

ISC – Ammonia Plan

SAFETY POLICY MANUAL - SECTION 3 - POLICY NO. HM 2.3



SAFETY DEPARTMENT | 6001 UNIVERSITY BOULEVARD MOON TOWNSHIP, PA 15108

412-397-4343

I. Purpose:

The purpose of the Island Sports Center Ammonia Plan is to ensure that personnel understand the potential hazards associated with ammonia and how to respond in a safe and timely manner in the event of an incident. In addition to the University's Emergency Response Plan and Preparedness, Prevention & Contingency (PPC) Plan, this document provides additional information and level of specificity regarding ammonia and/or an ammonia incident.

II. Scope & Applicability:

This policy applies to all personnel who work at the Island Sports Center – Ice Complex.

III. Definitions:

- A. **Ammonia**: Ammonia (NH₃) is a colorless gas, with a penetrating, pungent, and suffocating odor. It is easily dissolved in water to form a caustic solution called ammonium hydroxide, sometimes referred to as aqueous ammonia.
- B. **Threshold Limit Value (TLV) – Time Weighted Average (TWA)**: The concentration for a normal 8-hour workday and a 40-hour work week, to which it is believed nearly all workers may be repeatedly exposed, day after day, without adverse effect.
- C. **Short Term Exposure Limit (STEL)**: A 15-minute TWA exposure that should not be exceeded at any time during a work day. The STEL should occur no more than four times per day and there should be at least 60 minutes between successive exposures in this range.
- D. **Immediately Dangerous to Life and Health (IDLH)**: The concentration that upon exposure is likely to result in death or immediate or delayed permanent adverse health effects.
- E. **Upper Explosive Limit (UEL)**: The highest concentration of a vapor or gas which will explode, ignite or burn in the presence of an ignition source. Mixtures above this limit are too rich to burn.
- F. **Lower Explosive Limit (LEL)**: The lowest concentration of a vapor or gas which will explode, ignite or burn in the presence of an ignition source. Mixtures below this limit are too lean to burn.

IV. Nature of Ammonia:

From the Safety Data Sheet, its chemical name is Ammonia, Anhydrous. Ammonia is an irritant and corrosive to the skin, eyes, respiratory tract and mucous membranes. May cause severe burns, eye and lung injuries. It is not recognized by OSHA as a carcinogen (see attached SDS).

Table A below describes some chemical characteristics of ammonia and ammonium hydroxide. Approximately 80% of the ammonia produced is used in fertilizers and is found in many household and industrial-strength cleaning solutions. It is also used in the manufacture of other chemicals, and as a refrigerant in systems such as the one at the Island Sports Center.

Table A

Physical & Chemical Properties	Ammonia	Aqueous Ammonia
Odor Threshold	1 – 15 ppm	2 – 50 ppm
pH	11.6	14
Vapor Density	0.596 of air density (air = 1)	Na
Color & Odor	Colorless & pungent	Very pungent, choking
Physical State	gas	Liquid
OSHA TWA – TLV	50 ppm	50 ppm
ACGIH TWA - TLV	25 ppm	25 ppm
ACGIH STEL	35 ppm	35 ppm
IDLH	300 ppm	300 ppm
UEL	25%	Na
LEL	16%	Na

V. Site and Equipment Description:

- A. **General:** The ammonia system is located in the compressor room between the Colonials and Olympic rinks at the rear of the ice complex. A facility drawing and location of the ammonia system is attached. The ammonia system with its main chiller, three compressors, high pressure receiver and condenser contains approximately 1,275 gallons (or 6,566 pounds) of anhydrous ammonia.
- B. **Alarm System - compressor room area:** The ammonia room is equipped with a continuous monitoring gas sensor/ meter. The purpose of the system is to monitor the airborne concentration of ammonia in the area. The system has three stages of alarming and is designed to trigger an alarm at the following set points:
 - a. A “**low level alarm**” is initiated when the ammonia concentration reaches 25 ppm. This initial alarm level will trigger an alarm on the control computer and the alarm control panel will display the current alarm concentration levels.
 - b. A “**secondary level alarm**” is initiated when the ammonia concentration reaches 50 ppm. The alarm consists of: a trigger of the alarm on the control computer and the alarm control panel will display the current alarm concentration levels. In addition:
 - i. The blue warning light above the door at the entrance to the ammonia plant room will activate.
 - ii. The horn inside the ammonia room will activate.
 - iii. The alarm through the DDC control system will initiate an internal email/text message to the following: Operations Center (412) 397-4343, Dave Hanson (412) 916-1119, Tim Kirsch (412) 812-1134, Matthew Hyatt (724) 480-5290, Mike O’Neil (412) 865-8754, John Grodson (724) 650-6777 and Chris Durko (724) 255-0827.
 - c. A “**high level alarm**” is initiated when the ammonia concentration reaches 250 ppm. An alarm at this level initiates the need to evacuate the building. The alarm consists of: a trigger of the alarm on the control computer and the alarm control panel will display the current alarm concentration levels. In addition:
 - i. The blue warning light and horn above the door at the entrance to the ammonia room will activate – signaling building evacuation.
 - ii. The horn and red light inside the ammonia room will activate.

iii. The ammonia refrigeration system will shut down.

iv. The alarm through the DDC control system will initiate a third internal email/text message to the following: Operations Center (412) 397-4343, Dave Hanson (412) 916-1119, Tim Kirsch (412) 812-1134, Matthew Hyatt (724) 480-5290, Mike O'Neil (412) 865-8754, Tony Rubino (330) 921-1019 and Chris Durko (724) 255-0827.

C. **Alarm System - ammonia system vent line:** A vent line that exhausts directly out of the compressor room/building is also equipped with an ammonia sensor. There may be instances where a discharge triggers the ammonia alarm. This system/sensor is designed to trigger an alarm at the following set points:

- a. A “**low level alarm**” is initiated when the ammonia concentration reaches 5000 ppm. This initial alarm level will trigger an alarm on the control computer and the alarm control panel will display the current alarm concentration levels.
- b. A “**secondary level alarm**” is initiated when the ammonia concentration reaches 9000 ppm. The alarm consists of: a trigger of the alarm on the control computer and the alarm control panel will display the current alarm concentration levels. In addition:
 - i. The blue warning light above the door at the entrance to the ammonia plant room will activate.
 - ii. The horn inside the ammonia room will activate.

D. **Mechanical Operations - during the alarm sequence:**

a. **Ammonia Plant Room alarms:**

- i. A “**low level alarm**” - The ammonia plant will continue to operate normally during the “low level alarm”. The ammonia plant room exhaust fan (#ER-2) will start and keep the Ammonia Mechanical Room in a negative pressure condition.
- ii. A “**secondary level alarm**” - The ammonia plant will continue to operate normally during the “secondary level alarm”. The ammonia plant room exhaust fan (#ER-2) will start and keep the Ammonia Mechanical Room in a negative pressure condition.
- iii. A “**high level alarm**” - Upon reaching a ‘high level alarm’, an automatic shutdown of the ammonia plant will be initiated. The ammonia plant room exhaust fan (#ER-2) will start and keep the Ammonia Mechanical Room in a negative pressure condition.
- iv. A “**Red**” emergency button is located outside of the ammonia plant/room door and in the alley way rear entrance to the ammonia room on the exterior of the building. The “**Red**” emergency button will also turn on the ammonia room exhaust fan, if it has not already turned on.

b. **Ammonia System Vent Line Alarms:**

- i. A “**low level alarm**” - The ammonia plant will continue to operate normally during the “low level alarm”.
- ii. A “**secondary level alarm**” - The ammonia plant will continue to operate normally during the “secondary level alarm”.

- iii. A “**Red**” emergency button is located outside of the ammonia plant/room door. The “**Red**” emergency button will turn on the ammonia room exhaust fan, if it has not already turned on.
 - c. When the ammonia level in the Ammonia Mechanical Room reaches 250 ppm, the equipment will automatically go into shutdown mode. The computer monitor located in the Maintenance Control Room will flash and indicate an alert message:
 - i. **Horn on! Shutdown Active!** The Room NH3 icon located on the overview screen will display the ammonia level in Parts Per Million (PPM).
 - ii. As noted above, 50 ppm is the OSHA Permissible Exposure Limit based on an 8-hour Time Weighted Average (TWA). 25 ppm is the American Conference of Governmental Industrial Hygienist (ACGIH) TWA, which it is believed nearly all workers may be repeatedly exposed, day after day, without adverse effect.
 - iii. The National Institute for Occupational Safety & Health (NIOSH) has listed 300 ppm as a level that is immediately dangerous to life and health (IDLH).

