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Introduction

The document for the “Requirements for the Storage and Handling of Anhydrous Ammonia” is officially titled CGA G-2.1—2014 6th Edition. It is accepted by the American National Standards Institute commonly referred to as ANSI. This standard is meant to replace the ANSI K61.1—1999 / CGA G-2.1—1999 American National Standard Safety Requirements for the Storage and Handling of Anhydrous Ammonia 5th Edition.

The 2014 edition includes updated ammonia exposure information and extensive revision of the safety section to incorporate current regulatory and safety requirements and regulations. This edition also includes revised requirements for the re-installation of large pressure vessels, for the repair or alteration of pressure vessels, and for dealing with pressure vessels with missing dataplates by incorporating provisions of the National Board Inspection Code (NBIC). A new section defines specifications and inspection requirements for pressure transfer hoses used specifically in ammonia service (Information about pressure transfer hose requirements was previously addressed in an appendix to the 1999 edition). Another new section defines the requirements for heating devices for containers. The refrigerated storage pressure relief valves section also underwent another rewrite to address abnormal operating conditions and fire scenarios with respect to relief requirements.

The standard is intended to apply to the design, construction, repair, alteration, location, installation, and operation of anhydrous ammonia systems including refrigerated ammonia storage systems. The standard does not apply to ammonia manufacturing plants, refrigeration systems where ammonia is solely used as a refrigerant, ammonia transportation pipelines, and ammonia barges and tankers.

Ammonia Exposures

Table 2-Human physiological response to various concentrations of ammonia in air has been updated and expanded to more accurately describe the effects that ammonia may have on the human body.

Tables 3 & 4-Exposure Limits have been listed according to NIOSH and Emergency Response Planning Guideline Exposure Limits.

Federal, State, and local regulations – NH_3 is regulated by agencies including the DOT, OSHA, Dept. of Homeland Security (DHS), Environmental Protection Agency (EPA), and State Jurisdictions.

Definitions

The definition section has been expanded to include terminology used in the standard for better interpretation of the standard.

Codes

The National Board Inspection Code (NBIC) has been listed along with ASME Code and API-ASME Code because the NBIC applies to the repair and alteration of unfired pressure vessels. The latest edition of NBIC applies at the time the pressure vessel is repaired or altered.

Safety

Any person required to handle, transfer, transport, or otherwise work with ammonia shall be trained to understand the properties of ammonia, to become competent in safe operating practices, and to take appropriate actions in the event

of a leak or an emergency. Refresher Training should be completed every three years. (Iowa requires yearly training, see Iowa Rules Update)

Any person making, breaking, or testing any ammonia connection and transferring ammonia should do so in accordance with written operating procedures. These SOPs must be complete from startup to shutdown, allowing for emergency actions. They must be accurate and readily available for each specific facility and created in a way to allow someone unfamiliar with the site to operate it safely.

Emergency planning and response coordination

Sites handling anhydrous ammonia should preplan for emergencies with local emergency planners and/or responders. Only properly trained personnel operating under properly planned and coordinated emergency response programs should handle emergencies surrounding a release.

Unintentional releases over a Reportable Quantity (RQ) require immediate notification to the National Response Center (NRC), State Emergency Response Commission (SERC), and the Local Emergency Planning Committee (LEPC). The Federal Reportable Quantity for ammonia is 100 pounds within a 24 hour time period.

Note: In Iowa, this must be reported within 15 minutes to the NRC and DNR. If quantity is less than 100 pounds this must be reported to the DNR within 6 hours.

Releases incidental to transportation are also subject to release reporting requirements under DOT and may require notification to the NRC and DNR.

