

Chapter II

Disaster Fire Suppression

In this chapter you will learn about:

- **Fire chemistry:** How fire occurs, classes of fire, and choosing the correct means to extinguish each type of fire.
- **Hazardous materials:** How to identify potentially dangerous materials in storage or in transit.
- **Fire hazards:** Potential fire hazards in the home and worksite, and fire prevention strategies.
- **Fire suppression strategy:** How to evaluate fires, assess firefighting resources, and determine a course of action.
- **Portable fire extinguishers:** Types of portable fire extinguishers and how to operate them.
- **Safe fire suppression:** How to decide if you should attempt to extinguish a fire; how to approach and extinguish a fire safely.
- **Teamwork:** The importance of working with a buddy.

II. Disaster Fire Suppression

Introduction

During and immediately after a disaster, the first priorities of professional fire services are life safety and extinguishing *major* fires. They may be hampered by impassable roads, inadequate water supply, weather conditions, burning material, and inadequate resources to deal with the number of existing major fires. At this time, CERT fire suppression groups play a very important role in firefighting and fire prevention by:

- Putting out small fires before they become major fires.
- Preventing additional fires by removing fuel sources.
- Assisting with evacuations where necessary.

Portable fire extinguishers are an invaluable firefighting tool. They can be used to eliminate small fires that might otherwise grow into larger, more destructive fires and to prevent the loss of life and property.

Potential fuel sources include natural gas and electrical utilities as well as hazardous materials. Understanding hazardous materials and other fire hazards in the home and workplace will help you determine the appropriate course of action to take.

Work with a buddy.

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Fire Chemistry

Fires require three elements to exist:

- *Heat.* The temperature at which a material produces a vapor, and the temperature at which vapors will burn. (Vapors will self-ignite if the temperature is hot enough.)
- *Fuel.* The fuel for a fire may be a solid, liquid, or gas. The type and quantity of the fuel will determine which method should be used to extinguish the fire.
- *Oxygen.* Fires will burn vigorously in any atmosphere of at least 20 percent oxygen. Without oxygen, fuel could be heated until entirely vaporized, and it would not burn.

Together, these three elements are called the *fire triangle*, which is illustrated in the figure below.

Fuel is on the left, oxygen on the right, heat on the bottom.



Figure II-1. Fire Triangle

Fire Chemistry (Continued)

The three elements in the proper proportions will produce fire. Extinguishment is possible when one of the three elements is missing as shown in the following figure.

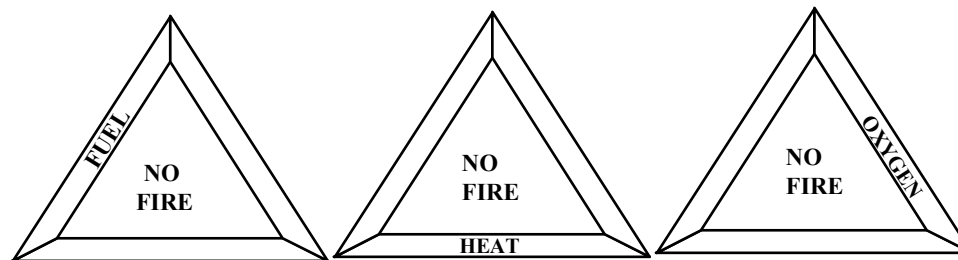


Figure II-2. Effect Of Removing Elements Of The Fire Triangle

Classes of fire are based on the type of fuel that is burning. There are four major classes of fire:

- *Class A.* Ordinary combustibles such as paper, cloth, wood, rubber, and many plastics.
- *Class B.* Flammable liquids (e.g., oils, gasoline, kitchen grease, paints, and solvents) and combustible liquids (e.g., charcoal lighter, kerosene, and diesel fuel). These fuels burn only at the surface because oxygen cannot penetrate the depth of the fluid. If ignited, it is the vapor that burns.
- *Class C.* Electrical equipment (wiring, fuse boxes, motors, power tools, appliances).
- *Class D.* Combustible metals such as aluminum, magnesium, and titanium.

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Fire Chemistry (Continued)

It is extremely important to identify the type of fuel so that the correct method and agent can be used to extinguish the fire.

The remainder of this chapter will deal with:

- CERT size-up.
- Firefighting resources.
- Safe fire suppression.

