Incident Summary #II-749858-2019* (#8752) (FINAL)

SUPPORTING INFORMATION	Incident Date		September 25, 2018
	Location		Vancouver
	Regulated industry sector		Boilers, PV & refrigeration - Refrigeration system
	Impact – Injury	Qty injuries	0
		Injury description	None
		Injury rating	None
	Impact – Damage	Damage description	Heat exchanger tube failure
		Damage rating	Moderate
	Incident rating		Moderate
	Incident overview		Multiple tube failures in an ammonia to brine shell and tube heat exchanger resulted in ammonia contamination of a brine underfloor heating system and the release of a small amount of ammonia to the atmosphere. The contaminated brine also migrated to the ammonia side of a brine chiller.
INVESTIGATION CONCLUSIONS	Site, system and components		This public skating arena uses 1,000 lbs. of ammonia as a refrigerant. Ammonia liquid is used to make skating ice and ammonia vapour to heat ancillary systems (such as the underfloor heating system). The underfloor heating system prevents the formation of perma-frost under the ice surface.
	Failure scenario(s)		When the previous 1996 heat exchanger failed (leaked), in 2015, it was replaced with a like unit of the same manufacturer. The brine had been contaminated with ammonia but was not replaced or neutralized.
	Facts and evidence		• There are no brine analysis records available at the time of the heat exchanger leak in May of 2015. • A November 15, 2016 analysis report indicates ammonia contamination of 4623 ppm (pH 11.10 – dissolved iron 33 ppm). The presence of iron indicates corrosion of pipes; • A December 12, 2017 report indicates ammonia at 3896 ppm (pH 11.50 – dissolved iron 45 ppm). • In December of 2017 the operators commenced venting of ammonia from the brine, and side-stream filtration of the brine. • A September 14, 2018 analysis report indicates ammonia at 2092 ppm (pH 10.30 – dissolved iron <10 ppm). • At 0800 plant operators detected noise coming from the machinery room. Upon entry to the machinery room they noticed the underfloor heating brine expansion tank overflowing, an ammonia smell and the 35 ppm leak alarm was activated. The heat exchanger was isolated and the plant shut down.
	Causes and contributing factors		It is very likely that the continued use of the contaminated brine produced a high rate of corrosion which resulted in the failure of the underfloor heating heat exchanger.