Facilities that have 500 pounds or more of ammonia on site at any one time are required to initially notify the SERC, LEPC, and local fire department and identify a facility coordinator. 40 CFR 355 (X)

Emergency Plans

Sites handling anhydrous ammonia should have an Emergency Action Plan or Emergency Response Plan. These sites may also be subject to OSHA's Process Safety Management (PSM), EPA's Risk Management Program (RMP), DOT Site Security, and DHS's Chemical Facility Anti-Terrorism Standard (CFATS). These standards have emergency planning requirements. Sites with less than threshold quantities may be subject to the OSHA and EPA General Duty Clause to maintain and operate a safe system.

Transportation personnel should be aware of actions to take or not to take in the event of a release incidental to transportation.

Permanent Storage Locations

Personal protection and first aid

Indoor facilities need a minimum of 2 emergency escape only respirators in compliance with OSHA 1910.134. The requirement for 2 full faced gas masks has been removed.

Gloves and goggles for each employee plus one. One pair of boots and a slicker, impervious to ammonia, along with a shower, eyewash station, or minimum 150 gal. of clean water in open container, must all be onsite. Emergency water should be available at each transfer location at the facility. Water should be within 100 ft. or 10 seconds travel time, with no obstacles in the way.

Cargo Tanks - 3.5.1 Cargo tank requirements are unchanged with the exception that an escape-only respirator may be substituted for a full face gas mask.

Site Security – Facilities should address and mitigate risk of possible ammonia release from a wide range of threats such as vandalism, ammonia theft, sabotage, and terrorism, in order to protect the facility, employees and the surrounding community, and may be required to address site security under DOT and/or DHS regulations. This would entail a site vulnerability assessment (SVA) and plan of action to assess the outcome of the SVA.

Accidental release – In the event of an accidental release neither due to fire nor any other heat impingement, the ammonia vapor may be reduced with a water fog from a safe location downwind from the cloud directed toward the point of ammonia release. Runoff of NH_3 contaminated water should be controlled, contained, and collected.

Fire exposure – If an ammonia container is exposed to fire sufficient that it appears that the tanks may rupture, the surrounding area should be evacuated to a safe distance in all directions.

When NH_3 is released from a vessel it should be injected into a water vessel as near as possible to the bottom, with the hose weighted or attached to get it near the bottom or a sparging device may be used.

Basic Rules

There are new requirements for storage pressure vessels listed in the new standard.

Equipment and systems – 5.1.1 The provisions of 5.2 shall not be construed as prohibiting the continued use of reinstallation of container constructed and maintained in accordance with the 1949, 1950, 1952, 1956, 1959, 1965, 1968, 1971, 1974, 1977, 1980, 1983, 1986, 1989, 1992, 1995, and 1998 editions of the ASME Code, or any revisions thereof, in effect at the time of fabrication.

Reinstalled pressure stationary vessels of 10,000 gallons minimum shall be subject to the following:

Any pressure vessel used as a storage tank shall have been registered with the National Board, or in lieu of National Board Registration, shall have available an ASME manufacturer's data report or be subject to testing.

Any pressure vessel used as a storage tank shall have either a 250 psig max allowable working pressure or shall have been re-rated for a 250 psig MAWP in full accordance with the NBIC.

Any pressure vessel used as a storage tank shall have:

Been stress relieved during fabrication in accordance with the code in effect at the time of fabrication,

Have cold-formed heads which have been stress relieved, or have been fabricated with hot formed heads.

Reinstalled pressure stationary vessels of 10,000 gallons minimum without all necessary documentation shall be subject to testing and shall consist of:

Nondestructive testing for weld defects,

Nondestructive testing for weld defects within the heat-affected zones at least 25% of vessel welds with emphasis on longitudinal welds. If SCC is indicated up to 100% of the welds is then required.

Storage vessels with man-ways shall be examined internally with wet-mag testing. Alternate recognized evaluation techniques may be substituted. Re-examination should be repeated at 10 year intervals.

Thickness testing is required to confirm the minimum wall thickness of the shell and both heads to maintain a 250 PSI rating. Corroded and abraded areas in the shell or heads of a container shall be thickness tested.

The inspection company shall provide a written report.

