



DEPARTMENT OF MINERAL AND ENERGY AFFAIRS

DIRECTIVE NO : B6

EFFECTIVE DATE: 20 April 1994

SUBJECT : A Guideline For The Monitoring Of Self-Contained Self-Rescuers

SCOPE : This directive is applicable to all mine safety and health enforcement personnel and Managers of all mines with underground workings for guidance in the compliance with the provisions contained in the Minerals Act, Regulation 24.20.1(b) to ensure that self-contained self-rescuers are maintained in good condition ready for instant use.

PURPOSE : The purpose of this directive and addendum is to guide Regional Directors and mine management in the compilation and approval of a code of practice relating to self-contained self-rescuers.

DIRECTIVE : Regional Directors must request a code of practice, in terms of Section 34(1) of the Minerals Act, to be drawn up by managers of all mines where self-contained self-rescuers are legally required, in order to ensure an effective, maintenance and preparedness system for such self-contained self-rescuers.

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GUIDELINES FOR THE MONITORING OF SELF-CONTAINED SELF-RESCUERS

1. INTRODUCTION

Self-rescuers were formally introduced in the South African mining industry following legislation promulgated in 1986. However, the body-worn self-contained concept was novel at the time and much of this initiative relied on research and development which even now, some six years later, is still ongoing. In fact, the South African mining industry could be regarded as having pioneered this innovation.

Irrespective of type, all self-rescuers provide additional worker protection in the event of any sudden or unanticipated development of an irrespirable atmosphere, mostly as a result of a fire or an explosion. It follows that the establishment of exacting standards and the means to ensure ongoing reliability featured as key elements in the research, development and implementation programme. In this respect self-rescuer monitoring programmes are not unique. In the United States of America, for example, the responsibility for such programmes falls to the US Bureau of Mines, under the direction of the Mines Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH). In Germany the Hauptstelle für das Grubenrettungswesen der Bergbau (Mines Rescue Centre) assumes this function.

In South Africa a preliminary monitoring programme was established in 1989 and funded by the National Energy Council. The findings of these ongoing surveys are available in the form of a number of Chamber of Mines Research Organization (COMRO) reports (see References). This programme has been superseded by a more comprehensive industry wide monitoring programme.

The present document is based on the collective experience of mines, suppliers and Miningtek (formerly COMRO) and represents a guideline designed to assist mine management in:

- (a) optimizing the life-saving potential of self-contained self-rescuers (SCSRs) by ensuring that devices deployed on mines are '**maintained in good condition and ready for instant use**' (Regulation 24.20.1 of the Minerals Act (Act 50 of 1991), and

- (b) achieving maximum cost effectiveness from the deployment of self-rescuers.

Key aspects which will be covered are infrastructural requirements, sampling and reporting procedures.

2. OBJECTIVES OF SCSR MONITORING

The main objectives of an SCSR monitoring programme would be:

- (i) to detect adverse performance trends in SCSRs in daily use which could ultimately jeopardise an escape in the event of an emergency.
- (ii) to assist mine management in achieving legal compliance with Regulation 24.20.1(b) of the Minerals Act (Act 50 of 1991) by ensuring that devices deployed on mines are 'maintained in good condition and ready for instant use',
- (iii) to detect any trend indicative of 'premature deterioration' in terms of negotiated agreements including periods of guarantee. Mines would thus be advantageously placed to minimise (or circumvent) replacement or refurbishment costs,
- (iv) to identify units which remain functional within established norms subsequent to the expiry of negotiated periods of guarantee. Mines would once again benefit in that premature replacement or refurbishment of fully functional units would have been averted, and
- (v) to provide feedback, through proper reporting, on all makes of self-rescuers. Individual mines would thus be well placed to make comparative evaluations on an ongoing basis and this could lead to enhanced cost-effectiveness since such evaluations would enable mines to negotiate agreements with suppliers from a position of strength. In turn, competition may be stimulated which could result in further improvements and cost benefits.

3. INFRASTRUCTURAL REQUIREMENTS

The purpose of establishing a certain minimum infrastructure is two-fold, namely

- (a) to provide the basis for a realistic performance monitoring programme, and
- (b) to enable management to closely monitor service agreements with suppliers, the possible development of unfavourable cost trends, etc.

The essential infrastructural requirements are directed towards establishing an effective system of records. This system should make provision for the features listed below.

1. The manufacturer's reference/service number allocated to individual units must be recorded and retained under all circumstances. This reference is fundamental and should never be superseded by any other reference which the mine, in the interests of simplicity, may wish to introduce. A dual system is acceptable but the original reference should be retained for references purposes.
2. Ideally, units should be allocated on a personal basis. For various reasons re-allocations cannot be avoided. However, such re-allocations should be restricted to employees within the same work category or the same general work category. The records should therefore be able to provide a full history of allocations. Where a system of 'double shifting' of self-rescuers is in place, it should also be clearly indicated on mine records.
3. Where units are upgraded or refurbished (by definition where the oxygen source and/or carbon dioxide absorbent are replaced), appropriate entries should be made in consultation with the manufacturer. Such refurbished units will be regarded as 'new' for the purposes of further monitoring.

