Ontario Recreation Facilities Association

Building Community Since 1947

Anhydrous Ammonia Exposure Worker Safety

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Building Community Since 1947

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Introduction

The responsible person for a registered refrigeration plant room would know that the CSA B-52 Mechanical Refrigeration Code (MRC) requires that all refrigeration rooms with ammonia must have a refrigeration vapour detector that will sound an alarm and start the ventilation equipment at vapour concentration levels of no higher than the 300 ppm as this is the IDLH: Immediately Dangerous to Life and Health level. Exposures at the IDLH are likely to cause death, irreversible (permanent) health effects or prevent escape. The audible alarm may sound below 300ppm however, at 300ppm the ventilation interlock system must engage.

However, most fail to understand why 300ppm is the maximum level setting, or how to properly and safely respond when the alarm is activated.

Leak detectors may have multiple settings that

generate different alarm levels (staged). These settings are often set to legally acceptable exposure limits for a worker to enter these areas. This guideline will explore the response obligations for worker safety when an ammonia leak alarm is activated.

Regulation 833 and WHMIS

Exposure to Ammonia is controlled under Reg. 833 of R.R.O. 1990 (Control of Exposure to Biological or Chemical Agents). Further, it is considered to be a controlled substance under WHMIS. Ammonia safety depends to a large degree upon effective employee education. WHMIS legislation includes requirements for employers to instruct employees on such things as:

1. Hazards that may result from improperly handling ammonia;
2. Emergency response procedures, including education, emergency repairs, the locations of safety showers, eye wash stations and the closest source of water;
3. Correct use of respiratory protective devices and other protective equipment; and
4. Recognizing equipment failures and reporting them without delay.

Risk and Hazards of Ammonia

Registered refrigeration ice plant rooms that contain anhydrous ammonia places every worker at risk from the hazard of exposure to this chemical. As required under Section 27 (2) of the OHSA a supervisor has a duty to:

a) Advise a worker of the existence of any potential or actual danger to the health or safety of the worker of which the supervisor is aware;

b) Where so prescribed, provide a worker with written instructions as to the measures and procedures to be taken for protection of the worker; and

c) Take every precaution reasonable in the circumstances for the protection of a worker. R.S.O. 1990, c. O.1, s. 27.

Anhydrous ammonia, either as liquid or gas, is a strong irritant to skin, eyes and the respiratory tract. Direct exposure by contact can cause severe burns. WHMIS Labels include:

- A - Compressed Gas
- B1 - Flammable Gas
- D1A - Very Toxic
- E – Corrosive

It is important that all WHMIS labels meet the new 2015 standards

Main Routes of Exposure: Inhalation. Skin contact. Eye contact.

- Inhalation: VERY TOXIC, can cause death. Can cause severe irritation of the nose and throat. Can cause life-threatening accumulation of fluid in the lungs (pulmonary edema).

- Skin Contact: CORROSIVE. The gas irritates or burns the skin. Permanent scarring can result. Direct contact with the liquefied gas can chill or freeze the skin (frostbite).
- Eye Contact: CORROSIVE. The gas irritates or burns the eyes. Permanent damage including blindness can result.
- Effects of Long-Term (Chronic) Exposure: May harm the respiratory system. Can irritate and inflame the airways.

Exposure Limits

Worker exposure limits to anhydrous ammonia is controlled under a variety of timelines:

- Time weighted average exposure limit (TWAEV) = 8 hour exposure
- Short term exposure value (STEV) = 15 minutes
- Ceiling exposure value (CEV) = maximum exposure

For ammonia the time-weighted-average exposure value is 17 mg/m3 (25 ppm). The short-term exposure value is 24 mg/m3 (35 ppm). As a gas it is colourless and has a specific gravity of 0.597 (air = 1.0) at 25°C under standard atmospheric pressure. Generally, ammonia has good warning properties because of its characteristic pungent and irritating odour.

Supervisors are reminded of their obligation to maintain a current MSDS for ammonia on site, while workers are reminded of their obligation to review the MSDS prior to handling ammonia.

Operating Engineers Regulation Procedure Manual

S. 46. Every owner of a plant shall keep on the premises of the plant an up-to-date, detailed operating procedures manual designed by or acceptable to the chief operating engineer or chief operator of the plant that sets out the procedures relating to training and the operation of all equipment and systems of the plant and all emergency procedures. O. Reg. 219/01, s. 46.

Highlights of the B-52 MRC

- The MRC states that permanent, securely attached, legible and readily accessible signage identifying the installer, refrigerant and amount, lubricant and amount, horsepower rating and tonnage capability, and field test pressure must be installed.

Note: an ammonia warning sign must also be posted on the plant room emergency egress to the outside to warn emergency services of the chemicals presence when entering from this location.

