Toxic Gas Safety Guidelines for Municipal Arena Operations in Alberta

Contents:

1. **Introduction:**

This document has been developed by the Alberta Municipal Health and Safety Association (AMHSA) as a guideline with basic information for Alberta Municipalities with arena operations where there may be potential for exposure to toxic gases. The information contained herein has been developed in collaboration with participants from various municipalities across Alberta. Additional information has been obtained through a variety of resources and legislation relating to the subject matter – see resources at the end of the document. This guideline is intended for general use and may not apply to every circumstance. It is not a definitive guide to regulations and does not relieve persons using it from their responsibilities under applicable legislation. All resources utilized are believed to be reliable and to represent the best current opinion on the subject. AMHSA does not guarantee accuracy or completeness of any information contained in this guideline and shall not be responsible or liable for any errors, omissions, or damages arising out of the use of this guideline. While every effort has been made to capture key components of mitigating the risks associated with potential exposure to toxic gases in arena operations, the information herein is not in any way intended to supersede or preclude the requirements of any legislation or governing bodies. Procedures and processes relevant to certified maintenance personnel are not covered. Any concerns regarding errors or relevant omissions should be sent to safety@amhsa.net for consideration.

Thanks to WorkSafeBC for their publication "Employer Information for Ice Rinks and Recreational Facilities"(November 2017) which has been a significant source of information in developing these guidelines. An additional source of information is the WorkSafeBC document entitled "Ammonia in Refrigeration Systems".

The majority of the information contained herein relates to ammonia. While the risk of exposure to ammonia may be low, the outcome of exposure can be catastrophic.

There is reference to carbon monoxide and nitrogen dioxide as well. Recommendations to mitigate the risk of exposure to these gases is general but included in this guideline under clause 14 – Control of Emissions of Toxic Gases.

2. **Background:**

There are approximately 308 arena complexes throughout the province of Alberta. Although not all are municipal owned, many of them are operated through municipalities which puts the onus on them to ensure the safety of operations. For those that are owned by municipalities and may be run by private organizations, there is still a degree of responsibility to ensure safety within the facility and its operations, as the owner. While their typical use is for sporting activities such as hockey, skating and curling, many arenas are also used for public gatherings such as concerts and other events. The focus of this guideline is on operations where sheets of ice are produced and maintained and through this process there may be a potential for elevated levels of toxic gases.

3. Potential toxic gases in arena operations:

3.1 Ammonia

Pure ammonia comes in two forms: gas and liquid. Ammonia is a very common product used for a variety of applications including household cleaning products, fertilizers, smelling salts, preservatives, fuel, etc. Ammonia gas is colourless with a characteristic pungent penetrating odour. It is lighter than air in a gaseous state so it tends to collect in higher areas or ceilings in the event of a release. A major ammonia spill can be disastrous as liquid ammonia evaporates quickly when exposed to air and creates an explosive fire hazard at higher concentrations. Anhydrous ammonia is widely used in industrial refrigeration applications and hockey rinks because of its high energy efficiency and low cost. Under normal and well maintained applications for arena operations, the use of ammonia poses very low risk of toxic exposure. A failure in the system could result in a release, with results which could range from a minor irritant to life threatening. The Alberta OH&S Code Occupational maximum exposure limits for ammonia are 25ppm for 8 hours and 35ppm for 15 minute exposure. Ammonia is immediately dangerous to life or health (IDLH) at 300ppm. Typically, ammonia can be sensed at around 5ppm unless an individual has become desensitized to it by repeated and/or long term exposure. Having adequate warning systems, ventilation, proper maintenance procedures, and well trained staff are just a few of the safety measures to have in place to ensure the risk of any kind of exposure is low to non-existent. See relevant clauses later in these guidelines for specifics in this regard.

Ammonia's fire hazard rating is usually stated as "slight." It is explosive in air at concentrations of 16-27 percent by volume. Ammonia is also extremely reactive which means it easily combines with other materials to form products that are often more hazardous than ammonia alone. Combustible materials should not be stored in the ammonia compressor rooms.

