ANNEXURE 2: Guidance note for lamproom practice
(For information purposes only)

DEPARTMENT: MINERALS AND ENERGY
Minerals and Energy for Development and Prosperity
Mine Health and Safety Inspectorate

GUIDANCE NOTE FOR LAMPROOM PRACTICE

CHIEF INSPECTOR OF MINES

Date First issued: .....
Effective date: .....

CONTENTS PAGE NO

1. INTRODUCTION

These guidance notes have been primarily prepared to assist the employer in ensuring that gas detection instrumentation, self-contained self-rescuers and portable lamps are in proper working order prior to going on shift.

2. LEGAL STATUS

2.1 This guidance note has been compiled to assist employers in preparing a Code of Practice for Lamproom Practice.

2.4 A guidance note sets out good practice and will be widely distributed by the Mine Health and Safety Inspectorate within the industry. As is the case with all other documents setting out accepted good practice, the application of inferior practices without justification could amount to negligence.

3. DEFINITIONS

3.1 **"Equipment"** means gas detection instrumentation, self-contained self-rescuers and portable lamps.

3.2 Gas detection instrumentation

3.2.1 **"Flammable gas measuring instruments and flammable gas warning devices"** means only those instruments and devices which comply with the South African Bureau of Standards specification SANS ~~101515~~.1515.

3.2.2 **"Carbon monoxide warning devices"** means only those devices which are battery operated portable personal units, capable of continuously sensing and able to give either a clearly audible or a clearly visible warning or both a clearly audible and a clearly visible warning should they be used in an atmosphere containing 100 ppm or more of carbon monoxide.

3.3 **"Self-Contained Self-Rescuers"** means a body–worn device, which complies with the South African Bureau of Standards specification SANS 1737.

3.4 **"OEM"** means original equipment manufacturer.

4. COMPETENT PERSON

4.1 Appointment

The Manager shall appoint a competent person who shall have successfully completed a training programme drawn up by the manager, and clearly define all his duties and responsibilities in writing.

4.2 Training

(i) The Manager, in consultation with the **OEM** of the equipment in use on the mine, shall draw up a mine specific training programme.

(ii) Refresher courses to be conducted annually and retraining done in the event of any change in specification of any equipment.

5. CERTIFICATION OF SPECIFICATION COMPLIANT

5.1 Gas detection instrumentation

The following is recommended for all specification compliant equipment in the lamproom:

5.1.1 Flammable gas

Copies of the SANS 1515-1 test certificates and the list showing the relevant serial numbers of all specification compliant instruments and devices in use should be displayed in the lamproom.

5.1.2 Carbon monoxide

Copies of the SANS 1515-3 test report for explosion protection for all battery powered portable personal warning devices in use shall be displayed in the lamproom.

5.2 **Self-contained self-rescuers** (SCSRs)

Copies of SANS 1737 batch test certificates for units purchased after 1 September 2002 of all makes of SCSRs in use on the mine should be displayed in the lamproom.

5.3 Portable lamps

Copies of all schedules giving full details and specifications of all portable lamps in use, on the mine shall be displayed in the lamproom.

6. ALLOCATION OF EQUIPMENT IN COMPLIANCE WITH SABS SPECIFICATIONS

6.1 Gas detection instrumentation

6.1.1 Flammable gas

Every designated person who is required to conduct tests or monitor for **flammable gas** is to be allocated a personal **flammable gas** measuring instrument or a personal **flammable gas warning device** as the case may be.

6.1.2 Carbon monoxide

Every designated person who is required to monitor carbon monoxide is to be allocated a personal carbon monoxide warning device.

6.1.3 Sensor for oxygen deficiency (please suggest a description for other gases)

6.2 Self-contained self-rescuers

Every person who is required to be equipped with a self-contained self-rescuer under Regulation 16 of the MHSA Act No. 29 of 1996 shall be allocated such for their sole use.

7. STORAGE OF EQUIPMENT

(i) Equipment should be stored in accordance with **OEM** recommendations.