VI. Procedures:

- A. **Routine Inspections & Maintenance:** As part of our routine maintenance inspections, the operating condition of the entire ammonia plant is monitored. At a minimum, annual inspection and calibration of the ammonia sensors and control systems are completed as part of our proactive maintenance procedures.
- B. **Handling & Storage:** By its nature, ammonia is considered a hazardous material and will be handled in accordance with the university’s Hazardous Materials & Waste Management Plan. This includes, but not limited to, the Hazard Communication and Hazardous Waste policies.
- C. **First Aid:** First aid assistance should be provided as necessary depending on the situation. **Refer to the Safety Data Sheet for Anhydrous Ammonia as attached to this plan.** Immediate actions associated with an ammonia exposure may include:

<i>First Aid and Emergency Services</i>		
Nature of Incident	Immediate Action	Second Action
Ammonia contact with skin or eyes	Immediately flush the exposed skin or eyes with running water for at least 15 minutes. An emergency shower / eye wash station is located outside the compressor room.	Bring victim to emergency services/physician.
Inhalation of ammonia gas/vapors	Immediately get the victim to fresh air.	Bring victim to emergency services/physician.

Emergency Response – Low Level Alarm: Ammonia Room-(25 PPM) or Vent Line- (5000 PPM)	
Responsibility	Action(s)
RMU Operations Center:	<p>Upon Receipt of an Ammonia Alarm – Notify the following:</p> <p>ISC Operations – Dave Hanson (412) 916-1119 Facilities Management – Matt Hyatt (724) 480-5290</p> <p>If Dave Hanson cannot be reached, contact Mike O'Neil (412) 865-8754 or Chris Durko (724) 255-0827.</p> <p>If Matt Hyatt cannot be reached, contact Tim Kirsch (412) 812-1134.</p>
ISC Operations:	<p>Notify the following: ISC Operations – Dave Hanson (412) 916-1119 Facilities Management – Matt Hyatt (724) 480-5290</p> <p>If Dave Hanson cannot be reached, contact Mike O'Neil (412) 865-8754 or Chris Durko (724) 255-0827.</p> <p>If Matt Hyatt cannot be reached, contact Tim Kirsch (412) 812-1134.</p> <p>Ensure that the door to the Ammonia Room is closed (if safe to do so). Continue to monitor the situation (from the Control Room PC).</p>
Facilities Maintenance:	<p>Notify the following: ISC Operations – Dave Hanson (412) 916-1119 Facilities Management – Matt Hyatt (724) 480-5290</p> <p>If Dave Hanson cannot be reached, contact Mike O'Neil (412) 865-8754. If Mike O'Neil cannot be reached contact Chris Durko (724) 255-0827.</p> <p>If Matt Hyatt cannot be reached, contact Tim Kirsch (412) 812-1134.</p> <p>Ensure that door to Ammonia Room is closed (if safe to do so). Assess the condition/system operations to determine the nature and extent of the incident. Personal protective equipment will be used as required. Initiate appropriate remedial actions.</p> <p>Note: Refer to the ISC – Preparedness, Prevention and Contingency Plan (PPC) for hazardous material spill/release measures and agency notification(s). Provide regular updates to the above list of notification contacts.</p>

Building EVACUATION may be initiated if conditions worsen, even prior to ammonia conditions/concentration reaching a “high level alarm”.

Emergency Response – Secondary Level Alarm: Ammonia Room-(50 PPM) or Vent Line- (9000 PPM)	
Responsibility	Action(s)
RMU Operations Center:	<p>Upon Receipt of an Ammonia Alarm – Notify the following: ISC Operations – Dave Hanson (412) 916-1119 Facilities Management – Matt Hyatt (724) 480-5290</p> <p>If Dave Hanson cannot be reached, contact Mike O’Neil (412) 865-8754 or Chris Durko (724) 255-0827.</p> <p>If Matt Hyatt cannot be reached, contact Tim Kirsch (412) 812-1134.</p>
ISC Operations:	<p>Notify the following: ISC Operations – Dave Hanson (412) 916-1119 Facilities Management – Matt Hyatt (724) 480-5290</p> <p>If Dave Hanson cannot be reached, contact Mike O’Neil (412) 865-8754 or Chris Durko (724) 255-0827.</p> <p>If Matt Hyatt cannot be reached, contact Tim Kirsch (412) 812-1134.</p> <p>Ensure that the door to the Ammonia Room is closed (if safe to do so). Continue to monitor the situation (from the Control Room PC).</p>
Facilities Maintenance:	<p>Notify the following: ISC Operations – Dave Hanson (412) 916-1119 Facilities Mgmt. – Matt Hyatt (724) 480-5290</p> <p>If Dave Hanson cannot be reached, contact Mike O’Neil (412) 865-8754 or Chris Durko (724) 255-0827. If Matt Hyatt cannot be reached, contact Tim Kirsch (412) 812-1134.</p> <p>Ensure that door to Ammonia Room is closed (if safe to do so). From the main control room, assess the condition / system operations to determine the nature and extent of the incident.</p> <p>Initiate appropriate remedial actions: Consider shutdown of building ventilation (HVAC units) and make-up air for boiler units with air intakes subject to ammonia release. Contact McCarl’s- 24hr # (724) 772-0510</p> <p>Note: Refer to the ISC – Preparedness, Prevention and Contingency Plan (PPC) for hazardous material spill/release measures and agency notification(s).</p>

	Provide regular updates to the above list of notification contacts.
Building EVACUATION may be initiated if conditions worsen, even prior to ammonia conditions/concentration reaching a “high level alarm”.	
<p align="center">Emergency Response – High Level Alarm: Ammonia Room-(250 PPM)</p> <p>At this point, a spill/leak has occurred where you cannot enter the room without proper personal protective equipment including the use of a self-contained breathing apparatus.</p> <p align="center">Only properly trained and equipped personnel are permitted to enter the area.</p> <p align="center">This condition requires an IMMEDIATE EVACUATION of the facility!</p> <p>In addition to the Responsibilities and Actions listed above for a “Low & Secondary Level Alarm,” the following actions must be initiated:</p>	
Responsibility	Action(s)
Building occupants must proceed to:	<p>R – Rescue anyone in danger or who may need assistance (as long as it is safe to do so).</p> <p>A – Activate the building fire alarm system then notify local fire department, advising of ammonia leak.</p> <p>C – Contain the spread of noxious gas by closing doors as you evacuate as long as it is safe to do so.</p> <p>E – Evacuate toward the front of the building and proceed to the designated evacuation point (unless otherwise instructed – to the parking lot in front of golf dome).</p> <p>There are wind socks on the front and rear of the building which should be observed in order to avoid the direction of the wind in the event of a potential gas leak.</p>
RMU Operations Center: 7am – 3pm After Hours: ISC Operations and Facility Management will execute down stream notification.	<p>Upon Receipt of an Ammonia Alarm (High Level Alarm) – Notify the following:</p> <p>RMU Police at (412) 397-2424</p> <p>Neville Twp. Emergency Services at 911</p> <p>ISC Operations – Dave Hanson (412) 916-1119</p> <p>Facilities Management – Matt Hyatt (724) 480-5290</p> <p>ISC Operations – Mike O’Neil (412) 865-8754 and Chris Durko (724) 255-0827</p> <p>Facilities Management – Tim Kirsch (412) 812-1134</p>
ISC Operations:	A notice of the alarm will pop up on the computer screens of Ops Center, Dave Hanson, Mike O’Neil, Chris Durko, ISC Front Desk and Matt Hyatt.



