

# ANHYDROUS AMMONIA EMPLOYEE TRAINING FACT SHEET

**VIDEO LENGTH: 17 MINUTES**

**PRODUCTION YEAR: 2022**

## **PROGRAM SYNOPSIS:**

Anhydrous ammonia is a common chemical used in manufacturing, the treatment of metals, and chemical processing. It is also an essential element of fertilizer and is used in a wide variety of industries as a refrigerant. To prevent harmful exposures to this useful chemical, OSHA, the Occupational Safety and Health Administration, has developed safety standards that regulate the use of anhydrous ammonia in the workplace. This program discusses some key requirements from these regulations as well as safe work practices and procedures necessary to prevent harmful exposures to anhydrous ammonia.

## **PROGRAM OBJECTIVES:**

After watching the program, the participant should be able to explain the following:

- The characteristics and properties of anhydrous ammonia;
- The effects of an exposure;
- The OSHA regulations involved in working with anhydrous ammonia;
- The PPE and safe work practice controls for handling anhydrous ammonia;
- How to respond to an exposure.

## **INSTRUCTIONAL CONTENT:**

### **INTRODUCTION**

- Anhydrous ammonia: a common chemical used in manufacturing, the treatment of metals, and chemical processing. It is also an essential element of fertilizer and is used in a wide variety of industries as a refrigerant and as part of the air scrubbing process to reduce carbon emissions.
- As beneficial as anhydrous ammonia is to these processes, it can also be very dangerous. Workers who become exposed to anhydrous ammonia can suffer serious injuries, health effects, or death.

### **CHARACTERISTICS & PROPERTIES**

- To prevent these types of harmful exposures, OSHA, the Occupational Safety and Health Administration, has developed safety standards that regulate the use of anhydrous ammonia in the workplace. During this program, we will discuss some key requirements from these regulations as well as safe work practices and procedures necessary to prevent harmful exposures to anhydrous ammonia.
- Anhydrous ammonia is a compound that is made up of one part nitrogen and three parts hydrogen. Anhydrous ammonia is often referred to by its molecular formula, NH<sub>3</sub>.
- The word anhydrous means without water, which distinguishes this type of ammonia from the aqueous forms of ammonia which are commonly used as cleaners and disinfectants.
- The fact that anhydrous ammonia contains no water contributes to its hazardous nature. When anhydrous ammonia contacts any type of moisture, it quickly combines with water to form ammonium hydroxide. Ammonium hydroxide is a very caustic solution which can cause irritation and burns to human tissues.
- At room temperature, anhydrous ammonia is a colorless gas with a pungent odor. In fact, the odor is so strong that you cannot voluntarily stay in an area of high concentration for very long because you literally won't be able to stand the smell.
- The boiling point of anhydrous ammonia is negative 28 degrees Fahrenheit. Because it has such a low boiling point, large volumes of anhydrous ammonia must be shipped and stored as a liquid.
- To be stored in its liquid state, anhydrous ammonia must be kept under very high pressure or be maintained below its boiling point of negative 28 degrees Fahrenheit. If liquid anhydrous ammonia is allowed to escape into room temperature and pressure, it will rapidly transform into a gas, forcibly expanding in volume and instantly cooling to negative 28 degrees Fahrenheit.

- The rapid expansion and cooling of escaping anhydrous ammonia can cause severe injuries or death, and the caustic nature of ammonium hydroxide can cause burns and other health effects. This is why workers must always take proper precautions to avoid creating an anhydrous ammonia leak or other harmful exposure.

## EFFECTS OF EXPOSURE

- At normal temperature and pressure, anhydrous ammonia is a gas that is both corrosive and toxic.
- When anhydrous ammonia comes into contact with your eyes, skin, lungs, or any mucous membrane, it will combine with the moisture present in these tissues causing tissue dehydration, cell destruction, irritation, and chemical burns.
- In addition, many injuries also occur from an unexpected high-pressure release of anhydrous ammonia. The force of the expanding gas can cause severe injuries while the extreme cold temperature of anhydrous ammonia can also cause severe frostbite and tissue damage.
- Anhydrous ammonia is also a respiratory hazard and can be fatal when inhaled at high enough concentrations. When concentrations of anhydrous ammonia exceed 300 parts per million, it presents an “immediate danger to life and health.” This potentially fatal level of concentration is also referred to as the “I-D-L-H” level.
- Some symptoms of respiratory exposure include irregular breathing, shortness of breath, coughing, choking or respiratory arrest.

