

## Incident Summary #II-717029-2018 (#7943) (FINAL)

SUPPORTING INFORMATION	Incident Date		June 10, 2018	
	Location		Kelowna, BC	
	Regulated industry sector		Gas - Natural gas system; Boilers, PV, Refrigeration - Boiler and pressure vessel system	
	Impact	Injury	Qty injuries	0
			Injury description	No injuries
			Injury rating	None
	Damage	Damage	Damage description	Fire damage to a hot water boiler combustion chamber and fire damage to integral control circuits located on the boiler.
			Damage rating	Moderate
	Incident rating		Moderate	
Incident overview		A clogged flue chamber created a buildup of unburnt (raw) gas, when ignited caused an internal explosion in the combustion chamber. This caused excessive internal heat and damaged the boiler external control wiring.		
canINVESTIGATION CONCLUSIONS	Site, system and components		A hot water fire tube boiler uses an ignited mixture (premix) of natural gas. This ignition will heat the boiler water for the purpose of maintaining and warming of the piping system for the buildings air temperature. An ignitor is used to ignite these gases within a combustion chamber where a fan blows the heat down internal fire tubes. The equipment uses these fire tubes where ignited gases can heat water within an enclosed space. The water is then pumped away from the boiler and into other piping system of the buildings. This is to raise the buildings air temperature as needed.	
	Failure scenario(s)		A few days prior to the incident the combustion burner door was lifted off to access the motor fan blades for inspection as the air flow combustion efficiency had been noticeably reduced. At this time the ignition electrode probe was removed to be cleaned but may have been incorrectly installed by the operator. It was also noted by the operator that there was a build-up of soot on the fire-tubes openings, but no maintenance was completed to clean the tubes. The combustion burner door was then closed up and the boiler was returned to service. A few days later the combustion incident occurred. The way the ignitor probe was reinstalled could have allowed large amounts of unburnt gas into the combustion chamber before ignition could occur. Once ignited, the pressure created within the chamber had nowhere to go because of the clogged fire tubes. This created the blow back of the firing gases causing the damage to the internal canister and external control wiring.	
	Facts and evidence		<p>Upon investigation the area within the internal combustion chamber where the fire tubes are located were found heavily clogged with soot.</p> <p>These areas of high soot potentially reduced the of ignited gas flow into the fire tubes.</p> <p>Also the ignitor probe was noted to be out of position where it created time for gas to flow without being ignited. When the gases were ignited it likely created an internal explosion in the combustion chamber.</p>	

## Incident Summary #II-717029-2018 (#7943) (FINAL)

### Causes and contributing factors

The areas of heavy soot within the combustion chamber contributed to the lowered efficiency of the combustion air movement. This required maintenance to correct. During this maintenance the combustion chamber was not cleaned of soot and the ignitors were reinstalled improperly causing a delayed ignition. This, combined with the sooted fire tubes, caused a buildup of raw unignited gas that when finally ignited caused the blowback. The delayed ignition of gas was restricted from traveling down the tubes due to soot buildup and resulted in detonation causing the damage to the equipment and control wiring.

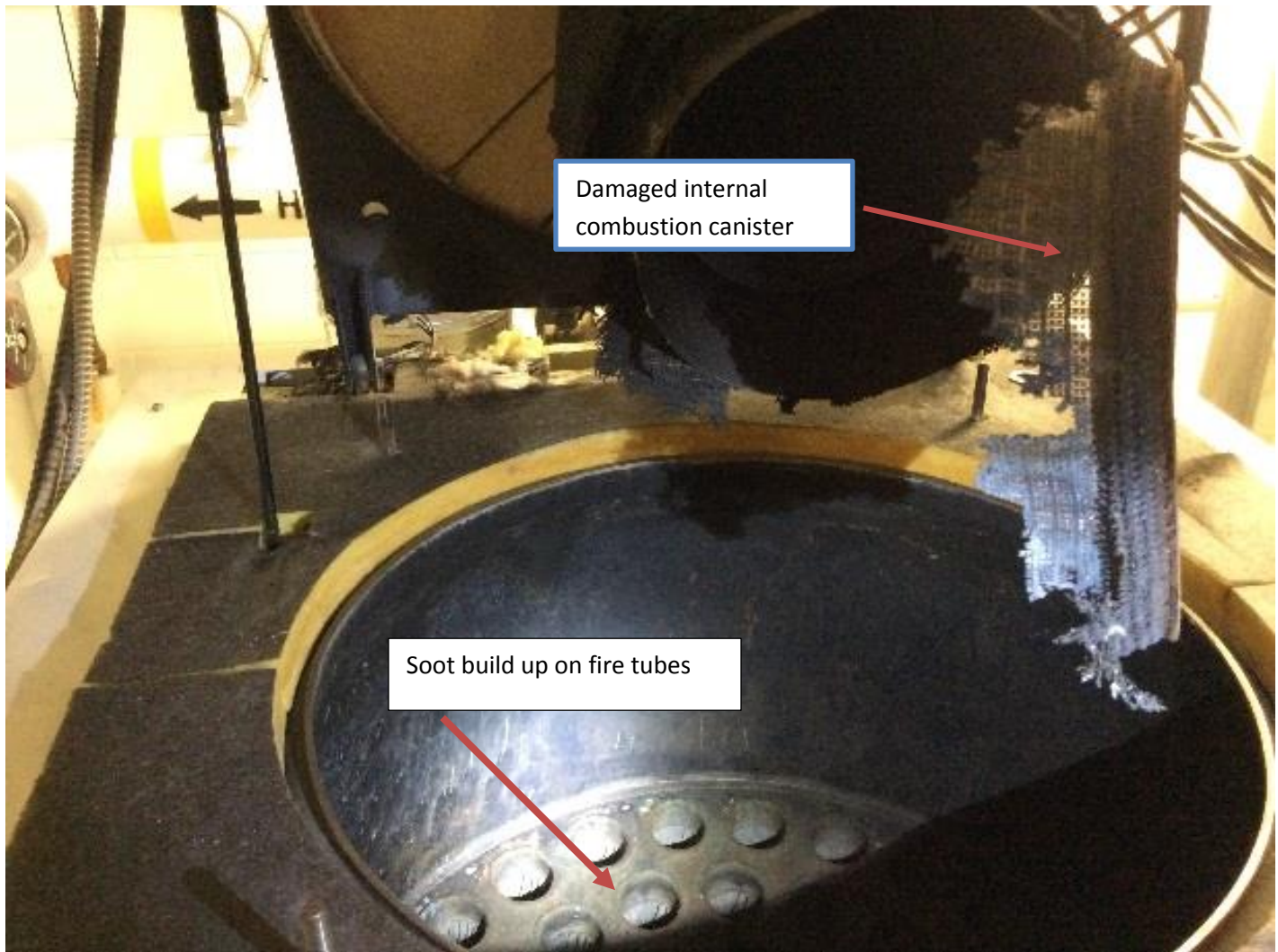


Photo 1: Burnt vent canister & sooted fire tubes



Photo 2: Ignition probes - top end





Boiler external burnt  
control wiring

Photo 3: Burnt wiring exterior top end



Photo 4: HW Boiler front & open combustion area