JS|HELD

PERSPECTIVES

Common Causes of Electric Space Heater Fires & Methods of Prevention

2nd Edition

Our perspectives feature the viewpoints of our subject matter experts on current topics and emerging trends.

INTRODUCTION

We all love staying warm in winter. We turn up the thermostat, burn logs in our fireplace; heat up the bed with an electric blanket, and sometimes use electric space heaters to keep the temperature cozy. When it comes to space heaters, it's important to note any objects in close proximity and/or in contact with the heater that could cause a fire. In this paper, we examine common causes of electric space heater fires, discuss methods to prevent their occurrence, and review fire investigation and subrogation considerations to be aware of following a fire event.

A LEADING CAUSE OF FIRES

According to the National Fire Protection Agency (NFPA), heating equipment is a leading cause of fires in U.S. homes. Local fire departments have responded to an average of 52,050 fires involving heating equipment each year from 2012-2016, accounting for 15% of all reported home fires during this time. As a result of these fires, there were 490 civilian deaths, 1,400 civilian injuries, and one billion dollars in direct property damage.

The Consumer Product Safety Commission reports that approximately 1,200 fires a year are caused by portable electric space heaters. Although electric space heaters are generally more expensive to operate than combustion space heaters, they are the only unvented space heaters that are safe to operate inside your home due to the lack of carbon monoxide emissions.

TYPES OF ELECTRIC SPACE HEATERS & HOW THEY CAUSE FIRES

There are four basic types of electric space heaters:

- Ceramic heaters, which contain a heating element that reaches a high temperature, and the element is usually packaged inside a glass envelope.

- Convection heaters, which contain a heating element that operates by air movement as the air circulates through the body of the appliance and across the heating element.

- **Fan heaters**, sometimes called a **forced convection heater**, which is a type of convection heater that includes an electric fan to speed up the airflow, usually allowing for increased heat production and distribution.

- Oil heaters, which are another type of convection heater where the casing of the heater is filled with oil that is used as a heat reservoir providing more even heating.

To understand how space heaters cause fires, it's important to know the basic dangers of the appliance. The first danger is the amount of current that is drawn during use. A common rating for electric heaters is 1500 watts, which equates to approximately 12.5 amps. This amperage is well within safe limits for operation in your home; provided the heater, power cord, receptacle, and electrical wiring are all in good working order, and that only one heater is used per electrical circuit. A defect in any of these crucial components can lead to a failure that may result in a fire.

A common problem associated with portable electric heaters involves the use of under-rated extension cords or a RPT (Relocatable Power Tap, also known as a multi-outlet power strip or plug strip). UL listed heaters (UL 1278) require the heater manufacturer to caution the user of an electrical space heater that the heater should be connected directly into an electrical receptacle and should not be used with an extension cord or a RPT. Supplying any electrical load with an underrated cord can lead to overheating of the cord's wiring insulation materials, potentially resulting in personal injury burns or shock if handled or a short circuit that could lead to a fire.

Another common fire hazard associated with portable electric heaters is their proximity to common combustibles. Most portable heaters warn consumers to maintain a minimum of three feet of clearance from all combustibles. Many newer space heaters have safety features that will eliminate the heat or shut the appliance off if the space heater overheats or falls. Most, however, can't detect if the objects around them are overheating or are in danger of ignition.

Figure 1 *- Fire damage resulting from an electric space heater.*

DO SPACE HEATERS PRODUCE CARBON MONOXIDE?

According to the CDC (Centers for Disease Control), at least 430 people die annually in the U.S. from accidental carbon monoxide (CO) poisoning. While electric space heaters do not produce carbon monoxide (CO), non-electric space heaters (propane gas, natural gas, kerosene, wood) can if incomplete combustion occurs. If these types of heaters are in use, it is recommended that a working CO detector be used to indicate the presence of high-level CO gas.

