

BOWDOIN COLLEGE AMMONIA EMERGENCY RESPONSE PLAN WATSON ICE ARENA

Purpose

This document meets the general requirements of Title 37-B MRSA Chapter 13 Section 795 (*Maine Emergency Management Agency – Facility Emergency Response Plans*) and the Emergency Planning and Community Right-to-Know Act (EPCRA) for the development, implementation and maintenance of a written emergency response plan for facilities using or storing listed Extremely Hazardous Substances. The purpose of this plan is to provide information to the employees of Bowdoin College regarding action to an accidental release of anhydrous ammonia from the refrigeration system at Watson Ice Arena.

Scope

This Ammonia Emergency Response Plan (AERP) applies to all employees of Bowdoin College (including part-time employees, student employees, and contractors working onsite) who may be involved in the maintenance of, or emergency action associated with, the Watson Ice Arena refrigeration system (Figure #1 and #2). The refrigeration system is operational from approximately September through March during the hockey/skating season. Maintenance activities are ongoing year-round.

Program Components - The AERP consists of the following components:

1. **Facility Emergency Coordinator.** The Associate Director of Environmental Health and Safety (EHS) will be designated the Facility Emergency Coordinator (FEC) in the event of an accidental release; the alternates are the Senior Associate Director of Facilities Operations and Maintenance and Director and Associate Director of Security, respectively. The names and contacts numbers for these personnel are provided in the attached Contact List in Attachment B, and in the Bowdoin College *Integrated Contingency Plan* (ICP).
2. **Refrigeration System.** The refrigeration system room in the arena contains a closed-loop refrigeration system storing 1,530 pounds of anhydrous ammonia, in two separate ammonia refrigeration packages (see location in Figures #2 & #3).
3. **Emergency Alarm Systems.** A dedicated monitoring and alarm system is connected remotely to the Communications Center at Rhodes Hall. The monitoring system collects three samples per second at four points located on the ceiling of the ammonia room. Arena personnel directly read and log the digital readout of airborne ammonia concentrations in the refrigeration system room four times a day. The emergency alarm system is manufacturer calibrated twice per year by a certified contractor. The main ammonia alarm panel is located on the west wall of the refrigeration system room, inside the ice resurfacer room. (Figures #4 & #5)

There are also remote warning lights in the following locations, and as pictured in each figure:

- On the south exterior side facing wall near the overhead door and secondary control box (Figure #3)
- On the west facing interior wall of the ice resurfacer room (Figure #4)
- Inside the Skate Shop (Figure #7)
- On the interior south wall of the arena at the ice resurfacer gate in the rink (Figure #8)
- On the east facing wall inside the refrigeration system room (Figure #9)

The detection system has two alarm set points, and functions as follows:

- **Alarm 1** sounds when the airborne ammonia concentration within the ammonia room reaches **15 parts per million (ppm) or 5% the IDLH (Immediately Danger to Life or Health concentration)**. Blinking yellow lights are activated to notify arena/athletics staff that there is an elevated level of airborne ammonia in the refrigeration room (see Figure

#3, #4, #7, #8 & #9). Ventilation fans (Figure #3) automatically start, and a general alarm is sent to the Communications Center.

- **Alarm 2** is currently not programmed or in operation by design.
- **Alarm 3** sounds when the airborne ammonia concentration reaches **45 ppm or 15% the IDLH concentration**. The general fire alarm in the arena is activated, and an alarm is sent to the Communications Center. Fire alarm lights and horn strobes are activated, and an automated public address system announcement begins stating that there is an emergency and directs occupants to evacuate 500 feet from the building.

BOWDOIN EMPLOYEES INCLUDING SECURITY PATROL MAY NOT ENTER THE REFRIGERATION ROOM ONCE ALARM 3 IS ACTIVATED

There are two (2) emergency shutdown switches for the system:

- In the ice resurfer room (Figures #4 & #6); and
- Inside the emergency control box on the exterior south side of the building next to the solar power disconnect (Figure # 3)

ONLY THE FOLLOWING PERSONNEL ARE AUTHORIZED OR MAY DESIGNATE SOMEONE TO SHUT DOWN THE AMMONIA SYSTEM:

- Facilities Management Environmental Control Technicians
- Brunswick Fire Department (BKFD) On Scene Commander
- AAA Energy Services Technician

Alarm System Operations During Maintenance Activities. To avoid false alarms, the ammonia monitoring alarm system is disabled when there are routine maintenance activities within the refrigeration room. (The building fire alarm systems are not affected). Communications Center will be notified prior to disabling the system and upon restore.

Any time that the monitoring alarm system is disabled the EF3 ventilation fans will be immediately turned on. Maintenance workers will utilize the personal ammonia meter for monitoring and detection until the monitoring system is restored. In the event of an emergency the fire alarm pull station will be activated as maintenance staff leave the building.

4. Notification and Evacuation Procedures.

Notification. Upon activation of **Alarm 1** (15 ppm), the Communications Center will be automatically alerted with a general alarm and will in turn immediately contact one of the Mechanical Services Technicians (see Contact List) to check on the status of the alarm. If the Technicians identify any issues they will contact AAA Energy Services.

Note: due to the automatic ventilation fan activation for low-level alarms, an intermittent small-volume release from the equipment may not be evident by observation or detection equipment several minutes later. The source of any valid alarm must be determined before resetting the system.

There are emergency ventilation switches operated by key on the interior of the ice resurfer room and the exterior of the refrigeration room (See Figures #2, #4, and #11 through #14). Bowdoin Security has 24-hour access to these keys as does Facilities Management.

Upon activation of **Alarm 3** (45 ppm), the arena Fire Alarm sounds automatically and the Communication Center is alerted; the dispatcher will then notify the **Brunswick Fire Department** and send a Bowdoin patrol officer to the scene to assist as directed.

Selected Bowdoin staff (per the *Facilities Management Call-In Protocol – Priority 1 List*) will also be notified by the Communications Center as soon as possible after the response has been initiated.

In the event of a release, it is mandatory to promptly alert response agencies:

Local Emergency Response	911
Maine DEP	(800) 452-4664
Maine Emergency Response Agency	(800) 452-8735
National Response Center	(800) 424-8802
OSHA	(207) 626-9160, (800) 321-6742 (within 24 hours for injuries requiring hospitalization or 8 hours for fatalities)

The Associate Director of Environmental Health and Safety or designee will be responsible for making the required notifications to outside emergency management and regulatory agencies, as outlined in **Attachment B: Contact List**.

Evacuation. Do not enter a visible cloud of ammonia. Immediately isolate the leak or spill area in all directions for 500 feet, and evacuate laterally and upwind. The isolation zone must be maintained until the gas has dispersed and BKFD On-Scene Commander (or designee) provides an all clear. **Attachment E** includes a site map showing a distance of 500 feet for reference purposes. To confirm wind direction, there is a wind direction flag visible from the parking lot on top of the 'Gray Building' between the parking lot and the athletic fields (See Figure #10). Information to gauge wind speed from the flag is in Attachment F.