3.2 Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless, and tasteless gas that is slightly less dense than air and can be highly toxic. Carbon monoxide is produced through several different sources. In arena operations, the most common source of carbon monoxide generation is from internal combustion in engine powered equipment such as ice resurfacing equipment (e.g., Zamboni®) and ice edgers. The Alberta OH&S Code Occupational maximum exposure limits for ammonia are 25ppm for 8 hours. There is no 15 minute exposure limit specified. The most common symptoms of carbon monoxide poisoning may resemble other types of poisonings and infections, including symptoms such as headache, nausea, vomiting dizziness, fatigue, and a feeling of weakness. Prolonged exposure to high levels of CO could result in death. Having adequate warning systems, ventilation, proper maintenance procedures, and well trained staff are just a few of the safety measures to have in place to ensure the risk of any kind of exposure is low to non-existent. See relevant clauses later in these guidelines for specifics in this regard.

3.3 Nitrogen Dioxide

Nitrogen Dioxide (NO_2) has a pungent, acrid odor. As with Carbon monoxide, NO_2 can be generated from fuel combustion in engine powered equipment such as ice resurfacing equipment and ice edgers. The Alberta OH&S Code Occupational maximum exposure limits for NO_2 are 3ppm for 8 hours and 5ppm for 15 minute exposure. Chronic exposure to NO_2 can cause respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma. Having adequate warning systems, ventilation, proper maintenance procedures, and well trained staff are just a few of the safety measures to have in place to ensure the risk of any kind of exposure is low to non-existent. See relevant clauses later in these guidelines for specifics in this regard.

4. Regulatory

The Pressure Equipment Safety Regulation (AR 49/2006) Section 6 declares the following codes and standards in force in respect of pressure equipment:

CSA Codes

- CSA B51 Boiler, Pressure Vessel, and Pressure Piping Code
- CSA B52 Mechanical Refrigeration Code
- CSA Z662 Oil and Gas Pipeline Systems

The main focus for this guideline is on CSA Standard B52-13. The purpose of this CSA Standard is to minimize the risk of personal injury by providing minimum requirements for the design, construction, installation, inspection, and maintenance of the mechanical refrigeration systems and volatile direct refrigeration systems. The following excerpts from this standard, Clause 6.3, apply to systems which are typically used in arena operations and relevant to the use of ammonia in these systems. They are classified as “Class T machinery rooms”.

These excerpts should be referenced to ensure compressor rooms are meeting the minimum requirements**.**

4.1 In accordance with B52, a machinery room shall meet the following special requirements:

a) There shall be no flame-producing device or hot surface over 427 °C (800°F) permanently installed in the room.
b) The room shall have at least one exit door that opens directly to the outer air. Other exits connecting with the building shall be permitted, but shall be through a vestibule equipped with approved self-closing, tight-fitting fire doors.
c) The machinery room envelope, including any vestibule, shall be of tight construction.
d) The machinery room walls, floor, and ceiling shall be of non-combustible construction. Walls, floors, and ceiling separating the machinery room from other occupied spaces shall have a rating of at least one-hour fire-resistive construction.
e) Exterior openings, if present, shall not be under any fire escape or any open stairway.
f) All pipes piercing the interior walls, ceiling, or floor shall be tightly sealed to the walls, ceiling, or floor through which they pass.

g) Air ducts passing through the machinery room shall be of tight construction and shall have no openings in such rooms.
h) Remote pilot control of the mechanical equipment in the machinery room shall be located immediately outside the machinery room and shall be provided solely for shutting down the equipment in an emergency. Ventilation fans shall have a control switch on a separate circuit located immediately outside of the machinery room, and shall be permitted to run as long as power is available.
i) An independent mechanical ventilation system shall be provided. In basements, the ventilation system shall be operated continuously. All locations shall be equipped with a vapour detector that shall automatically start the ventilation system. The vapour detector shall also initiate a supervised alarm so that corrective action can be initiated.
j) Access to the room shall be restricted to authorized personal. Signage indicating this should be placed at the entrance.

