

MANDATORY CODE OF PRACTICE FOR THE PREVENTION OF FLAMMABLE GAS EXPLOSIONS IN MINES OTHER THAN COAL MINES

VOH-COP-007

Version: 8

**This Code of Practice is Drawn Up in Accordance with DMRE Guideline 16/3/2/4-B5
(cross referenced to DMR 16/3/2/4-A6 & DME 16/3/2/1-A2) Issued by the Chief
Inspector of Mines**

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1. PURPOSE.

To implement and maintain a Prevention of Flammable Gas programme at Black Mountain Mine to protect the health and safety of employees.

2. SCOPE.

This Code of Practice applies to Black Mountain Mine

3. STATUS OF CODE OF PRACTICE.

- 3.1 The mandatory COP was drawn up in accordance with DMRE Guideline 16/3/2/4-B5 (cross referenced to DMR 16/3/2/4-A6 and DME 16/3/2/1-A2) issued by the Chief Inspector of Mines.
- 3.2 This is a mandatory COP in terms of Sections 9(2) & 9(3) of the MHSA.
- 3.3 The COP may be used in an accident investigation/inquiry to ascertain compliance and to establish whether the COP is effective and fit for purpose.
- 3.4 The COP supersedes all previous relevant COP's.
- 3.5 All managerial instructions, recommended procedures (voluntary COP's) and standards on the prevention of flammable gas explosions must comply with the COP and must be reviewed to ensure compliance.

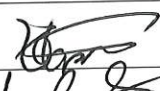
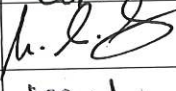
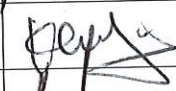
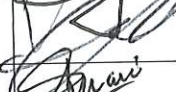
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4. MEMBERS OF THE DRAFTING/REVIEW COMMITTEE.

4.1 In terms of Section 9(4) of the MHSA the employer must consult with the health and safety committee and any other affected parties on the preparation, implementation or revision of this COP.

4.2 I, **Xolani Qamata (4.1 Appointee)**, hereby appointed the members as listed below on the drafting/reviewing committee for this COP.

4.3 Members of the Drafting/Review Committee:

NAME	DESIGNATION	QUALIFICATION	AFFILIATION	EXPERIENCE	SIGNATURE
Charles Klopper	VOH Manager	Cert in Mine Environmental Control	Mine Ventilation Society (MVS)	25 years	
Marius Magerman	Sectional Ventilation Officer	Cert in Mine Environmental Control	Mine Ventilation Society (MVS)	17 years	
Kotishi Mamosebo	Mining Manager	MMC	SANIRE	34 years	
Ishmael Mawasha	Section Manager: Mining	BTech Min, MO, MMCC		10 years	
Werner Carsten	Mine Overseer	Mine Overseer Certificate		23 years	
Francois van den Heever	Mine Overseer	Mine Overseer Certificate		17 years	
Edwin Matlapeng	Safety Manager	B-Tech Safety Management	IOSM	30 years	
Mbongani Mkheto	NUM Health & safety	Operator	NUM	16 years	
Erich Katzke	Training Manager	MSC HCM		32 years	
Llewellyn Barry	Full Time Health & Safety Rep	COMSOC 1 & 2		9 years	
Wendell Freeman	Full Time Health & Safety Rep	COMSOC 1 & 2 SAMTRAC		17 years	
Gary Ephraim	Commercial Manager	CIPS		29 years	
Lance Williamson	Engineering Manager	MSc (Eng) Mech and GCC		31 years	
Shane Links	Section Engineering	GCC		13 years	
Jacques Behr	Survey Manager	Mine Surveyor's Certificate of Competency		26 years	
Garth Boersma	HR Manager	P.G. Dip Management		28 years	

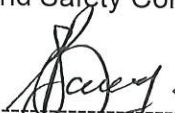
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Signed for and on behalf of the Joint Health and Safety Committee:

Llewellyn Barry

Name


Signature

22/04/2022
Date

W Freeman

Name


Signature

06/05/2022
Date

Approved: X Qamata – General Manager (4.1 Appointee)

Signature:



Date:

16/05/2022

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5. GENERAL INFORMATION.

5.1 MINE DESCRIPTION & LOCATION.

Black Mountain, coordinates -29.252929/18.817737, is an underground Base Metal mine situated near the town of Aggeneys, 70 km west of Pofadder and 110 km east of Springbok, consisting of the following major areas:

- Deeps section (situated 8 km west of Aggeneys)
- Swartberg section (situated 15 km west of Aggeneys)
- Concentration Plant (situated 10 km west of Aggeneys)

5.2 COMMODITIES PRODUCED.

The following main concentrates are produced at Black Mountain:

- Zinc, Lead & Copper

5.3 MINING METHODS.

Black Mountain (Deeps & Swartberg sections) is a fully mechanized mine utilizing the Cut & Fill and Blast-hole mining methods. The Processing Plant utilizes a sequential floatation process.

5.4 SYSTEMS USED AT THE MINE TO PREVENT FLAMMABLE GAS EXPLOSIONS.

5.4.1 Flammable Gas Warning Devices

Flammable gas detection/warning instruments, which comply with SANS 1515-2, are used for the early detection of flammable gas. These instruments are kept in the Lamp Room and are available for issue to the designated persons at the beginning of shift:

- The miners of Deeps stoping, development and tramming
- The miners of Swartberg stoping and development
- The miner / line supervisor of Backfill
- Ventilation and Occupational Hygiene personnel as and when required
- Raisebore operator as and when required
- Diamond drill operator as and when required
- Shaft Timbermen

All issues are recorded in the record book in the Lamp Room provided for this purpose.

5.4.2 Ventilation

Ventilation is the primary method to dilute and remove flammable gases should it be encountered.

5.4.3 Safe Declaration

Workings are examined and declared safe by a competent person (eg: miner) at the start of each shift/before work commences. The examination include testing for flammable gas and checking of ventilation.

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5.5 RELATED COPs, SOPs & OTHER DOCUMENTS.

Related COP's, SOP's and other documentation:

- Black Mountain Mining Occupational Health Baseline Risk Assessment
- VOH-COP-001 Lamp Rooms
- VOH-SOP-069 Lamp Rooms
- VOH-COP 002 Emergency Preparedness & Response
- VOH Std SS 0052: Underground areas
- BMF 039 - Monthly Blasting Schedule
- SOP 014 – Black Mountain Smoking Policy
- VOH-BMF-034 – Call-out procedure

6. TERMS & DEFINITIONS.

Abandoned area	An area in which no further mining activity is planned. It could be used as a return airway but is typically barricaded and/or sealed off to prevent inadvertent access. This definition also covers the term "old mined out areas" as per DMR instruction ref no. 11/4/4-9, dated December 2018 - Mining-related activity means activities such as further blasting, cleaning, sweeping, vamping, salvage and/or material reclamation - Inadvertent access means unplanned and/or unauthorized access
As & When Required	This COP will be reviewed and updated after every serious incident relating to the topic covered in the COP or if significant changes are introduced to procedures, mining and ventilation layouts, mining methods, plant or equipment and material
BMM	Black Mountain Mining
CIOM	Chief Inspector of Mines
Containment wall	A permanent wall designed for the purpose of isolating an area from the ventilation district
Confined space	An enclosed or partially enclosed space that is not intended or designed primarily as place of work. Due to its nature, a confined space poses particular hazards to personnel that include the potential for: - An oxygen deficient or otherwise non-breathable atmosphere - An oxygen enriched environment supportive of combustion conditions - An atmosphere that is explosive or flammable - An atmosphere that is toxic or contains harmful contaminants - Temperature levels that pose a hazard to personnel - Entrapment risks due to the nature of the confined spaces' entry and exit points - Engulfment risks due to the inrush of free-flowing solids or fluids
Contraband	Any device for the creation of any spark or flame &/or any pipe, cigar, cigarette or other than chewing tobacco, 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