IN THE EVENT OF A VERIFIED RELEASE AS CONFIRMED BY SHOP STAFF, AND/OR THE ACTIVATION OF THE FIRE ALARM EITHER AUTOMATICALLY BY AMMONIA LEVELS OR MANUALLY AT THE RESPONDERS DISCRETION, ALL BUILDING OCCUPANTS AT WATSON ARENA WILL EVACUATE THE SPACE REGARDLESS OF THE EVENT IN SESSION.

Occupants of Farley, Lubin, and Harpswell Apartments will be notified by security to shelter in place. Mechanical services will remotely close air intakes for all air handling units. All windows and doors must be kept closed. The incident commander may determine other actions/evacuation if necessary.

The BKFD On-Scene Commander (or designee) will be in charge of the response and direct any evacuation of the building and outside area or direct occupants to shelter-in-place. Emergency evacuation routes are posted throughout the building. Security and Facilities staff working in the arena shall remain available to assist in directing the evacuation by posting themselves at the exits of the building. Staff not on duty may be called in to assist in the event of a serious emergency. BKFD response personnel shall be responsible for directing the overall evacuation, inside and outside, and shall conduct a thorough sweep of the building to insure that all occupants have departed. Decisions regarding larger-area evacuations or other response measures will be at the discretion of the BKFD On-Scene Commander.

- 5. Transportation Routes and Methods.** The Ammonia system is fixed, closed loop system so there is no transportation or handling of the listed extremely hazardous substance, except in maintenance quantities by an approved contractor. The facility location and access/escape routes are depicted on **Attachment D: Site Location Plan**.

6. **Additional Information.** The Safety Data Sheet (SDS) for Anhydrous Ammonia is attached, and stored in Bowdoin College's digital, web-based system MSDSOnline.com (See **Attachment F: SDS – Anhydrous Ammonia**). *Note: username and password is not needed to enter the online system.*

The SDS sheet for anhydrous ammonia has an NFPA flammability rating of 1. The ammonia refrigeration room is placarded with an NFPA flammability of 3 to reflect a lower explosive limit (LEL) that is lowered due to the presence of an oil and ammonia mixture in the oil pots.

The layout of the arena is depicted in the attached building plan, which also outlines the emergency evacuation routes (See **Attachment C**). Designated employees in Facilities and Security may gain access to these spaces with their designated key cards.

7. **Emergency Response and Health Services.** Mutual aid agreements have been entered into with the Brunswick Fire (BKFD) and Police (BKPD) Departments, and Mid Coast Hospital (MCH) for emergency response and medical services in the event of an accidental release.
8. **Employee Training and Exercises.** Bowdoin employees who may be involved in the maintenance of, or an emergency action associated with, the refrigeration system must be trained and qualified for their responsibilities. Employees who frequently perform job tasks at Watson Arena are also included in the training and exercises. These employees include Grounds, Housekeeping, Security, Electrical Shop, Mechanical Services, Athletics and other Facilities Management personnel and supervisors of those employees. New employees whose job requires them to work in the arena shall be trained by their supervisor within one week of their arrival.
9. **Refresher Training.** Trained employees shall undergo a brief annual refresher conducted and documented by the Associate Director of Environmental Health and Safety in coordination with the annual drill to review the response plan and assess any changes noted in the course of the year. The goal of the drill will be to educate and train for a proper action to a live release of anhydrous ammonia. If there are significant changes in the system, alarms or emergency response procedures, updated training for all involved personnel will be conducted at the time of the changes. A live release response drill will be held annually as required by statute, to exercise this plan and review any changes that may be necessary. The Associate Director of Environmental Health and Safety shall document the drill and make written notifications to applicable authorities, specifically the County and State Emergency Management Agencies and the Brunswick Fire Department (see Attachment B: Contact List).

Program Review

The Associate Director of EHS will review this document annually in coordination with the scheduled employee training and drill, and make revisions as necessary to keep the Plan current with the physical setting and regulatory requirements.

ATTACHMENTS:

- Attachment A: Figures
- Attachment B: Ammonia Response Plan Contact List
- Attachment C: Watson Arena Exit Routes
- Attachment D: Watson Arena Site Location Plan
- Attachment E: Scale Site Map Showing Distance
- Attachment F: Wind Speed/Direction Diagram
- Attachment G: Safety Data Sheet - Anhydrous Ammonia

