



Facts About Fabric Flammability



North Central Regional
Extension Publication 174
Revised July 2003

Facts About Fabric Flammability

Have you ever known someone burned when their clothes caught fire? Did you want to blame someone else when it happened? Do you know how the fire started? What do you know about fabric flammability? If you have had no experience with clothing fires and burn injury, you may be surprised to learn how fast your clothes can burn if set on fire.

Clothing fires must be avoided because burn injuries are often severe, disfiguring, and can cause death. Such tragedies do not have to happen. However, you must take responsibility for your own personal safety by learning the facts. The Consumer Product Safety Commission (CPSC) is the governmental agency that administers the laws and standards that apply to fabric flammability. It issues many educational news releases, warnings, and recalls



of unsafe products, but cannot guarantee your safety. This publication will review facts about fabric flammability that everyone needs to know to avoid the costly and terrible consequences of a clothing fire.

Fact 1: Most clothing and household textiles will burn.

To burn, clothing must be ignited from some heat or flame source. You don't need a flame, only heat to start a clothing fire. When common apparel and household furnishing textiles get hot enough they will burn and give off toxic smoke. For example, if you leave a hot iron on a cotton shirt too long, the heat will scorch the shirt and can start a fire.

Fact 2: Clothing fires are started by common household ignition sources.

Clothing fires are often started by items commonly found and used around the house for heat or light. The majority of fires resulting in child fire injuries and deaths are started by children playing with fire in a bedroom with matches or lighters when fabric or paper ignites (1).

To reduce chances of clothing fires: Store all items likely to tempt small children safely out of reach. This includes...

- candles
- matches
- cigarettes and cigars
- cigarette lighters
- flammable liquids such as paint thinner, gasoline, charcoal lighter

Use space heaters and fireplaces safely. Before nap or bedtime, extinguish or turn off...

- cigarettes and cigars
- candles
- fireplace embers
- space heaters
- kitchen ranges

Never reach into a fire or across an open flame because your sleeve might catch fire. For example...

- candles
- gas flames or hot coils of kitchen ranges
- barbecue grills
- wood burning stoves
- fireplaces
- camp fires



Fact 3: Clothing fires can cause burn injury and death.

The exact number of clothing fires that happen while a person is wearing the clothing in the U.S. is unavailable because of the way data are collected. The National Electronic Injury Surveillance System (NEISS) compiles consumer product injury data based on reports from emergency rooms and health care facilities. NEISS estimated that nationwide 196,233 injuries (including 11,115 deaths) were associated with clothing in 2001, with 69.7 the rate per 100,000 population (1). However, not all of these are from clothing fires because cases of entanglement, suffocation, strangling, etc. are counted in these totals.

Nevertheless, when clothing catches fire, the burn injuries are often severe and may cause death. An example reported by the Consumer Product Safety Commission (CPSC) is the case of a 69-year-old man whose robe sleeve caught fire as he removed toast from an electric toaster. The terry-cloth robe burned quickly, also burning the man. Although the fire was extinguished, the man died four days later. (2) According to the CPSC, "a significant number" of clothing fires occur with people over age 65.

The U.S. Fire Administration points out that 80 percent of fire deaths occur in residences and that these residential fires most often start in the kitchen. People over 65 and children under 5 have the highest risk of fire death in these fires but the number of these involving a clothing fire was not indicated (3). Working smoke alarms dramatically increase

the person's chance of surviving a residential fire.

Fact 4: Clothing and household textile labels show if a fabric is flame resistant.

By looking at a fabric you cannot judge if it is flame resistant or flame retardant, so you must look for a label. If there is no label claiming flame resistance, you must assume the textile will burn rapidly.

Be sure you understand the terms used on clothing labels and other products.

If it says

Flammable
Inflammable
Combustible

It means

These three words mean the textile will burn readily.

Fireproof
Non-combustible
Non-flammable

These three terms mean the textile will not burn.

Fire resistant
Fire retardant
Flame resistant
Flame retardant

These four terms mean the textile will be slow to ignite, may burn more slowly, may self-extinguish when the heat source is removed.

Fact 5: The way a fabric burns depends partly on its fiber content.

