



Fire Prevention and Safety

Background

MASTERS OF DISASTER®

Fire Prevention and Safety

Fire Prevention and Safety is one of the topics in the series of *Masters of Disaster*® materials created by the American Red Cross for schools, clubs, organizations and families across the country. *Fire Prevention and Safety* teaches young people how to act in the event of fire and how they can prevent fires in their own homes.

These activities are specifically tailored for reaching children in lower elementary (K–2), upper elementary (3–5) and middle school (6–8) grades. *Fire Prevention and Safety* is divided into three sections:

- Fire and Fire Prevention
- Fire Preparedness
- If a Fire Occurs

Masters of Disaster Connections

Refer to the following modules in the *Masters of Disaster* series to learn more about a particular topic and to reinforce the objectives of the lesson.

- Many types of unintentional injuries can occur in the home, such as burns from fires, poisoning, breathing emergencies and falls. The *Home Safety* module explains how to prevent these injuries, which are among the leading causes of death for children ages 1–14 years old.
- Lessons in the *Wildland Fires* module will enhance young people's understanding of fire prevention and safety.
- An essential part of preparing for any disaster is to be ready with plans, supplies and practice. *Be Disaster Safe* inspires young people by teaching them to prepare for all hazards.
- The lessons of *In the Aftermath* focus on recovery after a disaster—for the individual, the school and the community.

Why Talk About Fire?

Residential fire is the fifth leading cause of unintentional death due to injury in the United States. Fires and burns also rank as the number one cause of residential death for children under the age of 15.

In 2005, 82 percent of all fire deaths occurred in residential structures, such as homes, dormitories, barracks and hotels. These fires caused 3,030 civilian deaths and \$6.7 billion in damage. According to the National Fire Protection Association (NFPA), every 2 hours and 53 minutes a home fire caused the death of a civilian.



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Most structure fires are preventable, including arson fires. According to the Federal Bureau of Investigation, more than half the people arrested for arson are under 18 years of age. Although other indicators of juvenile violent crimes are decreasing, the incidence of juvenile arson is on the rise. With education and counseling, fire-setting behavior can be prevented or deterred.

The NFPA reports that victims of fire are disproportionately young children or older adults. One-third of the fire-related deaths of young children result from children playing with fire.

In residential fires, asphyxiation kills nearly five times more people than burns. Fire consumes the oxygen in the air, while increasing the concentration of deadly carbon monoxide and other toxic gases in the atmosphere. Inhaling carbon monoxide can cause loss of consciousness or death within minutes.

Resources:

U.S. Fire Administration, "Topical Fire Research Series," accessed December 27, 2006.

<http://www.usfa.dhs.gov/fireservice/subjects/arson//topicalfire.shtm>

National Fire Protection Agency, "The U.S. Fire Problem" and "U.S. Home Structure Fires," accessed December 27, 2006.

<http://www.nfpa.org/categoryList.asp?categoryID=953&URL=Research+&+Reports/Fire+statistics/Trends>

Fire Science

A fire is uncontrolled burning. All fires start with ignition, which occurs when sufficient levels of fuel, heat and oxygen exist simultaneously. Ignition occurs when the temperature rises high enough to produce a flame. A continuous chemical reaction takes place when the fire triangle—fuel, heat and oxygen—is present. This is fire.

Any combustible or flammable substance is considered to be a fuel. Fuels come in many forms, like gases (methane and propane), liquids (gasoline, diesel fuel and kerosene) and solids (wood, coal, plastics, paper and cotton).

When all the fuel is used up, a fire will go out.

Oxygen must be present for combustion to occur. A colorless gas, oxygen composes nearly 21 percent of the earth's atmosphere. The combustion of fuel and oxygen emits heat. More available oxygen accelerates combustion. If the oxygen is removed, the fire will go out.

Heat is essential to fire, and it must be high enough to spark ignition. During a fire, heat moves away from the flame and into an adjacent area where there is fresh fuel. Remove the heat and the fire will go out.

Principles of physics and chemistry are at work in fire. Smoldering occurs when burning is slow, without flames. When burning is extremely fast, as when a gas leak mixes with air, an explosion can occur. A fire that is burning faster than smoldering, but slower than an explosion, is a flaming fire. A continuous



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chemical reaction between particles of fuel and oxygen, fire spreads because of heat transfer. The chemical reaction will cease and the fire will go out if the fuel or heat or oxygen is removed.

Heat transfer—the movement of heat—is important in a fire. Movement occurs in three ways: conduction, convection and radiation.

- **Conduction**—Heat is transferred through a solid surface from a heated to an unheated area, for example, a hand touching a hot solid surface.
- **Convection**—Heat is transferred by moving particles of liquids or gases from a heat source to a cooler area, for example, heat from boiling water to a flow of steam.
- **Radiation**—Heat is transferred by electromagnetic waves, for example, heat from a space heater that can be felt without touching the heater.

During a fire, a plume of hot, smoky air rises from the flames. In an enclosed space, like a room, hot smoke transfers heat to the ceiling and walls by convection. The fire radiates heat to other parts of the room. Hot smoke radiates heat downward toward the floor and the entire room is involved very quickly.

