



## Case Study:

### Brokrew Refurbishment – Restoring an Old Refuge Chamber

*Restoring non-compliant refuge chambers gives them new life and more importantly improves safety on-site.*

## Safety through Refuge Restoration

Across South Africa, many underground mines have older refuge chamber brands that are no longer in manufacture and therefore not supported with replacement componentry. Without spare parts available, a refuge bay will lose its ability to protect personnel during an emergency.

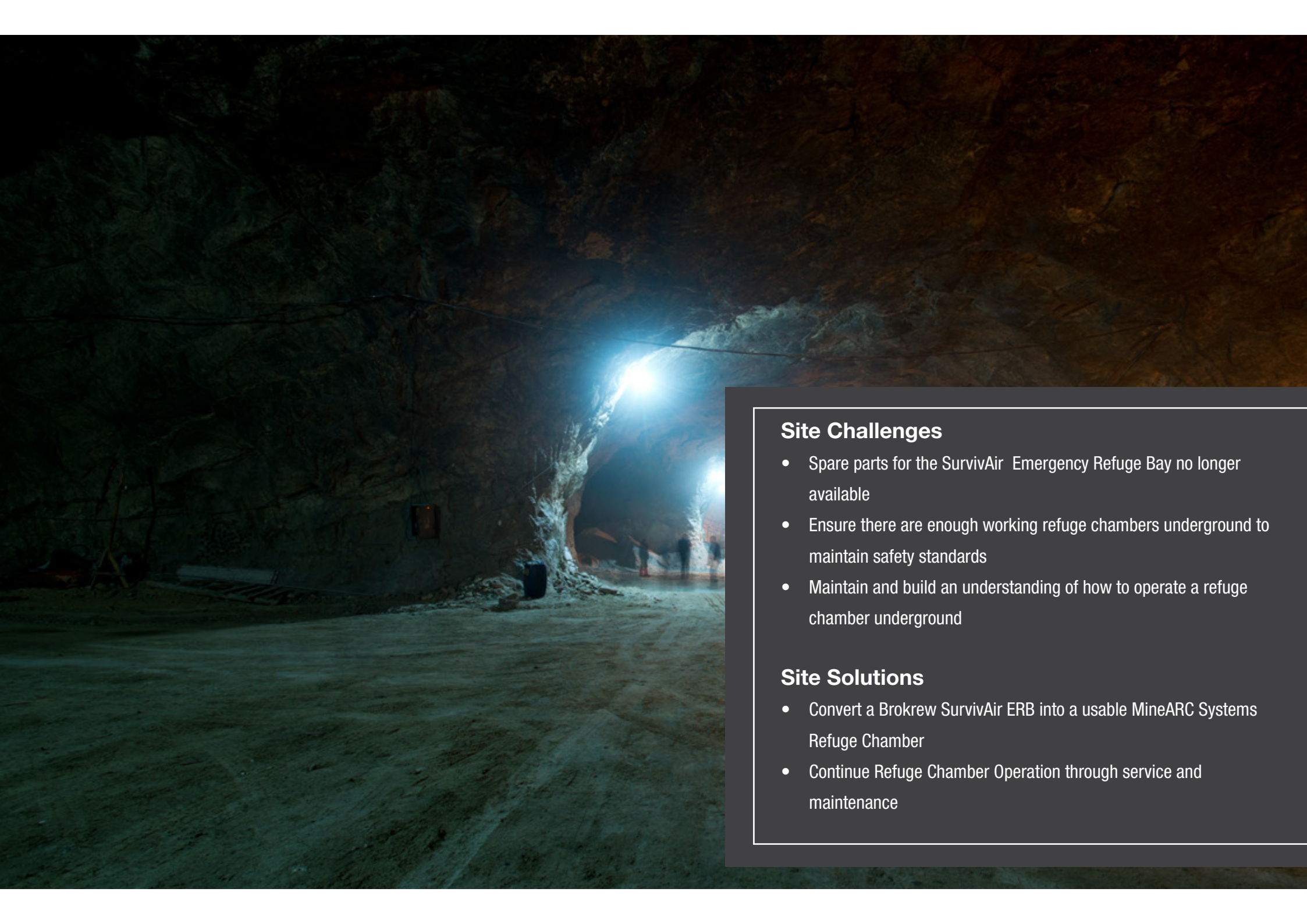
Refuge bays are used in underground mines as an essential part of an emergency response plan. They provide a safe and secure environment for personnel to remain while waiting for rescue or a hazard, such as a truck fire or toxic gas release, to subside.

How a refuge chamber keeps underground personnel safe, is through a series of specialty mechanisms and operational modes. Functional effectiveness is directly impacted by the integrity of the chamber and its upkeep.

A decommissioned SurvivAir Emergency Refuge Bay (ERB), required urgent restoration, as its parts and systems no longer supported a life-sustaining environment.



Pictured: Inside the decommissioned BroKrew Emergency Refuge Bay



### **Site Challenges**

- Spare parts for the SurvivAir Emergency Refuge Bay no longer available
- Ensure there are enough working refuge chambers underground to maintain safety standards
- Maintain and build an understanding of how to operate a refuge chamber underground

### **Site Solutions**

- Convert a Brokrew SurvivAir ERB into a usable MineARC Systems Refuge Chamber
- Continue Refuge Chamber Operation through service and maintenance

# 01.

## Converting a Brokrew SurvivAir ERB into a working Refuge Chamber

A refuge chamber refurbishment is a long-term solution to improve the cost-effectiveness and operation of the shelter.

### 01. A) Preliminary Inspections and Recommendations

Mike Sullivan, Service Manager at MineARC Systems Africa, met with the client and after inspection of the chamber, recommended a full conversion. The proposal was to supply all the life-sustaining components that will fit inside their existing SurvivAir ERB.

