Incident Summary #II-1441519-2022 (#29935) (FINAL)

SUPPORTING INFORMATION	Incident Date		September 16, 2022
	Location		Castlegar
	Regulated industry sector		Gas - Natural gas system
	Impact	Injury – Qty injuries	0
		Injury – Injury description	N/A
		Injury – Injury rating	None
		Damage – Damage description	A 26mm outside diameter (OD) 3/4-inch nominal pipe size (NPS) polyethylene underground gas pipe had several small holes melted along where a metallic tracer wire was affixed to it. Natural gas at a pressure of approximately 60 pounds per square inch (psi) leaked through the holes in the pipe outdoors. The wall and countertop surrounding a metal drainpipe and kitchen sink in the building were blown apart. Damage to the electrical components of the natural gas furnace required it to be replaced.
		Damage – Damage rating	Moderate
	Incident rating		Moderate
	Incident overview		During a storm, lightning struck near a public community hall. The nearby strike induced electrical current into a tracer wire affixed to an underground natural gas service line. The heat generated from the induced current melted holes at several points along the plastic gas piping, causing an uncontrolled gas leak outdoors.
INVESTIGATION CONCLUSIONS	Site, system and components		Natural gas was supplied by the gas utility to the public community hall through an underground gas service pipe fed from a gas main line. The service line was a 26mm OD (3/4” NPS) polyethylene pipe which ran approximately 50 meters (164’) from the main line to a gas meter on the outside of the building. The service line was buried at an average depth of 60-90cm (24-36”) and the gas pressure in the line was approximately 60 psi. Polyethylene gas pipes are commonly used for underground gas service due to being light weight, corrosion resistant and flexible. The pipes are typically connected through either heat fusion, electrofusion, or mechanical fittings. The pipe is non-conductive so to allow for use of electronic locating devices, it is required that the lines be installed with a metallic tracer wire or other electronically detectable tracing media. (*In areas where underground tracer wire is not permitted, such as electrical utility transmission right of ways, alternative means of line identification may be used*). Tracer wire for underground gas piping is typically #14 gauge single conductor, plastic coated copper, or copper clad steel wire approved for underground use.

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	The tracer wire is installed affixed or adjacent to the polyethylene gas pipe. It rises above ground at a service riser and is coiled and taped to the riser to allow for connection to electronic locating devices.
Failure scenario(s)	When the underground polyethylene gas service pipe was installed to the building, a tracer wire was taped directly to the pipe at approximately 1-meter intervals along its length from the gas main to the gas meter on the building. On the day of the incident there was a lightning storm in the area and the metal tracer wire was exposed to the induced electrical current of a lightning strike near the building. The current melted the copper and the insulation of the tracer wire and melted holes into the underground gas pipe resulting in several leaks along the length of the plastic gas pipe. The leak was detected by a caretaker after the storm who noticed a gas odour outdoors by the gas meter on the outside of the building.
Facts and evidence	Witness statements • Prior to the incident, multiple lightning strikes were observed in the area of the building. • The building was unoccupied at the time of the lightning storm. • The kitchen counter, cabinets and sink in the basement of the hall were damaged after the lightning storm. • The electrical components of the natural gas furnace were damaged, and the furnace needed to be replaced. • No obvious damage was observed on the exterior of the building after the storm. Gas utility installation procedure document • Tracer wire is to be taped directly to the pipe at regular intervals, every 2 meters or on either side of any tracer wire connection and at any bend in the pipe to hold the wire to the pipe's contour. • Where it is approved to install a polyethylene underground gas line within or across an electrical right-of-way, do not tape the tracer wire to the pipe, keep 150mm between the pipe and the tracer wire, and apply 3-4 wraps of tape to the pipe before taping the wire in place to provide additional insulation for the pipe in case of an electrical short. • When attaching tracer wire to a service riser (above ground) the wire should be brought up just below the meter cock, coiled several times, and taped into place with tape over the end of the tracer wire to prevent the wiring from electrically bonding to the piping riser or meter set. A tracer wire manufacturer best practice and installation guide • Contact between the tracer wire and the gas pipe is allowed but should be minimized. • A 2"-6" separation between the gas pipe and tracer wire is recommended.

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Codes and Standards

The CSA Z662 Standard for oil and gas pipelines, and the CSA B149.1 Natural gas and propane installation code both require polyethylene underground piping to be accommodated by an electronically detachable tracing media, such a tracer wire, but do not identify any required clearances between the two when installed in general locations.