- Systems containing more than 100 lbs. (45 kg.) of refrigerant require signage of specific size lettering identifying main disconnect and control switches, pressure limiting devices, and each pressure vessel and their shutoffs, and all refrigeration piping and whether the refrigerant is at high or low pressure and liquid or vapour state.
- Indicates the owner's responsibility to post a card in the plant giving operational and emergency instructions that include emergency and service contact information, and contact information for the nearest "regulatory authority".

Other

- Machinery rooms must be ventilated to the outdoors. Mechanical ventilation must meet minimum standards of flow capacity as set out in the code for normal operation as well as for emergencies. Provision of outdoor makeup air to replace exhausted air must be provided. Exhausted air must be to the outside where it will not be re-introduced to the building or cause any danger.
- Fan switches must be installed inside and outside the equipment room; those outside the room will be capable of starting, but not stopping the ventilation.
- All ducting must be sealed and have provisions for preventing the escape of refrigerant vapours into other areas of the building.

Safe Storage and Transportation of Ammonia Tanks

Storing of ammonia on site requires that the cylinders be in a cool dry location and secured from falling. The cylinder valve cap must also be securely in place to protect the valve from damage. The

maximum amount of ammonia that may be stored on site is 300lbs. Ammonia tanks should only be transported with a proper safety cart.

Safely Responding to an Ammonia Leak

Historically, there has been an expectation by facility supervisory staff that frontline workers should be prepared to respond to an ammonia leak. A caution is extended by the ORFA to members to revisit such past practice and provide frontline staff with clear direction on how to respond to an ammonia leak. Repairs must only be made by trained personnel using approved protective equipment and clothing. Staff must be prepared to evacuate the facility when a leak of above 300ppm occurs. Directing all other personnel and patrons to a location upwind of a leak.

Protecting Workers from Anhydrous Ammonia

NOTE: The following information is offered as general guidance only and should not be used to replace current MSDS or specific manufacturer direction.

Worker protection from anhydrous ammonia is required at 35ppm to 250ppm if the worker will be in the area for more than 15-minutes. Once the limit exceeds 300ppm+ protection must be immediately worn.

Note: Protective equipment should never be used as a substitute for safe work practices.

Personal Protective Equipment (PPE)

Where appropriate, the following equipment must be kept on hand, readily accessible and properly maintained:

Eye Protection

A pair of tight-fitting, indirect-ventilation splash goggles must be worn at all times when handling ammonia. Contact lenses must not be worn when handling ammonia.

Respiratory Equipment

For concentrations up to 300 ppm: A full-face piece chemical- cartridge respirator, with cartridges providing protection against ammonia, may be used as a minimum if eye protection is also supplied. Note: Ammonia specific. Respirator should be the green banded Ammonia specific cartridge not the black banded organic chemical cartridge (nor the yellow acid mist).

- **For emergency or planned entry into unknown concentrations or IDLH (immediately dangerous to life or health) concentrations, i.e. over 300 ppm:** A self-contained breathing apparatus (SCBA) with a full face piece and operated in a pressure-demand, or other positive-pressure, mode is required.

Protective Clothing

- Where there is a likelihood of a spill or during clean-up operations, wear both boots and shoe covers and slickers or jackets and pants made of ammonia-impervious materials. Wear gauntlets tucked inside the sleeves and trouser legs over the boots. If impervious clothing is not available, wear cotton, which is the preferred fabric for work clothing because it is more alkali resistant than wool and is more comfortable than all-synthetic fibers. Clothes, especially gloves, should also be insulated to prevent freezing of skin.
- In spill situations, both the person entering the spill area and a back-up/rescue person must wear a gas-tight suit in addition to the full-face piece positive-pressure SCBA that is required for emergency or planned entry into unknown concentrations or IDLH (immediately dangerous to life or health) concentrations.

Supervisors are reminded of their responsibility to train workers on the proper use of all PPE.

Refrigeration Contractor Exposure Plan

Owners are reminded of their obligation to ensure that all outside contractors are safe while on site. Creating a Job Hazard Analysis in partnership with the refrigeration contractor, as well as ensuring that the refrigeration mechanics are prepared to deal with an accidental release while conducting routine maintenance should be in place. Additionally, the refrigeration mechanic must have and use appropriate PPE at levels above the recommended STEV for ammonia.

Alarm System Maintenance

Owners are reminded of the need to annually check the ammonia alarm system to ensure for correct calibration and function. This review should be conducted by a qualified technician as part of the required registered refrigeration plant inspection program.

Conclusion

All facility staff must be made aware of the risks and hazards associated with ammonia. They must be further prepared to deal with a leak or other emergency situation involving ammonia. ORFA recommends that this information be added to the facilities health and safety board and the plant room operational and training manual.

Regulations and Codes

- Boiler and Pressure Vessels Regulation, R.R.O. 1990, Reg. 59
- Regulations for Industrial Establishments, R.R.O. 1990, Reg. 851
- Mechanical Refrigeration Code, CSA B52-14
- Ontario Fire Code, R.R.O. 1990, Reg. 454
- Operating Engineers Regulation

The ORFA provides the following ***Registered Refrigeration Ice Plant – Anhydrous Ammonia Alarm and Worker Exposure*** quiz to assist in the education of recreation staff in the risks and hazards associated with ammonia.

