

Anhydrous Ammonia in Propane Tanks

Hazards and Response



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Serious public safety and environmental problems can occur when liquid anhydrous ammonia (NH₃) and liquid propane are combined. Such events and adverse consequences occur in Minnesota all too frequently. This document outlines actions for responders to take in the event of such an incident.

Tanks Look Alike

Propane tanks look similar to anhydrous ammonia tanks, making accidental transfer possible. They are often located near each other at bulk storage facilities and can even share the same fence and barricade perimeter. Propane and NH₃ tanks can have similar plumbing.

Why Tanks are Different

Tanks are constructed differently to contain liquids with different properties.

Flammability

- Propane is extremely flammable.
- NH₃ does not ignite readily.

Corrosion

NH₃ is corrosive to brass, copper and galvanized components/fittings. When these components/fittings come in contact with NH₃ liquid or vapor, the metal will corrode and will fail. Therefore, if NH₃ is improperly added to a propane tank, liquid or vapor from both compounds could escape uncontrolled into the environment. Incompatible components/fittings exposed to NH₃ are compromised and must be disposed of immediately.

When Combined

- **Propane and NH₃ don't react or mix.** When the two compounds are combined, they will separate into layers within the tank. NH₃ is heavier and will sink as a liquid layer to the bottom of the tank.
- **Pressure in the tank increases quickly.** The vapor pressures of propane and ammonia in a closed container build upon each other. The total pressure in the tank becomes the sum of the two rather than the average of the two.

Pressure relief valves on propane tanks will open when internal pressure reaches 250psi. Propane alone will pressurize to 250psi at a temperature near 120°F; however, a propane/NH₃ mix pressurizes to 250psi at a much lower temperature between 70-80°F.

Table 1 shows the relationship between temperature and vapor pressure of these two compounds in a closed container. The numbers in red indicate when pressure relief valves will open, releasing NH₃ and propane vapors into the environment.

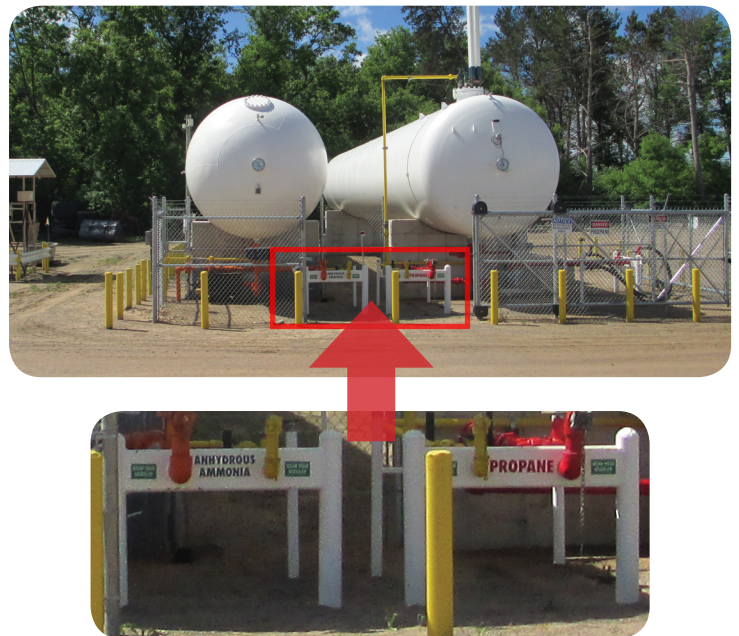


TABLE 1. Temperature versus vapor pressure of a large quantity mix of NH₃ and propane.

Temperature (°F)	Vapor Pressure (psi)
-30	5
-20	14
-10	26
0	39
10	56
20	75
30	97
40	122
50	152
60	186
70	224
80	268
90	317
100	371

Response

Immediate hazard: Release of NH₃ and propane.

Use the STARR method for a thorough response:

Secure, **T**elephone, **A**bate, **R**emediate, and **R**ecover.

Secure:

- Eliminate all nearby ignition sources. Do not allow smoking near the tanks;
- Reduce possible exposure by limiting personnel, customers, and suppliers to the site;
- Continually monitor weather conditions (air temperature, wind speed and direction);
- Monitor pressure gauge on storage tank. (see Table 1)

Telephone:

- Alert local law enforcement and firefighters (911). Consider notifying nearby residences for possible evacuation;
- Minnesota Duty Officer at 800-422-0798. One telephone call will activate all state emergency response services.

Abate:

- Monitor for the presence of escaping NH₃ and propane vapors;
- Expedient replacement of incompatible components/fittings is critical to address the immediate hazard;
- Removal of the propane/NH₃ mixture to other tanks is acceptable if incompatible components/fittings cannot be replaced.

Remediate:

- Flaring the propane/NH₃ mixture is the preferred disposal choice.
- A remote location is necessary to maintain public safety. If possible, choose a site distant from roads and residences;
- A vapor flare can be used to burn propane from the tanks. Vapor flares may take weeks to complete in cold weather, but much shorter time in warmer weather. Be aware that auto-refrigeration and a pressure drop will occur if the release of vapor to the flares causes a significant liquid temperature drop. Flaring directly from the storage tank is acceptable provided that all components/fittings are compatible and can be done safely;
- A liquid flare will greatly accelerate the flaring process.

Recover:

- After flaring off the propane portion of the mixture, the remaining NH₃ may be field applied or disposed of in a safe, environmentally responsible manner.

Prevention

Ensure appropriate signage and proper color coding is on transfer areas, plumbing, and each tank. Situate tanks in separate areas if possible or if tanks are adjacent, switch plumbing to opposite ends to prevent accidental mixing of NH₃ and propane.

Anyone working with these materials should maintain awareness about the hazards and response to prevent a release or incident. Make sure all handlers and users of NH₃ and propane are trained and competent in tank identification. Practice emergency response steps before an incident happens.

Most accidents occur at the end of a day or week when workers are tired. Ensure personnel safety and save thousands of dollars in cleanup costs by helping employees stay alert until their shift is complete.



Questions or Additional Information

Contact the Minnesota Department of Agriculture at 651-201-6387 or visit our website at www.mda.state.mn.us/agchemspills.

Helpful Websites

National Institute for Occupational Safety and Health. Pocket Guide to Chemical Hazards: www.cdc.gov/niosh/npg/

Propane Safety Council: www.propanesafety.com

National Institute of Standards and Technology (NIST) Chemistry Web Book: webbook.nist.gov/chemistry/fluid/