(ii) Storage area to be clean, oil free, free of silicone-based cleaners, well ventilated and well illuminated.

(iii) Due to the nature of the reactive chemicals contained in SCSRs, any unit which has been activated, vandalised, damaged, or which has failed the routine inspection including redundant units, should be immediately withdrawn from service and sealed in an impervious plastic bag and kept in an area away from other equipment. For safe disposal of these particular units it is recommended that they be returned to the **OEM** concerned.

8. EQUIPMENT CONTROL

8.1 Checking/testing

(i) The appointed competent persons shall test and check equipment in accordance with a procedure drawn up by the manager in consultation with the **OEM** to verify that the equipment is in proper working order prior to each shift.

(ii) With regard to SCSRs a special monitoring test programme by an approved testing authority should be implemented in accordance with Regulation16.4 (1) of the Mine Health and Safety Act (Act 26 of 1996).

8.2 Calibration of Portable Gas Detection Instruments

Calibration of portable instruments should be done in accordance with a procedure drawn up by the employer in consultation with the **OEM**.

8.3 General maintenance

8.3.1 Gas detection instrumentation and portable lamps

(i) Separate rooms for gas detection instrumentation and portable lamps should be dedicated for maintenance purposes.

(ii) Portable lamp repairs may be effected by the appointed competent person but in the case of gas detection instrumentation only the **OEM** or their accredited authorities may carry out any repair.

8.3.2 Self-contained self-rescuers

Repairs and/or refurbishment shall be effected only by the **OEM** or by their accredited authorities.

8.4 Battery charging programme (gas detection instrumentation and portable lamps)

Batteries are to be charged in accordance with a procedure drawn up by the manager in consultation with the **OEM**.

8.5 Records

(i) A record shall be kept for a period of 12 months in the lamproom of specific persons to whom equipment are issued in order that the user can at any time be identified from the records.

(ii) With regard to SCSRs a comprehensive record system should be implemented in accordance with Regulation 16.4(2) of the Mine Health and Safety Act (Act 26 of 1996).

(iii) In the case of gas detection instrumentation records of individual instruments and devices showing a history of testing, calibration and maintenance, shall be kept.

9. REPORTING

(i) The lampsman shall on a monthly basis report in writing to the Manager on all matters pertaining to the control of equipment.

(ii) Copies of these reports shall be kept for a period of one year.

10. COMPLIANCE TESTS

Tests and checks of equipment shall be made by the designated user in accordance with a procedure drawn up by the manager. A means of acknowledgement by the designated user shall be instituted to verify that such tests and checks have been conducted prior to going on shift and recorded.

ANNEXURE 3: Guidance note for multi-blasting operations
(For information purposes only)

REF: 24/2/P
LAST REVISION DATE:

DEPARTMENT: MINERALS AND ENERGY
Minerals and Energy for Development and Prosperity
Mine Health and Safety Inspectorate

GUIDANCE NOTE FOR MULTIBLASTING OPERATIONS

RE-ENTRY INTERVAL AFTER BLASTING AND PERMISSION TO BLAST MORE THAN ONCE IN 24 HOURS IN TERMS OF REGULATION 9.2(1)

CHIEF INSPECTOR OF MINES

Date First issued: .....
Effective date: .....

CONTENTS

CONTINUES ON PAGE 258 OF BOOK 3

Printed by and obtainable from the Government Printer, Bosman Street, Private Bag X85, Pretoria, 0001
Contact Centre Tel: 012-748 6200. eMail: info.egazette@gpw.gov.za
Publications: Tel: (012) 748 6053, 748 6061, 748 6065

This gazette is also available free online at **www.gpwonline.co.za**

Government Gazette
Staatskoerant

REPUBLIC OF SOUTH AFRICA
REPUBLIEK VAN SUID AFRIKA

Vol. 670 9 April April 2021 No. 44427

PART 3 OF 3

ISSN 1682-5845

9 771682 584003 44427

ACRONYMS

MHSA	Mine Health and Safety Act, Act 29/1996
RAW	Return airway
l	Length
w	Width
h	Height
m/s	Metres per second
m^3/s	Cubic metres per second
$m^3/s/m^2$	Cubic metres per second per square meter
Q_F	Force quantity

1. INTRODUCTION

This guidance note is not applicable to collieries.