Symptoms of Carbon Monoxide Poisoning

Victims of carbon monoxide poisoning often report flu-like symptoms. The following may indicate a high-level exposure:

- Aches and pains
- Headaches
- Weakness
- Nausea or vomiting
- Chest pain or shortness of breath
- Dizziness or lightheadedness
- Balance problems
- Memory problems
- Unconsciousness

HOW SPACE HEATERS ARE REGULATED

Space heaters are tested by organizations like Underwriters Laboratories (UL) and Canadian Standards Association (CSA). As an example of one of the numerous required tests, a UL listed portable electric heater must pass a tip-over test that simulates the most severe tip over orientation. The U.S. Consumer Safety Protection Commission (CPSC) helps reduce space heater risks by developing voluntary standards, issuing and enforcing standards, and banning unsafe consumer products. The CPSC also has a current list of recalled space heaters to protect consumers. Space heaters are also covered under the International Code Council (ICC) and National Fire Protection Association (NFPA) Fire Code (NFPA 1).

The ICC covers space heaters under the International Fire Code (IFC), Sections 605.10.1-4. The IFC lists under what occupancies, or types of spaces, space heaters can be used. It also specifies that only listed and labeled portable space heaters can be used, and that they should be plugged into an approved receptacle. While many organizations note to avoid using an extension cord with space heaters, Section 605.10.3 of the 2018 IFC unequivocally prohibits the use of extension cords with space heaters, with the following statement:

605.10.3 Extension cords. Portable electric space heaters shall not be plugged into extension cords.

Section 605.10.4 of the 2018 IFC discusses prohibited spaces for use of space heaters, such as being operated within three feet of any combustible materials and only in locations for which they are listed.

The NFPA covers space heaters in NFPA 1 - 2018, Section 11.5.3. One of the areas addressed in this section of the Fire Code covers space heaters used in offices. Some employees place heaters under their desk. While this may keep them from tipping over, they can also be forgotten and left on after workers leave for the day. The areas under a desk can also contain combustible materials in close proximity to the space heater, such as plastic waste receptacles which could create significant fire risks. In addition, it is nearly impossible to maintain three feet of clearance under a desk. NFPA 1 - 2018, Section 11.5 requires space heaters to be

plugged directly into an outlet due to the amount of current drawn to operate them. Extension cords should not be used to plug in an electric space heater. NFPA 1 allows the Authority Having Jurisdiction (AHJ) to prohibit the use of space heaters based on their past inspection findings that violate this requirement.

SPACE HEATER RECALLS

While most space heater fires are caused by proximity to combustibles, there are instances where space heaters can overheat and cause the units to melt, then ignite nearby available materials. The following are examples of space heaters that have been recalled by the CPSC (www.cpsc.gov):

Figure 2 *- Twin-Star Duraflame DFS-220-RED | Photo Credit to www.cpsc.gov*

- Twin Star recalled 31,000 Duraflame heaters that were overheating, then melting, then potentially igniting nearby materials. There were 32 reports of heaters burning or melting.

Figure 3 *- Home Depot Soleil Portable Heater | Photo Credit to www.cpsc.gov*

- Home Depot recalled 103,000 portable fan heaters due to the potential for the plastic housing to melt and catch fire. There were 464 reports of the fans melting.

https://www.cpsc.gov/Recalls/2013/home-depot-recalls-soleil-portable-fan-heaters

Figure 4 *- H.E. Industrial - Profusion Heat HA-22-48M | Photo Credit to www.cpsc.gov*

- H.E. Industrial recalls 8,500 electric garage heaters due to the potential of the heating element overheating and causing a fire hazard.

Figure 5 *- Dyson Hot and Dyson Hot+Cool (AM04 and AMO5) | Photo Credit to www.cpsc.gov*

- Dyson recalled 338,000 bladeless portable heaters in the U.S. and 43,000 in Canada due to a potential short that could cause the unit to overheat and cause a fire. There have been 82 incidents of units short-circuiting and overheating.

FIRE INVESTIGATION & SUBROGATION CONSIDERATIONS: WHAT TO BE AWARE OF FOLLOWING A FIRE EVENT

The fire site, whenever possible, should be secured if an electric space heater is believed to be a potential cause of the fire. This will allow the forensic expert to properly investigate origin and cause, as well as subrogation potential. The scene should be documented with photos and/or video as soon as possible before spoliation occurs. If the site has been disturbed, the space heater and any and all parts should be procured. The chain of custody should be protected with all transfers and secure locations documented in writing. The electric space heater should be stored in a secure location until it can be properly examined by the forensic expert, the manufacturer, and any other interested parties.

