



CLOSED DOORS COULD SAVE YOUR LIFE: SLOWING THE SPREAD OF SMOKE, HEAT AND FLAMES IN THE EVENT OF A FIRE



Why you should “Close Before You Doze”

As residential fires move through a home faster than ever, an analysis by leading fire safety researchers points to an important protective action that many people may be unaware of. A closed door can provide occupants with a critical barrier against heat and smoke, giving them precious additional minutes to escape or be rescued, and helping to protect property.

Modern building designs, construction materials and methods, and home furnishings contribute to fires that grow more quickly and become more intense.

Research conducted in July 2017 by UL’s Firefighter Safety Research Institute (FSRI) found that, during a home fire, conditions in rooms with



closed doors provided a safer environment for their occupants and increased their chances of survival. The study, which was conducted during a simulated basement fire, found that during a critical ten-minute period temperatures and concentrations of carbon monoxide and carbon dioxide reached potentially life-threatening levels in a room with an open door, while an adjacent room with a closed door successfully maintained temperatures and oxygen, carbon monoxide and carbon dioxide levels more consistent with survivable conditions.



UL FSRI Research proves that closed doors and windows are instrumental in protecting life during a fire

Researchers at UL’s FSRI have extensively studied the behavior of fires in residential settings, and have carefully analyzed the impact that various designs and construction methods can have on the speed and intensity with which a fire can spread. This research has contributed to a greater understanding of the nature of residential fires, and has help fire service personal develop more effective techniques for combatting residential fires and for limiting their impact.

The research has also resulted in UL’s “Close Your Door” initiative, a consumer-oriented campaign that highlights the importance of closed doors in helping to protect occupants during a residential fire.

Synthetic materials ignite faster and burn more intensely when exposed to an ignition source.

Building materials have an impact on home safety

Today, most manufacturers of modern home furnishings use high-performance synthetic materials and polyurethane foam for furnishing covers and padding. Gone are more traditional padding made of cotton, down or feathers.

Synthetic materials make home furnishings more resistant to wear and tear, and make

them easier to clean. Unfortunately, researchers at UL have repeatedly demonstrated that synthetic materials also ignite faster and burn more intensely when exposed to an ignition source. In one study, for example, UL researchers found that a test fire in a room furnished with traditional materials took nearly 30 minutes to reach flashover. A



test fire in a similar room with modern furnishings reached flashover in less than four minutes.

What’s more, burning synthetic materials generate greater amounts of smoke than natural materials, and the smoke is almost always more toxic. Combined with the open floor plans that characterize most new residential construction, occupants now have far less time to safely evacuate a house fire before conditions become untenable.

The research behind UL’s “Close Your Door” Initiative

UL has conducted dozens of studies to develop a better understanding of the characteristics of the modern residential fire. Some of those studies evaluate the reaction of building materials and home furnishings under fire conditions. Others investigate the health impact on firefighters from exposure to smoke and other particulates produced by fires. Still others address firefighting techniques or specific firefighting challenges.

CYD Basement Fire Table

Time (min)	Closed Bedroom Door				Open Bedroom Door			
	Temperature (F)	Oxygen	Carbon Dioxide	Carbon Monoxide	Temperature (F)	Oxygen	Carbon Dioxide	Carbon Monoxide
0	70	20.9	0	0	70	20.9	0	0
3	70	20.9	0	0	70	20.9	0	0
4	70	20.9	0	0	76	20.6	0	0
5	70	20.9	0	0	148	13.1	7.3	1.0
6	70	20.9	0.1	0	173	8.3	17.3	1.7
7	70	20.7	0.5	0.1	198	6.1	22.7	2.1
8	70	20.8	0.2	0.1	242	2.5	>25	2.7
9	70	20.8	0.2	0.1	256	0.9	>25	3.1
10	71	20.6	0.4	0.1	277	0.4	>25	3.2

UL’s Close Your Door initiative is based on UL’s extensive research and analysis of the effects of ventilation practices used by fire service personnel in residential fires. One such study focused on the effects of open layouts found in many modern residential floor plans, and whether coordinated, horizontal ventilation procedures contributed to a more successful firefighting outcome.

