

Incident Summary #II-1457097-2022 (#30224) (FINAL)

SUPPORTING INFORMATION	Incident Date	October 23, 2022	
	Location	Coquitlam	
	Regulated industry sector	Gas - Natural gas system	
	Impact	Qty injuries	4
		Injury description	An explosion in the attic space of the house during a fire, caused the ceiling drywall and insulation to drop down onto responding firefighters leading to 4 minor injuries including bruises and strains.
		Injury rating	Minor
	Damage	Damage description	Structural fire damage to the fireplace vent chase and attic space of the house.
		Damage rating	Major
	Incident rating	Major	
Incident overview	A fire occurred inside the enclosed wall space around a natural gas fireplace and its associated venting system in a residential home.		
INVESTIGATION CONCLUSIONS	Site, system and components	<p>The fireplace in the home is constructed of an outer metal shell surrounding an internal metal firebox which contains the flame and transfers the flue gases to a venting system that is connected to it. The flame and flue products do not come in contact with the fireplaces outer metal shell.</p> <p>The fireplace uses natural gas to produce a decorative flame and heat. The natural gas is controlled by a gas valve and a pilot light with a safety circuit. When the pilot light is proven by the safety circuit it will allow gas to flow through the gas valve to the burner when a connection is made between the thermostat terminals of the gas valve. A wall switch is connected by wiring to the thermostat terminals allowing the fireplace to operate continually when the switch is turned on. The pilot light assembly utilizes a thermopile to generate millivolt electricity from the heat of the pilot flame. The millivolt electricity is used for the gas valve solenoid so the fireplace can operate without the need for household electricity.</p> <p>The fireplace uses natural convection (the rising of warm air) to draw air in for combustion and to vent the hot flue gases directly to the outdoors through a Type B vent piping system. A Type B venting system protects combustible materials from the high temperatures of the flue gas and is comprised of interlocking insulated pipes and adjustable elbows which are required by code to be supported independent of the appliance. Type B venting systems are required to maintain a clearance to combustible material of 1" (25mm). The venting system in the home uses a metal plate attached to wooden framing and a clamp-on support collar to maintain clearances to combustibles and support the venting system.</p>	
	Failure scenario(s)	A gas fireplace was installed in a residential home approximately 30 years ago. The rear of the fireplace and the venting system were enclosed in a wall cavity like a typical installation. Water and condensation leaked into the wall cavity and over time led to damage to the wooden construction supporting the vent and created corrosion holes in the venting system and fireplace. The corrosion and structure damage	

caused the venting system to collapse under its own weight and effectively separate allowing heat and flue gases to escape into the enclosed wall cavity.

The day of the incident the fireplace was turned on with the wall switch and left operating continuously for approximately five hours. The hot flue gases escaped through the openings in the venting within the wall cavity causing pyrolysis (decomposition of the wood into charcoal) of the nearby combustible wood construction eventually leading to the ignition of a fire in the enclosed space.

As the fire progressed up the enclosed space, gases produced by the fire accumulated in the attic space and eventually ignited causing an explosion which forced the ceiling drywall down on top of fire fighters inside the home ([Photo 9](#)).

Facts and evidence

Witness statements

- The day of the incident there was a family gathering at the house and the fireplace had been turned on and left on continuously for up to 5 hours.
- A loud noise was heard from the roof and the fireplace began to operate with abnormal flame characteristics that seemed larger than normal.
- The fireplace switch was then turned off, but the fireplace continued to operate.
- Smoke began to emit from the wall sconces beside the fireplace and the occupants exited the home and called 911.

Site observations

- The venting for the furnace had collapsed and effectively separated ([Photo 4-5](#)).
- The venting elbow connecting to the fireplace and the top of the fireplace enclosure had corrosion holes ([Photo 5-6](#)).
- A large corrosion hole was observed on the top left of the fireplace outer casing, but the inner metal firebox was still intact ([Photo 7](#)).
- A decal on the fireplace identified the age of the appliance as 30 years old
- Fire patterns suggest the point of the fire origin was the combustible framing within the first 4 feet above the top of the fireplace.
- No evidence of a natural gas leak was found on the supply line or gas train of the fireplace.
- Some of the remaining undamaged wood construction within the wall cavity space showed evidence of rot from moisture and condensation over time.
- The thermostat wires from the wall switch to the gas valve were observed to have the insulation melted away and the bare conductors contacting each other.
- The fireplace venting was observed having a metal support plate and collar installed on the piping.
- No other ignition sources were found around the fire origin.
- No evidence was found of a gas leak from the gas system in the home that could have contributed to the explosion in the attic space.