	<p>The front desk will make a “PA” announcement, “Attention, attention: There is an emergency condition in the building, calmly evacuate to the parking area in front of the facility.” Repeat announcement and activate fire alarm if it has not already been done. Contact local fire department and advise them of ammonia leak</p> <p>Evacuation of the facility will generally follow RMU’s fire evacuation procedures and the R.A.C.E process except, occupants will be directed to evacuate away from the Ammonia Room and toward the front of the facility.</p> <p>Evacuate and have all persons move to the designated evacuation post – this will typically be to the parking lot in front of the Golf Dome. Personnel will determine wind direction to ensure occupants are located up-wind of and noxious gas.</p> <p>Do not allow anyone to enter/re-enter the facility.</p> <p>Contact Neville Island Emergency Services at 911 giving advanced warning of Ammonia Alarm vs Fire</p> <p>Consult with the fire department/emergency services upon their arrival.</p>
Facilities Management:	<p>Confirm auto shutdown of ammonia system.</p> <p>Assists with building evacuation to designated location. This will typically be to the parking lot in front of the Golf Dome. Personnel will determine wind direction to ensure occupants are located up-wind of and noxious gas.</p> <p>Continue remote monitoring of situation and provide technical information/details to emergency services.</p> <p>Determines need and coordinates additional support services such as:</p> <p>Private sector Hazardous Materials & Waste services. Arcwood Environmental 24hr # 1 (800) 48-SPILL or Clean Harbors 24hr # (800) 645-8265. Both provide hazardous material services to the university.</p> <p>Mechanical system support including provisions for equipment restoration. McCarl’s- 24hr # (724) 772-0510 Denny Bollman (412) 585-7079 Cell (724) 996-3823 Home</p> <p>Others as deemed appropriate.</p>



RMU Police:	<p>Conduct initial assessment of incident/conditions and initiate subsequent notification(s) as deemed appropriate including:</p> <p>Alert / activate notification to senior management and/or RMU Incident Command Team, as appropriate.</p> <p>Consult with the fire department/emergency services upon their arrival.</p>
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Attachments:

Attachment A – Site Plan

Attachment B – Facility Plan

Attachment C – Control Zones

Attachment D – Photos

Attachment E – SDS Sheet

ATTACHMENT A
SITE PLAN

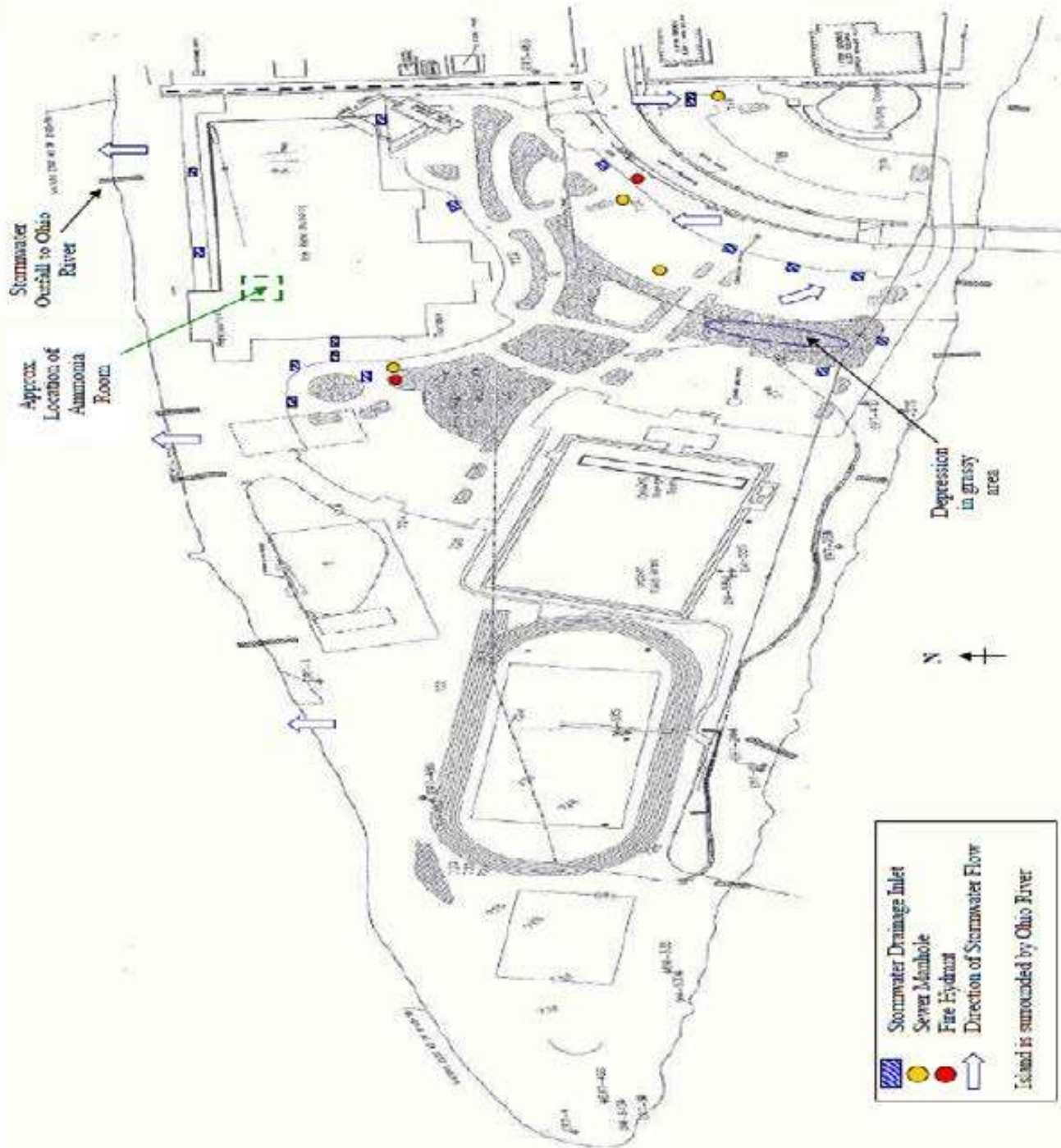
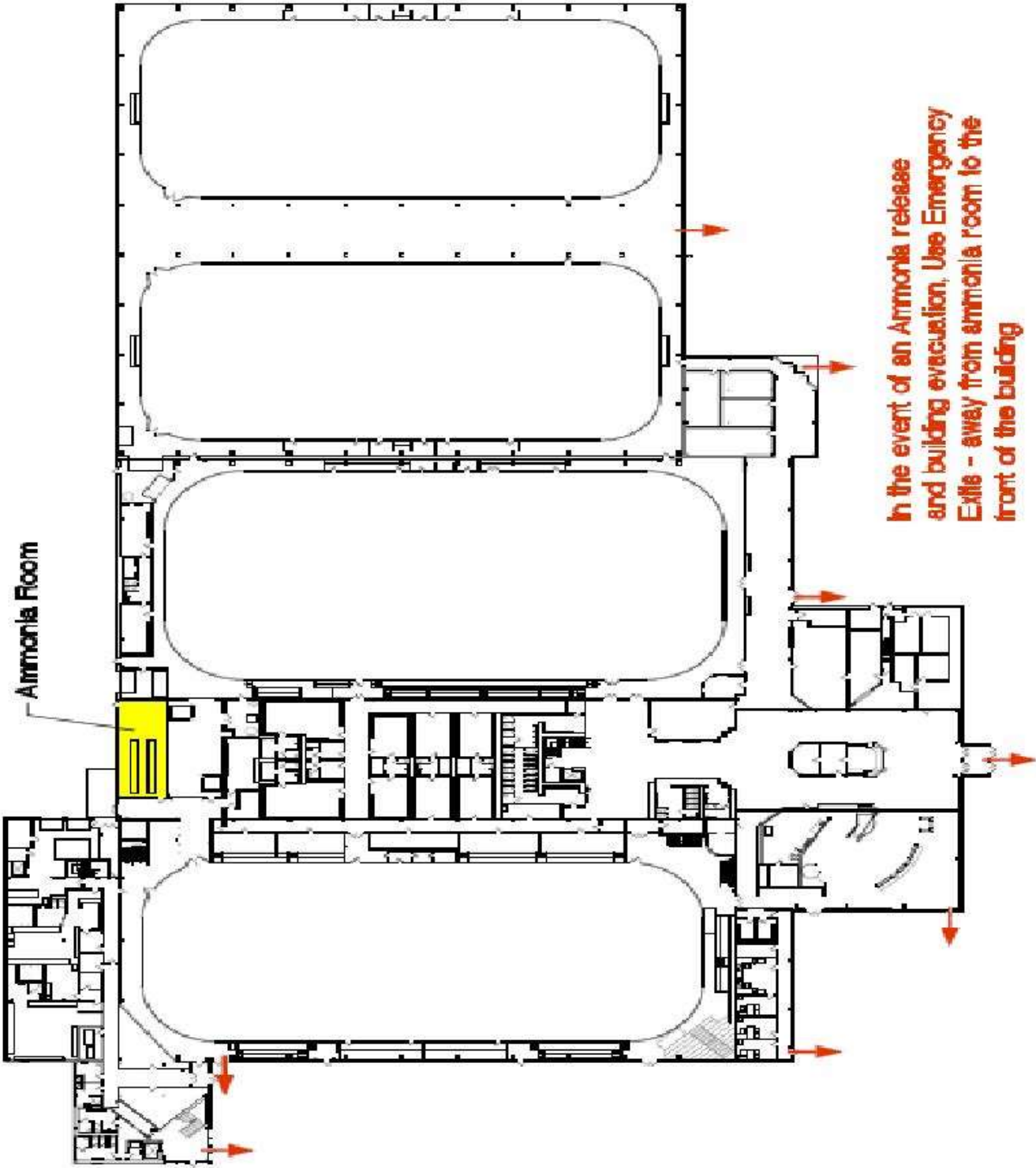