In class, your instructor may present additional information that is not included in this Participant Handbook. Feel free to take notes during the session.

Hazardous Materials

What Are Hazardous Materials?

Hazardous materials are any materials that corrode other materials, explode or are easily ignited, react strongly with water, are unstable when exposed to heat or shock, or are otherwise toxic to humans, animals, or the environment. Hazardous materials include, but are not limited to:

- Explosives
- Flammable gas and liquid
- Poisons and poisonous gases
- Corrosives
- Nonflammable gas
- Oxidizers
- Radioactive materials

Hazardous materials pose an ever-present danger. They are stored in all types of locations, and they are transported by a variety of means. They are commonly found in such places as industrial and commercial districts, highways, harbors, airports, and railroads. They are also found in homes and offices.

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Identifying Stored Hazardous Materials

Stored hazardous materials may be identified by means of the National Fire Protection Association (NFPA) 704 Diamond system of placards. These placards are located on the outside of buildings at the entrance to the storage area. An example of the NFPA 704 Diamond is shown in the following figure.

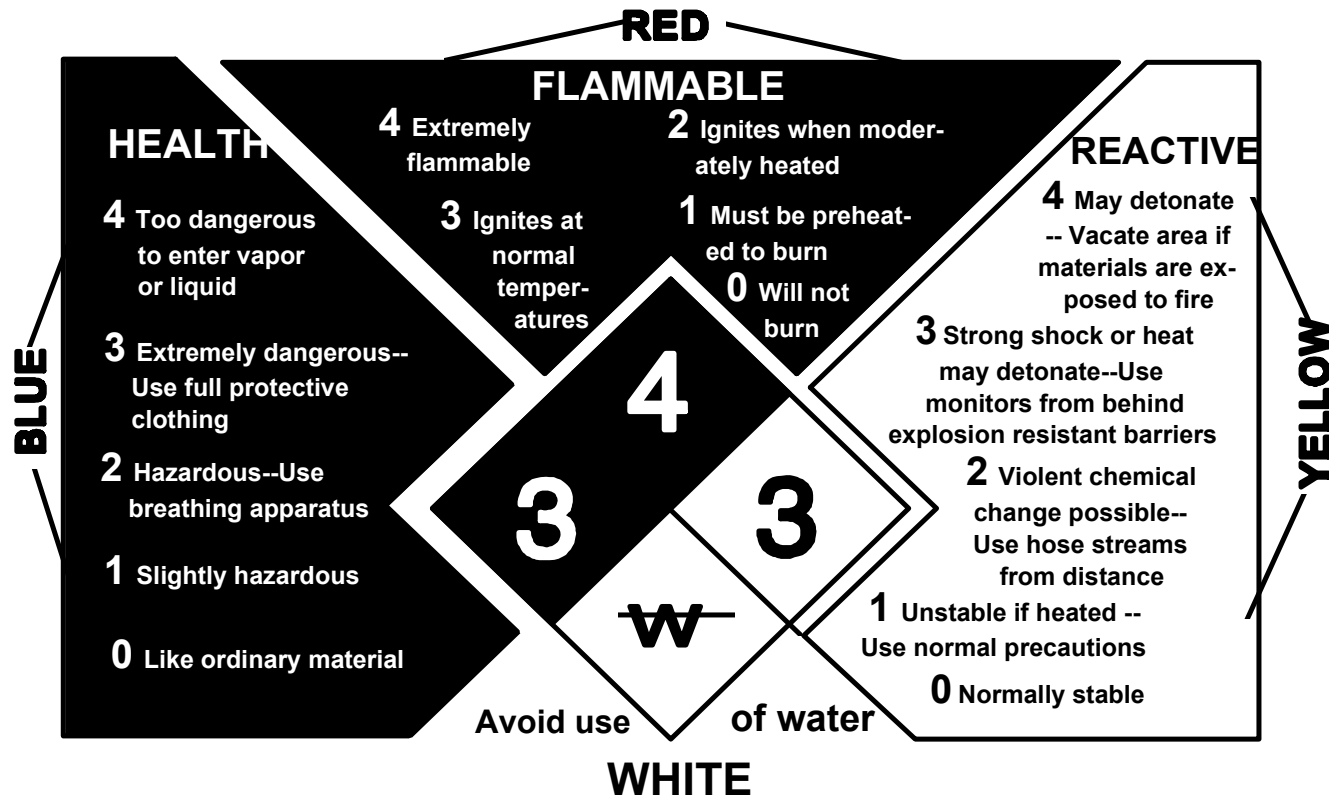


Figure II-3. National Fire Protection Association 704 Diamond

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Identifying Stored Hazardous Materials (Continued)

