Incident Summary (5615109)

SUPPORTING INFORMATION	Incident Date			Apr 2, 2017
	Location			Shawnigan Lake
	Regulated industry sector			Refrigeration System
	Impact	Injury	Qty Injuries	1
			Injury description	One person detected ammonia odour
			Injury rating	Minor
		Damage	Damage description	The refrigeration compressor pressure relief valve lifted. The refrigeration system was shut down and isolated. One hundred and twenty five pounds of ammonia was released to atmosphere.
			Damage rating	Moderate
	Incident rating			Moderate
DESCRIPTION	Incident overview			A 125lbs of ammonia was released through the refrigeration compressor safety relief valve while in operation. A witness detected the ammonia next door and informed the operator who investigated the source and shut down the refrigeration plant. There was no alarm or indication of ammonia inside the plant and the arena was vacant at the time of the incident.
	Site, system and components			The refrigeration plant is an indirect closed surface risk assessed public assembly site using 800 lbs of R717 ammonia as a refrigerant used for an ice rink. The plant consists of two compressors totalling 112kws. The refrigeration plant is monitored by a computer controlled monitoring system. Each compressor has a safety relief valve with a designed lift pressure of 250 psig.
CONCLUSIONS	Failure scenario(s)			Number two compressor pressure relief valve lifted causing the release of ammonia. 1. The safety devices failed to operate and the pressure relief lifted. 2. The pressure relief valve lifted before the designed set pressure.
	Facts and Evidence			The following is a summary from statements from the chief engineer, operator, off duty operator (witness) and contractor. At approximately 4:50pm, the witness detected the smell of ammonia from next door and went to the arena to notify the operator. During the transit, the witness verified that the pressure relief discharge piping was releasing ammonia by the visible cloud and the noise of the gas releasing to atmosphere. Once notifying the operator, the plant was immediately shut down. Upon investigation, number two compressor pressure relief valve had lifted as determined by the hot valve compared to the remaining pressure relief valves and the discharge piping flapper was closed. The chief engineer and the refrigeration contractor were called. 1. The computer program history had the highest pressure at 194 psig at 4:58pm and takes readings every 6 seconds. Readings in log confirm higher than normal pressures based on ambient temperature and higher than normal ice usage. Pressures indicate load increased by 10psig the previous four days before the incident. Previous history showed reading as normal trends. 2. The pressure relief valve was installed new February 1, 2015. Records and valve tag validate date. The pressure relief valve had a design lift pressure of 250psig.

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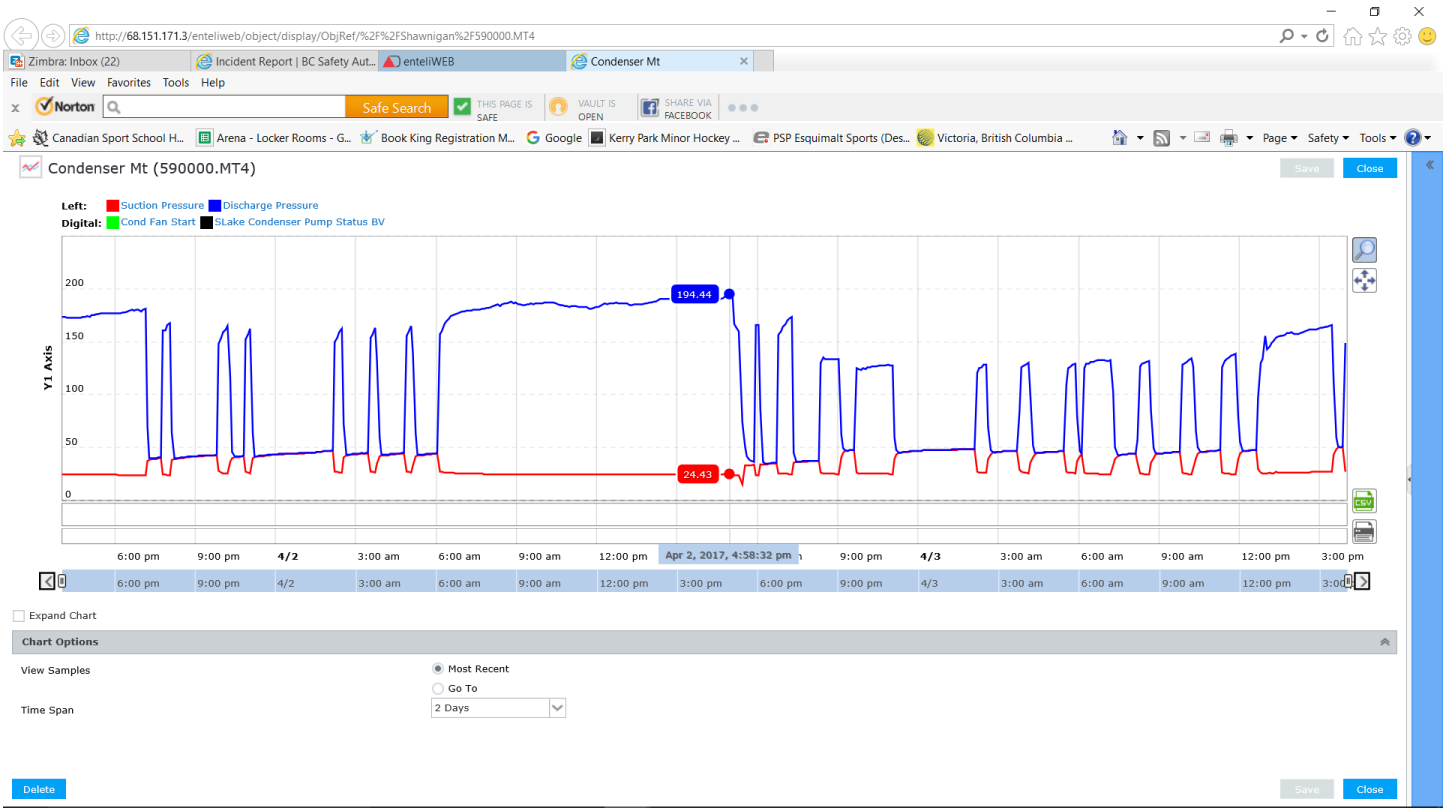
		The following was verified by a refrigeration contractor on the 6 Apr 2017: 3. The pressure gauges, computer monitor programming, and transducer were tested against a certified gauge to prove accuracy. 4. The mechanical high pressure safety switch on the affected compressor was tested and verified to shut down the compressor at 205 psig. Last test was dated 25 May 2016 with a set point of 210 psig. The computer monitoring high pressure trip was tested and verified at 200 psig. Both tests conducted in situ by shutting down the condenser fan to increase the system pressure. 5. The following was verified: the computer software, blockages of piping, and possible mechanical failure of the condenser fan. 6. The pressure relief valve was visually examined for damage and any abnormal condition. The pressure relief valve was retested with nitrogen and lifted at 230 psig vice the set pressure of 250 psig. 7. Contractor contacted the manufacturer and there was a recall on the pressure relief valve for sticking closed vice premature lifting.
	Causes and Contributing Factors	It is probable that the cause of the ammonia discharge was the pressure relief valve lifting prematurely. The pressure relief valve bench test demonstrated it lifted prior to the 250psig set pressure. In order for the pressure in the system to reach the set point of the safety relief valve the safety devices would have to fail and in each case these were successfully tested. The gauges and transducer were also tested validating that the pressure in the system never reached the lifting pressure of the pressure relief valve.

Photos or diagrams (if necessary) Computer monitoring system displaying maximum pressure at 194 psig



Pressure relief valve bench test – lift at 230 psig