A recent mine disaster has brought the blasting and ventilation arrangements, especially regarding development multi-blasting, into urgent need of review. It furthermore highlighted that the increased risk of **flammable gas** explosions, in underground metalliferous mines, must be managed.

This guidance note has been amended in line with the Industry Best Practice Guideline produced by the Group Environmental Engineers, submitted through the Chamber of Mines. The purpose of this guidance note is to ensure that the re-entry periods applied under differing occupational environmental conditions ensure that no persons are exposed to occupational health risks.

2. LEGAL STATUS

This guidance note has been compiled to assist mines with the calculation of re-entry periods for the different types of multi-blasting.

A guidance note sets out good practice and will be widely distributed by the Mine Health and Safety Inspectorate within the industry. As in the case with all other documents setting out accepted good practice, the application of inferior practices without justification could be regarded as negligence.

3. RELEVANT PROVISIONS OF THE MHSA

3.1 The employer must assess the hazards and respond to the risks to health and safety, in terms of Section 11 of the **MHSA**, to which employees may be exposed while they are at work.

3.2 The employer must establish and maintain a system of occupational hygiene measurements and engage the part-time or full-time services of a person qualified in occupational hygiene techniques to measure levels of exposure to hazards at the mine, in terms of Section 12.(1) of the **MHSA**.

3.3 Every system of occupational hygiene measurements must be appropriate in terms of the hazards to which employees are, or may be, exposed and must provide information, which the employer can use to eliminate, control and minimise such health risks and hazards, in terms of Section 12.(2) of the MHSA.

3.4 Records must be kept of all such measurements in order that it can be linked, as far as practicable, to an employee's records of medical surveillance, in terms of Section 12.(3) of the MHSA.

4. DEFINITIONS

In order to differentiate between mining operations using multi-blasting and time blasting, these definitions will apply. It should be noted that in all three definitions cognisance must be taken of the occupational hygiene regulations, which requires that no persons must be exposed to airborne contaminants.

Time-blasting

Blasting operations taking place not more than once in any 24-hour cycle (as per paragraph 5.2).

Multi-blasting

Multiple blasting including shaft sinking operations, which could take place during any working shift. Such blasting may only take place where efficacious means of separating intake and return air e.g. a dedicated return airway is provided (as per paragraph 5.3).

Fixed-time multi-blasting

Blasting more than once per 24 hours, but not more than once per shift, for both stoping and development, taking cognisance of a re-entry period sufficient to clear all airways where persons are expected to work or travel (as per paragraph 5.4).

The re-entry period must be determined by a risk assessment and validated whenever key factors, that can have a significant effect on the re-entry conditions, change.

5. RE-ENTRY INTERVALS

In terms of Regulation 9.2(1) of the **MHSA** the employer must ensure that the occupational exposure to health hazards of employees is maintained below the limits set out in Schedule 22.9(a) and (b). The intervals which must expire before persons are allowed to re-enter the workings of your mine in which blasting has taken place, should be fixed as follows:

5.1 Nil re-entry interval

A re-entry interval need not be observed where persons are expected to work or travel if uncontaminated **through ventilation** has been established and is effective / operational.

5.2 General re-entry interval

Should blasting fumes however contaminate the air in any of the workings the general re-entry interval, as set out in the paragraph below, must be observed in those workings.

A general re-entry interval after the blast in all ventilation districts must be observed in terms of Regulation 9.2.1: "The employer must ensure that the occupational exposure to health hazards of employees is maintained below the limits set out in Schedule 22.9(2)(a) and (b)". This re-entry interval must be determined after a detailed and recorded risk assessment and excludes the workings mentioned in paragraphs 5.1, 5.3 and 5.4.

