unambiguous and concise.
- 1.2 It should be indicated in the COP and on each annex to the COP whether -
 - 1.2.1 the annex forms part of the COP and must be complied with or incorporated in the COP or whether aspects thereof must be complied with or incorporated in the COP; or
 - 1.2.2 the annex is merely attached as information for consideration in the preparation of the COP (i.e. compliance is discretionary).
- 1.3 When annexes are used, the numbering should be preceded by the letter allocated to that particular annex and the numbering should start at one (1) again. (E.g. 1,2,3,.....A1, A2, A3...)
- 1.4 Whenever possible illustrations, tables, graphs and the like, should be used to avoid long descriptions and/or explanations.
- 1.5 Relevant Safety in Mines Research Advisory Committee projects must also be considered when assessing risks. A list of relevant projects is included as Annex 4 of the guideline. (Annex 4 is attached for information).
- 1.6 When reference has been made in the text to publications or reports, these sources must be included in the text as footnotes or side notes as well as in a separate bibliography.
- 1.7 Annex 5 is a fault tree showing mechanisms of a coal dust explosion. The authors of the guideline could use this annex to establish the possible causes of a coal dust explosion. Annex 5 is attached for information.





PART C: FORMAT AND CONTENT OF THE MANDATORY COP

1 TITLE PAGE

The COP should have a title page reflecting at least the following -

- 1.1 name of mine;
- 1.2 the heading of the COP (for example, Mandatory COP for The Prevention of Flammable Gas and Coal Dust Explosions);
- 1.3 a statement to the effect that the COP was drawn up in accordance with guideline DME 16/3/2/1-A1 issued by the Chief Inspector of Mines;
- 1.4 other relevant guidelines' reference numbers and dates of issue;
- 1.5 the mine's reference number for the COP;
- 1.6 effective date; and
- 1.7 revision dates.

2. TABLE OF CONTENTS

The COP must have a comprehensive table of contents.

3. STATUS OF MANDATORY COP

Under this heading the COP must contain statements to the effect that -

- 3.1 the mandatory COP was drawn up in accordance with guideline DME 16/3/2/1-A1 issued by the Chief Inspector of Mines;
- 3.2 this is a mandatory COP in terms of sections 9(2) and (3) of the MHSA;
- 3.3 the COP may be used in an accident investigation/inquiry to ascertain compliance and also to establish whether the COP is effective and fit for purpose;
- 3.4 the COP supersedes all previous relevant COPs; and
- 3.5 all managerial instructions, recommended procedures (voluntary COPs) and standards on the relevant topics must comply with the COP and must be reviewed to ensure compliance.

4. MEMBERS OF THE DRAFTING COMMITTEE

- 4.1 In terms of section 9(4) of the MHSA the employer must consult with the health and safety committee on the preparation, implementation or revision of any COP.
- 4.2 It is recommended that the employer should, after consultation with the employees in terms of the MHSA, appoint a committee responsible for the drafting of the COP;





- 4.3 The members of the drafting committee assisting the employer in drafting the COP must be listed giving their full names, designations, qualifications, affiliations and experience. The committee must include competent persons sufficient in number to effectively draft the COP.

5 GENERAL INFORMATION

Relevant information relating to the mine must be stated in this paragraph. The following minimum information must be provided -

- 5.1 a brief description of the mine and its location;
- 5.2 the mining methods;
- 5.3 a brief description of the ventilation system used on the mine;
- 5.4 a determination of the flammable gas content of the coal seams being mined;
- 5.5 a determination of the flammable gas release rates of the coal being mined;
- 5.6 a history of the flammable gas and/or coal dust ignitions which have occurred on the mine;
- 5.7 a brief description of the systems used relating to the prevention of coal dust explosions;
- 5.8 the volatile content of the coal;
- 5.9 the explosibility index of the coal; and
- 5.10 other relevant COPs.

6 TERMS AND DEFINITIONS

Any word, phrase or term of which the meaning is not absolutely clear or which will have a specific meaning assigned to it in the COP, must be clearly defined. Existing and/or known definitions should be used as far as possible. The drafting committee should avoid jargon and abbreviations that are not in common use or that have not been defined. The definitions section should also include acronyms and technical terms used.

7 RISK MANAGEMENT

- 7.1 Section 11 of the MSHA requires the employer to identify hazards, assess the health and safety risks to which employees may be exposed while they are at work, record the significant hazards identified and risks assessed.
- 7.2 The COP must address how the significant risks identified in the risk assessment process must be dealt with, having regard to the requirements of section 11(2) and (3) that, as far as reasonably practicable, attempts should first be made to eliminate the risk, thereafter to control the risk at source, thereafter to minimise the risk and thereafter, insofar as the risk remains, to provide personal protective equipment and institute a programme to monitor the risk.
- 7.3 To assist the employer with risk assessment all possible relevant information such as accident statistics, research reports, manufacturer's specifications and approvals should be obtained and considered.
- 7.4 In addition to the periodic review required by section 11(4) of the MSHA, the COP must be reviewed and updated after every ignition or explosion of flammable gas or coal dust or if significant changes are introduced to procedures, mining and ventilation layouts, mining methods, equipment and material.
- 7.5 Relevant Safety in Mines Research Advisory Committee projects must also be considered when assessing risks. (In this regard see annex 4 which is attached merely for information.)





8. ASPECTS TO BE ADDRESSED IN THE MANDATORY COP

The COP must set out how the significant risks identified and assessed in terms of the risk assessment process referred to in paragraph 7.1 will be addressed. The COP must cover at least the aspects set out below unless there is no significant risk associated with that aspect at the mine. (The COP must clearly indicate who is responsible for undertaking each task and what should be achieved. See paragraph 1.1 of Part D).

8.1 PREVENTING THE ACCUMULATION OF AN EXPLOSIVE CONCENTRATION OF FLAMMABLE GAS

The employer must ensure that a management system is in place that prevents the accumulation of an explosive concentration of flammable gas. The COP must consequently address the following:

8.1.1 Ventilation

Layout for all production sections or changes in ventilation systems must include -

- 8.1.1.1 sequence of the ventilation related work to be done and completion dates;
- 8.1.1.2 areas of the mine where there possibly might be flammable gas;
- 8.1.1.3 ventilation structures;
- 8.1.1.4 mining sequence that complements the ventilation flow;
- 8.1.1.5 air quantities, velocities and airflow patterns;
- 8.1.1.6 procedures for its approval by the employer, manager or competent person;
- 8.1.1.7 special precautions where two or more sections are situated in the same ventilation district; and
- 8.1.1.8 any other special measures to be adhered to such as the holings through and sizes of barrier pillars.

8.1.2 Mining near or through Dykes, Burnt Coal or Geological Discontinuities

Measures to ensure that the layout excavation and process conforms to the requirements stipulated in 8.1.1. In addition to the above, measures that will ensure -

- 8.1.2.1 the most appropriate mineral excavation process (explosive route or mechanical breaking);
- 8.1.2.2 availability of correct geological information;
- 8.1.2.3 the prevention of dangerous accumulations of flammable gas;
- 8.1.2.4 adequate supervision;
- 8.1.2.5 proper monitoring and control of environmental conditions; and
- 8.1.2.6 that any other special precautions required, are identified.

