

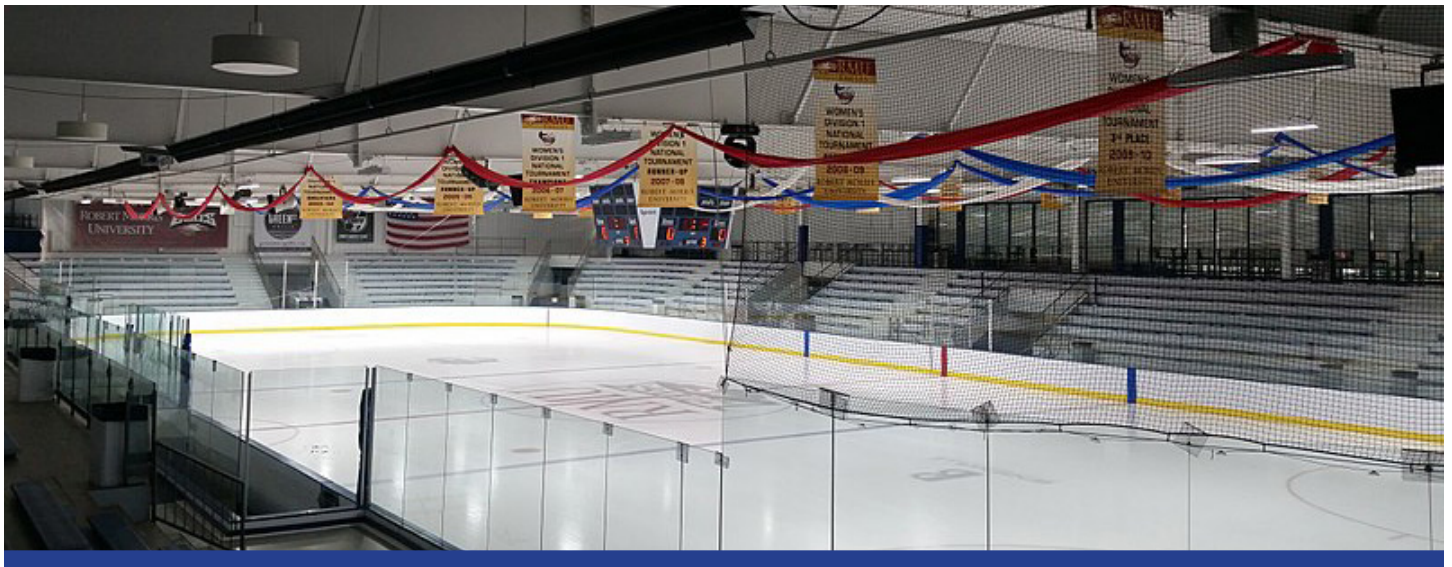


# Ammonia

## SAFETY IN NEW ENGLAND ICE RINKS

### Recommendations for Ice Rink Operators with Ammonia Refrigeration Systems

U.S. EPA New England has developed this document to assist ice rink owners and operators with ammonia refrigeration systems in communicating effectively with their employees, contractors, vendors, and customers about ammonia refrigeration safety. Helping facilities to minimize the risk of potential chemical releases, such as an accidental release of ammonia at a refrigeration facility, is a national priority for U.S. EPA.



### What is ammonia?

Anhydrous ammonia is a toxic gas recognizable by its pungent odor. Anhydrous ammonia compressed into a liquid form is commonly used in mechanical refrigeration systems for indoor ice rinks and other facilities. It becomes a gas when released into the ambient air.

### How does ammonia relate to ice rinks?

Ammonia refrigeration is an economically and environmentally efficient option for ice rinks and other refrigeration facilities. Of the many types of refrigeration systems used in the U.S.,

ammonia is one of the most energy-efficient. Unlike some refrigerants, ammonia does not cause damage to the ozone layer.

Some ice rink facilities that use R-22 refrigeration systems are switching to ammonia. In 2020, the U.S. will cease production and import of chlorofluorocarbons (CFCs) such as R-22 (also called HCFC-22) to reduce negative impacts on the ozone layer. This will lead to a decrease in the supply of R-22.

### What are the risks of ammonia exposure?

While there are many benefits to an ammonia-based refrigeration system, there are

also potential risks to health and safety if the ammonia is not properly managed and contained. When released as a gas, ammonia is a severe irritant to the eyes, nose, and throat. Exposure can cause headaches, coughing, difficulty breathing, and impaired vision.

Prolonged exposure to high concentrations of ammonia can lead to asthma, blindness, and pulmonary edema (fluid in the lungs), which can be fatal. Skin contact with liquid ammonia can cause burns, blisters, and frostbite, as well as blindness or eye damage. Ammonia gas can also be flammable or explosive when  
continued >>

released into the air at high concentrations, which is why it is important to have a well-ventilated machine room.

Proper maintenance and management of ammonia refrigeration systems can prevent a system failure or leak from occurring, reducing the risk of exposure. Ice rink staff should also be trained to recognize ammonia's pungent odor, which could indicate a leak.



headache



irritated eyes



difficulty breathing

## What are the requirements for refrigeration systems in ice rinks?

Anhydrous ammonia is an extremely hazardous substance regulated under the Clean Air Act (CAA) and the Emergency Planning and Community Right-to-Know Act (EPCRA). CAA Section 112(r)(1), the General Duty Clause, requires facility owners and operators to ensure safe management of any extremely hazardous chemicals handled or stored onsite, including ammonia. Rinks with more than 10,000 pounds of ammonia must prepare a Risk Management Plan (RMP), and can learn more at <https://www.epa.gov/rmp>.