The diamond is divided into four colored quadrants, each with a rating number inside it. The colored quadrants provide information about the type of danger caused by the material. The numbers within the red, blue, and yellow quadrants (provided for professional firefighter use only) indicate the degree of risk associated with the material. *Consider these placards a “stop sign” for CERT members, unless in your planning stages you have identified the dangers involved.*

Identifying Hazardous Materials In Transit

Hazardous materials that are being transported are marked with Department of Transportation (DOT), United Nations (UN), or North American (NA) warning placards. For the DOT system, each diamond-shaped placard includes a color, symbol, name, and number, each of which indicates the type of hazard. The DOT placards are illustrated in the figure below.

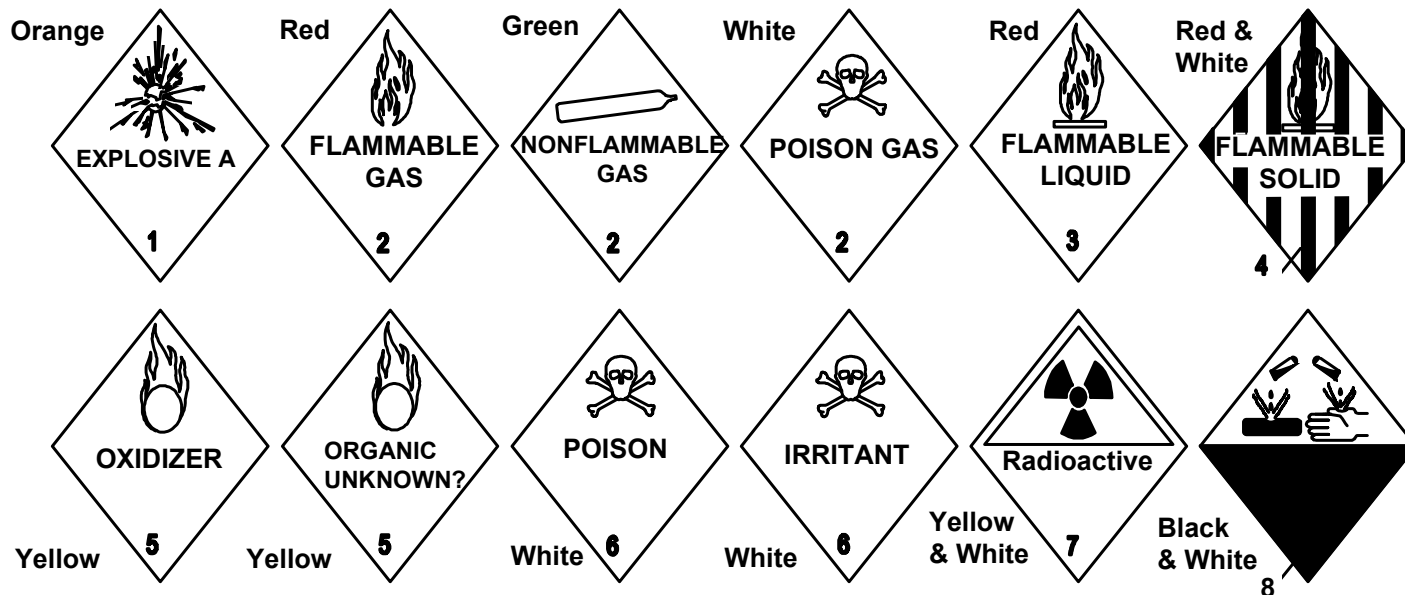


Figure II-4. DOT Warning Placards

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Identifying Hazardous Materials In Transit (Continued)

The UN and NA systems are displayed mainly on tank cars, cargo tanks, and portable tanks. Examples of UN and NA placards are shown in the figures below.

