

Incident Summary #II-1253155-2021 (#23970) (FINAL)

SUPPORTING INFORMATION	Incident Date	September 13, 2021	
	Location	Vancouver	
	Regulated industry sector	Gas - Natural gas system	
	Impact	Qty injuries	20
		Injury description	1 worker experienced symptoms of carbon monoxide (CO) poisoning including sever dizziness, a persistent headache, and nausea. 19 other people from the building experienced various symptoms of carbon monoxide poisoning including shortness of breath, nausea, lethargy, and headache. CO tests were performed on site with some patients having confirmed CO by blood tests. Some patients followed up at healthcare facilities for CO poisoning.
		Injury rating	Moderate
	Damage	Damage description	Dangerous concentrations of CO were released into the parkade and migrated into the lobbies and halls of the building. Multiple supporting hanger brackets were missing from the venting and a 6 foot portion of gas boiler venting was knocked off by a vehicle.
		Damage rating	Major
	Incident rating	Major	
Incident overview	An unsupported portion of a gas fired boiler's venting system was knocked off by a vehicle driving through the parkade. CO was released into the parkade and building exposing the occupants and was measured as high as 233 parts per million A gas fitter on site for an unrelated maintenance visit was exposed to CO, recognized the symptoms and notified emergency personnel.		
INVESTIGATION CONCLUSIONS	Site, system and components	<ul style="list-style-type: none"> • The apartment building is a 22 story high rise tower constructed of concrete. • Two natural gas fired boilers for hot water are located in the boiler room in the uppermost parkade floor. • The boilers have parallel exhaust venting systems which include metal venting with horizontal and vertical sections, hangers and fasteners for the venting. • The venting system for the boilers use a combination of the vertical atmospheric pressure difference between the boiler and the higher exit points along with power booster fans to ensure products of combustion exit the building safely. • The power booster fans are inline with the boiler venting systems and increase the rate of exhaust. They are electrically interlocked with the boiler that feeds them to turn off the boiler if its fan is not working. • An exterior ground level exhaust enclosure houses the fans. • The parkade boiler room has an intake vent that runs beside the boiler exhaust fans. The intake vent system provides fresh air for the parkade boiler room from the ground level with the assistance of a power booster fan in the boiler room. • The parkade has a supply air fan and an exhaust fan. • Carbon monoxide is a colourless, odourless, tasteless gas that is toxic to humans and animals. Exposure to carbon monoxide interferes with the body's ability to absorb oxygen, which can result in serious illness or death. (For more information on carbon monoxide check out "CO Safety Tips") 	

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<p>Failure scenario(s)</p>	<p>Two boilers (Image 1) were installed in the parkade with their respective venting systems running horizontally through the parkade then up to the outside exhaust enclosure that contains two power booster fans. An unsupported section of one of the boilers venting systems was most likely knocked off (Images 2/3/4) by a truck with a luggage rack as it drove through the lowest part (Image 5) of the parkade in the night prior to the incident. Over the night, and until the boiler was identified and shut down the next day, products of combustion were intermittently released into the parkade, boiler room and eventually up through the building. Building staff noticed the piece of vent (Image 4) on the concrete parkade floor in the morning but were not aware what system it was for at that time. Unrelated to the knocked off vent piece, a gas contractor was scheduled to perform yearly maintenance the following morning. Products of combustion had entered the parkade boiler room through the boilers draft hood and/or from the exit corridor resulting in dangerous levels of CO in the boiler room. Recognizing the symptoms of CO poisoning while working in the space, the gas fitter vacated the boiler room and called 911.</p>
<p>Facts and evidence</p>	<p>Gas contractor statements</p> <ul style="list-style-type: none"> • The gas fitter went to site on the morning of Monday Sept 13, 2021, for scheduled yearly boiler maintenance. • Upon entering the basement boiler room, they smelled what they attributed to be a dirty boiler smell that can be similar to products of combustion containing CO. • One of the two AO Smith boilers in the basement was not working which was later found to be a due to a seized exhaust fan. The air proving switch for the venting was triggered to shut down the boiler when the exhaust fan seized and stopped working. • The second boiler in the basement was running when called for heat - on and off at the time of the site visit. • The gas fitter worked in the boiler room for approximately 45 minutes. • At first, they found the fumes did not seem to be strong and may have been going mostly into the parkade. • The gas fitter stated they went outside to order parts and upon returning they left the parkade boiler room door open. • With the parkade boiler room door to the hallway opened, which happened to correspond with the boiler firing back up, the gas fitter soon got severely dizzy and a persistent headache. • The gas fitter held a lighter flame to the boilers draft hood and the exhaust was spilling back into the boiler room. • After leaving the room and learning from site personnel of the vent piece being hit by a car and knocked down, they proceeded to check on the missing vent in the parkade and found that it was not supported by anything in the area where the vehicle hit the vent. • The vent was found on the side of the parkade concrete floor and some of the supporting hangars were not in place. The rods were still in place but the nuts, washers and strut were not installed or in the area where the vent had been hit. • Recognizing they were experiencing symptom of CO poisoning, the gas fitter called 911 and opened the exterior doors to the parkade. • The gas fitter stated that the CO may have travelled up the open parkade stairwell doors or through the parkade elevator shaft to get into the occupied areas of the building such as the lobbies and residences. • The boiler venting system shuts down if the exterior power booster fan is not working. The vent piece being knocked down would not trigger that shutdown.