Industry codes and guidelines help EPA and facilities understand the standards of care for facilities with ammonia refrigeration systems. The International Institute of Ammonia Refrigeration (IIAR) and the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) have issued guidelines and standards for safe installation, use, and maintenance of ammonia refrigeration equipment through the American National Standards Institute (e.g. ANSI/IIAR Standard 2 and ANSI/ASHRAE Standard 15, respectively).

EPCRA requires facilities to report information about hazardous chemicals to emergency planners and responders. EPCRA Section 302 requires rinks to report the presence of any extremely

hazardous substances listed at 40 C.F.R. Part 355, including ammonia, to the state emergency response commission. Also, Section 312 of EPCRA requires some rinks to report annually on the presence of chemicals in order to aid local emergency response planning. Ice skating rinks and other facilities are required to submit an annual chemical inventory report to the state, local emergency planning committee, and fire department if they have on-site extremely hazardous substances (EHSs), including ammonia, or other hazardous chemicals. The threshold for ammonia is 500 pounds; thresholds may vary for different substances. Note that EPCRA's annual chemical inventory requirements may not apply to municipally-owned and operated rinks in states that do not have an OSHA-approved state plan to protect workers.

Facilities and operations also must be in compliance with applicable OSHA requirements (such as regulations at 29 C.F.R. § 1910.111 pertaining to the storage and handling of anhydrous ammonia), as well as state fire and safety codes. Ammonia tanks must be registered with the State under the National Board Inspector Code (NBIC) operated by the National Board of Boiler and Pressure Vessel Inspectors.





A chiller in an ammonia refrigeration system. *Image Source: Stevens Engineers*

## How can you protect your customers, workers, and self from ammonia exposure?

### 1) Complete a Process Hazard Review

The General Duty Clause of the Clean Air Act requires facilities to identify hazards which may result from the accidental release of ammonia or other hazardous substances using appropriate hazard assessment techniques. Facility staff should be aware of the risks and potential impacts of ammonia exposure, as well as the

hazards associated with their refrigeration systems. Facilities may use industry checklists to conduct this hazard review, provided they account for site-specific conditions.

### 2) Maintenance

All facilities should have a preventative maintenance program in place for all equipment based on the equipment manufacturers' recommendations and industry standards of care. This program will ensure and document regular system maintenance, routine checks for ammonia system leaks, provisions on hand

for emergency repairs, safe procedures for oil removal, and start-up/shut-down procedures for seasonal facilities. Staff should continue to monitor and maintain ammonia systems and other facility equipment even while the facility is closed for the season.

### 3) Ventilation and Detection System

All facilities utilizing an ammonia refrigeration system should have an ammonia detection system installed in the machine room that will detect an ammonia leak and trigger an alarm and independent ventilation system.

IIAR has issued standards that outline specific ammonia system requirements, including provisions for these systems.

#### 4) Plan for Emergencies

All facilities that use an ammonia refrigeration system should have an emergency plan in place. This plan should include evacuation procedures, locations of safety showers and eye wash stations, phone numbers for medical and local emergency responders, operating procedures for emergency shut-down of facilities and off-season monitoring, and any other pertinent information that may be required in the case of an ammonia leak. Emergency phone-numbers and operating procedures need to be publicly posted and visible. Facilities should report the presence of all hazardous chemicals above certain thresholds annually through the State's EPCRA reporting system to aid local fire departments in their own emergency response plans. In case of an accidental release of ammonia, immediately notify the State, and the National Response Center and 911 that an incident has occurred.

#### For more information:

##### Len Wallace

wallace.len@epa.gov

##### Elise Simons

simons.elise@epa.gov

#### Online Resources:

**Ammonia Refrigeration List of Key Safety Measures.** EPA May 2018. <https://www.epa.gov/enforcement/safety-standards-ammonia-refrigeration>

**Application of Climate-Friendly Ice Rink Technologies: Brooklyn Park Community Activity Center.** EPA July 2015. [https://www.epa.gov/sites/production/files/2015-07/documents/application\\_of\\_climate-friendly\\_ice\\_rink\\_technologies\\_brooklyn\\_park\\_community\\_activity\\_center.pdf](https://www.epa.gov/sites/production/files/2015-07/documents/application_of_climate-friendly_ice_rink_technologies_brooklyn_park_community_activity_center.pdf)

**Compliance Assistance Tools and Resources for the Ammonia Refrigeration Sector.** EPA June 2017. <https://www.epa.gov/enforcement/compliance-assistance-tools-and-resources-ammonia-refrigeration-sector>

**Emergency Planning and Community Right to Know Act (EPCRA)** <https://www.epa.gov/epcra>

**Enforcement Alert: EPA Enforcement Efforts Focus on Prevention of Chemical Accidents.** EPA February 2015. <https://www.epa.gov/enforcement/enforcement-alert-epa-enforcement-efforts-focus-prevention-chemical-accidents>

**Guidance for Implementation of the General Duty Clause: Clean Air Act (CAA) Section 112(r)(1).** EPA May 2000. <https://www.epa.gov/enforcement/guidance-implementation-general-duty-clause-clean-air-act-caa-section-112r1-may-2000>

**Ice Rinks and the Phaseout of HCFC-22.** EPA July 2015. <https://www.epa.gov/ods-phaseout/ice-rinks-and-phaseout-hcfc-22>

*This document is intended for regulatory guidance only, and should not be substituted for a thorough review of existing federal regulations. Please note that state and local regulations regarding ammonia and other toxic substances may be more stringent than federal regulations. Threshold amounts for reporting an accidental release of ammonia vary by state. Be sure to review your state and local requirements as well as the federal requirements discussed in this factsheet.*