

## Incident Summary (II-648560-2018 #)

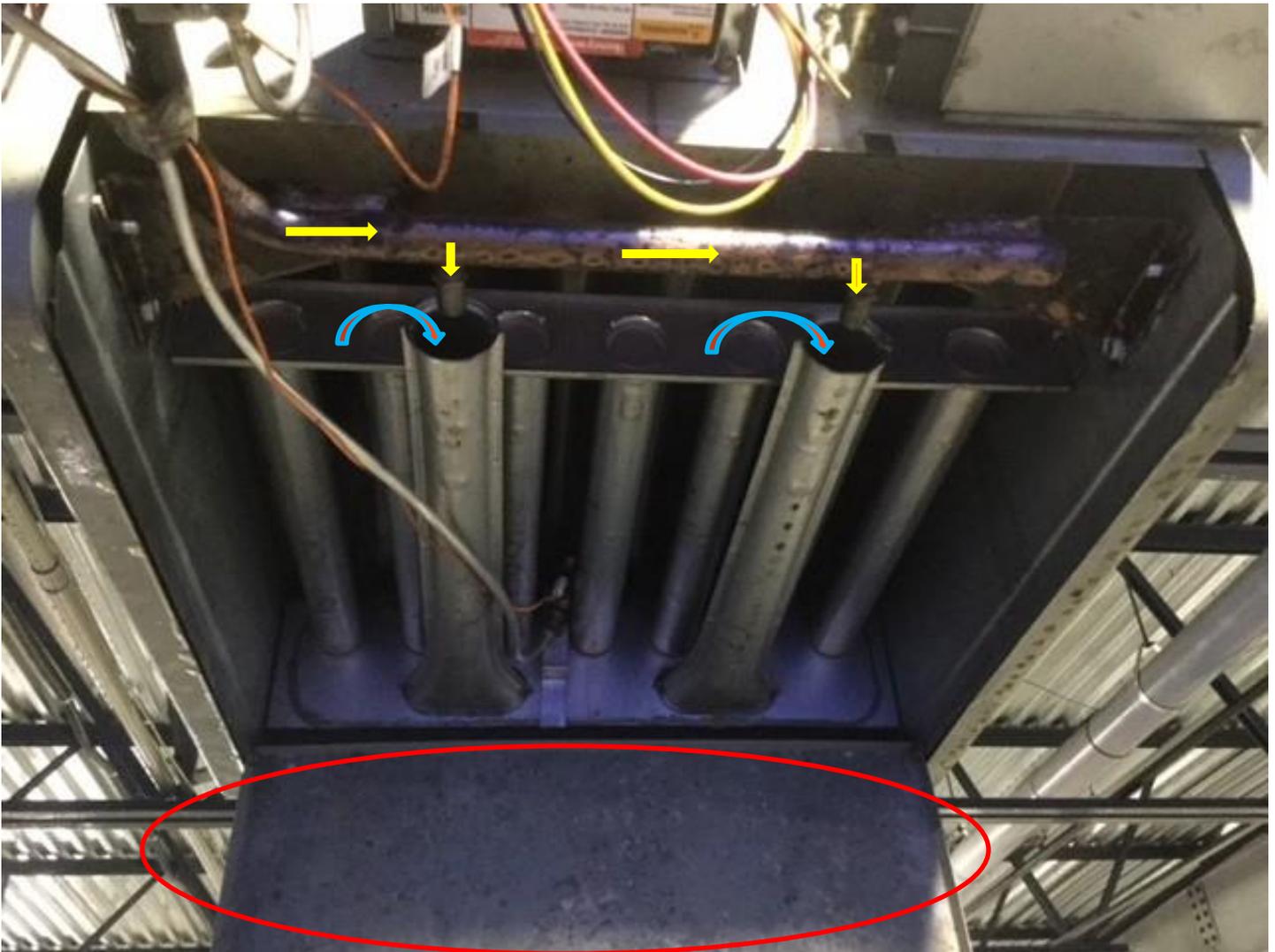
SUPPORTING INFORMATION	Incident Date	<i>February 07, 2018</i>	
	Location	<i>Abbotsford BC</i>	
	Regulated industry sector	<i>Natural Gas system</i>	
	Impact Injury	Qty injuries	<i>0</i>
		Injury description	<i>N/A</i>
		Injury rating	<i>None</i>
	Damage	Damage description	<i>Fire damage to a warehouse heater , equipment and materials stored within the warehouse.</i>
		Damage rating	<i>Major</i>
Incident rating	<i>Major</i>		
Incident overview	<p><i>The warehouse room where the fire occurred was used to store large quantities of food packaging materials such as plastics, cardboards and Styrofoam. These materials were stacked and bundled up on wooden pallets for easy storage.</i></p> <p><i>High above these materials is where a typical warehouse heater (unit heater) was installed and operating. A failure took place within the heater that led to a serious warehouse fire.</i></p>		
INVESTIGATION CONCLUSIONS	Site, system and components	<p><i>Warehouse heaters (also called “unit heaters”) are commonly installed and used to heat larger open spaces such as warehouses, shops and garages. They are typically suspended from the ceiling so as to be up and out of the way.</i></p> <p><i>This style of heater employs the “induced draft” method that uses a small blower to draw natural gas and air into the burners where they meet an ignition source to create a controlled flame inside the heat exchanger. The design and layout of the burners along with correct gas pressure, clear orifices / passages and uninterrupted air supply is how this controlled flame achieves good and complete combustion. If one of these becomes compromised or changed it can wreak havoc on the process and lead to unwanted by-products such as carbon monoxide and soot.</i></p> <p><i>It is also crucial that the heat exchanger passages remain unrestricted so that the exhaust gases can travel safely from the heat exchanger to the chimney and reach the outdoors. All gas appliances require periodic servicing to ensure all of these components remain clean, unrestricted and functioning properly.</i></p> <p><i>This heater has a total of 7 horizontal burners and 7 corresponding vertical heat exchanger passage ways that house the flames and allow the flue gases to make their way up towards the venting system.</i></p> <p><i>A larger propeller style fan is mounted to the heater and pushes surrounding air over the outside of the heat exchanger transferring heat to the air and warming up the space.</i></p>	