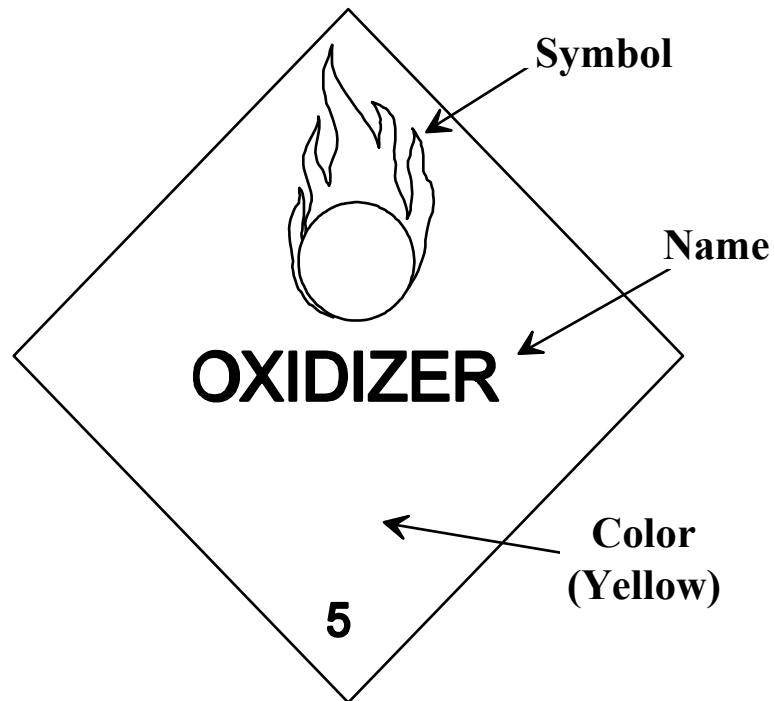


Figure II-5. UN Placarding System

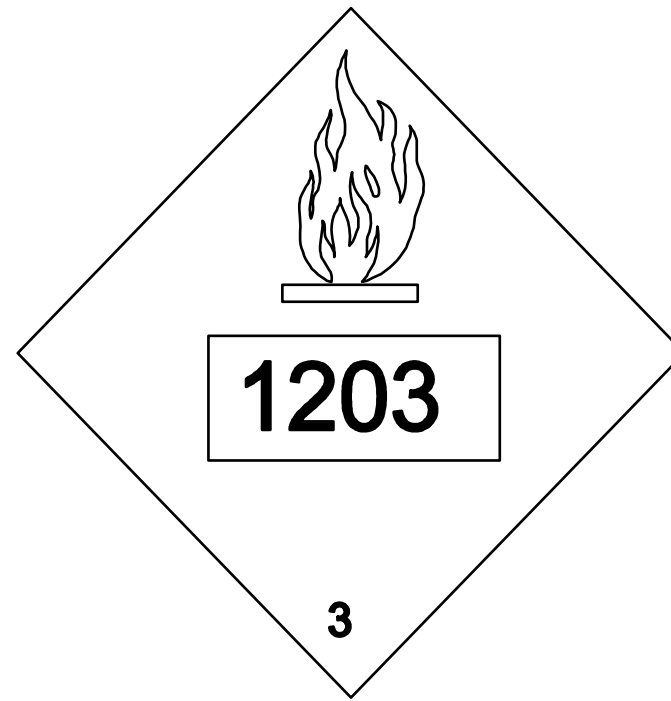


Figure II-6. NA Numbering System

Like the NFPA 704 Diamond, the DOT, UN, and NA placards should mean a “stop sign” for CERT members. If they are present, there is danger. *STOP!*

Reducing Hazards In Home And Office

Introduction

What can you do about fire hazards in the home or office? Simple fire prevention practices will go far in reducing the likelihood of fires. First, *locate* potential sources of ignition. They may include electrical hazards, natural gas hazards, and flammable or combustible liquids. Then do what you can to *reduce or eliminate* fire hazards. This section will address the elimination of hazards related to:

- Electricity
- Natural gas
- Flammable or combustible liquids

Electrical Hazards

When misused or neglected, electricity can cause serious injury or death. With a little effort, however, most electrical hazards can be eliminated. Ways to reduce electrical hazards include:

- Avoid the “electrical octopus.” Eliminate tangles of electrical cords and don’t overload electrical outlets.
- Don’t run electrical cords under carpets.
- Replace broken or frayed cords immediately.
- Properly maintain electrical appliances. Remove or replace malfunctioning appliances.

Fire safety begins at home.