A general inspection provides an overview of the chambers structural integrity and the condition of the internal mechanisms. The site was provided with a detailed report on the chamber's infrastructure, highlighting the concerning state of equipment and out-dated features such as the battery placement.

Once stripped and sandblasted, the frame of the exposed refuge bay underwent a secondary structural inspection. Examining the refuge chamber in this raw form identifies defects such as rust or holes, which impact the reliability of the shelter.



Pictured: Inspecting the components and structure of the Brokrew SurvivAir Refuge Bay

## 01. B) Refurbishing a Refuge Chamber

Restoration of the non-compliant Brokrew Emergency Refuge Bay was completed at the MineARC Systems Africa manufacturing facility.

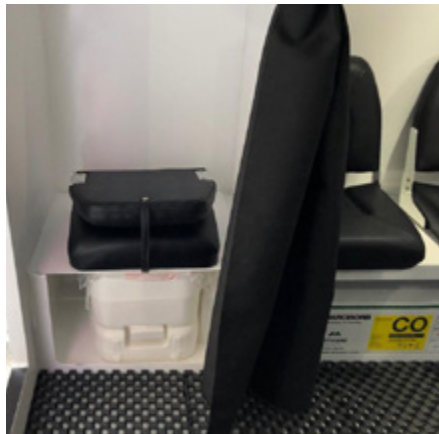
Under the direction of engineering, the chamber underwent minor remodelling. Renewal of structural elements allowed for the installation of check valves, compressed air, and removal of the internal battery supply.

Critical features of the upgrade included;

- Installation of an Extra-Low Voltage carbon monoxide and carbon dioxide scrubbing system
  - MARCISORB carbon monoxide and carbon dioxide chemical cartridges
- Aura-FX Digital Gas Monitor, measuring carbon dioxide, carbon monoxide, and oxygen gas levels as well as the internal temperature
- A Compressed Air Management System (CAMS) to control the flow of mine air to the chamber, reducing excess waste and cost
- An external back-up battery supply

Upon completion, the site had a fully certified, 16-person, 36-hour emergency refuge bay. Besides the apparent external design differences, the life-sustaining systems and integrity of the finished chamber met the high-quality standard of all MineARC Products. All MineARC Refuge Chambers, including refurbishments, undergo a four-stage sign-off approval.

The chamber restoration improved the operation and efficiency, during stand-alone, externally-supported, and stand-by mode.



**Converting a Brokrew  
SurvivAir ERB into  
a working Refuge  
Chamber**

## Converting a Brokrew SurvivAir ERB into a working Refuge Chamber

### 01. C) Avoiding Explosive Risks with Refuge Chamber Battery Placement

Refuge chamber batteries provide vital power to the shelters life-sustaining systems during an emergency. Although power to refuge chambers in underground mines is primarily supplied by a connection to the electrical system, if this fails, the battery bank ensures the chamber can run for a set duration.

Batteries within a refuge bay should be stored externally, minimising the potential for explosions, fires or exposure to fumes.

The SurvivAir Emergency Refuge Bay kept the back-up battery supply within the chamber, posing an additional hazard. Refuge chamber batteries should be kept in ventilated, protected enclosures. If a fault occurs with the batteries in a sealed environment, such as a refuge chamber, fumes from the batteries can cause it to ignite. For example, [a hydrogen gas build-up within a refuge chamber that stored its batteries internally](#) caused the shelter to explode risking the safety of all personnel underground.



Pictured: The original BroKrew Refuge Bay stored its batteries inside the refuge chamber. An external UPS was fabricated to store the new battery bank.



Pictured: MineARC conducting on-site service and operational training

As the SurvivAir ERB is no longer manufactured and off the shelf spares are not available, it potentially dangers any employee who uses the refuge bay in an emergency. Refuge bays which cannot be serviced and maintained using original equipment manufacturer (OEM) parts run the risk of under performing, or in worst case not operating at all.

The site had an existing fleet of MineARC Refuge Chambers. Conversion of the SurvivAir ERB to a MineARC ELV Refuge Chamber, achieved consistency across the site in regards to spare parts, servicing and training. This conversion provided several additional benefits, including:

- A better understanding of refuge chamber operation, as a single operational process was taught
- Efficient ordering of spare parts
- Streamlined maintenance and service procedures

With the SurvivAir alteration completed, the refuge chamber is now more user-friendly, with a full back up of spare parts, and detailed service plan.

## 02.

### Continue Refuge Chamber Operation through Service and Maintenance

The choice to refurbish the SurvivAir Emergency Refuge Bay ensured site maintained its emergency-preparedness. The project fully restored the shelter to comply with safety guidelines and streamline maintenance procedures on-site. Low refuge chamber maintenance risks the lives of personnel underground and damages the safety culture. When a refuge bay cannot be serviced and repaired with the OEM spares, it impacts the integrity and operational capacity of the chamber.



Pictured: The restored, fully compliant refuge bay

## Tailored Industry Solutions

### Refuge Chambers & Toilets

- MineSAFE Essential Design
- Non-MineARC Refuge Chamber Refurbishment
- EnviroLAV Standard Design

### Life-Supporting Technology

- Airlocks
- GuardIAN Refuge Chamber Monitoring
- Service Kits
- Aura-FX Digital Gas Monitoring
- Compressed Air Management System
- ELV Scrubber
- MARCISORB Chemical Cartridges

### Training & Education

- Dual language training and operation materials
- On-site operational training
- On-site certified refuge chamber servicing
- Operational guides

## For More Information

To learn more about how MineARC Systems can support your site, visit [minearc.com](http://minearc.com)