Attachment A
Watson Ice Arena Ammonia Action Plan
Figures

Figure #1



Figure #2



Figure #3

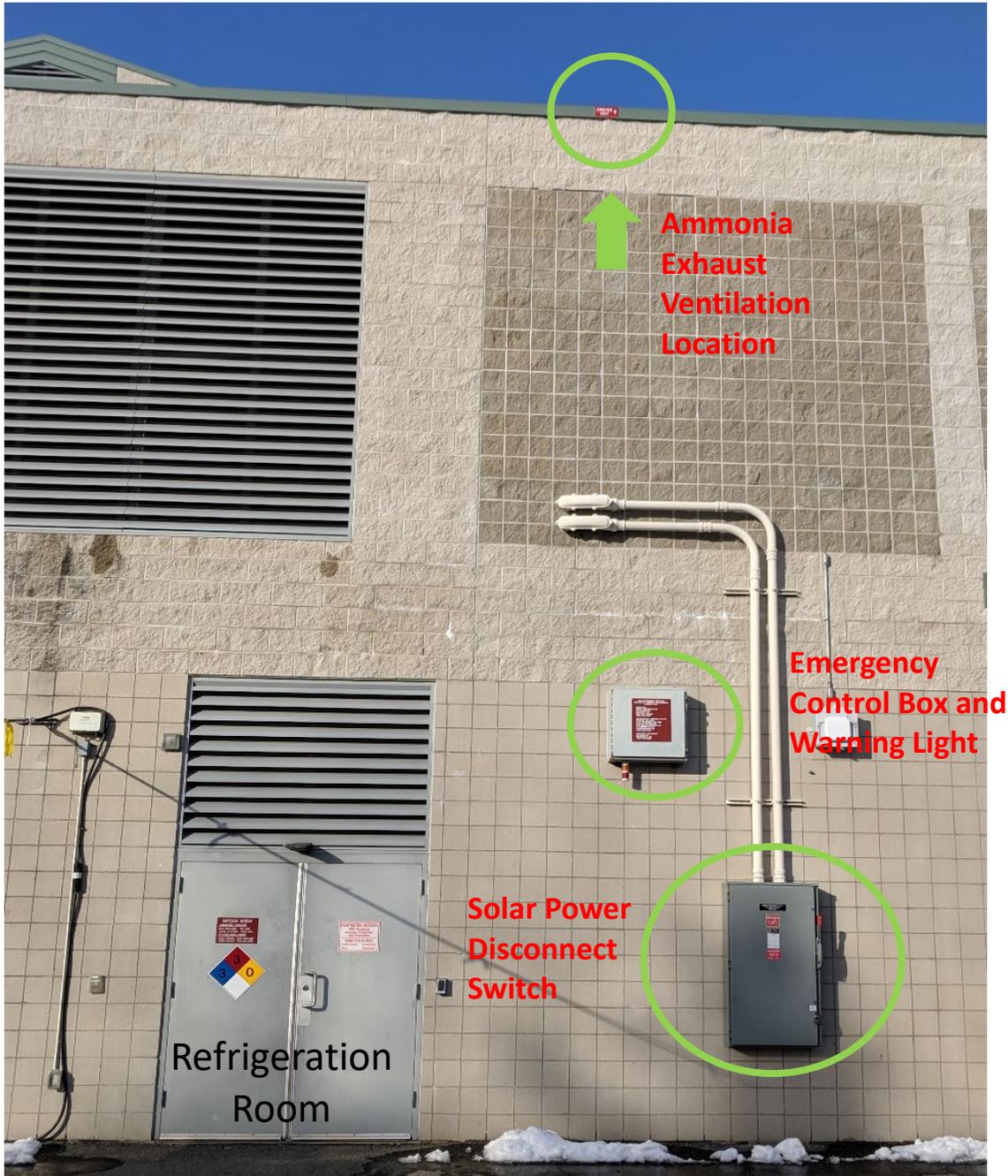


Figure #4

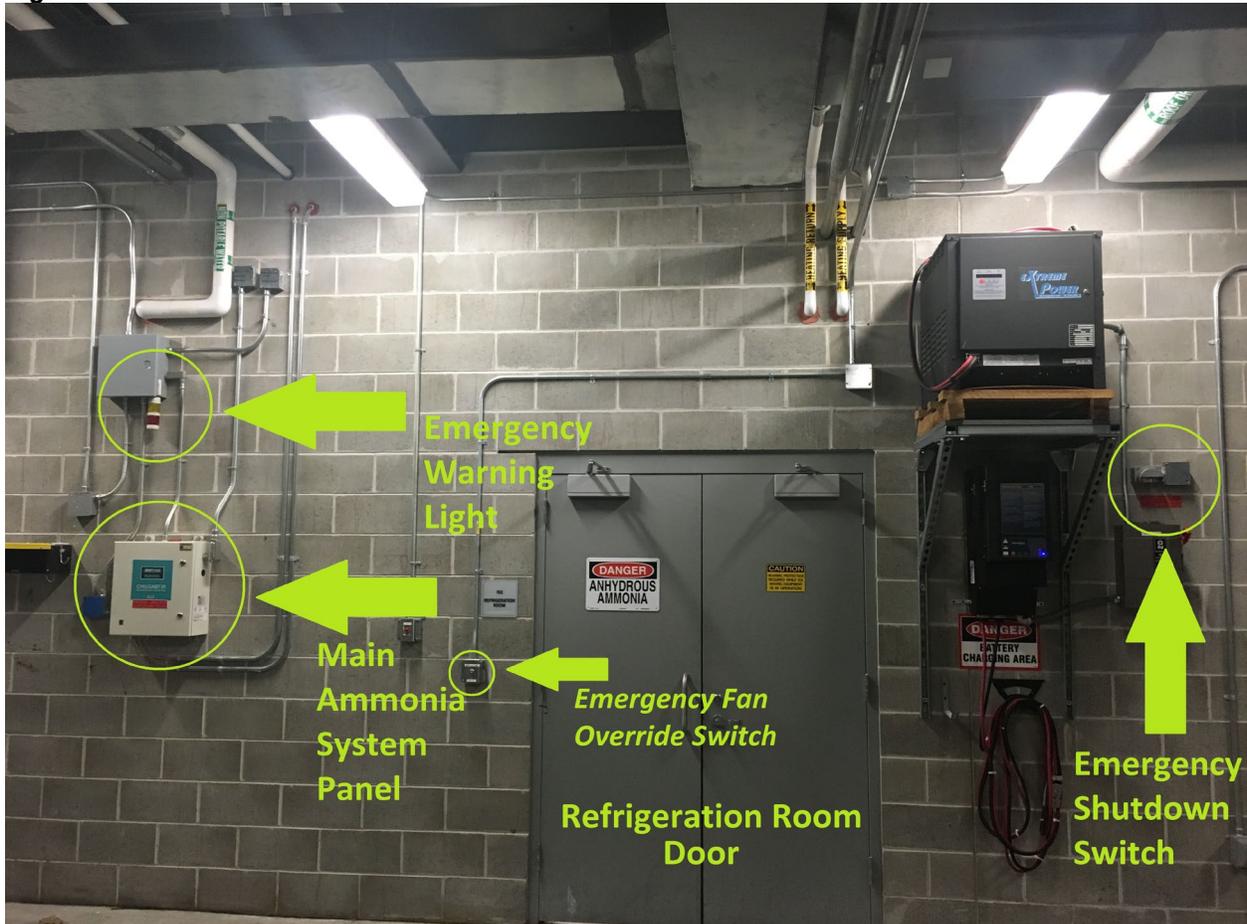


Figure #5

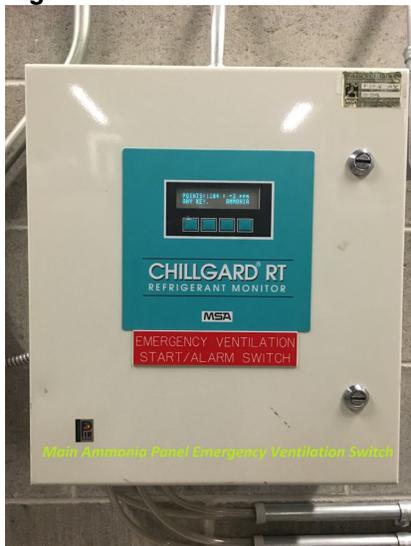


Figure #6



Figure #7



Figure #8

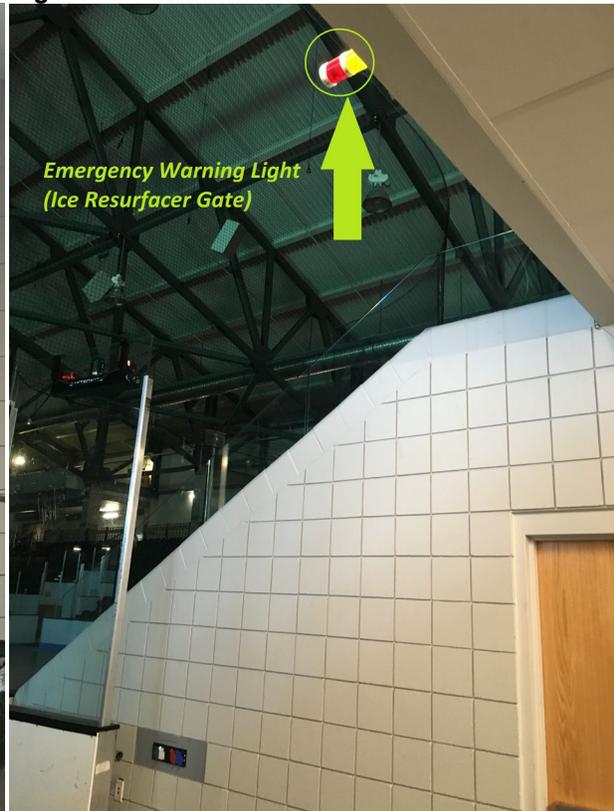


Figure #9

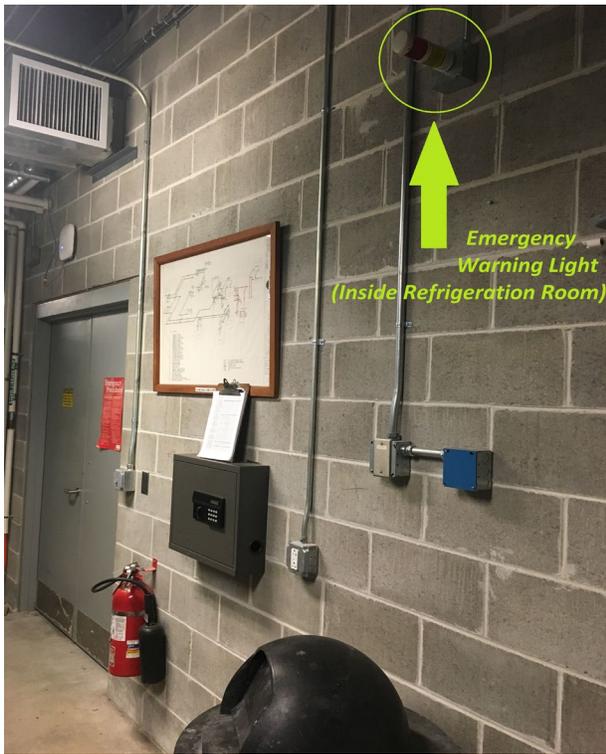


Figure #10



Figure #11



Figure #12



Figure #13



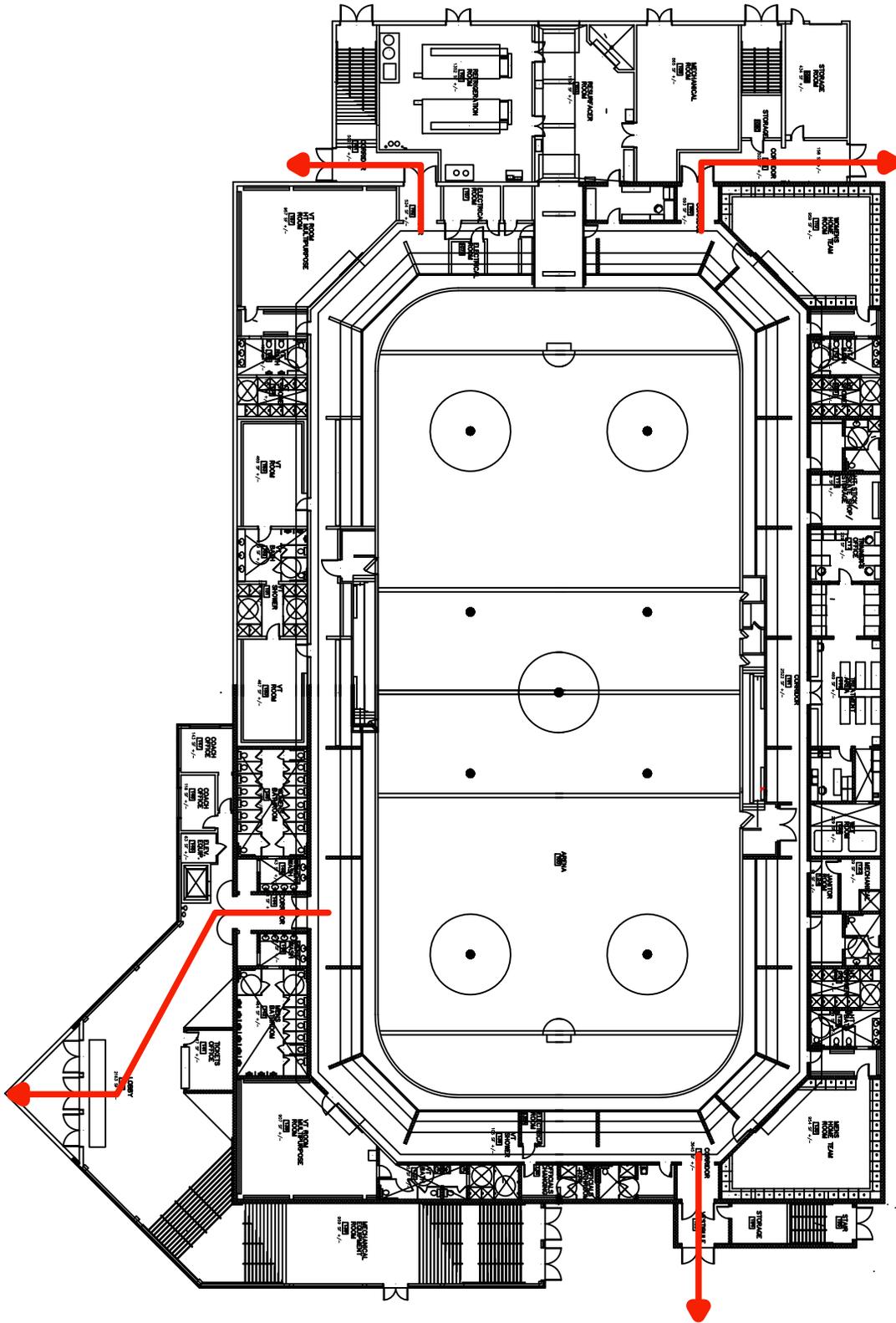
Figure #14



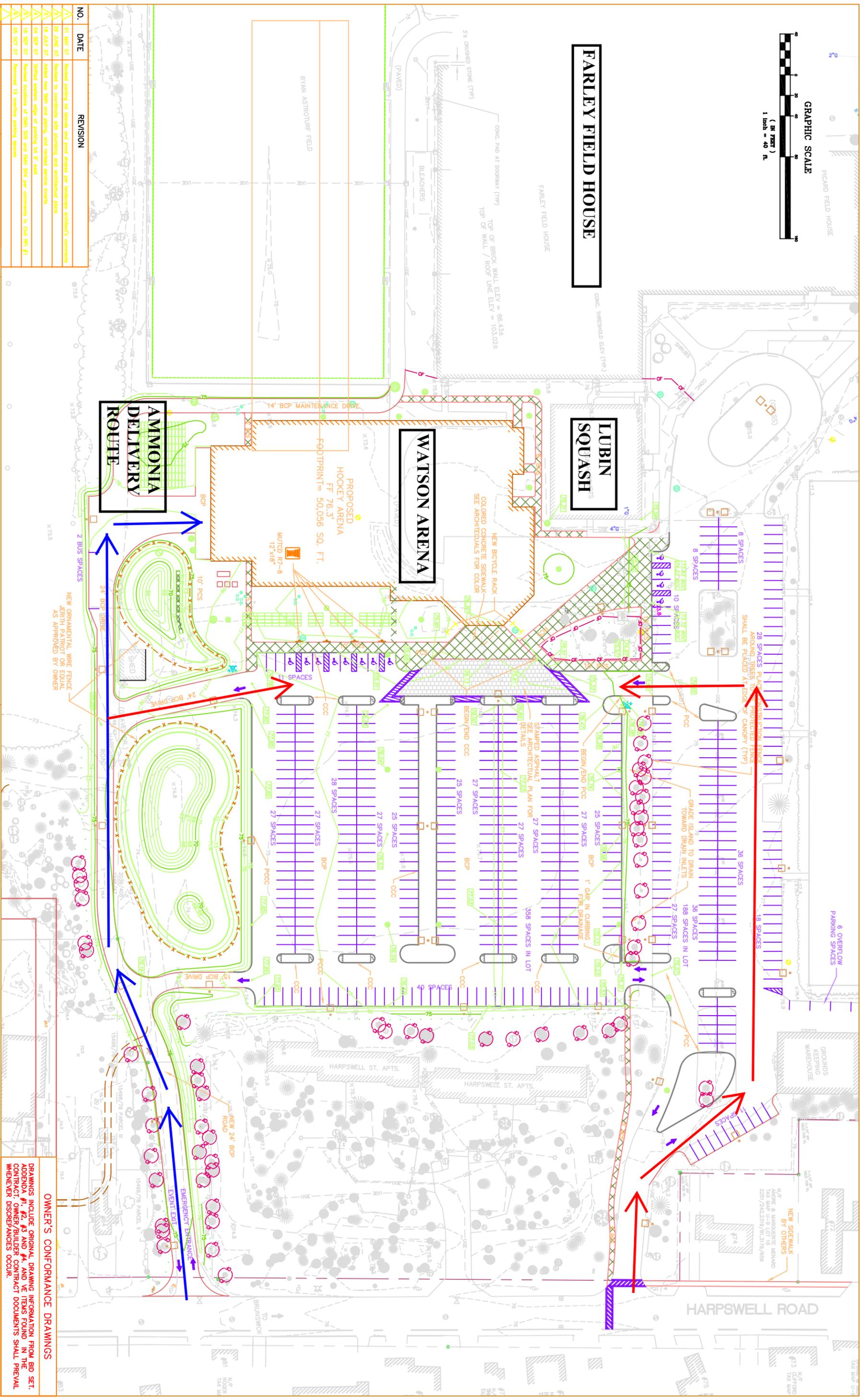
**Attachment B
Watson Ice Arena Ammonia Action Plan
Contact List**

Name	Business	Home	Cell/Radio
FACILITIES MANAGEMENT			
Tim French Mechanical Services Shop Leader	207-725-3457	207-729-5774	207-837-3140/170
Jeff Tuttle Director of Facility Management	207-725-3071	N/A	207-314-7232/101
Charly Wojtysiak Associate Director of Environmental Health and Safety (*Facility Emergency Coordinator)	207-798-4132	N/A	207-385-7993