5.3 Multi-blast re-entry interval

In terms of Regulation 9.2.1 the employer must ensure that the occupational exposure to health hazards of employees is maintained below the limits set out in Schedule 22.9(2)(a) and (b).

A minimum 30-minute re-entry interval must be observed, and the following provisions must be made applicable to all multi-blast development ends or shafts being sunk:

5.3.1 *Minimum air quantities required (relative to the air density at the working face)*

5.3.1.1 The quantity of air forced shall be established through a risk assessment process to ensure that the air supplied is of a quality as set out in Schedule 22.9 (2) (a) and (b) and should not be less than 0,25 m^3/s for every square meter of face area, for all multi-blast development ends.

5.3.1.2 The quantity of air exhausted from the development end should be not less than twice more than the quantity of air supplied by the force column referred to in paragraph 5.3.1.1 above. A minimum force exhaust ratio of 1:2 should be maintained at all times to ensure that no uncontrolled re-circulation takes place in the overlap section.

5.3.2 *Ventilation arrangements*

5.3.2.1 Horizontal development, inclines, declines and raises.

5.3.2.1.1 An exhaust-overlap system of ventilation should be used for every end being multi-blasted.

5.3.2.1.2 The intake of the exhaust column should be carried to a point not exceeding thirty (30) metres from the face.

5.3.2.1.3 The distance between the discharge of the force column and the advancing face must be such as to ensure that the ventilating air reaches the face and should not be more than twenty (20) metres from the face of the end after the blast.

5.3.2.1.4 The minimum overlap distance between the exhaust column intake and the force column intake points should be at least 10 metres and not exceeding 25 metres.

5.3.2.1.5 Fans in the exhaust column should be positioned in such a manner that the exhaust column remains under negative pressure, thus ensuring that no exhaust fumes leak back into the intake air flowing to the face.

(a) To prevent open circuit exhaust fans from recirculating, sufficient **through ventilation**, at least 0.4 $m^3/s/m^2$ of **through ventilation**, should be provided at these fan sites at all times.

(b) The exhaust fans in an exhaust-overlap system, which are the primary source of ventilation, should be interlocked with all other electrical appliances and equipment in the end being multi-blasted. This is to ensure that, in the event of the exhaust fans stopping, all other electrical appliances and equipment will also shut down.

(c) No butterfly valves must be positioned in any exhaust column in development ends.

5.3.2.1.6 The force fan must be positioned only in the overlap section of the ventilation system.

5.3.2.1.7 An effective dust allaying mechanism must be operated during the blast and re-entry period at a discharge point not exceeding 20 metres from the face.

5.3.2.1.8 If, at any stage, blasting fumes from the end being multi-blasted contaminates any working places in the vicinity, then multi-blasting must cease and conventional time blasting (as per paragraph 5.2) or fixed-time blasting (as per paragraph 5.4) must be followed until conditions have been rectified for multi-blasting. The ends so contaminated must also of necessity be on conventional time blasting.

5.3.2.1.9 The dust and fumes from blasting operations must be exhausted directly to surface via an established RAW and must not contaminate any place where persons may be required to work or travel.

5.3.2.1.10 The number of air changes, calculated on the volume of air between the face and the intake of the force column, required shall be determined through a risk assessment process to ensure that on re-entry after the blast the air in the development end is of a quality as set out in Schedule 22.9 (2) (a) and (b) and should not be less than 8.

NB: For raises, winzes and declines the following will, in addition, apply:

(a) The exhaust column intake must be situated in the crosscut; and

(b) Ore passes must never be completely empty, to prevent re-circulation.

5.3.3 Shafts

5.3.4 The bank area must be kept clear of blasting fumes and the shaft must remain downcasting, in the bank area, at all times.

5.3.4.1 The force column delivery must at least be to the bottom deck of the stage during blasting.

5.3.5 *Compliance testing*

5.3.5.1 Workplace environmental conditions on re-entry must be of a quality as set out in Schedule 22.9(2)(a) and (b).

5.3.5.2 Gravimetric dust measurement results on re-entry with a tyndallometer or similar dust-measuring instrument must be less than an AQI of 1,0 taken over a 2-minute period, using previously determined hazardous pollutant values.