8.1.3. Main Fans

- 8.1.3.1 The making and keeping of records for the operation, monitoring, maintenance and inspection of main fans.
- 8.1.3.2 Measures to be taken to ensure the health and safety of persons who may be affected due to unplanned stoppages of fans.

8.1.4 Barometric Pressure

- 8.1.4.1 Monitoring and recording of the fluctuations in the barometric pressure.
- 8.1.4.2 Measures to reduce the significant risks associated with such fluctuations.



8.1.5 Secondary Mining (Top/bottom coaling or total extraction methods)

- 8.1.5.1 Ventilation system to include aspects required by 8.1.1.
- 8.1.5.2 The system for the ventilation of goafs and bleeder roads.

8.1.6 Intake, Return Airways and Belt Roads

- 8.1.6.1 Measures to ensure that intake, return airways and belt roads remain unrestricted, accessible and that safe roof and side wall conditions prevail.
- 8.1.6.2 Measures to ensure that air velocities prevent dangerous accumulations (explosive concentrations) of flammable gas from coal and other sources and dust from becoming airborne; and

8.1.7 Other Areas

Measures for the ventilation of underground dams, sealing of abandoned areas, seals, workshops, substations, transformers, pump stations, staple pits, shaft bottoms, boxholes, underground and surface bunkers and ancillary workings to conform to the requirements of 8.1.1.

8.1.8 Sealing of abandoned areas

- 8.1.8.1 Measures to ensure that, where workings of the mine are abandoned for any reason, they remain ventilated to prevent a build up of an explosive concentration of flammable gas, or are sealed off.
- 8.1.8.2 Measures to ensure that the planning and maintaining of ventilation, tests for flammable gas and stone dusting as per COP are conducted up until final sealing has been completed.
- 8.1.8.3 Measures to ensure the removal of conductors, bonding straps in boreholes and shafts. In the case of boreholes the removal of casings and plugging thereof as well as the record keeping of the above in a book provided for the purpose.

8.1.9 Choice and type of walls/seals

- 8.1.9.1 Measures to ensure that containment walls built for the purpose of containment of flammable gas are installed with means for the monitoring of the atmosphere behind such walls.
- 8.1.9.2 Measures to address the risk posed by walls/seals built before the coming into effect of this guideline.
- 8.1.9.3 Measures to ensure that explosive proof seals are used where the atmosphere of sealed areas stabilises within the explosive range or takes a long time to do so or remains in the explosive range for a long period.
- 8.1.9.4 Measures to ensure safe working conditions for employees working near abandoned areas.

8.1.10 Opening of old areas

The employer must establish a system for monitoring and evaluating the atmospheric conditions and other relevant parameters for the re-opening of old areas.





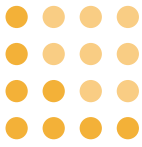
8.2 PROVIDING FOR THE EARLY DETECTION OF FLAMMABLE GAS

- 8.2.1 An appropriate gas testing and gas monitoring strategy including the type/s of instruments to be used.
- 8.2.2 A procedure that ensures that employees are competent to test for flammable gas and dangerous accumulations of any explosive mixture of flammable gases.
- 8.2.3 The compliance of all devices and measuring instruments used for the detection and measurements of flammable gases with the OEM specification.
- 8.2.4 Maintenance, calibration and record keeping in respect of gas testing monitoring systems/instruments.
- 8.2.5 Users pre-use tests and checks of the flammable gas warning and measuring instruments, including on-board monitoring devices, by users in accordance with a procedure drawn up by the employer.
- 8.2.6 Testing for the presence of flammable gas or dangerous accumulations of any explosive mixtures of flammable gases, frequency, responsible persons and localities.
- 8.2.7 Procedures to be followed if flammable gas is detected and for the clearance thereof.
- 8.2.8 Procedures for the determining of sufficient numbers of gas detection instruments.

8.3 PREVENTING THE IGNITION OF FLAMMABLE GAS

Measures to prevent frictional ignitions

- 8.3.1 The method and procedure for the examination and changing of cutter picks.
- 8.3.2 Measures to ensure a continuous flow rate and pressure of water supply to a mechanical miner.
- 8.3.4 Measures to be applied for minimising the risk of ignitions from occurring during goafing where total extraction takes place.
- 8.3.5 Where a mechanical miner is used, excluding shearers employed in wall mining, a system to ensure that a mechanical miner will not ignite flammable gas, and that includes user pre-use checks, operational checks, maintenance programmes, and any other means of preventing a frictional ignition.
- 8.3.6 Measures to ensure that the use of electricity or electrical equipment does not create the risk of igniting flammable gas.
- 8.3.7 Where lightning could ignite flammable gas, compliance with SABS specification 0313 is required.
- 8.3.8 Where spontaneous combustion could ignite flammable gas, measures for the inspection and monitoring of abandoned areas and atmospheres behind seals must be stipulated.



- 8.3.9 Measures to ensure that the use of explosives does not create the risk of igniting flammable gas.
- 8.3.10 Measures to prevent contraband from being taken underground.
- 8.3.11 Measures to ensure that any welding, flame cutting, flame heating, grinding, vulcanising, soldering, pick sharpening, photography video or audio taping will not ignite flammable gas or any explosive mixture of flammable gas.
- 8.3.12 Measures to prevent holing into any area which may contain a dangerous accumulation of flammable gas.
- 8.3.13 Where flammable gas could enter the workings under pressure, measures to prevent the ignition of such gas.

8.4 LIMITING THE FORMATION AND DISPERSION OF COAL DUST

- 8.4.1 Measures to ensure the limiting of formation of coal dust at coal mining faces, conveyor and transfer points and tramming routes.
- 8.4.2 Measures to ensure the regular clean up and removal of coal accumulations in face areas before stone dust applications, conveyor belt roads, transfer points, travelling roads, return airways and equipment.

8.5 INERTISATION OF COAL DUST

8.5.1 Degree of Inertisation

Measures to ensure that the following minimum levels of inertisation are adhered to:

- 8.5.1.1 Inbye of the face area, intake airways must be maintained at a minimum percentage by mass of incombustible matter content of 80%.
- 8.5.1.2 Outbye the face area, intake airways must be maintained at a minimum of 65% incombustible matter content. Workshops, sub-stations, battery charging stations and other similar places where work is done or equipment is maintained, situated in intake air must nevertheless be maintained at a minimum of 80% incombustible matter content.
- 8.5.1.3 In return airways a minimum percentage by mass of incombustible matter content of 80% must be maintained up to a minimum distance of 1000 m from the face. Beyond this distance, a minimum percentage by mass of incombustible matter content of 65% must be maintained. Where barriers are installed, the incombustible matter content by mass, outbye the face area and outbye of the barriers must be maintained at not less than 65%.
- 8.5.1.4 All accessible roads within 250m radius from areas in the process of being sealed off, must contain a minimum percentage by mass of incombustible matter content of 80%, unless the area has been sealed off with explosion proof seals, or other seals as determined by the risk assessment.
- 8.5.1.5 In conveyor roads a minimum percentage by mass of incombustible matter content of 80% must be maintained up to a minimum distance of 180m from the face. Beyond this distance, a minimum percentage by mass of incombustible content of 65%. The installation of stone dust/water barriers is mandatory.