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<p>Failure scenario(s)</p>	<p><i>Over time the burners in this heater became dirty and restricted. The left most burner was affected the most and began producing soot that started to accumulate on the walls of the heat exchanger directly above this burner. As the heater ran it produced more and more soot resulting in further restriction of the flue gases and compounding the issue. Eventually these flue gases could no longer make their way up towards the venting system and were forced to spill back into the burner compartment and out through the bottom of the heater pulling the flame with it. This condition is known as a “rollout” in trade terminology. The heat and flames began melting and damaging wiring and other plastic and electrical components just outside the burner compartment. A glowing piece of carbon or hot melted plastic dropped down onto the combustible material stored below as an ember and source of ignition.</i></p>
<p>Facts and evidence</p>	<ul style="list-style-type: none"> <li><i>-The left most heat exchanger passageway was completely plugged with soot .Pictures were taken to show this and can be seen below.</i></li> <li><i>-Flame pattern on the outside of the unit heater suggest that a flame rollout occurred burning the paint off of the outside of the heater. (See pictures)</i></li> <li><i>-Melted wiring and other electrical components also suggest that a flame rollout occurred overheating the wiring and components.</i></li> <li><i>-Eye witness accounts stated that the flames from the burning cardboard did not reach high enough to come into contact with the heater, suggesting that the source of ignition came from the heater itself.</i></li> <li><i>-Questions were asked regarding maintenance intervals for these appliances. No record of service could be produced.</i></li> <li><i>- The equipment manufacturer states that the appliance and components need to be serviced and checked annually in the owner’s manual.</i></li> <li><i>-The unit heaters were approximately 7 years old based on the unit serial numbers and the age of the building.</i></li> <li><i>-The high location of these heaters make it doubtful that anyone working in the warehouse would have noticed any abnormalities with the appliance as they carried out their day to day operations.</i></li> </ul>
<p>Causes and contributing factors</p>	<p><i>It is very likely that a dirty burner caused the heavy accumulation of soot in the heat exchanger. This ultimately led to the rollout condition that melted other plastic and electrical components on the appliance. It is also very likely that a flaming piece of these components dropped onto the combustibles below and started the fire.</i></p>



Pictured above is a typical warehouse heater (Unit heater) in normal working condition.