5. Hazard Assessments

In accordance with part 2 of the Alberta OH&S Code (2009) 7(1), "an employer must assess a work site and identify existing and potential hazards before work begins at the work site or prior to the construction of a new worksite." Every effort should be made to eliminate the hazard or the risk associated with it. In the case of toxic gases in arena operations, the risk of exposure may be very low but the potential still exists. Assessments should be specific to the potential hazard such as ice resurfacing, ice edging, working in ammonia compressor rooms, etc.

When developing hazard assessments one should take into consideration the following questions:

1. How much of the toxic gas exists – i.e., how much ammonia is on site?
2. Where is the ammonia located?
3. What are the requirements for proper storage of the ammonia?
4. Are safety data sheets readily available and where are they located?
5. What circumstances, events, failures, or errors could cause conditions leading to an emergency?
6. What is the worst case emergency that could occur?
7. Where could an emergency occur?
8. Is there a risk to adjacent facilities/workplaces?
9. Are emergency baths, showers, eye wash equipment readily available and of the capacity to meet the needs in the event of an exposure of a toxic gas harmful to the eyes or skin i.e., ammonia? This equipment should meet the requirements of ANSI Standard Z358.1
10. What type of PPE is required for specific tasks?
11. Is it readily available?
12. What monitoring and alarm systems are present for notification of an emergency?

6. Working Alone

In accordance with Part 28 of the Alberta OH&S Code, an employer must have a formal process in place for employees who may be working alone in a hazardous environment and assistance is not readily available if there is an emergency. This may apply to an employee entering an ammonia compressor room alone. If conducting any activities of prolonged nature and high risk, a minimum of 2 employees should be involved. Provisions must be in place to have an effective means of communication with the employee in the room and must include regular contact by the employer or designate at intervals appropriate to the nature of the hazard.

7. Emergency Response Plan

Part 7 of the Alberta OH&S Code specifies that "an employer must establish an emergency response plan for responding to an emergency that may require rescue or evacuation." Specifics regarding a toxic gas release should be included in the emergency response plan even though the risk of a toxic gas exposure may be low. If there was a toxic gas release and the potential for exposure it may likely require evacuation of parts, or all, of the facility. In accordance with Part 7 of the Alberta OH&S Code, at a minimum the emergency response plan must include:

1. the identification of potential emergencies;
2. procedures for dealing with the identified emergencies;
3. identification of, location of and operational procedures for emergency equipment;
4. emergency response training requirements;
5. location and use of emergency facilities;
6. fire protection requirements;
7. alarm and emergency communication requirements;
8. first aid services required;
9. procedures for rescue and evacuation;
10. emergency exits are clearly identified; and
11. designated rescue and evacuation of workers.

In addition to the above requirements, the emergency plan should include the safety of patrons utilizing the facility as well as those in surrounding areas should there be a significant toxic gas release. It is also highly recommended that municipalities liaise with their local emergency responders to ensure they are aware of the potential risks, emergency plan, and are in a position to effectively deal with a toxic release.

8. Labelling

Unmarked pipes are a danger to both people and property. Incidents, injuries, and damage to equipment can be caused by not knowing what is flowing through the pipes that surround us. By marking and identifying pipes, errors and incidents can be prevented. It also makes maintenance work easier and helps prevent time-consuming searches.

Just like hazardous materials in other containers, as regulated by WHMIS 2015, piping systems should be appropriately labeled. Pipe marking labels must effectively communicate the contents of the pipes and give additional detail if special hazards (such as extreme temperatures or pressures) exist.

8.1 Label Placement

Labels should be positioned on the pipes so they can be easily seen and read from the normal angle of approach. For example, labels should be placed below the centerline of the pipe if the pipe is overhead and above the centerline if the pipe is below eye level. Labels should be located adjacent to valves and fittings, adjacent to changes of direction, on both sides of wall or floor penetrations, and at regular intervals on straight segment runs with spacing between that allows for easy identification (15.25 meters or 50 feet is the suggested maximum spacing, but closer spacing may be needed for visibility).