Workers should answer each question True or False.

Question	T	F
Anhydrous ammonia, either as liquid or gas, is a strong irritant to skin, eyes and the respiratory tract.		
Direct exposure by contact can cause severe burns to human skin.		
A Supervisor must, where so prescribed, provide a worker with written instructions as to the measures and procedures to be taken for protection of the worker.		
Exposure to Ammonia is controlled under Reg. 833 of R.R.O. 1990 (Control of Exposure to Biological or Chemical Agents).		
WHMIS requires a supervisor to train a worker in the correct use of respiratory protective devices.		
For ammonia the time-weighted-average exposure value is (35 ppm).		
The short-term exposure value for ammonia is (25 ppm).		
Ammonia does not have good warning properties because of its characteristic pungent and irritating odour.		
The B-52 Mechanical Refrigerant Code states that permanent, securely attached, legible and readily accessible signage identifying the refrigerant and amount must be on the plant room door.		
All refrigeration rooms using ammonia must have a refrigeration vapour detector that will sound an alarm and start the ventilation equipment at vapour concentration levels of		
A pair of tight-fitting, indirect-ventilation splash goggles must be worn at all times when handling ammonia.		
A self-contained breathing apparatus (SCBA) with a full face piece and operated in a pressure-demand, or other positive-pressure, mode is required when ppm levels have exceeded 350ppm.		
In spill situations, both the person entering the spill area and a back-up/rescue person must wear a gas-tight suit in addition to the full-face piece positive-pressure SCBA.		
All facility staff must be made aware of the risks and hazards associated with ammonia.		
Only trained workers should handle ammonia.		

Supervisors Signature: _____

Date: _____

Date Workplace specific training completed:

_____

Placed in employees training file on:

_____

Bradford West Gwillimbury

Employee Chemical / Biological Exposure Form

DATE OF INCIDENT (DD/MM/YYYY)	TIME (am / pm)

SECTION I – Required Information (to be completed by employee)

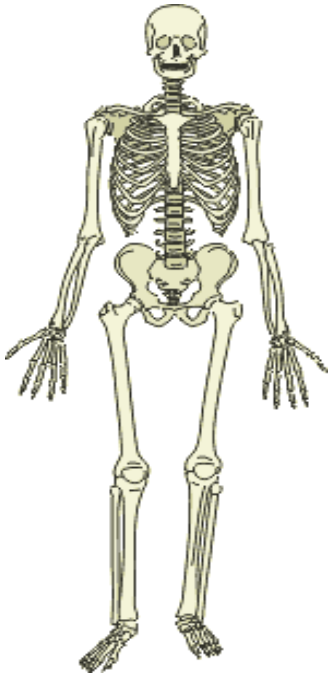
Employee Name:	Department:	Employment status: ☐ FT ☐ PT ☐ Vol.
Occupation at time of injury:	Usual occupation? ☐ Yes ☐ No	Is the worker a student / contract employee? ☐ Yes ☐ No

SECTION II - Incident / Accident Information

Date reported(mm/dd/yy):	Time of day (am/pm)	Who was the incident reported to:
Name of chemical if known:	Type of biological exposure (i.e. blood):	Type of infectious disease if known:

Describe clearly how the employee became exposed:

Circle or shade area of exposure below:



☐ Front
☐ Back
☐ Right side only
☐ Left side only

Length of exposure: Less than…

☐ 15 minutes ☐ 30 min ☐ 1 hour ☐ 1-2 hours ☐ 2-3 hours ☐ > 3 hours

How was the employee exposed?

☐ Inhaled ☐ Ingested ☐ Injected ☐ Skin Contact ☐ Eye contact

☐ Other (please explain): _____

First Aid: ☐ Yes ☐ No Administered by: _____

Please detail type of first aid provided:

* Complete first aid log book

* If the worker received medical treatment, the *Employee Incident / Accident Form* must be completed, and Human Resources must be notified.

Where did it happen? (be specific)	Please list any witnesses:

SECTION III – Health and Safety Prevention Measures

Was the employee wearing the appropriate PPE? ☐ Yes ☐ No, if not was there a reason: _____

Was the employee following proper procedures as defined in the MSDS or applicable SOP? ☐ Yes ☐ No, if not was there a reason:

Decontamination methods used:

What steps will be taken to prevent further reoccurrences (if possible)

SECTION IV – For Bradford Fire & Emergency Services use only

Vehicle Number:	Incident #	Incident Type: ☐ Smoke/ fire ☐ Medical ☐ MVA ☐ Chemical / hazardous waste

SECTION V – Sign-off

Supervisors Name:		Worker Area: Was the incident described accurately? ☐ Yes ☐ No	
Signature:	Date:	Signature:	Date:

Distribution: ☐ **Department Head / Manager** ☐ **Human Resources**

Please attach a copy of the Chemical's MSDS if available