Minimize the Risk Involved in Using Ammonia Refrigeration

Anhydrous ammonia is a common refrigerant due to its excellent heat transferring properties, availability, and low cost for large commercial operations. Typically, ammonia refrigerant is used in facilities where larger coolers and freezers are required. Ammonia refrigeration is commonly used for food processing, cold storage warehousing, wineries, breweries, dairies, ice cream plants, seafood processing, and petrochemical facilities.

Ammonia is a combustible, toxic, colorless, highly irritating gas with a sharp, suffocating odor. Exposure to high concentrations of ammonia in air causes immediate burning of the eyes, nose, throat, and respiratory tract and can result in blindness, lung damage or death. Inhalation of lower concentrations can cause coughing, and nose and throat irritation. People will notice the pungent odor and irritating affects at low levels (less than 50 ppm).

Another concern is the combustible nature of ammonia. A release of ammonia from refrigeration equipment can create a flammable vapor cloud, subject to fire or explosion.

Protecting People:

Ammonia gas can cause serious, sometimes fatal injuries. Injuries range from minor skin burns, mucous membrane irritation, respiratory damage, or fatalities. Ammonia's potential injury severity depends on the dose and how it contacts the individual (e.g., skin, eyes, inhalation, or multiple routes).

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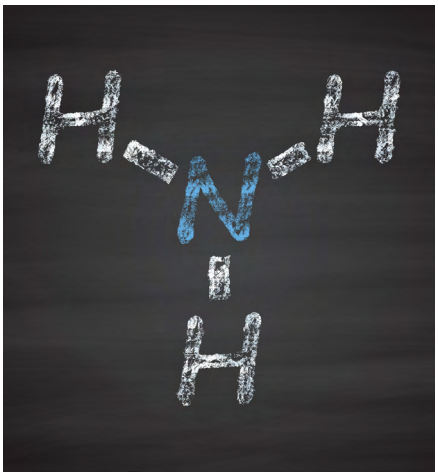

Exposure to employees and/or the public depends on the amount of ammonia leaked and proximity to occupied areas of the facility and to the surrounding community (schools, residential neighborhoods, public spaces).

Any facility using Anhydrous Ammonia should develop written standard procedures for safe operations and emergency response. Procedures should be specific to the facilities and include:

- Effective warning signage
- Appropriate loading procedures in place
- Proper color coding and labeling
- Employee training (including driver selection and training)
- Personal protective equipment (PPE) program
- Emergency response and pre-planning with the local emergency agencies
- First Aid training and equipment
- Emergency Action Plan
- SARA Title III (Emergency Planning and Community Right to Know Act) compliance

Protecting Facilities and Materials

Because Anhydrous Ammonia is combustible, leaks can result in fire or explosions. Common causes of leaks include:

- Pipe failure from vibration
- Corrosion of pipes, fittings and connections
- Valve or compressor failure
- Improper use of hoses for loading and unloading operations
- Overfilling of vessels
- Lack of barriers and other proper protective equipment of tanks and piping.

Controlling fire and explosion exposure begin with proper design and construction. Ammonia refrigeration equipment should be separated from normally occupied spaces. This should be accomplished by a separate building (preferred) or as a cutoff room. This room should be provided with at least one exterior wall and a door leading directly outside. Non-combustible construction is preferred, as well as avoiding the storage of combustible materials inside the room. The room should be provided with a fire sprinkler system designed to NFPA Standards.

Exterior walls should contain vent relief panels and designed for explosion-venting wall systems. Interior walls should be vapor-tight and designed to be pressure resistive, so the walls do not explosively vent.

Exhausts systems should vent directly to the outdoors. As ammonia is lighter than air, the exhaust should be close to the ceiling level and the fresh air intakes should be at floor level.

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Ammonia machine rooms are considered “hazardous” locations. Therefore, all electrical systems in the room should be designed and installed for that specific environment according to NFPA 70 National Electric Code. Ventilation should be provided for both continuous (normal) operations and emergency operations. Emergency ventilation should have both automatic and remote manual activation systems. The ventilation system should be provided with back up electrical supply (such as a backup generator) to insure proper operations during electrical interupptions.

Because Ammonia is toxic and combustible, a leak detection system is critical. A two stage ammonia detection system that will report to a constantly attended location, such as, a central station monitoring company should be installed. Further, a detection system should continuously sound a local alarm while simultaneously activating the ventilation system. In addition, if the refrigeration system is shut down due to an ammonia leak, refrigerated stock can spoil. To minimize the potential of loss, facilities should be equipped with backup generators, an emergency contingency plan, or both.

References and Resources:

- Plant ammonia safety self-inspection. Federal OSHA has a printable checklist that helps assess 35 plant safety questions.
- Ammonia receiving operations, ammonia storage vessels, and transport hoses are vulnerable places for leakage and potential human contact that demand scrutiny. Minimum guidance from OSHA can be found here.
- In addition, it is important to know, understand, and follow original equipment manufacturers’ use, maintenance, and emergency protocols.
- Emergency Response resource
- Ammonia refrigeration systems with 10,000 lbs. or more bring them under OSHA 1910.119 – The Process Safety Management Standard.
- Applicable Codes (NFPA, EPA, OSHA, FM Global, DOT, SDS, UL)
- Resources OSHA, NIOSH, EPA, NFPA, ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers), UL
- Other pertinent legal requirements and codes may include DOT, EPA, along with any state or local codes.

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