Incident Summary #II-1029477-2020 (#18496) (FINAL)

Inci3737373737SUPPORTING INFORMATION	Incident Date		June 23, 2020
	Location		Port Alberni
	Regulated industry sector		Refrigeration System
	Impact – Injury	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Impact – Damage	Damage description	Loss of containment from an isolation valve to regulator valve flange set due to gasket seal failure.
		Damage rating	Moderate
	Incident rating		Moderate
	Incident overview		Technical Safety BC was notified due to a release of ammonia within a machine room. Two certified individuals were executing seasonal plant start up activities in an effort to generate ice surface. The ammonia release initiated alarms, equipment shutdown, plant evacuation of staff and emergency services to attend the site. The arena was closed to the public at the time of release.
INVESTIGATION CONCLUSIONS	Site, system and components		The refrigerant plant is an indirect closed surface system using R717 ammonia as refrigerant. The total nameplate rating of the facilities three compressors is recorded as 120 kw. Direct digital control (DDC) automation is utilized to maintain plant operating conditions.
	Failure scenario(s)		While generating ice surface, close frequency pressure excursions likely induced by the rapid opening and closing of a pressure regulating valve located between isolation valve #14 and #15 to the systems outdoor condenser were encountered. At this time a flanged connection upstream of isolation valve #14 and downstream of the regulating valve failed to contain line pressure and ammonia vapor was released into the machine room.
	Facts and evidence		The plant was being prepared for start-up. The plant seasonal start-up conducted by certified individuals included surface preparation, maintenance activity, commissioning of new equipment and monitoring of the process. A newly installed rooftop condenser was commissioned June 22, 2020. The associated tasks supporting ice generation began June 20, 2020. By June 23, 2020 the refrigeration plant was charged with ammonia and operating. The ammonia release was after 11 am on June 23, 2020. The low level alarm, set at 25 parts per million (ppm), was triggered followed seconds later by the high level alarm set at 200 ppm. The high level alarm stopped sounding at 11:23 am. The detection of ammonia exceeding 200 ppm lasted less than five minutes. Authorized personal were in the refrigeration plant vestibule at the equipment console at the time of alarm. When the audible alarm ceased, ammonia was still detected at 67 ppm within the machine room. With no additional leakage detected authorized personal entered the machine room with personal protective equipment, and used a wrench to tighten the fasteners at the flange location immediately downstream of isolation valve #14. At this time ammonia was detected on location at 41 ppm. The ammonia detection

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	ranged from 41 ppm to 0 ppm completely dissipating in less than five minutes after tightening the fasteners. No loss of containment was reported during post incident valve testing. Gasket and gasket seating surface damage is not suspected. The valve actuator was temporarily overridden to remain open until it was determined why the valve was actuating erratically during operation. Post incident testing of the regulating valve confirmed an actuator differential pressure was set at the recommended value of five pounds per square inch (psi.). Prior to the ammonia release a compressor outlet piping gage was observed ranging between 150 psi. to 175 psi. in approximately 5 second cycles. The intermittent pressure spikes are likely the result of the regulating valve cycling closed. 175 psi. is within the refrigeration system's design pressure and over pressurization is not suspected. It was reported that no adverse vibrations were encountered during start-up, mechanical damage is not likely a contributing factor contributing to the ammonia release. The DDC system was installed at the time of facility construction by a controls contractor and later serviced by separate contractors. Changes in service providers since construction of the facility has occurred. The current DDC maintenance and plant maintenance activities are provided by separate service providers. DDC programming changes likely occurred since facility construction.
Causes and contributing factors	The loss of containment at a mechanical flanged joint was likely caused by relaxation of the mechanical fasteners. Fastener relaxation can be expected when utilized in systems experiencing fluctuating thermal conditions, vibration or advanced length of service. Fastener relaxation can be controlled with fastener torque procedures, inspection intervals or eliminating mechanical flanged connections with welded connections. Contributing factors likely include the direct digital control systems logic not updated. A rapidly opening and closing pressure regulating valve. Possible contributing factors include a recent condenser installation. Testing and updating of the DDC system's programming to accommodate plant changes could eliminate undesired plant equipment response.

