

## Incident Summary #II-814368-2019 (#11013) (FINAL)

SUPPORTING INFORMATION	Incident Date	February 19, 2019	
	Location	Abbotsford	
	Regulated industry sector	Gas - Natural gas system	
	Impact	Qty injuries	8
		Injury description	5 adults and 3 Children were taken to hospital after being exposed to carbon monoxide .
		Injury rating	Minor
	Damage	Damage description	Venting connector for residential furnace and water heater became dislodged from a vertical chimney.
		Damage rating	Moderate
	Incident rating	Moderate	
	Incident overview	<p>Occupants within a home began to feel ill and uncomfortable. Several of the occupants reported developing a headache.</p> <p>Emergency services were called and initial report was that occupants thought there might be some type of gas leaking inside the home.</p> <p>First responders used a gas analyser to determine carbon monoxide was present at a level of 100 parts per million.</p> <p>All 8 occupants were evacuated and sent to hospital to be treated for carbon monoxide exposure.</p> <p><i>1 part per million (ppm) =1 part of carbon monoxide gas per 1 million parts air by volume.</i></p>	
INVESTIGATION CONCLUSIONS	Site, system and components	<p>Gas appliances such as furnaces and water heaters need to be connected to effective venting and chimneys so that all the exhaust flue gases are safely vented to the outdoors. Any connections or fittings need to be secured to each other by use of sheet metal screws or mechanical fasteners.</p> <p>Carbon monoxide is the result of incomplete combustion however even under normal circumstances it can be present within the flue gases.</p> <p>A few attributes of Carbon monoxide to be aware of are as follows,</p> <p>Carbon monoxide is commonly referred to as <b>CO</b> and is:</p> <p><b>Colourless</b>- Cannot be seen</p> <p><b>Tasteless</b>- Cannot be detected by sense of taste</p> <p><b>Odourless</b>- Cannot be detected through sense of smell, however, CO can also be accompanied by aldehydes. Aldehydes' odour can somewhat resemble vinegar, which can be detected by sense of smell, and may also result in a metallic taste in the mouth.</p> <p><b>Toxic</b>- Can cause death if enough is absorbed into the bloodstream.</p>	

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Failure scenario(s)	Over the years this venting system was subject to expansion and contraction when heating up and cooling down as well as vibrations from the connected furnace and blower motor. Eventually this caused the vent to dislodge from where it was friction fit into the vertical chimney.
Facts and evidence	<ul style="list-style-type: none"> <li>-Vent connector was found dislodged from chimney connection (See <b>picture 1</b>)</li> <li>-Furnace filter was extremely dirty and plugged.</li> <li>-100 ppm CO reading was confirmed.</li> <li>-Weather was cold, resulting in longer run times of the furnace and more flue gases spilling into the basement.</li> </ul>
Causes and contributing factors	<p>The furnace/ water heater vent connector fitting was not secured to the vertical chimney by way of screws or other fasteners. This operated without incident for many years however eventually became dislodged. It is likely that a dirty/unbalanced furnace blower wheel or worn bearings caused increased vibration the past few years resulting in further dislodging of the vent.</p> <p>Another factor that may have contributed to the carbon monoxide being dispersed throughout the home is the badly plugged furnace air filter. If such a filter is plugged, normal airflow through the return duct will be restricted and air can be drawn into the blower downstream of the plugged filter. In this case, the flue products that had spilled into the space around the furnace, may have been drawn into the blower and mixed with the supply air feeding the warm air ducts throughout the home. (See <b>Diagram-1</b> below)</p>



**Picture 1-** Yellow arrows point to where flue gasses were spilling from dislodged vent. Horizontal section of vent is where water heater is connected into furnace vent.