AAA Energy Services (servicing contractor)	207-883-1473		
SECURITY			
Communications Center (EMERGENCY)	207-725-3500		
Randy Nichols Director of Safety & Security	207-725-3474	N/A	207-837-1151
Aaron Bailey Assistant Director, Cultural Property Security and Emergency Management	207-798-4352	N/A	207-552-8794
ATHLETICS			
Tim Ryan Director of Athletics	207-725-3247		
EMERGENCY RESPONDERS			
Brunswick Fire and Police Departments	911		PD Station: 207-725-5521 FD Station: 207-725-5541
Mid Coast Hospital	207-729-1641		
National Weather Service: HAZMAT Weather Support	207-688-3224		
REGULATORY AGENCIES			
Maine Department of Environmental Protection (ME DEP) Hazmat Hotline	800-482-4664		
Cumberland County Emergency Management Agency (CCEMA)	207-892-6785		
Maine Emergency Management Agency (MEMA)	207-626-4503		
Maine State Police 1-800-452-4664 (After 5:00PM to reach DEP and MEMA)			
Federal Emergency Management Agency (FEMA)	617-223-9540		

Attachment C
Watson Ice Arena Ammonia Action Plan
Watson Arena Exit Routes



Attachment D
Watson Ice Arena Ammonia Action Plan
Watson Arena Site Location Plan



NO.	DATE	REVISION
01	MAY 07	Revised parking lot blinds and pond slopes per landscape architect's comments
02	JUNE 07	Revised to coordinate with plumbing and architectural plans
03	JULY 07	Added new SMI and piping and revised service inverts
04	SEP 07	Shifted station edge of parking lot 9' west
05	SEP 07	Revised locations of DMU S&S and DMU S&S per comments in Civil #1
06	OCT 07	Removed 19 overflow parking spaces

STRUCTURAL AND CIVIL ENGINEER

BEAR MOUNTAIN DESIGN
 217 MAXHAM MEADOW WAY, SUITE 3D
 WOODSTOCK, VERMONT 05091
 TELEPHONE NO. 1-802-457-4550
 E-MAIL ADDRESS: HWM@BMDAC.COM

BOWDOIN COLLEGE HOCKEY ARENA GRADING PLAN

OWNER'S CONFORMANCE DRAWINGS

DRAWINGS INCLUDE ORIGINAL DRAWING INFORMATION FROM BID SET. APPENDIX #1, #2, #3 AND #4. AND VE ITEMS FOUND IN THE CONTRACT. OWNER/BUILDER CONTRACT DOCUMENTS SHALL PREVAIL WHENEVER DISCREPANCIES OCCUR.