## REGULATIONS

- In order to protect workers from injury and illness related to anhydrous ammonia, the Occupational Safety and Health Administration has issued their standard 1910.111, titled “Storage and Handling of Anhydrous Ammonia.” In addition, OSHA has also published limits for employee exposure to anhydrous ammonia in 1910.1000 Table Z-1 titled “Limits for Air Contaminants.”
- OSHA has set the permissible exposure limit or “PEL” for anhydrous ammonia at 50 parts per million over an eight-hour time-weighted average.
- When levels of anhydrous ammonia exceed this permissible exposure limit, organizations must take measures to reduce the amount of anhydrous ammonia in the air.
- If the levels of anhydrous ammonia cannot be reduced by other means, then workers must be provided with the appropriate respiratory protection and other PPE necessary to avoid harmful exposure.
- In addition to OSHA, there are other organizations that issue exposure guidelines. Two such organizations are the National Institute for Occupational Safety & Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (The ACGIH).
- NIOSH publishes a Recommended Exposure Limit or “R-E-L” of 25 parts per million averaged over a 10-hour period while the ACGIH publishes a Threshold Limit Value or “T-L-V” of 25 parts per million averaged over an 8-hour period.
- These organizations also recommend a short-term exposure limit or “STEL” of 35 parts per million for a 15-minute period of exposure.
- The recommendations of NIOSH and the ACGIH are not legally binding and often exceed OSHA’s requirements.

## PERSONAL PROTECTIVE EQUIPMENT

- When exposure levels cannot be reduced to permissible levels, or there is the potential for an accidental release of anhydrous ammonia, workers will be required to wear appropriate respiratory protection.
- Before using any type of respirator or breathing apparatus, you must undergo a medical evaluation by a licensed physician who will determine your physical ability to use the equipment effectively.
- You will also be trained in the selection, care, and proper use of your respirator as well as the techniques you must use to achieve a proper fit and how to verify that the respirator is properly sealed to your face.
- When working in conditions where there is the potential for exposure up to 250 parts per million, a **half-face** respirator with chemical cartridges that provide protection from ammonia may be used. The assigned protection factor or “A-P-F” of this type of respirator is 10.
- For concentrations up to 300 parts per million, a **full-face** respirator with chemical cartridges that provide protection from ammonia may be used. The assigned protection factor or “A-P-F” of this type of respirator is 50.
- When using these types of cartridge respirators, you should not be able to smell any ammonia. If you do smell ammonia, then your cartridges may need to be changed or you may not have a proper seal.

- If ammonia concentrations may be above the IDLH level of 300 parts per million, or the potential level of ammonia concentration is unknown, then a self-contained breathing apparatus, or S-C-B-A, operating in positive-pressure mode must be used. The assigned protection factor or “A-P-F” of a SCBA is 10,000.
- If you are unsure how to use your respirator or have questions about cartridge selection or proper fit, stop and ask for help.
- Exposure to anhydrous ammonia can also be damaging to the skin and eyes. This is why various types of personal protective equipment will be required when working with or near anhydrous ammonia.
- To avoid general skin exposure, long sleeve chemical-resistant protective clothing that is impervious to liquid contact offers good protection. The level of protection chosen should match the potential level of exposure.
- To protect the hands, loose-fitted neoprene, butyl rubber, or other impervious chemical gloves with extended cuffs should be worn. The cuffs should be turned up so ammonia will not run down your arms when they are raised.
- Gloves that fit loosely can be removed more easily in an emergency.
- If you work with ammonia that is used as a refrigerant, you may want to wear lined gloves to keep your hands warm when handling cold metal.
- To protect your eyes, non-vented safety goggles should be worn. For additional protection of the face, a face shield can be worn in combination with safety goggles.
- A face shield alone does not offer any protection for your eyes. Always wear eye protection in combination with a face shield.
- Contact lenses should not be worn in areas where there is potential for exposure to anhydrous ammonia.
- The level of required PPE will depend on the potential concentrations of an exposure. Always wear the personal protective equipment required by your company when working with or near anhydrous ammonia.

## **SAFE WORK PRACTICES**

- The potential for an unexpected release of anhydrous ammonia is greatest when it is being transported or transferred. In addition, the failure of hoses, valves, or storage vessels can be the cause of a major release of anhydrous ammonia.
- When working with tanks and transfer equipment, they must be inspected frequently. Transfer hoses and relief valves are the two most important elements of an inspection process.
- Relief valves have a replacement date stamped on the valve body. Make sure this date has not passed.
- All hoses should be free of cuts, bulges, worn spots, or other damage. Hoses must be labeled “anhydrous ammonia” and be marked with the year of manufacture and an expiration date. Hoses whose expiration date has passed must be removed from service.
- Make sure that all connections are clean and free of dirt and debris. Threaded connections must be in good condition.
- Be aware that all storage, handling, transfer, and other equipment must be approved for use with anhydrous ammonia.
- Unapproved equipment may be incompatible with anhydrous ammonia or may fail under the high pressures involved.
- Tanks used to store anhydrous ammonia should be painted silver or white to best reflect heat.
- Tanks should never be filled greater than 85 percent capacity to allow for the expansion of the gas as the temperature or pressure changes.
- Before operating any valve that controls anhydrous ammonia, all workers involved in the process must read and understand the valve operator’s manual. This valve operation training must be documented.
- Tanks containing anhydrous ammonia must be secured in place before any valves may be operated. This helps ensure that active connections aren’t inadvertently broken due to any shifting or movement of the tank.
- Anhydrous ammonia tanks must also be located where there are no obstructions to escape from the area if a leak occurs.
- During the transfer process, employees should stay a distance away and upwind of the involved valves and hoses.
- If an anhydrous ammonia release does occur, immediately evacuate the area to a safe location while also alerting others to the danger. Follow your company’s Emergency Response Plan for reporting the situation.
- Never attempt to control or contain an anhydrous ammonia leak unless you have been properly trained and authorized, as well as having the necessary protective equipment such as a self-contained breathing apparatus and protective chemical-resistant suit.

