

## **Ammonia in Refrigeration Systems in Ice Arenas**

The majority of ice arenas and curling rinks in Canada use ammonia as a refrigerant in their refrigeration systems to cool the floors in their rinks and subsequently allow applied water to freeze into an ice surface. These refrigeration systems are heavily regulated both in design and operating regulations which provides the highest level in regards to system integrity.

This sheet is intended to provide general information regarding the characteristics of ammonia, how it is used and handled in a typical refrigeration plant, what procedures are in place for safety and what is required in cases of emergency.

### **A. What is Ammonia?**

The liquid ammonia referred to in this fact sheet should not be confused with the “liquid ammonia” commonly found in households. Household ammonia is actually a diluted mixture of ammonia and water. The ammonia commonly used in refrigeration systems is ammonia gas that has been compressed into a pure liquefied form, sometimes referred to as anhydrous ammonia.

Ammonia gas is colorless and has a characteristic pungent, penetrating odor which is very irritating to the eyes, nose, and respiratory system, which makes it easy to detect low concentrations in the air. Ammonia is a product that falls within WHMIS/GHS legislation.

It is also much lighter than air. If ammonia gas escapes from a refrigeration system or a storage container, it tends to collect in high areas or ceilings.

Ammonia’s fire hazard rating is usually stated as “slight” as it is only explosive in air at concentrations of 16–27 percent (by volume).

### **B. How does the ammonia act as a Refrigerant?**

In ice arenas the ammonia refrigerant is in a closed loop which essentially means it is contained within the system. In most typical refrigeration systems the cold ammonia is circulated or flooded around a series of tubes which contains a brine solution (calcium chloride and water). This is inside a vessel known as the “Chiller”. This cold brine is circulated to the rink floors and is what allows the floor to be cooled. As the ammonia cools the brine it takes on heat and this heated ammonia is compressed and circulated through piping to an evaporative condenser. **In the condenser, cold water is circulated over the piping which condenses the ammonia into liquid form which is then circulated back to the chiller and the process starts over again.** The ammonia does not enter in to the rinks or other areas of the facility and is contained within vessels or piping in the refrigeration plant.

### **C. What safety procedures are in place?**

Ammonia refrigeration systems are required to be installed, operated and maintained in accordance with the requirements of the Boiler, Pressure Vessels and Refrigeration Regulation, the Mechanical Refrigeration Code-B52, ASME, AHRAE and the BC Safety Act.

Operational personnel that handle the regular operation of the refrigeration plant receive training by attending and completing courses that are held throughout the province and offered by agencies such as the Recreation Facilities Association of BC (RFABC). Upon completion they must pass a provincial examination to be certified with Technical Safety BC (TSBC). These personnel are on shift either continuously or for designated periods of time depending upon the requirements of their annual operating permits which are issued by TSBC.

Operators are regularly recording and monitoring the plant and equipment during their shifts and logs are kept and reviewed regularly.

Refrigeration systems have ammonia detection systems that will alarm according to levels that are stated in the regulations.

Operators are trained and certified annually in the proper use and care of respirators which are readily available at the facility and may be used should procedures specify.

#### **D. What to do if an ammonia leak occurs?**

Emergency Response and Fire Safety Plans containing written safe work procedures (SWPs) are in place for incidents and operations which are reviewed on a regular basis. These allow the operators to perform their responsibilities safely and effectively and provide a safe facility for the public to enjoy.

#### **E. Summary**

This fact sheet is intended to provide an overview of ammonia in a typical refrigeration system. If anyone would like to further discuss or gain a more comprehensive understanding then please contact your local facility or the RFABC for further information.