9. Personal Protective Equipment (PPE)

Workers conducting any servicing or maintenance work in an ammonia compressor room where there is a risk of an ammonia leak should be wearing a full face respirator with the appropriate cartridges for protection against ammonia gas. Workers must be fit tested for the respirator being used and clean shaven in the area where the respirator seals to the face. Due to the corrosive effects of ammonia, it is necessary during some tasks to cover up skin that may be exposed. It is important to note that clothes must not be contaminated with grease, lubricants, or cleaners as they can react violently with ammonia gas which could result in severe burns. Because eye irritation from exposure to ammonia gas normally does not occur until concentrations reach about 70ppm, eye protection may not be mandatory under normal working conditions, typically where the levels are below 25ppm. If eye protection is used it should be vapour rated to ensure there is no risk of contaminants entering the eyes. Hearing protection is also recommended to ensure there is no chance of ammonia gas contacting the membranes in the ear canal. Anyone entering the room for routine checks, other than to conduct servicing or maintenance work, should have an escape respirator with them at all times while in the room.

9.1 Respirators

Employees who are required to wear a respirator, while conducting work activities in an area that may pose of risk of toxic gas exposure, are to be governed by part 18 of the Alberta OH&S Code, subsections 244 to 254.

Key items to ensure are in place for respirator users are:

1. familiarity of the potential risk of exposure and what that exposure may be;
2. respirators provided are appropriate for the potential exposure;
3. workers must use the provided equipment as prescribed;
4. a code of practice must be in place that governs the selection, maintenance and use of the equipment;
5. equipment selected must be in accordance with CSA Standard Z94.4;
6. equipment must be properly stored and kept clean;
7. if the equipment is not regularly used but kept for emergency use, it must be inspected at least monthly by a competent worker;
8. employees must be fit tested to ensure an adequate seal;
9. employees must be clean shaven where the face piece of the equipment seals to the skin of the face.

NOTE – The use of SCBA or air purifying systems are not covered in this guideline as these would typically only be used by certified maintenance employees and emergency responders. Both of these are outside of the scope of this guideline.

10. Safe Work Practices

Safe work practices are generally written methods outlining how to perform a task with minimum risk to people, equipment, materials, environment, and processes.

Safe work practices should be developed as a result of completing a Hazard Assessment and should closely reflect the activities most common in the tasks undertaken.

All safe work practices should be kept in a location central to the work being performed and readily available to the workforce. Some safe work practices will require specific job procedures (see clause 11), which clearly set out in a chronological order each step in a process.

11. Safe Job Procedures

Safe job procedures are a series of specific steps that guide a worker through a task from start to finish in a chronological order. Safe job procedures are designed to reduce the risk by minimizing potential exposure.

Safe job procedures are usually developed by management and workers as a result of a hazard assessment, incident investigation, and/or as a supplement to a safe work practice.

Safe work procedures should be included in the municipality's Worker Orientation program. All workers should be aware of the fact that safe job procedures have been established, are in effect, are written down and must be followed.

12. Training

Throughout the Alberta OH&S legislation, there is reference made to employees having to be competent. Competent, as defined in the Alberta OH&S Regulation, is "in relation to a worker, means adequately qualified, suitably trained and with sufficient experience to safely perform work without supervision or with only a minimal degree of supervision." The degree of training will depend on the degree of the hazard of the task. All records of training should be detailed and readily available upon request. If the task is of high risk, such as working on ammonia compressors, it may be beneficial to maintain a competency check list whereby a highly competent employee, who is well versed in the procedures of the task at hand, observes an employee when they are undertaking the task, and verifies their competency against a set checklist of activities to be observed. In developing the checklist, as well as the training materials, one should always refer to the manufacturers' specifications to ensure key components are adequately covered. In the absence of manufacturers' specifications, the expertise of a professional engineer should be sought for advice on completing high risk activities in a safe manner.

