

# Anhydrous Ammonia in Propane Cylinders

## Safety Considerations for Mitigation

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### Introduction

There are a variety of chemical hazards associated with clandestine drug labs. Anhydrous ammonia is a particular problem, due to its widespread use in the manufacture of illegal methamphetamine. Ammonia is generally stolen from agricultural sources, and transferred to a propane cylinder for storage. Twenty-pound barbecue grill cylinders are encountered most frequently, however a wide variety of cylinders may be used.

Propane cylinders are not designed to hold anhydrous ammonia. Their modified brass valves are incompatible, and subject to severe corrosion and deterioration. Corroded valves can be identified by their characteristic blue color. It is not uncommon to discover cylinders that are leaking due to internal corrosion and failure of the valve. Tanks may also be modified with a variety of makeshift fittings. Cylinders that are overfilled or heated are subject to dangerous high pressures and potential failure with increased temperature.

Anhydrous ammonia can also be stored as a super-cooled liquid (-28° Fahrenheit), in insulated thermos-type containers. These containers are not designed to hold pressure, and are subject to potential catastrophic failure as the ammonia warms to ambient temperature and internal pressures increase.

**There are several options for mitigating cylinders containing ammonia, however each has associated risks, and should be evaluated for safety based on the condition of the container and circumstances at the scene.**

Anhydrous ammonia is a dangerous liquefied gas, which poses a significant health threat if not handled properly. When approached with caution, training and protective equipment, it is possible to minimize the hazards posed by these cylinders, in order to manage them as safely as possible.

### Anhydrous Ammonia hazards and properties

Anhydrous ammonia is colorless, liquefied gas under pressure. Anhydrous ammonia is used extensively in agriculture where it is applied to the soil as a source of nitrogen. It is also used widely in refrigeration and cold storage facilities including building cooling systems.

The odor threshold of ammonia is approximately 3-5ppm, and responders are generally aware of leaking cylinders by the odor at levels well below hazardous concentrations. High concentrations of ammonia vapor are visible as a white fog.

Ammonia becomes a severe respiratory hazard and eye irritant at approximately 300 PPM (Immediately Dangerous to Life and Health (IDLH) value). At this concentration and in conjunction with the correct temperature and humidity level, ammonia vapor can also be a skin absorption hazard. When dealing with the public safety element, respiratory protection considerations may need to be taken for the asthmatics, children and the elderly. Due to the significant respiratory and eye exposure hazards, it is essential to use a Self-Contained Breathing Apparatus (SCBA) for any situation involving anhydrous ammonia improperly stored in meth lab containers. SCBA and firefighter's structural turnout gear may be adequate for circumstances involving low concentrations of vapor for rescue situations.

Extreme caution should be taken if the potential for a liquid exposure exists. Liquid anhydrous ammonia in contact with

exposed skin will result in immediate frostbite and caustic burns. It will freeze clothing to the skin, as it is approximately -28 degrees F within 3 feet of the release point. Therefore, level A protection is recommended for any potential splash exposures or high vapor concentrations. It should be recognized that SCBA and structural firefighter's protective clothing provides a limited degree of protection in the event of an unexpected emergency or life safety situation.

Ammonia vapors are generally lighter than air, and in open environments they will readily dissipate to the atmosphere. It is important to ventilate any enclosed areas where vapors may concentrate. Ammonia has a Lower Explosive Limit (LEL) of 15%, and while this is relatively high, it can present an explosion hazard inside an enclosed space or in close proximity to the point of release

### **Mitigation Safety Considerations**

**There are several methods that have been used to address anhydrous ammonia in propane cylinders. All of these methods involve a degree of risk, and each has safety hazards which need to be evaluated with respect to scene circumstances, condition of the cylinder and valve, temp & pressure and public safety concerns. Always suspect that a propane cylinder with anhydrous ammonia will be a problem and that a small leak can rapidly turn into a large leak.**

Mitigation options include:

- **If not leaking**, overpack in a 55 gallon drum with ice and vermiculite for cleanup contractor to take.
- Opening the valve and venting the contents to air (using a water fog to control vapor cloud).
- Connecting a hose to the valve and venting the contents into a container of water.
- Puncturing the container from a safe distance by shooting it.
- Taking no action; evacuating the area; and seeking outside assistance from the Clan Lab Enforcement Team roster

