Incident Summary #II-969084-2020 (#16383) (FINAL)

SUPPORTING INFORMATION	Incident Date		January 20, 2020
	Location		Chilliwack
	Regulated industry sector		Gas - Natural gas system
	Impact – Injury	Qty injuries	0
		Injury description	None
		Injury rating	None
	Impact – Damage	Damage description	A natural gas copper tube flare connection was damaged resulting in a moderate release of natural gas inside of a residential home.
		Damage rating	Moderate
	Incident rating		Moderate
	Incident overview		A gas range was pulled away from the wall in a single family detached residential home and the gas line supplying the range began to leak. When the homeowner attempted to repair the leaking gas line, it separated completely from its connection. The open gas line released gas into the home for approximately 20 minutes until a technician from the gas utility closed the valve at the gas meter.
INVESTIGATION CONCLUSIONS	Site, system and components		Natural gas travels from the outlet of the gas utilities' meter to appliances in the home via a piping and tubing system. Gas piping and tubing systems are made to be gas tight so the combustible gas cannot escape to atmosphere. The tubing used in the branch line to the range is copper tubing and is sealed to the valve using a flared fitting. The fittings are made of brass and have a male threaded portion with a beveled sealing surface and a threaded flare nut that screws on to the male portion of the fitting. The flare nut is first placed over the end of the copper tubing then the end of the copper tubing is flared out using a specialized tool so the nut can slide over the flare but not come off of the tube. The flared copper meets up with the beveled sealing surface on the fitting, then the nut is threaded over the fitting and tightened, compressing the copper to the sealing surface on the brass fitting generating a gas tight seal. **(See picture #1)** Gas shut off valves are installed in a gas system to shut off the gas supply to entire systems and/or individual appliances. The shut off valves for the individual appliances allow a gas branch line to be isolated from the rest of the system. This allows safe alteration or repair of an individual gas line or appliance without the release of gas or the interruption of the gas supply to other appliances on the system. Gas piping, tubing, hoses and fittings are required to be secured to be protected from damage and strain.

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Failure scenario(s)	The homeowner pulled the gas range away from the wall in preparation for new kitchen flooring. He noticed a gas smell and used soapy water to check the gas connection at the rear of the stove for leaks. Bubbles indicated a gas leak on a copper tube flare connection upstream of the appliance shut off valve. He attempted to tighten the flare connection with wrenches to stop the leak. When he did this the entire copper tube came out of the flare nut and started to release gas into the home. The home owner went outside and shut off a gas valve on a copper gas line he believed was for the range but was in fact only for a gas fireplace in the home. When he realised this did not stop the flow of gas, the other occupants in the home evacuated and the homeowner went back in to shut off the main breaker at the electrical panel, opened doors and windows to ventilate the home, then exited and contacted the gas utility company. The gas utility company dispatched a technician. The technician arrived at the home approximately 20 minutes later and observed the gas meter dial still spinning rapidly. The technician shut off the main gas valve at the meter stopping all gas flow to the home and stopping the leak.
Facts and evidence	**Witness statements** **Home occupant** • Home was originally built in the 1970's and is currently under renovation • A older gas range was already installed in the home when they purchased it • No alteration of the gas line to the shut off valve behind the range was done since they have owned the home. • Her husband pulled out the gas range and smelled gas. He tested the line with soapy water and found a leak on the flare nut. He then attempted to tighten the leaking gas connection at the flare nut with wrenches. That is when the gas line detached from the flare nut and started leaking into the home. • Her husband then went outside to the gas meter in an attempt to shut off the gas and closed a shut off valve on a copper line coming from the meter. The gas leak at the range did not stop so they evacuated the house and contacted the gas utility company. **Gas utility technician** • Received a call from dispatch of a gas leak and arrived at the residence approximately twenty minutes later • Upon arrival on site he saw the family standing on the street out front of the home and the doors and windows in the home were open. The owner told him he shut off the gas valve at the meter but it did not stop the leak. • When he checked the gas meter the main shut off valve was still on and the meter dial was spinning rapidly showing a heavy flow of gas. He then shut off the main gas shut off upstream of the meter and all gas flow to the house stopped. • After letting the house ventilate he entered the home to test for gas with the gas detection meter and saw a 5/8" copper gas line behind the range that had been separated from the flare nut that was still attached to the flare fitting.