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Controlled recirculation	Air from a working face or place which returns to the same working place or face under pre-determined conditions
COP	Code of Practice
Dead end	Every unused accessible end, tunnel, shaft or heading which has advanced more than twice its width or height, whichever is the greater
DMRE	Department of Mineral Resource & Energy
Electrical interlocking	An arrangement of control electrical equipment apparatuses interconnected so that their functions occur in a predetermined sequence to assure safety; this should be listed as electrical interlocking
Employee	Includes both BMM and Contractor & Business Partner employees
Employer	Black Mountain
Explosion proof seal	A seal which is designed to withstand a static pressure of 140kPa
Explosion protected apparatus	Any apparatus used in a hazardous location and selected in accordance with the guidelines as defined in the South African National Standards SANS 10108-2005, as amended. "The classification of hazardous locations and selection of apparatus for use in such locations and the Recommended Practice ARP0108-2013, Regulatory requirements for explosion protected apparatus "
Explosive range	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, Coward triangle, Le Chetallier's Rule
Flammable gas	Either methane or hydrogen or other hydrocarbons or a mixture of any gases
Flammable gas measuring instrument	Type A Instrument Flammable gas measuring instruments (FGMI) and flammable gas warning devices and instruments which comply with the South African National Standards SANS 1515-1, as amended
Flammable gas trap	Any working which is not connected at its highest point to other workings on a higher elevation than the highest point. U-tubes can also be regarded as gas traps
Flammable gas warning device	Type C Device A portable battery operated, continuous-duty device designed to give a clear audible and visible alarm, should it be placed in an atmosphere containing a concentration of flammable gas, which equals or exceeds the alarm set point The device may not have a facility allowing to turn off or disable its operation in the working place and must be able to monitor and alarm; this instrument must comply with SANS 1515-2, as amended (fixed, transport and vehicle mounted flammable gas measuring and warning sensor heads) gas measuring equipment primarily used in mines and the SANS 10108- 2013 (as amended) – regulatory requirements for explosive prevention

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General atmosphere	Any point outside a radius of 150 mm away from the source or point of issue of flammable gas
Hazardous location	Any location, where there may be a significant risk of ignition gas, dust, mist or vapour, including the following: i) For underground mines other than coal mines any location where, under normal operating conditions, there is a continuous presence of flammable gas measured at a concentration of 0.5% or more by volume of air ii) For surface mines and surface locations at all mines, any location as identified in accordance with SANS 10108, as amended. "The classification of hazardous locations and the selection of such locations"
Low point	A change in the tunnel gradient that results in a low point being created that could close the natural air path by the accumulation of broken rock or mining water
Light metal	Aluminium, magnesium, titanium and any alloy containing more than: • 15 per cent aluminium by mass of the alloy • 15 per cent aluminium, magnesium and/or titanium, taken together, by mass of the alloy, or • 6 per cent magnesium and/or titanium, taken together or separately, by mass of the alloy
MHSA	Mine Health & Safety Act, 1996 (Act No. 29 of 1996), as amended
Monitoring	The repetitive and continued observation, measurement, and observation of health &/or environmental or technical data, according to prearranged schedules, using nationally or internationally acceptable methodologies
OEM	Original Equipment Manufacturer
PPE	Personal Protective Equipment
Permanently stopped area	An area with the "footprint" of current mining operations which is intended to be stopped indefinitely, such as: • A panel which has reached its mining limit and mining operations have ceased; or • A portion of a raise line which have been worked out, but where mining operations are taking place in the vicinity and the stopped area is required as a second outlet, and/or logistics supply and/or ventilation flow
SANS	South African National Standard
Sealed area	An area which is sealed off with explosion proof seals or containment walls in accordance with this mandatory COP
Specialist flammable gas measuring instrument	An intrinsically safe instrument that indicates the presence of flammable gas in the air in the range 0-100% and is only used by a competent person in the use of the specific instrument
Temporary stopped area	An area within the "footprint" of current mining operations which is intended to be stopped for a limited period of time, such as:

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	- A panel (or other working place) which is stopped due to leads and lags, adverse environmental conditions, etc. or - A re-development end which is stopped while waiting for an adjacent panel to catch up so that holing between the two can be affected
Through ventilation	Air flow, under the influence of surface fans or designated booster fan installations (installed in such a manner to assist surface main fans)
Uncontrolled recirculation of air	When any amount of air has been delivered by a particular mechanical ventilation system, re-enters the inlet of that system
U-tubes	A working place where ventilation is returned from a higher or lower point back to the same elevation, and where there is no holing from the highest elevation to any other workings or airways above that elevation
VOH	Ventilation & Occupational Hygiene

7. RISK MANAGEMENT.

7.1 RISK ASSESSMENT.

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 and to record the significant hazards identified and risk assessed. This COP addresses how the significant risks identified in the risk assessment process are dealt with, having regard to the requirements of Section 11(2) and (3) that, as far as reasonably practicable, attempts are made to, in order of priority:

- Eliminate the risk at source
- Control the risk at source
- Minimize the risk
- Provide PPE insofar as the risk remains
- Monitor the risk via a formal programme

Types of Risk Assessments:

- Baseline Risk Assessment:** conducted to systematically identify and prioritize the risks of all the processes. It covered all the underground mining sections and workshops as well as surface areas such as the plant and main workshops. The baseline could be updated through the use of one or more of other types of risk assessments used.
- Issue Based Risk Assessments:** used to conduct a risk assessment in great / greater detail, due to the significance of the risk involved and the need for greater understanding of the causal factors. Issue-based Risk assessments can therefore be done in great variance / degree of detail and complexity – depending on the degree of risk involved.
- Continued Risk Assessments:** used to identify (usually pre-defined) hazards of a restricted and specific work area or equipment, prompting immediate action – to the point of conclusion, by the person who identified the hazard – due to significance of the risk involved. Examples are: Occupational hygiene measurements and planned surveys/inspections.

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- d) "Smart Start": Pre-task risk assessments conducted before a task is performed and recorded in a pocket-sized booklet designed specifically for that purpose.

A comprehensive Occupational Health Baseline Risk Assessment (HRA 006/14) was conducted to systematically identify and prioritize the risks of all the processes. It covered all the underground mining sections and workshops, as well as all surface workings. The baseline is updated through Continuous Risk Assessments.

The main purpose of the assessment was to comply with the relevant Occupational Health and Safety Legislation, identify and evaluate current control measures, provide recommendations for control of risks in the workplace and obtain and provide detailed information.

7.2 RELEVANT INFORMATION.

To assist with the risk assessment process all possible relevant information such as accident statistics, ergonomic studies, research reports, manufacturers specifications, approvals, design criteria and performance figures for all relevant equipment were obtained and considered.

7.3 PERIODIC REVIEW.

In addition to the periodic review required by Section 11(4) of the MHSA, the COP will be reviewed and updated after every serious incident relating to flammable gas, or if significant changes are introduced to procedures, mining and ventilation layouts, mining methods, plant or equipment and material. The periodic review will not exceed a period of three (3) years.

8. ASPECTS ADDRESSED IN THE COP.

8.1 IDENTIFICATION OF FLAMMABLE GAS SOURCES, OCCURANCES AND COMPOSITION.

The procedures for the identification of flammable gas sources, occurrences and compositions are as follows:

8.1.1 Flammable Gas: Identification and Occurrence

Attached as annexure (A), a letter from the Mine's Chief Geologist from information obtained from a thesis produced for the University of Cape Town in 1993 that no flammable gas is likely to be present in the rocks of the Aggeneys deposits.

- This information has been confirmed by the fact that since mining started in 1976 at Broken Hill / Deeps no intersection of Flammable gas has been reported despite routine measurements of same.
- From the above it can be determined that no significant risk can be identified for the intersection of Flammable gas in the workings of the mine.
- However, the Health and Safety of all employees at Black Mountain is of the utmost importance. This Code of Practice will therefore cover the procedure to be taken for the

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detection, measurement, occurrence, composition and control of flammable gas that may be intersected in the mine's workings.

