Ammonia Awareness and Safety

Airgas Safe
Safe Ammonia Facilities Education

WORK SMART. BE SAFE.
Agenda

- Anhydrous Ammonia Handling
- Chemical Properties of Ammonia
- Exposure Guidelines
- First Aid Procedures
- MSDS Review
- Protective Equipment
- Emergency Action Plan: evacuation, assembly & notification
Introduction

- What is SAFE: Safe Ammonia Facilities Education?
  - SAFE is a program designed to meet BASIC ammonia awareness training required *annually* by OSHA for individuals that may be affected by an ammonia release.
  - SAFE is **not** designed to be a comprehensive technical training for ammonia handling. Work with your Airgas sales representative to schedule an advanced technical training for your team working with ammonia.
Ammonia Handling

- Site receives anhydrous ammonia via railcar
Ammonia Handling

- Ammonia unloaded into pressurized bullet storage tanks
Ammonia Handling

- Delivery trucks filled from storage tanks
- In a truck or vessel, ammonia is in both liquid and vapor forms.
Safety Precautions

- Ammonia Technicians are HAZWOPER trained
- DOT emergency response guides are found in the cab of every Airgas ammonia delivery vehicle.
- Ammonia delivery hoses are removed from service 3 years before manufacturers recommended expiration.
Safety Precautions

• Delivery and storage equipment utilize best-in-class safety mechanisms:
  – Check Valves
  – Relief Valves
  – Remote shut down
  – Excess Flow Valves
What is Ammonia?

- Ammonia is a combination of liquefied air and hydrogen, usually formed from natural gas decomposed by heating.

\[ \text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3 \]
You Produce Ammonia

Ammonia in small amounts is one of the basic life-giving building blocks for all mammals (including Man).

Ammonia is not a cumulative metabolic poison.

Ammonia is not a known carcinogen.

Daily Human Ammonia Production

<table>
<thead>
<tr>
<th>Total Body Production</th>
<th>17,000 mg/d</th>
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<tbody>
<tr>
<td>Continuously Breathing</td>
<td>379 mg/d</td>
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</table>
A Continuous Cycle

- Ammonia in large quantities is used as fertilizer to make plants grow
- Eating plants makes animals (including you and me) grow
- Animal waste helps plants grow
Where is Anhydrous Ammonia Used?

• Agricultural Applications
• Chemical Process Industries
• Pollution Control
• Refrigeration
• Water Treatment
• Metal Treatment
Where is Anhydrous Ammonia Located in Refrigeration Facilities?

- Anhydrous Ammonia is found throughout the plant site including:
  - Pressurized receiver
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- Anhydrous Ammonia is found throughout the plant site including:
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  - Compressors
Where is Anhydrous Ammonia Located in Refrigeration Facilities?

- Anhydrous Ammonia is found throughout the plant site including:
  - Pressurized receiver
  - Compressors
  - Piping
Recognizing Ammonia

- The most recognizable property of ammonia is:
  
  **Smell**

- Ammonia’s strong, pungent and irritating smell gives early and positive warning that ammonia is present.
Rule of Exposure

- 5 ppm  - You can **smell** it.
- 50 ppm  - It can **harm** you – Long Term Exposure
- 300 ppm  - **IDLH** – Immediate Danger to Life & Health
- 5,000 ppm  - It can **kill** you

**BASIC RULE:**

If you can **smell** ammonia – **be concerned**, move out of the ammonia cloud as soon as possible and immediately notify others.
## Rule of Exposure – Values in PPM

<table>
<thead>
<tr>
<th></th>
<th>5</th>
<th>50</th>
<th>500</th>
<th>5,000</th>
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</tr>
</thead>
<tbody>
<tr>
<td>5 to 20 Detectable</td>
<td>25 PEL in Some States</td>
<td>150 to 200 General Discomfort Eye Tearing</td>
<td>700 Eye Damage Begins</td>
<td>10,000 Skin Damage</td>
<td>Visible Cloud Immediately Fatal</td>
</tr>
<tr>
<td>50 ppm</td>
<td>35 STEL</td>
<td>300 IDLH</td>
<td>1,700 Coughing Bronchial Spasms</td>
<td>2,500 May Be Fatal (30 Minutes or Less)</td>
<td>40,000 Visible Cloud w/Moisture</td>
</tr>
<tr>
<td></td>
<td>50 ppm Detectable by all Fed OSHA PEL</td>
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</table>
Ammonia Exposure

