Incident Summary #II-1817926-2025 (#55737) (FINAL)

SUPPORTING INFORMATION	Incident Date			January 1, 2025
	Location			Gibsons
	Regulated industry sector			Gas - Natural gas system
	Impact	Injury	Qty injuries	0
			Injury description	N/A
			Injury rating	None
		Damage	Damage description	The retail establishment sustained the following damage within the bakery preparation area and surrounding areas: • Approximately 70 sq ft of ceiling collapsed causing damage and asbestos to be released. • Fluorescent lighting fell from the ceiling. • Fire suppression system activated causing water damage within the bakery preparation area and adjacent aisles. • Wall adjacent to the commercial oven door shifted approximately 3-inches. • Items stored on a 7-foot-high shelving behind the wall were thrown into the aisle. • Adjacent aisle racking also had products displaced.
			Damage rating	Major
	Incident rating			Major
	Incident overview			A commercial oven in a grocery store, that had been altered approximately three weeks earlier, exploded on startup.
INVESTIGATION CONCLUSIONS	Site, system and components			The commercial oven is a natural draft bakery oven equipped with a front-mounted draft hood. It bakes breads and pastries on a series of revolving wire racks, ensuring even heat distribution and consistent baking results. The oven consists of a heating compartment, technically referred to as the combustion chamber, with a volume of 337 cubic feet. It utilizes seven gas jet burners, each 12-inches long, for a total burner length of 7-feet. A gas jet burner uses multiple small jets or orifices to release gas at high velocity. This high-speed flow entrains air and mixes it with the gas prior to combustion, resulting in a more complete and efficient burn. Each burner delivers 240-cubic feet of gas per hour. Considering the calorific value (heating value) of natural gas, this equates to a heat output of approximately 240,000 British thermal units (BTUs) per hour. The oven features a permanent pilot, a small continuous gas flame that serves as the ignition source for the main burners. The pilot flame is monitored by a thermocouple which is a small metal cylinder containing two different metals. When heated, the thermocouple generates a small electrical voltage that keeps a solenoid valve open, allowing gas to flow to the burner. If the pilot flame extinguishes, the thermocouple stops producing voltage, causing the valve to close and stopping gas flow to the burners.

Incident Summary #II-1817926-2025 (#55737) (FINAL)

Once ignited, the burner operates in either high fire (full 240,000 BTUs) or low fire (reduced BTUs). This dual-mode operation keeps the oven warm when idle and allows rapid heating when baking begins. The switch between high and low fire is achieved by splitting the gas train into two lines. Low fire uses smaller gas piping to reduce flow, while high fire uses larger piping and a thermostatic valve that opens or closes based on the temperature set on the thermostat. This ensures the combustion chamber reaches and maintains the desired temperature.

The oven is designed to operate continuously on low fire, switching to high fire only when there is a demand for baking. When not in use, an isolation valve shuts off all gas supply to the burners.

As a natural draft gas appliance, the oven relies on the unforced movement of air driven by temperature differences—hot air rises while cool air descends, creating a pressure differential that facilitates airflow. This process is essential for proper combustion and is supported by adjustable air intake grills at ground level and a vent that safely expels combustion by-products and excess heat outside the building. Additionally, a vent hood at the front of the oven captures and removes excess heat from the oven's exterior.

Act, Regulation, Code and Directives appertaining to this incident.

Safety Standards Act –
Section 68 Alteration of regulated products –
(1) a person must not alter a regulated product if the alteration would or is likely to
(a) result in the product ceasing to meet the requirements of the regulations, or
(b) result in the product ceasing to meet the standards
(i) required to be met by the certification agency, or any successor of that agency, that authorized the use of a certification mark for the regulated product, or
(ii) applied to that regulated product by a provincial safety manager in issuing an approval under section 10.
(2) If an alteration to a regulated product is permitted under section (1), a person must not do the alteration unless that person is
(a) a licensed contractor,
(b) authorized to do so under this Act, or
(c) approved by the appropriate safety manager if the safety manager is satisfied that the person is capable of safely doing the alteration.

Gas Safety regulation –
Section 54 Unrepairable appliance –
(1) a person who finds any appliance or gas equipment beyond repair or in an unsafe condition must
(a) place the appliance or gas equipment out of service, and
(b) promptly notify a safety officer of its condition and location.
(2) If the initial notification under subsection (1)(b) is verbal, it must be promptly confirmed by a written statement setting out the facts.

Directives –
D-GA 2014-05 Obsolete gas appliances replacement parts / components. This Directive explains the conditions a regulated gas appliance can be altered and by whom.

