Incident Summary #II-1695882-2024 (#45521) (FINAL)

SUPPORTING INFORMATION	Incident Date		April 9, 2024
	Location		North Vancouver
	Regulated industry sector		Boilers, PV & refrigeration - Refrigeration system
	Impact – Injury	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Impact – Damage	Damage description	A small amount of ammonia was released through an open pipe.
		Damage rating	Minor
	Incident rating		Minor
	Incident overview		An ammonia leak occurred inside the machinery room 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		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. 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. To replace a component of the refrigeration system, the ammonia in that system needs to be isolated, removed and purged before work can proceed. 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.
	Failure scenario(s)		A licensed refrigeration contractor was hired to replace one ammonia condenser and remove other equipment for the ammonia refrigeration system for the recreational ice facility. The system including the chillers was pumped out and ammonia was removed. The chiller was at 0psig and after a pipe was cut to remove. It was covered with duct tape to keep the smell down. Dissolved ammonia in the oil was released from solution as the plant increased in temperature causing a small amount of positive pressure to build behind the tape, until it released the ammonia vapour.

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Facts and evidence	Construction Superintendent statements: We were decommissioning for the removal of piping connected to chiller. Pump out and removal of liquid refrigerant occurred on April 8, 2024, and vented using our procedure. The system piping was purged down to 0psi and opened to atmosphere on all piping required to be removed. The piping connected to the chiller was left with an open end and was taped shut to prevent excessive smell coming out from the chiller. The dissolved ammonia in the oil was released from solution as the plant increased in temperature causing a small amount of positive pressure to build behind the tape, until it released the ammonia vapour. On call staff received notification from security to high alarm. The fire department was also dispatched and evacuated occupants from building. Our technician dispatched around 8:35 pm and arrived around 9:30 pm to investigate and the ammonia reading was 48ppm. A noticeable smell of ammonia was coming from taped off chiller connection. The technician suspected oil still residing in insulated oil pot in the drop leg. Nitrogen was then used to force oil out of the drop leg until it was all drained. A vacuum pump was then hooked up to pull residual vapor from chiller and oil pot. To avoid this from happening again during the ammonia removal process, draining of oil from the oil pot should be completed removing the residual oil and dissolved ammonia. After the oil is removed, nitrogen and vacuum purging should be used to draw vapor out of any trapped oil pockets. The open connections should only be taped off once all fluids are completely drained to eliminate the risk of dissolved refrigerant pressurizing the piping.
Causes and contributing factors	It is highly likely that failure to nitrogen purge and vacuum the oil pot and drop leg did not remove all the ammonia from the refrigeration system prior to the cutting of the pipe, was the primary cause of the incident. Contributing factors to the incident include: • Failure to recognise that the bottom of the chiller, oil pot and drop leg will have enough ammonia diffused into the oil. • The temperature increased, ammonia diffused out of the oil and created enough pressure to push the duct tape out.

Image 1 - The pipe that was cut.

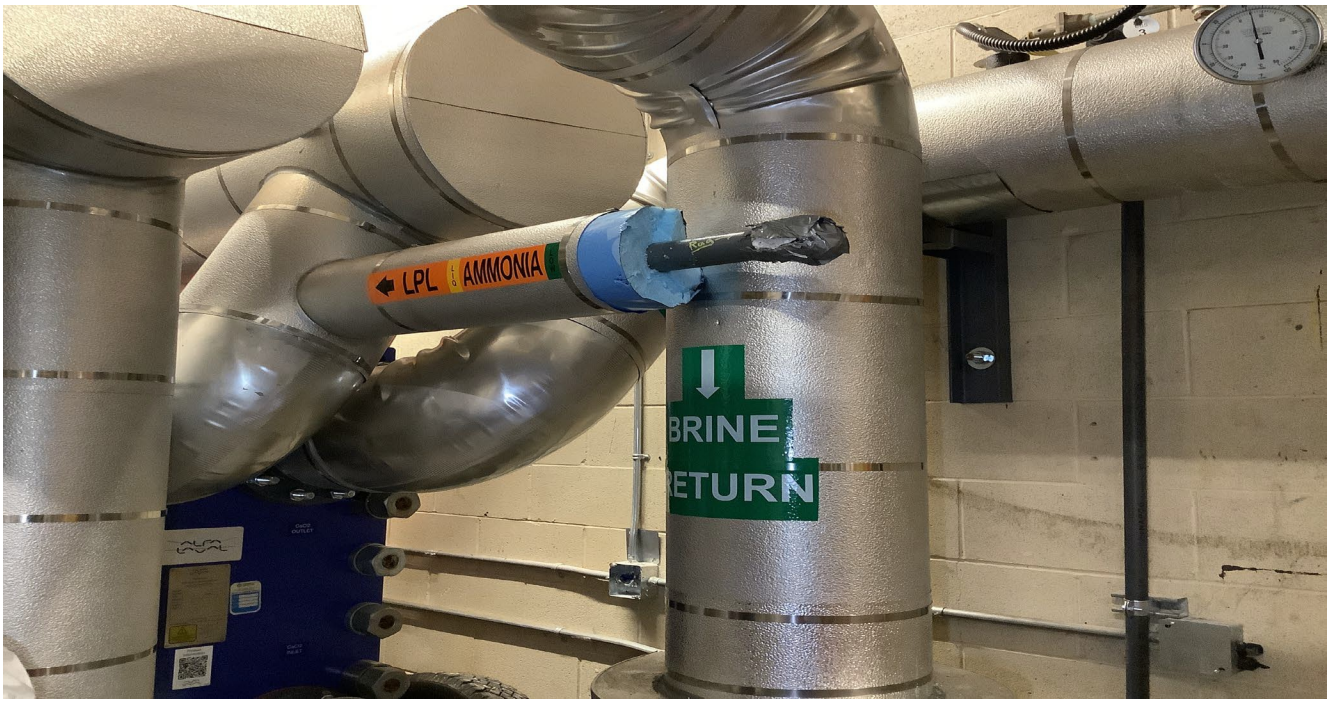

Image 2 - Ammonia pipe.

Image 3 – Overall.