SPACE HEATERS: GUIDELINES FOR SAFE USE

Fortunately, there are simple safety guidelines that help greatly reduce the chance of a fire caused by a portable electric heater when properly followed. The following safety tips are outlined by the CPSC and most of these tips are also posted on new packaging when an electric heater is purchased:

- Never operate a heater you suspect is damaged.
- Before use, inspect the heater, power cord, and plug for damage.
- Follow all operation and maintenance instructions. Visit www.cpsc.gov or www.SaferProducts.gov to see if your electric heater has been recalled.
- Never leave the heater operating while unattended, or while you are sleeping.
- Keep combustible materials such as beds, sofas, curtains, papers, and clothes at least three feet (1 meter) from the front, top, sides, and rear of the heater.
- Be sure the heater plug fits tightly into the wall receptacle. If not, do not use the outlet to power the heater. Poor electrical connections are another leading cause of fires.
- During use, check frequently to determine if the heater plug or cord, wall outlet, or outlet faceplate is hot. If the plug, outlet, or outlet faceplate is hot, immediately discontinue use of the heater. Have a qualified electrician check and/or replace the plug or faulty wall outlet(s). If the cord is hot, disconnect the heater and have it inspected/repaired by an authorized repair technician.
- Avoid the use of an extension cord or a plug strip unless you are confident the rating exceeds the heater's power requirements.
- Ensure that the heater is placed on a stable, level surface and located where it will not be knocked over.
- When purchasing a heater, ensure that the space heater has been tested by a Nationally Recognized Testing Laboratory (NRTL). Underwriters Laboratories (UL) is the most commonly recognized NRTL in the US.
- Never place the space heater power cord underneath rugs or carpeting. This can result in damage to the power cord, potentially causing it and nearby objects to burn.
- To prevent electrical shocks and electrocutions, always keep electric space heaters away from water and NEVER touch an electric heater if you are wet.

CONCLUSION

While electric space heaters can help keep room temperatures warm, they can also be dangerous and cause fires. Space heaters should never be left unattended or used within three feet of any combustibles and should always be plugged directly into an outlet. While most new units have built-in safety features to help prevent fires, there are many older units still in use without those features.

In the event of a fire, the fire scene should be protected and secured to prevent spoliation of the scene before a qualified fire origin and cause investigator can inspect the site. If the electric space heater is determined to be the cause of a fire, the unit and any parts should be secured and protected. The chain of custody outlining handling of the space heater and all transfers should be documented in detail. The unit should be stored in a secure location until a qualified expert and the manufacturer can inspect and evaluate the space heater.

ACKNOWLEDGMENTS

We would like to thank Marc Fennell, IAA-CFI, Rodney Sanders, IAAI-CFI, CFEI, CVFI, PI & David L. Montague, PE for providing insight and expertise that greatly assisted this research.

MORE ABOUT J.S. HELD'S CONTRIBUTOR

David L. Montague is a Professional Engineer (PE) in J.S. Held's Equipment Consulting Practice. David conducts forensic investigations involving residential, commercial, institutional, and industrial facilities and the myriad of systems involved in these varied occupancies. His experience encompasses vehicular and equipment investigations stemming from fire, lightning, manufacturing defect, maintenance defect and other failure modes. He leads forensic investigations involving personal injury, has experience testifying, and has been a qualified forensics expert.

Contact David L. Montague at dmontague@jsheld.com
or +1 901 351 6849.

REFERENCES

1. International Code Council (2018). Fire (2018). Country Club Hills, IL: International Code Council Inc.

2. Richard Campbell (2018). NFPA's "Home Fires Involving Heating Equipment". Quincy, MA. National Fire Protection Association Research

3. U.S. Consumer Product Safety Commission (2013) – CPSC Safety Alert "Reducing Fire Hazards for Portable Electric Heaters". Publication 098. Bethesda, MA. www.cpsc.gov.

4. Underwriters Laboratories (2009). Electric Heaters – Tip-over Protection from Issue 1, 2009 The Code Authority Newsletter. Northbrook, IL. UL LLC.

5. https://www.cdc.gov/dotw/carbonmonoxide/index.html#:~:text=Every%20year%2C%20at%20least%20430,due%20to%20accidental%20CO%20poisoning

6. https://www.newair.com/blogs/learn/does-an-electric-heater-produce-carbon-monoxide-answers-to-your-burning-safety-questions