Statement from the gas utility

- A review of their records has found one other documented instance of lightning causing tracer wire to create holes in underground gas services since 2014.
- Tracer wires are installed along all their polyethylene gas service and mains across the province.
- "*These gas lines are outside of building structures. If these gas lines are damaged due to lightning strikes, natural gas is expected to release into atmosphere and the smell of mercaptan should be detected for incident reporting.*"

Site and equipment investigation observations

- Melted copper spatter was observed along the length of the gas pipe where the wire was affixed and only pieces of the wire remained (Photo 6-7).
- The gas pipe had blackened pitted marks along its entire length. There were melted deformations along the entire length of plastic pipe, with many pinholes that melted all the way through (Photo 4-7).

Statements from gas utility employees

- The underground pipe to the address runs from the building to the adjacent Highway about 100ft away.
- The gas pipe crossed under the highway where it connected into a mainline on the other side.
- When they arrived at the site, they could smell gas along the full length of the underground pipe.

Causes and contributing factors

It is very likely that the tracer wire being directly affixed to the underground pipe without any separation, as per the gas utilities installation procedure, caused the incident, as the lightning induced current melted the wire and created holes into the plastic line causing gas leaks.

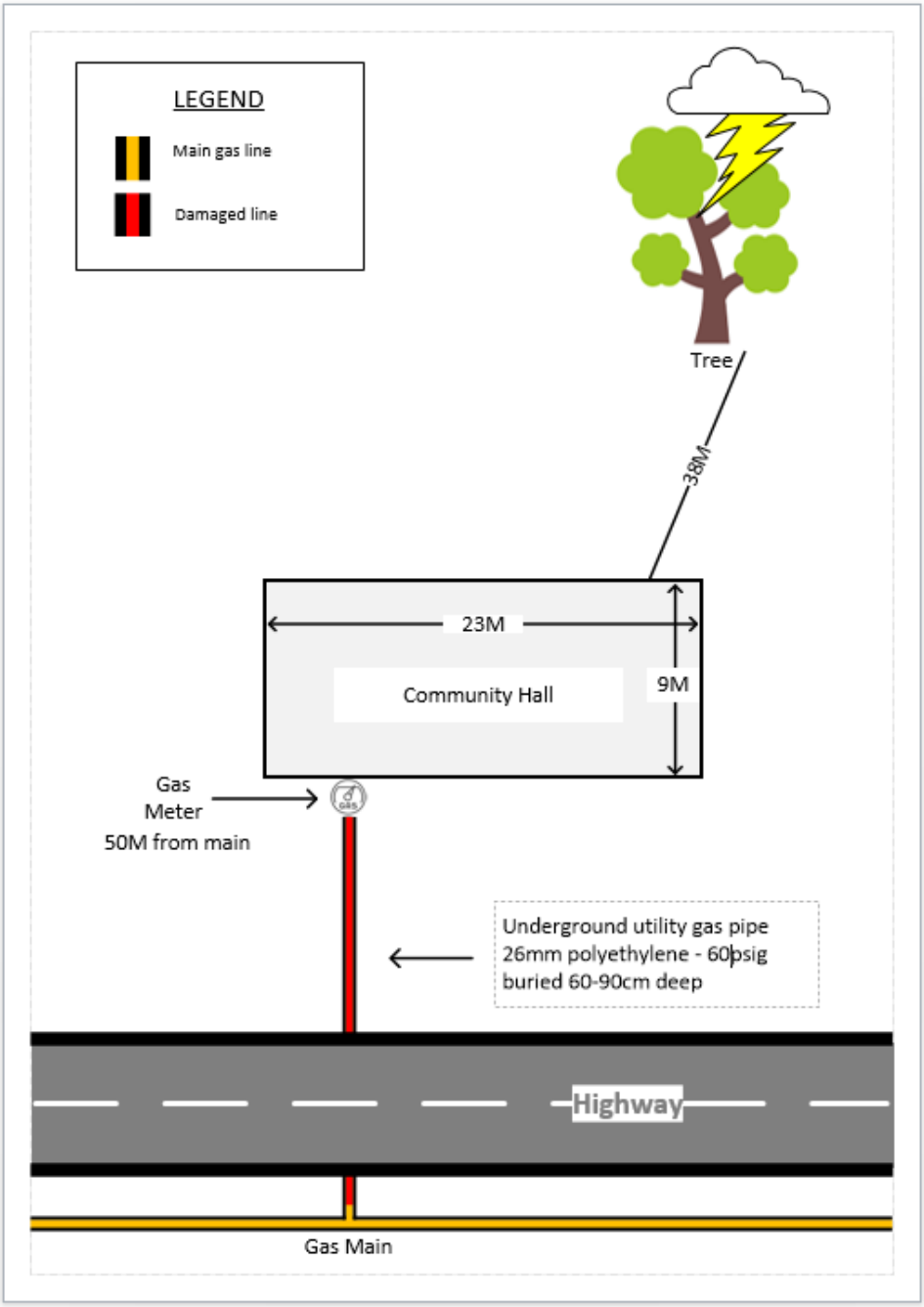

Photo 1 – shows locations of the damaged gas line and a tree that was struck by lightning.