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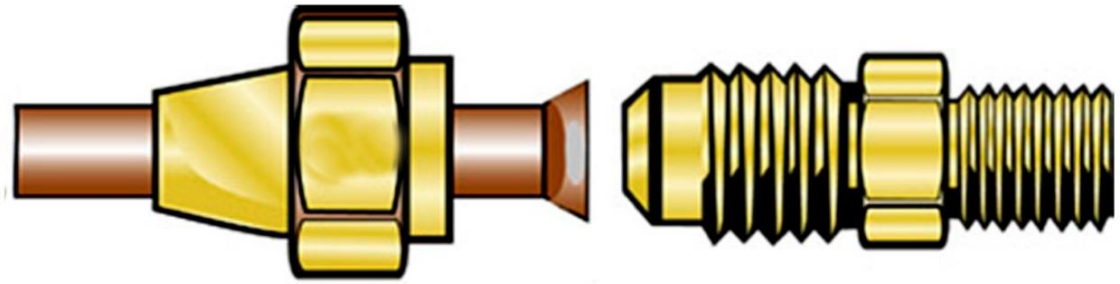
	Photographs (Site visit completed after the gas line was repaired by a certified gas fitter and the gas supply had been turned back on to the home) • 5/8” copper gas line comes through the floor behind the location of the range and is secured with a flare connection to a brass flare by pipe thread 90 degree elbow threaded into a 1/2” gas shut off valve. **(See picture #2)** • A stainless steel flexible appliance connector with a black iron cap on the end is installed downstream of the range gas shut off valve • The copper gas line and shut off valve were not secured to the back wall behind the range. • The damaged copper line shows a very shallow flare shoulder with bending and marks consistent with a strong lateral pulling force **(See picture #3-5)** • The main gas line from the gas meter has a branch line outside with a red handled shut off valve and a copper gas line going into the masonry chimney for the gas fireplace. **(See picture #7)** • The main black iron pipe gas line going from the gas meter into the house is partially covered with vines and leaves. **(See picture #7)** **Measurements** • The failed tubing flare interior shoulder width measured 2 mm compared to 4mm of an exemplar flare created on the same tube
Causes and contributing factors	It’s very likely that the gas leak was caused by the copper tube being incorrectly flared by the installer with insufficient material on the flare shoulder. This allowed the copper tube to pull out of the flare nut when it was strained by the movement of the gas range and subsequent attempt to tighten the connection after it started to leak. A contributing factor to the connection failure was the gas tube, fitting and shutoff valve not being secured to the back wall allowing the flare connection to be strained when the appliance was pulled out. The high volume of gas which escaped was very likely caused by the homeowner not being aware of how to shut off the gas supply.

