Incident Summary #II-1264711-2021 (#24310) (FINAL)

SUPPORTING INFORMATION	Incident Date		October 4, 2021
	Location		Surrey B.C.
	Regulated industry sector		Gas - Natural gas system
	Impact – Injury	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Impact – Damage	Damage description	A 65 U.S. Gallon water heater in a commercial application serving domestic hot water to an apartment building caught fire resulting in damage to the regulated gas appliance.
		Damage rating	Moderate
	Incident rating		Moderate
	Incident overview		During operation of a Category I water heater in a mechanical room serving a commercial building, the water heater caught fire resulting in the fire alarm system going off and notifying emergency services. Minor damage to the water heater resulted from the fire. A gas contractor was on site at the time of the fire working on other equipment in the mechanical room and they extinguished the fire by means of a fire extinguisher.
INVESTIGATION CONCLUSIONS	Site, system and components		Potable water is heated through a certified gas appliance that serves a building. The gas appliance installation shall follow local codes, regulations and manufactures specifications. The proper permits shall be obtained to inspect and confirm compliance of the installation. This is required by the *Safety Standards Act*. A category I gas appliance is defined as an appliance that operates with a non-positive vent static pressure with a flue loss not less then 17%. As per the gas code “a vent or chimney shall provide effective venting and shall be designed and constructed to remove all flue gases to the outdoors”. Proper venting of flue products for a category I appliance is achieved by following good engineering practices. Draft is obtained by the flue gases being less dense and at a higher velocity in the vent then the atmospheric air on the outside of the appliance burner and vent. Outside air enters the draft hood and assists in venting of the flue gases. Flame rollout is a hazardous condition where the venting of flue products is not taking place and the flame has nowhere to go other then rollout the front of the unit where the burner is located. Air supply is defined as combustion air, excess air, primary air, secondary air, and flue gas dilution air. All of which is required for proper combustion of natural gas and proper venting of flue products for a category I gas appliances. Air supply is provided by ducting from the outdoors and terminated on the outside with a grill to prevent animals and foreign debris from getting into the ducting.

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	Aldehydes can be produced by improper venting of flue products causing condensing of the flue products. Aldehydes have a sharp penetrating odor and can generate a white powdery residue on surfaces. (Image 1-2). The Safety Standards Act is a regulation set out by the B.C. government for gas contractors and gas fitters to follow regarding compliance with local codes and permits for regulated equipment.
Failure scenario(s)	- The installation of the water heater by a previous gas contractor was done with no permit and not following the B149.1-15 gas code. - The 24" diameter B-vent stack was originally designed to only serve the original boiler of the mechanical room. The water heater was installed for a temporary fix to provide the building with hot water. Improper vent sizing and vent connections took place for the installation of the water heater and venting. - The water heater was venting into an existing 24" diameter B-vent style venting system. The draft hood vent connector size for the water heater is 8" diameter. - The air supply for the mechanical room was completely plugged on the outside of the building. This situation created difficulties in drafting of the flue gases of the water heater (Image 3-4). - Another gas contractor serviced the water heater after the water heater had been in operation for 1 year and two months. This service was observed to be inadequate as no recommendations were made to correct the non-compliances subject to gas code. Testing for proper drafting of the water heater was not completed. - Over time because the water heater had inadequate draft, flue gases started condensing causing residue to build up in the heat exchanger and within the venting system. Build up of residue restricted the water heater venting through the heat exchanger and venting system. - During the installation of other gas equipment within the same mechanical room, a gas contractor noticed the water heater showed signs of flame roll out days before the fire took place. Plans were made to address the issue but no immediate attempt to mitigate the issue was performed. - This condition eventually led to flame roll out at the burner causing a fire.
Facts and evidence	An invoice provided by the strata management of the building shows the installation of the water heater was performed on 03-23-2020. A search for a permit performed and a conversation with the installing contractor proved no permit was obtained for the installation of the water heater. An invoice provided by the strata management of the building shows the inadequate service of the water heater was performed on 05-11-2021. After the fire, the contractor on site installed a like for like installation of a new water heater to temporarily provide hot water to the building while finishing the new boiler installs that would eventually provide full time heating and domestic hot water. A combustion analysis was performed of the water heater installed the same way as the previous water heater. The analysis showed the new appliance venting with inadequate draft in the venting system. This took place in October which is optimum venting conditions due to the density of the outside air. A combustion analysis was provided from a gas contractor along with a verbal statement of the findings of the temporary tank installation. (Image 7)

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	Visual inspection of the venting system was observed and photographed showing the water heater venting into an oversized B-vent to the roof. Visual inspection of the venting system and the gas appliance that caught fire showed a build up of residue (Image 2). Conversation with the onsite workers and the gas contractor confirmed the conditions were properly documented in the photos they provided.
Causes and contributing factors	It is very likely that due to the non-compliant installation of the oversized venting system serving the water heater, proper draft was not obtained. Over time residue built up in the venting and heat exchanger restricting the flue passages. The restricted venting caused the hot water heater's burner flame to roll out of the appliance causing heat and fire damage to the bottom and sides of the water heater. Improper gas contractor servicing took place during the lifetime of the water heater. These conditions contributed to the eventual flame rollout and fire, damaging the regulated gas appliance.