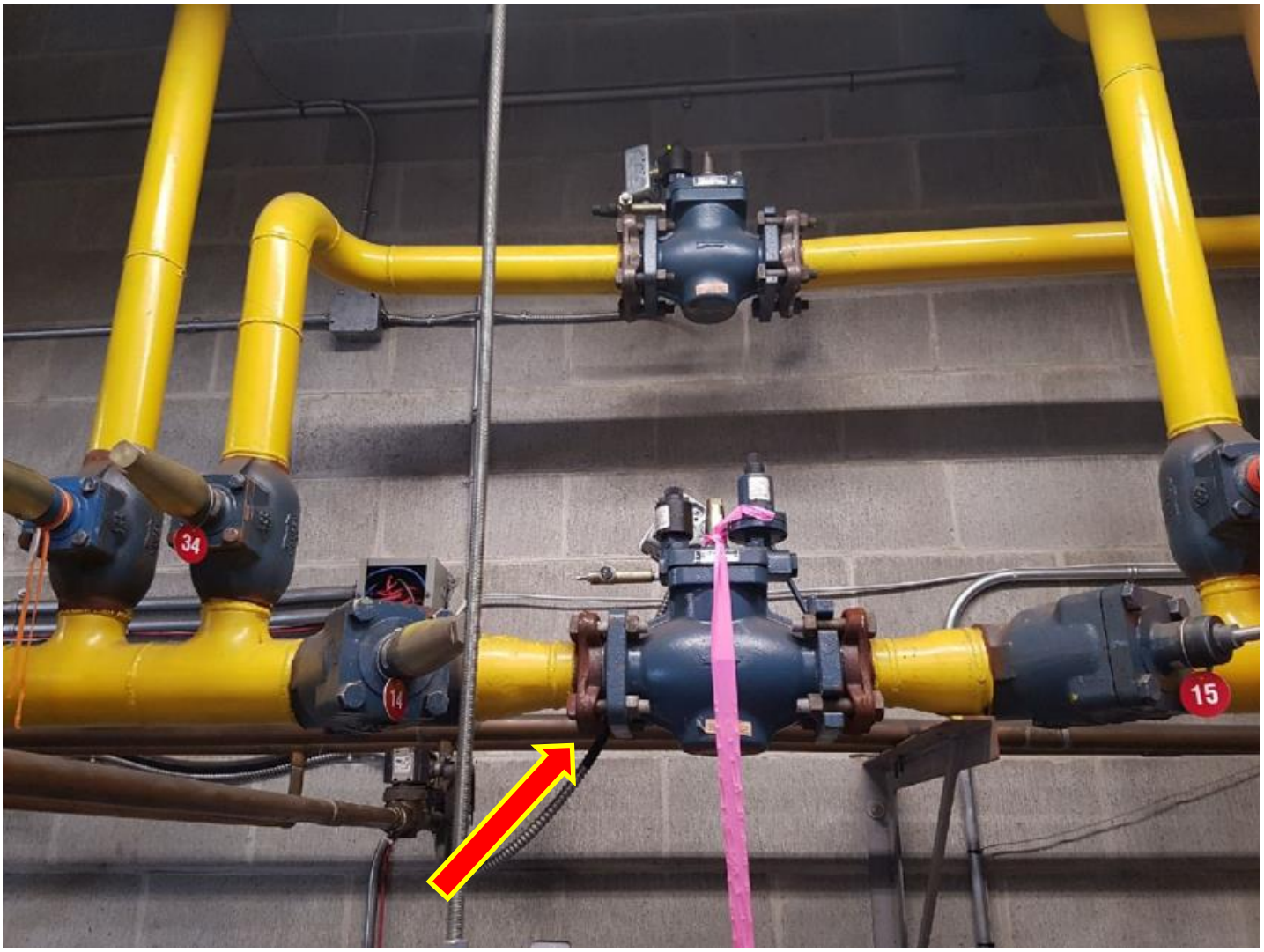

Image 1/1

Pink ribbon identifies regulating valve with actuator components on bonnet. Loss of containment occurred at left side flange connection indicated with red arrow.