Modern safety chamber technology

MechChem Africa talks to MineARC Systems' Jason van Niekerk, sales manager for Africa, and Alex Farquhar, business development manager for the global petrochemical industry, about the company's innovative chamber technologies for protecting lives on sites that are subject to potentially deadly and very expensive safety risks.

MineARC Systems officially opened in South Africa in 2013 to cater for the need for emergency safe refuge chambers for underground mines. "Our first clients were Anglo American Coal and Sibanye Gold Mine," Van Niekerk tells *MechChem Africa*.

"The African business grew from there. We started to manufacture chambers in North Riding in Johannesburg and to supply and install our solutions in key countries around Africa where underground mines are prevalent," he adds.

"We have now also started to supply the African chemical industry with shelters. So far, we have commissioned two – one in Namibia on a uranium processing plant and another in Morocco for a fertiliser plant, both to mitigate against the risk of an ammonia release," he says.

Farquhar notes that the safe refuge technology originated in Australia back in 1999 and quickly became well established in hard rock mining. "We are celebrating our 21st this year, and we have grown to have manufacturing facilities in Perth, Australia; Dallas, Texas and in Johannesburg. We are now supplying to over 60 countries globally," he says.

"When it comes to the petrochemical market, chambers, safe havens or refuges are not established products anywhere in world – so much so that there is not even a common set of terms for them. In the petrochemical industry in the US, they are called 'safe havens', here in Australia, they are called 'shelters' or 'refuges', and the mining industry prefers the term 'refuge chambers'. Acceptance of the need for the technology is growing, though. It is something everyone facing potential risks to life should be looking at," says Farquhar.

Describing the technologies currently embedded in chambers, Farquhar first points out that every shelter is designed to protect the lives of people at risk. This means that MineARC's solutions are customised to suit a specific site and the particular risks faced by those working there.

"For an underground mine safety chamber, the risk generally involves loss of respirable atmosphere from underground fires. Rescuing the miners may take several days, so the chamber needs to sustain life for anywhere from 36 to 96 hours, depending on the depth, complexity and type of mine.

"Our ChemSAFE chambers, on the other hand, seldom need to isolate people for much longer than 12 hours. Chemical incidents are generally immediately catastrophic, but fires and explosions tend to burn-out relatively quickly, and gas releases will usually dissipate within 12-hours or so. I have chambers built for as little as two hours," he explains.

Each refuge chamber has its own backup power and redundant systems to enable self-contained operation, so even if there is catastrophic plant loss, these systems will continue to operate. "Grid power is connected to each chamber, which trickle charges a battery bank. We assume that power may be lost, however, so the battery bank is designed to power the chamber for the full containment time," he adds.

"We provide supplemental oxygen, we offset the humidity and heat, and we scrub out the CO_2 from the breath of each person being protected. The idea is to sustain a comfortable and life-sustaining environment in the chamber for the full extent of a potential incident," Farquhar explains.

A critical component of these systems is communication. "Underground, mines are moving towards fibre and LTE Wi-Fi," notes Van Niekerk, "but many are still running on hardwired solutions. Our systems come with a comms port and aerial connection, so we can easily connect to any mine's local network.

"A key innovative feature of our chambers is the inclusion of our GuardIAN Network Intelligence suite, which uses the network to access two-way video and voice technologies to maximise the connectivity between the trapped personnel and the outside world. It was initially designed for communication to and from the chamber, but we have been adding supplementary products around that, such as environmental gas monitoring, tracking and lighting," he informs *MechChem Africa*.

MineARC's underground mine safety chamber can sustain life for anywhere from 36 to 96 hours, depending on the depth, complexity and type of the mine.

Farquhar explains: "Modern connected gas monitors are used to continuously track the gas levels in areas surrounding the shelter. This helps rescuers efficiently and safely re-enter the area following an emergency. We also now use tracking technologies in high-risk petrochemical systems to identify where everyone is at any point in time. We have cameras in control rooms that can do remote monitoring via dashboards and we can install navigational lighting systems as part of a solution to help get people into the chambers as quickly as possible, which is critical following any incident," he says.

Safety procedures alone cannot save people when there is an incident. Purpose built technologies can. "We have saved lives on sites that have adopted our solutions, which has made these companies acutely aware of the value of these systems. It's a matter of education and advocacy to others that are currently taking risks," he notes.

As well as self-contained purpose-built toxic gas shelters, MineARC has also become a specialist in blast resistant buildings and shelter-in-place solutions. Largely targeting the chemical and petrochemical industries, these are conversions to existing buildings designed to shelter people in-situ.

"If a petrochemical facility has offices onsite, it seldom makes sense for people to be sent outside to find the shelter, so we identify a room or some space inside the building and we upgrade sealing performance and equip the area with the everything needed to control the air quality and climate, to keep people alive and comfortable until they can be safely evacuated.

"We are trying to get more of the petrochemical plant operators to see the benefits of technologies such as these," continues Van Niekerk. Even this year, we saw a fatal incident at a refinery in Cape Town.

"Plants in South Africa tend to have an escape gas room and, having seen many of these, they are often little more than a room with standard doors and taped up windows. This is totally inadequate for protecting people in the event of any serious gas release. We are trying to educate operators at plants such as these as to what is truly required to sustain employees until they can be safely rescued," he says.

"The shelter-in-place option is also ideal for control rooms, where people will often have to stay at their stations, regardless of what is happening outside. We can go to site, do visual and leak testing and identify the potential for improving the isolation capability. If too difficult, we also have 'room in a room' solutions, where we install a sealed room inside the control room to ensure employees can safely remain in place," says Farquhar.

Safe Haven chambers provide supplemental oxygen, offset the humidity and heat, and scrub out the CO_2. The idea is to sustain a comfortable and life-sustaining environment in the chamber for the full extent of a potential incident.

He cites a growing need for shelters as a result of the emerging use of hydrogen fuel in the Australian shipping industry. "Hydrogen poses challenges in terms of its use and storage. One solution involves the use of ammonia as the source of hydrogen, so we hope to see more widespread use of our technology to mitigate against ammonia hazards.

"Safety solutions should be seen as another essential tool in a plant's emergency response plan. In mitigating against real and potentially very expensive risks of disaster, what better way is there than adopting the best possible tools on the market? All employers need to make sure there is no question about whether people are safe while working down a mine or on a plant," he notes.

"We should all be thinking about doing everything we can to keep our people safe, rather than simply meeting minimum safety requirements," Van Niekerk concludes. ❑

ChemSAFE chambers protect against immediately catastrophic incidents that dissipate relatively quickly, usually within 12-hours or so.