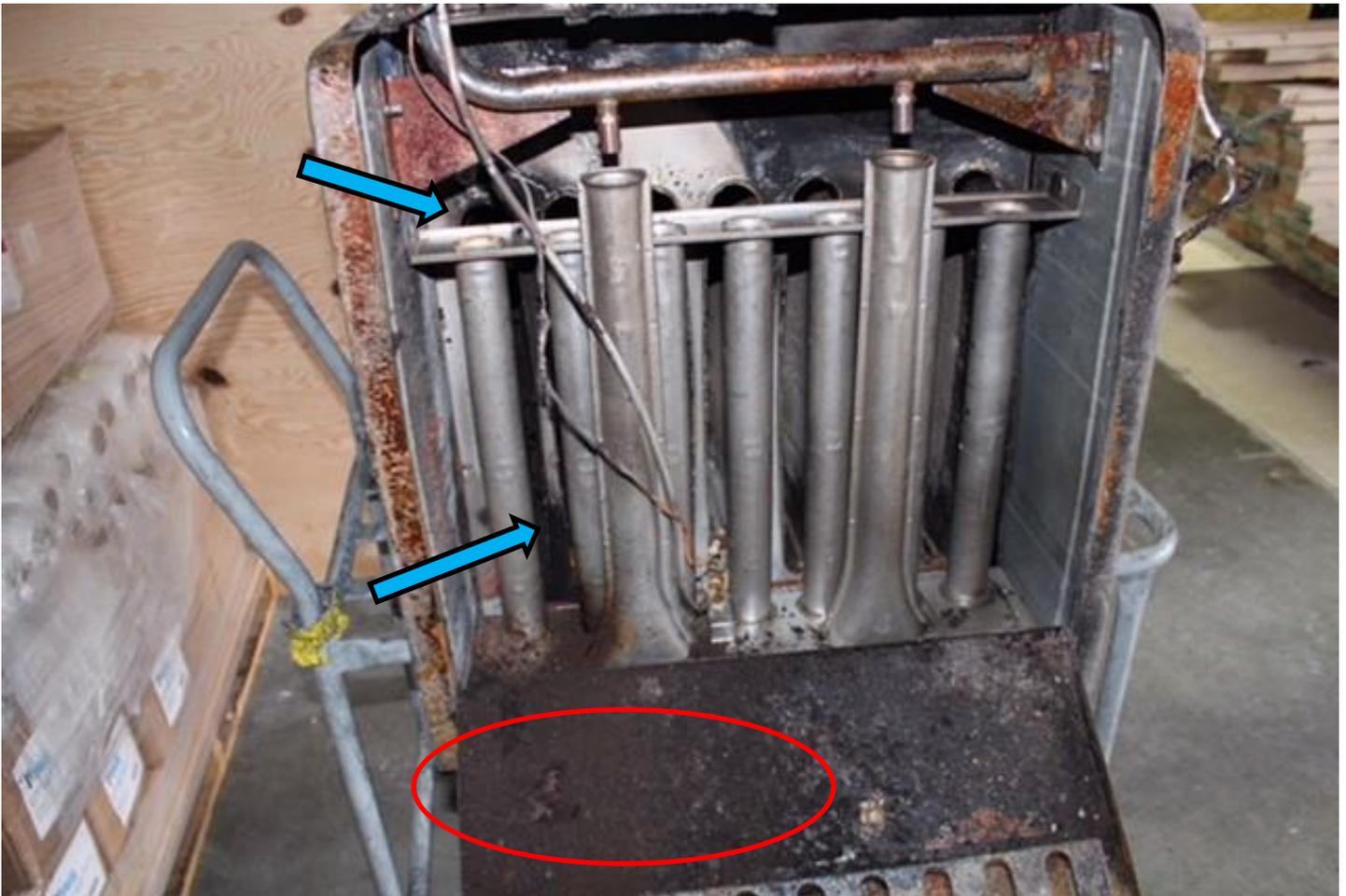


Looking up at the burners and flue passageways on a heater in good working condition.

-The red oval circles the flip down burner access tray, no signs of dirt, debris or soot.

-Yellow arrows pointing right show the flow of gas through the manifold , with the yellow arrows pointing down to where natural gas is fed into the burners through the orifices.

-Blue arrows are where air is drawn in and mixed with the natural gas



A view of the burners of the damaged heater. This heater was removed from site and is currently laying on it's side on a dolly for easy inspection.

-Red oval circles the left side of the flip down burner access where allot of soot, rust and debris can be seen.