Figure 1 - Facility Layout and Site Drainage Map

ATTACHMENT B
FACILITY PLAN

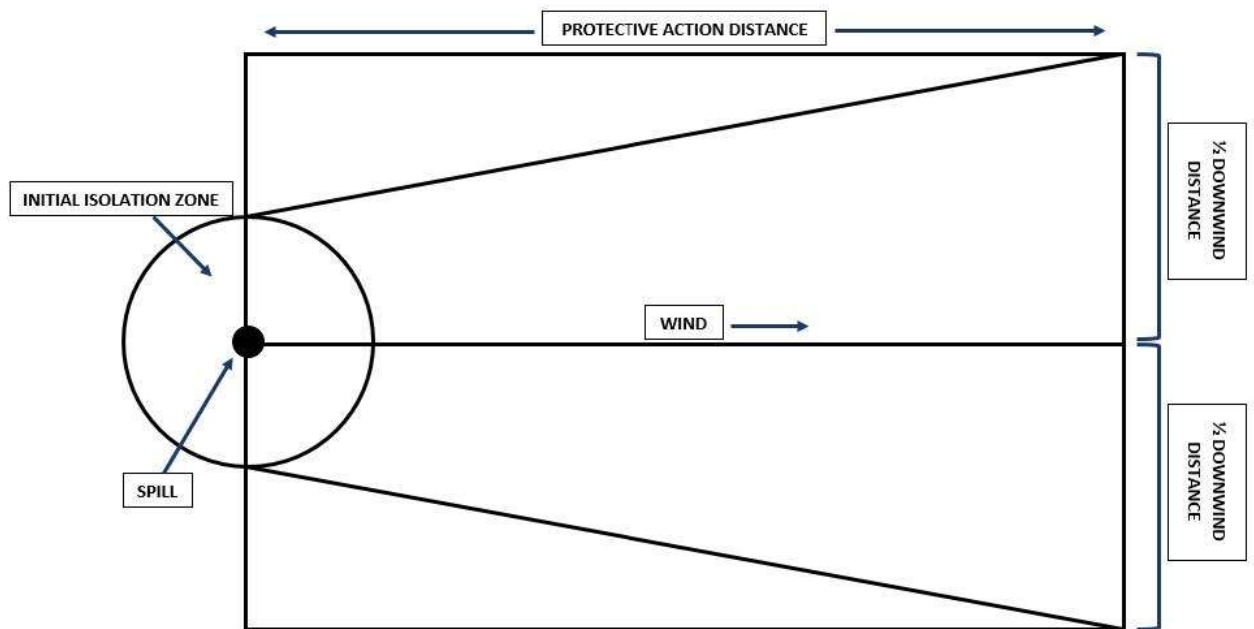
RMU Island Sports Center
ISC Complex



ATTACHMENT C **CONTROL ZONES**

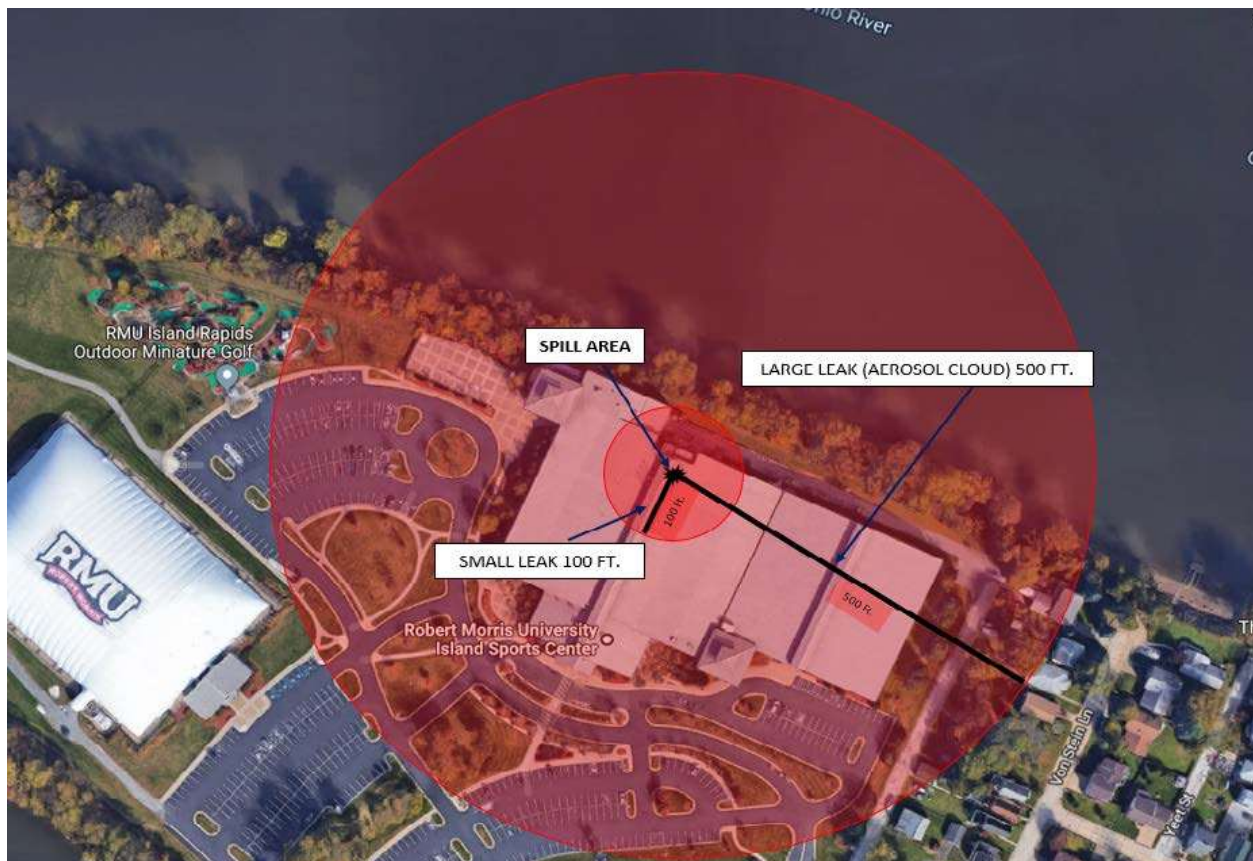
The control zones (Initial Isolation and Protective Action Zone) are used to protect people from vapors resulting from spills involving dangerous goods that are considered toxic by inhalation, such as ammonia. The initial isolation zone defines an area surrounding the incident in which persons may be exposed to dangerous (upwind) and life-threatening (downwind) concentrations of ammonia. The protective action zone defines an area downwind from the incident in which persons may become incapacitated and unable to take protective action and/or incur serious or irreversible health effects.

In the figure below, the spill is represented by the black dot in the center. The Initial Isolation Zone is represented by the black circle, within which the public must be evacuated and not be permitted to enter (except response personnel with appropriate personal protective equipment). The Protective Action Zone, the area where people are at risk of harmful exposure if the chemical is inhaled, is defined by a square whose length and width is the same as the Protective Action Distance determined.



