



Staying safe from ammonia and other industrial chemicals



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Municipal ice skating arenas can be cold places with warm hearts, helping build the spirit of community among residents. However, these much-loved buildings can also be deadly, as seen in the fatality of three workers in an ammonia leak in October 2017 at a facility in Fernie, B.C. There are risks to employees, to visitors of the building, and to the surrounding community.

It's not just ice skating rinks – ammonia leaks are a risk at curling arenas and any other place where this useful, but hazardous, substance is used in large quantities, commonly as an industrial refrigerant in warehouses and food-processing facilities. Similar dangers exist from leaks in buried oil and gas pipelines, propane storage and dispensing facilities, and other industrial facilities where large volumes of hazardous substances are stored, transferred, and handled.

Municipal officials need to inform themselves about what risks their community faces, and determine whether they have taken all reasonable precautions to protect the health and safety of employees and the general public.

Understanding the Risks Posed by Ammonia

Anhydrous ammonia is one of the most common hazards facing communities in Canada. One reason is its widespread use in facilities that are close to human habitation, particularly ice skating and curling facilities. Another problem is that ammonia is harmful in small quantities – it can quickly spread inside a building and, if it's released to the atmosphere, it can affect nearby residents. Typically stored under pressure as a liquid, anhydrous ammonia is a dense gas at atmospheric pressure and temperature. While brief exposure at low concentrations may cause no lasting harm, more serious exposures to higher concentrations can cause permanent injury and even death.

However, there are well-established methods for determining what the risks are, such as calculating the likelihood and severity of potential leaks, establishing the engineering or procedural controls for managing those risks, and dealing with releases if they occur. Many

of these steps can also be applied to other risks to community safety, including pipeline or storage tank leaks, train derailments, or unplanned releases of industrial chemicals from other facilities.

Communities may need to take the lead in addressing this risk because the federal and provincial regulations for ammonia management are not particularly strong. While regulations exist for the risk assessment and management of very large quantities of ammonia, such requirements do not exist for smaller, but still extremely hazardous, quantities of this industrial chemical. Emergency planning for ammonia was not regulated in Canada until 2003, and the regulations now in place govern only large users of ammonia – 4.5 tonnes or more. This leaves owners of many mid-size and smaller municipal facilities (such as the one in Fernie) without clear direction around process safety management and risk management planning.

Managing Current and Future Ammonia-Related Risks

Municipalities need to deal with future, as well as current, risks from ammonia and other industrial chemical hazards.

Future risks may come from planned municipally-owned facilities, where the community will expect the facility design to incorporate current best practices in process safety management.

Risks can also come from new commercial and industrial facilities. The municipality's approach to a new development should be: "We're glad you're coming to our community. Now, let's discuss how you're going to help keep our residents safe from any risks from your operation."

The required steps should be clearly set out in the planning, by-laws, and permitting process. This should include planning land development so that there is a safe distance separating populations from any risks. Planning guidance such as that published by the Major Industrial Accidents Council of Canada (MIACC) can help in this regard.

In the case of existing facilities, there may be little or no buffer between the potential hazard and the properties being used for residences, schools, and other sensitive purposes. Sometimes, this is because infill development has begun encroaching on industrial properties that were previously far from other developed land. In this case, it is important to understand the potential risks posed by these existing facilities and to ensure that your industrial partners are taking reasonable precautions to protect the health and safety of members of your community.

Managing Risks Specific to Artificial-Ice Facilities

As well as being able to direct community planning, municipalities need to implement good risk-management practice – particularly in community-owned buildings, such as indoor ice rinks with ammonia refrigeration systems. This involves two aspects: the design of the physical plant, and the procedures involved in operating and maintaining it.

Evaluating the physical plant involves regular examination of the physical condition of the pipes, pumps, compressors, condensers, chillers, valves, tanks, isolation seals, and other components of the system. The system should be subject to regular operating checks, inspections, maintenance, and mechanical integrity reviews. Alarms,

interlocks, sirens, and other emergency notification systems also need to be checked regularly. Clear safe work procedures need to be written and implemented for municipal employees and contractors who work on these systems.

The development and maintenance of emergency preparedness and response systems is equally important. Most artificial-ice facilities in Canada have alarm systems that will be triggered by ammonia releases. For example, an alarm will sound in the compressor room if relatively low concentrations of ammonia, perhaps 25 parts per million, are detected, alerting qualified personnel to check the system to see if there is potential for a larger problem. These alarms should be set to trigger evacuation or shelter-in-place for higher concentrations of the gas. Other sensors, positioned elsewhere in the building, can provide alerts if the gas is found outside the compressor or engine room.

If higher concentrations are found, alarms and flashing lights can notify all of the building's patrons of the emergency.

In a fire, common practice is to clear the building. But, in an ammonia leak, it may be safer to stay inside, because emergency procedures may involve releasing the ammonia in the system to the outside atmosphere. Understanding what to do in the event of an emergency is crucial when time is of the essence. It is important to identify potential emergency scenarios and properly plan to respond to these different levels of emergency – including notifying the surrounding community if needed.

If a plume could involve the full inventory of ammonia in the facility's system, risk management planning should determine what populations would be within reach. Such worst-case situations need to be considered along with other credible release scenarios. Computer-based modeling using likely wind directions and speeds, and other local environmental factors can then calculate the size and location of the emergency planning zone, and how long emergency services have for notifying nearby residents. The message might be to stay indoors, close windows, and turn off ventilation systems until the cloud passes. There might also be a need for an evacuation of the area around the arena, as was the case in Fernie, where residents stayed out of their homes for several days while investigators searched for the cause of the ammonia leak.

Developing Robust Risk Management Plans

Experience has found that the best risk management plans come from a variety of perspectives brought together in one room.

Representatives from operations and maintenance can provide knowledge of the facility and how it works, while emergency services contribute their advice on how to respond to an emergency. Based on what they have seen work elsewhere, external engineering and environmental firms can complete the risk assessments and advise on possible improvements to the system. They can also carry out atmospheric dispersion modeling to see how an ammonia leak might impact the community.

Working together, municipal leaders, staff, and external advisors can find ways to protect the community from the risks of ammonia, allowing residents to stay fit, healthy, and safe. **MW**

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