Case Study:

First MineARC Methane Shut Off System installed for Egyptian Tunnel

In a first for MineARC Systems, Methane Shut Off Systems (MSOS) have been engineered for installation on two MineARC TunnelSAFE Refuge Chambers currently mounted on the rear of two separate Tunnel Boring Machines (TBM’s) at an Egyptian tunnel construction site in Port Said.

Tunnels under construction are exposed to potentially explosive conditions while penetrating areas where oil, gas or coal may release combustible gases, in particular Methane (CH4). Methane is the main constituent of natural gas. Whilst being non-toxic, when inhaled the odourless and extremely flammable gas is an asphyxiant gas and may displace oxygen in an enclosed space resulting in suffocation.

Even low emissions of CH4 can be hazardous. When mixed with air, Methane is combustible in concentrations of between 5 and 15 %. 5 % concentration is the lower explosive limit (LEL) or methane, while 15 % value is the upper explosive limit (UEL). Methane concentrations in air that are below the LEL or above the UEL are not explosive.

When a methane pocket is exposed, the gas is emitted from the strata, usually at a high concentration. The most likely place to find emitted CH4 is in the face area of the tunnel where it will collect in unventilated corners. In the case of operations using a TBM, Methane can accumulate at the muck discharge and behind the face shield. If the tunnel is unlined, any location along the entire length is a potential site for a Methane layer at the crown. Enough ventilated air must be provided to immediately dilute the methane gas to safe levels as soon as the gas enters the tunnel. A good ventilation system will supply enough fresh air to reduce gas levels far below the LEL as soon as the gas is emitted from the strata.

In the event of a methane gas leak, a refuge chamber is no longer safe for operation due to its electrical componentry being at risk of causing an explosion. MineARC’s Methane Shut Off System (MSOS) is a manually activated electromechanical system that will isolate all electrical components and will prevent the UPS back up from restarting them. The MSOS unit will fundamentally shut down the refuge chamber and automatically seal the battery box.

Prior to evacuation from the tunnel, the MSOS is activated by pressing one of the shut-off switches located adjacent to the chamber door (externally) and adjacent to the ELV Scrubber (internally). Personnel will be notified of the chambers state visually with intrinsically safe amber flashing lights and audibly via a distinct siren. Once activated the refuge chamber is rendered uninhabitable and is not to be occupied.

Utilising a closed loop compressed air system, once MSOS is activated compressed air flows from the cylinders inside the chamber through an actuating cylinder. This cylinder, mounted on the interior face of the battery box cover plate, closes a knife gate valve which seals the battery box. Once the battery box is cleared of any potentially explosive gases such as Methane from the local atmosphere and Hydrogen from charging batteries, a separate airline supplied from the same cylinders purges air through a gland in the rear bulkhead; pressurising the battery box to a level higher than the surroundings and reducing the risk of contamination ingress.

Once the traces of Methane have cleared and re-entry in to the tunnel is safe, the refuge chambers can be returned to service by ensuring that both emergency MSOS buttons have been reset.

The Egyptian TunnelSAFE Refuge Chambers were recently commissioned by Ryan Woods, MineARC Service Technician. Ryan also completed refuge chamber operator training for 80 people during his visit.

For more information on MineARC’s Methane Shut Off System, please email info@minearc.com