INITIAL ISOLATION ZONE

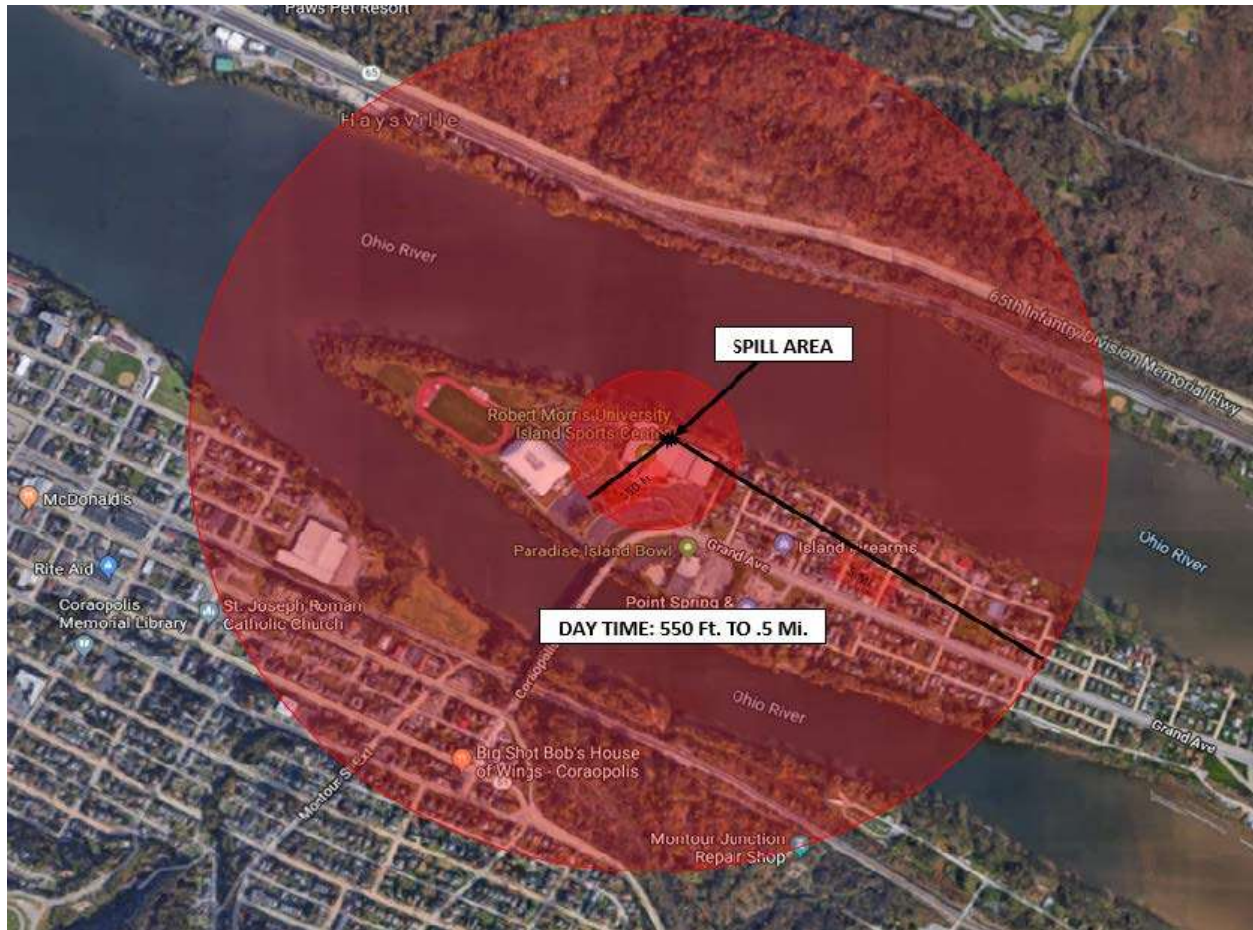
In the figure below, the spill is represented by the black star in the center. The initial isolation zone is represented by the red circles within which the public must be evacuated and not be permitted to enter (except response personnel with appropriate personal protective equipment). The radius of the initial isolation zone is determined by the size of the spill. For a small leak (less than 100 Lbs.) the initial isolation distance would be 100 feet. For a larger leak the initial isolation distance would be 500 feet. The initial isolation distance extends equally in all directions from the spill, including upwind.



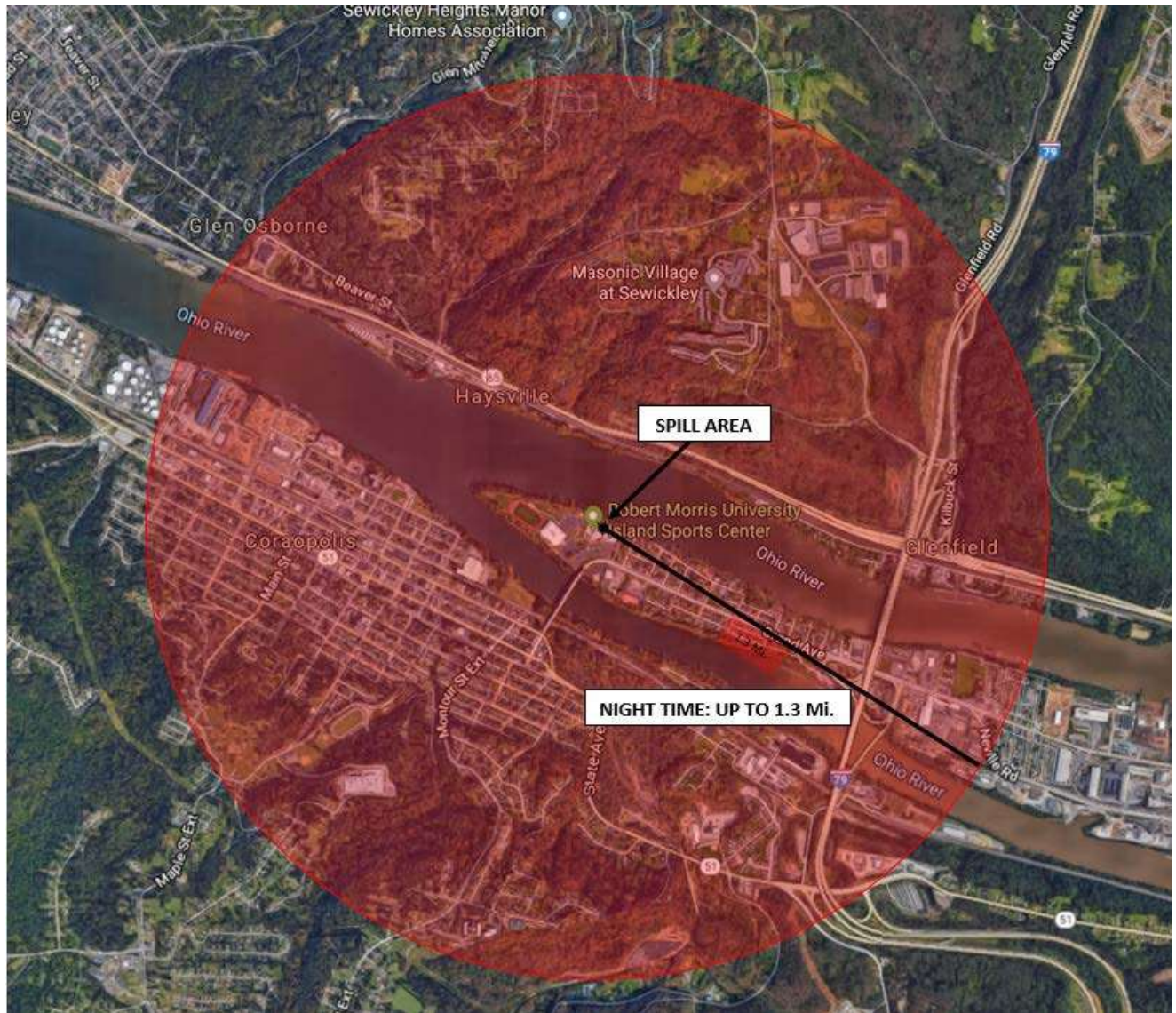
PROTECTIVE ACTION DISTANCES

In the figures below, the spill is represented by the black star in the center. The potential protective action zones are represented by the red circles, within which the people are at risk of harmful exposure if the chemical is inhaled and therefore, should be evacuated. The protective action distance is determined by the size of the spill and whether the spill occurs during day or night. For a leak in the daytime protective action distance could be from 550 Ft. to 0.5 Mi. depending on the size of leak. For the nighttime the protective action distance could be up to 1.3 Mi. depending on the size of leak. The crosswind evacuation distance is half of the downwind evacuation distance.