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Electrical Hazards (Continued)

When an electrical emergency does occur, be prepared to handle an electrically charged appliance fire. Know where the power shut-off and circuit breakers or fuses are, and know how to shut off the power.

- For circuit boxes: Switch off smaller breakers first, then the main breaker.
- Fuse boxes: Unscrew the individual fuses, then pull the main switch.

Examples of circuit and fuse boxes are shown in the figures below. Do *not*, however, enter a flooded basement to shut off the electrical supply.

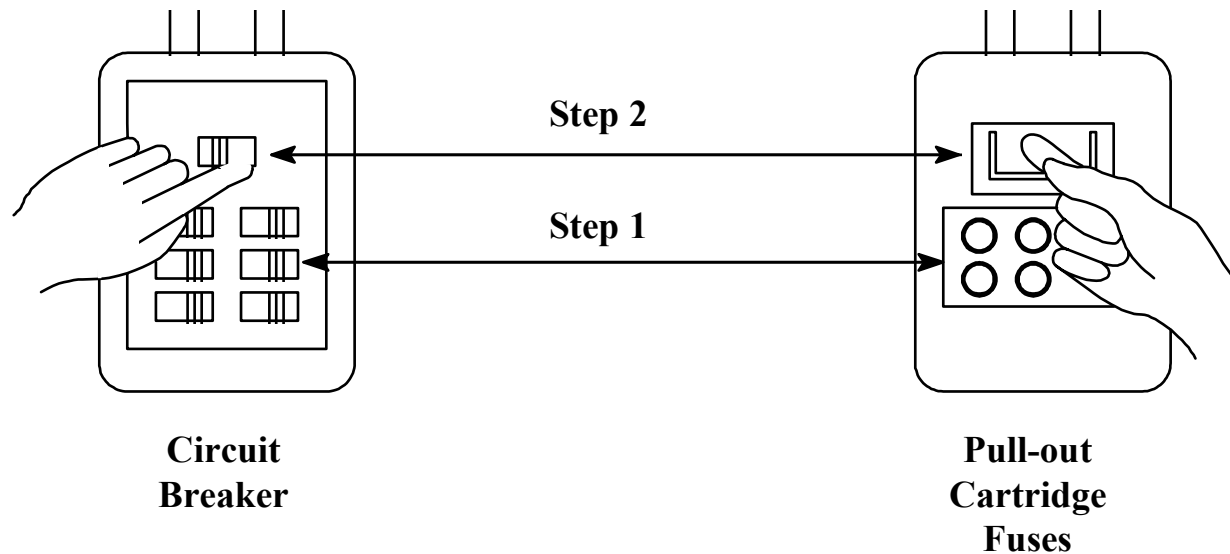


Figure II-7. Circuit Box With Shut-Off

Figure II-8. Fuse Box With Shut-Off

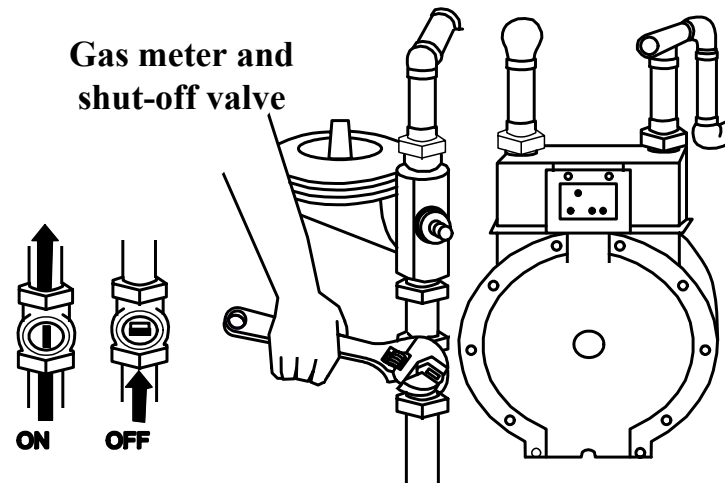
When turning power back on, turn the main breaker or switch on first, then switch on the smaller breakers or fuses.