8.5.1.6 Before any area is sealed off, the roof, sides and floor, as far as reasonably practicable, must be stone dusted to ensure a minimum percentage by mass of incombustible matter content of 80%.

8.5.2 Inertisation of coal dust by the use of water

Where it is proposed that water be used to inertise coal dust, the following must be specified-

8.5.2.1 the areas of the mine to be treated by this method;

8.5.2.2 the method of applying water;

8.5.2.3 the frequency of application;

8.5.2.4 methods for the determination that sufficient water has been applied; and

8.5.2.5 responsible persons to ensure that these requirements are adhered to.

8.5.3 Inertisation of Coal Dust by the Application of Stone Dust

Measures to ensure that the suppliers of stone dust comply with the following minimum quality requirements -

8.5.3.1 stone dust must preferably be pulverized limestone or dolomite and light in colour;

8.5.3.2 it contains not less than 95% by mass of incombustible matter, and with a density similar or equal to pulverised limestone;

8.5.3.3 it contains not more than 5% by mass of free silica, or any other toxic substance in concentrations detrimental to health;

8.5.3.4 it is of such fineness that, when dry, all will pass through a sieve of 600 micrometers aperture and at least 50% by mass through a sieve of 75 micrometers aperture;

8.5.3.5 unless directly wetted by water, it does not cake and will readily disperse into the air;

8.5.3.6 test each batch delivered and issue a certificate showing the results of these; and

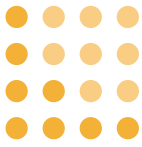
8.5.3.7 should any other incombustible dust be used, compliance with the ability to stop flame propagation of a coal dust explosion must be tested and approved for use at a SANAS accredited institution.

8.5.4 Extent of stone dust application

Measures to ensure that the underground workings of a bituminous coal mine are protected by the application of stone dust within 10m from all the working faces, unless such workings are-

8.5.4.1 inaccessible, unsafe to enter; or

8.5.4.2 extend to the face from and including the last through road, in which the coal dust has been washed from the roof and sides and the floor is too wet to propagate an explosion.



8.5.5 Frequency for the application of stone dust

Measures to ensure that the frequency of applications of stone dust adheres to the following -

8.5.5.1 Face Area

Stone dust must be applied, and re-applied, as often as is necessary, to maintain the incombustible matter content by mass at a minimum of 80%. The frequency rate of application must not be less than once in every four production shifts, unless a risk assessment, which includes rates of deposition of float coal, or other sampling indicates otherwise. This also applies to roads within the face area including roads carrying return air.

8.5.5.2 Pillar extraction operations

In pillar extraction operations, stone dust must be applied on a retreat basis at the same frequency rate as in paragraph 8.5.5.1 above.

8.5.5.3 Total extraction operations

In total extraction operations, stone dust must be injected regularly into the mined areas before the occurrence of the initial goaf, so as to inert the dust cloud that will be raised when it occurs.

8.5.5.4 Return Airways

In both longwall and shortwall mining, stone dust must be introduced, during coal winning, into the return airways.

8.6 COMPLIANCE WITH REQUIREMENTS RELATING TO SAMPLING AND ANALYSIS OF SAMPLES

Measures to ensure that the requirements set out in Annex 1 are adhered to. (Annex 1 must be complied with and incorporated in the COP).

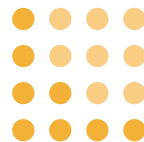
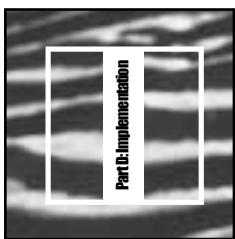
8.7 COMPLIANCE WITH REQUIREMENTS RELATING TO THE DESIGN OF BARRIERS TO PREVENT THE PROPAGATION OF COAL DUST EXPLOSIONS

Measures to ensure that stone dust/water barriers adhere to the criteria set out in Annex 2. (Annex 2 must be complied with and incorporated in the COP).

8.8 COAL DUST EXPLOSIONS IN CONFINED AREAS

The measures to prevent the accumulation and ignition of flammable gas and/or explosive mixtures of flammable gases in confined areas on surface such as beneficiation plants, silo's and bunkers must be stipulated.





PART D: IMPLEMENTATION

1. IMPLEMENTATION PLAN

- 1.1 The employer must prepare an implementation plan for the COP that makes provision for issues such as organizational structures, responsibilities of functionaries and programmes and schedules for the COP that will enable proper implementation of the COP. (A summary of, and a reference to, a comprehensive implementation plan may be included.)
- 1.2 Information may be graphically represented to facilitate easy interpretation of the data and to highlight trends for the purpose of risk assessment.

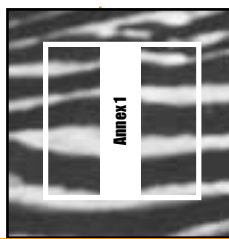
2. COMPLIANCE WITH THE COP

The employer must institute measures for monitoring and ensuring compliance with the COP.

3. ACCESS TO THE CODE AND RELATED DOCUMENTS

- 3.1 The employer must ensure that a complete COP and related documents are kept readily available at the mine for examination by any affected person.
- 3.2 A registered trade union with members at the mine, or where there is no such union, a health and safety representative on the mine, or if there is no health and safety representative, an employee representing the employees on the mine, must be provided with a copy on written request to the employer. A register must be kept of such persons or institutions with copies to facilitate updating of such copies.
- 3.3 The employer must ensure that all employees are fully conversant with those sections of the COP relevant to their respective areas of responsibility.





ANNEX 1

(THIS ANNEX MUST BE COMPLIED WITH AND INCORPORATED IN THE COP)

COMPLIANCE SAMPLING AND ANALYSIS OF SAMPLES

1. STONE DUST SAMPLING PROGRAMS

A sampling program that will ensure compliance with the requirements of incombustible matter content and the taking of samples must be set out as follows:

1.1 Compliance Sampling

- 1.1.1 samples must be systematically collected from the roads of all accessible workings of a colliery;
- 1.1.2 the workings of a colliery must be divided into the face areas and zoned back areas and these areas must be clearly demarcated on a plan;
- 1.1.3 the sample of the dust on the roof and sides must be taken separately from the sample of dust on the floor;
- 1.1.4 in the case of dust on the roof and sides the sample must be taken to a depth not exceeding 6 mm and in the case of dust on the floor to a depth not exceeding 25 mm;
- 1.1.5 every sample taken must be representative of the whole surface of the roof and sides as well as the floor of the length of road being sampled and must be collected by a method of strip sampling by which the dust is collected from a succession of transverse strips, 100 mm wide and equally spaced not more than 5 m apart. Intersections must be sampled diagonally across to include a sample from at least two pillar corners;
- 1.1.6 where it appears that the roof and sides or the floor, as the case may be, is wet, the sample must nevertheless be collected. Excess water must be drained off by placing the sample on a 2 mm aperture sieve, for at least one minute; and
- 1.1.7 areas where water has collected in pools on the floor, need not be sampled but must be recorded as such.