DATE ISSUED: 21 MAR 07
 REISSUED: 05 OCT 07

C1.03

**Attachment E
Watson Ice Arena Ammonia Action Plan
Scale Site Map Showing Distance**



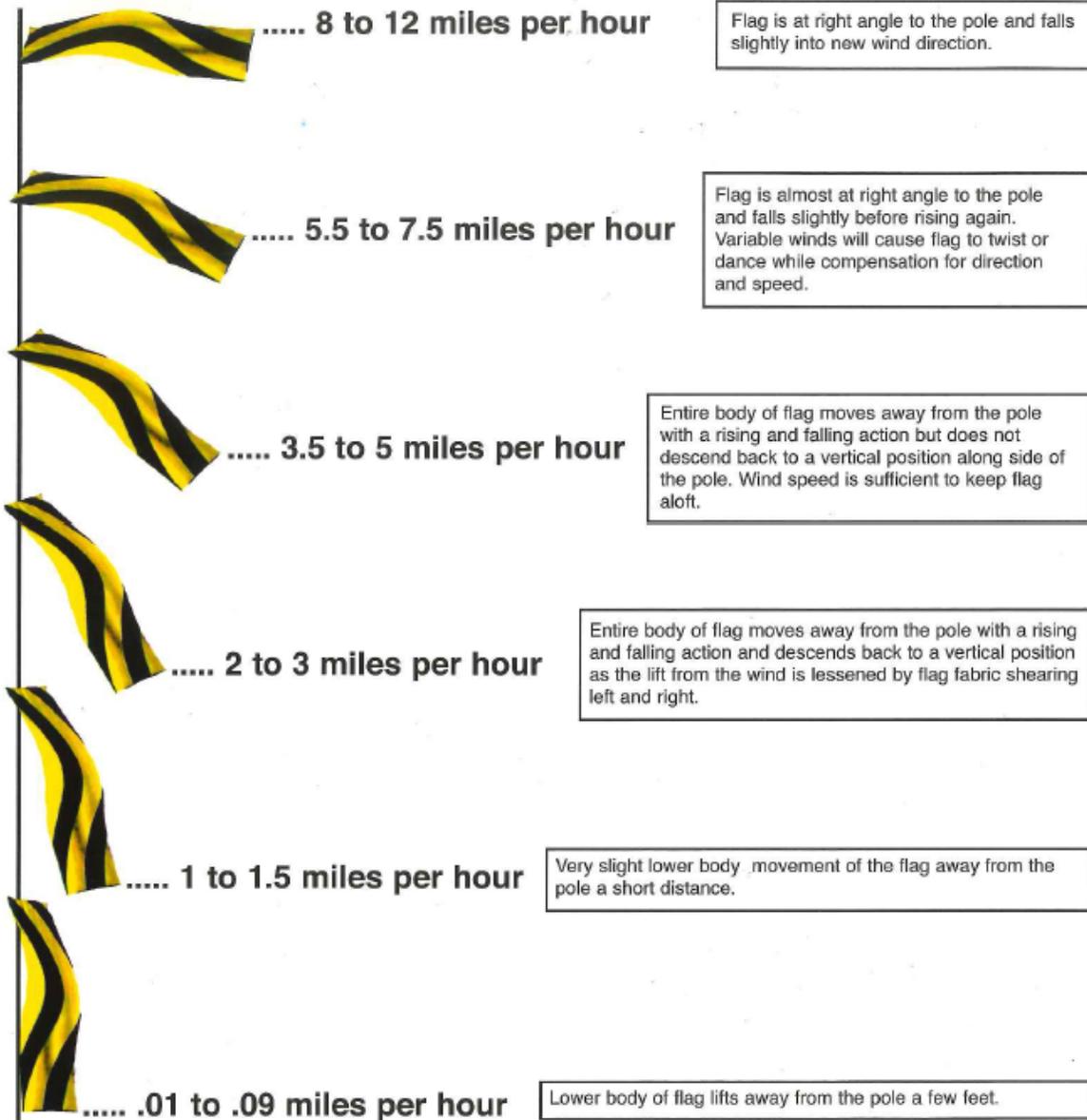
In the event of an ammonia release, the above diagram shows a distance of 500 feet surrounding the roof top vents. Precautions should be taken avoid this area in the event of a release.

Attachment F
Wind Direction & Speed Indicator

WIND DIRECTION & SPEED

US Patent 5,701,840

WIND TRACKER POSITION RELATIVE TO APPROXIMATE WIND SPEEDS



Attachment G
Watson Ice Arena Ammonia Action Plan
Safety Data Sheet – Anhydrous Ammonia

Safety Data Sheet

Version 1.18
Revision Date 08/01/2016

SDS Number 300000000003
Print Date 05/19/2018

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Ammonia

Chemical formula : NH₃

Synonyms : Ammonia, Anhydrous

Product Use Description : General Industrial

Manufacturer/Importer/Distributor : Air Products and Chemicals, Inc
7201 Hamilton Blvd.
Allentown, PA 18195-1501
GST No. 123600835 RT0001
QST No. 102753981 TQ0001

Telephone : 1-610-481-4911 Corporate
1-800-345-3148 Chemicals Cust Serv
1-800-752-1597 Gases/Electronics Cust Serv

Emergency telephone number (24h) : 800-523-9374 USA
+1 610 481 7711 International

2. HAZARDS IDENTIFICATION

GHS classification

Flammable gases - Category 2
Gases under pressure - Liquefied gas.
Acute toxicity - Inhalation Category 4
Skin corrosion - Category 1B

GHS label elements

Hazard pictograms/symbols



Signal Word: Danger

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Hazard Statements:

H221:Flammable gas.
H280:Contains gas under pressure; may explode if heated.
H314:Causes severe skin burns and eye damage.
H332:Harmful if inhaled.
EUH071:Corrosive to the respiratory tract.

Precautionary Statements:

Prevention : P210:Keep away from heat, hot surfaces, sparks, open flames, and other ignition sources. No smoking.
P264:Wash hands thoroughly after handling.
P280:Wear protective gloves/protective clothing/eye protection/face protection.

Response : P301+P330+P331 :IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P305+P351+P338 :IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 :Immediately call a POISON CENTRE/doctor.
P377 :Leaking gas fire: Do not extinguish, unless leak can be stopped safely.

Storage : P403+P233:Store in a well-ventilated place. Keep container tightly closed.
P405:Store locked up.

Disposal : P501:Disposal of contents/container to be specified in accordance with regulations.

Hazards not otherwise classified

Flammable.
Vapors may form explosive mixture with air.
Immediate fire and explosion hazard exists when mixed with air at concentrations exceeding the lower flammability limit (LFL).
Wear self-contained breathing apparatus and protective suit.
Direct contact with liquid can cause frostbite.
May react violently with water.
Do not breathe gas.
Corrosive to eyes, respiratory system and skin.
Compressed liquefied gas.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Concentration (Volume)
Ammonia	7664-41-7	100 %

Concentration is nominal. For the exact product composition, please refer to technical specifications.

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4. FIRST AID MEASURES

- General advice : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped. Use chemically protective clothing.
- Eye contact : In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Keep eye wide open while rinsing.
- Skin contact : Flush with copious amounts of water until treatment is available. Immediate medical treatment is necessary as untreated wounds from corrosion of the skin heal slowly and badly.
- Ingestion : Ingestion is not considered a potential route of exposure.
- Inhalation : Move to fresh air. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. Mouth to mouth resuscitation is not recommended. Use a barrier device. If unconscious place in recovery position and seek medical advice. In case of shortness of breath, give oxygen. Consult a doctor.
- Most important symptoms/effects - acute and delayed : Aspiration may cause pulmonary edema and pneumonitis. Coughing, irritation in the throat and nasal tract. May cause severe chemical burns to skin and cornea. Suitable first-aid treatment should be immediately available. Seek medical advice before using product. Cough. Headache. Nausea.