Systems and components installed under earlier code versions in affect at time of construction may be acceptable for continued use. Documentation of the determination that the equipment is safe to continue to use, taking into consideration risk reduction and physical and legal restraints would need to be presented.

Requirements for **new** construction and original test, repair, and alterations of containers other than refrigerated storage tanks. The entire container shall be postweld heat treated after completion of all welds to the shells and heads. Exception: implements of husbandry will not require postweld heat treatment if they are fabricated with hot-formed heads or with cold-formed heads that have been stress relieved.

Containers must be built to current ASME Code and shall be inspected by a person who holds a valid National Board Commission.

Now listed in the standard is the process for repair or alteration of pressure-containing parts of a container. Any container repair shall be performed in compliance with the applicable provisions of the current edition of the National Board Inspection Code. All repair or alteration shall conform as much as possible to the ASME Code section and edition to which the container was constructed, subject to acceptance of the inspector.

NBIC provisions: R- Stamp certification required to complete any repair to a pressure vessel. R-Stamp must contract an Authorized Inspection agency. Inspector must fill out an R-1 or R-2 form for the repair or alteration. R-Stamp firm must apply the appropriate repair tag to a pressure vessel.

Per NBIC, pressurized storage tanks must have a legible dataplate in order to be repaired or altered.

Pressure vessels (nurse tanks), must have a legible dataplate in order to be repaired or altered.

Repairs and alterations to nurse tanks which penetrate the tank wall shall be fully compliant with NBIC, including inspection.

Repairs and alterations to nurse tanks which do not penetrate the tank wall shall be fully compliant with NBIC, except authorized inspection shall not be required.

Location of containers – The definitions of place of public assembly, residential of institutional occupancy are further defined. Distance from railway is 100 feet. Local AHJ would still have influence on the definition of place of public assembly.

Markings of non-refrigerated containers.

Storage tanks without dataplates – Storage tanks without legible dataplates may have their dataplates replaced by their manufacturer in accordance with NBIC.

Tanks missing dataplates that are not replaceable must be inspected and tested for thickness, water capacity, and outside surface area. They must be taken out of service by 2030.

Container Appurtenances – Openings must be labeled as to whether opening is in contact with liquid or vapor. No pertinent changes

Piping, Tubing, and fittings – All piping shall conform to ANSI/ASME B31.3 Process Piping

All metal flexible connections for permanent, nonrefrigerated installations shall be double braided and have a minimum working pressure of 350 psig.

All exposed piping shall be protected from physical damage from impact.

After assembly, piping shall be tested and proved to be free from leaks at a pressure specified by ASME B-31.3. After assembly also means reassembly after a replacement or repair is made to the piping or for example replacing a hydrostatic valve. Underground piping shall be evaluated at a minimum of every 5 years to ensure leak tightness.

Hose subject to container pressure shall be designed for a minimum working pressure of 350 psig and a minimum burst pressure of 1750 psig. Hose assemblies, when made up, shall be capable of withstanding a test pressure of 525 psig.

On all rubber hose ½ inch OD and larger used in ammonia service and subject to container pressure, there shall be etched, cast, or impressed at 5 ft. intervals on the outer hose cover the following information:

Anhydrous Ammonia, XXX psig (Maximum Working Pressure), Manufacturer's Name or Trademark, Year of Manufacture

For hoses other than rubber construction, which includes metal flexible connections, the above information should be affixed on the outer hose ends if stamped on the hose ends by the manufacturer. For all hoses, these markings shall be maintained clear and legible.

At a minimum, prior to each day's use the hose assembly shall be visually inspected for possible weakness.

Hose assembly weaknesses include: cuts or nicks, deterioration, blistering, bulges, flat spots, or kinks, coupling damage or slippage, leaks, or obliterated markings.

The maximum service period of the hose shall be as recommended by the manufacturer, or if used in conjunction with an additive recommended by the manufacturer of the additive. If manufacturer has not specified maximum service life the hose shall be removed 10 years from the date of manufacture.