1.2 Sampling of Face and Back Area

1.2.1 Face Area

- 1.2.1.1 Samples from face areas must be taken at intervals not exceeding 14 working days, or at lesser intervals, if so determined by risk assessment.
- 1.2.1.2 In the face area, a composite sample must consist of the combined material, collected from 5 equally spaced transverse strips (except where measurements are affected by diagonal sampling at intersections), over a measured distance of 20 m. The dust on the roof and sides must be taken separately from the samples of dust on the floor and the two sets of results reported separately.

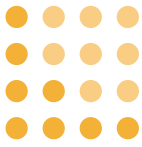




- 1.2.1.3 A series of 3 composite samples must be collected from all return airways, the belt road, and at least one intake airway, over a distance not less than 60 m length of roadway, commencing at a location approximately 15 m from the face. Similarly, a series of composite samples must be collected over the full length of the last through road.
- 1.2.1.4 In the case of either longwall or shortwall mining, a series of 5 composite samples must be collected from all gate roads over a distance of not less than 100m length of roadway, commencing at the face.
- 1.2.2 Back Area Requirements -
 - 1.2.2.1 The workings of a colliery outbye of the face area must be divided into zones not exceeding 1200 m in length. These zones must further be divided into sub-zones, not exceeding 100 m in length, from which representative samples must be taken at intervals not exceeding 30 days.
 - 1.2.2.2 In the back area a composite sample must consist of the combined material collected from 11 equally spaced transverse strips (except where measurements are affected by diagonal sampling at intersections) over a measured distance of 100 m. Samples from the roof and sides should be treated separately from those obtained from the floor.
 - 1.2.2.3 Samples from sub-zones must comprise of composite samples taken from at least one return airway, the belt road and one other intake airway.
 - 1.2.2.4 Sampling of zones must be scheduled so that each sub-zone is sampled at least once per year.

2. Analysis Samples

- 2.1 Samples must be analysed by either the colourimetric method or by a laboratory determination of mass of incombustible matter, or by both methods. Samples may also be analysed using a portable stonedust analyser. Only laboratories accredited by SANAS and analysers approved by a certification body accredited by SANAS may be used for these purposes.
- 2.2 Dust collected at a mine must without delay be processed and the incombustible matter content of the samples determined. Descriptions of the two methods are set out in 2.2.1 and 2.2.4 below -
 - 2.2.1 Colourimetric Method
 - (a) analysing of samples by using the colourimetric method can be done on surface or underground. In both cases the method described remains the same. For the underground option drying facilities and adequate lighting must be provided. This option evaluates the degree of inertisation in the shortest possible time, permitting immediate remedial action. (Moisture correction is not considered in this option);
 - (b) the colour of a sample of dust must be compared with that of a scientifically prepared standard colour sample, known to contain eighty percent, or sixty five percent as the case may be, of incombustible matter content. When on such comparison, the colour of the sample is found to be the same colour or lighter than that of the standard sample, the incombustible matter content in the dust must be taken to comply with the prescribed percentage of the total incombustible matter content;



- (c) any sample that appears to be below the prescribed percentage of incombustible matter content must be analysed using the laboratory method described below; and
- (d) in addition to (c) above, at least ten percent of the remaining samples must be analysed using the laboratory method.

2.2.2 A separate standard colour sample must be prepared for each geographical/working area of a mine in the following manner -

- (a) grind some dry coal dust from the seam in each area for which the standard colour sample is being prepared so that it passes through a 250 micrometers sieve;
- (b) determine the ash content of the sieved coal dust. The ash content must not exceed 20 percent by mass on a dry basis;
- (c) pass through a 250 micrometers sieve some dry stone dust of the type used in the mine;
- (d) weigh quantities of the sieved coal dust and sieved stone dust in proportions that will give the desired incombustible matter content i.e. 65% and 80%;
- (e) mix the dust thoroughly by stirring, shaking or rolling but do not grind the mixture;
- (f) using the approved laboratory method, determine the incombustible matter content of the mixture and verify that it is not less than the required;
- (g) whenever there is change in the colour/reflectivity of the stone dust supplied to the mine, and whenever the colour of the coal seam changes distinctly, new standard samples must be prepared; and
- (h) at intervals of not more than 3 months, re-test the standard and keep a record of the results of these tests. If the standard has an incombustible matter content which is less than that required, replace the standard with a new one.

2.2.3 The procedure for the preparation and evaluation of collected dust samples is as follows -

2.2.3.1 split the sample and retain one half of the sample, if required, for laboratory analysis. Air-dry the portion to be compared if necessary. Sieve the sample through a 250 micrometers sieve and mix the sample thoroughly but do not grind it.

2.2.3.2 compare the colour of the mixed sieved sample with that of the standard colour sample. The comparison must be made under good and even illumination. When conditions permit, and if by choice, this comparison is done underground, it must take place at a designated site. The comparison must be done in a suitably designed light box. The person performing this duty must be trained to prepare the samples and to conduct the colourimetric test. Furthermore, his ability to distinguish between the colour ranges, must have been determined.

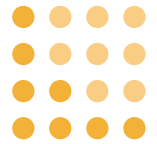
2.2.3.3 if any sample fails the comparison test, this must be reported without delay to the employer who must ensure that the area concerned is properly inertised timeously.

2.2.4 Laboratory Method

Analysis of samples in a laboratory must be carried out by the following method or by other methods approved by the laboratory concerned -

2.2.4.1 the residue of a weighed quantity of dust, after that quantity has been dried at a temperature not exceeding 140°C, and the loss of mass attributable to moisture ascertained, must be heated in an open vessel to a temperature not less than 480°C, and not





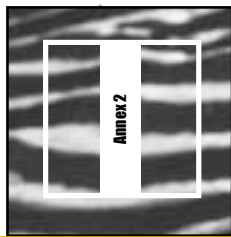
more than 520° C, until the coal is completely burnt away. The incinerated residue must be weighed;

2.2.4.2 the sum of the masses of moisture and incinerated residue must be recorded as incombustible matter and be expressed as a percentage of the total mass of the dust; and

2.2.4.3 where samples were air dried before analysis by the laboratory method, a correction may be made to the incombustible matter content of the dust sample analysed by laboratory method. The corrected total incombustible content is equal to $M + I (100 - M/100)$ where M is the percentage loss of mass during air-drying and I is the percentage of total incombustible matter in the dust as determined by the method described in the preceding paragraph.

3. Keeping of Records

- 3.1 the certificates showing the quality of stone dust supplied to the mine must be retained for two years; and
- 3.2 a record must be kept of the date, places sampled and results of the analysis of the mine dust sampling program. Failure of more than 20% of the number of samples of a given area is unacceptable and requires immediate remedial action, which must be reflected in the record referred to in 3.1.