Immediate Medical Attention and Special Treatment

- Treatment : Treat bronchospasm and laryngeal edema if present. Observe for delayed chemical pneumonitis, pulmonary hemorrhage or edema. Obtain medical attention. If exposed or concerned: Get medical attention/advice.

5. FIRE-FIGHTING MEASURES

- Suitable extinguishing media : All known extinguishing media can be used.
- Specific hazards : Extinguish fire only if gas flow can be stopped. If possible, shut-off source of gas and allow the fire to burn itself out. Downwind personnel must be evacuated. Ammonia can form explosive compounds when combined with mercury. Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Product is nonflammable and does not support combustion. Use of water may result in the formation of very toxic aqueous solutions. Move away from container and cool with water from a protected position. Do not allow run-off from fire fighting to enter drains or water courses. Keep containers and surroundings cool with water spray. If possible, stop flow of product. Most cylinders are designed to vent contents when exposed to elevated temperatures.
- Special protective equipment for fire-fighters : In the event of fire, wear self-contained breathing apparatus. Use self-contained breathing apparatus and chemically protective clothing.

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Further information : Use of water may result in the formation of very toxic aqueous solutions., Combustion by-products may be toxic., If flames are accidentally extinguished, explosive re-ignition may occur; therefore, appropriate measures should be taken(e.g. total evacuation to protect persons from cylinder fragments and toxic fumes) should a rupture occur., In the event of fire, cool tanks with water spray .

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures : Remove all sources of ignition. Evacuate personnel to safe areas. Ventilate the area. Approach suspected leak areas with caution. Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits.

Environmental precautions : Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

Methods for cleaning up : Keep area evacuated and free from ignition sources until any spilled liquid has evaporated. (Ground free from frost.) Ventilate the area. Wash contaminated equipment or sites of leaks with copious quantities of water. Reduce vapor with fog or fine water spray.

Additional advice : If possible, stop flow of product. Increase ventilation to the release area and monitor concentrations. If leak is from cylinder or cylinder valve, call the emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

7. HANDLING AND STORAGE

Handling

Use equipment rated for cylinder pressure. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling or being knocked over. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Only experienced and properly instructed persons should handle compressed gases/cryogenic liquids. Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged

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valves should be reported immediately to the supplier. Close valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shock. Never attempt to lift a cylinder by its valve protection cap or guard. Do not use containers as rollers or supports or for any other purpose than to contain the gas as supplied. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Keep container valve outlets clean and free from contaminants particularly oil and water. Do not smoke while handling product or cylinders. Never re-compress a gas or a gas mixture without first consulting the supplier. Never attempt to transfer gases from one cylinder/container to another. Always use backflow protective device in piping. Purge air from system before introducing gas. Purge system with dry inert gas (e.g. helium or nitrogen) before gas is introduced and when system is placed out of service. Avoid suckback of water, acid and alkalis. Installation of a cross purge assembly between the cylinder and the regulator is recommended. When returning cylinder install valve outlet cap or plug leak tight. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50°C (122°F). Never attempt to increase liquid withdrawal rate by pressurizing the container without first checking with the supplier. Never permit liquefied gas to become trapped in parts of the system as this may result in hydraulic rupture.

Storage

Flammable storage areas should be separated from oxygen and other oxidizers by a minimum distance of 20 ft. (6.1 m.) or by a barrier of non-combustible material at least 5 ft. (1.5 m.) high, having a fire resistance rating of at least 1/2 hour. Post "No Smoking or Open Flames" signs in the storage areas. Use a back flow preventative device in the piping. Do not open valve until connected to equipment prepared for use. Use only with equipment of compatible materials of construction, rated for cylinder pressure. Close valve after each use and when empty. Read and follow the Safety Data Sheet (SDS) before use. Open/close valve slowly. Close when not in use. Wear Safety Eye Protection. Check Safety Data Sheet before use. Use a back flow preventative device in the piping. Do not open valve until connected to equipment prepared for use. Use only with equipment of compatible materials of construction, rated for cylinder pressure. Close valve after each use and when empty. Read and follow the Safety Data Sheet (SDS) before use. Full containers should be stored so that oldest stock is used first. Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Observe all regulations and local requirements regarding storage of containers. Stored containers should be periodically checked for general condition and leakage. Local codes may have special requirements for toxic gas storage. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Keep containers tightly closed in a cool, well-ventilated place. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Return empty containers in a timely manner.

Technical measures/Precautions

Containers containing flammable gases should be stored away from other combustible materials. Where necessary containers containing oxygen and oxidants should be separated from flammable gases by a fire resistant partition. Provide sufficient air exchange and/or exhaust in work rooms. Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance with local regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Handle product only in closed system or provide appropriate exhaust ventilation at machinery.
Provide natural or explosion-proof ventilation adequate to ensure concentrations are kept below exposure limits.

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Provide readily accessible eye wash stations and safety showers.

Personal protective equipment

- Respiratory protection : Keep self contained breathing apparatus readily available for emergency use. Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits. Users of breathing apparatus must be trained.
- Hand protection : Sturdy work gloves are recommended for handling cylinders. Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
- Eye protection : Safety glasses recommended when handling cylinders. A full faceshield should be worn in addition to safety glasses when connecting, disconnecting or opening cylinders.
- Skin and body protection : Use chemically protective clothing. Safety shoes are recommended when handling cylinders. Encapsulated chemical protective suit in emergency situations.
- Special instructions for protection and hygiene : Ensure adequate ventilation, especially in confined areas. Provide good ventilation and/or local exhaust to prevent accumulation of concentrations above exposure limits.

Exposure limit(s)

Ammonia	Time Weighted Average (TWA): ACGIH	25 ppm	-
Ammonia	Short Term Exposure Limit (STEL): ACGIH	35 ppm	-
Ammonia	Recommended exposure limit (REL): NIOSH	25 ppm	18 mg/m3
Ammonia	Short Term Exposure Limit (STEL): NIOSH	35 ppm	27 mg/m3
Ammonia	Permissible exposure limit: OSHA Z1	50 ppm	35 mg/m3
Ammonia	Short Term Exposure Limit (STEL): OSHA Z1A	35 ppm	27 mg/m3
Ammonia	Time Weighted Average (TWA) Permissible Exposure Limit (PEL): US CA OEL	25 ppm	18 mg/m3
Ammonia	Short Term Exposure Limit (STEL): US CA OEL	35 ppm	27 mg/m3
Ammonia	Short Term Exposure Limit (STEL): TN OEL	35 ppm	27 mg/m3

9. PHYSICAL AND CHEMICAL PROPERTIES

- Appearance : Liquefied gas. Colorless gas
- Odor : Ammoniacal.
- Odor threshold : No data available.
- pH : Not applicable.