4. All units should be subjected to a full check at least once a week. The responsible official should record (by exception only) any finding or information relevant to routine service agreement checks. A specific example relates to units opened for some reason or another and then resealed. Records should also contain information on lost or destroyed units.
5. Full records should be kept on units randomly allocated (e.g. as back-up units or units reserved for visitors) or for supervisory staff not going underground on a daily basis. Normally these units would be excluded from the basic monitoring programme because of their potential limited exposure.

The above requirements all have a bearing on the overall monitoring programme. However, of particular importance at mine level is the information generated under point 4 above. In summary, mine records should reveal the following information on any unit:

- Make of self-rescuer (Manufacturer and model)
- Manufacturer's serial number
- Mine reference number (if different from manufacturer's number)
- Date of manufacture
- Date of purchase
- Date of issue
- Allocation history
- Service history

The precise infrastructure required to satisfy a record system of this nature cannot be prescribed. Excellent purpose-developed computerised systems are available from certain suppliers and this option should certainly be given serious consideration. With regard to suitable personnel it would be well worth considering a technically inclined (or qualified) person who

- (a) could receive some form of 'accreditation' or in-house training from the supplier/manufacturer, and who

- (b) could concurrently assume responsibility for other safety equipment, e.g. methanometers.

In addition to the above the manufacturer or supplier should be able to furnish the mine with a full service history of all units. Mine records could thus be such that trends could be identified with respect to

- (a) component breakdown
- (b) component breakdown related to work category (or even individuals), and
- (c) maintenance costs.

4. SAMPLING

The sampling strategy developed takes into consideration a number of factors, i.e. the consumer risk (the risk of accepting units which should be rejected), the producer risk (the risk of rejecting units which should have been accepted) and weighing up the sampling cost against the protection required. With due consideration of all of these factors a two-tiered approach has been adopted. This consists of

- (a) screening a minimum of 10 units (Appendix I) per mine per annum, with relatively small and relatively large mines being accommodated on a pro rata basis where indicated, and
- (b) conducting further investigations, on the basis of a sequential sampling procedure, in the event of units exhibiting unacceptable deterioration during the screening phase.

Mines should take the initiative for arranging tests which could then be detailed in collaboration with the testing agency, in particular with respect to the following:

- number of units required for assessment (routinely 10),
- the desired allocation history (work category, period in daily use), and
- service history requirements.

Mines would deliver units so identified, together with allocation and service histories, respectively, to a mutually convenient collection/delivery point.

Present assessments are based on destructive testing and arrangements for the refurbishment of these units should be agreed on. There are two main options, namely that

- (a) components of used units are returned to participating mines to take whatever further action is desired, or
- (b) the testing agency undertakes to have components of units delivered to suppliers for refurbishment.

Obviously, such arrangements should be agreed upon at the outset and a contact/liaison person will have to be nominated. However, since the activation of units for the purpose of monitoring takes place in a controlled laboratory environment (which minimises loss of or damage to components) and because the data base may well be communicated to manufacturers at the discretion of the mine, a strong argument exists for negotiating a preferential refurbishment fee.

The method of assessment appears in Appendix II, and basic data comprise

- oxygen generation
- carbon dioxide absorption
- breathing resistance
- inhalation air temperature
- observations relevant to structural integrity, as well as to defects arising as a result of poor packaging or quality control, and
- signs of tampering.

5. REPORTS

The information obtained through monitoring will permit the generation of routine reports by the testing agency. Reports will be circulated to mines in the first instance. Where requested, and subject to the mine's approval

where appropriate, reports would also be circulated more widely (e.g. to Groups and the industry as a whole). The format of these reports, and the amount of information disclosed, will differ, depending on the end use.

Reports to individual mines will, however, seek to categorise self-rescuers as follows:

Category 1 : functional performance falls within specifications used for the approval of new units.

Category 2 : functional performance falls outside approval specifications but with lifesaving potential unimpaired.

Category 3 : functional performance exceeds rejection limits, i.e. survival would be jeopardised if the self-rescuer is used in the normal escape mode.

The above reports would obviously interpret the data base and, if indicated, make recommendations to mine management. In the event of any serious and rapid deterioration in either functional or structural integrity, all mines likely to be affected will be informed immediately.

6. COST IMPLICATIONS

There are certain cost implications and, although it is impossible to address this consideration except in broad terms, attention can nevertheless be directed towards the important determinants of costs to individual mines.

Firstly, mines would be required to establish, if indicated, an infrastructure which meets a certain minimum requirement. This has been dealt with in some detail in Section 3.

Secondly, mines will be responsible for bearing the cost of refurbishing units withdrawn in terms of the monitoring programme. These costs will depend on the supplier/manufacture and also on the type (chemical versus compressed oxygen) of self-rescuer. Further reference to these costs appears in Section 4.

Thirdly, a programme has been established under the auspices of the Safety in Mines Research Advisory Committee (SIMRAC) whereby funds are available during 1993, 1994 and 1995 to cover the costs of assessing the condition of self-rescuers deployed on mines.