ANNEX 2

(THIS ANNEX MUST BE COMPLIED WITH AND INCORPORATED IN THE COP)

DESIGN, INSTALLATION, MAINTENANCE AND MONITORING OF BARRIERS TO PREVENT THE PROPAGATION OF COAL DUST EXPLOSIONS

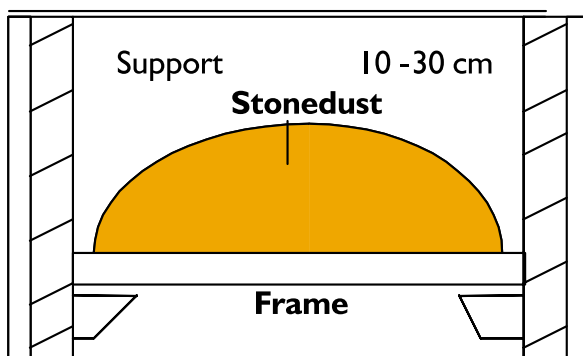
1. STONE DUST BARRIER

1.1. Construction of Stone Dust Barriers

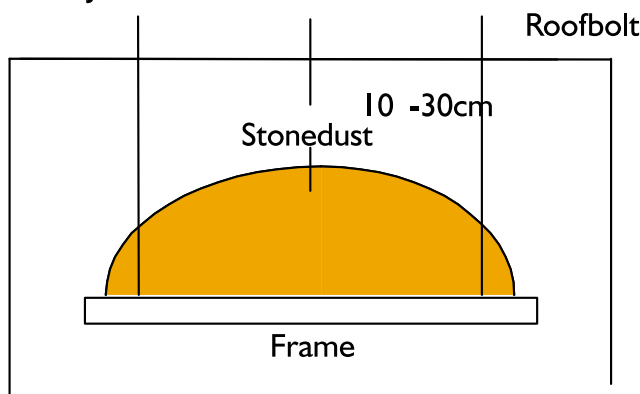
Stone dust barriers referred to as the Polish design are constructed as detailed below:-

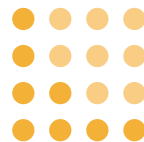
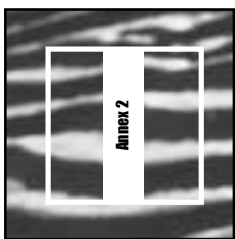
- 1.1.1 Shelves consisting of loose, lightweight boards are placed on a frame, which is supported by suitable means. Frames must be installed horizontally in such a manner that the shelves will be readily displaced by the pressure wave.

I. TIMBER/PROP SUPPORT



2. ADJUSTABLE BRACKET FROM ROOFBOLT





- 1.1.2 The shelves must be installed as close as possible to the roof and sides, so that the apex of the stone dust on the shelf must be within 30 cm, but not closer than 10 cm, from the roof.
- 1.1.3 The height of the frame, supporting the boards, must be at least 20 cm and the width must not be more than 30cm.
- 1.1.4 Lightly loaded shelves must be not more than 40 cm wide with a load of approximately 30 kg per meter of shelf length. (Average pyramidical height of 14 cm).
- 1.1.5 Heavily loaded shelves must be not more than 50 cm wide with a load of approximately 60 kg per meter of shelf length. (Average pyramidical height of 20 cm).

1.2 Types of Stone Dust Barrier

The two types of stone dust barriers are referred to as light and heavy.

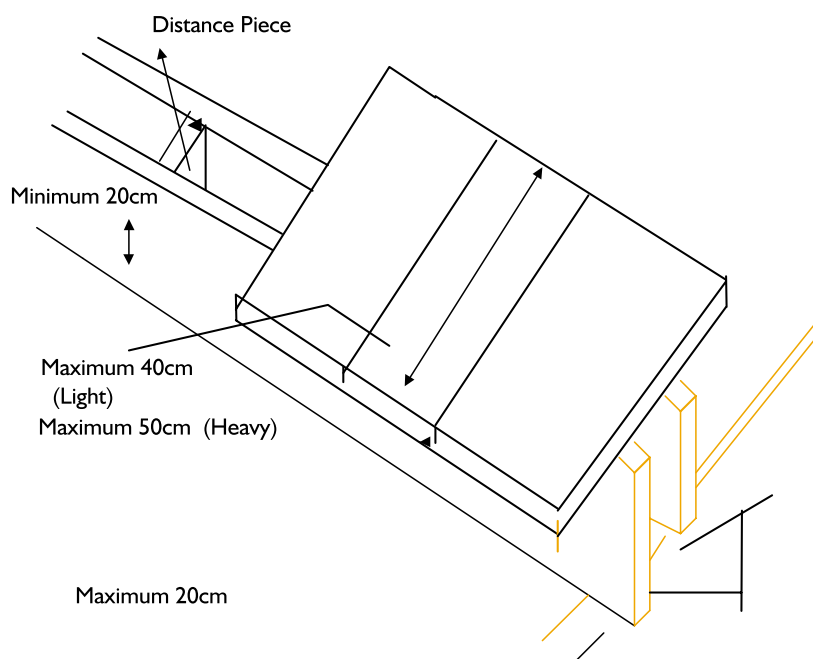
1.2.1 Light Barriers

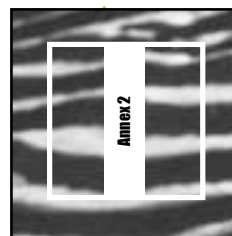
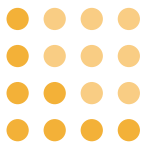
Loading of 100 kg of stone dust per square meter of roadway. Each self must carry 180 kg. Spacing between each must be not nearer than 1,5 m and not more than 2 m apart.

1.2.2 Heavy Barriers

Loading of 400 kg of stone dust per square meter of roadway. Heavy barriers contain one-third light shelves (180 kg) and two-thirds heavily loaded shelves. Shelves are to be spaced not closer than 1,5 m and not more than 2,0 m apart.

1.3 Siting of Stone Dust Barriers





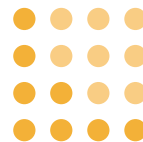
- 1.3.1 Conveyor Belt Road: A barrier must be provided in every production section in the road carrying a conveyor belt. Either a light barrier or a heavy barrier must be used.
- 1.3.2 Light barriers must be sited not closer than 80m and not further than 180m from the last through road.
- 1.3.3 Heavy barriers must be sited not closer than 120m and not further than 360m from the last through road.
- 1.3.4 Single Entries: Every single entry must be protected with a barrier, in exactly the same way as for conveyor roads.
- 1.3.5 Return Airways : Return airways must be protected by either high levels of incombustible matter i.e. a minimum of 80% incombustible matter content for the first 1000m outbye of the face or by a light barrier, not closer than 80m and not further than 180m from the last through road. Outbye of the face area, the minimum incombustible matter could then be reduced to 65%.