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Melting point/range	: -108 °F (-77.7 °C)
Boiling point/range	: -28 °F (-33.5 °C)
Flash point	: Not applicable.
Evaporation rate	: Not applicable.
Flammability (solid, gas)	: Refer to product classification in Section 2
Upper/lower explosion/flammability limit	: 28 %(V) / 15 %(V)
Vapor pressure	: 124.73 psia (8.60 bara) at 68 °F (20 °C)
Water solubility	: Hydrolyses.
Relative vapor density	: 0.588 (air = 1)
Relative density	: 0.7 (water = 1)
Partition coefficient (n-octanol/water)	: Not applicable.
Auto-ignition temperature	: 630 °C
Decomposition temperature	: No data available.
Viscosity	: Not applicable.
Molecular Weight	: 17.03 g/mol
Density	: 0.044 lb/ft3 (0.0007 g/cm3) at 70 °F (21 °C) Note: (as vapor)
Specific Volume	: 22.49 ft3/lb (1.4040 m3/kg) at 70 °F (21 °C)

10. STABILITY AND REACTIVITY

Chemical Stability	: Stable under normal conditions.
Conditions to avoid	: Heat, flames and sparks.
Materials to avoid	: Copper, silver, cadmium and zinc and their alloys; mercury, tin, acids, alcohols, aldehydes, halogens and oxidizers. Ammonia can form explosive compounds when combined with mercury. May react violently with oxidants. May react violently with acids. Reacts with water to form corrosive alkalis. Overexposure to the atmosphere results in water absorption.

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Hazardous decomposition products : No decomposition if stored normally.
Possibility of hazardous Reactions/Reactivity : Vapors may form explosive mixture with air.

11. TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Likely routes of exposure

Effects on Eye : Causes eye burns. May cause blindness. Irritating to eyes. Causes severe eye burns. May cause permanent eye injury.

Effects on Skin : Causes skin burns. Contact with liquid may cause cold burns/frostbite. Causes skin irritation. Causes skin burns.

Inhalation Effects : Toxic by inhalation. Can cause severe eye, skin and respiratory tract burns. Irritating to respiratory system. Can cause severe lung damage. May be fatal if inhaled. Delayed adverse effects possible. Prolonged exposure to small concentrations may result in pulmonary edema. Delayed fatal pulmonary edema possible.

Ingestion Effects : Ingestion is not considered a potential route of exposure.

Symptoms : Aspiration may cause pulmonary edema and pneumonitis. Coughing, irritation in the throat and nasal tract. May cause severe chemical burns to skin and cornea. Suitable first-aid treatment should be immediately available. Seek medical advice before using product. Cough. Headache. Nausea.

Acute toxicity

Acute Oral Toxicity : No data is available on the product itself.

Inhalation : LC50 (1 h) : 7338 ppm Species : Rat.

Acute Dermal Toxicity : No data is available on the product itself.

Skin corrosion/irritation : Causes skin burns.

Serious eye damage/eye irritation : Risk of serious damage to eyes.

Sensitization. : No data available.

Chronic toxicity or effects from long term exposures

Carcinogenicity : This product contains no listed carcinogens according to IARC, ACGIH, NTP and/or OSHA in concentrations of 0.1 percent or greater.

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Reproductive toxicity : No data is available on the product itself.

Germ cell mutagenicity : No data is available on the product itself.

Specific target organ systemic toxicity (single exposure) : No data available.

Specific target organ systemic toxicity (repeated exposure) : No data available.

Aspiration hazard : No data available.

Delayed and Immediate Effects and Chronic Effects from Short and Long Term Exposure

Asthma.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity : May cause pH changes in aqueous ecological systems.

Toxicity to other organisms : No data available.

Persistence and degradability

Biodegradability : No data is available on the product itself.

Mobility : No data available.

Bioaccumulation : Refer to Section 9 "Partition Coefficient (n-octanol/water)".

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products : In accordance with local and national regulations. Return unused product in original cylinder to supplier. Contact supplier if guidance is required. Must not be discharged to atmosphere.

Contaminated packaging : Return cylinder to supplier.

14. TRANSPORT INFORMATION

DOT

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UN/ID No. : UN1005
Proper shipping name : Ammonia, anhydrous
Class or Division : 2.2
Label(s) : 2.2
RQ Substance : Yes
Marine Pollutant : Yes

* NOTE: This product contains a USDOT Hazardous Substance and will meet the Reportable Quantity definition when shipped to, from, or within the United States, in the amount specified in 49CFR 172.101 Appendix A.

** NOTE: This product contains a substance that is regulated as a Marine Pollutant when transported in bulk packages (liquid – volume exceeding 450 liters, gas – water capacity exceeding 454 kilograms).

IATA

Transport Forbidden

IMDG

UN/ID No. : UN1005
Proper shipping name : AMMONIA, ANHYDROUS
Class or Division : 2.3
Label(s) : 2.3 (8)
RQ Substance : Yes
Marine Pollutant : Yes

* NOTE: This product contains a USDOT Hazardous Substance and will meet the Reportable Quantity definition when shipped to, from, or within the United States, in the amount specified in 49CFR 172.101 Appendix A.

** NOTE: This product contains a substance that: 1) is regulated as a Marine Pollutant, or 2) meets the definition of toxic to the aquatic environment.

TDG

UN/ID No. : UN1005
Proper shipping name : AMMONIA, ANHYDROUS
Class or Division : 2.3
Label(s) : 2.3 (8)
RQ Substance : Yes
Marine Pollutant : Yes

* NOTE: This product contains a USDOT Hazardous Substance and will meet the Reportable Quantity definition when shipped to, from, or within the United States, in the amount specified in 49CFR 172.101 Appendix A.

** NOTE: This product contains a substance that: 1) is regulated as a Marine Pollutant, or 2) meets the definition of toxic to the aquatic environment.

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Further Information

Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. The transportation information is not intended to convey all specific regulatory data relating to this material. For complete transportation information, contact customer service.

15. REGULATORY INFORMATION

Toxic Substance Control Act (TSCA) 12(b) Component(s):

None.

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on Inventory.
Canada	DSL	Included on Inventory.
Australia	AICS	Included on Inventory.
Japan	ENCS	Included on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification

Acute Health Hazard Sudden Release of Pressure Hazard.

EPA SARA Title III Section 313 (40 CFR 372) Component(s) above 'de minimus' level

Ammonia

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

This product does not contain any chemicals known to State of California to cause cancer, birth defects or any other harm.

16. OTHER INFORMATION

NFPA Rating

Health : 3
Fire : 1
Instability : 0

HMIS Rating

Health : 3

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Flammability : 1
Physical hazard : 2

Prepared by : Air Products and Chemicals, Inc. Global EH&S Product Safety Department

Telephone : 1-610-481-4911 Corporate
1-800-345-3148 Chemicals Cust Serv
1-800-752-1597 Gases/Electronics Cust Serv

Preparation Date : 05/19/2018

For additional information, please visit our Product Stewardship web site at
<http://www.airproducts.com/productstewardship/>
