



# HAZARD ALERT

Cherie Berry, Commissioner of Labor

1-800-625-2267 ♦ [www.nclabor.com](http://www.nclabor.com)

Occupational Safety and Health Division

1101 Mail Service Center, Raleigh, NC 27699-1101

## Ammonia Refrigeration Systems: Process Safety Management Is Vital to Employee Safety

On June 20, 2009, an ammonia line ruptured during maintenance at a poultry processing plant in Robeson County, N.C., killing one employee and injuring several others. This accident should remind employers of the hazards associated with the use of anhydrous ammonia as a refrigerant at food processing plants.



### What Is Anhydrous Ammonia?

Anhydrous ammonia (ammonia gas) occurs naturally and is an important source of nitrogen that is needed by plants and animals. It is commercially produced by the reaction of nitrogen and hydrogen under conditions of high temperature and pressure.

Ammonia (Chemical Abstracts Service No. 7664-41-7) boils at -28.1 degrees F and is highly soluble in water. Anhydrous ammonia is typically shipped as a liquid under pressure and readily converts to a gas when released to air, forming a white "smoke" by freezing moisture in the air.

### Why Is Ammonia Hazardous?

Ammonia is considered a high health hazard because it is corrosive to the skin, eyes and lungs. Exposure to 300 parts per million (ppm) is immediately dangerous to life and health. Ammonia is also flammable at concentrations of about 15 percent to 28 percent by volume in air. When mixed with lubricating oils, its flammable concentration range is increased. It can explode if released in an enclosed space with a source of ignition present, or if a vessel containing anhydrous ammonia is exposed to

fire. Fortunately, ammonia has a low odor threshold (20 ppm), so most people will seek relief at much lower concentrations.

### What Industries Are at Risk?

Ammonia is widely used as a refrigerant in a variety of industries, including:

- Meat, poultry and fish processing facilities
- Dairy and ice cream plants
- Wineries and breweries
- Fruit juice, vegetable juice and soft drink processing facilities
- Cold storage warehouses
- Other food processing facilities
- Seafood processing facilities aboard ships
- Petrochemical facilities

### Process Safety Management

The key to preventing ammonia leaks is hazard recognition. Facilities that use 10,000 pounds or more of anhydrous ammonia must comply with the Process Safety Management (PSM) Standard, 29 CFR 1910.119. A key provision of this standard is the requirement for the employer to conduct a hazard analysis for each process,<sup>1</sup> i.e., a careful review of what could go wrong and what safeguards must be implemented to prevent releases of highly hazardous chemicals. Process hazard analyses must be updated and revalidated at least every five years and retained for the life of the process.

*1. A process includes any activity or combination of activities including any use, storage, manufacturing, handling or the on-site movement of highly hazardous chemicals (HHC). A process includes any group of vessels that are interconnected and separate vessels located such that HHC could be involved in a potential release.*

The PSM Standard requires a written program that includes other employer requirements, such as, but not limited to, compiling process safety information on all covered processes; written operating procedures; pre-startup safety review; mechanical integrity of process equipment (including hoses used for the transfer of a highly hazardous chemical); management of change to process equipment; and communication between host employer and contractor employers regarding how the work of the contractors' employees will impact a covered process. The PSM Standard also requires the issuance of hot work permits for hot work operations conducted on or near a covered process, incident investigations (including "near misses") within 48 hours, and employee involvement and training.

### Preventing Ammonia Leaks

Some of the operations associated with ammonia refrigeration systems are ammonia receiving and storage, the condenser area, piping and pressure vessels, refrigeration spaces, and the machine room. Ammonia receivers and storage vessels are permanently connected to a mechanical refrigerating system by inlet and outlet pipes for the storage of the liquid refrigerant.

Ammonia refrigeration systems are closed systems for which the most obvious hazard is an ammonia release. A release can occur as a result of improper ammonia receiving operations or ammonia storage in vessels or the use of improper hoses.

Ammonia is delivered by an outside source (rail car, over-the-road tank car or cylinder) to a facility. The ammonia is transferred to the storage vessel or some other portion of the system using pumps, compressors or simply differential pressure. Once the transfer is complete, workers must perform standard shutdown operations to turn off the pumps or compressors and



to disconnect the hoses.

Hoses that are used for loading or unloading ammonia into or from refrigeration systems have a limited life. The user must be alert to any signs of deterioration before hose failure can occur. Hoses that are designed and marked for use with ammonia must be used and replaced according to manufacturer recommendations.

Accidental release of ammonia from storage vessels due to vessel failure can result from improper design and installation (including improperly designed relief valves), thermal expansion or contraction, corrosion, overfilling, or external damage (for example, from a forklift).



### Available Resources

The PSM Standard as well as other information used in the development of this hazard alert regarding the use of anhydrous ammonia and ammonia refrigeration systems can be accessed through the OSHA Web site: [www.osha.gov](http://www.osha.gov).

The OSH Division's Consultative Services Bureau provides free services to employers around the state. See the NCDOL Web site at [www.nclabor.com/osh/consult/consult.htm](http://www.nclabor.com/osh/consult/consult.htm) for information about this program and to download a request form.

### Disclaimer

*This industry alert provides general information about the hazards associated with the use of anhydrous ammonia in refrigeration systems and ways to prevent releases that can have catastrophic consequences. This document is not intended to be a substitute for the compliance with the requirements of the Process Safety Management Standard or any other applicable OSH standard.*