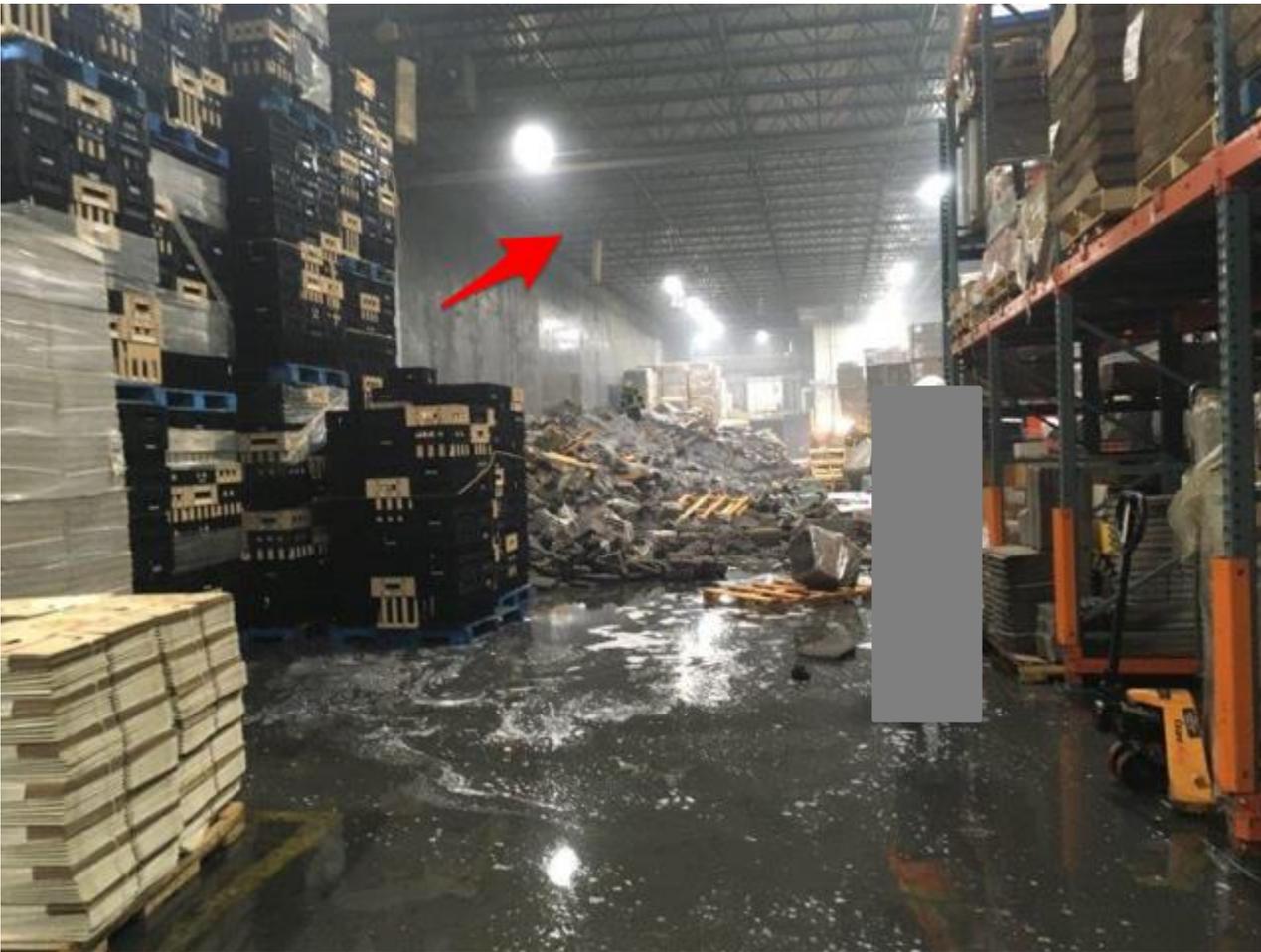
-blue arrows point to the left most burner and heat exchanger passage way.



Picture above: This is a close up of the left most flue gas passage way. This is caked on soot that accumulated on the walls of the heat exchanger and completely plugged this passage. For normal operation this needs to be totally unrestricted.



The flame pattern seen here suggest that a flame rollout occurred, causing the flames to lick the bottom and side of the heater.



Fire damaged combustibles laying in a pile. The red arrow points to the approximate location where the heater was hanging from the ceiling.



Another heater in the same warehouse can be seen hanging high above the skids of material.