Natural cellulosic fibers (cotton, linen), manufactured cellulosic fibers (acetate, lyocell, and rayon), and synthetic fibers (acrylic, nylon, lastol,olefin, polyester, and spandex) can burn quickly when ignited, but

they behave somewhat differently as they burn. Generally cellulose burn with a yellow flame, light smoke, and have glowing embers—like a fireplace log, only much faster. Synthetics may catch fire quickly or shrink from the flame initially, but ultimately, they will sputter, flame, and melt to the skin or the flaming melt will drop to the floor. Wool and silk are protein fibers and are difficult to ignite. They may self-extinguish, but this varies depending on the closeness of the weave or knit (fabric density) and other finish treatments. **Table 1**

describes typical burning characteristics of fibers, ranking them from the most to least hazardous. No flame proof fibers are used in ordinary wearing apparel.

Fabrics that are a blend of two or more fibers do not burn in the same way as either fiber. Sometimes, blends are more dangerous than either fiber. For example, fabrics of 50 percent cotton and 50 percent polyester tend to burn longer than a similar fabric of either cotton or polyester.

Fact 6: The way a fabric is made (knit, weave, lace, etc.) affects how it burns.

Heavy close structures ignite with difficulty and burn more slowly than light, thin, or open fabrics. In general, summer weight clothing is more likely to catch fire than winter weight fabrics. However, heavy weight fabrics burn **longer** when ignited, because there is more flammable material present.

Fabrics with more of the fiber surface area exposed to air have more oxygen available to support burning and therefore burn more easily. Thus, thin, gauzy fabrics, lace, or brushed fabrics can be very flammable. Also, fabrics with a napped or brushed surface of fine fibers can catch fire easily because of the greater amount of fiber surface exposed to oxygen in the air.

Fact 7: Close-fitting clothes are less likely to catch fire than loose-fitting ones.

Since clothing must come into contact with an ignition source to catch fire, keeping a safe distance from heat and flame sources helps to prevent fires, especially if your clothes move with you.

Clothes that fit closer to the body are less likely to stray (or get blown) into a flame source accidentally than clothes with loose, flowing design. For example, clothes designed with fullness, frills, ruffles, fringe, or trailing ties that extend from the body are more apt to catch fire than those without these features.

Long sleeves can easily be set on fire as you reach across a gas flame or electric coil on a kitchen range.

Table 1: Burning Characteristics of Fibers

less safe	cotton/linen	Burns with a hot, vigorous flame, light colored smoke, and leaves red glowing ember after flaming stops. Does not melt or draw away from the flames.	
	rayon/lyocell	Burns similarly to cotton and linen, except that it may shrink up and become tighter to the body.	
	acetate	Burns with a rapid flame and melts when burning. May melt and pull away from small flames without igniting. Melted area may drip off the clothing carrying flames with it. When flames have died out, the residue is a hot, molten plastic and is difficult to remove from any surface.	
	acrylic	Burns similarly to acetate, except that it burns with a very heavy, dense, black smoke. It drips excessively.	
	nylon, lastol, olefin, polyester, and spandex	Burns slowly and melts when burning. May melt and pull away from small flames without igniting. Melted area may drip off clothing carrying flames with it but not to the extent of acetate and acrylic. Residue is molten and hot and difficult to remove. May self-extinguish.	
	wool and silk	Burns slowly and is difficult to ignite (especially in winter garments). May self-extinguish.	
	modacrylic and saran	Burns very slowly with melting. May melt and pull away from small flames without igniting. Self-extinguishes.	
	aramid, novoloid, and vinyon	Chars, does not burn.	
	more safe		

Loose fitting or maternity tops can be set on fire at the hem as a person reaches above a range to get something from a cupboard.

Clothes that have quick-release features (for example with snap front closures) so they can be pulled off immediately if ignited, are desirable. This increases the chance that the garment can be removed before serious burn injury occurs if the garment catches fire.

Fact 8: Flame resistant fabrics burn slowly.

Flame resistant or flame retardant (FR) fabrics are those that ignite with difficulty, burn slowly when set on fire, and go out or self-extinguish when the source of flame is removed. Because of this, flame resistant fabrics allow more time to remove clothes or put out the fire. This little margin of safety can make a big difference in the degree and extent of burn injury.

Flame resistant fabrics do not protect you in a burning building or if you reach into a burning stove or an oven. Firefighters have specially designed clothing that withstands very high heat for very limited amounts of time; they also have special masks and breathing apparatus to prevent smoke inhalation. This level of protection is not offered by flame resistant clothing found in some work uniforms and other apparel such as children's sleepwear. Some people think flame resistant clothing is more protective than it really is. FR apparel can only provide a small margin of safety—perhaps enough time to let you remove the clothes or smother the fire.

