As a refrigerant, ammonia has many beneficial characteristics: zero global warming, high latent heat, zero ozone depletion, it’s one of the cheapest refrigerants and wide availability. Many of the older designs of industrial refrigeration plants are charged with large volumes of ammonia. The new generation of plants are being charged with smaller quantities of ammonia and due to the availability of suitable equipment, for example compressors and even semi-hermetic compressors, ammonia is no longer restricted to the large industrial market.

However, ammonia is both toxic and hazardous and if good safety and maintenance procedures are not adhered to, it can cause injuries and like other refrigerants, it can indirectly cause fatalities.

This being the case, it’s always good to see that the industry is involved in presenting new ideas and concept to end users, which is why safety and emergency procedures were the focus of a one-day workshop presented by Padriac Durham of Gauge Refrigeration Management in Auckland, New Zealand. The workshop was held at the Italian Club in Cape Town on 25 April 2019. Participants included A Perks Enterprises (co-presenters), Crossberth Cold Storage, Hexkoel Commercial Cold Storage, Puregas, Table Bay Cold Storage, Ammonia Training Services, Ceres Fruit Growers, Commercial Cold Storage, and GEA Africa.

PERSONAL EXPERIENCE
At the early age of 25, Durham learnt from first-hand experience to respect ammonia. Due to his lack of training and knowledge, and some over-confidence, he became involved in a near-tragic situation where he had to flee from a plant to get medical help. He was trying to drain oil from an ammonia charged plant when a valve broke and released excessive ammonia which, if he had been properly trained, he could have dealt with quickly and effectively. He was hospitalised for weeks to recover from his injuries.

Research has shown that 67% of injuries from the release of ammonia, have occurred to service personnel, only 30% to response team members and 3% to the public.

IN CASE OF EMERGENCY
Attendees were divided into groups and asked to review past assessment of emergencies done by Durham. Each group was then given a scenario related to real emergencies. Each scenario included a mix of personal experience, emergency procedures, and data from research papers. The scenarios were designed to challenge the participants to think critically and apply the knowledge they had gained to real-life situations.

1. Cold store operators, suppliers of bulk ammonia, service contractors and training providers attended the one day ammonia safety and emergency response workshop.
2. His career in training started when Padriac Durham tried to drain oil from a plant and he was not prepared, over-confident, untrained and careless.
3. Aerial photograph of the Italian Club illustrates the three-dimensional conical shaped ammonia cloud that would form in the event of an ammonia release.
4. Nico Lategan of Table Bay Cold Storage tries a compact, quick fit gas mask, while Gideon Matherbe looks on with a more conventional mask.
group needed to comment as to how the emergency could have been prevented. One group assessed an actual release on a tuna trawler as the result of the failure of a corroded shut-off valve, which was out of sight in the confined space below deck, that it had not been maintained. The release was so excessive, the trawler was turned into the wind to allow the cloud of ammonia to blow away from the crew until the plant could be isolated. Other incidents were studied: a filling hose from a bulk road tanker that fractured and the blade of an evaporator motor that fractured and cut into the evaporator piping. Attendees offered preventative steps as better maintenance, installation of leak detectors and regular visual inspections. The response to each emergency also indicated poor or total lack of plans to cope with emergencies, which can occur at any time. The common thread through all of the discussions was the lack of training, preparedness and just the feeling that ‘this will never happen to us’. Panic and fear will occur when the pungent odour of ammonia is detected, or clouds of ammonia vapour are seen. This is a scary situation if you are not trained in how to cope and address the situation. The longer it takes to get it under control, the more the incident will escalate. In an ammonia release, visibility is seriously impaired due to the white vapour produced when ammonia flashes off into the atmosphere and saturates an area.

In the open car park of the Italian Club, Durham illustrated a white-out drill, demonstrating how to get to safety with eyes shut through clouds of ammonia vapour. It was interesting to see him illustrating that keeping low to the ground, with one foot firm on the ground, and the other stretched forward and swaying to detect any obstruction, was the most effective way.

PPE
Respiratory protective equipment in the form of gas masks and breathing apparatus are legal requirements of each plant. A mask should also be at hand or being worn when doing repairs or routine maintenance such as.
draining oil or replacing valves. In the case of emergencies, masks, suits and self-contained breathing apparatus are required.

Durham showed the steps in fitting the most basic mask and getting all the straps equally tightened to ensure a full seal between mask and face. Gideon Malherbe of A Perks Enterprises demonstrated a self-contained breathing apparatus with cylinder and mask. Using a self-contained apparatus certainly requires training and is a requirement of SANS10147 for sites with ammonia charges in excess of 500kg. Slip-on masks without straps and a new full body productive suit were also demonstrated.

**FIRST AID PROCEDURES**
First aid procedures with ammonia differ from standard procedures. Flushing with water to remove ammonia that has come in contact with parts of the body, is paramount and the location of the regulatory emergency shower became a topic of discussion. Although showers are normally located outside the plant room, if the release was heavy and from the plant room, it would be impractical or impossible to shower in a cloud of ammonia.

Having the characteristics of ammonia, safe exposure limits, safety equipment, and possible causes for failures, the workshop was required to draft an emergency management plan (EMP). With an aerial photo of the Italian Club, the impact of an ammonia release on the neighbouring areas could be mapped out. Each of the EMPs of the group were analysed and acted in theory. In analysing the EMPs, the importance of preparedness and to have one incident controller in the event of an emergency was evident.

**NOTHING TO FEAR**
The workshop certainly instilled confidence in the attendees that with proper training and adhering to safety procedures, ammonia refrigeration systems are not to be feared and have far-reaching efficiency benefits with the least direct and indirect impact on the environment.

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