Flare Fitting



Flared Copper

Picture #1

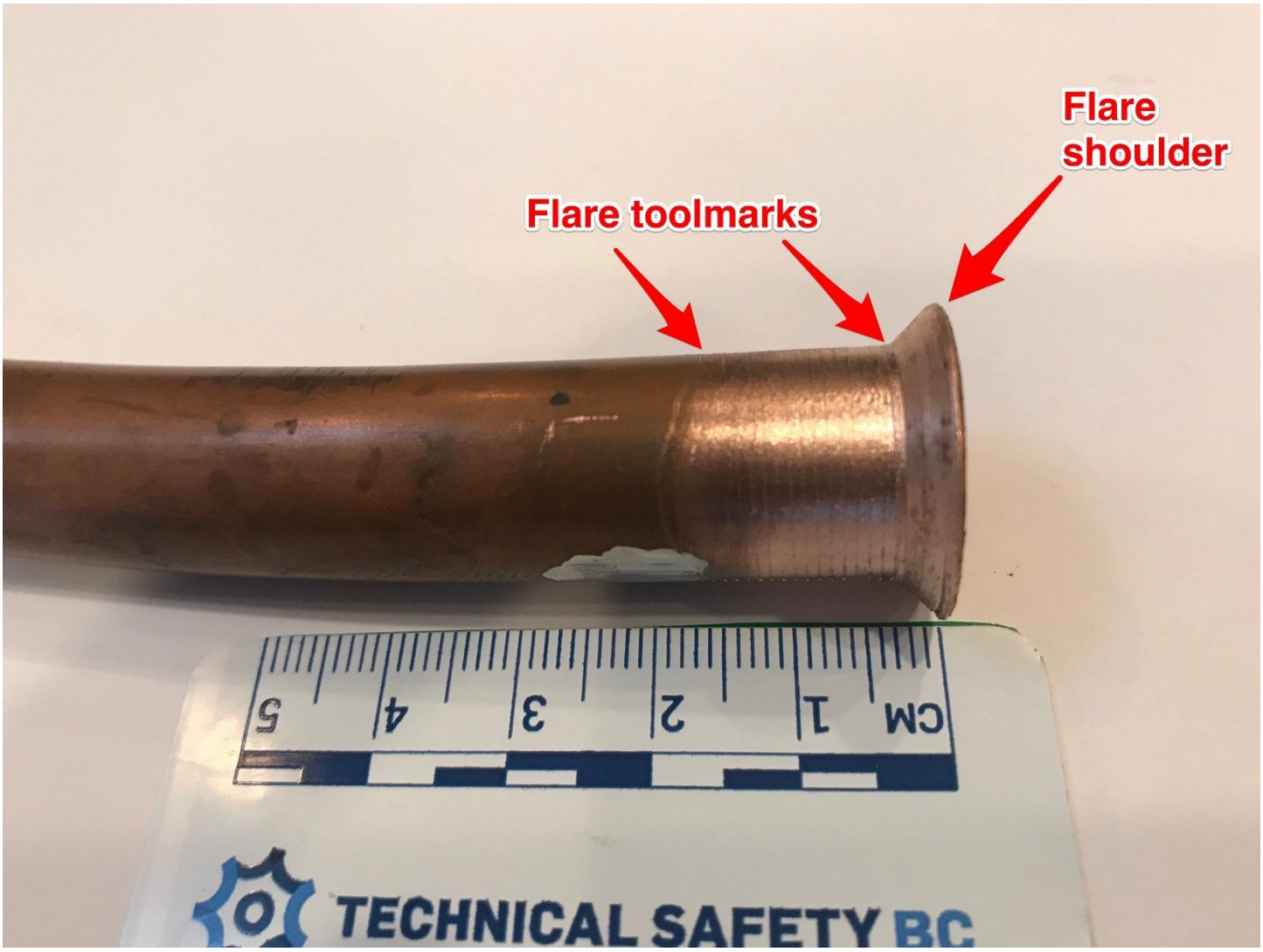
Example of a flared copper connection to a brass flared fitting