5.3.6 *Blasting initiation*

Blasting initiation must be conducted electrically.

5.4 Fixed-time multi-blast re-entry interval

For blasting more than once in 24 hours, but not more than once per shift, a minimum re-entry interval will be determined after a detailed and recorded risk assessment with the following provisions made applicable to all fixed-time multi-blast development ends or stopes:

5.4.1 *Minimum air quantities required (relative to the air density at the working face)*

5.4.1.1 The quantity of air forced shall be established through a risk assessment process to ensure that the air supplied is of a quality as set out in Schedule 22.9 (2) (a) and (b) and should not be less than 0, 15 m^3/s for every square metre of face area, for all multi-blast development ends.

5.4.1.2 The minimum stope face velocity averaged across the height of the stope should be determined through a risk assessment process to ensure that the quality of air is such that it meets the requirements as laid down in Schedule 22.9 (2) (a) and (b) and should not be less than 0.25 m/s. This should vary when determining the desired re-entry interval.

5.4.1.3 The number of air changes, calculated on the volume of air between the face and the intake of the force column, required shall be determined through a risk assessment process to ensure that on re-entry after the blast the air in the development end is of a quality as set out in Schedule 22.9 (2) (a) and (b) and should not be less than 8. The risk assessment must take into account all areas that maybe contaminated by the blast including "kickback".

5.4.2 *Compliance testing*

5.4.2.1 Workplace environmental conditions on re-entry must be of a quality as set out in Schedule 22.9(2)(a) and (b).

5.4.2.2 Dust measurement results on re-entry, with a tyndallometer or similar dust-measuring instrument, must be less than an AQI of 1,0 taken over a 2-minute period, using previously determined hazardous pollutant values.

5.4.3 *Blasting initiation*

Blasting initiation must be conducted electrically.

6. RISK ASSESSMENT

6.1 Aspects to be addressed

The risk assessment must, at least, cover the following;

6.1.1 A risk-assessment must be conducted and recorded on the specific operation.

6.1.2 Appropriate exposure measurements and environmental engineering controls must be put in place to comply with legal occupational hygiene requirements.

6.1.3 Hazards to be taken into account when conducting a risk assessment should include, but not limited to, the following:
- Noxious fumes from blasting;
- Dust created by blasting;
- **Flammable gas**;
- Thermal environment; and
- Diesel emission

6.2 Waiting Place

6.2.1 Blasting must be carried out from a place of safety demarcated by the manager. This position must be sign posted as "Waiting Place" and also act as a **contraband** control point, where applicable.

6.2.2 The blasting times must be recorded, and the re-entry interval must be specified and posted on the waiting place signboard and other relevant conspicuous places.

6.3 Miscellaneous

6.3.1 Continuously operating **flammable gas** measuring instruments must be used at all drilling sites (inclusive of cover/diamond/prospect drilling sites).

6.3.2 All calculations must be done and verified by the person engaged in terms of section 12.1 of the MHSA.

6.3.3 Your attention is also drawn to the MHSA Regulations published in the Government Gazette No. 23583, dated 2 July 2002. The following regulations must be noted: 9.1(3), 9.1(4) and. 9.2(1).

6.3.4 All persons concerned must be made fully conversant with the terms of this guidance note, copies of which must be readily available to them.