As the smoky gas layer becomes hotter, it radiates more and more heat to the rest of the materials in the room, and everything that can burn suddenly ignites. This is called flashover. At this point, the fire spreads to other rooms and is extremely difficult to control.

Fire Safety

Home fires are almost always preventable. Everyone must constantly be aware of the possibility of fire in the home and take positive measures to practice fire prevention daily.

Children must know that matches and lighters are tools for adults. Instruct children to tell an adult right away if they find matches or lighters or see someone playing with fire, matches or lighters.

Children should also know that candles are a frequent cause of devastating fires in homes. Candles must be kept well away from any combustible or flammable items or materials and must never be left unattended. The increasing popularity of candle usage has led to a dramatic increase in the number of tragic fires. In case of a power outage, remember to use flashlights for emergency lighting, not candles.

Discussing disaster ahead of time helps reduce fear and lets everyone know how to respond during a fire. Not discussing fires and other disasters in advance can lead to confusion during an emergency and more long-term emotional problems afterward.

What to Tell Children

- **Practice Stop, Drop and Roll.** If your clothes catch on fire, know how to Stop, Drop and Roll. Stop what you are doing, drop to the ground, cover your face, and roll back and forth until the flames go out. **DO NOT RUN**—running makes the fire burn faster. (Note: Children tend to confuse this message with the Crawl Low and Go message about



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how to exit a burning building. Make sure they understand that Stop, Drop and Roll is to be used only when clothing catches on fire.)

- Practice Crawl Low and Go. If you must escape through smoke, crawl low, under the smoke. Fires produce many poisonous gases. Some are heavy and sink low to the floor; others rise, carrying soot toward the ceiling. Crawling with your head at a level of one to two feet above the ground will provide the best air. Close doors behind you.
- Practice getting out as safely and quickly as you can. The less time you are exposed to poisonous gases, heat or flames, the safer you will be.
- Practice going to your family meeting place and then choosing one person to call 9-1-1 or your local emergency service number. Gathering in a specific location right outside your home will quickly let you know who is outside and allow you to tell firefighters which people are still inside and their probable locations.
- Memorize the number to call in a fire or other emergency (9-1-1 or your local emergency service number).
- Remember, in a real fire, once you are out, stay out.
- It is a firefighter's job to rescue people and pets, not your job. (Note: Often, children are concerned about the safety of their pets, so discuss this issue before a fire starts. In many cases, pets are able to get out on their own. Only trained firefighters, who have proper breathing apparatus and protective clothing, should go into a burning or smoky building.)
- Firefighters are our friends, and they will help in case of fire. (Note: A firefighter wearing full protective gear can look frightening, and if children do not know who is under all that equipment, they may try to hide from a firefighter during a fire. A visit to a fire station can help ease children's fears.)

Note: You should not be concerned that talking about these topics will make children fearful. On the contrary, children are frightened about what is not discussed aloud. Let children speak freely about their concerns—such as how to escape from a second-story window or what to do if they cannot find their dog in a fire situation—so they will have confidence in their ability to respond appropriately in an emergency.

Fire Safety Checklist

Develop a Family Disaster Plan

- All family members should know what to do in case they are not together.
- Develop a contact plan to use in case your family has a fire while a family member is out of town.
- Draw a floor plan of your home; mark two fire-escape routes for each room.
- Select a safe outside place for everyone to meet after escaping from a fire.
- Conduct a home fire drill at least twice a year with all members of your family.
- Practice a crawl-low escape from your bedroom, as though you were crawling under a layer of smoke.



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- Learn to call 9-1-1 or your local emergency service number after evacuating.
- Remember, in case of real fire, once you are out, stay out.

Protect Your Property

Smoke and Carbon Monoxide Alarms

- Install alarms inside and outside each sleeping area, right outside the kitchen and on each level of your home. It is best to use interconnected smoke alarms so if one sounds they all will sound.
- To maintain alarms, vacuum cobwebs and dust from the mechanisms once a month.
- Push the test button on each alarm once a month to make sure the alarm is working.
- Make sure children can recognize the sound of the alarms.

Note: Home fire sprinkler systems complement the work of smoke alarms in the home, providing a way to fight flames immediately.

Fire Extinguishers

- Install extinguishers high on the wall, near an exit and away from heat sources.
- Get training in the use of your fire extinguisher from the fire department or the manufacturer of the fire extinguisher.
- If you try to use a fire extinguisher on a fire and the fire does not die down immediately, drop the extinguisher and get out.
- Check your fire extinguisher at least once a year to ensure that it is properly charged.

If a Fire Occurs

- If you are in a burning house or building, implement your escape plan immediately.
- Use stairs or a fire escape. Do not use an elevator. Stay calm. Go outside to your family meeting place.
- If you are escaping through a closed door, feel the door with the back of your hand before opening the door slowly.
- If you see smoke or fire in your first escape route or if the door is warm, use your second way out.
- If you must exit through smoke, crawl low under the smoke to your exit.
- If smoke, heat or flames block your exit routes and you cannot get outside safely, stay in the room with the door closed. Open the window and hang a bright-colored cloth or sheet outside the window so fire-fighters can find you. Wait by the window for help.
- Once you are out, stay out!

Note: For more detailed information about fire safety, see the “Checklists” section.



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