The intersecting of flammable gas of significant quantities at the mine is improbable. However, should a flammable gas intersection occur, it would most likely be encountered at/during:

- 8.1.1.1 Ingress through faults and weak zones
- 8.1.1.2 Cover drilling
- 8.1.1.3 Pilot hole drilling
- 8.1.1.4 Normal shot-hole drilling
- 8.1.1.5 Occurrence of flammable gas with water
- 8.1.1.6 Blast induced fracture planes

All persons involved in the measurement and reporting of flammable gas will be made aware as to where to expect occurrences of flammable gas and are to pay particular attention to the above when measuring for flammable gas.

8.1.2 Identifying & Recording of Flammable Gas Intersections

The presence of flammable gas will be tested for by competent persons (eg: miner, shift boss, timberman, VOH official) using approved gas detection instruments. Testing includes:

- As part of safe declaration process
- During cover and pilot hole drilling
- Continually during the shift
- VOH personnel – eg: during VOH surveys

Intersections of flammable gas will be recorded in the safe declaration book by the responsible competent person (eg: miner). In addition, the type of instrument used has a recording function which can be downloaded. This downloaded information then becomes part of an exemption report generated by the GDI software.

8.1.3 Flammable Gas Intersections and Responsibilities of Competent Persons

Should the flammable gas be intersected, the area will be cleared of all personnel, demarcated and barricaded. Personnel on the return side will be notified. The shift boss and ventilation official will be notified in order to conduct a verification measurement. Ventilation controls such as the force ducting will be advanced to within 7 meters of the flammable gas source and aimed towards the hanging to prevent possible layering of gas.

Responsibilities will be as follows:

- Should Flammable gas be intersected, the Ventilation officer accompanied by the Shift boss (and Mine Overseer if available) will measure the intersection with another Flammable Gas Detection Instrument (FGDI) to confirm the presence of flammable gas and assess the situation.

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8.1.4 Sampling of Flammable Gas Intersections – Exceedance of 1.4% by Volume

If the event that the concentration of Flammable gas in the **general atmosphere exceeds 1.4% by volume** the following sampling procedure will be implemented to determine the composition and concentration in order to identify the upper and lower limits of the gas source:

- All precautionary measure as set out above will be applied.
- All sampling work will be done under the direct supervision of a competent person.
- Only persons involved with the sampling of the flammable gas will be allowed into the area.
- All necessary precautions to prevent the ignition of the gas will be done during the sampling operations.
- Continued measurement of the flammable gas will be conducted during the sampling.
- A representative sample, as directed by an accredited laboratory, will be collected and submitted to the accredited laboratory for analysis to determine the composition and concentration in order to identify the upper and lower limits of the gas source.
- Based on the results of the analysis, additional or amended controls could be implemented.

8.2 CONTROL OF GAS EMISSIONS

8.2.1 Precautionary Measures

Precautionary measures as set out below will be implemented to control the release of flammable gas:

8.2.1.1 Through Ventilated & Force Ventilated Workings with Dedicated Return Airways

- Should flammable gas be intersected on the face/working the area will be demarcated. Ventilation controls such as force ducting will be advanced to within 7 meters of the flammable gas source and aimed towards the hanging to prevent possible layering of gas.
- Should the concentration of flammable gas remain below 1.0% in the general atmosphere work may continue under any special precautions that may be necessary and set out by the responsible Section Manager after consultation with the VOH Manager.
- These precautions will amongst others include blasting frequency & methods, re-entry periods and the installation of electrical equipment beyond the last point of through ventilation.
- If the concentration of flammable gas exceeds 1.0% in the general atmosphere all work will cease and persons withdrawn from the end, which will be barricaded off.
- Only persons involved with the dilution and dispersion of the flammable gas will be allowed to work in the area. This will be done under the direct supervision of a competent person.
- Measurement of flammable gas will then be conducted at any booster or main fans in which the return air from the end passes through.
- All necessary precautions to prevent the ignition of the gas will be done during the dilution and dispersion operations.
- No diesel-powered equipment will be allowed to enter areas where flammable gas in excess of 1.0% is found and should water need to be pumped from the end, only compressed air driven pumps will be used.

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8.2.1.2 Development Ends/Sill Drives (Coursing)

- In circumstances where the development end's return air courses through other workings the precautions as in point 8.2.1.1 above will apply and all persons in those workings will be withdrawn from the area and the workings barricaded off until such time as the flammable gas levels drop below 1.0%.

8.2.1.3 Abandoned / Sealed Areas

- Areas on the mine which have been abandoned and previously had a history of flammable gas will be sealed off and monitored via a testing pipe in the wall, as close as possible to the hanging wall, on a weekly basis for flammable gas. Should there be an indication of flammable gas build up over a period of time the area will either be ventilated to dilute/remove the gas build up or sealed off by the construction of a containment wall capable of withstanding a static pressure of 140kPa.
- The above containment wall will be built according to a design given by a civil engineer or similar competent person.
- To date however, no such areas exist at Black Mountain.

8.2.1.4 Approaching & Holing into Abandoned Areas

Precautions to be taken when approaching or holing into abandoned ends:

- Warning Notes from the Survey Department will be supplied to the Mining Department well in advance prior to holing into abandoned areas. Such notes form part of planning sessions.
- Stopping Distances of Workings Approaching Abandoned Areas - Stopping distances as per the warning notes supplied by the survey department will be adhered to when approaching abandoned areas. Such notes forms part of planning sessions.
- Maximum Excavation Sizes - Maximum excavation sizes forms part of the planning session in which mining methods, ventilation and geological features are discussed.
- Methods to Probe for Water and Gas Accumulations - Diamond drilling is used as cover drilling in order to probe for any water or gas accumulations in virgin mining areas.
- Ways of Re-Establishing Ventilation Before and After Holing - Re-establishing ventilation depends on the particular area and is thus discussed at formal and informal meetings between the mining and ventilation departments. Layouts for the re-establishing of ventilation will be drawn up and adhered to following these meetings.

8.3 DETECTION OF FLAMMABLE GAS.

8.3.1 Selection of appropriate flammable gas detection instruments

- Only flammable gas detection instruments, complying with SANS 101515, will be used for the early detection of flammable gas.

8.3.2 Availability of a sufficient number of flammable gas detection instruments

- Black Mountain Mining (Pty) LTD will endeavour to maintain a minimum of 45 GDI's on the mine at all times.

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8.3.3 Issuing of flammable gas detection instruments to employees - For full details please refer to COP 001 Lamp Rooms / SOP 069 Lamp rooms:

- GDI's all allocated to designated persons, which collects it at the start of shift and returns it to the lamp room at the end of the shift.
- Prior to proceeding underground, a verification check is done to ensure correct functionality of the GDI.

8.3.4 Testing for and dealing with flammable gas will be as per 8.2.1 above. The intersection of flammable gas on Black Mountain Mining (Pty) LTD would be a significant occurrence bearing in mind that historically no intersections of flammable gas have ever occurred.

Any flammable gas in the general atmosphere of 1.0% and above as measured 300mm from any pilot/cover/drill hole will immediately be acted upon in the following manner:

- Stop all work and isolate all electrical equipment with the exception of any ventilation force fans serving the area.
- Remove all persons and trackless diesel equipment from the area.
- Barricade area off and warn all persons working in the same ventilation district if applicable.
- Notify Shift boss, Mine Overseer and Section Manager.
- Notify Ventilation and Occupational Hygiene department.
- The Department of Mineral Resources, Kimberley office, will also be notified.

8.3.5 Maintenance and calibration of Flammable Gas Detection Devices (FGDI's) will only be done as per the OEM specification – please refer to COP 001 Lamp Rooms / SOP 069 Lamp rooms for full detail.

- Lamp room personnel will only conduct general maintenance, with the OEM or their accredited service provider conducting more specialised maintenance & repairs.

8.3.6 Formal training is conducted as follows:

- The OEM or their accredited service provider conduct training on an annual basis for Lamp room and Training personnel. Training will include the correct use and care of the flammable gas detection instruments.
- Lamp room – received training in the basic maintenance, calibration and inspections of gas detection instruments.
- Training officials – receives "Train-the-Trainer" training in order to conduct training of employees in the inspection, calibration checks and use of gas detection instruments
- Training of users (competent persons) includes:
 - The miners of Deeps stoping, development and tramming
 - The miners of Swartberg stoping and development
 - The miner / line supervisor of Backfill
 - Ventilation and Occupational Hygiene personnel
 - Raisebore operator as and when required
 - Diamond drill operator as and when required
 - Shaft Timbermen

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8.4 REPORTING OF FLAMMABLE GAS.