7. CALCULATION OF THE RE-ENTRY INTERVAL FOR A DEVELOPMENT END

$$\frac{Volume\ of\ end\ (l \times w \times h) \times air\ changes}{Force\ air\ volume (Q_F) \times 60(\min)}$$

∴ Re-entry period (minutes): $\frac{Volumetric capacity \times 8}{Q_F \times 60}$

∴ For an end 100m long, 4m high x 4m wide, with a force quantity of 10m^3/s and 8 air changes:

$= \frac{100 \times 4 \times 4 \times 8}{10 \times 60}$ min utes

= 21 minutes

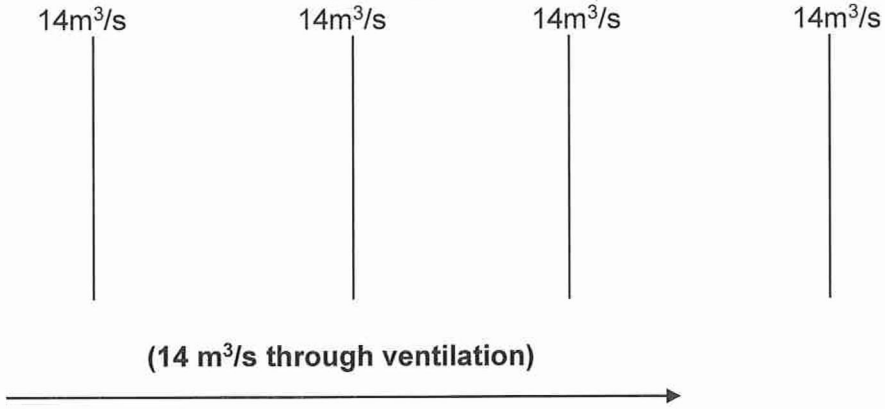
For multiple ends, ventilated **sequentially**, the re-entry period will be the sum of the individual end re-entries, **plus** 8x the volumetric capacity of the haulage connecting the ends to the RAW.

NOTE:

If, at any stage, blasting fumes from any end being multi-blasted contaminates any working places in the vicinity then multi-blasting must cease and conventional time blasting, or fixed-time blasting, must be done until conditions have been rectified for multi-blasting.

8. CALCULATION OF THE RE-ENTRY INTERVAL FOR SEQUENTIALLY VENTILATED DEVELOPMENT ENDS

EXAMPLE 1



Assumptions:

1. All ends are at maximum length (180m)
2. Spacing of ends: 120m apart

3. No ventilation column leakage

4. 14m^3/s force ventilation per end (Q_F)

Re-entry per end, including the time taken to clear the haulage to the next end, per 8 air changes:

End		**Haulage**
$= \frac{l \times w \times h \times 8}{(Q_F) \times 60}$	+	$\frac{l \times w \times h \times 8}{(Q_F) \times 60}$
$= \frac{180 \times 4 \times 4 \times 8}{14 \times 60}$	+	$\frac{120 \times 4 \times 4 \times 8}{14 \times 60}$
= 27,4	+	18,3 minutes

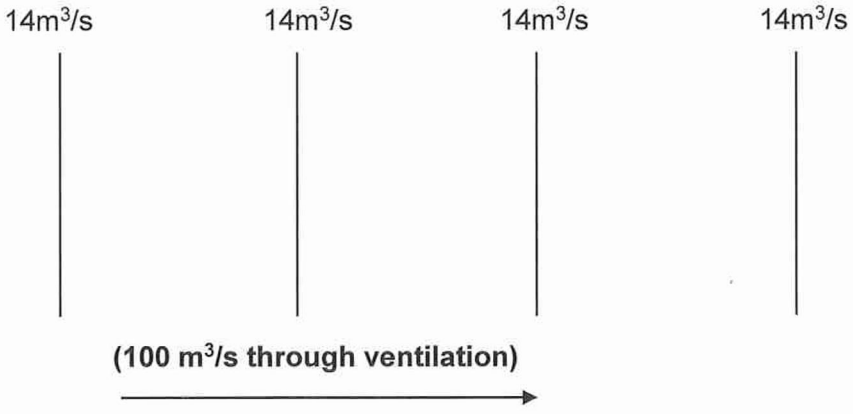
= 45,7 minutes, Say 46 minutes

Re-entry to the last end (no haulage to clear) = 27,4 minutes

Total re-entry, based on 8 air changes = (46 x 3) + 27,4
= 165,4 minutes. **Say 165 minutes**