### **For Every Situation:**

- Establish Incident Command; Involve police, fire and EMS in a Unified Command
- Evacuate the immediate area an appropriate distance downwind (See NAERG 2000 for evacuation distances)
  - Evaluate shelter-in-place possibilities
- Establish a water supply at the scene
  - Water fog can be used to suppress vapors. Use as wide a pattern as possible
  - Water is essential for decontamination and first aid in the event of an exposure
  - Consider containment of run off
- Ensure good ventilation
  - It may be necessary to move the cylinder to a safe, outside location
- Evaluate the condition of the container. Use SCBA and appropriate personal protective equipment and have emergency decontamination ready.
  - Determine the visual condition of the cylinder. Is it full or empty?
    - Look for visual indications of bulging, cracking paint, damage to tank shell
    - Determine general condition of the valve. Is it blue? Does it appear functional?
      - What degree of corrosion is visible? Minor? Moderate? Severe?
      - Check visible threads and determine the degree of thread extension into the neck of the tank. (Barbecue cylinder valves have approximately 1" of thread; 1/2" visible outside is normal.

**NOTIFY THE MN DUTY OFFICE AT 800-422-0798 IF THERE IS A RELEASE OF ANHYDROUS AMMONIA**

Several techniques can be used to cool the tank and reduce internal pressure:

- Water can be used to cool a cylinder if the water temperature is cooler than the container. (This should be evaluated carefully as warmer water will increase the pressure in the tank.)
- A CO2 fire extinguisher can be used to rapidly cool the tank and reduce internal pressure. The effect will last a relatively short time, but may be effective prior to handling the tank.
- Cylinders can be packed in ice to reduce their temperature (if ambient temperature is above freezing).

Depending on circumstances, cylinders **may** need to be mitigated in place.

If a cylinder needs to be moved to a safer area:

- It should be evaluated and determined to be in adequate condition for transport.
- It should be secured in a large open container.
  - If possible, the tank should be placed on a 4 - 6" cushion of sand / sawdust inside the container
- It should be packed in ice to reduce internal pressure and secure it from shifting during transport.
- The container should be firmly secured during transportation.

### **Open Air Venting**

In many circumstances, a cylinder may be vented to the atmosphere by simply opening the valve and releasing the contents to the atmosphere. This should be done with the cylinder in an upright position. Downwind vapor concentrations will vary significantly with atmospheric conditions. Where exposures are a concern, a water fog can be used to suppress the vapor cloud. This runoff (ammonium hydroxide) is corrosive and toxic to aquatic life & should not be allowed to reach waterways or storm sewers.

**Notify the MN Duty Officer at 800-422-0798 of this intentional release for State reporting requirements.**

### **Venting into water**

If the valves are in good condition, it is possible to discharge the ammonia into a large container of water.

The ammonia should be plumbed from the valve to the container, and injected as near the bottom as possible. The water will absorb the ammonia, resulting in a solution of ammonium hydroxide. **CAUTION: THIS MAY BE A SUPER HOT SOLUTION.** There should be at least ten parts of water for each one part ammonia to be absorbed (a 55 gallon drum is adequate for a #20 propane tank). The resultant ammonium hydroxide should be disposed of in compliance with local regulations. The hose should be regular NH3 hose or nylon braid NH3 which is neoprene cover over a neoprene tube with multiple textile braids or steel braid NH3 hose which is neoprene wrapped cover with a stainless steel braid and butyl tube.

### **Puncturing from a safe distance by shooting**

It is common for cylinder valves to corrode internally and clog, so that the contents and pressure will not be released when the valve is opened. Even valves that appear in good condition may not function when clogged internally. In some cases, a request is made for law enforcement to ventilate the cylinder or insulated container, by shooting it from a safe distance, in order to release the pressure and contents. **It is critically important to evaluate all other possible options, safety hazards and outcomes, before deciding to shoot a container. Due to the extremely dangerous nature of discharging a firearm, shooting a container should be viewed as a last available option, and should be carried out with extreme caution.**

It is important to understand the explosion and fire risks posed by shooting a cylinder that actually contains propane, rather than anhydrous ammonia or even propane residue leftover from its original use. It is important to evaluate

downrange exposures, trajectories of bullets and bullet fragments, ensure an adequate backdrop and evaluate ricochet potential, so that there are no unanticipated risks. It is important that an adequate weapon be used (a sighted rifle), with sufficient accuracy and energy to cleanly penetrate the cylinder. Be prepared that the cylinder will move in all directions once penetrated.