8.4.1 The employer will report the presence of flammable gas in accordance with the Mine Health & Safety Act Regulation 23.4(g) as follows:

- If such flammable gas is detected for the first time.
- The first time such flammable gas is again detected after not having been detected therein for a continuous period of three months.
- Initial reporting the DMRE will be done by the quickest means which could include telephone, whatsapp, email or similar means by the manager.
- Formal reporting will be by the Chief Safety Officer on the SAMRASS 1 form – Accident and Dangerous Occurrence Report Form.

8.4.2 In addition to the above, the following internal/external reporting of flammable gas in the general atmosphere will be done:

- All internal stakeholders, including relevant employees, full time health & safety representative, section safety representatives. Methods to report will include formal safety meetings, toolbox talk notifications, Safety incidents flash, etc.
- Vedanta Management. Methods to report will include formal safety meetings and electronic means as appropriate.

8.5 CLEARANCE OF FLAMMABLE GAS

8.5.1 Dilution, Removal & Dispersion of Flammable Gas, Including Roof Layering

Dilution, removal and dispersion will be as per 8.2.1 above. However, if circumstances dictate otherwise, the appropriate planning will be done to ensure the safety of personnel.

Any flammable gas in the general atmosphere of 1.0% and above as measured 300mm from any pilot/cover/drill hole will immediately be acted upon in the following manner:

- Stop all work and isolate all electrical equipment with the exception of any ventilation force fans serving the area.
- Remove all persons and trackless diesel equipment from the area.
- Should the flammable gas intersection be on the face/working the area will be demarcated and ventilation controls such as the force ducting will be advanced to within 7 meters of the flammable gas source and aimed towards the hanging to prevent any possible layering of gas.
- Barricade area off and warn all persons working in the same ventilation district if applicable.
- Subsequent monitoring, as part of dilution, removal & dispersion will include monitoring from the intake in the general atmosphere and against the roof between the intake, the source of the flammable gas and in the return to ensure effective dilution.

8.5.2 Isolating Electricity without Affecting the Ventilation System where Applicable

- Black Mountain Mining is not considered a Fiery mine and as such no flame proofing or explosion protection of electrical equipment is required.
- Should flammable gas exceeding 1.0% in the general atmosphere be intersected in any development end, all electrical equipment, with the exception of any ventilating fans in that end and as far back as necessary, will be isolated until such time as the flammable gas

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levels fall below 1.0% in the general atmosphere. Should the level of flammable gas in the general atmosphere within a 30-meter radius exceed 1.0% the fan will not be re-started and other arrangements to ventilate the end will be made.

- c) No development ends are equipped with automatic re-starting fans.
- d) Positioning of fans in series – *Refer to SS0052*. In general, this is not standard procedure at BMM, but will be monitored should it be necessary.
- e) As far as is reasonably practical, development fan switchgear is installed in fresh air.
- f) Should any ventilating fan stop/trip for any reason, tests for flammable gas at the fan will be conducted prior to re-starting the fan.
- g) All main electrical equipment that poses a significant risk (mainly sub stations) is identified with basic fire-fighting measures in place.
- h) No development fans are equipped with automatic re-starting facilities.

8.5.3 Withdrawing People from the Return

Should any work be conducted in the return airway of an area where flammable gas has been identified, the following applies:

- a) Stop all work and isolate all electrical equipment in the area if safe to do so.
- b) Remove all persons and trackless diesel equipment from the area.
- c) Barricade area off to prevent access and warn all persons working in the same ventilation district if applicable.

8.6 DEVELOPMENT ENDS & ACCESSIBLE TUNNELS NOT IN THROUGH VENTILATION

In order to ensure that the build-up of flammable gas in development ends (including sill drives) and accessible tunnels not in through ventilation is prevented, the following applies:

8.6.1. Minimum Air Quantity

- Due to variation in size, the minimum air quantity for each individual force ventilated end will be determined by using a minimum quantity of $0.3\text{m}^3/\text{s}/\text{m}^2$.

8.6.2. Minimum Air Velocity

- Based on the calculation as per above, the velocity in ends will also vary depending on dimensions of the end. In this regard it will be endeavoured to maintain a minimum velocity in the return area of end at a minimum of 0.25m/s .

8.6.3. Ventilation Column Sizes for the Different Applications

Force ventilation systems in development ends:

- 1015mm diameter ventilation column, with 110 kW axial flow fans.
- 1015mm diameter ventilation column, with 75 kW axial flow fans.
- 760mm diameter ventilation column, 45 kW axial flow fans.

Force/Exhaust ventilation systems are generally not used, but should the need arise the following will apply:

- Force system - 760mm diameter ventilation column, 45 kW axial flow fan.

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- Exhaust system - 1015mm diameter ventilation column, with 110 kW or 75 kW axial flow fans.

8.6.4. Fan Types, Sizes & Positions

Installation will be as per layouts submitted by the VOH department to the Mining department, aligned to the requirements of VOH-SOP-022 Auxiliary Fan & Ducting Installation, which also stipulates the positioning of auxiliary fans. The following applies:

- 110 kW axial flow fans, 1015mm diameter.
- 75 kW axial flow fans, 1015mm diameter.
- 45 kW axial flow fans, 760mm diameter.

8.6.5. Ventilation Methods

- Force ventilation systems are primarily used to ventilate development ends and other accessible tunnels not in through ventilation.
- Should the need arise, Force/Exhaust ventilation systems will be utilized as a means of ventilation.

8.6.6. Restrictions on Ventilation Column Size & Distance

Force ventilation system are as follows:

- 110 kW axial flow fans, 1015mm diameter – 300 meters.
- 75 kW axial flow fans, 1015mm diameter – 250 meters.
- 45 kW axial flow fans, 760mm diameter – 180 meters.

8.6.7. Maximum Distance of a Ventilation Column Discharge from the Face of Tunnels

- Requirements as stipulated in VOH-SOP-022 Auxiliary Fan & Ducting Installation applies -
- The maximum permissible distance: column discharge to the face is 30 meters.

8.6.8. Minimum & Maximum Overlap Distances of Ventilation Systems

Force/Exhaust ventilation systems are generally not used at Black Mountain, but should the need arise the following will apply:

- Minimum overlap – 6 meters; Maximum overlap – 10 meters.

8.6.9. Methods of Ensuring that the Force Volume is Always Directed to the Working Face

- Installation of ventilation infrastructure are conducted by a dedicated trained construction crew. Over inspection to ensure correct installation is by means of the direct supervisors, during safe declaration and over inspected by line management and the VOH department during ventilation surveys.

8.6.10. Blasting Frequency

- Timed blasting takes place at the end of day and night shift, at approximately 06H00 & 18H00 daily.

8.6.11. Blasting Method & Re-Entry Period

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- After charging the face, each miner will withdraw all personnel and then start to connect the electrical detonators to the blasting wire. Each miner will then proceed to the respective Blasting point. Before reaching the Blasting point, each miner will first close the blasting/no-entry barricade.
- At the blasting point, each Miner will call the Late-shift Shift boss in control room and report that he/she is ready to initiate the blast. Once all the miners reported readiness for initiating of Blast, the Shift boss will inspect the lamp room visitor's book as well as the clearance board to ensure that any person remaining in the book or board, can be accounted for. Once cleared/accounted for, the shift boss then gives the miners permission to initiate their Blast.
- Each miner (positioned at the respective Blasting point) connects the Shot Exploder to the wires, which is connected to the electrical detonators at the charged face. The Miner will turn the key of the shot-exploder and initiate the blast. After the blast is initiated, the miner will report back to the Late-Shift shift boss to indicate that blast is completed. The miners will then proceed to surface (end of shift).
- The next shift will have a 1-hour re-entry period. Entering an area after the 1 hour period will be strictly conducted in conjunction with the "entry examination" procedures.

