Incident Summary #II-1674372-2024 (#44359) (FINAL)

SUPPORTING INFORMATION	Incident Date		February 15, 2024
	Location		Penticton, BC
	Regulated industry sector		Gas - Propane system
	Impact – Injury	Qty injuries	1
		Injury description	Burns to hands and face.
		Injury rating	Major
	Impact – Damage	Damage description	Trailer subjected to explosion and is a total loss.
		Damage rating	Severe
	Incident rating		Severe
	Incident overview		A recreational vehicle (RV) trailer exploded with a single occupant inside after a new propane cylinder was attached to it. The RV trailer was located at an RV park and was being lived in full time.
INVESTIGATION CONCLUSIONS	Site, system and components		Propane gas is stored in liquid state in cylinders on the front of a trailer. It is piped to appliances via a propane piping system. This system can be composed of black malleable iron fitting or soft copper tubing. If the ends are left open or if there are leaks, propane can find a source of ignition and ignite. If the propane is in the correct concentration when it finds a source of ignition it may explode. The alteration of gas systems and piping in BC, including adding, replacement or removal, is regulated work. An individual must not perform regulated work in respect to a gas system unless the individual is authorized or qualified to do the work.
	Failure scenario(s)		Propane was being used as a fuel for cooking and heating water in the trailer. Three weeks prior to the explosion, the occupant of the trailer ran out of propane. During the three-week period between the propane running out and the explosion the occupant was performing renovations on the bathroom in the rear of the trailer. These included removing the shower and relocating a wall. During these renovations the copper propane line to the water heater was cut in two places. The occupant purchased a new 100 lb propane cylinder because they wanted more propane storage and replaced one of the propane hoses with a longer one to attach the larger cylinder to the trailer. The occupant turned on the propane cylinder to the trailer and heard a hissing noise, they also note that the propane regulator appeared to be vibrating. The occupant entered the trailer and turned on the stove and oven within the trailer. Although there was a propane detector installed within the unit the occupant did not hear it alarming. The propane leaked from the open propane line which had been cut inside the trailer. The leaking gas accumulated and contacted a source of ignition which resulted in an explosion.

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Facts and evidence	• An investigation performed by a TSBC gas safety officer and an independent fire investigator found a new 100 lb propane cylinder had been installed at the front of the trailer and the propane hosing had been modified to accommodate the bigger tank. The shorter piece of propane hosing was found within the trailer and an invoice for a new piece of propane hosing was found within the trailer proving the system was modified. • The center burner of the trailer's stove was found in the "Lite" (Fully open) position after the explosion occurred. • The investigation found evidence renovations were occurring in the back of the trailer, this included a reciprocating saw in the room where the renovations were occurring. An interview with the victim also confirmed that renovations had been occurring in the rear of the trailer at the time of the incident. • The copper propane line serving the water heater was found cut in two places and roughly 15 inches of soft copper tubing could not be located on the site after extensive searching. • Cut marks in the copper tubing as well as in the insulation on the side of the water heater, and no evidence of crimping, tearing, or other mechanical damage from the explosion could be found on the two cut ends of the copper tubing. Copper material was also observed on the blade of a reciprocating saw found in the bathroom at the time of investigation. • Burn patterns consistent with a burning fuel leak could be found on the floor around the cut supply end of the copper propane tubing. • Witnesses indicated extinguishing a jet of flame from that location after the explosion. • Video obtained of the explosion shows a flame front propagating from the back of the trailer to the front of the trailer as well as the occupant within the trailer when the explosion occurred. • During an interview with the Owner/Occupant of the trailer they admitted to installing the new propane cylinder and hoses. The owner occupant was neither a certified gas fitter, nor a licensed gas contractor. • The Owner/Occupant admitted during an interview, when the propane from the cylinder was turned on a loud buzzing noise and vibrations from the regulator were observed, which is consistent with an open propane line.
Causes and contributing factors	It is very likely that propane found its way out of the open gas line and accumulated to an explosive accumulation before it found a source of ignition leading to the explosion. The regulated work of altering the propane gas line in the trailer, being performed by an unqualified, unlicensed individual likely contributed to this incident.

Image 1 - Incident scene at time of investigation.

Image 2 - Alternate angle of incident scene.

Image 3 - Propane cylinders mounted on front of trailer, including new 100lb propane cylinder and modified supply hose.

