

Incident Summary #II-1700480-2024 (#45699) (FINAL)

SUPPORTING INFORMATION	Incident Date	April 22, 2024	
	Location	North Vancouver	
	Regulated industry sector	Boilers, PV & refrigeration - Refrigeration system	
	Impact	Qty injuries	1
		Injury description	Multiple workers and members of the public were in the area at the time of the leak. One bystander experienced symptoms of ammonia exposure and was treated by emergency services on site.
		Injury rating	Minor
	Damage	Damage description	Up to 100 pounds of ammonia was released into the atmosphere outdoors. The immediate area around the facility was cordoned off, neighbouring companies were alerted, and the facility, a nearby condo building and children's daycare were instructed to hold in place until the leak was stopped.
		Damage rating	Moderate
	Incident rating	Moderate	
	Incident overview	An uncontrolled ammonia leak occurred outside of a public athletic club with indoor ice facilities. The leak happened during decommissioning work of an ammonia refrigeration condenser by a refrigeration contractor and resulted in the facility enacting their Ammonia Release Emergency Protocol.	
INVESTIGATION CONCLUSIONS	Site, system and components	<p>Ammonia is a clear colourless gas with a strong pungent suffocating odour and is used as a refrigerant in some large refrigeration systems. Exposure to ammonia can irritate and burn the skin, mouth, throat, lungs, and eyes. Exposure to high levels of ammonia can be fatal.</p> <p>The refrigeration system at the facility includes ammonia condensers and connected ammonia piping. Their function is to expel the heat from the ammonia vapour that will become ammonia liquid.</p> <p>To replace a component of the refrigeration system, the ammonia in that system needs to be isolated, removed and purged before work can proceed.</p> <p>An apprentice worker may do regulated work for which specific qualifications are required under the <i>Safety Standards Act</i> if the individual is supervised by a person who is authorized to do the type of work and supervises the individual and provides guidance and assistance as the work is being performed.</p> <p>Decommissioning of a regulated product including ammonia refrigeration systems is regulated work. Licensed contractors must assess the associated risks with the work and ensure they are effectively mitigated and/or controlled prior to proceeding. Clarification of the requirements pertaining to decommissioning can be found in Technical Safety BC Directive D-BP 2024-02 Decommissioning Requirements.</p>	

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Failure scenario(s)

A licensed refrigeration contractor was hired to replace two ammonia condensers for the ammonia refrigeration system for the recreational ice facility. On the day of the incident a crane was hired, and work was to be completed to replace the condensers.

The contractor held a pre-job meeting in the morning to discuss the day's work and potential hazards. A refrigeration mechanic apprentice, who had been employed by the contractor for two years, arrived at the site 2.5 hours late and did not participate in the pre-job meeting. After the apprentice showed up late, the job foreman, who is a certified refrigeration mechanic, instructed the apprentice to cut some welds on the condenser. The intent of the instruction was to have welds affixing the base of the condenser to the elevated metal structure cut with a grinder in preparation for the crane to lift it out.

The ammonia vapour lines connected to the condenser still contained ammonia and had not yet been isolated, evacuated or purged with nitrogen in preparation for removal. The details of the job were not effectively communicated from the foreman to the apprentice, and when the apprentice went to the condenser with the grinder, he observed black felt marker lines on the ammonia piping and thought they were the marks on the welds that the foreman had instructed him to cut. The apprentice proceeded without direct supervision from the qualified site foreman and began to cut into the live ammonia vapour line with the grinder. Once he had cut into the pipe, ammonia began to escape. The foreman was informed of the leak by the apprentice and the piping was isolated by closing shutoff valves. The facility enacted their Ammonia Leak Emergency Protocol, and the immediate area was cordoned off and the facility, neighbouring businesses, school, and daycare were alerted until the leak stopped approximately one hour later. One bystander walked into the cordoned off area after being warned of an ammonia leak in the area and experienced symptoms of ammonia exposure and was treated at the scene by emergency response personnel.

Facts and evidence

Facility operator statements:

- Up to 100 pounds of ammonia was released from the leak.
- The facilities Ammonia Leak Emergency Protocol was enacted.
- The condo building, daycare and local business were notified of the leak.
- The windsock identified that the wind was blowing east towards the neighbouring park.
- One bystander was informed to stop but continued to proceed through the area and later came back complaining of ammonia exposure symptoms.
- The fire department and ambulance arrived and treated the bystander with oxygen on site and they were released.

Site foreman statements:

- They completed a pre-job meeting to discuss the work for the day and identify and hazards.
- The apprentice was 2.5 hours late and did not participate in the pre-job meeting.
- When the apprentice arrived, he told him to cut the bottom welds on the condenser.
- He did not provide direct supervision to the apprentice as they proceed with the work.

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	<ul style="list-style-type: none"> • The apprentice had been employed by the contractor for over two years. • The hole in the piping made by the grinder was approximately ¼" long. <p>Refrigeration apprentice statements:</p> <ul style="list-style-type: none"> • He was late to the job site. • He was directed by the site foreman to cut the welds on the condenser. • He saw felt marker lines on the ammonia piping and thought they were marks for cutting. • Once he cut into the pipe and the leak began, he stopped cutting and informed the foreman. • The they went and closed the ammonia valves to isolate the leaking piping to the condenser. <p>Timeline of events submitted by the Chief Engineer:</p> <ul style="list-style-type: none"> • The ammonia isolation valves were shut after the ammonia pipe was cut. • The area was cordoned off with caution tape. • The leak stopped approximately 1 hour after the pipe was cut.
<p>Causes and contributing factors</p>	<p>It is highly likely that failure to isolate and remove ammonia from the refrigeration system prior to, or during disassembly was the primary cause of the incident.</p> <p>Contributing factors to the incident include:</p> <ul style="list-style-type: none"> • Ineffective communication between the qualified foreman and the apprentice led to the incorrect cutting of the live ammonia line resulting in the leak. • The apprenticed not participating in the pre-job safety meeting before starting work allowed him to begin work without a full understanding of the potential works hazards. • The apprentice working without direct supervision from a qualified person authorized to do the work allowed the work to proceed without the hazard being identified.



Image 1 - Ammonia condensers installed on the raised metal structure with connected yellow ammonia piping.



Image 2 - Condenser # 2 after removal from the structure.



Image 3 - Ammonia Vapour Piping (yellow) after being completely cut.