Key components to cover in training relating to toxic gases should include, but are not limited to;

1. Ventilations systems
2. Monitoring equipment
3. Emergency procedures
4. Respirator use and care
5. WHMIS 2015
6. Equipment operation
7. Maintenance

13. Monitoring and Alarm Systems

An effective system includes 24 hour monitoring that constantly tracks toxic gas levels and activates an alarm that responds if concentrations reach a pre-set level.

The following basic information and recommendations on toxic gas monitors and alarms can assist when designing and maintaining your system:

1. Continuous, also called fixed, monitors are useful because they are placed in the locations where releases are most likely to happen and can provide ongoing monitoring at those locations. However, it is important to also use portable monitors, which rapidly provide accurate information about the concentration where the worker is located. Portable monitors are extremely helpful for certain work activities and when responding to an emergency.
2. Continuous/fixed gas monitors **are required** in ammonia machine room vestibules. They must be designed so that workers can obtain the conditions inside the room **before** entering.
3. As part of your risk assessment, identify other locations (beyond the machine room) where additional fixed monitors should be placed due to the potential for ammonia or other toxic gases to be released.

4. Upper set points for monitors should be set at a margin of safety, which is recommend to be well below the 300 ppm IDLH (immediately dangerous to life or health) concentration limit for ammonia. Consideration should be given to setting these I line with Alberta OH&S at 25ppm for 8 hour exposure and/or 35ppm for 15 minute exposure. During a release of ammonia, concentrations can vary over time and by location.
5. Pressure relief devices must be equipped with detectors and alarms to notify the operators when the pressure relief valve releases ammonia.
6. For CO and NO_2 emissions, personal monitors worn by equipment operators are a practical option. If the equipment is producing high levels of emissions the operator can take immediate action and shut down the equipment and ventilate the area. Where fixed monitors are used they should be designed to activate an alarm system as well as turn on ventilation fans at a pre-determined level. They should be placed close to the area of highest concentration but not where they may be damaged. Typically the highest levels of emissions from fuel powered equipment is near the surface of the ice so monitors should be located about 75-90 cm (30-36 inches) above the ice surface.

Since Ammonia is lighter than air, sensors are normally positioned in the breathing zone, 1.2 to 1.8 meters (four to six feet) above grade, or above the potential leak sources, although some sources of information from manufacturers suggest near the ceiling. Fixed systems should be mounted in accordance with the manufacturer's specifications. A direct readout of the system should be positioned such that it can be seen from outside the enclosed area.

14. Control of Emissions of Toxic Gases

One method of control for reducing the risk of exposure to toxic chemicals in arena operations is through the use of adequate and effectively designed mechanical ventilation systems. This applies to addressing concerns of elevated levels of toxic gases such as CO and NO_2 within the arena as well as ammonia gas in compressor rooms and other areas.

CO and NO_2 in arena operations are generated by internal combustion motors powered by gas, diesel or propane. Theses motors are typically found on ice re-surfacing equipment and ice edgers. The concentration of contaminants is determined by the efficiency of the combustion of the fuel. Well maintained equipment, fuelled by propane, usually generates less CO than those fuelled by gasoline. As for NO_2, the differences are minimal. Regardless of the type of fuel used, regular maintenance and upkeep of the motor by a qualified technician is essential to control emissions of CO and NO_2. Another solution to mitigating the risk of exposure would be the purchase of electric powered equipment. When using fuel powered equipment, the facility ventilation system should be working effectively. Keeping gates and doors open will also assist in exhausting emissions and supplying fresh air.

The air in an ammonia compressor room is to be discharged to the outside to control the temperature within the room and also to ensure any ammonia leakage is vented outside of the room. Signage should be posted on the door(s) to compressor rooms restricting access. CSA Standard B52 specifies the mathematical calculations for determining the ventilation flow required for these rooms.