Image 4 - Stove at time of investigation with red box showing center knob in “Lite” position.

Image 5 - Close up stove knob in “Lite” position.

Image 6 - Trailer water heater at rear of unit.

Image 7 - Interior of trailer water heater showing piping configuration. Arrow indicates propane supply piping.

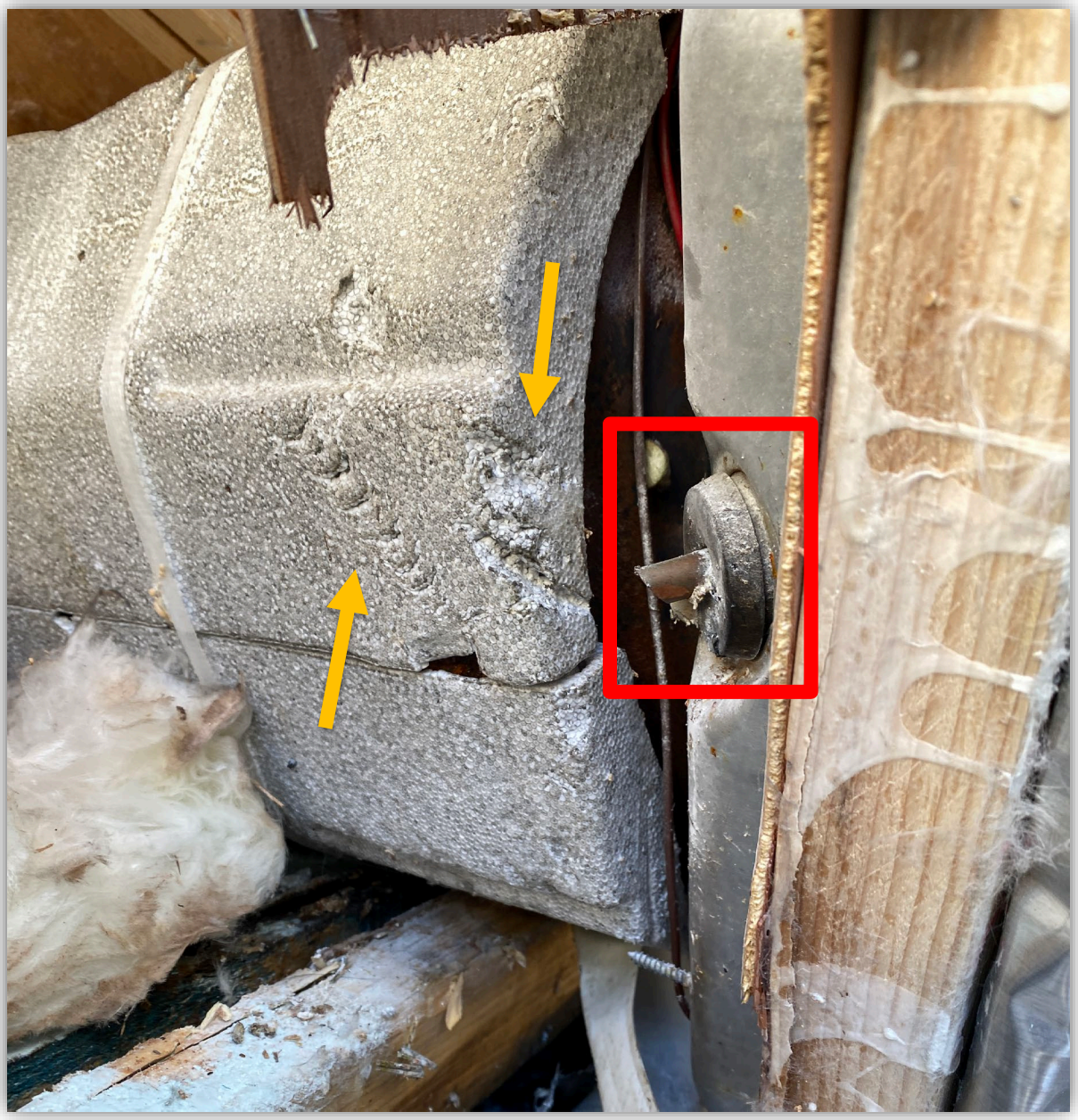

Image 8 - Side view of water heater showing copper propane tubing. Arrow indicates cut marks found in water heater insulation.

Image 9 - Alternate view of propane tubing connection to water heater.

