Strata REFUGE Solutions
for MINES, TUNNELS, CHEMICAL PLANTS, & SURFACE OPERATIONS
ABOUT STRATA WORLDWIDE

Strata Worldwide is a leading global provider of products and technologies that promote higher levels of worker safety on the job. The company specializes in solutions for underground working environments, providing safety and communications systems for both day-to-day operations and emergency situations.

Strata has been a global leader in underground emergency refuge since late 2006, and was the first company in the United States to introduce a completely powerless chamber for underground coal mines. We now offer numerous portable chamber designs, specialized kits for permanent safe rooms, government approved breathing air systems and various communications and gas detection options for refuge structures. To date, we have placed over 1600 chambers into service across 21 countries worldwide.

Current applications include:
- Coal Mines
- Metal/Non-Metal Mines
- Tunnels
- Chemical Plants
- Surface Operations

* CE Certified
The Strata ERC is a complete safety system designed to provide immediate refuge and breathable air in the event of an emergency that compromises the quality of breathing air in the working environment. They serve as a cache of clean, breathable air, ideal for any situation where workers could become trapped. Chambers are intended to be an alternative option when escape is not possible.

### BASIC FUNCTION:
In the event of an emergency (such as a fire, explosion, gas leak or roof fall), ERCs will provide a safe environment for a pre-set number of occupants. The ERCs are designed to be fully autonomous for remote locations with battery backup systems available for up to 96 hours of stand-alone operation. The ERCs can also be connected to available utilities (power, compressed air and water) to extend the safe environment indefinitely.

### CONSTRUCTION:
ERCs are fabricated using a minimum ¼ inch (6mm) high strength steel plate with an internal structural skeleton built with rolled tubular steel sections to create a strong, airtight outer shell. Corrosion resistant coatings are used both externally and internally to protect the steel from harsh environments.

<table>
<thead>
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<th>Occupancy</th>
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<th>20</th>
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<tbody>
<tr>
<td>Length (ft/m)</td>
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<td>Height (ft/m)</td>
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<tr>
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<td>18,000/8,100</td>
<td>20,000/9,000</td>
<td>22,000/10,000</td>
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Notes: (1) Dimensions and weights may vary based on specifications; (2) Weights assume 96 hour of battery capabilities and DC air conditioners; (3) Lengths may not include optional airlock.

### AIRLOCK:
An optional entrance compartment can be created by adding a secondary steel door or heavyweight PVC curtain. This compartment prevents contaminants from entering the chamber when the main door is opened during initial entry. An optional active purge system can be installed to flush the airlock using compressed air prior to entering the main chamber.

### HANDLING:
Each chamber is equipped standard with forklift guides, and lifting eyes for lifting with a crane. An optional hardened skid plate can be added for sliding the unit into place. A crash bar is fitted around the structure to minimize damage when transporting underground. Special lifting eyes and attachments can be supplied to lower vertically down a shaft or for hanging beneath an elevator car, if required.

### WHEELS & TOWING:
An optional package with wheels and a tow bar can be added to facilitate easier mobility. Wheels are constructed of solid rubber. For rough terrain, a high clearance wheel mounting option can be added that provides 16” of clearance beneath the chamber.
SAFETY & DIRECTIONAL DECAL PACKAGE:
Chambers have large reflective signs fitted to all sides to identify the unit and direction to reach the entrance. A reflective band around the chamber enhances visibility.

SEATING AND STORAGE:
Storage space is provided under the seats and on overhead shelving. Seats are constructed from a high-grade, humidity resistant padding and materials for durability.

EMERGENCY SIDE ESCAPE HATCH:
In case of a secondary emergency, such as a rock fall blocking the main chamber entrance, an inward opening hatch is fitted to provide a secondary escape route.

PAINTING:
Exterior Safety Yellow or White (customer preference) corrosion resistant coatings are available. The interior coating is a non-toxic low VOC material suitable for human exposure.

COMPRESSED AIR CONNECTION (OPTIONAL):
If the ERC is connected to the operation's compressed air supply system, air can be supplied for an indefinite period of time. A high-quality air filtration system filters out any oil, water, odor or organic compounds in the air before it is released into the chamber. A silencer is used to reduce noise levels. Pressure relief valves are installed to maintain a positive internal pressure while continuously purging the chamber of human exhaled carbon dioxide.

