



# Case Study:

## Custom Central Control Room Shelter for Chlorine Gas Release

*Tronox in Kemerton Industrial Park, Western Australia, install custom Safe Haven with remote plant access*

Chemical risk management is crucial for manufacturing and processing facilities. Tronox manufactures Titanium Dioxide ( $\text{TiO}_2$ ), which adds brightness and durability to paints, plastics, paper and other everyday products.

During a risk assessment, on-site safety personnel identified the need for additional emergency response steps in an accidental chlorine gas release. These actions required control room operators to keep the facility running, plus allow rescue teams to carry out tasks.

Control room operators are required to remain at their stations during an emergency, as the plant cannot be simply shut down due to process safety requirements. It's important that the plant can be maintained at a safe and stable level while the incident is resolved. Several steps were taken to reduce the risk of exposure, including installing a ChemSAFE Custom Shelter.

### Key takeaways

- A custom chemical shelter allows staff to safely remain on-site and keep the chemical plant operational during emergencies to ensure the plant can continue to operate safely
- Monitoring equipment helps to protect against hazardous events such as chlorine gas release
- Emergency rescue teams use the chemical shelter as a command centre, complete with communications, monitoring and rescue equipment



Pictured: ChemSAFE custom-engineered chemical shelter



# chemSAFE

SAFE HAVEN

## Challenges

- Remote Plant Control
- Emergency Response Station
- Chlorine Gas Risk Management
- High Traffic Positive Pressure Airlock

## Solutions

- Provide External Plant Management from Inside the Chemical Shelter
- Safeguard and Support the Rescue Activities of Emergency Response Crew Solution
- Protect Personnel Against Chlorine Gas Release
- Support Multiple Entries from ERTs while Maintaining Positive Pressure



# 01.

## Provide External Plant Management from Inside the Chemical Shelter

The chemical shelter was fitted with an inbuilt desk for a console and computer equipment needed by plant operators. The office-like setup allows external control of the plant from within the safe haven, reducing the risk of exposure to on-site personnel and allowing safe operations to continue.

Site-wide communications systems, both ethernet based and twisted pair, were installed to provide two-way connections between the control centre, emergency responders, and the chemical facility.

Multiple computers and screens gave a complete overview of the chemical plant, permitted external management, and provided access to valuable real-time data from external monitoring systems. This information is passed onto the emergency response team to support rescue and risk management activities.



Pictured: Inbuilt desk and computer equipment

Tronox requested that the chemical safe haven have the capacity to store emergency response equipment, including full-length chemical suits and Self-Contained Breathing Apparatus (SCBA). Control Room personnel will either remain in the refuge or put on chemical protection attire and PPE located in the shelter before returning to the chemical control room or performing search and rescue operations.

The structure of the shelter was custom designed to accommodate the dual-purpose requirements. Additional storage and layout features include:

- Hanging storage for Self-Contained Breathing Apparatus (SCBA),
- Shelving for HAZMAT chemical suits, disposable chemical protection coverall, gloves, plus search and rescue equipment
- Bench seating to easily remove rescue equipment and PPE, as well as inspect the equipment
- Under seating storage for additional site-supplied PPE such as helmets and eye protection
- Open space to allow placement of chemical suit on the ground before donning
- Medical stretcher



## 02.

**Safeguard and Support  
the Rescue Activities of  
Emergency Response  
Crew**

# 03.

## Protect Personnel Against Chlorine Gas Release

Chlorine gas is widely used in manufacturing and industrial applications; however, it poses a severe risk to the health and safety of personnel if accidentally released.

Based on a risk assessment, the ChemSAFE Chemical Shelter was engineered for a four-hour standalone duration. The sealed environment contains a chemical air scrubber, breathable air supplies, climate control, and other essentials for 12-people to comfortably and safely remain within the refuge for the four hours if required.

Inside the chemical safe haven, the Aura-FX Digital Gas Monitor with chlorine gas sensors measure  $Cl_2$  levels inside and outside the chamber. Gas readings sent from the internal and external aura gas sensors, along with internal video feed and refuge system parameters, are viewable via the secure web-based GuardIAN Refuge Chamber Monitoring dashboard.



Pictured: Aura-FX Internal and External Digital Gas Monitoring



Pictured: Additional air pressure systems support multiple re-entries

As the safe haven serves as an emergency chemical shelter and command centre, safety and operations personnel must be able to enter and exit the chamber multiple times during an emergency.

A critical element of safe refuge design is its ability to prevent the ingress of toxins and other airborne hazards from entering. This is achieved through the application of positive internal pressure within a sealed environment. Due to the expected high traffic of the airlock system, a different approach had to be made, where the shelter integrity could be maintained whilst allowing high airlock usage and faster entry through lower cycle times.

To meet this challenge, the chemical shelter is equipped with a large volume airlock for multiple cylinder cache, air curtains, positive pressure flushing system, dedicated Chlorine gas detection and positive pressure maintenance system in the primary chamber. Each mechanism provides a unique action to maintain the integrity of the internal space.

- The airlock has ample stored volume to allow flushing for multiple entries
- The air curtains create a pressure barrier to actively prevent contaminants from accompanying personnel during passage, allowing rapid entry through the airlock
- A Positive Pressure Flushing System (PPFS) releases measured amounts of air from compressed air cylinders to remove contaminants from within the airlock during cycling
- The Positive Pressure Maintenance System applies differential pressure to the inner chamber, ensuring a constant outward flow of air

# 04.

## Support Multiple Entries from ERTs while Maintaining Positive Pressure

While all steps are taken to prevent the occurrence of hazardous events, Tronox understood the nature of manufacturing and had the foresight to invest in safety equipment that would support operations if such an event was to occur. By installing the customised ChemSAFE chemical shelter, the facility can help ensure the plant is maintained at a safe level during incidents.



Pictured: MA1849 Custom ChemSAFE on-site

## Tailored Industry Solutions

### Refuge Chambers & Safe Havens

- ChemSAFE Standard Design, customised
  - » 12 Person capacity
  - » Chemical protection for 4 Hours
  - » Console for plant control
  - » Space for CCR personnel to suit up in chemical suits/SCBA
  - » Storage for search & rescue equipment

### Life-Supporting Technology

- Airlock
- Air Curtains
- Positive Pressure Flushing System
- Positive Pressure Maintenance System
- Automated Oxygen Delivery System
- Series IV Controller with Gas Scrubbing
- Aura-FX Digital Gas Monitoring
- Reverse-cycle climate control with dehumidifying
- GuardIAN Remote Monitoring
- Backup battery system

### Training & Education

- Training and operation materials
- On-site operational training

## For More Information

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