Causes and contributing factors

It is highly likely a failure of the building envelope allowed water and condensation to enter the enclosed wall cavity which caused damage to the wooden venting support structure and corrosion of the vent which compromised its strength causing it to collapse and separate. The separated vent allowed escaping heat and flue gases to start the fire.

It is probable that heat in the wall cavity caused the thermostat wire insulation to melt and the bare conductors to contact each other which contributed to the incident by allowing the fireplace to continue operating when the wall switch was turned off.



Photo 1 – Street View from Google Maps with **RED** box showing the fireplace venting before the incident.



Photo 2 – RED box showing gas fireplace venting chase after the incident.



Photo 3 – Gas fireplace and damaged venting and vent chase.



Photo 4 - Gas fireplace showing fire damage and collapsed venting.

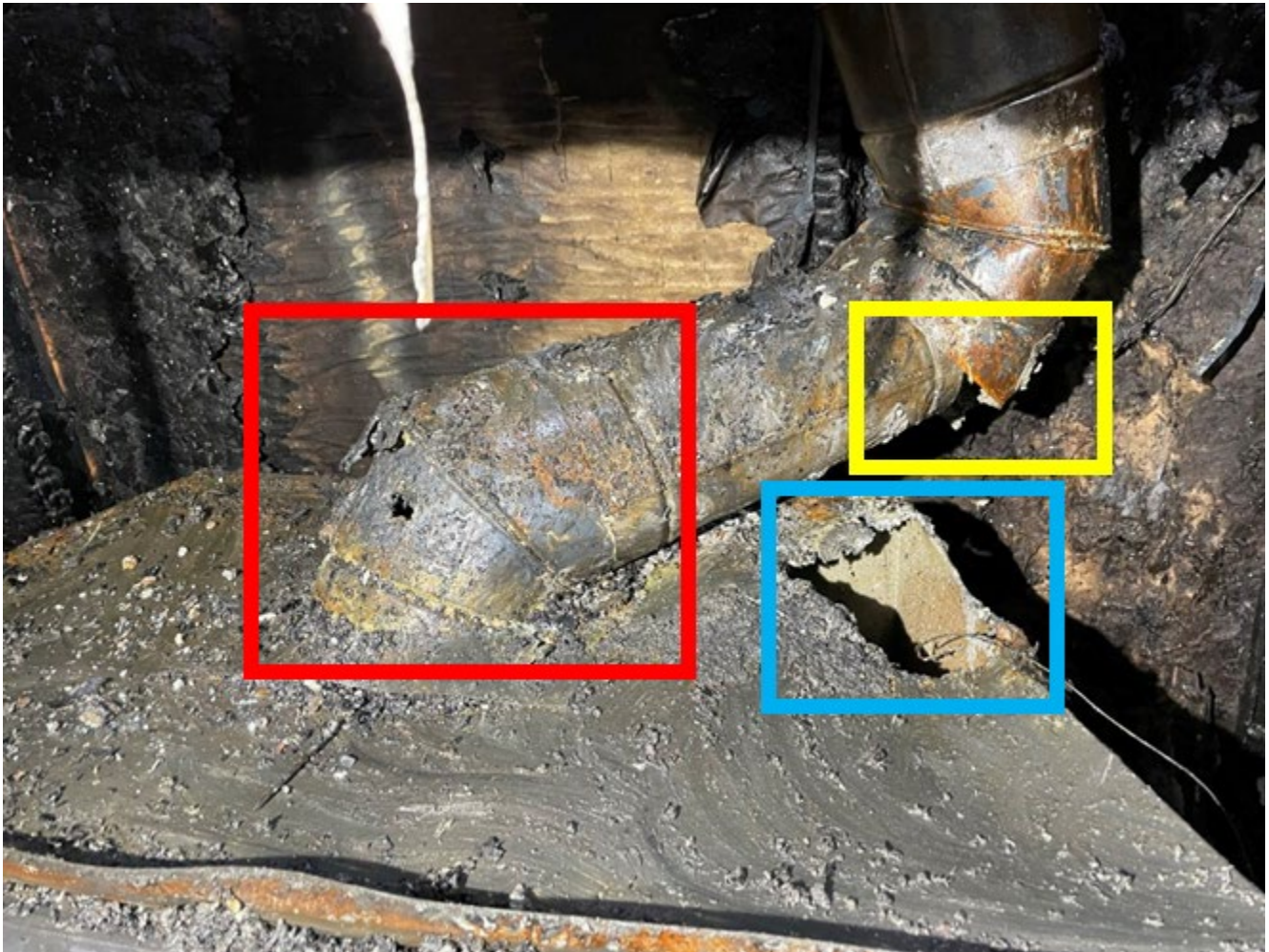


Photo 5 – Top of fireplace and venting. **RED** box showing corrosion holes in venting elbow. **BLUE** box showing corrosion hole in fireplace outer cabinet. **YELLOW** box showing separation of venting pipe from piping elbow.

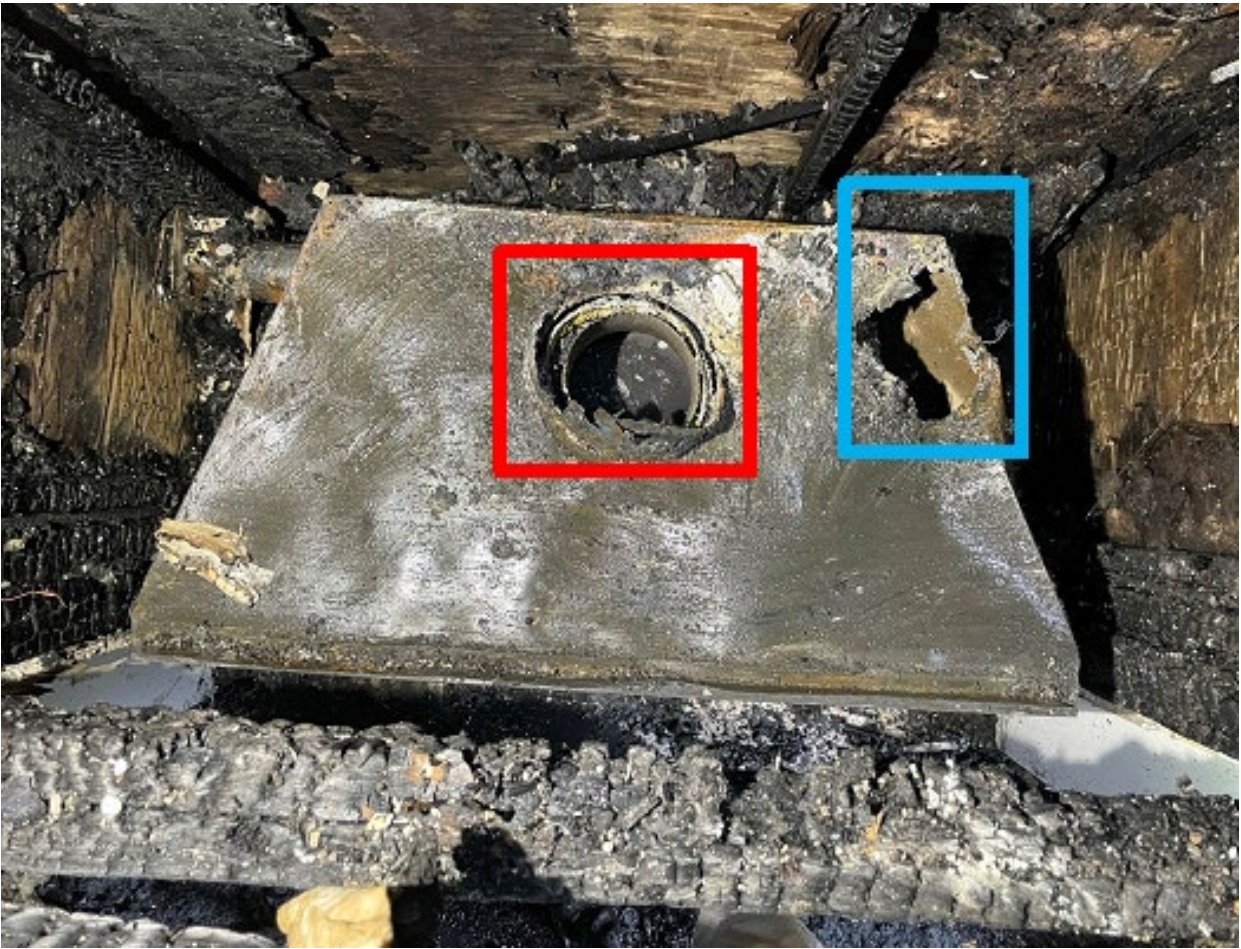


Photo 6 – Top of fireplace with venting removed. **RED** box showing corroded venting outlet. **BLUE** box showing corrosion hole in the fireplace outer cabinet.