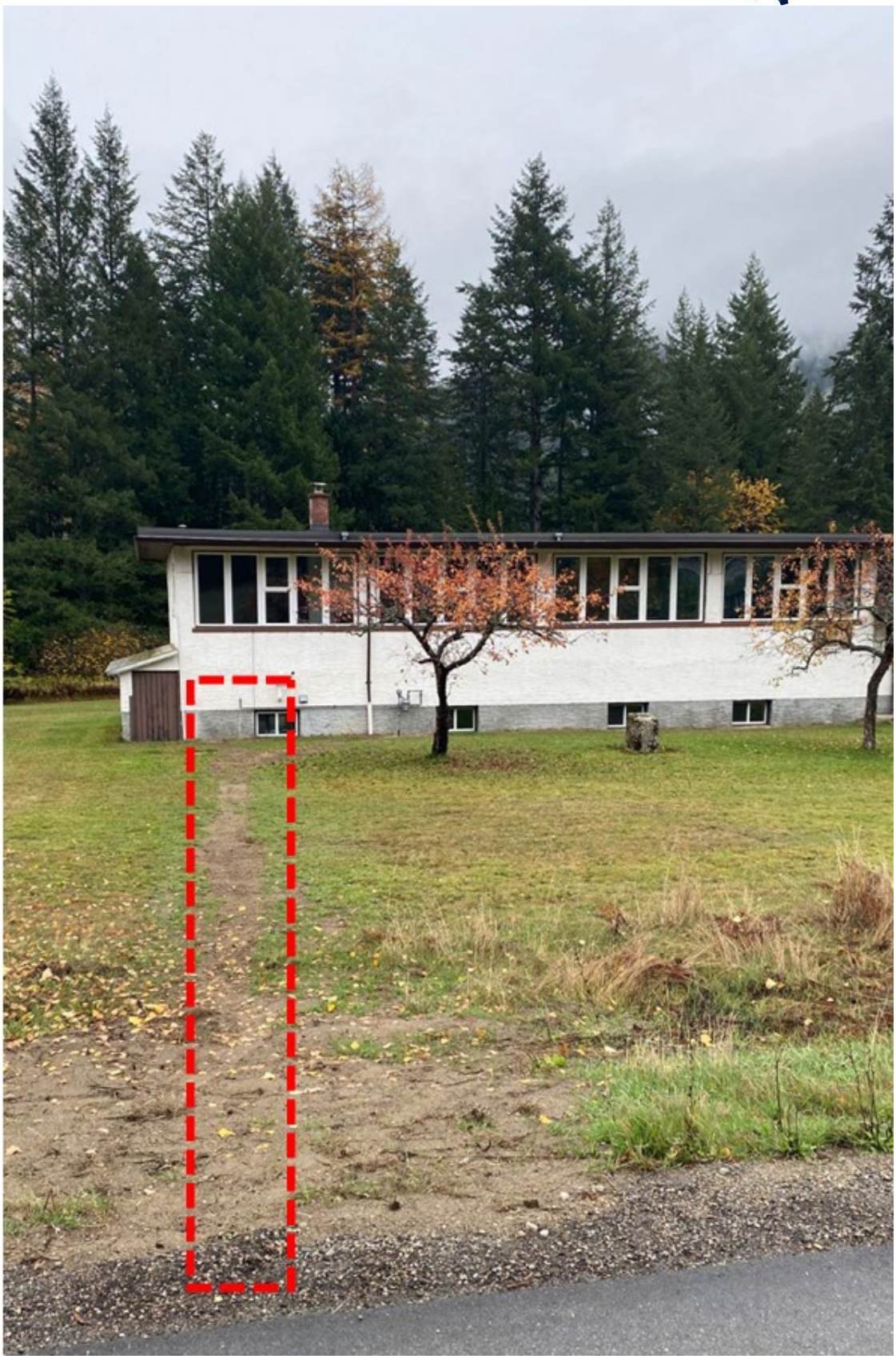

Photo 2 – Community Hall from highway after repairs were completed. **RED** - shows original location of gas meter at building and path of leaking underground gas line.