15. **Inspection Checklist**

In collaboration with various municipalities, AMHSA has developed an arena inspection checklist, which focuses on toxic gases. The checklist covers the following key items:

1. Respiratory Protective Equipment;
2. Other Personal Protective Equipment;
3. Hazard Assessments;
4. Safe Work Practices/Procedures;
5. Emergency Response;
6. Ammonia Systems;
7. Exhaust Emissions;
8. Ventilation Systems
9. Working Alone;
10. Confined Space;
11. Compressor Rooms;
12. Training.

This checklist, in a downloadable Word document, can be found at AMHSA.net and searched by keyword "Arena".

16. **Compressor Room Checks**

As an industry best practice, overseen by the plant manager and/or chief engineer, ammonia compressor rooms should be inspected, at a minimum, every 2 hours when the facility is open to the general public or more often should any variation in normal operations in the room be detected. If the facility is closed the inspection should be conducted, at a minimum, once every 24 hours. Plant room inspections should cover:

1. general status of equipment operations;
2. review of the air quality and temperature in the room;
3. check equipment gauges for pressure and temperature fluctuations;
4. check equipment for any fluid or noxious gas leaks;
5. overall safety of the plant including housekeeping, fire protection etc.

Field level hazard assessments (FLHA) should be conducted prior to conducting any type of work in the compressor room. A log of checks completed should be documented in a log book. Log books should be bound with pages numbered and each entry dated to ensure accuracy of the entry. An additional log book at the entrance is recommended for all workers entering the room to review.

17. **Safeguards on Equipment**

Factory guards installed on compressors, particularly with older systems, may not be adequate to ensure there is no risk of contact with any body parts. All guarding on moving parts should fully enclose moving parts such as belts etc., to ensure there is no risk of coming in contact with employees working in the area.

18. **Cylinder Handling and Storage**

If ammonia is being used in portable cylinders the following should be adhered to in regards to storing and handling of the cylinders:

1. Use signs to clearly identify storage areas. Only qualified personnel should be allowed to access the area.
2. Store cylinders and containers in an upright and secured manner and in a cool, dry, and relatively isolated area, protected from weather and extreme temperatures.
3. Keep cylinders away from heat sources.
4. Clearly mark empty cylinders and separate them from full ones.
5. Handle cylinders with extreme care when moving. Do not allow them to strike objects and do not drop them.
6. Do not use slings or magnetic devices to move cylinders.
7. Ensure valve protection hoods are in place when not connected to a system.
8. Do not lift a cylinder by its valve protection hood.
9. Do not modify, alter, or repair cylinders and valves.

19. **Maintenance of Systems – In accordance with CSA B52 – Clause 8.4**

In order to preserve the operating efficiencies, equipment integrity, personal protection, and protection to both the building environment and the natural environment, the owner or owner's representative responsible for the system, shall have maintenance of the system performed by a person certified as per the regulating authority, as follows:

1. In accordance with the refrigeration equipment and other system component's operation and maintenance manuals;
2. if no such manuals exist then in accordance with applicable regulations (e.g., the *Environmental Code of Practice for the Elimination of Fluorcarbon Refrigerants in the Air Conditioning and Refrigeration Industry*); and
3. in accordance with the information below:
    a) Pressure-relief valves shall be replaced or recertified at intervals no longer than five years.
    b) Recertification of relief valves shall be conducted in accordance with the requirements of the regulatory authority having jurisdiction and CSA B51.
    c) Pressure-limiting devices shall be tested at least once every 12 months for set point accuracy and for their ability to properly stop the affected equipment.
    d) Other safety devices shall be tested at least once every 12 months for set point accuracy and for their ability to properly stop the affected equipment.
    e) Permanent space leak detectors shall be tested for function at the specified refrigerant concentration in accordance with the manufacturer's instructions. The maximum interval between tests shall not exceed one year.
    f) All safety-related maintenance recommendations by the equipment manufacturer(s) shall be followed.

g) All power and control electrical terminations shall be checked at least once every 12 months and tightened if necessary. The check shall look for evidence of excessive temperatures and be verified as acceptable for integrity, continuity, and corrosion at least once every 12 months or as per the manufacturer's recommendations; and be as per the applicable Electrical Code.

h) Periodic visual inspection in conjunction with operational system logging and operating characteristics of the equipment and system components shall be performed to identify existing or pending problems. These inspections shall include, but not be limited to, the following items and time frames:

I. All refrigerant lines, vent lines, and system components shall be inspected quarterly for vibration, corrosion, and/or physical damage.