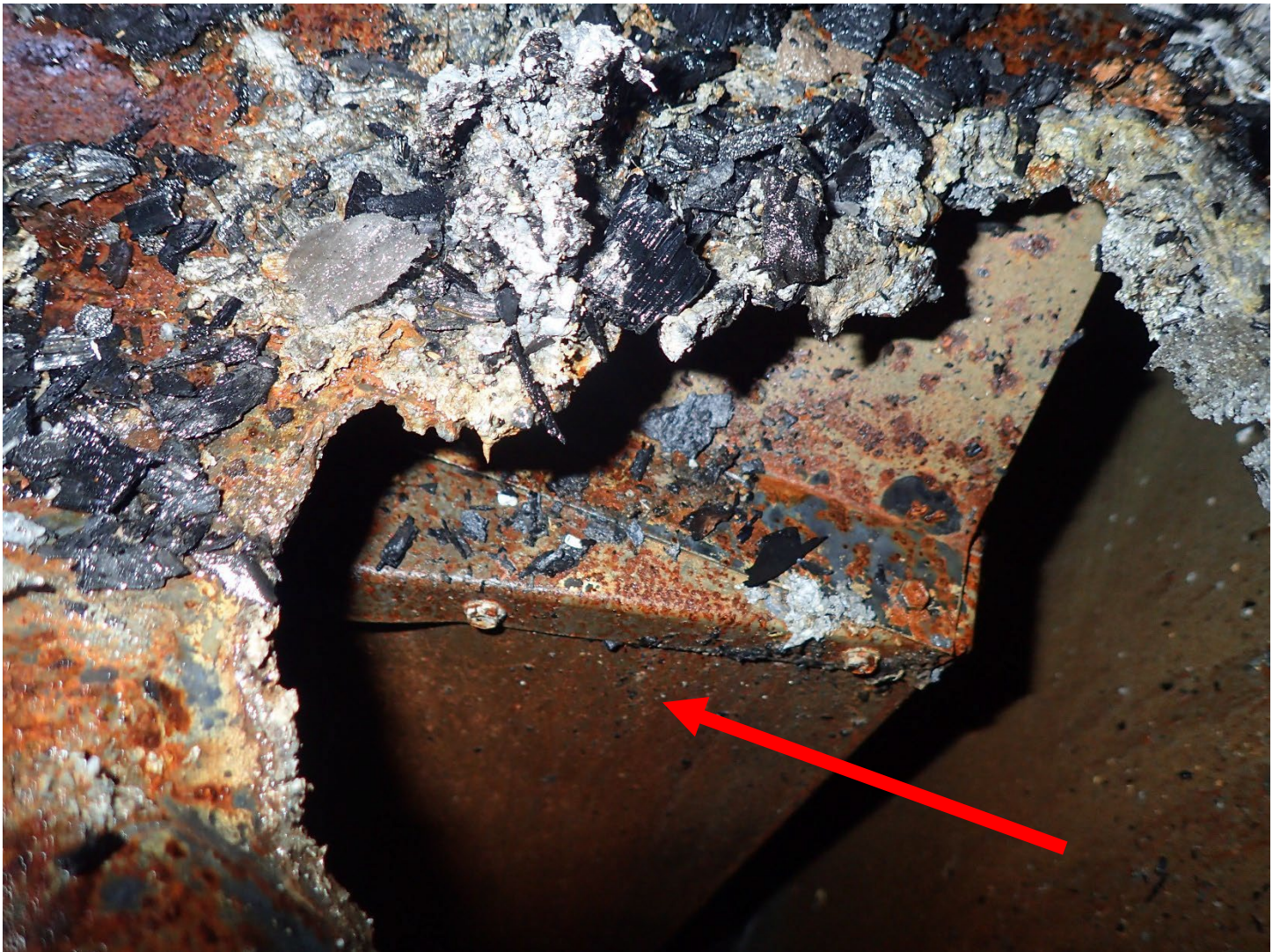


Photo 7 – Closeup of the corrosion hole in fireplace outer cabinet. **RED** - shows undamaged internal metal firebox.

