

Incident Summary #II-1405542-2022 (#28732) (FINAL)

SUPPORTING INFORMATION	Incident Date	July 11, 2022	
	Location	Burnaby	
	Regulated industry sector	Boilers, PV & refrigeration - Boiler and pressure vessel system	
	Impact	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Damage	Damage description	Damage was limited to the gasket seals, with no damage to the heat exchanger.
		Damage rating	Insignificant
Incident rating	Insignificant		
Incident overview	A gasket seal leak occurred in the Splitter Unit on the exchanger at the channel head gaskets during a maintenance cleaning process. The unit was shut down and was being prepared for maintenance. In this transient condition, steam was used as one medium for pre-maintenance cleaning steps at the time of the failure. The tube side was isolated from service but still had gas oil slop material.		
INVESTIGATION CONCLUSIONS	Site, system and components	<p>Refinery, Splitter Unit (Splitter unit could be any conventional device for the separation), Crude Feed Heat Exchanger (in refineries heat exchangers are used for the crude oil distillation and subsequent refining stages) splitter bottoms (tube side/hot side) to crude feed (shell side/cold side) exchanger, steam had replaced the crude feed on the shell side for pre-maintenance.</p> <p>Tube Side (The flowing medium within the tubes is known as the 'tube side' medium. The flowing medium outside of the tubes is known as the 'shell side' medium. Each medium has one entry and one discharge).</p> <p>Heat exchangers will be considered as pressure vessels and the rules from BPVR safety regulations and CSA B51 (clause 7) will apply.</p>	
	Failure scenario(s)	<p>An overpressure scenario due to thermal/hydraulic expansion from the steam on the shell side of the E-5304 exchanger. The failure happened during a scheduled operational shutdown when blocking in the Splitter bottoms circuit around heat exchanger from the pump to facilitate Column cleaning.</p> <p>Heat exchangers are used to transfer heat from one medium to another. The mediums in normal service are both hydrocarbons. During this transient condition, the heat exchanger worked in reverse, with the steam thermally heating the blocked-in gas oil material. Hydraulic pressure was created as the gas oil liquid thermally expanded resulting in an abnormal overpressure scenario at the gasket sealing connection. Once the pressure was relieved, there was no further leaking.</p>	

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<p>Facts and evidence</p>	<p>On Sunday July 10th nightshift, the splitter was successfully shutdown to prepare for the planned repairs to the diesel section of the column on the week of July 11th. During the initial steam out phase on the morning of Monday July 11th, Operations Personnel discovered that the channel cover gasket on the unit had failed and leaked a small volume of product. Further investigation also revealed that the gasket between the channel head and the exchanger shell had also failed. Process trending tools indicated the tube side pressure increased during the steam out process.</p> <p>The Fixed Equipment Inspector performed an external inspection at all flanges to determine the location and extent of damage.</p> <p>Two leaks at flange joint connections were noted. Location 1 was noted at the channel-to-channel cover flange from approximately 2:00 to 10:00. There was no active leak at the time, though the product was fresh, and a puddle of product was noted on the ground directly below the exchanger. Location 2 was noted at the channel to exchanger shell / tube sheet, from approximately 6:00 to 9:00. This was not actively leaking, though fresh product was on the flange and bolts.</p> <p>Piping connections to the exchanger were free of damage. There were no issues with cladding and the vessel, saddle type supports, were free of damage and secured to the exchanger. Visual inspection was performed on associated piping circuit.</p> <p>Facility staff stated that the site isolation procedure will require an update to add a protocol to follow for this type of transient maintenance condition.</p>
<p>Causes and contributing factors</p>	<p>Plant manager and investigation team have found that there was no documented protocol for draining blocked in the equipment (specifically one side of an exchanger) when applying a source of energy to the other side, certainly during abnormal operations (steam / chemical cleaning in this case).</p>