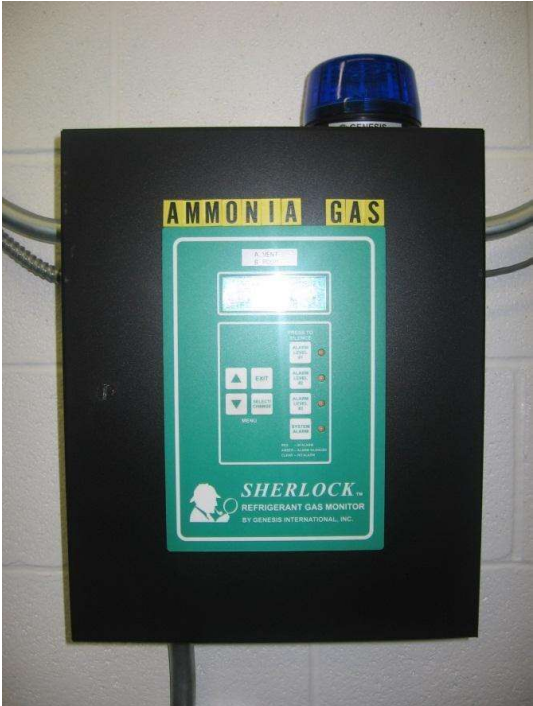
Daytime:



Nighttime:



**ATTACHMENT D
PHOTOGRAPHS**



ATTACHMENT E
SDS



Tanner Industries, Inc.

SAFETYDATASHEET

Section 1. Identification

Product Name: **Ammonia, Anhydrous**
Synonyms: Ammonia
CAS REGISTRY NO: 7664-41-7
Supplier: Tanner Industries, Inc.
735 Davisville Road, Third Floor
Southampton, PA 18966
Website: www.tannerind.com
Telephone (General): 215-322-1238
Corporate Emergency Telephone Number: 800-643-6226
Emergency Telephone Number: Chemtrec: 800-424-9300
Recommended Use: Various Industrial / Agricultural

Section 2. Hazard(s) Identification

Hazard: Acute Toxicity, Corrosive, Gases Under Pressure, Flammable Gas, Acute Aquatic Toxicity
Classification: Acute Toxicity, Inhalation (Category 4) Note: (1 - Most Severe / 4 - Least Severe)
Skin Corrosion / Irritation (Category 1B)
Serious Eye Damage / Irritation (Category 1)
Gases Under Pressure (Liquefied gas)
Flammable Gases (Category 2)
Acute Aquatic Toxicity (Category 1)

Pictogram:



Signal word: **Danger**
Hazard statements: Harmful if inhaled.
Causes severe skin burns and serious eye damage.
Flammable gas.
Contains gas under pressure; may explode if heated.

Very toxic to aquatic life.

Precautionary statements: Avoid breathing gas/vapors.

Use only outdoors or in well-ventilated area.

Wear protective gloves, protective clothing, eye protection, face protection.

Keep away from heat, sparks, open flames and other ignition sources. No smoking.

Precautionary
statements
(continued):

IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a doctor/physician and seek medical attention for severe exposure or if symptoms persist. Specific treatment, see supplemental first aid instructions in Section 4 (First Aid Measures).

IF ON SKIN: Rinse immediately with plenty of water before removing clothes. Contaminated clothing could possibly be frozen to skin. Rinse skin with water or shower (minimum of 20 minutes). Specific treatment, see supplemental first aid instructions in Section 4 (First Aid Measures).

IF IN EYES: Immediately call a doctor/physician and seek medical attention. Rinse continuously with water for several minutes (minimum of 20 minutes). Specific treatment, see supplemental first aid instructions in Section 4 (First Aid Measures).

Wash contaminated clothing before reuse.

Store in a well-ventilated place. Keep container tightly closed. Protect from sunlight. Store locked up.

In case of leakage: Eliminate all ignition sources, if safe to do so.

In case of leaking gas fire: Stop flow of gas before extinguishing.

Dispose of contents/container in accordance with local, regional, national, international regulations as applicable. See section 13 (Disposal Considerations).

NFPA Rating:

Health (Blue) - 3

Flammability (Red) – 1

Instability (Yellow) – 0

Special Hazards (White) – NA



Note: The degree of hazard for flammability may be 3 in a confined space.

NFPA Numbering System:

0 = Least Hazardous / 4 =

Most Hazardous HMIS

Rating:

ANHYDROUS AMMONIA		
HEALTH	-	3
FLAMMABILITY		1
PHYSICAL HAZARD		0
PERSONAL PROTECTION		H

See note in Section 16 regarding the Hazardous Materials Identification System (HMIS).

HMIS Hazard Index:

0 = Minimal, 1 = Slight, 2 = Moderate, 3 = Serious, 4 = Severe

Section 3. Composition / Information on Ingredients

CHEMICAL NAME: Ammonia, Anhydrous

CAS REGISTRY NO: 7664-41-7

SYNONYMS: Ammonia

CHEMICAL FAMILY: Inorganic nitrogen compounds

COMPOSITION: 99+% Ammonia

Section 4. First Aid Measures

IF INHALED: Immediately remove person to fresh air and keep comfortable for breathing. In case of severe exposure or if irritation persists, breathing difficulties or respiratory symptoms arise, seek medical attention. If not breathing, administer artificial respiration.

If trained to do so, administer supplemental oxygen, if required.

IF ON SKIN: Immediately rinse skin and contaminated clothing with plenty of water before removing clothes. Clothing that has been contacted by liquid ammonia may freeze to the skin. Thaw frozen clothing from skin before removing. Flush skin with copious amounts of tepid water for a minimum of 20 minutes. Do not rub or apply topical, occlusive compounds, such as ointments, certain creams, etc., on affected area. For liquid ammonia contact, seek immediate medical attention. For severe vapor contact or if irritation persists, seek medical attention.

IF IN EYES: Immediately rinse continuously with copious amounts of tepid water for a minimum of 20 minutes. Eyelids should be held apart and away from eyeball for thorough rinsing. Do not rub or apply topical, occlusive compounds, such as ointments, certain creams, etc., on affected area. Seek medical attention.

IF SWALLOWED: Rinse mouth. Do not induce vomiting. If conscious, give large amounts of water to drink. May drink orange juice, citrus juice or diluted vinegar (1:4) to counteract ammonia. If unconscious, do not give anything by mouth. Seek medical attention.

NOTETOPHYSICIAN: Respiratory injury may appear as a delayed phenomenon. Pulmonary edema may follow chemical bronchitis. Supportive treatment with necessary ventilation actions, including oxygen, may warrant consideration.

Section 5. Fire Fighting Measures

EXTINGUISHING MEDIA:

Water Spray, Water Fog, Dry Chemical, Carbon Dioxide (CO₂) or foam.

SPECIAL FIRE FIGHTING PROCEDURES:

Must wear protective clothing and a positive pressure SCBA.

Stop flow of gas or liquid if possible.

Approach fire upwind and evacuate area downwind if needed.

Use water spray to keep fire-exposed containers cool and control vapors.

If a portable container (such as a cylinder or trailer) can be moved from the fire area without risk to the individual, do so to prevent the pressure relief valve of the trailer or portable container from discharging or the cylinder from rupturing. If relief valves are inoperative, heat exposed storage containers may become explosion hazards due to over pressurization. Stay upwind when containers are threatened.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

Outdoors, ammonia is not generally a fire hazard. Indoors, in confined areas, ammonia may be a fire hazard, especially if oil or other combustible materials are present.

Combustion may form toxic nitrogen oxides (NO_x).

Section 6. Accidental Release Measures

GENERAL:

Only properly trained and equipped persons should respond to an ammonia release.

Wear eye, hand and respiratory protection and protective clothing; see Section 8, Exposure Controls / Personal Protection. Stop source of leak if possible, provided it can be done in a safe manner.

Leave the area of a spill by moving laterally and upwind.

Isolate the affected area. Non-responders should evacuate the area, or shelter in place.

SPECIFIC STEPS TO BE TAKEN:

For a hazardous material release response, Level A and/or Level B ensemble including positive-pressure SCBA should be used. A positive pressure SCBA is required for entry into ammonia atmospheres at or above 300 ppm (IDLH).

Stay upwind and use water spray downwind of container to absorb the evolved gas.

Do not apply water directly to container, unless there is heat impingement, as ammonia boils at -28 °F (direct water will heat container), and more vapors will be released.

Caution: Adding water directly to liquid spills will increase volatilization of ammonia, thus increasing the possibility of exposure. Contain spill and runoff from entering drains, sewers, streams, lakes and water systems by utilizing methods such as diking, containment, and absorption.

Section 7. Handling and Storage

SPECIAL PRECAUTIONS:

Only trained persons should handle anhydrous ammonia. Store in well-ventilated areas, with containers tightly closed. Protect from temperatures exceeding 120 °F (48.8 °C). Protect containers from physical damage. Keep away from ignition sources, especially in indoor spaces. Do not use plastic. Do not use any non-ferrous metals such as copper, brass, bronze, tin, zinc or galvanized metals. Use only stainless steel, carbon steel or black iron for anhydrous ammonia containers or piping.

OSHA 29 CFR 1910.111 prescribes handling and storage requirements for anhydrous ammonia.