8.6.12. Ventilation Method(s) of Development Ends in Series & Restrictions on the Maximum Number of Ends that may be Ventilated in Series

- Development ends in series will be force ventilated, with each having its own dedicated fan and ventilation columns.
- The maximum number of development end to be ventilated in series is two, with the provision that loading is not allowed in the first end.
- If more than two ends are situated in the same ventilation district, the fans in the other ends must be stopped and effectively barricaded with no entry signs to prevent access. Only authorized personnel are allowed to remove these barricades, with the safe declaration procedure followed should an end that was stopped be restarted.

8.6.13. Methods to Ensure Uncontrolled Recirculation Does Not Take Place

Requirements as stipulated in VOH-SOP-022 Auxiliary Fan & Ducting Installation applies -

- Intake and fan position are stipulated in VOH-SOP-022. This requires that the intake must be at least 10 meters in through ventilation to prevent uncontrolled recirculation.

8.6.14. Methods of Breaking Away a New End from an Existing End or Tunnel – A risk assessment is conducted involving key stakeholders as part of the planning process:

- Services that need to be disconnected during the breakaway stage.
- Protection of services (where possible) during the breakaway stage.
- Distance of advance of new end before services could be reconnected.
- Distance of advance before ventilation can be established in the end, this should not exceed 20 meters from through ventilation.

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8.6.15. The installation of Electrical equipment Beyond the Last Point of Through Ventilation & Applicable Safety Precautions

- Prior to any electrical work commencing, the responsible miner for the area will monitor for gases, the temperature and airflow as part of the safe declaration process.
- The engineering team conducting the installation will continuously monitor the temperature during the time work is conducted.

8.7 MINING METHODS

8.7.1 Conventional Mining (Stopes)

Not Applicable – Black Mountain is a mechanized mine.

8.7.2 Mechanized Mining

8.7.2.1. Minimum Air Quantity per Stope

- Through ventilated stopes: The minimum air quantity for each through ventilated stope will be determined by using a minimum quantity of 0.06m³/s/ kW of trackless mobile machinery as the dimensions of stopes can vary.
- Force ventilated stopes: please refer to the sections on development ends and accessible tunnels not in through ventilation.

8.7.2.2. Minimum Air Velocity in a Stope

- Through ventilated stopes: the minimum air velocity is 0.25m/s.
- Force ventilated stopes: please refer to the sections on development ends and accessible tunnels not in through ventilation.

8.7.2.3. The Installation of Electrical equipment & Safety Precautions Applicable Thereto

- Prior to any electrical work commencing, the responsible miner for the area will monitor for gases, the temperature and airflow as part of the safe declaration process.
- The engineering team conducting the installation will continuously monitor the temperature during the time work is conducted.

8.8 STOPPED AREAS

8.8.1 Temporarily Stopped Working Place

In order to ensure that the build-up of flammable gas is prevented, the following applies:

8.8.1.1. Circumstances Under Which Areas can be Temporarily Stopped

- Health & safety related, including clearance of flammable gas, should it be encountered.
- Awaiting holing from another working.
- Production requirements (according to mine planning) could result in some working being temporarily stopped.

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8.8.1.2. Methods of Preventing Access to Temporarily Stopped Areas

- Effective barricades with no entry signs will be installed at temporary stopped areas to prevent inadvertent access. Only authorized personnel are allowed to remove these barricades to allow entry, following the safe declaration protocols.

8.8.1.3. For Removing the Ventilation System

Removal of ventilation infrastructure are conducted by trained construction crews:

- Prior to any work being conducted, a risk assessment will be conducted highlighting all hazard and risks. The responsible miner will monitor for gases, the temperature and airflow as part of the safe declaration process prior to work commencing.
- Ventilation infrastructure will be removed from the furthest point, working backwards.
- The team conducting the removal will continuously monitor the temperature/gases during the time work is conducted.

8.8.1.4. To Monitor any Build-Up of Flammable Gas

- Should the temporary stopped working place have a history of flammable gas emissions, a risk-based approach will be followed stipulating the monitoring requirements.

8.8.2 Permanently Stopped Working Place

8.8.2.1. Prevention of Flammable Gas Build-Up

- Circumstances Under Which Areas can be Permanently Stopped
 - Area have been mined out (end of production).
 - Area become unsafe to mine.
- Method of Removing the Ventilation System

Removal of ventilation infrastructure are conducted by trained construction crews:

 - Prior to any work being conducted, a risk assessment will be conducted highlighting all hazard and risks. The responsible miner will monitor for gases, the temperature and airflow as part of the safe declaration process prior to work commencing.
 - Ventilation infrastructure will be removed from the furthest point, working back
 - The team conducting the removal will continuously monitor the temperature/gases during the time work is conducted.
- Monitoring of any Build-Up of Flammable Gas
 - Permanently stopped areas which have a history of flammable gas will be sealed off and monitored for flammable gas, via a testing pipe through the wall, on a weekly basis.
 - Should there be any indication of flammable gas build-up over a period of time the area will either be ventilated to dilute/remove the gas build up or sealed off by the construction of an explosion proof seal capable of withstanding a static pressure of 140kPa. The wall will be fitted with a test pipe through which flammable gas monitoring can be conducted.

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- This containment wall will be built according to a design given by a civil engineer or similar competent person.

8.8.2.2. Safe Accumulation of Flammable Gas

- Measures to Ensure that Containment Walls are provided with Means to Monitor any Build-Up of Flammable Gas Behind Such Walls
 - Permanently stopped areas which have a history of flammable gas will be sealed off and monitored, via a testing pipe through the wall, on a weekly basis for flammable gas. This frequency could be increased based on the percentage of flammable gas detected.
- Measures to Ensure that Explosive Proof Seals are Used & Demarcated where the Atmosphere of Sealed Areas Stabilizes within the Explosive Range
 - Should the flammable gas stabilize within the explosive range, an explosive proof seal will be construction capable of withstanding a static pressure of 140kPa.
 - This containment wall will be built according to a design given by a civil engineer or similar competent person.
 - The wall will be fitted with a test pipe through which flammable gas monitoring can be conducted.
 - Demarcated with a sign stating "*Explosive Proof Seal. Do not tamper or remove*".
- Measures for the Monitoring of the Atmosphere within the Sealed Areas
 - Containment and explosive proof seals will be fitted with a test pipe through which flammable gas monitoring can be conducted.
 - Monitoring of Sealed off areas on the mine which have a history of flammable gas will be sealed off and monitored, via a testing pipe through the wall, on a weekly basis for flammable gas. This frequency could be increased based on the percentage of flammable gas detected.

8.8.3 Approaching & Holing into Stopped Areas

To ensure that the approaching and holing into temporarily or permanent stopped areas is done safely, the following applies:

8.8.3.1. Procedures to Ensure Warning Notes are Timeously Issued by the Surveyor when Any Working Approach Any Stopped Area

- Warning Notes from the Surveyor will be supplied to the mining department well in advance prior to holing into abandoned areas. Such notes form part of planning sessions.
- No holing will be allowed without the issue of such note.

8.8.3.2. Stopping Distance of Workings Approaching Stopped Areas

- Stopping distances as per the warning notes from the Surveyor will be adhered to when approaching stopped areas. Such notes forms part of planning sessions.

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8.8.3.3. Maximum Excavation Sizes of Workings Approaching Any Stopped Area

- Maximum excavation sizes forms part of the planning session in which mining methods, ventilation and geological features are discussed and would normally be limited to a maximum of 6 x 5 meters (width x height).

8.8.3.4. Procedure to Probe for Water & Gas Accumulations in Any Stopped Area

- Diamond drilling is used as cover drilling in order to probe for any water or gas accumulations in virgin mining areas.

8.8.3.5. Procedure of Re-Establishing Ventilation in Any Stopped Area Before & After Holing

A risk assessment is conducted involving key stakeholders as part of the planning process:

- Determine if area will be through ventilated or force ventilated.
- The return airway system is reviewed and verified for the particular area.
- Draft and supply layout of required infrastructure work required in order to establish effective ventilation. Implement and monitor.
- Additional services to be installed, including electricity and water.