Re- entry interval to this section after the general blast = 2¾ hours

EXAMPLE 2



Assumptions:

5. All ends are at maximum length (180m)

6. Spacing of ends: 120m apart

7. No ventilation column leakage

8. 14m^3/s force ventilation per end (Q_F)

Re-entry per individual end, including the time taken to clear the haulage to the next end, per 8 air changes:

End		**Haulage**
$= \frac{l \times w \times h \times 8}{(Q_F) \times 60}$	+	$\frac{l \times w \times h \times 8}{(Q_F) \times 60}$
$= \frac{180 \times 4 \times 4 \times 8}{14 \times 60}$	+	$\frac{120 \times 4 \times 4 \times 8}{100 \times 60}$
= 27,4	+	2,6 minutes
= 30 minutes		

Re-entry to the last end (no haulage to clear) = 27,4 minutes

Total re-entry, based on 8 air changes: = (30 x 3) + 27.4

= 117,4 minutes. **Say 120 minutes**.

Re- entry interval to this section after the general blast = 2 hours

9. ADVANTAGES AND DISADVANTAGES OF FORCED AND EXHAUST OVERLAP SYSTEMS

9.1 Advantages of forced column system when multi-blasting

9.1.1 Good quality air is delivered to the face at high velocity where the workers derive maximum benefit.

9.1.2 Only a single fan and single column are required.

9.1.3 The fan and fan motor are always in fresh air.

9.1.4 Leakage is always from the column and hence easily detected.

9.2 Disadvantages of forced column system when multi-blasting

9.2.1 Persons travelling and working in the drive do so in return air.

9.2.2 Long re-entry periods after the blast are necessary, hence rendering this system unsuitable for multi-blast development

9.2.3 Fumes from the blast are returned to the general mine air circuit.

9.3 Advantages of exhaust overlap system when multi-blasting

9.3.1 Rapid clearance of blasting fumes permits short re-entry period.

9.3.2 Persons travelling and working in the drive do so in fresh air as the return air is exhausted via the main column.

9.3.3 Blasting fumes are exhausted directly to return.

9.4 Disadvantages of exhaust overlap system when multi-blasting

9.4.1 The quality of air supplied to the face is inferior to that supplied by the forcing system. The slow-moving intake air along the drive can pick up heat, dust and gases in transit to the face.

9.4.2 Two columns and two fans are required.

9.4.3 Poor conditions can exist in the overlap section.

NOTE:

(a) Fans in the exhaust column must be positioned in such a manner that the exhaust column remains under negative pressure, thus ensuring that no exhaust fumes leak back into the intake air flowing to the face.

(b) The exhaust fans, which are the primary source of **through ventilation**, should be interlocked with all other electrical appliances and equipment in the end being multiblasted. This is to ensure that, in the event of the exhaust fans stopping, all other electrical appliances and equipment will also shut down.

