



THE SCIENCE BEHIND CARELESS SMOKING FIRES

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Improperly discarded cigarettes are the cause of hundreds of fires every year. Edmonton Fire Rescue Services reports that since 2010, the improper disposal of smoking materials has caused more than \$46 million in damages across Edmonton. While just last year in Langford, B.C., over the course of Canada Day weekend, five fires were caused by improperly discarded cigarettes, including one house fire that resulted in \$200,000 in damage.

THE FIRE TRIANGLE

Based on these reports, you might imagine that it's easy for a discarded cigarette to start a fire. However, it's more difficult than you think. In order for these incidents to occur, the stage has to be set just right.

A fire needs three things to ignite, which fire investigators often refer to as the fire triangle: Heat, fuel and oxygen. A smouldering fire occurs when all three elements are present, but lacking sufficient oxygen to transition to an open flame.

A full-length cigarette only produces 5 watts of heat energy, which decreases as the cigarette is consumed. If you think of the heat from a 60-watt light bulb you'll realize that 5 watts is not very much. So, for a cigarette to start a smouldering combustion, it needs to be placed in such a way that it doesn't extinguish itself before ignition occurs. And of course, it needs to be placed in contact with an appropriate fuel source.

In order to support smouldering combustion the fuel needs to be organic, this includes cotton sheets, vegetation such as peat moss, or simply the paper and filters from other cigarettes. Once it begins, a fire can continue to smoulder with a minimum amount of oxygen until something tips the scales.

An increase in airflow can cause a smouldering fire to become an open flame. A smouldering mass can eventually provide enough heat energy to burn

through items such as mattresses, recliners, couches, etc. Once through the bottom or side of, say, a mattress, more oxygen can mix with the area of consumption, allowing the smouldering fire to transition into an open flame.



Now that we know how smoking-material fires start, it will be clear why they originate where they do.

WHERE THERE'S SMOKE...

We can divide where smoking-material fires originate into two general zones: Interior and exterior. While we investigate more interior than exterior fires started by smoking materials, an NFPA report comparing data from 1980-1984 and 2007-2011 shows a definite increase in fires originating in outdoor areas of the home and a decrease in fires originating indoors.



Between 1980-1984, 39% of fires started by smoking materials originated in the bedroom, and only 1% originated on a balcony or porch. Between 2007-2011, fires starting in the bedroom were down to 18%, and those originating on a balcony or porch were up to 14%. They attribute this to changes in smoking habits over the past 40 years where many homes banned smoking indoors.

INTERIOR

The two most common rooms where smoking-material fires start are the bedroom and living room. While these fires are caused by cigarettes, they are often the result of people who fall asleep or doze off while smoking in bed or on the couch. The most commonly ignited items are mattresses and bedding, and upholstered furniture, which are

usually covered in a mix of organic fabrics, making them excellent fuel sources. If a cigarette were to fall between two cushions, for example, or between a person and the arm of a couch, it would be in direct contact with the material and well insulated – ideal conditions for smouldering combustion to occur.

The reason this scenario is so dangerous, and why cigarettes are the leading cause of fatal fires, is because as the fire smoulders it produces toxic gases which further affect the victim. I have investigated many accidental smoking-material fires where the person in the room/structure succumbed to smoke inhalation. Those who are fortunate to get out alive rarely do so unscathed. Most suffer from severe smoke inhalation and thermal burns.

EXTERIOR

Smoking-material fires that start outside the home usually originate from planters or butt cans where people discard their cigarettes. With regard to the latter, what happens is that all the paper and filters from the old cigarettes act as fuel and begin to smoulder. When the wind picks up, the oxygen level increases and the fire transitions to open flame.

Where planters differ is the fuel source. Many people don't realize that potting soil contains peat moss and other organic matter which is flammable – especially as it dries out. Similarly, fires can originate under decks where old leaves and grass clippings have accumulated.

Adjusters should be aware that many common smoking-material fires, whether they originate indoors or outdoors, have the ability to spread and often cause extensive damage to the structure. I have investigated many fires which started outside, spread to the vinyl siding and then breached the home. The damage to the interior was extensive to the point that anyone without a proper understanding of fire dynamics would think the fire began inside.



When attending one of these incidents, the best readily available resource for adjusters is the homeowner/witness. Their observations and statements can be very useful in determining whether you are dealing with a potential smoking-materials fire. Here are a few questions adjusters should ask upon arriving at a scene:

- What was the homeowner doing prior to the fire? Were they smoking? If so, when?
- What are their smoking habits? Where do they usually smoke?
- Was anyone else in the vicinity who could have been smoking? A tenant, guest, etc.
- Did they see or smell any smoke?
- Did they see the fire ignite?
- At what stage was the fire when they first noticed it (white smoke, flaming, etc.)?
- What did they see on fire (couch, bed, pillows, clothing, etc.)?
- What did the fire department observe when they arrived? Was the fire venting out of windows and doors or was the fire localized to the point of origin?

KEY QUESTIONS

While science makes accidental smoking-material fires seem improbable, they do occur, and with startling frequency.

TIMING IS CRUCIAL

Timelines are another component in eliminating smoking material as an ignition hypothesis. Research has shown that from the time a full-length cigarette is properly placed in a suitable fuel, it takes at least 22 minutes for it to transition to an open flame. Burn tests I have personally been involved with while at the Office of the Fire Marshal took up to 89 minutes in some cases. On one occasion, paper in a garbage can ignited in 4 minutes, but that was extremely rare. To put that in a practical perspective, if someone says that 10 minutes after lighting a cigarette, a fire was venting out the windows, you will want to investigate further to substantiate such an improbable claim.



These are just a few things an adjuster should consider in order to get an indication of what type of fire they are dealing with. Upon hiring an experienced fire and explosion investigator, this will also help in determining the origin and cause of the fire and identifying opportunities for subrogation.



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Tom is a NFPA 1033 certified Fire and Explosion Investigator with over 15 years of experience conducting complex investigations into large losses, incendiary fires, explosions, and fatal fires. His professional experience includes 5 years with the Office of the Fire Marshall, 10 years with Kingston Fire and Rescue, and 20 years with the Canadian Armed Forces, during which he was recognized by the Government of Canada for leadership excellence. Tom has instructed numerous fire investigations courses and has testified as an expert witness on federal criminal cases in Ontario Provincial Courts.

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