8.9 FIXED INSTALLATIONS

8.9.1. In order to ensure that flammable gas accumulations at fixed installations are prevented, the following applies at fixed installation:

8.9.2. Position of Ventilation Appliances

- Ventilation flow, ventilation appliances and fixed installations are depicted on the "Mine Ventilation and Rescue Plans", which is updated on a quarterly basis, and includes (but are not limited to) the items specified under 8.9.4 below.

8.9.3. Main Surface and Underground Booster Fans

- Deeps Main Surface Fans – centrifugal type fans.
- Swartberg Main Surface Fans – Axial type fans.
- Underground booster fans: not applicable – not installed/used.

8.9.4. Fixed Installations - for the purpose of this COP, includes:

8.9.4.1. Pump stations

8.9.4.2. Dams, sumps, silos and settlers

8.9.4.3. Shaft bottoms

8.9.4.4. Belts

8.9.4.5. Workshops

8.9.4.7. Repair bays

8.9.4.8. Cutting and welding bays

8.9.4.9. Sub-stations

8.9.4.10. Mini sub-stations

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8.9.4.12. Stores

8.9.4.13. Hoist rooms (*none installed underground at BMM*)

8.10 STOPPAGE, CHANGE OR REVERSAL IN VENTILATION

In order to ensure that employees are not exposed to risks associated with flammable gas the following procedures must be followed for the immediate withdrawal from, and subsequent return of employees to, the working area in the event of stoppage, noticeable change or reversal in the ventilation in the working area:

Main Fan Stoppage – Deeps Shaft

Currently Deeps has three main surface fans situated at the Deeps shaft section. Two fans are in operation, with the third fan as a standby. Should any stoppage of a main ventilation fan occur, the following procedure is followed:

- A visual alarm indicating such stoppage is reflected in the Deeps control room.
- The control room operator then notifies the technician / electrician.
- The technician / electrician will attempt to start the fan that stopped.
- Should the fan not start the standby fan will be started and the cause for the other fan not starting will be determined.
- Should a total power failure occur, the necessary personnel as per BMF034, BMM call-out list will be followed in order to manage the situation.
- In addition, should the need arise, at least one main fan can be run from the Generator situated at Deeps Shaft.

Main Fan Stoppage – Swartberg Shaft

Currently Swartberg has three main surface fans situated at the Swartberg section. Two fans are in operation, with the third fan as a standby. Should any stoppage of a main ventilation fan occur, the following procedure is followed:

- Current alarm is localized at the fans, but the telemetry system is being routed to the Swartberg control room to have fan stop notifications.
- Should the control room operator be notified of a fan stoppage, he/she then notifies the technician / electrician.
- The technician / electrician will attempt to start the fan that stopped.
- Should the fan not start the standby fan will be started and the cause for the other fan not starting will be determined.
- Should a total power failure occur, the necessary personnel as per BMF034, BMM call-out list will be followed in order to manage the situation.

Noticeable Changes or Reversal in Ventilation

The following procedure applies:

- Noticeable changes or reversal in ventilation will immediately be notified to the Deeps or Swartberg control room, who will in turn notify the VOH department and the relevant section manager.
- In the interim, the relevant section line management will endeavour to determine the cause of noticeable changes in the ventilation in their area of responsibility.

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- c) Should the relevant section line management not be able to determine the cause, the Deeps control room will be notified, who in turn will notify the VOH department and the relevant section manager.
- d) The VOH department will then determine the cause and the action required to restore the ventilation to normal.
- e) Should the cause be a total power or fan failure the call-out list as per BMF 034 will be followed in order to manage the situation.

8.11 IDENTIFICATION OF HAZARDOUS LOCATIONS

Hazardous locations will be specified if / when flammable gas is detected. As no flammable gas has been detected in the history of Black Mountain no such areas are currently specified:

- Hazardous locations with regards to flammable gas will be demarcated on the ventilation and rescue plans should it be identified.

8.12 PREVENTING IGNITION OF FLAMMABLE GAS

In order to ensure the controlling of potential ignition sources the following applies:

8.12.1 Contraband

A "No Smoking" policy in all underground working areas is in force on Black Mountain Mining:

- 8.12.1.1. Orientation of Employees with regard to the Risks taking Contraband into Underground Mines includes Induction and various other means are utilized to create awareness and educate people on the dangers of smoking underground.
- 8.12.1.2. Methods of Warning Employees of the Dangers of Taking Contraband into the Workings of a Mine includes Induction and various other means are utilized to create awareness and educate employees on the dangers of smoking underground.
- 8.12.1.3. The Random Search of Persons about to Proceed into or while in the Workings of a Mine are done by the line management and the security department as per the Black Mountain Smoking Policy: SOP 014.
- 8.12.1.4. Use of Light Metals SANS 10012 as Amended - Currently the use of light metals is permitted as Black Mountain has not had any flammable gas intersections. This will be reviewed should flammable gas be interested.

8.12.2 Open Flame & Other Ignition Sources

- 8.12.2.1. Safe Procedures for Welding, flame cutting, flame heating, and similar work such as friction cutting, grinding, vulcanizing, soldering, photography, etc. will be allowed under normal circumstances to continue in the underground workings and will be done according to Safe working procedures as laid out in the Mine's "Permit to Work BMF 116" procedure. Should any flammable gas be detected in mine workings, **NO** open flame work such as

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welding, cutting, etc. will be allowed to take place in the working/end where such flammable gas has been detected.

Where flammable gas in excess of 1.0% is present no taking of photographs/video, taping etc will be permitted.

- 8.12.2.2. Training of Competent Persons to Perform Work - All persons required to conduct work involving open flames are trained in the mine's "Permit to Work" procedure. Only authorized and trained personnel are allowed to operate open flame equipment.
- 8.12.2.3. Issuing and Control of Flint Lighters and Shot Exploders - Flint Lighters and shot exploders are issued to authorized and competent personnel only.
- All persons receiving flint lighters or shot exploders signs acceptance there-off.
 - Each miner is issued with a dedicated shot exploder. These shot exploders are charged and locked in the lamp room of which only the dedicated miner and lamp room personnel have access to.
- 8.12.2.4. Workshops & Cutting Bays - Good housekeeping principles are enforced in all workshops and cutting bays, with precautionary measures implemented for as per the "Permit to Work" system in cutting operations. Ventilation requirements are monitored as and when required to ensure all work are conducted in a safe and healthy manner.
- 8.12.2.5. Precautions when Working Outside Approved Workshops & Cutting Bays are as per the "Permit to Work" (BMF 116) are enforced to ensure safe and healthy conditions when working Outside approved Workshops or Cutting Bays.
- 8.12.2.6. Safety Procedures when Conduction such Work (Working Outside Approved Workshops & Cutting Bays) - The Permit to Work procedure sets out the requirements for the ventilation, inertisation, fire prevention and gas testing procedure before, during and on completion of such work.
- 8.12.2.7. Flashback arrestors are installed on all gas cutting cylinders in order to prevent back-feeding of gas.
- 8.12.2.8. All gas cylinders are transported, stored and used only in the approved manner to ensure the safety and health of all personnel.
- 8.12.2.9. The issue, safekeeping and examination of both equipment and devices used are as per the Permit to Work procedure.

8.12.3 Electrical Equipment

- 8.12.3.1. Explosion protected apparatus
- None in used

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8.12.3.2. The use of electrical equipment that requires special precautions.