Fact 9: Most flame resistant fabrics do not have chemical finishes.

When FR fabrics were first offered to consumers, some were created by adding special finishes to the fabric—like putting frosting on a cake. Today's FR fabrics used in children's sleepwear are not made that way. Usually the molecule of the fiber itself is altered to provide flame resistance. You could say the recipe for the cake was changed, because the FR fibers now have a different molecular structure than regular fibers of the same type or generic class. Two polyesters that look and feel the same may have very different burning characteristics as a result. If a garment is not labeled flame resistant, you must assume it is not.

FR cotton uniforms and work clothing must have chemical finishes applied because the cotton fiber in its natural state will burn.

Fact 10: U.S. governmental flammability laws and rules govern wearing apparel, but do not mean that clothes will not burn.

No flammability standard for fabrics used in everyday apparel makes anyone safe from burn injury in a burning house or building. However, the various flammability laws and standards give individuals a little extra time to take action to limit a fire in clothes being worn, carpets and rugs, or mattresses. These laws, regulations, and their interpretation can be found in Part 1602-1632 of the Code of Federal Regulations (4).

The Flammable Fabrics Act of 1953 and its amendments were passed to assure a measure of consumer safety with regard to fabric fires, but these standards do not mean that clothing will not burn (4). Flammability tests are destructive tests, i.e. the samples are burned and afterward are no longer useable, so appropriate sampling of manufactured goods is important. The Flammable Fabrics Act and all related standards listed below are currently under the jurisdiction of the Consumer Product Safety Commission.

- **Part 1610—Standard for flammability of clothing textiles**, provides for testing flammability of clothing and textiles and establishes three classes for textiles: Class 1 “normal flammability”—for fabrics “generally accepted in the trade as having no unusual burning characteristics,” Class 2, applicable only to fabrics with raised fiber surfaces that may be used in clothing with “intermediate flammability” or burning characteristics between “normal and rapid and intense burning” and Class 3, which includes textiles that are “considered dangerously flammable and recognized by the trade as being unsuitable for clothing because of their rapid and intense burning.” (4, p. 602-3). Fabrics or garments in Class 3 may not be used in clothing (4, p. 618).

- **Part 1615—Standard for the flammability of children's sleepwear, sizes 0 to 6X (FF 3-71)** applies to children's pajamas, nightgowns, or similar related items such as robes, intended for sleeping. It exempts underwear or diapers, infant



garments (size 9 months and smaller), or specified “tight-fitting garments” as defined by dimensions for each size that are labeled in accordance with the standard. Such a label might state:

“WEAR SNUG FITTING. NOT FLAME RESISTANT” or

“FOR CHILD’S SAFETY GARMENT SHOULD FIT SNUGLY. THIS GARMENT IS NOT FLAME RESISTANT.”

“LOOSE-FITTING GARMENT IS MORE LIKELY TO CATCH FIRE.”

Fabrics, trims, seams, and closures for children’s sleepwear must pass a more rigorous flammability test than the test used for general wearing apparel and their flame resistance must be durable for up to 50 launderings. Manufacturers must label this sleepwear or its packaging with precautionary instructions so that consumers will not use laundering treatments known to reduce their flame resistance. (See 4, 630-638.)

Sometimes fabric softeners or carbonate-based detergents used in normal home laundering can build up on fibers making a normally flame resistant fabric more flammable. Therefore, the labels about care of flame resistant clothing should be followed carefully.

- **Part 1616—Standard for the flammability of children’s sleepwear: Sizes 7 through 14 (FF 5-74)** applies to pajamas, nightgowns, and other sleeping apparel for children in this size range and the same test requirements must be met as in **Part 1615** on previous page.

Children’s sleepwear is the only wearing apparel that is covered by a special standard and requires a more rigorous flammability test. However, it is known that incidence of burn injury is also high among the elderly, especially those who lack agility to remove themselves from flame sources.

Fact 11: Maintaining flame resistant properties in children’s sleepwear requires following care label instructions.

Children’s sleepwear must have a care label as other wearing apparel does. This label may give particular warnings about avoiding use of laundering products that would alter flame resistant characteristics. Fabric softeners in liquid form have been shown to increase the speed in which certain fabrics burn because the coating itself is flammable. Dryer drying may make fuzzy fabrics more fluffy, adding to their likelihood of catching fire (5). Carbonate-based detergents also can deposit on fibers making fabrics more flammable (6).