2. WATER BARRIERS

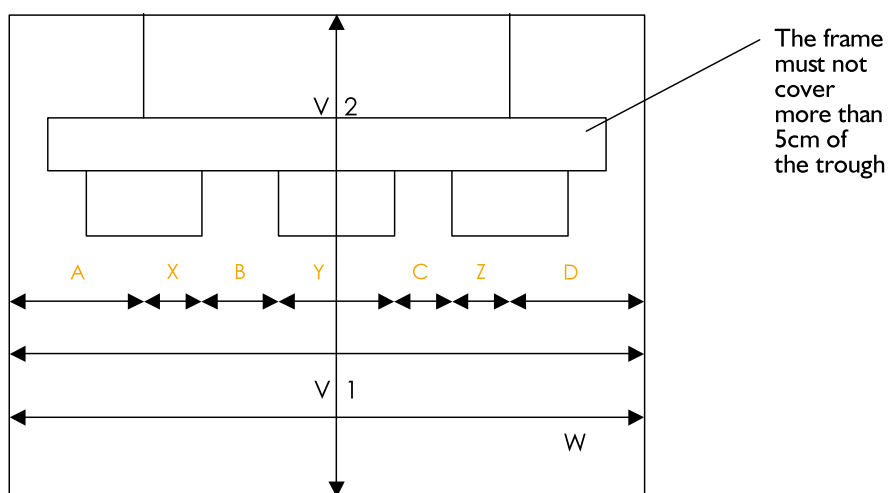
2.1 The use of water barriers

- 2.1.1 The use of concentrated water barriers is an alternative to employing stone dust barriers or bagged stone dust barriers.
- 2.1.2 The minimum quantity of water must be 200l/m^2 of cross sectional roadway area or 5l/m^2 of roadway volume over the length of the barrier, whichever is the largest. The distance between the first and last row of troughs must be at least 20m but not more than 40m.
- 2.1.3 All troughs must be fitted with lids to prevent ingress of foreign material and minimise evaporation. Troughs and lids must be constructed from a material of such composition as to be readily shattered by the action of the pressure wave . The minimum quantity of water for large troughs (90 litres capacity) must be 80 litres and for small troughs (45 litres capacity) 40 litres. An indication must be provided to show the minimum water level in the trough.
- 2.1.4 Troughs should be placed with the longer sides of the trough at the right angles to the line of the roadway. Exceptionally, one trough in a group may be placed longitudinally. The design of troughs further require that:
 - 2.1.4.1 The troughs remain serviceable for as long as possible under the effect of heat,
 - 2.1.4.2 The water contained in the troughs is released and dispersed under the effects of the dynamic blast pressure of the explosion;
 - 2.1.4.3 The trough material is flame resistant to a defined flame application. It must not continue to burn independently after removal of the flame;
 - 2.1.4.4 The material must not allow any static electrical charge, capable of igniting mixtures of air and flammable gas, or firing electrical detonators, to build up or be discharged from the surface of the trough; and
 - 2.1.4.5 The composition of the material in normal use will not have characteristics detrimental to health.

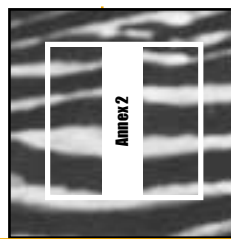




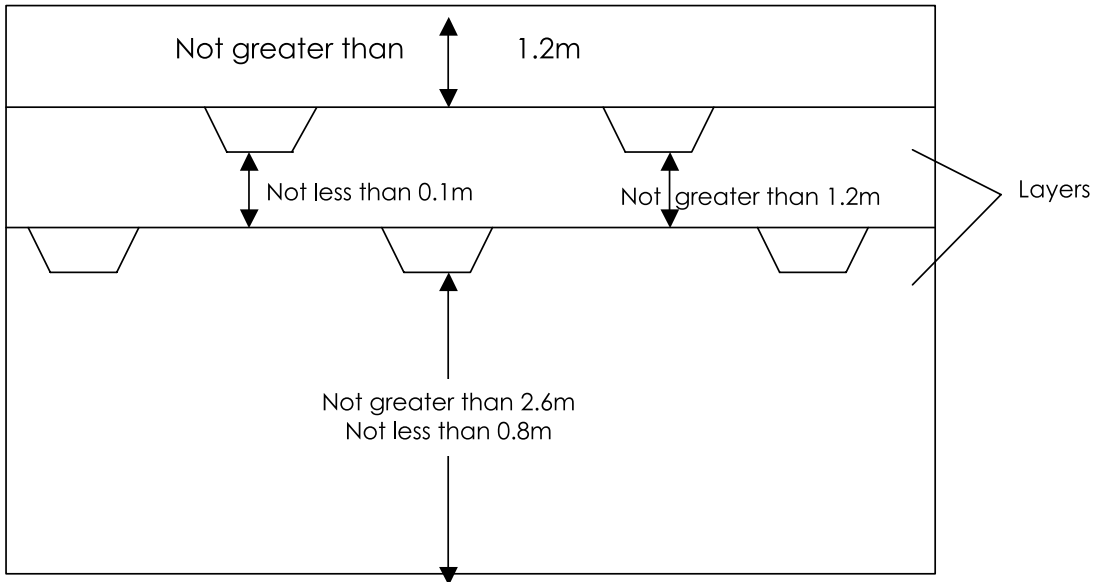
- 2.1.5 Troughs may be suspended from the roadway support or mounted on equipment within the roadway. The sides of any troughs inside or mounted on cross-members of frames must not have more than 5cm of their height covered by such cross-members. Where troughs are mounted on equipment, a form of retaining lip must be provided which must be not less than 3cm.
- 2.1.6 With reference to the sketch below, the following is applicable when troughs are installed in a single layer:



- 2.1.6.1 For roadways up to 10m^2 , $X + Y + Z$ must cover at least 35% of W .
- 2.1.6.2. For roadways up to 15m^2 , $X + Y + Z$ must cover at least 50% of W .
- 2.1.6.3 For roadways in excess of 15m^2 $X + Y + Z$ must cover at least 65% of W .
- 2.1.6.4 Distance of A or B or C or D must not exceed 1,2m.
- 2.1.6.5 The total distance of $A + B + C + D$ etc must not exceed 1,5m.
- 2.1.6.6 Distance $V1$ must not be less than 0,8m and must not exceed 2,6m.
- 2.1.6.7 Distance $V2$ should not exceed 1,2m. Whenever this distance is exceeded, additional troughs must be placed above and they may be in excess of 2,6m above floor level, but there should not be more than 1,2m between the base of layers of troughs.



2.1.7 Where more than one layer of troughs is required the following will apply -



2.1.7.1 When troughs are arranged in rows less than 1,2 m apart, measured along the roadway, troughs in one row must not conceal troughs in the adjacent row from the blast effect.

2.1.7.2 No trough must have any part sheltered from the effect of a blast wave by a rigid installation in the roadway.

2.1.7.3 In circumstances where the dispersion of water over the cross sectional area of the roadway might be obstructed by equipment, additional troughs must be installed to improve distribution.

2.2 Siting of Water Barriers

2.2.1 Conveyor Belt Roads

A barrier must be provided in every production section in the road carrying a conveyor belt. The barrier must not be sited closer than 120m and not further than 360m from the last through road.

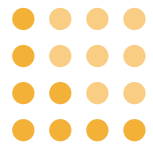
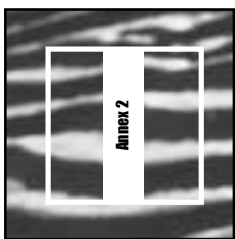
2.2.2 Single Entries

Every single entry must be protected with a barrier, sited as above.

2.2.3 Return Airways

Unless the incombustible matter content by mass of the dust is maintained at a minimum of 80% up to 1000m from the face, a barrier must be provided in each road carrying return air. The barrier must be installed not closer than 120m and not more than 360m from the last through road.





3. Bagged Stone Dust Barriers

3.1 The Use Of Bagged Stone Dust Barriers

The use of bagged stone dust barriers is an alternative to employing stone dust barriers or water barriers.

