



## Mines Safety Bulletin No. 141

**Subject:** Maintenance of refuge chambers for underground mines

**Date:** 27 March 2017

### Background

Underground mine workers need access to a safe place of refuge in the event of an irrespirable atmosphere. Refuge chambers provide a safe haven to support life, with a supply of breathable air that must be ready for use at all times.

The basic life-support features of a refuge chamber include:

- reliable and clean compressed air supplies
- the capability to totally seal workers from an external irrespirable atmosphere
- a cooling system to prevent heat-related disorders over an extended period of use
- an effective chemical scrubber system(s) to remove expired contaminants (e.g. carbon monoxide, carbon dioxide).
- reliable power or battery supplies.

The Department of Mines and Petroleum's 2013 guideline on refuge chambers in underground mines recommends each refuge chamber have a design operating capacity of no less than 36 hours for occupants when operating as a stand-alone unit. Any refuge chamber not capable of sustaining life for this duration should not be used for emergencies (as defined by r. 4.36, Mines Safety and Inspection Regulations 1995), unless a risk assessment has confirmed its adequacy.

The Department of Mines and Petroleum have concerns that the capacity for some refuge chambers to support life in an emergency may have been compromised.

### Summary of hazard

A compromised refuge chamber may lead to the following issues during an emergency:

- inability to support life for the recommended minimum duration of 36 hours
- ingress of contaminants into the refuge chamber
- failure of life support systems to operate effectively (e.g. contaminant gases, heat)
- reduced battery power capacity.

### Contributory factors

A poor understanding of the critical life support system components in a refuge chamber may decrease awareness of the factors that can affect the chamber's performance and operational time.

## Functionality

- Placement of the refuge chamber in a higher ambient temperature environment than the operating range specified by the original equipment manufacturer (OEM).

*Note: A higher temperature may compromise the effectiveness of the cooling system, resulting in greater power consumption.*

- Batteries replaced with a different type or mixed with different types, which may compromise the operational time of the refuge chamber.
- Corrosion of battery terminals, chassis and internal electronics equipment in the refuge chamber.
- Use of out-of-date chemicals in the scrubber system, which may reduce the effectiveness of contaminant removal from the air.

## Maintenance and inspection

- Failure to identify defects due to the inadequacy of the inspection or service program.
- Inadequate maintenance of the mine air supply filtration system.

*Note: Oil, moisture and salt can enter the refuge chamber and damage sensitive electrical and electronic equipment.*

- Inadequate maintenance and inspection of seals and pressure equalisation mechanisms (e.g. valves).

*Note: Irrespirable air from the exterior can enter the refuge chamber due to a failure to maintain positive pressure (i.e. damaged doors, rubber seals and grommets).*

## Actions required

The following actions are recommended to duty holders to assist in maintaining a refuge chamber so it can support life in an emergency situation.

### Functionality

- Design and maintain the power supply to the refuge chamber so it is fully functional at all times throughout an emergency.
- Check the functionality of each refuge chamber regularly and after each move.

### Modifications

- Apply a formal change management process to refuge chamber modifications, including the OEM's review and authorisation prior to modifying the chamber.
- Keep records of any modifications.

### Maintenance and inspection

- Implement an adequate risk-based monitoring program to maintain refuge chambers in a state of readiness for the duration of any foreseeable emergency.
- Equip and maintain refuge chambers in accordance with the OEM's specifications.
- Verify that refuge chamber seals and pressure equalisation mechanisms are effective through regular leak testing.
- Ensure repair, replacement or maintenance work is undertaken by a competent person(s).

## Further information

- Department of Mines and Petroleum, *Refuge chambers in underground mines — guideline*, [www.dmp.wa.gov.au/Documents/Safety/MSH\\_G\\_RefugeChambersUGmines.pdf](http://www.dmp.wa.gov.au/Documents/Safety/MSH_G_RefugeChambersUGmines.pdf)
- Refuge chambers in underground mines (webpage), [www.dmp.wa.gov.au/Safety/Refuge-chambers-in-underground-7896.aspx](http://www.dmp.wa.gov.au/Safety/Refuge-chambers-in-underground-7896.aspx)

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