Refer to Compressed Gas Association (CGA) G-2.1 for the recommendations for the storage and handling of anhydrous ammonia.

VENTILATION:

Local exhaust should be sufficient to keep ammonia vapor below applicable exposure standards.

WORKPLACE PROTECTIVE EQUIPMENT:

Protective equipment should be stored near, but outside of anhydrous ammonia area. Water for first aid, such as an eyewash station and safety shower, should be kept available in the immediate vicinity. See 29 CFR 1910.111 for workplace requirements.

DISPOSAL:

See Section 13, Disposal Considerations. Classified as Resource Conservation and Recovery Act (RCRA) Hazardous Waste due to corrosivity with designation D002, if disposed of in original form.

Section 8. Exposure Controls / Personal Protection

EXPOSURE LIMITS FOR AMMONIA: (Vapor)

Ammonia		
USA ACGIH	ACGIH TWA	25 ppm
USA ACGIH	ACGIH STEL	35 ppm
USA NIOSH IDLH	NIOSH IDLH	300 ppm
USA NIOSH	NIOSH REL (TWA)	18 mg/m ³ ; 25 ppm

USA NIOSH	NIOSH REL (STEL)	27 mg/m ³ ; 35 ppm
USA OSHA	OSHA PEL (TWA)	35 mg/m ³ ; 50 ppm
Alberta	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
British Columbia	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
Manitoba	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
New Brunswick	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
Newfoundland & Labrador	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
Northwest Territories	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
Nova Scotia	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
Nunavut	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
Ontario	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
Prince Edward Island	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
Quebec	TWAEV / STEV	25 ppm (TWAEV), 35 ppm (STEV)
Saskatchewan	TWA / STEL	25 ppm (TWA), 35 ppm (STEL)
Yukon	TWA / STEL	25 ppm (TWA), 40 ppm (STEL)
Mexico	OEL TWA (mg/m ³)	18 mg/m ³
Mexico	OEL TWA (ppm)	25 ppm
Mexico	OEL STEL (mg/m ³)	27 mg/m ³
Mexico	OEL STEL (ppm)	35 ppm

PROTECTIVE EQUIPMENT:

EYE/FACE PROTECTION: Chemical splash goggles should be worn when handling anhydrous ammonia. A face shield can be worn over chemical splash goggles as additional protection. Do not wear contact lenses when handling anhydrous ammonia. Refer to 29 CFR 1910.133 for OSHA eye protection requirements.

SKIN PROTECTION: Ammonia impervious gloves and clothing (such as neoprene, butyl and Teflon) should be worn to prevent contact during normal operations, such as loading/unloading and transfers. Chemical boots can be worn as additional protection.

RESPIRATORY PROTECTION: Respiratory protection approved by NIOSH for ammonia must be used when applicable safety and health exposure limits are exceeded. For escape in emergencies, NIOSH approved respiratory protection should be used, such as a full-face gas mask and canisters/cartridges approved for ammonia or SCBA. A positive pressure SCBA is required for entry into ammonia atmospheres at or above 300 ppm (IDLH).

Refer to 29 CFR 1910.134 and ANSI: Z88.2 for OSHA respiratory protection requirements. Also refer to 29 CFR 1910.111 for respiratory protection requirements at bulk installations.

VENTILATION: Local exhaust should be sufficient to keep ammonia vapor below applicable exposure standards.

FOR A HAZARDOUS MATERIAL RELEASE RESPONSE: Level A and/or Level B ensemble including positive-pressure SCBA should be used. A positive pressure SCBA is required for entry into ammonia atmospheres at or above 300 ppm (IDLH).

Section 9. Physical and Chemical Properties

APPEARANCE AND ODOR:	Colorless liquid or gas with a pungent odor. Odor threshold 2 - 5 ppm.
SOLUBILITY IN WATER:	(per 100 pounds of water): 86.9 pounds at 32 °F, 51 pounds at 68 °F
SPECIFIC GRAVITY OF GAS (air = 1):	0.596 at 32 °F
SPECIFIC GRAVITY OF LIQUID (water = 1):	0.682 at 28 °F (Compared to water at 39 °F).
WEIGHT (per gallon):	5.15 pounds at 60 °F
PH:	Not applicable (Highly alkaline/base).
BOILING POINT:	-28 °F at 1 Atm.
FORMULA:	NH ₃
MOLECULAR WEIGHT:	17.03 (NH ₃)
FLAMMABILITY	
FLASHPOINT:	None
FLAMMABLE LIMITS OF VAPOR IN AIR:	LEL/UEL 16% to 25% (Listed in the <i>NIOSH Pocket Guide to Chemical Hazards</i> at 15% to 28%).
AUTO IGNITION TEMPERATURE:	1,204 °F (If catalyzed). 1,570 °F (If un-catalyzed).
CRITICAL TEMPERATURE:	271.4 °F
DECOMPOSITION TEMPERATURE:	-108.4 °F
GAS SPECIFIC VOLUME:	20.78 Ft ³ /Lb at 32 °F and 1 Atm.
VAPOR DENSITY:	0.0481 Lb/Ft ³ at 32 °F
LIQUID DENSITY:	38.00 Lb/Ft ³ at 70 °F
VISCOSITY:	0.00982 cP at 68 °F
EVAPORATION RATE:	Not applicable
APPROXIMATE FREEZING POINT:	-108 °F
VAPOR PRESSURE:	114 psig at 70 °F
SURFACE TENSION:	23.4 Dynes / cm at 52 °F
CRITICAL PRESSURE:	111.5 Atm
PARTITION COEFFICIENT:	-114 at 77 °F

Section 10. Stability and Reactivity

REACTIVITY:

Anhydrous ammonia has potentially explosive reactions with strong oxidizers. Anhydrous ammonia forms explosive mixtures in air with hydrocarbons, chlorine, fluorine and silver nitrate. Anhydrous ammonia reacts to form explosive products, mixtures or compounds with mercury, gold, silver, iodine, bromine, silver oxide and silver chloride.

CHEMICAL STABILITY:

Stable under normal ambient conditions of temperature and pressure. Heating a closed container causes vapor pressure to increase. Will not polymerize.

POSSIBILITY OF HAZARDOUS REACTIONS:

Will react exothermically with acids and water.

CONDITIONS TO AVOID:

Avoid anhydrous ammonia contact with chlorine, which forms a chloramine gas, which is a primary skin irritant and sensitizer. Avoid contact with galvanized surfaces, copper, brass, bronze, mercury, gold and silver. A corrosive reaction will occur.

INCOMPATIBLE MATERIALS:

Anhydrous ammonia is incompatible with acetaldehyde, acrolein, boron, chloric acid, chlorine monoxide, chlorites, nitrogen tetroxide, perchlorate, sulfur, tin and strong acids.

HAZARDOUS DECOMPOSITION PRODUCTS:

Anhydrous ammonia decomposes to hydrogen and nitrogen gases above 450 °C (842 °F). Decomposition temperatures may be lowered by contact with certain metals, such as iron, nickel and zinc and by catalytic surfaces such as porcelain and pumice.

Section 11. Toxicological Information
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Potential health effects: Ammonia is an irritant and corrosive to the skin, eyes, respiratory tract and mucous membranes. Exposure to liquid or rapidly expanding gases may cause severe chemical burns and frostbite to the eyes, lungs and skin. Skin and respiratory related diseases could be aggravated by exposure. The extent of injury produced by exposure to ammonia depends on the duration of the exposure, the concentration of the liquid, gas or vapor and the depth of inhalation.

Exposure Routes:

Inhalation (vapors, gas), skin and/or eye contact (vapors, liquid, gas).

Symptoms of acute exposure:

Inhalation: Exposure may result in severe irritation and/or burns of the nose, throat and respiratory tract. May cause dyspnea (breathing difficulty), wheezing, chest pain, bronchospasm, pink frothy sputum, pulmonary edema or respiratory arrest. Extreme exposure may result in death from spasm, inflammation or edema. Respiratory injury may appear as a delayed phenomenon. Pulmonary edema may follow chemical bronchitis. Brief inhalation exposure to 5,000 ppm may be fatal. **Skin:** Irritation, corrosive burns, blister formation (vesiculation) may result. Contact with liquid may produce freeze burns (frostbite) and caustic burns.

Eyes: Vapors may cause severe irritation. Tearing, eye burns, permanent eye damage or blindness may occur. Effects of direct contact may range from irritation and lacrimation to severe injury and blindness.