In that study, 15 different fire test experiments were conducted on two houses at UL’s fire testing facility in Northbrook, IL. The first house was a traditional single story structure, with eight rooms and measuring about 1200 square feet. The second house, a more contemporary, two-story, 3200 square foot home, featured 12 rooms with an open floor plan. In each fire test experiment, the ventilation locations and the number of ventilation openings were changed to simulate the effect of opened and closed doors and windows.

Among its many findings, this study determined that closed doors and windows are instrumental in protecting life during a fire. In fact, UL researchers found that simply closing a door can help to maintain suitable room temperatures and oxygen levels inside long enough to significantly increase a person’s chances of survival.



A second UL study focused on the impact of vertical ventilation produced similar results. In that study, carbon monoxide and room temperature levels were measured in two side-by-side bedrooms, one with the door closed and the other with the door open. In 17 different fire tests, carbon monoxide and room temperature levels measured in the closed bedroom at 3 feet above the floor were consistently adequate to protect an occupant until firefighters arrived. In the open bedroom, test measurements showed that an occupant would likely be unconscious or dead before firefighters' arrival.

Other findings from UL's research on the importance of a closed door in protecting occupants and property in a residential fire include:

- Historically, escape times from residential fires averaged 17 minutes. However, with the introduction of synthetic materials and components in construction products and furnishings, average escape times have dropped to just 3 minutes.
- In a residential fire, rooms furnished with synthetic materials and fabrics reach flashover an average of seven times faster than rooms furnished with natural materials.
- Residential fires often generate indoor temperatures as high as 2000°. However, behind a closed door, recorded temperatures can be as low as 100°.
- A closed door can provide protection against potentially lethal levels of carbon monoxide (CO). CO levels in a room with an open door can be as high as 10,000 parts per million (ppm), compared with approximately 100 ppm in a room behind a closed door.
- A door of almost any construction affords an effective barrier against the effects of a fire. Even a hollow-core door can withstand a fire for up to five minutes, while a solid wood door can last as long as 10 minutes.

How does closing the door align with good fire safety tactics?

In a fire, a closed door provides an effective barrier to heat, smoke and toxic chemicals. It can help to protect occupants behind the door, giving them precious additional minutes to await rescue or to identify possible escape routes. And a closed door can also protect pets, property and valuable or irreplaceable possessions.

The findings that support UL's Close Your Door Initiative are also consistent with firefighting science and contemporary fire safety best practices. Modern residences and furnishings have created a radically different environment for firefighters, and response and reaction times are now a fraction of what firefighters could expect in traditional residential fires.



As a result, closed doors and windows are more important than ever. They help to limit the air supply that's required to help a fire grow, thereby slowing the fire spread. And slower fire growth also means more time for firefighters to apply water to the fire, which absorbs the fire's energy and rapidly reduces its strength.

Other steps consumers can take to help protect themselves

In addition to closing the door, consumers can take additional steps that will help to protect them in the event of a fire in their home. Of course, the most important first line of defense is having working smoke alarms. Interconnected smoke alarms should be placed inside and outside of every sleeping area and on every floor. They should also be tested regularly to ensure they are working properly.

Consumers should also establish a fire escape plan for their families. An escape plan helps to ensure that everyone knows exactly what to do in case of a fire and identifies a meeting place. And it certainly doesn't hurt to review the plan twice a year, and even to conduct periodic fire drills (just like school!) to practice escape plans and identify potential problems.

Finally, in case of an actual fire, the goal should always be to get out as fast as possible, and to close the door to help limit the flow of oxygen. Doing so can keep the fire smaller and more manageable for the fire department, and can help protect property. And for those who can't escape, a closed door between an occupant and the fire can provide valuable additional minutes before firefighters are able to effect a rescue.



Conclusion

Modern building designs, construction materials and methods, and home furnishings are all contributing to fires that grow more quickly and become more intense. UL's research has demonstrated that the simple act of closing a bedroom door can provide occupants with additional protection in case of a fire. A closed door can mean valuable additional minutes to plan an escape or await rescue by firefighters. It's a simple but proven strategy that can save lives.

UL FSRI works to further advance fire safety knowledge by conducting research with the fire service to develop leading-edge fire service education programs. UL's FSRI education programs have been accessed by hundreds of thousands of firefighters around the world, and have contributed to the safety of firefighters and the communities they serve.

For more detailed information on fire safety research conducted by UL's Fire Safety Research Institute, go to <https://ulfirefightersafety.org/>. To learn more about UL's Close Your Door initiative, go to www.closeyourdoor.org.