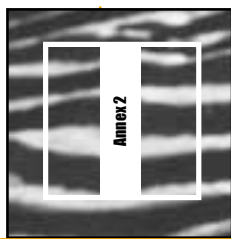
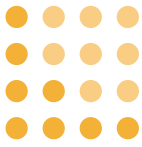
3.2 Minimum Requirements of Bagged Barriers:

- 3.2.1 Each plastic bag must contain either 5 kg for low seams or 6 kg for high seams of dry stone dust complying with the specifications specified previously.
- 3.2.2 The quality, hook and ring as well as the rupture characteristics of the plastic bags used in bagged stone dust barriers must comply to the specifications of the products tested at the GP Badenhorst research facility. Documentary evidence as to the source and quality at each batch of bags purchased must be kept at the mine.
- 3.2.3 COPs must detail how the bags are to be closed so as to exude water when bags are installed in barriers underground.
- 3.2.4 COPs must clearly specify how the bags are to be suspended below the roadway roof. The system must ensure that the vertical distance between suspended bags and the roof, and the horizontal distance between bags and between the outer bags and side-walls, are to be maintained at all times.

3.3 Construction of Bagged Stone Dust Barriers

The following requirements on the construction of a bagged stone dust barrier apply -

- 3.3.1 The horizontal distance between the hooks of the bags on a plane must be not less than 0,4 m and not greater than 1,0m when measured across the roadway width. The actual distances are determined by the total mass of stone dust that needs to be incorporated into a barrier which is itself determined by the roadway dimensions. To cover a range of workings heights, the following requirements apply -
 - (a) for roads in the height range of less than 3,0 m, each row must have a single level of bags suspended below the roof;
 - (b) for roads in the height range 3,0 m to 3,5 m, each row must have a single level of bags suspended not more than 0,5 m below the roof;
 - (c) for roads in the height range 3,5 m to 4,5 m, each row must have two levels of bags suspended at approximately 3,0 m and 4,0 m above floor level;
 - (d) for roads in the height range of more than 4,5 m but less than 6,0 m, each row must have three levels of bags suspended at approximately 3,0 m, 4,0 m and 5,0 m above floor level;
 - (e) the distance between the bags and the side of the pillar must not be nearer than 0,5m and not further than 1,0m.
 - (f) the distance measured along the road between rows of bags within the barrier must be not less than 1,5 m and not greater than 3,0m;



- (g) If MA is the mass of stone dust based on cross-sectional area and MV is the mass based on volume, then MA must be at least 100 kg per square meter of cross-section area and MA must be at least 1 kg of stone dust per cubic meter of roadway volume; and
- (h) the total mass of stone dust to be used in a barrier must be based on the greater of MA and MV.

3.4 Layout of the Stone Dust Barrier

A full-bagged stone dust barrier must consist of four sub-barriers installed over a minimum distance of 100 meters of continuous roadway. Three complete sub-barriers must be in position at all times, while the fourth sub-barrier may be in the process of being moved ahead as the section advances. The following distances must be maintained -

- 3.4.1 the first sub-barrier, closest to the last road, must not be installed closer than 60m and not further than 120m from the last through road;
- 3.4.2 the fourth sub-barrier, furthest from the last through road, must be installed not more than 120 meters from the first sub-barrier;
- 3.4.3 the two intermediate sub-barriers must be equidistant between the first and fourth sub-barriers;
- 3.4.4 the presence of splits must be ignored in determining distances; and
- 3.4.5 the maximum distance between sub-barriers must not exceed 30 meters.

3.5. Siting of Bagged Stone Dust Barriers

3.5.1 Conveyor Belt Roads.

A barrier must be provided in every production section in the road carrying a conveyor belt.

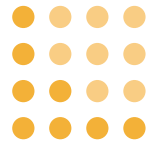
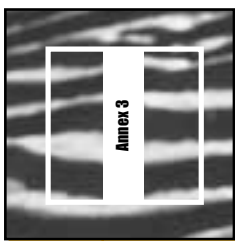
3.5.2 Single Entries

Every single entry must be protected with a barrier the same as per conveyor belt roads.

3.5.3 Return Airways

Must be protected either by high level of incombustible matter (80%) for the first 1000m out by of the face or by a barrier.



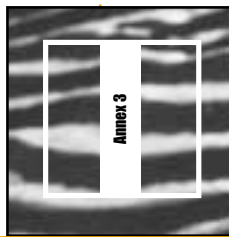


ANNEX 3

REFERENCES

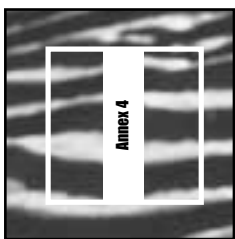
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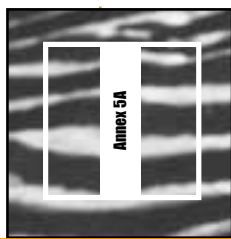
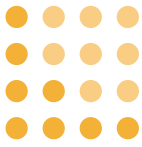


ANNEX 4

RELEVANT SIMRAC REPORTS (FOR INFORMATION ONLY)