Incident Summary #II-1817926-2025 (#55737) (FINAL)

		B149.1-20 Natural Gas and Propane installation code • Clause 4.1.3 states an appliance, accessory, component, equipment, or any other item shall be installed in accordance with the manufacturer's certified installation instructions and this code. • Clause 4.2.2 when deviation from or postponement of these requirements is necessary, permission in writing shall be obtained from the authority having jurisdiction before the work proceeds, and this permission shall apply only to the particular installation for which it is given. • Clause 4.3.1 Before leaving installations, installers shall ensure that the appliance, accessory, component, equipment, or piping and tubing they installed complies with code requirements, and the person initially activating the appliance shall ensure that the appliance is in safe working order. • Clause 4.3.4 before installing any replacement part of an appliance, the installer shall ensure that the replacement part provides operational characteristics at least equivalent to those of original part. **B149.3-20 Code for the field approval of fuel-burning appliances and equipment** • Clause 7.2.1 a pilot burner and its components shall be installed according to the manufacturer's instructions and shall be firmly secured in place to maintain correct alignment. • Clause 7.2.2 a pilot shall be designed, installed, and adjusted to provide safe and reliable ignition of the main burner and so that there will be no injurious flame impingement on heating surfaces that can cause incomplete combustion or damage to these surfaces. • Clause 8.3.3 a burner shall be provided with a means to a) be firmly secured in place to maintain its correct position; b) prevent accidental movement of any adjustable part; and c) maintain complete and stable combustion under all operating conditions. • Clause 8.3.12 when a burner has a flame width (or run length for duct burners) in excess of 3 feet (900mm) from the source of burner ignition, a) the main burner flame shall be proven at the furthest point(s) along its base from the source of ignition; b) the source of ignition shall be located in the combustion zone adjacent to the entry of the fuel or fuel/air mixture to the burner; and c) the main burner flame shall be proven at a location providing the most stable flame detection at all firing rates and not affected by the source of ignition.
	Failure scenario(s)	A gas fitter was called to repair a commercial oven and identified that the thermocouple needed to be replaced. The thermocouple size was odd, and the part was not immediately available but the gas technician was under pressure to get the commercial oven back up and running. As such, a different sized thermocouple was used from the technician's van. This required the pilot assembly to be relocated approximately 3 feet and attached with a piece of wire. This relocation, coupled with some partially blocked air vents to the oven burners, likely altered the ignition characteristics of the burner. Testing after the incident identified in its current configuration, 80% of the time, only half the burner ignited. This would allow approximately 120 cubic feet per hour of unburnt gas to be introduced and later ignited. When the lower explosive limit was reached from the unburnt gas, an explosion occurred resulting in the observed damage.

Incident Summary #II-1817926-2025 (#55737) (FINAL)

	Facts and evidence	**Site Observations** The pilot was found 1-inch below the burner's jets as it was not secured as per current code. This possibly aided in the burner not igniting fully, as the position of the pilot relative to the burner jets is critical for proper ignition. The fresh air grills on the commercial oven were observed to be partially obstructed with dust and dirt which could reduce the amount of fresh air entering the combustion chamber. This could have several effects: • Reducing the fresh air into the combustion chamber makes the natural draft effect to be reduced allowing more gas to accumulate in the combustion chamber and not be dissipated via the vent. • Reduces the gas air mixing effectiveness of the burner making the burner harder to ignite and maintain a constant flame throughout the burner. While testing the low gas pressure on the low fire portion of the gas train, the gas pressure was so low that it showed zero gas pressure on the test gauge. This caused some of the burner jets to not stay ignited. This also allows unburnt gas to enter the combustion chamber due to the danger of causing another explosion. We could not determine the amount of unburnt gas that was released into the combustion chamber The gas safety officer observed that visually confirming full burner ignition at each initial startup could reduce, though not eliminate, the risk of explosion due to the low-fire condition. However, this procedure is not specified in the manufacturer's documented operating instructions. The influence of exhaust fans could not be confirmed or denied as at time of testing all exhaust fans had been removed due to asbestos contamination. The commercial oven is a natural draft type with no additional makeup air supplied so there is a remote possibility that the exhaust fans contributed to the explosion. It is important to note for testing purposes; the front doors of the commercial oven were left open so investigators could observe the burner to document the results and for safety. Having the oven open will improve air flow in the combustion chamber which improves the chances of the burners completely igniting. It was reported that the commercial oven is started with the doors closed. Combined with partially obstructed air grills, this condition may further inhibit full burner ignition. **Gas Contractor** – Supplied documents verifying the timeline of repairs, alterations and issues found with the commercial oven, including confirmation of the date the pilot was relocated. Confirmed the name and class of the gas fitter responsible for the work conducted on the commercial oven, and the date the gas fitter became certified with the authority having jurisdiction. **Gas Fitter** – During the interview conducted by the Gas Safety officer it was identified that some of the repairs were conducted without supervision and prior to the gas fitter receiving their gas fitter certification in October 2024. When asked how long the gas fitter had been working on the oven, it was determined work had been ongoing since 2022. The gas fitter explained the most recent issues started in June 2024 that and were related to the oven's burner and pilot system. To address the pilot issue the gas fitter explained that in July 2024, he replaced the thermocouple. However, the original thermocouple was 60 inches long and the gas fitter only had a 48-inch thermocouple available. To accommodate the shorter part, he relocated the entire pilot assembly 3 feet to the right of its original position and