Fact 12: Flammability standards exist for carpets, rugs, and mattresses, but other home furnishings do not have special standards.

Textiles in many home furnishings products, such as bedding, drapery, and upholstery, are not covered by special flammability standards, but carpets, rugs, and mattresses are (4).

In the 1970s, governmental rules were adopted to require that carpets, rugs, and mattresses pass prescribed flammability tests to help reduce the burn injury, death, and destruction caused by fires in the home. These standards remain in effect.

- **Part 1630—Standard for the surface flammability of carpets and rugs (FF 1-70)** applies to all types of carpets and rugs used as floor covering, regardless of their fiber content or fabrication method. This standard was enacted because of concern that flames from a spark or small ignition source falling on carpet might start a fire that would spread to drapery and interior furnishings to start building or home fires. The test method for this flammability standard uses a match to set a specified tablet of methenamine on fire in the center of a carpet specimen held by a steel frame. The carpet passes the test if the flame does not spread more than three inches in any direction defined by a steel ring. One of a kind antique, Oriental, or hides (skins) may be excluded from testing (4, p. 696-714).

- **Part 1631—Standard for the surface flammability of small carpets and rugs (FF 1-70)** applies to rugs less than 24 sq. ft. in size and/or not longer than 6 feet. These are tested as above.

- **Part 1632—Standard for the flammability of mattresses and mattress pads (FF 4-71, Amended)** was enacted because of the frequency of cigarette ignition of mattresses because people persist in smoking in bed. It excludes sleeping bags, pillows, mattress foundations and water beds, love seats, sofas, sofa-beds, etc. (4, p. 715-733).

WHAT TO DO IF YOUR CLOTHES CATCH FIRE:

Your actions in the first few seconds of a clothing fire—if a sleeve or hem catches fire— make a big difference in the extent of injury that you might have.

- If your clothes are quick release, strip them off your body—better to be bare than burned.
- STOP, DROP, and ROLL if clothes are not quick release. This will tend to smother the fire. Your first impulse may be to run to move away from the fire source, but if your clothing is on fire running will just fan the flames and make it worse.
- Call 911. Report your location clearly and wait for emergency personnel. If your area of burn injury is small, it may be quicker to go to your closest emergency room.
- If you see someone else with clothes on fire—and you are not in a burning building or room—have them stop and lie down, then throw a wool blanket or coat over the fire to smother it.
- Seconds of inaction give the clothing fire a greater chance to cause severe pain and injury.
- Wait for firefighters with appropriate protective gear to rescue persons in burning buildings.

If you regularly take care of children, remember that they are naturally curious about fire. Adults must provide a safe living and learning environment for them. This includes providing adequate supervision so they do not have a chance to play with fire.

References:

- (1) Federal Emergency Management Agency, U. S. Fire Administration, *Children and Fire in the United States: 1994-1997*. Retrieved from <http://www.usfa.fema.gov/downloads/pdf/children.pdf> May 1, 2003.
- (2) U.S. Consumer Product Safety Commission, *U.S. Consumer Product Safety Review*, Fall 2002, Vol. 7, No. 2.

(3) U.S. Department of Homeland Security, Federal Emergency Management Agency, Fire Administration, *Facts on Fire*, March 6, 2003 Retrieved from <http://www.usfa.fema.gov/public/facts.cfm> May 1, 2003.

(4) Consumer Product Safety Commission, *Code of Federal Regulations, Commercial Practices 16 Part 1602-1632. Subchapter D—Flammable Fabrics Act Regulations*, Revised as of January 1, 2002.

(5) Consumer Reports, *Fabric softeners and flammability*, Vol. 65, No. 8, August, 2000.

(6) Consumer Product Safety Commission, *Your Home Fire Safety Checklist*, CPSC Document #556 Retrieved from <http://cpsc.gov/cpscpub/pubs/556.html> May 15, 2003.

Prepared by Jan Stone, extension textiles and clothing specialist, and Sara Kadolph, professor, textile and clothing department, Iowa State University.

No endorsement of companies or their products mentioned is intended, nor is criticism implied of similar companies or their products not mentioned.

File: T&C 7

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Stanley R. Johnson, director, Cooperative Extension Service, Iowa State University of Science and Technology, Ames, Iowa.

. . and justice for all

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Many materials can be made available in alternative formats for ADA clients. To file a complaint of discrimination, write USDA, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call 202-720-5964.