Image 1 – Showing fire damage to the flame safeguard wiring of the water heater and build up of residue on the gas valve. Taken by safety officer on site.

Image 2 – Showing the water heater that caught fire showing evidence of residue on the burner and bottom of the water heater. Taken by the gas contractor on site and submitted to Technical Safety B.C.

Image 3 – Showing the plugged outside air supply termination.

Image 4 - Showing the plugged grill for the air supply for the mechanical room.

Image 5 – Showing the water heater after the fire with smoke damage and evidence of residue on the floor. Submitted by the gas contractor to Technical Safety B.C.

Image 6 - Showing the installation of the new temporary water heater venting in the exact same location and venting style as the water heater that caught fire. (Arrows showing the 8” C-vent making a non-compliant adaption to the 24” B-Vent).

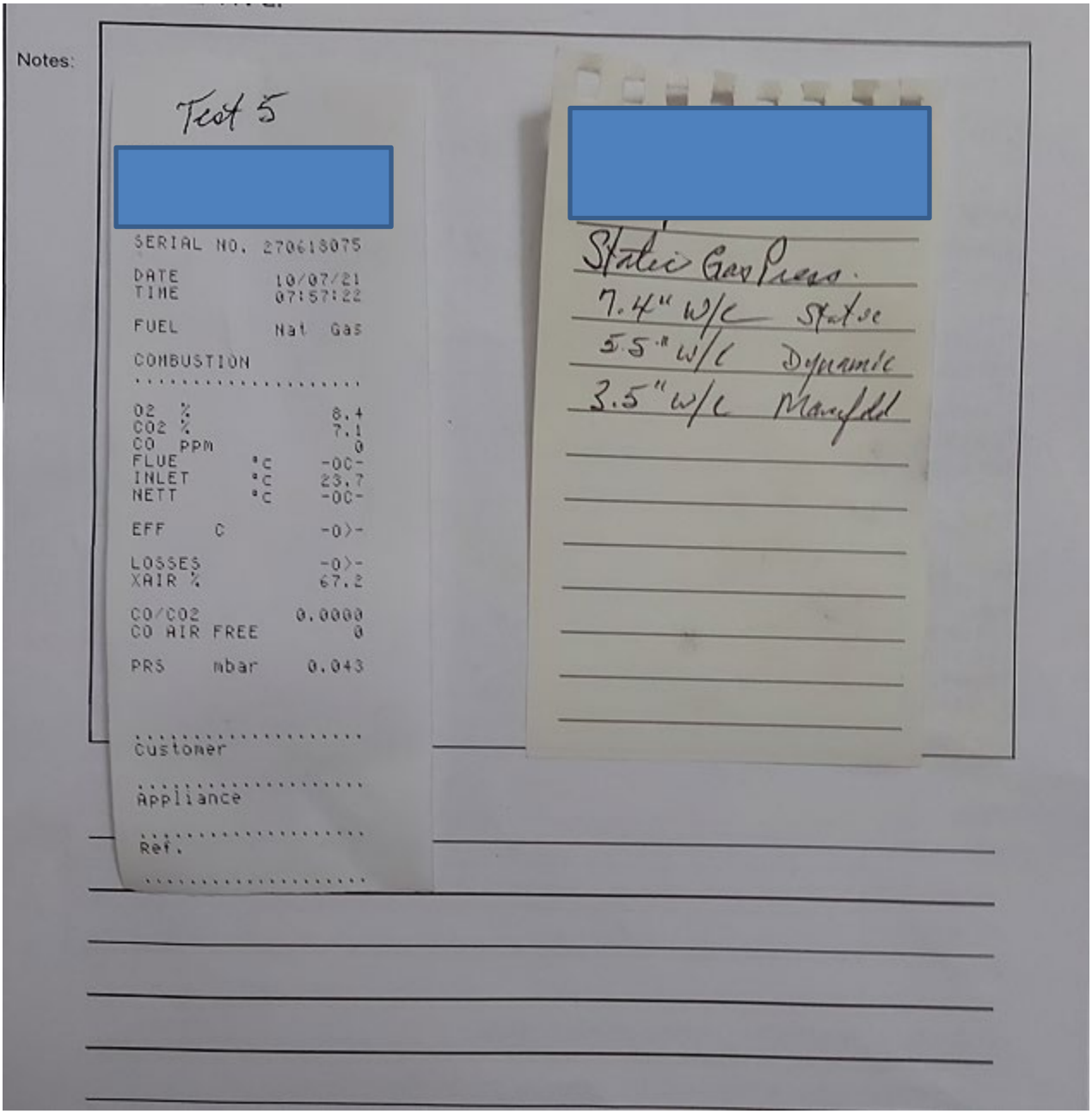

Image 7 – Combustion analysis data sheet of the temporary water heater installed with non-compliant over sized venting. Supplied by the gas contractor.