- None in used

8.12.3.3. Interlocking of fans in series and other electrical equipment used in relevant areas:

- In general, fans in series are not used at Black Mountain. In the event that it is used, the requirement to interlock will be assessed and if deemed necessary, will be interlocked
- Interlocking of conveyor belts with the automated fire detection and suppression system is in place

8.12.3.4. The positioning of fans in series – distances between the fans will be based on the size (kW) of the fans:

- 110 kW axial flow fans, 1015mm diameter – 300 meters.
- 75 kW axial flow fans, 1015mm diameter – 250 meters.
- 45 kW axial flow fans, 760mm diameter – 180 meters

8.12.3.5. Switchgear in development ends (& sill drives) are positioned as followed:

- All switchgear is installed in sub-stations, with gully stands installed in working areas to supply electrical power to the working facing

8.12.3.6. Flammable gas testing before starting or stopping electrical equipment

- Flammable gas testing is conducted prior to starting and stopping of electrical equipment (eg: auxiliary fans) by the responsible mining personnel

8.12.3.7. Identification of electrical equipment that poses a significant risk and measures to deal with such risk:

- Currently non in use, but all electrical equipment installation are covered under a risk assessment

8.12.3.8. No automatic re-starting of auxiliary (development end / sill drive) fans and other electrical equipment are in use at Black Mountain.

8.12.4 Friction Ignitions

Sources identified that could result in frictional ignition:

- Misalignment of conveyor belts
- Spillages underneath conveyor belts
- Damaged idlers
- Trackless mobile machinery

Prevention and control include start of shift pre-use checklists for conveyor belts to ensure frictional ignitions, as mentioned above, are identified and corrected. The same applies to trackless mobile machinery. All appliances are maintained as per the mine's maintenance schedule.

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8.12.5 Static Electricity

Sources identified that could result in static electricity and prevention controls:

- Flexible ducting in use for development and in-stope ventilation: The flexible ducting in use at Black Mountain Mining complies with the requirements of NCB 245:1985 - Fire and Electrical Resistance Properties of Supported and Unsupported Sheeting. The report is available on request.
- Main and mini sub installations - All main- and mini substations are earthed to prevent the release of any static electricity.

All appliances are maintained as per the mine's maintenance schedule.

8.13 CONFINED SPACE

8.13.1 Measures to Prevent Explosions in Confined Spaces

Measures to prevent the accumulation and ignition of flammable gas and/or explosive mixtures in confined areas – The 'Permit to Work' system on Confined Space will be followed, and includes:

- Providing ventilation should work be done in a confined space
- Measuring of gases within the confined space

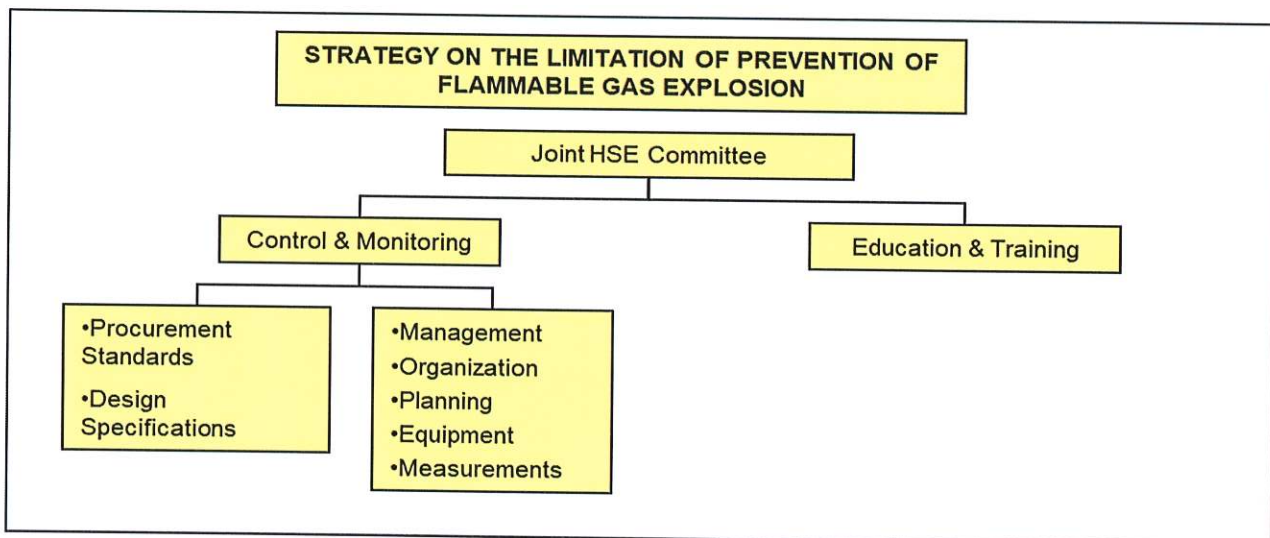
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PART D: IMPLEMENTATION.

1. IMPLEMENTATION PLAN.

1.1 The implementation plan for this COP covers the following: Organizational structures, responsibilities of functionaries and programs and schedules for the COP that will enable proper implementation of the COP.

1.1.1 The overall Flammable Gas Explosion Prevention programme is depicted schematically below. This is an integrated approach that requires planning, co-ordination and co-operation between various departments and structures:



The main focus is the Prevention of Flammable Gas build-up and explosions in the workplace and assessments, testing and surveillance to provide the necessary assurance on the success of the control programme.

a) Risk Assessment

- Risk assessments for exposure and control have been conducted taken into account relevant information from credible sources.

b) Workplace Monitoring & Assessments

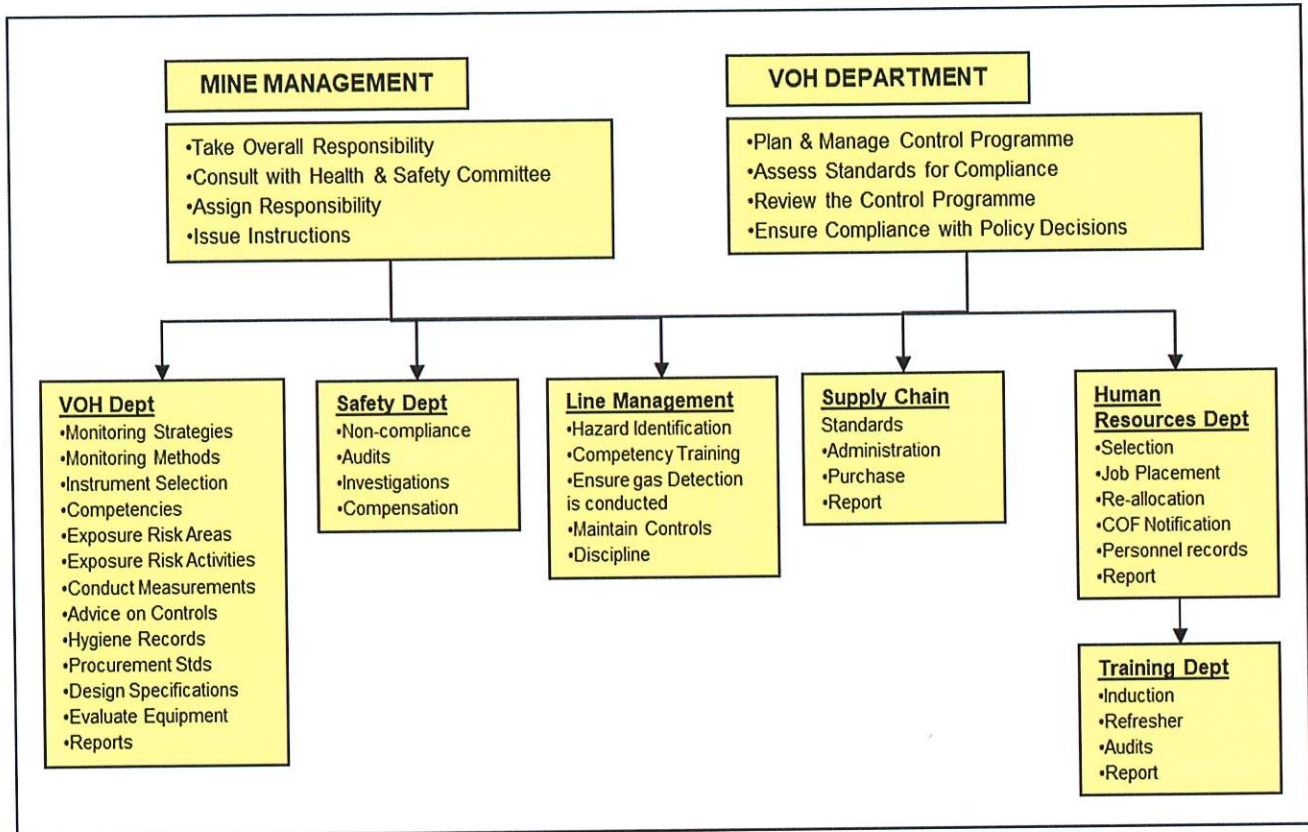
- Workplace monitoring and assessments are conducted by supervisors, with over-inspections conducted by Safety, VOH and Management teams.
- Gas detection is conducted by designated persons at the start and during the shift as part of safe declaration and ongoing monitoring.

c) Functions & Responsibilities

The functions and responsibilities of departments, committees and disciplines are depicted schematically below (see text for details):

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➤ Mine Management

The owners of the mine must take responsibility for health and safety in terms of the Act. The management of this responsibility is delegated to Mine Management. The Act also requires that a health and safety committee be established for consultation on health and safety issues. This role is fulfilled by the "Joint Health and Safety Committee", which is represented by management and employees.