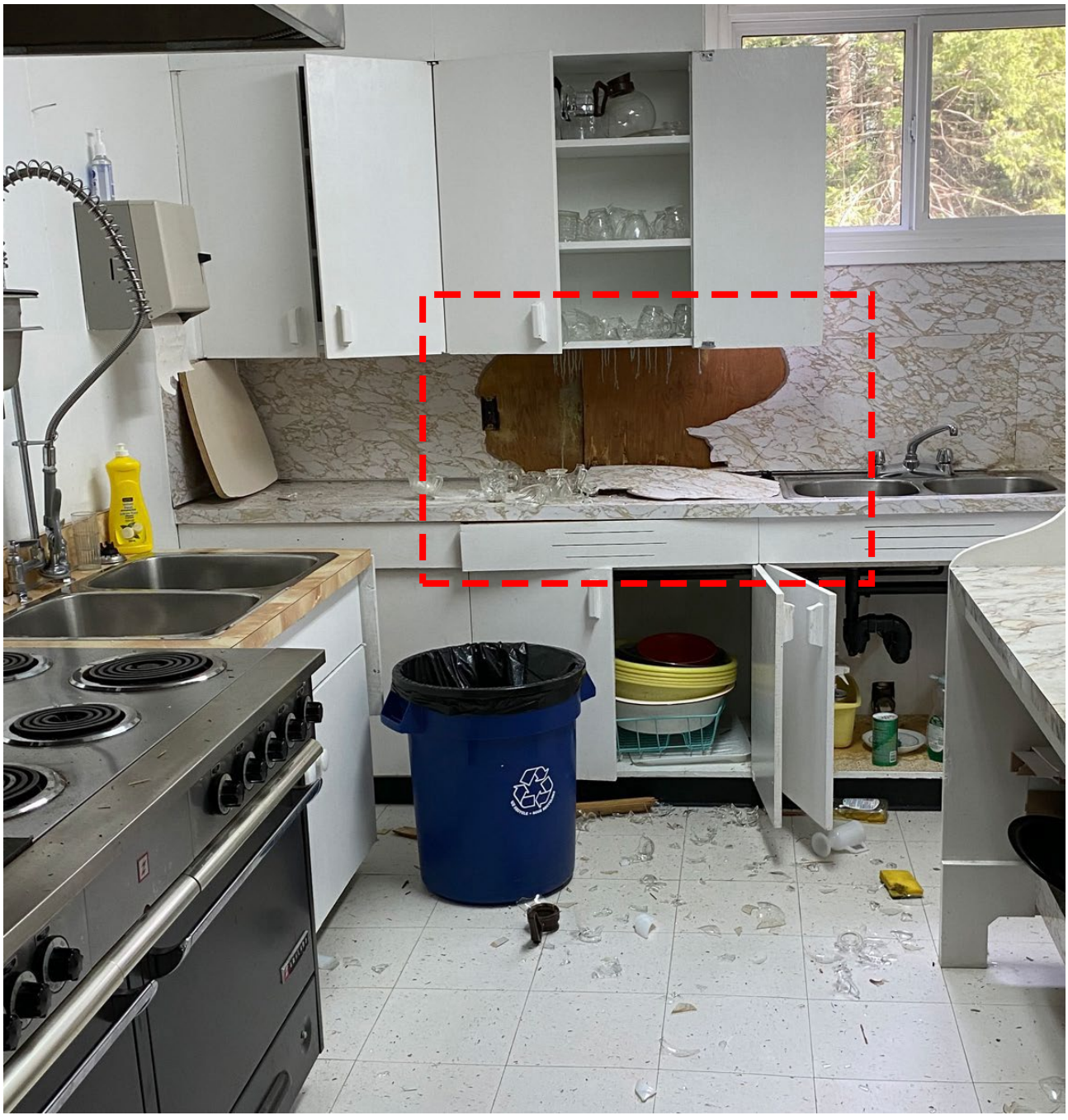

Photo 3 – Community Hall kitchen. **RED** - shows area of wall and counter that cover a metal drainpipe and vent that was damaged from a lightning strike.

Photo 4 – Gas service line after removal from ground.

Photo 5 – Closeup of copper spatter from tracer wire, charring and melting on gas pipe.

Photo 6 - Remnants of tracer wire melted to pipe. Red box shows tape used to affix tracer wire to pipe.

Photo 7 – Closeup of tracer wire and melted pipe.

Photo 8 – Tree showing damage from lightning strike.

Photo 9 – Lightning damage at tree base and scrap metal piping in the ground.