- Exposure to liquid anhydrous ammonia or high concentrations of ammonia vapor can cause:
  - Blindness
  - Dehydration of body tissue
  - Chemical burns
  - Frostbite

- Learn the signs of a release, first aid procedures, and have an emergency action plan!
Ammonia Characteristics

- Anhydrous = without water
- Pungent, colorless gas
- Stored as liquid under pressure (or refrigerated)
- DOT: Non-flammable compressed gas
- Ammonia UN identification number is 1005
  - This number identifies ammonia on shipping documents and vehicles as hazardous, and references information from DOT Emergency Response Guide.
- Pressure varies greatly with temperature
  - 50° F = 75 psig
  - 90° F = 165 psig
Ammonia Characteristics

• Ammonia is sensitive to pressure and temperature
  – A small volume of liquid anhydrous ammonia will produce a large volume of gas at atmospheric pressure.

• Ammonia has a limited flammability range
  – 15-28% in air generally found only in confined space.
  – Mixtures of oil and ammonia may reduce lower level to 8%

• Ammonia has a very strong affinity for water.
  – 1 gallon of water will absorb 1,300 gallons of ammonia vapor by volume.
Ammonia Loves Water

This is **BAD** because:

- NH₃ attacks the moist areas of the body
- The body is mostly water
- The eye is 90% water
- Exposure can result in immediate eye damage
Ammonia Loves Water

This is **GOOD** because:

- Water can be used for first-aid treatment for NH3 exposure
- Water can be used to absorb an ammonia vapor release

**NOTE:**

- Water should NEVER be used on liquid ammonia. This will result in a violent reaction and vapor release!
Water - First Aid for Ammonia

• Large quantities of water (15 minutes of continued flushing) are recommended for washing contaminated skin areas or for eye contact.

• RULE: For an eye exposed to Ammonia, hold the eyelid open and wash for 15 minutes with water.
First Aid Treatment for Ammonia

INHALATION:

1. Remove from exposure.
2. Administer artificial respiration or oxygen if breathing has stopped.
3. Seek medical aid.
First Aid Treatment for Ammonia

SKIN CONTACT:

1. Immediately flush with large quantities of water and continue for 15 minutes. Do not remove clothing if frozen to skin.

2. Seek medical aid.
First Aid Treatment for Ammonia

EYE CONTACT:

1. Immediately flush with large quantities of water. Continue for 15 minutes.
2. Seek medical aid.
First Aid Treatment for Ammonia

INGESTION:

1. Do NOT induce vomiting. Give 1-2 glasses of milk or water.
2. Seek medical aid.
# Anhydrous Ammonia MSDS Sheet

1. Chemical Product & Company Identification
2. Composition, Information on Ingredients
3. Hazards Identification
4. First Aid Measures
5. Fire Fighting Measures
6. Accidental Release Measures
7. Handling and Storage
8. Exposure Controls/Personal Protection
9. Physical & Chemical Properties
10. Stability & Reactivity
11. Toxicological Information
12. Ecological Information
13. Disposal Considerations
14. Transport Information
15. Regulatory Information
16. Other Information
Personal Protective Equipment (PPE) Requirements For Ammonia

REQUIRED
RUBBER GLOVES

REQUIRED
EYE PROTECTION

RECOMMENDED
FACE SHIELD
(not a substitute for goggles)

RECOMMENDED
LONG SLEEVE SHIRT

SAFE
Safe Ammonia Facilities Education
Skin Damage

- Critical skin damage begins at 24.8°F and becomes irreversible at -18.5°F.

- The degree of tissue injury is proportional to the duration and concentration of exposure.

- Alkaline burns go deeper than acid burns.

- Alkali burns are yellow, soapy, and soft in texture. When burns are severe, skin turns black and leathery.
What NOT to wear

• Never wear contact lenses when working near ammonia!
  – Ammonia may become trapped behind the contact lens, increasing the risk of damage to the eye and reducing the effectiveness of the eyewash.
Respirators & SCBAs

• Several types of respirators available
  – Full-face, 1/2 mask, Escape
  – Cartridge or Canister

• Only use respirators for escape or in a MINOR release:
  – Ammonia odor while using a respirator might indicate improper fit, missing or broken seals, or ammonia concentration exceeding capacity.