Ingestion: Ingestion is unlikely since the material is a gas under normal atmospheric conditions. If ingested, it may cause burns and corrosion, severe pain of the mouth, throat, esophagus and stomach or may be fatal

Chronic Exposure:

Repeated exposure to ammonia may cause chronic irritation of the eyes and respiratory tract.

Toxicity:

LC₅₀ - 5131 mg/m³ (7338 ppm) to 11,592 mg/m³ (16,600 ppm), 60 minute exposure, Rat. LD₅₀ - 350 mg / kg (Oral / Rat).

Not listed in the National Toxicology Program (NTP).

Not recognized by OSHA as a carcinogen.

Not listed as a carcinogen by the International Agency for Research on Cancer (IARC monograph).

Germ cell mutagenicity information is not available. Reproductive toxicity information is not available.

Section 12. Ecological Information

Ammonia is harmful to aquatic life at very low concentrations. Notify local health and wildlife officials and operators of any nearby water intakes upon contamination of surface water.

Toxicity:

Terrestrial plants: LOEC = 3-250 ppm NH₃.

Aquatic plants: LOEC = 0.5-500 mg NH₃-N/L.

Acute toxicity to invertebrates: 48 h LC50 = 2.94 mg un-ionized NH₃-N/L.

Chronic toxicity to invertebrates: NOEC = 0.163- 0.42 mg un-ionized NH₃/L.

Acute toxicity to fish: 96-h: LC50 = 0.09 – 3.51 mg un-ionized NH₃/L. Chronic toxicity to fish: NOEC = 0.025- 1.2 mg un-ionized NH₃/L.

Environmental Fate Information: Ammonia dissipates relatively quickly in ambient air and rapidly returns to the soil via combination with sulfate ions or washout by rainfall. Ammonia strongly adsorbs to soil, sediment particles and colloids in water under aerobic conditions. Biodegradation of ammonia to nitrate occurs in water under aerobic conditions resulting in a biological oxygen demand (BOD).

Persistence/Degradability:

Biodegradable in soil. Ozonation in the air. Soluble in water.

Bioaccumulative Potential:

Not applicable.

Mobility in Soil:

No additional information available.

Other Adverse

Effects:

No additional information available.

Section 13. Disposal Considerations

Dispose of unused contents/container in accordance with local/regional/national/international regulations as applicable.

Listed as hazardous substance under the Clean Water Act (CWA) (40 CFR 116.4 and 40 CFR 117.3).

Classified as hazardous waste under the Resource Conservation and Recovery Act (RCRA) (40 CFR 261.22 Corrosive #D002).

Comply with all regulations.

Suitably diluted product may be utilized as fertilizer on agricultural land.

For hazardous waste regulations information call the RCRA Hotline (800) 424-9346, or visit the US EPA website.

Section 14. Transport Information

14.1

US Department of Transportation (US Domestic)

HAZARD CLASS:	2.2, Non-Flammable Gas. (49 CFR 173.115)
PROPER SHIPPING NAME:	Ammonia, Anhydrous
IDENTIFICATION NUMBER:	UN 1005
LABEL / PLACARD:	2.2, Non-Flammable Gas



(Only as required by 49 CFR 172.322)

PACKAGE MARKINGS:	Refer to 49 CFR 172.302, General marking requirements for bulk packagings. Refer to 49 CFR 172.301, General marking requirements for non-bulk packagings.
ADDITIONAL INFORMATION:	Refer to 49 CFR 172.328, Cargo Tanks for additional marking requirements. Marine Pollutant Requirements: Subject to the requirements of 49 CFR 172.322. The words "Inhalation Hazard" shall be entered on each shipping paper in association with the shipping description, shall be marked on each non-bulk package in association with the proper shipping name and identification number, and shall be marked on two opposing sides of each bulk package.

14.2

International

HAZARD CLASS: 2.3 (Poison Gas), Subsidiary 8 (Corrosive)

PROPER SHIPPING NAME: Ammonia, Anhydrous

LABEL / PLACARD: 2.3, 8 / Poison Gas, Corrosive (Subsidiary)

IDENTIFICATION NUMBER: UN 1005 ADDITIONAL INFORMATION: Marine pollutant

ENVIRONMENTAL HAZARDS:

IMDG, Known Marine Pollutant: Yes

United Nations Model Regulations, Environmentally Hazardous: Yes



Section 15. Regulatory Information

Subject to the reporting requirements of Section 302, Section 304, Section 312 and Section 313, Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986 and 40 CFR 372.

Under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), Section 103, any environmental release of this chemical equal to or over the reportable quantity of 100 pounds must be reported promptly to the National Response Center, Washington, D.C. (1-800-424-8802).

Emergency Planning & Community Right to Know Act, (EPCRA) extremely hazardous substance, 40 CFR 355, Title III, Section 302 – Ammonia, Threshold Planning Quantity (TPQ) 500 pounds.

Listed on the US EPA Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

EPA Hazard Categories – Immediate: Yes; Delayed: No; Fire: No; Sudden Release: Yes; Reactive: No

Clean Air Act – Section 112(r): Listed under EPA's Risk Management Program (RMP), 40 CFR Part 68, at storage/process amounts greater than the Threshold Quantity (TQ) of 10,000 pounds (ammonia, anhydrous).

Anhydrous ammonia is listed under Department of Homeland Security regulation 6 CFR Part 27, Chemical Facility Anti-Terrorism Standards (CFATS) at storage / process amounts greater than the threshold quantity of 10,000 pounds (ammonia, anhydrous).

Occupational Safety & Health Administration (OSHA): This material is considered to be hazardous as defined by the OSHA Hazard Communication Standard 29 CFR 1910.1200. This material is subject to Process Safety Management requirements of 29 CFR 1910.119 if maintained on-site, including storage / process, in quantities of 10,000 pounds (ammonia, anhydrous) or greater.

Section 16. Other Information

Preparation Information: Revision Date 11/1/2018 Revised by: HJS Replaces Revision Date 5/1/2015

Revisions to this Safety Data Sheet

- Section 2: Added note regarding the degree of hazard for flammability in a confined space. Added note regarding the Hazardous Materials Identification System (HMIS).
- Section 8: Reformatted and added information for Canada and Mexico.
- Section 14.1: Updated information for Package Markings and added “Additional Information.”
- Section 14.2: Updated “Additional Information” and “Environmental Hazards.”
- HMIS Rating: The American Coatings Association’s (ACA) *Hazardous Materials Identification System (HMIS®)* and *corresponding HMIS® Implementation Manual*, aid employers with the development and implementation of a comprehensive Hazard Communication Program. The program and manual address hazard assessment, labeling, Safety Data Sheets (SDS), and employee training. ACA’s HMIS® hazard rating scheme is designed to be compatible with workplace labeling requirements of the U.S. Occupational Safety and Health Administration’s (OSHA) revised Hazard Communication Standard (HCS). It is constructed to communicate hazard information to employees through training and the use of colors, numbers, letters of the alphabet, and symbols of types of personnel protective equipment (PPE). HMIS® ratings are to be used with a fully implemented HMIS® program. It is the responsibility of the employer to determine the appropriate hazard classification and personnel protective equipment (PPE) code for this material.
- For more information on HMIS® consult the HMIS® Implementation Manual.
- HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

Acronyms:

ACGIH: American Conference of Governmental Industrial Hygienists

ANSI: American National Standards Institute

CAS: Chemical Abstracts Service

CFR: Code of Federal Regulations

DHS: Department of Homeland Security

DOT: Department of Transportation

EPA: Environmental Protection Agency

HMIS: Hazardous Materials Identification System

IARC: International Agency for Research on Cancer

IDLH: Immediately Dangerous to Life or Health

IMDG: International Maritime Dangerous Goods

NFPA: National Fire Protection Association

NIOSH: National Institute for Occupational Safety and Health

NTP: National Toxicology Program

OSHA: Occupational Safety and Health Administration

PEL: Permissible Exposure Limit

PPM: Parts Per Million

RCRA: Resource Conservation and Recovery Act

REL: Recommended Exposure Limit

SCBA: Self Contained Breathing Apparatus

STEL: Short Term Exposure Limit

TLV: Threshold

Limit Value

TWA: Time

Weighted

Average

Disclaimer:

The information, data, and recommendations in this safety data sheet relate only to the specific material designated herein and do not relate to use in combination with any other material or in any process. To the best of our knowledge, the information, data, and recommendations set forth herein are believed to be accurate. We make no warranties, either expressed or implied, with respect thereto and assume no liability in connection with any use of such information, data, and recommendations.

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