

Incident Summary #II-972306-2020 (#16462) (FINAL)

SUPPORTING INFORMATION	Incident Date	January 25, 2020	
	Location	Langley BC	
	Regulated industry sector	Boilers, PV & refrigeration - Refrigeration system	
	Impact Injury	Qty injuries	0
		Injury description	No Injuries
		Injury rating	None
	Damage	Damage description	Liquid feed solenoid valve O-ring was damaged causing ammonia to escape the valve body and release into the machine room.
		Damage rating	Minor
Incident rating	Minor		
Incident overview	A meat processing plant houses an anhydrous ammonia refrigerant plant as part of the plants process. A solenoid valve located in the refrigeration machine room had a damaged O-ring resulting in ammonia leaking outside the valve body. A licensed refrigeration contractor identified the leak and performed repairs including replacing the damaged O-ring.		
INVESTIGATION CONCLUSIONS	Site, system and components	<p>The liquid feed solenoid valve allows liquid ammonia at a high pressure (145psi) to pass through the valve and serves the ammonia liquid storage tank. The ammonia liquid storage vessel serves the compressor pumps with a constant supply of liquid ammonia. The solenoid valve control module and valve body are connected with four screws to hold the solenoid stem and body together. An O-ring is placed between the valve stem and the body which prevents the liquid ammonia from escaping out of the valve body.</p> <p>The storage vessel has a liquid level sensor that senses the level in the storage vessel. When the level in the tank falls to a certain level demand for liquid ammonia is required to keep the vessel filled with ammonia. The level sensor sends a signal to the liquid feed solenoid valve that will actuate the valve position from 0-100% to maintain the level in the tank.</p>	
	Failure scenario(s)	The liquid feed solenoid valve allows liquid ammonia to flow through it. The solenoid tube and control module assembly is held together by four screws and an O-ring is placed between the valve stem and body to create a seal between the connected body and stem. Constant temperature swings from ammonia passing through the solenoid valve from its open and closed position created an environment for the O-ring material to degrade overtime (approximately 20 years of service). The O-ring material failed and allowed ammonia to escape through the valve body from a lack of seal.	
	Facts and evidence	<ul style="list-style-type: none"> -Pictures of the solenoid tube assembly disassembled to show internal parts -Pictures of damaged O-ring with evidence of wear and tear in the material. -Contractor Service report dated Jan 25 describing tightening screws on valve to stop leak.. -Contractor service report dated Jan 27 describing servicing the valve and replacing damaged O-ring. -Duty holder email Jan 25 describing the sequence of events from the ammonia release. 	

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	<ul style="list-style-type: none">-Picture of what a new O-ring would look like in the valve assembly-Contractor witness statement indicating temperature fluctuations of (20F-100F) between liquid ammonia passing through the valve in the open position and back to the closed position as a likely scenario for the O-ring degradation.-Contractor witness statement indicating the liquid ammonia storage vessel was installed in the year 2000 and that the solenoid valve was a component for the vessel installation to give an approximate age of the valve.
Causes and contributing factors	<p>-It is highly likely the O-ring did not create a positive seal to prevent ammonia from escaping the valve assembly. The O-ring prevents ammonia from escaping a small gap between the connected sections of the valve stem and body. The age and temperature swings from cyclic fatigue of the valve constantly opening and closing caused the O-ring material to degrade over an approximate 20 year service life and eventual fail.</p>