Hoses shall be visually inspected at least annually for possible hose weaknesses. This inspection shall be documented. Hoses used seasonally shall be inspected before each season. Hoses subject to DOT regulations, such as cargo tanks, shall be inspected in accordance with 49 CFR Subpart 180.407 and 180.416.

Hoses shall be pressure tested at least annually. This pressure test requirement does not apply to implements of husbandry with respect to filling and field application. The testing does apply to the metal flexible connections or "braided hose".

Pressure testing shall be completed in accordance with CGA P-42-2010 Section 8.2. Each hose assembly shall be marked or tagged with the date of qualification resulting from repair and pressure testing. The testing date shall be durably marked on the hose as well as documented by the tester and owner.

Containers may only be pressured with ammonia vapor. Failure to remove air may promote stress corrosion cracking of the pressure vessel.

Containers and cylinders shall be filled or used only upon the owner's authorization.

Stationary storage locations with a water capacity greater than 4000 gal shall have approved emergency shut off valves or back flow valves installed in the liquid and vapor fixed piping of the transfer system within 5 lineal feet or within reasonable distance of where the hose or swivel piping is attached to the fixed piping. The aforementioned valves shall be protected from any possible pull away while connected incident between the mobile container and the transfer station such that a break resulting from a pull will occur on the hose side of the connection.

Installation of Storage Containers

Piers, or saddles, should extend over at least one third of the circumference of the shell. If not, engineering documents will be required that state existing pier design provides equal conformity.

Containers, once installed underground, shall not later be reinstalled aboveground or underground, unless they successfully withstand hydrostatic pressure retests at the pressure specified for the original hydrostatic test as required by the ASME Code under which the tank was constructed.

Shut off valves on storage tank openings shall be kept closed and protected by suitable means against tampering or theft of product when the installation is unattended. Examples of suitable means could include valve locks, remote surveillance, security systems, fencing, lighting motion detectors, alarms, or chemical additives that render anhydrous ammonia unusable or undesirable for illicit use. One means of protection is usually not adequate and multiple means of protection may be needed.

Identification for emergency

A legible sign shall be displayed on the premises at which a storage system is located, so as to be readily visible to emergency personnel, with lettering not less than 2 inches in height, stating the following:

- the phrase "EMERGENCY INFORMATION"
- the name of the facility
- the name or title of at least 2 responsible persons
- the area code and telephone numbers of each person listed, and
- the phrase "the 911 address is", and the appropriate 911 address.

Refrigerated Storage – Not applicable to Ag Anhydrous Ammonia Systems

Tank cars (railcars) for the transportation of ammonia

Anhydrous ammonia tank cars shall be loaded and unloaded only at locations approved by the jurisdictions having authority and meeting requirements of 3.4, (Safety Equipment), and 5.10.1 through and including 5.10.9.2, (Transfer of Liquids section) . Approved rail car loading and unloading locations, other than permanent facilities shall:

- Notify first responders of location, duration and times of operation; and
- Maintain a minimum of 2 qualified people present during transfer of ammonia; and
- Post emergency information in accordance with section 6.8. (Emergency Sign)

A tank car shall not be loaded or shipped unless it meets DOT specifications for the shipment of ammonia.

Implements of husbandry

Nurse tanks with missing data plates must conform to DOT regulations in order to be kept in service.

When containers are mounted on farm wagons, care should be taken to ensure that the weight is distributed appropriately over the axles.

Farm wagons operating on public roads shall be provided with a slow moving vehicle emblem whenever that vehicle is towed at or below the slow-moving vehicle speed limit, as established by state or local regulations.

Each nurse tank shall be equipped with the following safety features:

- 5 gal. of clean water per container ready accessible

- Step by step NH_3 transfer instructions

- First aid instructions if injured by NH_3

- No hazard warning label – this is a change

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