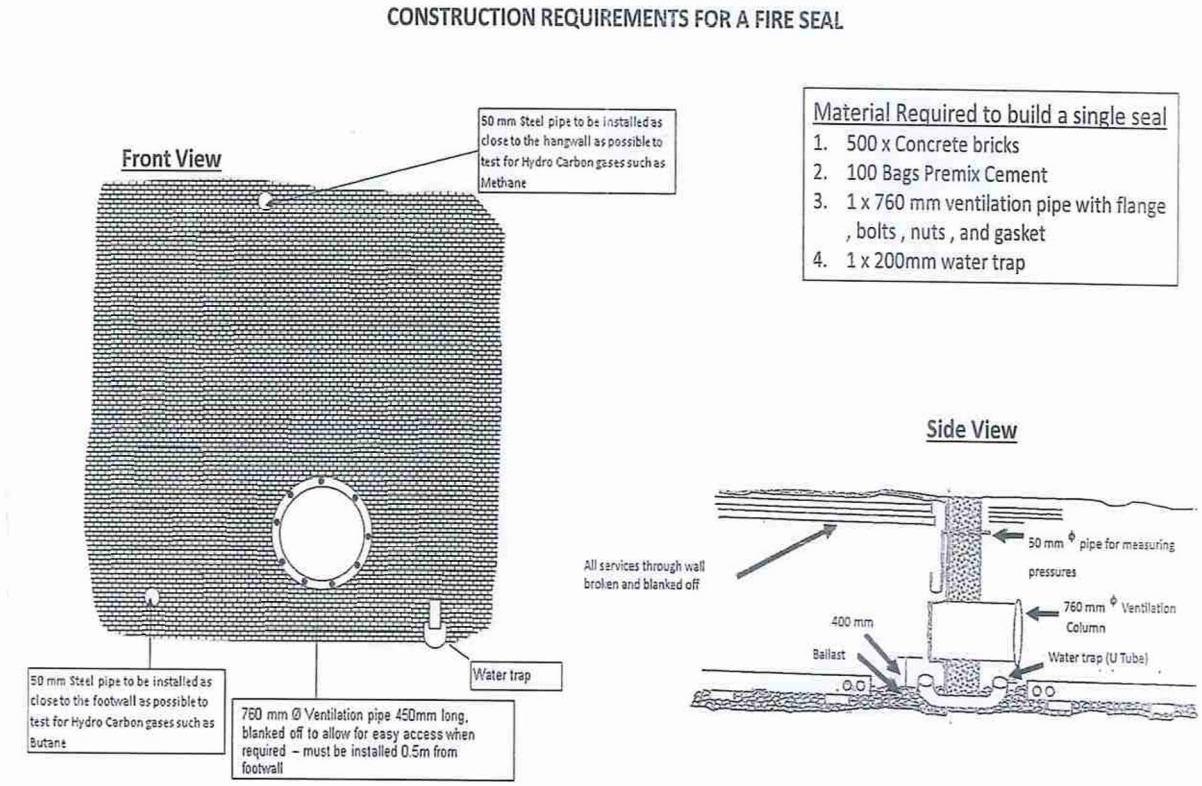
(c) No butterfly valves must be positioned in any exhaust column.

(d) To prevent open-circuit exhaust fans from recirculating a volume of at least $0,4m^3/s/m^2$ of **through ventilation**, at such fan sites, must be maintained at all times.

REFERENCES

- Environmental Engineering in SA Mines – Mine Ventilation Society of South Africa, pp 279 – 283
- Mine Ventilation Practitioner's DATA BOOK - Mine Ventilation Society of South Africa, pp UV-DE 2 to UV-DE 7

ANNEXURE 4: Construction requirements for a fire seal



ANNEXURE 5: References
(For information purposes only)

Cook AP - "GAP 504". - The Occurrence, Emission and Ignition of Combustible Strata Gases in Witwatersrand Gold Mines and Bushveld Platinum Mines, and Means of Ameliorating Related Ignition and Explosion Hazards, 1999.

The Mine Ventilation Society of South Africa - "Environmental Engineering in South African Mines".

"Mine Health and Safety Act" - Act No. 29 of 1996 as amended

DMR "Lamprooms guidance note"

DMR "Emergency preparedness guideline"

SANS documents 10108, I0086 -1 and 2 ARP 0108 SANS 1515-1 and 2 etc. to be included.

SANS 10108:2003 The classification of **hazardous locations** and selection of equipment to the used in such locations.

SANS 100086-1: 2011 The installation, inspection and maintenance of equipment used in explosive atmospheres, Part 1 installations including surface installation on the mine.

SANS 100086-2: 2011 The installation, inspection and maintenance of equipment used in explosive atmospheres.

ARPO 108:2013 Regulatory requirements for explosive provided apparatus.

SANS 1515-1:2006 (Battery operated portable **flammable gas** measuring instruments and warning sensor head) gas measuring equipment primarily used in mines.

SANS 1515-2:2006 Fixed (transport and vehicle mounted **flammable gas** measuring and warning sensor heads) gas measuring equipment primarily used in mines and the ARP 0108 -2013-Regulatory requirements for explosive prevention.