- No one should be allowed to return to the area until the situation is remedied and the “all clear” command is issued.

## **RESPONDING TO EXPOSURES**

- Despite all of our efforts, there is always the risk of exposure when handling or working near anhydrous ammonia. Properly responding when someone is sprayed with liquid ammonia or engulfed in a cloud of vapors can significantly limit the seriousness of any resulting injury.
- If a person’s eyes or skin have been exposed, get him or her to an eyewash station, safety shower, or sink immediately.
- Flush the affected area for 15 to 20 minutes. Use as much water as possible, as it will dilute the ammonia and reduce its potential to damage the skin.
- Do not attempt to remove any clothing at this point. In many cases the extreme cold temperature of anhydrous ammonia will freeze exposed clothing to the skin and removing it can cause additional injury to the skin. Wait until contaminated clothing has been thawed before removing it.
- If ammonia has entered the eyes, make sure to hold the eyelids open while flushing with large amounts of water for 15 to 20 minutes.
- Make sure you know where the safety shower and eye wash stations are located, and be able to find and operate them, even with your eyes closed.
- Victims suffering either a skin or eye exposure should be treated by medical professionals as soon as possible.
- If someone has inhaled low levels of ammonia, move the victim to a safe area with plenty of fresh air and monitor their condition.
- Higher concentration exposures may result in convulsive coughing or respiratory spasms and require immediate medical assistance.
- All exposures to anhydrous ammonia, even those that seem minor, require medical attention and evaluation. Always report any exposure right away.

## **CONCLUSION**

- In this program, we have discussed the characteristics and properties of anhydrous ammonia and explained why it can be so dangerous.
- We learned the effect that exposure to anhydrous ammonia has on our bodies and how to respond should an exposure occur.
- We reviewed some of the control measures that are used to prevent exposure and the safe work practices that should be followed to prevent an accidental release.
- We also discussed the use of respirators and other personal protective equipment to reduce the level of exposure when necessary.
- Working with or near anhydrous ammonia can be hazardous, but it doesn’t have to be...that part is up to you and your commitment to workplace safety.

## **Anhydrous Ammonia Employee Training**

### **ANSWERS TO THE REVIEW QUIZ**

1. a
2. a
3. b
4. a
5. b
6. a
7. a
8. b
9. a
10. b

## Anhydrous Ammonia Employee Training

### REVIEW QUIZ

Name \_\_\_\_\_ Date \_\_\_\_\_

*The following questions are provided to determine how well you understand the information presented in this program.*

1. Anhydrous ammonia is a common chemical used in manufacturing, the treatment of metals, and chemical processing.
  - a. True
  - b. False
  
2. At room temperature, anhydrous ammonia is a colorless gas with a pungent odor.
  - a. True
  - b. False
  
3. To be stored in its liquid state, anhydrous ammonia must be kept under very high pressure or be maintained below its boiling point of negative 50 degrees Fahrenheit.
  - a. True
  - b. False
  
4. When concentrations of anhydrous ammonia exceed 300 parts per million, it presents an "immediate danger to life and health."
  - a. True
  - b. False
  
5. OSHA has set the permissible exposure limit or "PEL" for anhydrous ammonia at 100 parts per million over an eight-hour time-weighted average.
  - a. True
  - b. False
  
6. If ammonia concentrations may be above 300 parts per million or the potential level of ammonia concentration is unknown, then a self-contained breathing apparatus, or "SCBA," operating in positive-pressure mode must be used.
  - a. True
  - b. False
  
7. Hoses must be labeled "anhydrous ammonia" and be marked with the year of manufacture and an expiration date.
  - a. True
  - b. False
  
8. Tanks used to store anhydrous ammonia should be painted red or blue.
  - a. True
  - b. False
  
9. Never attempt to control or contain an anhydrous ammonia leak unless you have been properly trained and authorized.
  - a. True
  - b. False
  
10. If ammonia has entered the eyes, make sure to hold the eyelids open while flushing with large amounts of water for 5 to 10 minutes.
  - a. True
  - b. False