

Incident Summary (Reference# 5243)

SUPPORTING INFORMATION	Incident Date	January 10, 2018	
	Location	Vancouver	
	Regulated industry sector	Natural gas system	
	Impact	Qty injuries	None
		Injury description	None
		Injury rating	None
	Damage	Damage description	The venting on a steam boiler was severely damaged
		Damage rating	Minor
	Incident rating	Moderate	
Incident overview	A surplus of natural gas accumulated in the appliances venting system which ignited causing an explosion damaging the venting system		
INVESTIGATION CONCLUSIONS	Site, system and components	<p><i>This specific steam boiler has several safeties and operating controls which must be satisfied to complete an electrical circuit prior to ignition. Prior to ignition the combustion chamber and venting require four air changes (this purges out any raw fuel that may have accumulated which ensures a safe start of the appliance). The combustion chamber is purged by a direct drive motor which is equipped with a blower wheel which moves the air. Air movement is proved through a pressure switch and is part of the safety circuit of the appliance. The combustion air assembly for this specific steam boiler is also equipped with a damper blade that will modulate the amount of air coming into the steam boiler to ensure the main flame is stable throughout different firing conditions by ensuring a proper fuel air mixture. When all the safeties and operating controls are in normal operation and there is a call for the appliance to be on the sequence is as follows. The combustion air is energized for approximately 20 seconds, then the pilot flame is ignited by an ignition transformer (creates a high voltage spark). The spark ignites the pilot lines natural gas and is then sensed by a flame rod (flame sensor). Upon the pilot flame being established and sensed this then allows the main burner to ignite and continue to operate provided that all safeties and operating controls stay within desired parameters and until operating set point is achieved. The flame-safeguard monitors the pilot flame, safeties, and provides safe operation of the appliance by monitoring the flame signal and tripping if a safety device opens or a flame signal is lost (this is a resettable device.)</i></p>	
	Failure scenario(s)	<p><i>The steam boilers venting overtime began to delaminate internally creating a blockage in the venting system. The combustion air damper wore down over time and eventually was seized in an almost fully closed position. The appliance was no longer venting the flue gases correctly or bringing sufficient air into the combustion chamber for adequate pre-purging of the appliance and proper operation to maintain adequate combustion. The reset was pushed multiple times on the flame-safeguard system on initial start-up of the steam boiler.. With the reset button being pressed multiple times the gas most likely caused natural gas to accumulate in the boiler and venting system.</i></p>	

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Facts and evidence	<ul style="list-style-type: none">-Venting found obstructed as inner liner delaminated blocking the vent.-Combustion air damper on steam boiler found seized in closed position-Boiler reset multiple times prior to explosion in venting system.
Causes and contributing factors	<p>Likely the failure of the venting system was caused by the steam boiler not successfully completing a pre-purge of the combustion chamber due to damaged combustion air damper and blockage in the vent.. This more than likely created the natural gas to accumulate in the venting system.</p> <p>With the reset button being pressed multiple times the gas most likely accumulated at which point when it was restarted the explosion occurred.</p>

Photos or diagrams (if necessary)