• Self-Contained Breathing Apparatus (SCBA) required for major releases
  – Should only be used by Emergency Responders

• Proper use of respiratory equipment requires training, maintenance and practice!
Additional Safety Concerns

- Do not fill storage tanks more than 87.5% or a hydrostatic condition may result
  - When a vessel (tank, pipe segment, etc.) is completely filled with liquid ammonia it is in a hydrostatic condition
  - When in a hydrostatic condition, a small temperature increase can cause an extreme, rapid increase in pressure that may result in rupture
Additional Safety Concerns

• Never leave equipment unattended during and ammonia delivery!

• Ensure that Hydrostatic Relief Valves (HRVs) are installed wherever liquid can be closed between two points in piping.
Additional Safety Concerns

- Do not use ‘yellow’ metal components:
  - Copper or copper alloys, zinc, or brass
Additional Safety Concerns

- Ensure that hoses and relief valves are not expired and are in good condition
- Vessels that read 0 PSIG may still contain ammonia!
  - Liquid ammonia at -28°F exists at 0 PSIG
- Welding on pressure vessels is regulated and should only be done in authorized repair shops- NEVER on a vessel containing ammonia!
Ammonia Cylinder Concerns

• Do NOT:
  – Open and close valves to check operation
  – This will release additional ammonia!

• ALWAYS:
  – Loosen caps and plugs *slowly* to vent trapped ammonia before removing.
  – Be sure that valves behind caps and plugs are tightly closed!
Recognize How an Ammonia Vapor Release Might Look

- Ammonia Vapor
  - Lighter than air
  - May be colorless as below
  - May have a visible cloud as below
Action for an Ammonia Release

- If you smell ammonia, see it, or hear an alarm, immediately do the following:
  
  ✓ Follow your plan!
  
  ✓ Evacuate the affected area
  
  ✓ Notify everyone in the affected and surrounding areas
  
  ✓ Assemble to be counted
Get Out Of A Vapor Cloud

- Which way do you move to get out of the way of an ammonia vapor cloud?

  **UPWIND?**  **DOWNWIND?**  **CROSSWIND?**
Using the Windsock

- Windsocks can help you identify what way the wind is blowing.
- In the event of an ammonia release you want to move upwind.
Assemble To Be Counted

- Follow the site’s Emergency Action Plan
- Know your designated Assembly Location
- **DO NOT LEAVE** the Assembly Location until you have been accounted for and are instructed to leave
Site Emergency Action Plan

• Required for every site which falls under the EPA’s Risk Management Plan requirement
• Includes evacuation routes and assembly points
• Should be part of site safety orientation
Evacuate

REMEMBER

If a release occurs, know where to go!

Let the Emergency Responders handle the incident.
Notification: Be PROMPT!

- 911
- Certified Unified Program Agency Administering Agent (CUPA/AA)
- Governor’s Office of Emergency Services Warning Center
- National Response Center (NRC): 15 min
- Air Quality Management District
Notification

• Local Emergency Planning Committee (LEPC)
• CHEMTREC (For transportation related incidents)
• County Health HAZMAT
• Fire Department
• County Sanitation District (If entering sewer)
Ammonia-Related Regulations & Standards

- ANSI K61.1 - Safety Requirements for the Storage and Handling of Anhydrous Ammonia
- OSHA 29 CFR 1910.11 - Storage and handling of anhydrous ammonia
- OSHA 29 CFR 1910.119 - Process Safety Management (PSM)
- California Title 8
- www.gpoaccess.gov/cfr/index.html
Ammonia-Related Regulations & Standards in California

- Federal, State, County AND City regulations may include:
  - California Title 8
  - CalOSHA
  - CUPA
  - LA County Fire (or local department)
  - SCAQMD
  - LA County (or local) Health Hazmat
RMP/PSM Requirements for Anhydrous Ammonia

- PSM Prevention Program
- Documented Management System
- Worst Case & Alternative Release Scenario Analysis & Modeling
- Submittal of RMP Summary to EPA
PSM Prevention Program

- Process Safety Info
- Process Hazard Analysis
- Operating Procedures
- Training
- Mechanical Integrity
- Management of Change
- Pre-startup Safety Review
- Compliance Audits
- Safe Work Practices
- Employee Participation
- Contractor Requirements
- Incident Investigation
- Emergency Response Procedures
- Trade Secrets