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- The air intake fan for the parkade boiler room was working and interlocked with the boiler on the day of the incident. The boiler utilizes an aquastat interlocked with the intake fan's air proving switch. When the aquastat calls for heat, it triggers the intake fan to start and when the air proving switch is triggered the boilers then starts.
- The parkade supply air fan the parkade exhaust fan both were not working as found in the days after the incident. The supply air fan had a loose fan belt and was not pushing air. The parkade exhaust fan had a broken fan belt and was not working.
- The gas fitter stated that this building has make up air equipment that runs constantly for the lobbies and common areas to provide positive pressure to keep out fumes such as suite cooking fumes or parkade exhaust.
- The gas contractor stated that they have a maintenance contract with the building which involves basic boiler maintenance and boiler cleaning.

Venting contractor statements

- When reviewing on site in July 2021, they found the venting had corrosion and a dent near the location that it was later hit by the vehicle. They stated the rods and hangers had been removed in the location near to where the piece was later hit by the vehicle.
- They stated that the lack of support where the vehicle hit the vent left the vent vulnerable to being disconnected.
- They stated that while repairing the vent in the days following the incident, the fresh air intake fan for the parkade boiler room would run when the boiler was on.

Building management personnel statements

- Prior to the incident on July 12th, 2021, the venting was damaged by a vehicle and had corrosion in the same place as where the piece was knocked down in this incident. It was still intact, but quotes were obtained for repairs.
- On the night before the incident and the morning of the incident, multiple site personnel noticed a piece of metal vent on the parkade concrete floor but were not aware of any hazard associated with it being down at that time.
- On Monday September 13th, 2021, after the gas fitter notified the building manager that there was an issue with CO in the parkade, they both went to the parkade to look at the vent piece that had been knocked down. The 6 foot piece of venting was found on the parkade drive off to the side.
- 911 was called and the fire department and ambulances came to site.
- The fire department found high levels of CO in the parkade and pulled the fire alarm to evacuate the building. They also placed portable ventilation fans at the main entrance to the building.
- While the fire department brought in more fans and performed CO level tests throughout the building, 60-75 tenants at a time congregated outside the building and some received CO tests by emergency personnel.
- Utility representatives showed up and turned off the gas to the building until the venting could be repaired.
- Building staff stated a truck with a roof rack entered the parkade prior to the vent being knocked off and left the parkade afterwards. The entry was confirmed by on site video capture. The same vehicle was further witnessed bumping into low height sprinklers in the parkade on the day following the incident.
- They stated the truck with the roof rack is suspected to have hit the vent at the lowest point of the parkade at around 6 foot 3 inches/ 75 inches ([Image 5](#))
- They stated that there was no maximum height roll bar at the entrance to the parkade at the time of the incident.
- The parkade boiler room did not have a CO detector.

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	<ul style="list-style-type: none"> • They stated the roof make up air unit for the common areas runs constantly and was operational prior to the incident. • They stated that at least one of, if not both the parkade fan and parkade fresh air intake fan were not working prior to the incident. • They stated the power booster fan for the boiler room fresh air intake vent was working prior to the incident. • They stated that the parkade boiler room adjoins a hallway that runs from one side of the building the other side. The hallway has exit stairwells at both ends of the building, a door to the parkade halfway down the hallway, and an entrance for the elevator. • Mechanical equipment preventative maintenance for the building is stated as including daily inspections by building personnel and yearly boiler cleaning by a gas contractor. <p>Fire department personnel statements</p> <ul style="list-style-type: none"> • The gas valve to the boiler was shut off at 1:20pm. • CO levels of 80-233 parts per million (PPM) were taken in the parkade. A CO level of 230 PPM was taken in the boiler room. • CO levels of between 25-33 PPM were taken in the main lobby with the front doors open and in hallway/lobbies through all levels of the building. • CO levels of 5-10 PPM were taken in some accessed suite residences. • For this site, there were no parkade exhaust fans. Other parkades have CO detectors with integrated exhaust fan systems to clear products of combustion from vehicles or other sources. • This buildings parkade is relatively enclosed and isolated from fresh air. • The CO may have travelled up the stairwells or the elevator shaft to the common areas of the building. • They noticed that other parkades have mechanical protection cages for the venting systems. <p>Occupant statements</p> <ul style="list-style-type: none"> • An occupant stated they were driving a vehicle with a luggage rack into the parkade on the Sunday night Sept 12th, 2021 but did not hear any hollow twang type sounds. • While driving through the parkade the driver could hear their luggage rack scraping on the concrete ceiling. • The driver stated they recall seeing the vent piece on the ground in the parkade but couldn't recall the date.
<p>Causes and contributing factors</p>	<p>Conclusions</p> <p>A parkade boiler was due for its yearly cleaning and had a portion of the vent knocked off in a low area of the parkade where the venting was not properly supported. The open vent exhausted products of combustion including carbon monoxide into the parkade where there were inoperative intake air or exhaust fans. Throughout the night the hazardous levels of carbon monoxide accumulated in the parkade boiler room and eventually in the occupied areas of the building. The hazard was detected by the gas fitter identifying the exposure to carbon monoxide during the maintenance visit.</p> <p>Causes and contributing factors</p> <p>The carbon monoxide release was caused by the unsupported venting being hit by a vehicle in a low area of the parkade. The fact that there were no maximum vehicle height roll bars at the parkade entrance is a plausible contributing factor.</p>



Image 1 - Gas fired water boilers



Image 2 - Vent piece down (red arrow) and hangers for vent gone (red rectangle).



Image 3 - Hanger missing (red rectangle) and rod bent up (red arrow) near missing vent piece.



Image 4 - Vent pieces found on the parkade concrete floor.



Image 5 - A measurement of 76 inch (6 foot 4 inch) taken by safety officer to the bottom of the vent hanger near to where vent was knocked down.