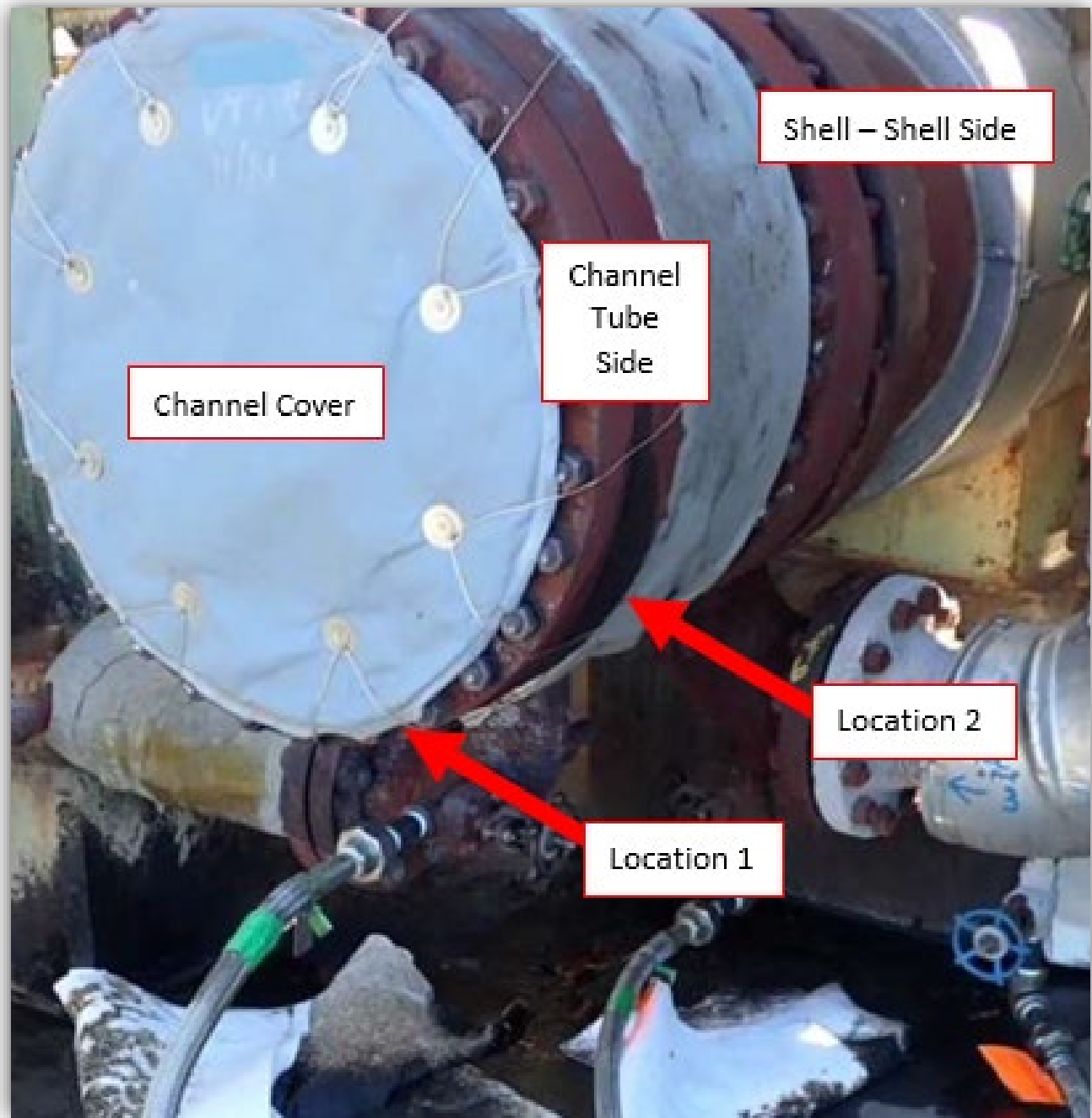


Image 1 – Flange leak locations 1 and location 2.