HEALTH HAZARD INFORMATION SHEET
AMMONIA REFRIGERANT (i.e., NH_3, ANHYDROUS AMMONIA)

1. What is ammonia refrigerant?

Ammonia refrigerant (NH_3) is also known as Anhydrous Ammonia.[1] It is a flammable, corrosive, colorless gas at Standard Temperature and Pressure (STP) that has a pungent odor.[2] [3] It is easily liquefied by compression or cooling so it can be used in large refrigeration systems[2].

2. How FSIS employees are potentially exposed to Ammonia Refrigerant in their workplaces?

Under normal circumstances, FSIS employees should never be directly exposed to Anhydrous Ammonia in the workplace. However, the danger always exists that exposure will occur due to a leak or catastrophic release of Anhydrous Ammonia from a refrigeration system. A release of Anhydrous Ammonia could happen in a number of ways: physical impact to the refrigeration system, seal leaks, piping corrosion, and hydraulic shock.[4]

If a major leak or release was to occur, it would likely be detected quickly, and the establishment, including FSIS employees, would most likely be evacuated.

3. What are the health effects of exposure to ammonia refrigerant?

In low concentrations, Ammonia can be irritating to the eyes, lungs, and skin and at high concentrations or through direct contact it is immediately life threatening.

Symptoms include, difficulty breathing, chest pain, bronchospasms, and at its worst, pulmonary edema, where fluid fills the lungs and respiratory failure can result. Skin contact with high concentrations of Anhydrous Ammonia may cause severe chemical burns. Exposure to the eyes can cause pain and excessive tearing, in addition to injury to the corneas. [3, 5]

Being exposed to high concentrations of Anhydrous Ammonia is immediately life threatening. FSIS in-plant personnel (IPP) should maintain a high level of awareness around refrigeration systems and associated piping for leaks due to the corrosiveness of Anhydrous Ammonia.

There is a remote possibility that close proximity to an Ammonia refrigeration system or associated piping when there is a catastrophic release could result in an acute exposure to Anhydrous Ammonia in its liquid form. Such exposure can cause redness, swelling, ulceration of the skin, and frostbite; and, if eyes are contacted, pain, redness, swelling of the conjunctiva, damage to the iris and cornea, glaucoma, and cataracts.[3]

4. What OSHA standards and exposure guidelines apply to ammonia refrigerant?

The OSHA Permissible Exposure Limit (PEL) for Anhydrous Ammonia is 50 parts per million (ppm) or 35 milligrams (mg)/cubic meter (m^3). This is based on a full shift, 8-hour time weighted average (TWA) exposure.

The American Conference of Governmental Industrial Hygienists (ACGIH) recommendations are more restrictive than the OSHA PEL. The ACGIH Threshold Limit Value (TLV) for an 8-hour TWA exposure is 25 ppm (18 mg/m^3). ACGIH also recommended a ceiling exposure limit (not to be exceeded at any time) of 35 ppm (27 mg/m^3). The American Industrial Hygiene Association (AIHA), Emergency Response Planning Guide (ERPG) for ammonia states that 25 ppm is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour while experiencing only mild, transient health

effects or without perceiving a clearly defined objectionable odor. Limiting exposures to this level is considered good workplace practice.

Ammonia is immediately dangerous to life and health (IDLH) at concentrations of 300 ppm or higher.[6]

It is also important to note that the odor threshold for ammonia has been reported at very low levels ranging from 0.037 to 1.0 ppm. So ammonia can be detected by most people at concentrations that do not represent a health exposure. (However, all cases where an ammonia odor is detected, especially if it is not typical, should be reported to the FSIS supervisor.)

In addition, the establishment may be required to comply with the OSHA Process Safety Management (PSM) Standard (29 CFR 1910.119). This standard is applicable to any facility that has 10,000 pounds or more of Anhydrous Ammonia stored and used onsite at any one time, and serves to prevent or minimize the consequences of catastrophic releases.