When a cylinder containing ammonia is shot or vented rapidly, the product will flash-boil, releasing both vapor and liquid spray under high pressure. With the instantaneous release of pressure, the temperature of the ammonia drops to its boiling point of  $-28^{\circ}\text{F}$  (auto refrigeration), and ammonia that doesn't vaporize instantly, will remain as a dangerous, super-cooled liquid. This cold, liquid ammonia will evaporate as it warms, and water can be applied to increase vaporization. The tank may even freeze over and plug creating a bigger problem.

### **Taking no Action, Evacuating the Area, Seeking Professional Assistance**

In some circumstances, it may be advisable to seek professional assistance and hire a private cleanup contractor to transport the cylinder off-site to an approved disposal facility. The MN Duty Officer #800-422-0798 has access to those contacts.

The US Drug Enforcement Agency has received an exemption from the US DOT, RSPA (#DOT-E 12009), authorizing the transportation in commerce, of anhydrous ammonia in DOT cylinders not designed for anhydrous ammonia. This exemption covers contractors working on behalf of the DEA, and requires that:

- Shipment is from clandestine drug labs to proper disposal facilities only
- Cylinders are inspected and determined to be in adequate condition for transport
- Only non-leaking cylinders are authorized for transport
- Cylinders be secured in an open-head drum, packed in ice with the top bung open
- Transportation must be by private carrier only (i.e. a cleanup contractor)
- Packages are monitored every 2 hours for leaks
- Each cylinder must be equipped with a valve plug
- A copy of the exemption must be carried aboard the vehicle during transportation

### **First Aid and Exposure Response -Call 911**

Exposure to anhydrous ammonia can cause dehydration, caustic burning and freezing. Liquid or vapor contact with the eyes will cause severe injury or blindness. Liquid contact with the skin will cause 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> degree chemical burns. It is critical to have an on-scene water supply in the event of an emergency.

In the event of an exposure to anhydrous ammonia, secure the area, and move the victim upwind to fresh air if possible. Request medical assistance. Decontaminate the victim with copious amounts of water. Remove clothing and irrigate affected body tissues with water for at least 20 minutes. Keep patient warm & monitor breathing and for signs of hypothermia. Consider administering humidified oxygen. Transport to hospital for treatment and evaluation.

### **Evidence, Law Enforcement and Felony Violations**

Cylinders should be evaluated for use as potential evidence, and all actions should be documented in a law enforcement case file. The crime scene should be protected with proper evidence and chain of custody procedures. **Do not remove the tank from to the scene and transport to an evidence storage locker.** The presence of ammonia can be demonstrated using pH paper (pH approx. 11) or an ammonia Dräger tube.

Possessing, placing and transporting anhydrous ammonia in improper containers, and tampering with legal storage equipment is a criminal felony under the MN Fertilizer Control Law (MN Statute 18C.201 Subd. 6 and 7). The felony criminal penalties are included in the Agricultural Chemical Enforcement Law, (MN Statute 18D.331 Subd. 5).

It is a violation of Mn/DOT hazardous materials rules to place any unauthorized hazardous material in a DOT specification cylinder, under MN Statute 221.033, which adopts Federal HMR by reference.

This act violates the Federal Hazardous Materials Regulations (HMR), under 49 CFR, Title 49 173.24 (c).

**Helpful References:**

**Materials Safety Data Sheets**

<http://MSDS.PDC.CORNELL.EDU/msdssrch.asp>

**North American Emergency Response Guidebook**

<http://hazmat.dot.gov/guidebook.htm>

**NIOSH Pocket Guide to Chemical Hazards**

<http://www.cdc.gov/niosh/npg/npgd0000.html>

**Minnesota Duty Officer**

**800-422-0798**

**651-649-5451**

**Bureau of Criminal Apprehension**

**651-642-0610**

**United States Drug Enforcement Agency**

**Minneapolis Office - 612-348-1700**

**Chicago Office - 312-353-7875**