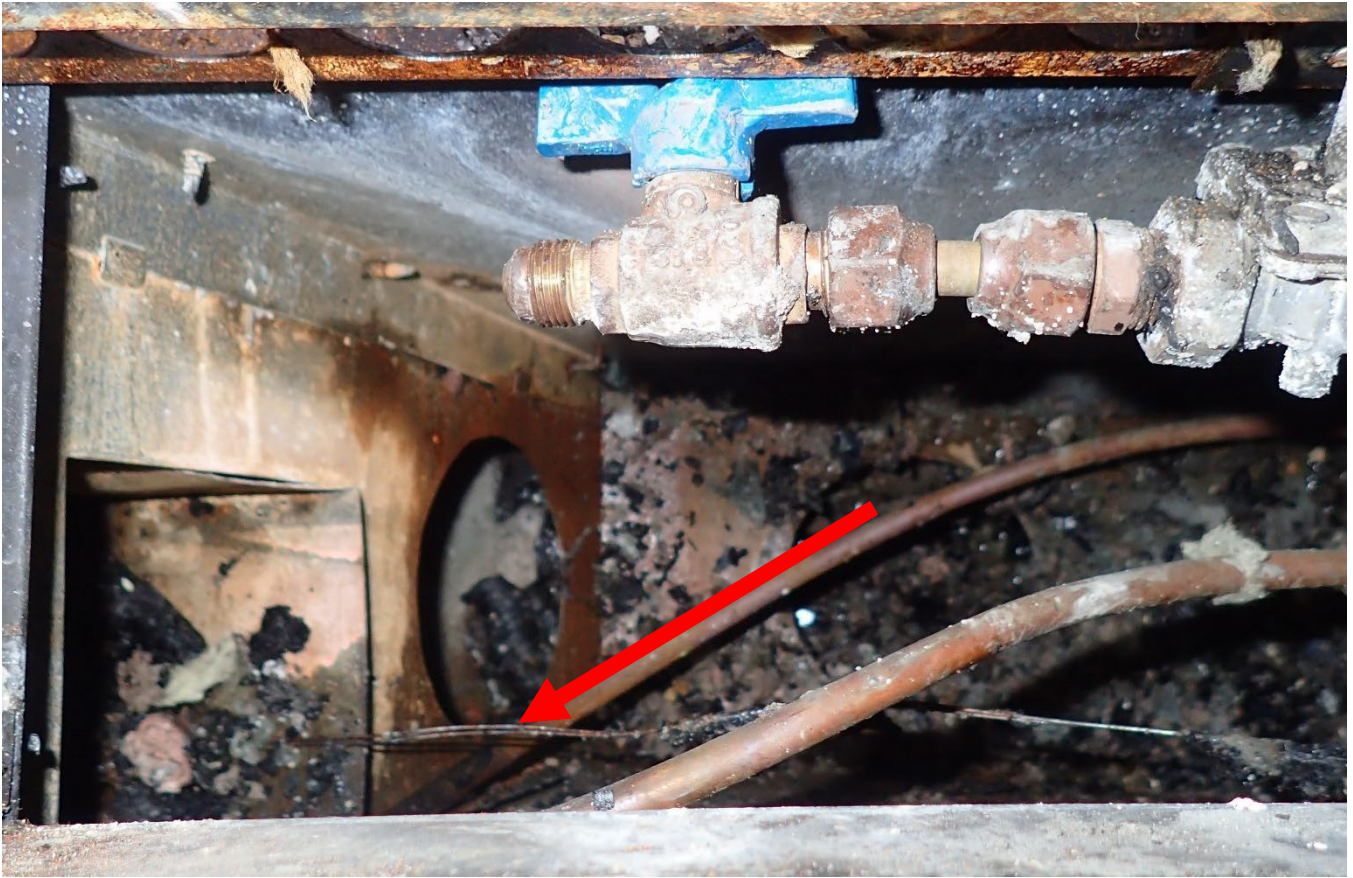


Photo 8 – The gas fireplace lower opening. **RED** - shows the thermostat wires from the wall switch to the gas valve with the outer insulation melted and bare wires contacting each other.



Photo 9 – Ceiling space above the fireplace showing the result of the explosion forcing the drywall and insulation down and subsequent fire damage.