Incident Summary #II-1817926-2025 (#55737) (FINAL)

		secured it using a piece of wire. The gas fitter stated that no consultation was made with the manufacturer regarding this modification. When questioned about the use of wire to secure the pilot, the gas fitter initially saw no issue, stating that the pilot had previously been held in place with wire. When the gas fitter saw the position of the pilot post-incident, he stated he had not placed it in the location observed, which was significantly lower than expected. e reiterated that when he tested the pilot, the burner ignited fully. However, he demonstrated limited understanding of how relocating the pilot and securing it improperly could have contributed to the explosion. The gas fitter expressed feeling pressured to restore the oven's functionality for the retail outlet and believed at the time that the work was safe, within his scope of practice, and compliant with code. This belief extended to all gas work he had performed. However, the Gas Safety Officer found that the actions and decisions taken did not reflect a clear understanding of safety standards or regulatory compliance.
		Commercial Oven Manufacturer – The manufacturer confirmed that the commercial oven was produced in the late 1960s. They also stated that they no longer support parts for this model and do not have a copy of the original installation instructions. However, they did provide the most relevant and comparable installation documentation currently available. **Gas Utility** – Provided notice confirming site address, that the incident was reported on January 1, 2025, the gas appliance involved was a bakery oven and, in their opinion, it was caused by delayed ignition resulting in a small explosion. **Retail Establishment** – Supplied documents verifying the timeline of repairs, alterations and issues found with the commercial oven, including confirmation of the date that the pilot was relocated. **Bakery Manager** – Provided a statement detailing the sequence of events leading up to the explosion. Stated the commercial oven was running between 5 and 20 minutes before the explosion. Confirmed the startup procedure of the commercial oven and conveyed how the assistant started up the commercial oven on the day of the incident (the assistant was unavailable at time of the interviews). They also explained that there had been repairs made to the commercial oven, including replacing the burner isolation valve. **Third Party Testing Company** Testing was conducted on the commercial oven, and a detailed report was submitted outlining the testing conditions, methodology, findings, and conclusions. The report identified several critical issues: • **Pilot Location -** The pilot was improperly positioned, which affected its ability to reliably ignite the entire burner. • **Incomplete Ignition -** During testing, only 50% of the burner ignited. The remaining unlit portion allowed unburnt gas to enter the combustion chamber, posing a significant safety risk. • **Burner Performance -** When operating in low-fire mode, the burner pressure registered at zero inches water column. As a result, the burner could not maintain a consistent flame across its full length.

Incident Summary #II-1817926-2025 (#55737) (FINAL)

		• **Ventilation Concerns -** It was also noted that approximately 30% of the fresh air grills serving the commercial oven were obstructed, which may have contributed to poor combustion performance. The overall conclusion of the report was: "*Based on observations of the burner lighting inconsistently, and the amount of gas coming from half of the burner while the other half is lit, we can determine that delayed ignition was the cause of the explosion. The amount of gas that would be required to reach a lower explosive limit of 4 percent gas in air [is] 23284.8 square inches (13.475 square feet) The burning rating is 240,000 Btu's at 3.5 inches water column manifold pressure. At these set points, with no airflow and only half the burner lit, the lower explosive limit causing an explosion would be met in 6 minuets and 44 seconds. Considering the timeline of events as described, this fits the length of time from startup of the oven to when the explosion occurred on site".* • **Fire department** – Confirmed they had received a call on January 1, 2025, at the site address. They attended site whereupon they found the sprinkler system had activated in the bakery area, caused by an explosion from the oven. The fire department made the area safe.
	Causes and contributing factors	**The incident occurred when accumulated gas from an unlit portion of the burner ignited inside the oven. This was contributed to by:** • Improper modification - The pilot was relocated to accommodate a shorter thermocouple, which was the only part available at the time. This decision was made under perceived pressure to return the oven to service quickly. • Lack of technical understanding - The technician demonstrated a limited understanding of the regulatory and safety requirements involved in modifying a regulated gas appliance. • Insufficient maintenance - Approximately 30% of the fresh air grills serving the oven were blocked with dirt and dust, reducing airflow and contributing to unsafe combustion conditions.

