

# TALES FROM A FORENSIC FUEL EXPERT: THE CAUSES AND CULPRITS OF GAS APPLIANCE FAILURES

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**Fire places. Stoves. Boilers. Furnaces. Water heaters. Pool heaters. Dryers.**

What do they all have in common? Quite a bit. They are all gas burning appliances, and all used on a daily basis. What most people do not know about these appliances is that they all require annual inspection and maintenance. If that maintenance does not occur, then these appliances have one more thing in common—they all become potential failure hazards. >>>

## THE GOLDEN RULE OF FUEL BURNING APPLIANCES: **AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE**

It is simple math: the cost of being proactive far outweighs the cost of a fire, flood or explosion. For example, it may take two days for an inspector to inspect a small 20-unit factory. At \$85 an hour, the annual cost is around \$2,000. Most of the incidents I have investigated involving gas appliances had around \$200,000+ worth of damage on average, per loss.

Failed equipment on hot water tank systems alone have resulted in as much as \$1.5 million in damages in 2014 while improperly installed pipes and valves have caused facilities to be unproductive for up to 30 days.<sup>1</sup> 60% of these claims could have been mitigated or prevented.<sup>2</sup> Not only do companies who invest in maintenance minimize risk, they reduce critical downtime.

Most manufacturers require gas fueled appliances to be inspected or maintained annually. A few require bi-annual maintenance. In the case of rentals, the onus is on the rental company to have the appliance maintained or replaced. If you rent a hot water tank, call your provider to discuss maintenance and/or inspection.

Over the past 15 years, I have investigated over 300 cases involving fuel burning appliances. I have found three reoccurring reasons for failure:

- 1) MAINTENANCE ISSUES**
- 2) PRODUCT DEFECTS**
- 3) INSTALLATION ISSUES**

**AS FOR THE APPLIANCES INVOLVED, THE  
“CULPRITS”, ANY OF THEM CAN BE FOUND  
UNDER THE FOLLOWING CAUSES:**

### **CAUSE #1: MISSED MAINTENANCE**

When investigating an incident involving a gas fueled appliance, the first two questions I ask the owners are, “When was the last time you had this appliance serviced?” and “By whom?” The usual response is: “Never”. Again, most manufacturers want an appliance inspected or maintained annually. Some insist on bi-annual maintenance.

#### **CULPRIT: FURNACES**

When furnaces are not properly maintained, the heat exchanger can crack. When this happens, it can catch on fire and the flames can spread to other components. I recently completed an investigation on the cause of a furnace fire and found that the furnace’s heat exchanger was clogged. The furnace eventually caught on fire and the fire spread to the rest of the house. Keeping to a regular maintenance schedule for your furnace—at least once a year—will not only prevent a fire, but it will maintain the efficiency of the appliance as well.

#### **CULPRIT: POOL HEATERS**

Spas, apartment buildings, gyms, hotels—if they have a pool, they have a pool heater. These heaters must be serviced every year because they are different from other heaters. Pool heaters often run 24-7, unlike other heaters that operate for short durations. The radiant heat is much more intense. A fire could result if combustible clearances have been jeopardized. Or, if animals chew on the wiring, it could cause a short circuit and, in turn, the heater could catch fire. The repercussions of such an incident can be catastrophic. Trust me, I have seen it firsthand.

#### **CULPRIT: NATURAL GAS/OXYGEN TORCHES**

Portable tools and appliances should also undergo routine inspections. Their hoses are particularly vulnerable due to

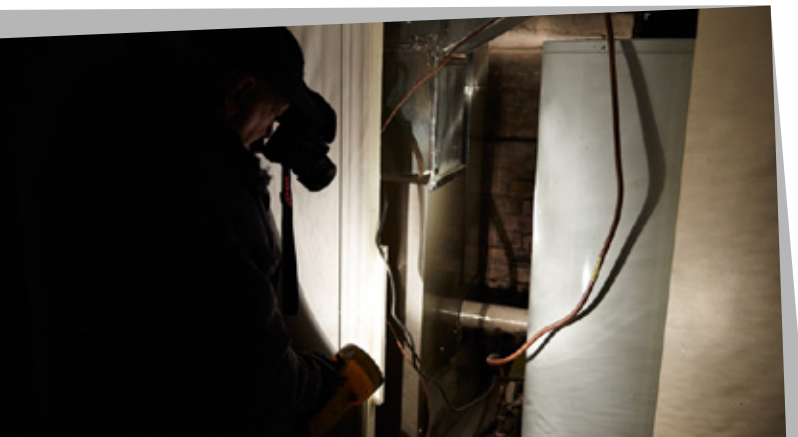
use, vehicles running over them, animals chewing on them, abrasions and extreme heat. Any damage to the hoses can lead to a gas leak, which can lead to failure and fire.