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Natural Gas Hazards

Natural gas presents two kinds of hazards. It is an *asphyxiant*, meaning that it robs the body of oxygen, and it is *explosive*—leaking gas can easily be ignited, causing an explosion and subsequent fires. Ways to reduce natural gas hazards in a disaster include:

- Installing a gas detector near your furnace and hot water heater and testing the detector monthly to ensure that it works.
- Locating and labeling the gas shut-off valve. (Multiple gas units in an apartment building are usually identified by apartment number or letter.) **NOTE:** After the natural gas is turned off, it should be turned on only by a trained utility technician.



**Have wrench stored in a specific location
where it will be immediately available**

Figure II-9. Natural Gas Meter With Shut-Off

- Knowing how to shut off the gas. The valve position indicates ON/OFF. **NOTE:** Never enter the basement of a structure that is on fire to turn off any utility.
- Having the proper tool (gas wrench, pliers, channel locks, ViseGrips, etc.) in your disaster supplies kit or near the gas valve.

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Natural Gas Hazards (Continued)

- Strapping the water heater to the wall in two places: from the top and from the bottom of the tank. Each strap should cross behind the water tank and fasten to wall studs behind the tank. (See Figure II-10 below.)
- Have a licensed plumber attach the water heater to the gas supply by a flexible gas line with shut-off that will move in the event of an earthquake.