5. How are occupational exposures to Ammonia refrigerant monitored or measured?

OSHA uses detector tubes for on-site sampling to detect anhydrous ammonia. The detection limit for these tubes is as low as 0.5 ppm, with upper measurement limits between 70 - 260 ppm.[10]

6. What safety precautions should be followed by FSIS employees to protect against exposure to ammonia refrigerant?

If an Ammonia odor is detected, FSIS employees should leave the work area immediately, determine if an evacuation is in progress, and notify their supervisors. If an alarm is heard, FSIS employees should immediately leave the area and follow the appropriate emergency action plan to evacuate the establishment. Medical attention should be sought immediately if an FSIS employee experiences any difficulty breathing; burning in lungs, in eyes, or on skin; has any vision impairment; or experiences any other medical symptoms.[7] An employee who believes they may have been exposed to Ammonia should notify their supervisor, even if they are not symptomatic.

If a PSM plan is in place, employees should be familiar with emergency preparedness for an Ammonia release. At a minimum, the FSIS inspector-in-charge (IIC) should obtain a copy of the PSM plan and employees should be provided with training on the applicable requirements including the establishment's notification and emergency response procedures.

7. Where can FSIS employees get additional information on ammonia refrigerant?

Safety Data Sheets (SDSs) must be readily accessible to FSIS staff at FSIS locations. They must be made available upon request at facilities being inspected.

8. How should training for this Health Hazard Information Sheet be recorded?

Per requirements found in FSIS Directive 4791.1 Section IX, all occupational health and safety training is to be recorded using either AgLearn or FSIS form 3530-12. Training records are to include the topics covered, date, and employee name. The Agency is to retain all training records for a minimum of five years."

Additional information can also be found by going to the OSHA Ammonia Refrigeration E-Tool, found at https://www.osha.gov/SLTC/etools/ammonia_refrigeration/index.html.

Please contact your district's Occupational Safety and Health Specialist or email AskEmployeeSafety@fsis.usda.gov if you have any questions or concerns

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[1] Occupational Safety and Health Administration, "Ammonia Refrigeration E-Tool," United States Department of Labor, https://www.osha.gov/SLTC/etools/ammonia_refrigeration/index.html (accessed 29 Oct. 2014).
[2] Merriam-Webster Dictionary, "Ammonia," Merriam-Webster, http://www.merriam-webster.com/dictionary/ammonia (accessed 29 Oct. 2014).
[3] Praxair, Inc., *Praxair Material Safety Data Sheet, Product: Ammonia, Anhydrous* (December 2006), http://www.prest-o-sales.com/other_links/gases/PDF/Msds/ammonia_p4562g.pdf (accessed 29 Oct. 2014).
[4] Office of Solid Waste and Emergency Response, *Hazards of Ammonia Releases at Ammonia Refrigeration Facilities (Update)* (August 2001), United States Environmental Protection Agency, http://www.epa.gov/oem/docs/chem/ammonia.pdf (accessed 29 Oct. 2014).
[5] The Emergency Response Safety and Health Database, "Ammonia Solution (UN 3318); Anhydrous (UN1005): Lung Damaging Agent," Centers for Disease Control and Prevention, http://www.cdc.gov/niosh/ershdb/EmergencyResponseCard_29750013.html (accessed 30 Oct. 2014).
[6] Occupational Safety and Health Administration, "Ammonia," United States Department of Labor, https://www.osha.gov/dts/chemicalsampling/data/CH_218300.html (accessed 29 Oct. 2014).
[7] Global Cold Chain Alliance, *Ammonia Safety* (February 2011), http://www.gcca.org/wp-content/uploads/2013/04/ammonia_safety_poster.pdf (accessed 29 Oct. 2014).
[8] MySafetyLabels, "Anhydrous Ammonia Label: ANSI Design," http://www.mysafetylabels.com/Chemical-Label/Anhydrous-Ammonia-Chemical-Label/SKU-LB-1584-013.aspx (accessed 30 Oct. 2014).
[9] The Emergency Response Safety and Health Database, "Ammonia Solution (UN 3318); Anhydrous (UN1005): Lung Damaging Agent," Centers for Disease Control and Prevention, http://www.cdc.gov/niosh/ershdb/EmergencyResponseCard_29750013.html (accessed 30 Oct. 2014).
[10] Occupational Safety and Health Administration, "Ammonia," United States Department of Labor, https://www.osha.gov/dts/chemicalsampling/data/CH_218300.html (accessed 29 Oct. 2014).