BREATHEABLE AIR SYSTEM:
The onboard Breathing Air System, standard in all chambers, consists of high purity oxygen cylinders and an active carbon dioxide scrubber. The scrubber can be designed to meet any regulatory CO₂ standards for exposure (typically 5000 to 10000ppm).

The scrubber draws power from the chamber's power source - either the main power line or an onboard battery backup. The scrubber utilizes sealed replaceable cartridges, factory filled with a medical grade granular soda lime material. A special filter fabric keeps any particles from circulating inside the chamber. The rectangular shape of the cartridges stack and pack efficiently beneath the seats.

The cartridges are changed periodically based on the number of occupants and the maximum allowable level of CO₂. The used cartridges are neatly placed back under the seats and no open handling or exposure to soda lime takes place.
Strata includes a proprietary timer on the scrubber that calculates and audibly alarms to indicate it is time to change the cartridges. Simply dial in the number of people in the chamber.

Oxygen cylinders are fitted with individual flow-rate valves set according to the number of occupants. This controls the amount of oxygen released into the environment. Occupants monitor the oxygen levels and make adjustments to the flow as necessary.

A new automated oxygen system that measures oxygen levels in the chamber and automatically adjusts the oxygen flow to keep the level within a 19.5% to 22% range is now available. This system removes the human factor from the critical control of oxygen.

**CO DETECTION/DIVERSION LINE (OPTIONAL):**
If the ERC is connected to an external source of compressed air, and there is the possibility of carbon monoxide being drawn into the inlet of the compressor system, Strata offers a unique CO detection and diversion system. Using a continuous sensor, if CO is detected in the compressed air entering the chamber, an audible alarm will sound and a valve will automatically re-direct the air flow to the outside of the chamber. ERC’s with this feature will require activating the onboard Breathing Air System in place of the compressed air.

**CO CONVERSION SYSTEM:**
Strata offers several options for removing CO from the main chamber of the ERC. A stand-alone battery powered CO converter that runs continuously for up to 72 hours on a single battery or replaceable cartridges using precious metal catalysts that can be customized to address any expected CO levels.

**DC BACKUP POWER:**
A fully automatic battery backup system consisting of high storage capacity AGM batteries and specialized multi-stage chargers is standard on all ERC’s requiring autonomy. The systems are normally connected to local power to maintain the charge on the battery but will automatically and seamlessly switch to battery power should the local power be disrupted. The battery bank is sized to provide power to operate air conditioner(s), CO₂ scrubber, lighting systems, atmospheric monitoring gas detectors and communication system (upon request) for the designed duration.

The units are equipped with standard transformers capable of adapting a wide range of available AC power voltages and frequencies to feed the onboard power requirements. The transformers are flexible and can be easily re-configured should the available power change.

**LIGHTING/SIREN:**
Low power consuming 24-volt LED lights are mounted inside the chamber. Additionally, RED and BLUE 24-volt LED indicator lights are mounted on the outside to signal occupancy and emergency conditions. An external siren can be activated from inside the chamber to indicate an emergency and help locate the chamber audibly should smoke be present.

**COOLING & DEHUMIDIFYING SYSTEM (OPTIONAL):**
The Strata ERC’s are equipped with a DC powered air conditioner that runs directly off the battery bank. No complicated or inefficient conversion from DC to AC is necessary. The industrial air conditioners are uniquely designed to handle the high quantity of moisture produced by humans in a confined space. Specialized insulation can also be added for high temperature external environments.
ACCESSORIES

PRIVATE SANITATION:
A variety of toilet configurations are available to handle the inevitable calls of nature. Privacy and cleanliness are keys to maintaining a safe and healthy environment.

FOOD & WATER:
Individually packaged emergency water and special food bars are provided to maintain people for the duration of confinement. Food and water is stored beneath the seats and has a 6-year shelf life.

FIRE EXTINGUISHER(S):
A 20lb (9kg) ABC dry chemical fire extinguisher is mounted and secured outside the airlock compartment. Additional units available upon request.

FIRST AID:
A first aid kit to suit the number of occupants is included. A compact foldable stretcher can be provided as an option.

MULTI-GAS MONITORING (OPTIONAL):
Scrubbers can be equipped with individual CO₂ and O₂ sensors provided by Trolex that continuously monitor the environment within the chamber. The sensors will provide a visual and audible alarm if the measured gas levels fall outside the safe levels. The Trolex sensors are easily calibrated using the unique e-Module concept.