Image 1 - Partially restricted combustion air inlets.

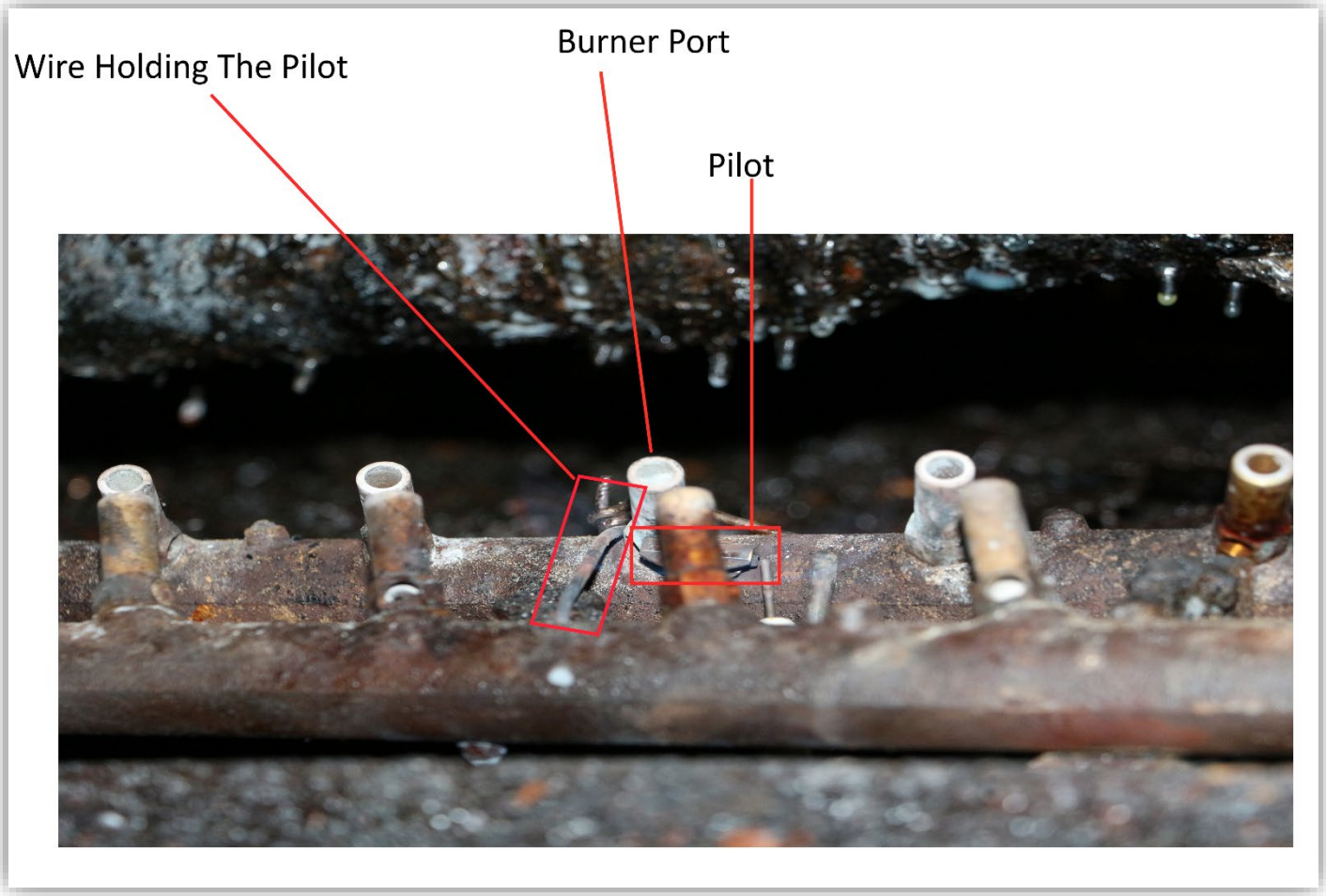

Image 2 - The revised location of the pilot assembly.