II. All lines, including vent lines and outlets, shall be inspected quarterly for blockages and insulation condition.

20. **Reporting a Release**

In accordance with the Alberta Environmental Protection and Enhancement Act, Section 5, there is a requirement to report specified releases to the Alberta Government. The following are some general guidelines in this regard.

1. No person shall knowingly release or permit the release of a substance into the environment in an amount, concentration or level or at a rate of release that is in excess of that expressly prescribed by an approval, a code of practice or the regulations.
2. A person who releases or causes or permits the release of a substance into the environment that may cause, is causing or has caused an adverse effect shall, as soon as that person knows or ought to know of the release, report it to:
   i. the Director,
   ii. the owner of the substance, where the person reporting knows or is readily able to ascertain the identity of the owner,
   iii. any person to whom the person reporting reports in an employment relationship,
   iv. the person having control of the substance, where the person reporting is not the person having control of the substance and knows or is readily able to ascertain the identity of the person having control, and
   v. any other person who the person reporting knows or ought to know may be directly affected by the release.

20.1 Manner of Reporting

A person who is required to report to the Director pursuant to the above shall report in person, by telephone or by electronic means and shall include the following in the report, where the information is known or can be readily obtained by that person:

1. The location and time of the release;
2. A description of the circumstances leading up to the release;

3. The type and quantity of the substance released;
4. The details of any action taken and proposed to be taken at the release site;
5. A description of the location of the release and the immediately surrounding area.

A sample template form for reporting such a release can be found the AMHSA website by typing "release" in the search field. The template is in the SafetyNet library.

20.2 Duty To Take Remedial Measures

Where a substance that may cause, is causing or has caused an adverse effect is released into the environment, the person responsible for the substance shall, as soon as that person becomes aware of or ought to have become aware of the release;

1. take all reasonable measures to repair, remedy and confine the effects of the substance, and
2. remediate, manage, remove or otherwise dispose of the substance in such a manner as to prevent an adverse effect or further adverse effect, and
3. restore the environment to a condition satisfactory to the Director.

Appendix 1 - Resources

The following is a list of resources that was utilized in the review to develop these guidelines. It includes most of the key resources utilized. There were a number of other documents submitted by participants in various municipalities that were also reviewed to establish these guidelines but are not included in the listing below.

1. Alberta Boilers Safety Association (ABSA)
2. Alberta Environmental Protection and Enhancement Act
3. Alberta Labour - Ammonia at the Work Site Bulletin
4. Alberta Labour - Carbon Monoxide at the Work Site Bulletin
5. Alberta OH&S Act, Regulations and Codes
6. Alberta Safety Codes Act - Pressure Equipment Safety Regulation 49/2006
7. AMHSA Arena Inspection Checklist
8. Bradley ANSI Z358.1 - Quick Compliance Guide
9. CSA B52-13 – Mechanical Refrigeration Code
10. Natural Resources Canada - Comparative Study of Refrigeration Systems for Ice Rinks
11. Occupational & Environmental Medicine - Exposure to carbon monoxide and nitrogen dioxide in enclosed ice arenas
12. Ontario Recreation Facilities Association (ORFA) - Ice Arena Registered Refrigeration Plant Safety Bulletin
13. ORFA – Developing a Registered Refrigeration Plant Room Inspection, Maintenance and Readings Program
14. US Environmental Protection Agency - Indoor Air Quality and Ice Arenas
15. WorkSafe BC - Employer Information for Ice Rinks and Recreational Facilities
16. WorkSafe BC - Ammonia in Refrigeration Systems
17. WorkSafe BC - Hazards of carbon monoxide in sports arenas bulletin