Picture #2

Repaired copper tube flare connection behind gas range

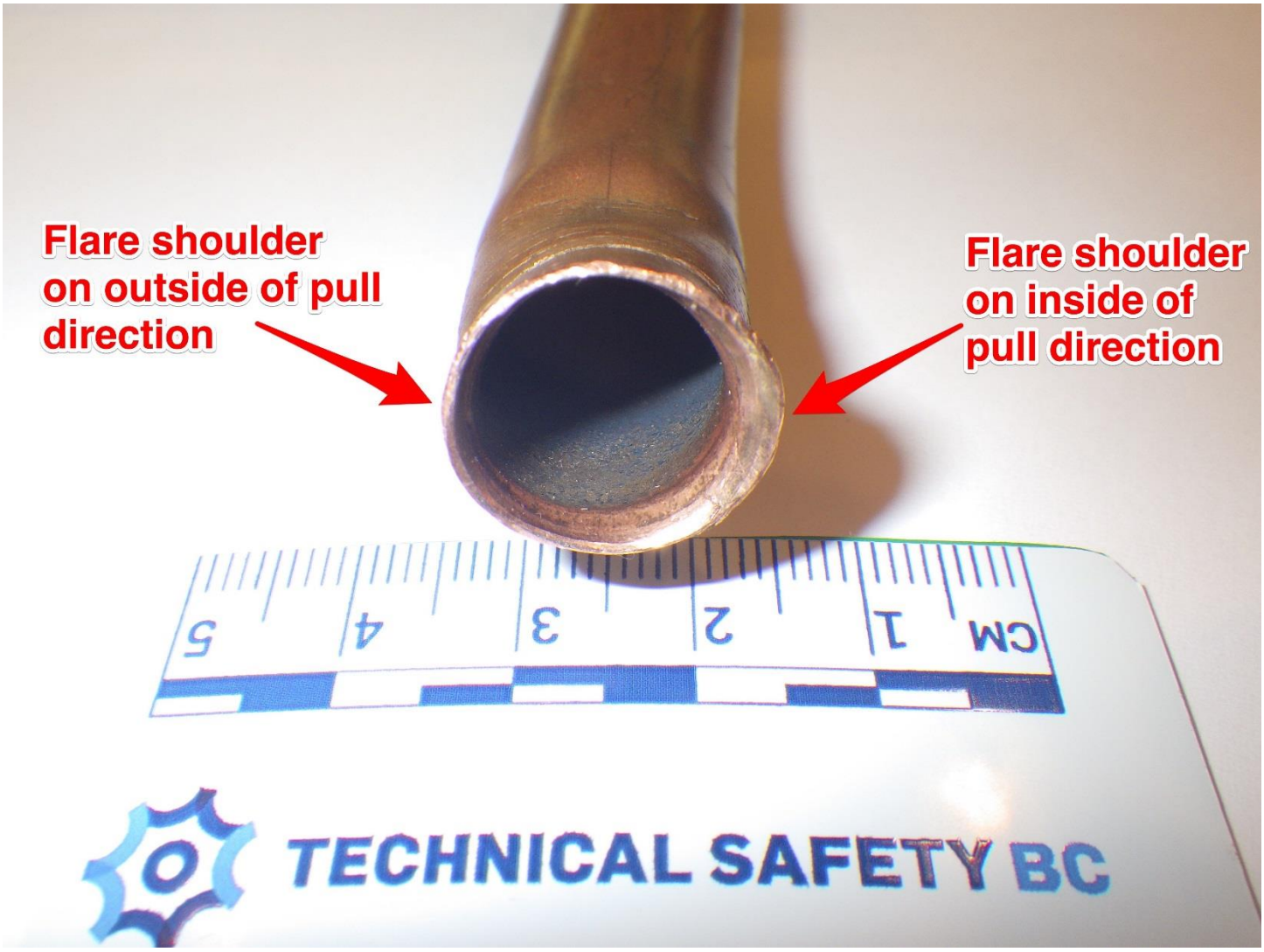
Picture #3

Close up of failed flare connection showing amount of shoulder material and direction of pulling force



Picture #4

Exemplar copper tube flare created on opposite end of copper tube piece with the failed flare connection