Other responsibilities relating to the Prevention of Flammable Gas Explosion programme include:

- The compilation and implementation of the mine's health and safety policy
- Approval of specific Prevention and Management practices and procedures and the issuing of instructions relating to the implementation of the practices and procedures
- The delegation of responsibilities to designated persons
- Provision of resources to fulfil the Prevention and Management practices and procedures
- Manager: Reporting of Flammable gas in accordance with Regulation 23.4(g) of the Mine Health & Safety Act

➤ Training Department: Education & Training

Education & Training is a fundamental prerequisite to the success of the Prevention of Flammable Gas Explosion programme. The purpose is to improve employees' awareness of Flammable Gas

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hazards and its consequences, and to motivate them towards active participation on controlling the risks according to their position and function within Black Mountain.

- a) The objectives of employee induction and education with regards to Prevention of Flammable Gas Explosion practices and procedures are to:
 - i) Promote a comprehensive understanding of the nature, the cause and the consequences of flammable gas explosions
 - ii) Ensure that employees are capable of recognizing potential flammable gas sources and are encouraged to contribute to risk assessments and the implementation of appropriate control measures
- b) Target groups for training with regards to Prevention of Flammable Gas Explosion practices and procedures:
 - i) Every person in the workplace (i.e. employers, senior managers, line managers, supervisors, health and safety representatives/committee members and all employees) will be given an overview of the Prevention of Flammable Gas Explosion programme, the process of hazard identification and risk assessment, as well as how risk management systems and procedures will be implemented in the workplace
 - ii) Persons responsible for formulating and implementing risk management systems and procedures relating to Prevention of Flammable Gas Explosion practices and procedures (i.e. managers, line managers, supervisors and health and safety representatives/committee members) will be required to develop their competence in hazard identification, risk assessment and risk management systems
- c) Main topic areas for an overview or general training course:
 - i) Legislation relating to Prevention of Flammable Gas Explosion practices and procedures and means of compliance, including codes of practice and risk management systems
 - ii) Risk of exposure to the Flammable Gas Explosions and exposures, including possible impact on health & safety and the work environment
 - iii) Hazard identification, risk assessment and risk management procedures
 - iv) Gas Detection Instruments, including pre-use inspections, calibration checks, gas measurements, actions should gases be detected, reporting, etc.
 - v) The need for communication and consultation with all concerned in formulating and implementing measures aimed at managing risk and complying with legislation
 - vi) Workplace strategies for the management of risks associated with Explosion Prevention, Mitigation & Management practices and procedures
 - vii) Risk assessment, testing and practices should flammable gas be intersected

➤ VOH Department

Main functions include:

- Preparation of Prevention of Flammable Gas Explosion documentation, including Code of Practice, risk assessments, standards, etc.
- Occupational Hygiene monitoring equipment
- Audits and reporting

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➤ Safety Department

From a safety perspective the responsibilities include:

- Audits and reporting of non-conformances
- Chief Safety Offices - Formal reporting to the DMRE in accordance with Regulation 23.4(g) of the Mine Health & Safety Act

➤ Line Management

The main function of Line Management is to create a culture of limiting exposures by:

- Continuous hazard identification
- Competency training
- Maintenance of controls

➤ Supply Chain

The contribution of the Supply Chain to the programme is to:

- Supply of required PPE and fit for purpose equipment
- Report, for review purposes, on procurement statistics

In addition to the above, the Supply Chain plays a major part in the acquisition of new equipment with regards to Manufacturers / Suppliers as is shown below.

➤ Original Equipment Manufacturers (OEM's) / Suppliers

The contribution of the OEM's / Suppliers to the programme is as follows:

- The principle approach to be taken is to control the exposure levels of the equipment supplied to the mine. Section 21 of the MH&S Act is applicable in this regard.
- It should be noted that, if an exposure hazard is associated with equipment supplied to mines, the supplier can only relinquish its responsibility with regard to risks if the exposure characteristics of the equipment are specified, the necessary precautions against exposure control are stipulated and the mine management has accepted, in writing, the responsibility of implementing those precautionary measures
- Therefore, equipment can only be accepted after the relevant documentation of acceptance has been duly completed

- 1.2 Information may be graphically represented to facilitate easy interpretation of the data and to highlight trends for the purposes of risk assessment.

2. COMPLIANCE WITH THE COP.

Measures to ensure compliance is instituted through auditing from first, second and third party auditors.

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3. ACCESS TO THE COP & RELATED DOCUMENTS.

- 3.1 A complete electronic COP, with related documents, is kept readily available at the mine for examination by any affected person. Hard copies, when printed, are treated as uncontrolled copies. Line supervisors and management have direct access to these electronic copies and can distribute it to affected employees when required. On written request to the Manager, any other affected person will be supplied with copies. A register will be kept of such persons or institutions to facilitate updating.
- 3.2 The registered Trade Unions and Full Time Health and Safety Representative will be supplied with copies of this COP. A register will be kept of such persons or institutions to facilitate updating.
- 3.3 The employer will ensure that all employees are fully conversant with those sections of this COP relevant to their respective areas of responsibility.

4. Distribution and Access

- The latest revision of this document is available as a read only on the document on the Intranet. The Compliance Officer shall maintain an authorised hard copy of this policy/procedure in the relevant location.
- Line Managers, who have staff reporting to them that do not have access to the Intranet, shall ensure that these personnel are adequately guided and informed.

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Annexure A

BLACK MOUNTAIN

A Division of Anglo Operations Limited

Registration number: 1921/006730/06

Note

To: Assistant Manager

From: Chief Geologist

Date: December 01, 2001

Subject: Methane in Aggeneys Deposits

Methane (CH₄) and other inflammable gases are found in sedimentary rocks rich in organic material. Typical examples in South Africa are the coal seams and carbonate rocks of the Transvaal Sequence.

Methane in sedimentary rocks is formed during the decay of organic material. Under high-pressure conditions the methane can be dissolved in water, and released again when the pressure is released or reduced.

The deposits at Aggeneys are situated in the metasedimentary and metavolcanic rocks of the Namaqualand Metamorphic Complex (NMC). These rocks were deposited between 1300 and 1600 million years ago and were subjected to polyphase deformation and upper amphibolite facies metamorphism. Peak metamorphic pressure and temperature conditions were approximately 3.5 – 4.0 kb and 660° C (Hoffman, 1993). The temperatures during metamorphism were sufficiently high to have driven off inflammable volatiles and fluids.

In conclusion it can be stated that due to the metamorphic history of the metasediments and metavolcanites of the NMC no inflammable gases are present in the rocks of the Aggeneys deposits. This is confirmed by the fact that in the 20 years of mining at Broken Hill no intersection of flammable gas was reported.

JE Potgieter
CHIEF GEOLOGIST

Reference:

Hoffman, D.(1993). Aspects of the Geology, Geochemistry and Metamorphism of the Lower Orebody, Broken Hill deposit, Aggeneys. Unpubl. MSc.Thesis.Univ. Cape Town. 211pp.

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