The ERC's can be fitted with fixed Trolex multi-gas monitoring systems to read CH₄, CO, CO₂, O₂ and other gasses. The data can be readily transmitted to a central station.

CUSTOM CONSTRUCTION & DESIGN
Custom chambers can be built and kitted according to customers’ individual requirements. All units are identical in purpose and function to standard ERCs and include the standard equipment and supplies.
- Air filtration system
- Onboard backup batteries and breathable air system
- Food, water and a lavatory

Segmented ERC
Strata Segmented ERCs are constructed and delivered in segments to be assembled underground. This design optimizes transportation and handling and helps to overcome entry shaft and/or handling restrictions possible at individual operations.

Low-Profile ERC
Low-profile units have reduced heights to accommodate low seam heights. These are most commonly the Strata Fresh Air Bay inflatable units, as they offer greater flexibility at lower height, easier maneuverability and natural heat dissipation.

Tunneling ERC
Tunneling-specific ERCs are designed and constructed to be narrower in width to suit the tunneling environment. Tunneling chambers can be mounted directly onto Tunnel Boring Machines (TBMs), onto rails or placed within the tunnel while operations are active.

Compact and Mobile ERC
Strata offers a small (4- to 6-person) compact chamber that is designed to stay close to the working section for quick and easy deployment.
Strata CUSTOM Refuge Solutions

**Powerless Chambers – Steel and Inflatable**

Strata offers completely powerless, steel walk-in and inflatable chambers that are ideal for explosive/gassy environments. Onboard oxygen, compressed air cylinders and an air-powered carbon dioxide scrubber provide breathable air for up to 96 hours of occupancy. The Fresh Air Bay inflatable unit is an explosion-resistant skid that houses all cylinders, equipment and supplies, along with the highly durable inflatable tent. In an emergency, the tent is inflated, filling to full size with clean air.

**STRATA CHANGE-OVER STATION**

The Strata Change-Over Station (COS) is a walk-through, transitional chamber that offers workers a temporary nontoxic environment in which to exchange personal breathing air units during an evacuation. It functions as a storage cache for SCSRs or other personal breathing devices in the case of an emergency.

The COS has an entry and exit door and is intended to provide a clean, well-lit area in which workers can safely exchange their breathing air apparatus, communicate, rest and rejuvenate during self-evacuation. The COS includes an air filtration system for a mains airline connection, as well as an onboard battery and air supply backup. Backup supplies can be provided for an excess of 24 hours.

**SPECIFICATIONS:**
- Onboard oxygen and air cylinders
- CO₂ scrubbing system
- Storage rack for up to 50 self-rescuers

**OPTIONAL SUPPLIES PROVIDED:**
- Mine maps
- Communications system
- First aid kit
- Water

**STRATA SAFE ROOM**

The Strata Safe Room is a pre-constructed refuge room equipped with Strata’s refuge equipment and supplies to sustain life for workers trapped in emergency situations.

Breathable air can be provided through a borehole from the surface, compressed mine air with a high-quality air filtration system, or oxygen cylinders with alternative forms of CO₂ scrubbing.

**Carbon Dioxide (CO₂) Scrubber Options**
- Battery-powered or air-powered active scrubber with fans to circulate air through soda lime filled cartridges
- Soda lime curtains hung in room and passively absorb CO₂ out of the air

**Oxygen Supply Module**
- Collection of 3-9 oxygen cylinders per skid
- Multiple skids can be used for additional cylinders
- Regulators and flow meter valves included
- Up to 3,300 cubic feet (93,000 L) of oxygen available per module

**Air Cooling Module**
- Operates on mine power or battery backup
- Minimum of 48 hours continuous cooling
DESIGN AND MANUFACTURING:
Strata chambers are designed in the United States and Australia. Manufacturing facilities are located in the U.S., Australia, Mexico and South Africa.

TRAINING:
Each chamber includes a set of operating and training manuals, as well as a PowerPoint DVD (multiple languages). Additional training and/or support provided upon request and as agreed upon.

STRATA SAFE ROOM OPTIONS:
Options:
- Explosion-resistant access door that can withstand 15psi overpressure
- Airlock and purge air system
- Auxiliary battery power with 24 hours of additional power
- Lighting and alarm kit including LED interior lighting, LED exterior flashing beacon, alarm, batteries and charger
- Benches

Optional Supplies Provided:
- Food and water
- First aid kit
- Communication device
- Flashlights
- Gas monitors
- Portable toilet