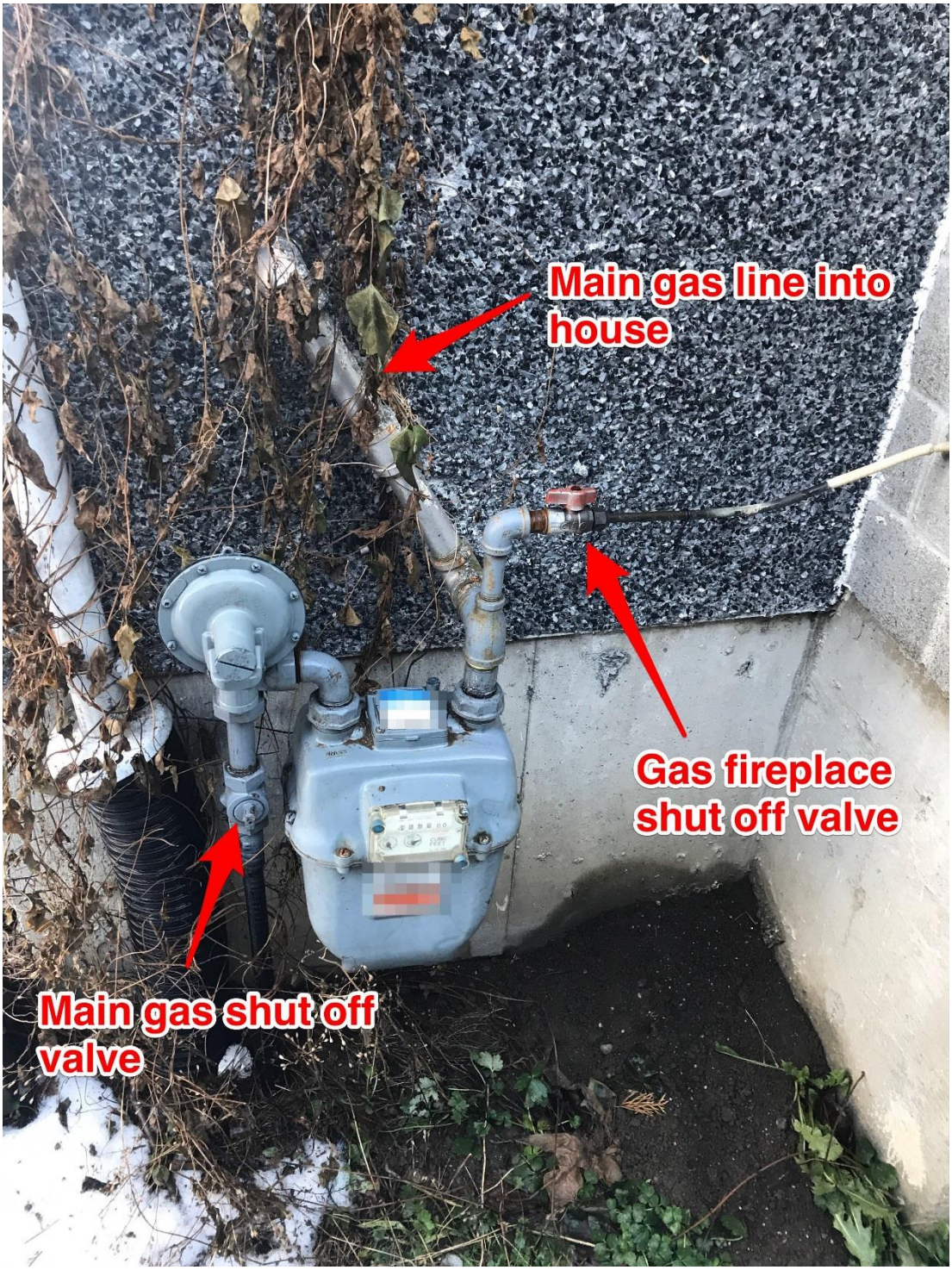


Picture #5

Close up #2 of failed copper tube flare connection showing amount of shoulder material and direction of pulling force

Picture #6

Example #2 of exemplar copper tube flare



Picture #7

House gas meter, gas lines and shut off valves