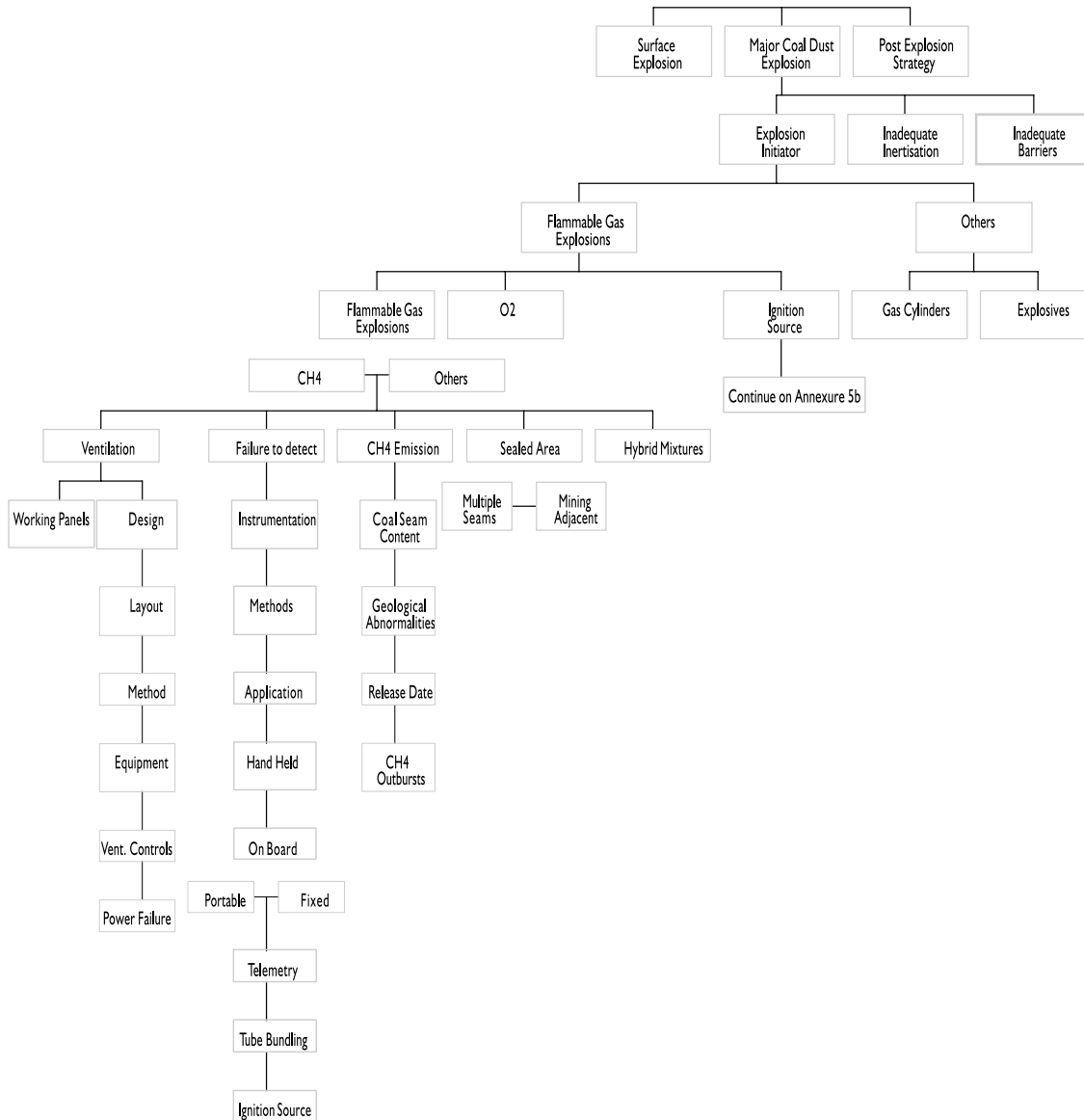
COL010	Assessment of Explosion Barriers
COL027HB	Handbook to reduce the exposure of workers to dust
COL027ES	Reduction of Worker Exposure to Dust in Collieries
COL029a	Improving underground ventilation conditions in coal mines
COL031	Prevention, detection & control of underground fires in coal mines
COL104	Simulation of coal dust explosions
COL115	Assessment of the design of refuge bays in coal mines
COL116	The suitability of using jet fans to ventilate CM miner headings in collieries
COL226	Identify methods to reduce the risks of frictional ignition hazards
COL236	Assessment of dispersed barrier systems
COL310	Design scrubber systems to enhance dust capture efficiency
COL322	Systems to limit coal dust and methane explosions in collieries
COL431	Training aids to assist employees to recognise frictional ignition hazards
COL443	Alternative inerting materials for coal mine explosions
COL446	Expand and enhance the use of stone dust barriers for different conditions
COL465	Determination frictional resistance factors for bord and pillar coal mines
COL467	Reduction of risks due to dust generation on strip mine haul roads
COL501	To test dispersed stonedust barriers for effectiveness in bord and pillar
COL502	The design, construction and testing of underground seals
COL518	Mechanical Miner Environmental Control.





ANNEX 5A

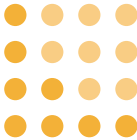
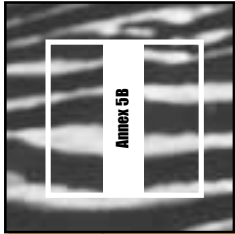
**FAULT TREE SHOWING MECHANISMS OF A COAL DUST EXPLOSION
THIS ANNEX IS FOR INFORMATION ONLY.**



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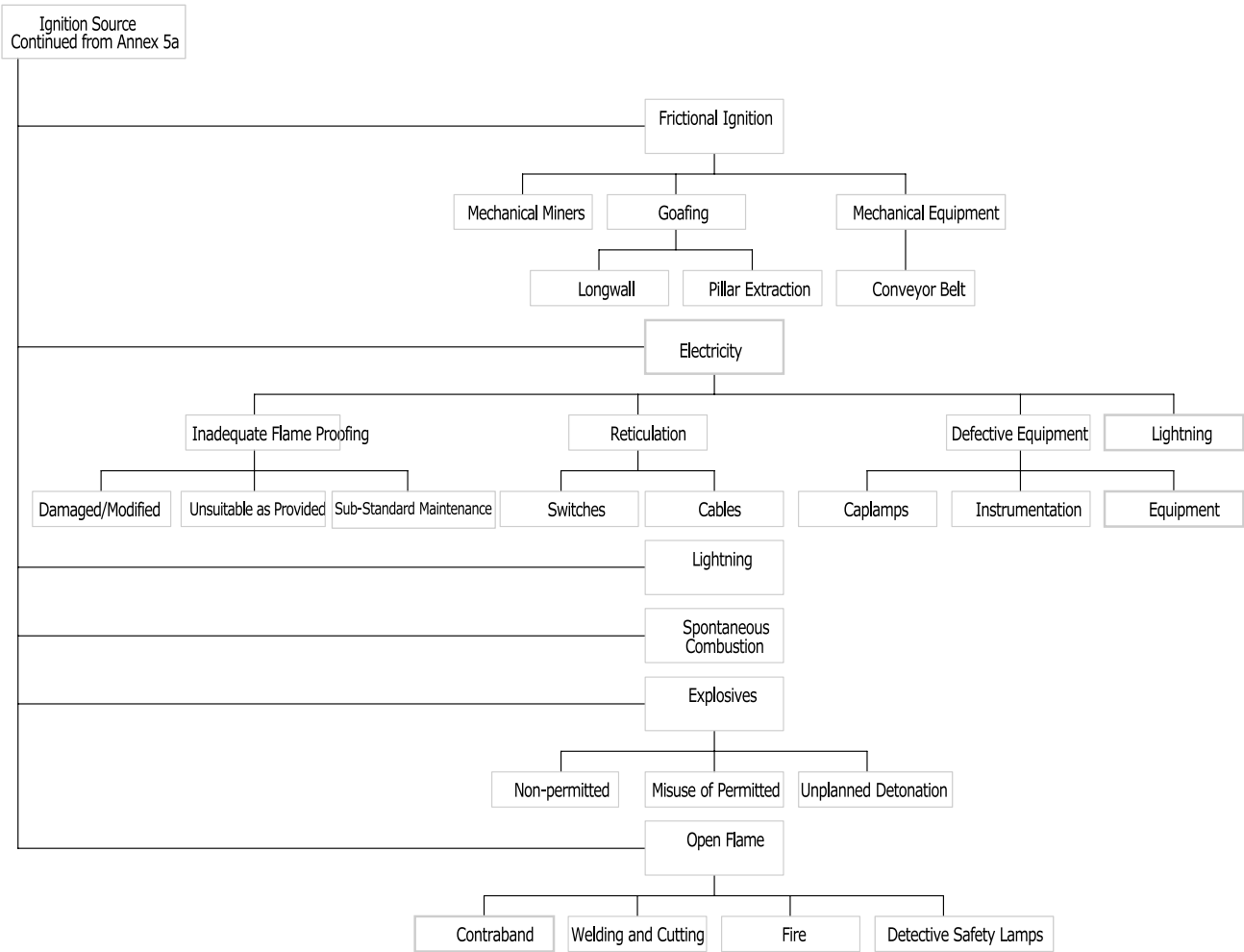
ANNEX 5A





ANNEX 5B

FAULT TREE SHOWING MECHANISHMS OF A COAL DUST EXPOSITION THIS ANNEX IS FOR INFORMATION ONLY





DEPARTMENT OF MINERALS AND ENERGY