Image 10 - View of bathroom at time of investigation. Arrows indicate area where copper propane tubing left floor and connected to water heater. Note burn marks around where propane tubing left floor.

Image 11 - Close up of cut copper propane tubing.

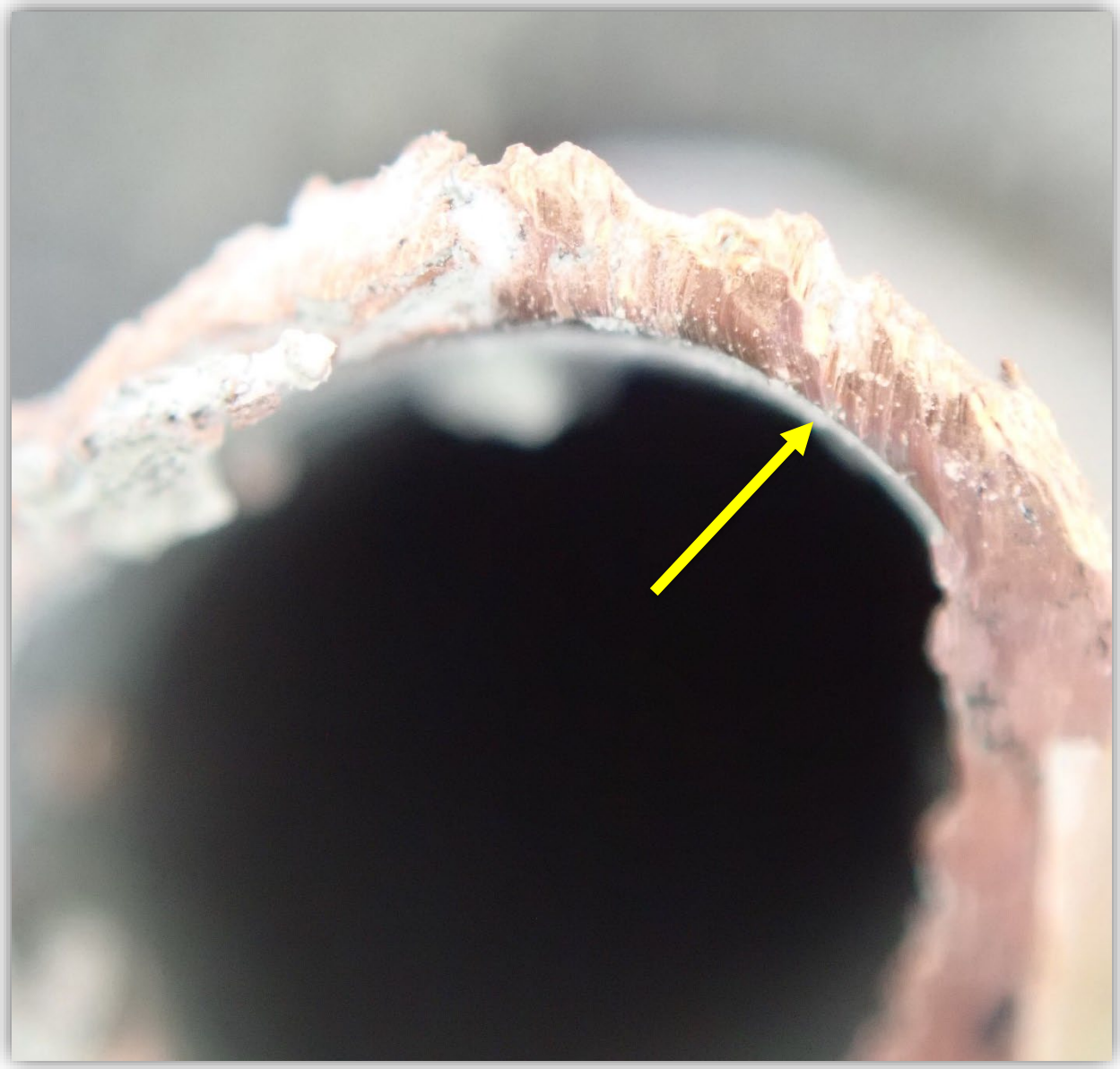

Image 12 - Close up of cut copper propane tubing, arrow indicates cut marks in soft metal.

Image 13 - Supply side of cut propane tubing.

Image 14 - Close up of cut propane tubing arrow indicates cut marks in soft metal.