

## Incident Summary #II-1674930-2024 (#44402) (FINAL)

SUPPORTING INFORMATION	Incident Date	February 18, 2024	
	Location	Smithers	
	Regulated industry sector	Gas - Natural gas system	
	Impact	Qty injuries	1
		Injury description	An occupant returned home to find their pet deceased near the mechanical room. The occupant had been getting headaches and feeling drowsy over the past few months. A visit to the emergency room confirmed the occupant had been poisoned due to carbon monoxide (CO) exposure inside their home.
		Injury rating	Moderate
	Damage	Damage description	A clogged heat exchanger and vent restricted the flow of the flue gases to outside causing incomplete combustion and high levels of carbon monoxide spilling into occupied space of the home.
		Damage rating	Major
	Incident rating	Major	
	Incident overview	A Superhot atmospheric boiler used to heat a house was venting its products of combustion into the home. The homeowner found his pet deceased on the floor near the mechanical room and called the local authorities to check his gas system. The homeowner had been experiencing symptoms of CO poisoning for some time.	
INVESTIGATION CONCLUSIONS	Site, system and components	<p>The boiler has a heat exchanger consisting of pipes containing the fluid being heated. The pipes are finned to assist in gathering heat from the flame. This heat exchanger is located between the main burner of the boiler and the venting used to vent the products of combustion outside. When a call for heat is initiated, the flame will heat up the exchanger while a pump is used to push the fluid through the exchanger, the products of combustion are then vented to the outside.</p> <p>A by-product of incomplete combustion is carbon and soot that can adhere to interior surfaces, building up and leading to restriction of the flue passages and burner compartment. If not serviced and cleaned, these restrictions caused by incomplete combustion can grow exponentially, causing more issues over time.</p>	
	Failure scenario(s)	<p>The fins on the boiler were clogged with soot and carbon from incomplete combustion. The boiler has been used for over ten years with no periodic maintenance completed. The soot carried through from the top of the heat exchanger through to the venting.</p> <p>When the heat exchanger was blocked, the flue gases could not be safely removed from the appliance and needed to find other ways to escape. Unvented flue gases, which contained carbon monoxide that is harmful to occupants of the home, slowly filled the home.</p> <p>There were no functional CO detectors in the home.</p>	

## Incident Summary #II-1674930-2024 (#44402) (FINAL)

<p>Facts and evidence</p>	<p>Occupant Statement:</p> <ul style="list-style-type: none"> <li>• Had symptoms of headache and tiredness for many months.</li> <li>• His pets were sick at first, they thought it was linked to their food.</li> </ul> <p>Site Observation:</p> <ul style="list-style-type: none"> <li>• Soot was present throughout the boiler after the heat exchanger.</li> <li>• There was a 4" combustion air duct located in the mechanical room.</li> <li>• Gas piping system was sized according to code requirements.</li> </ul>
<p>Causes and contributing factors</p>	<p>The flue and the appliance heat exchanger were covered in soot. The soot shows that the combustion of this boiler was incomplete. This combustion process was, over time, blocking the heat exchanger and lining the venting with soot, limiting the ability of the flue gases to be vented through the vent stack.</p> <p>Factors that contributed to the incident were:</p> <ul style="list-style-type: none"> <li>• The boiler had been in service for many years, without any periodic maintenance or service by a qualified individual.</li> <li>• No carbon monoxide alarms were in the home.</li> </ul>



Image 1 - Soot blocking heat exchanger. The fins are covered in soot. This photo was taken after the unit failed. A gas fitter tried to clean after the fact as well.





Image 2 - Burner compartment. The atmospheric burners were in this space. The soot at the rear of the burner compartment and cracking of refractory likely caused by flame impingement.



Image 3 - Top cover of the heat exchanger. This will seal in the burner compartment from the outside of the boiler and convey flue gases through the centre hole to flue.



Image 4 - Soot inside flue. Soot is located through the flue to termination, this proves there was incomplete combustion during usage.