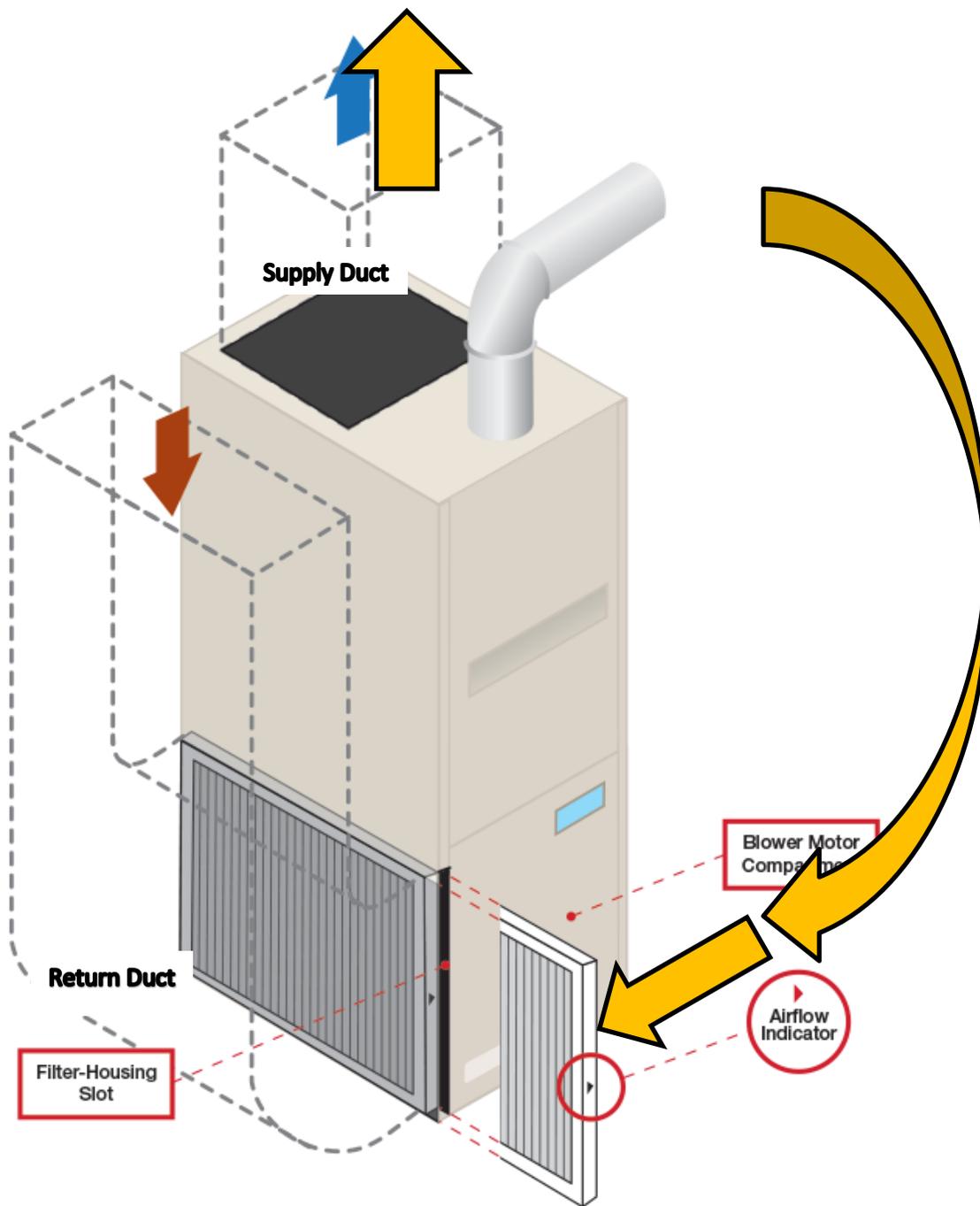
**Picture-2**

Furnace vent elbow pictured above , connects directly to vent connector in **Picture-1** ( Yellow arrow points to where elbow was connected to the dislodged vent seen in **picture-1** )



**Picture-3**

Above: Vintage furnace Circa 1970's. See filter missing cover plate in bottom left hand corner.



**Diagram-1-** If the furnace filter becomes plugged, the increased restriction can cause the blower motor to draw air/ spilled products of combustion into the furnace downstream of the filter and distribute them through the home.

*-Yellow arrows above show how these flue gases from the dislodged vent could have been drawn into the blower and pushed throughout the home via the supply duct.*