## CAUSE #2: MANUFACTURING DEFECT

In my experience as a forensic expert, I have been on many cases where design flaws have been the cause of a fire, flood or explosion.

### CULPRIT: WATER HEATERS

When water heaters are not assembled correctly, they can pose a serious safety hazard. There have been instances where I have been involved in explosion investigations and confirmed that key components were not installed properly during the manufacturing process. In one case of an improperly installed water heater burner, shortly after the water heater was installed, it exploded. The explosion resulted in significant damages and physical injuries.



### CULPRIT: GAS FURNACES

Gas furnace malfunctions can be extremely costly. In one case, two hours after the installation of a new furnace, it caught fire due to a cracked pipe fitting, causing \$250,000 worth of damage to the building. I have also encountered a furnace that

had an exhaust motor operating in reverse. Instead of sucking the fumes out of the house, it was blowing them into it.

### CULPRIT: DRYERS

During the design phase of most appliances, manufacturers must put protective measures within the appliance to safeguard it from the perils associated with transporting and shipping. If it cannot handle such conditions, it is considered a defect in the manufacturer's design. I was brought in to investigate the cause of a dryer fire and found that the dryer's burner came apart during shipping. When it was installed and turned on, gas leaked out of the open tube and the flame was redirected. It should have taken the installer two minutes to notice this. However, lack of attention to detail resulted in \$250,000 in claims!

## CAUSE #3: IMPROPER INSTALLATION

In 2012, the Gas Code in Ontario was updated to help contractors and installers understand that the Code is not the only installation requirement that must be adhered to. Installers and contractors need to read and understand the manufacturer's certified instruction manuals in addition to knowing the Code. They must also inform the user how to properly use the appliance they installed.

I frequently get involved in providing post-loss investigations relating to appliance failures for both industrial and residential incidents. Improper installation of such appliances is often the cause of the loss.

### CULPRIT: HOT WATER TANKS

Along with water main breaks and overflowing appliances, hot water tanks are one of the most common sources of water damage.<sup>3</sup> I have investigated multiple cases involving leaking hot water tanks. It is surprising how many were due to faulty installation. When improper tools and techniques are used to

solder the tank's joints, the joints can pop apart. In one case, it was only two days after installation.

### CULPRIT: GAS STOVES

The biggest problem I come across in fire cause analysis involving gas stoves is setting appropriate clearances from combustible materials. Often stoves are installed too close to a combustible wall, floor or cabinetry. There are specific clearances that need to be maintained. The 2012 Gas Code of Ontario states that installers must use the most stringent safety requirements—whether they are found in the Code or in the manufacturer's instructions. There have been many times that I have gone to a scene to inspect a new appliance and found the manual still in its plastic cover. Manufacturers have been known to change their installation specs on an appliance from week to week.

### CULPRIT: AIR CONDITIONERS

I have performed forensic fire analysis at scenes involving air conditioners, and more often than not, the installer installs the air conditioner coil too close to the furnace. The air conditioner's coils often sit above the furnace. If you put them too close to the combustion chamber, they can catch fire very easily. Unfortunately, it is a common occurrence.

### MORE THAN MAINTENANCE

In my experience, the people and companies who spend money on prevention do not see as much downtime, or have as many incidents. But there is more to prevention than annual maintenance. Consider having Origin and Cause arrange to have your installation of fuel burning appliances inspected. It may save lives as well as money.

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Accepted as an expert witness in all levels of criminal and civil courts, Joseph specializes in natural gas and propane fuelled fires and explosions. He has completed over 500 natural gas leak investigations and more than 100 fire and explosion investigations. His professional background includes 30 years with Enbridge Gas Distribution, where he held multiple roles including 10 years as a fuels safety inspector at TSSA, performing audits and investigating incidents, and as an operations supervisor, delivering field service support and interpreting codes and regulations governing gas distribution and related equipment.

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#### REFERENCES:

- <sup>1</sup>: Zurich Canada 'A cure for water damage in offices and habitational buildings'
- <sup>2</sup>: Insurance Institute for Business & Home Safety: <https://www.disastersafety.org/studies-reports/water-heater-failure-risks/>
- <sup>3</sup> <http://www.globeadvisor.com/servlet/ArticleNews/story/gam/20140227/RBSWWEATHER2226ATL>