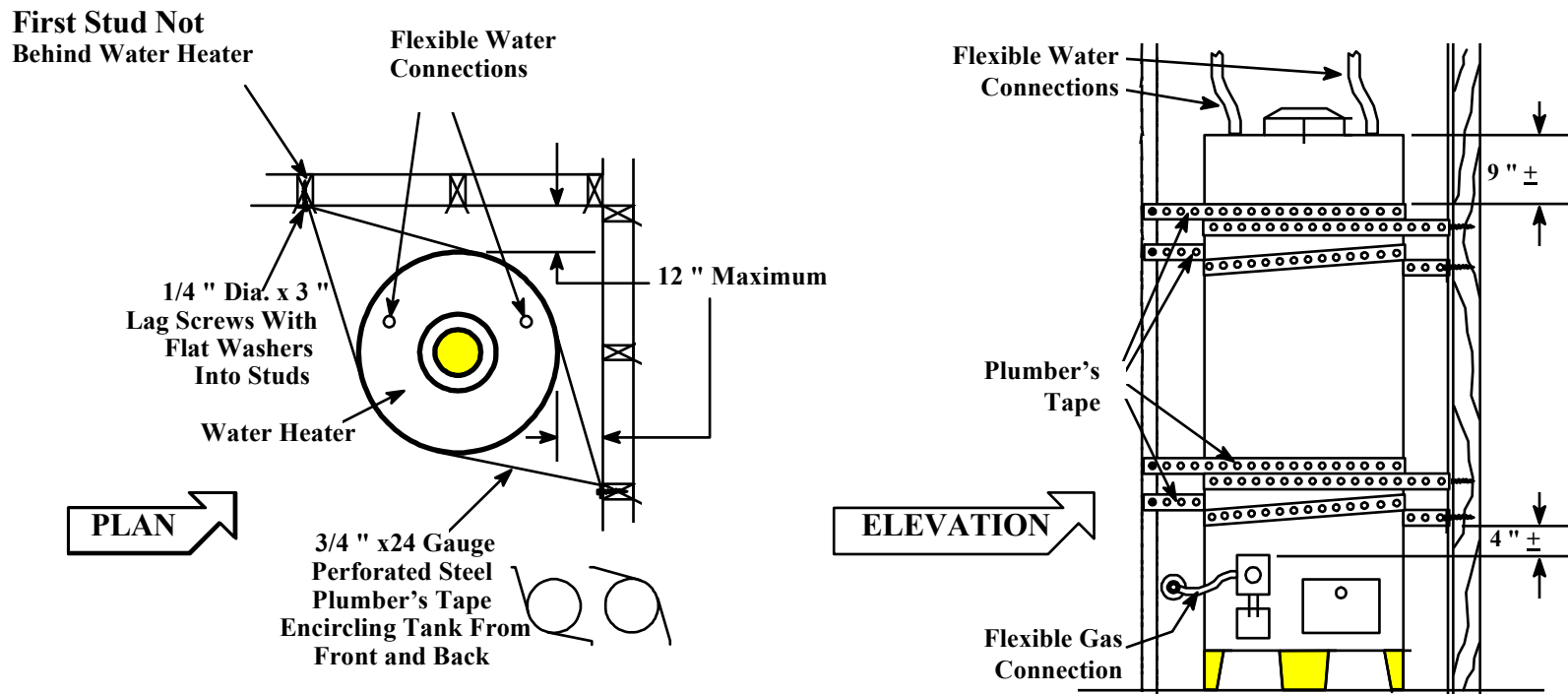


Figure II-10. Hot Water Heater Bracing

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Flammable Liquid Hazards

Many typical household products, such as gasoline, charcoal lighter, and paint thinners and removers are flammable. In addition, many household products such as air fresheners, deodorants, hair sprays, insecticides, and furniture polish are packaged as aerosols. Aerosols contain flammable propellants and may explode if heated.

To minimize hazards associated with flammable products:

- Read labels to identify flammable products.
- Store them properly (remember the L.I.E.S. rules—Limit, Isolate, Eliminate, Separate).

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CERT Size-Up

Before fire suppression operations can begin, rescue teams must first ensure the safety of all rescuers, then citizen life safety. Once these primary concerns have been addressed, CERT size-up can begin.

The first task in fire suppression is the size-up or gathering of information for decision making and planning. Size-up is a continuous data-gathering process that will dictate whether to attempt fire suppression, and planning for extinguishing the fire. CERT size-up answers these questions:

- Can my buddy and I fight the fire safely?
- Do my buddy and I have the right equipment?
- Are there other hazards?
- Is the building going to collapse?
- Can my buddy and I escape?

Some of the factors involved in each step of size-up are shown in the checklist on the following pages. Use the checklist as a guide for CERT size-up. Taking the actions listed will help the CERT member make safer decisions. Practice will make this process more automatic.

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CERT Size-Up (Continued)

Step 1: Gather Facts	If Yes Check	If No Check
<ul style="list-style-type: none"><i>Time</i> Does the time of day or week impact fire suppression efforts? How?<i>Weather</i> Will weather conditions impact your safety? If yes, how will your safety be impacted? Will weather conditions impact the fire situation? If yes, how will the fire situation be impacted?<i>Type Of Construction</i> What type(s) of structure(s) are involved? What type(s) of construction are involved?		

Table II-1. CERT Size-Up Checklist

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CERT Size-Up *(Continued)*

Step 1: Gather Facts (Continued)	If Yes Check	If No Check
<ul style="list-style-type: none">• <i>Occupancy</i> Are the structures occupied? If yes, how many people are likely to be affected?• Are there special considerations (e.g. children, elderly)?• <i>Hazards</i> Are hazardous materials involved? Are any other types of hazards likely to be involved? If yes, what other hazards?		
Step 2: Assess And Communicate The Damage		
<ul style="list-style-type: none">• Take a lap around the building. Is the damage beyond the CERT team's capability? If yes, what special requirements or qualifications are required?• Are normal communication channels functioning?		

Table II-1. CERT Size-Up Checklist
(Continued)

CERT Size-Up (Continued)

Step 3: Consider Probabilities	If Yes Check	If No Check
<ul style="list-style-type: none">• <i>Life Hazards</i> Are there potentially life-threatening hazards? If yes, what are the hazards?• <i>Path Of Fire</i> What is the path of the fire? Does the fire's path jeopardize other areas? If yes, what other areas may be jeopardized?• <i>Additional Damage</i> Is there great risk or potential for more disaster activity that will impact personal safety?		
Step 4: Assess Your Own Situation		
<ul style="list-style-type: none">• What resources are available with which you can suppress the fires?• What equipment is available?		
Step 5: Establish Priorities		
<ul style="list-style-type: none">• Can fire suppression be <i>safely</i> attempted by CERT members? If no, do <i>not</i> attempt suppression.• Are there other, more pressing needs at the moment?		

Table II-1. CERT Size-Up Checklist
(Continued)

CERT Size-Up ***(Continued)***

Step 6: Make Decisions

- Where will deployment of available resources do the most good while maintaining an adequate margin of safety?

Step 7: Develop Action Plans

- Determine how personnel and other resources should be deployed.

Step 8: Take Action

- Put the plans into effect.

Step 9: Evaluate Progress

- Continually size up the situation to identify changes in the:
 - Scope of the problem.
 - Safety risks.
 - Resource availability.
- Adjust strategies as required.

Table II-1. CERT Size-Up Checklist
(Continued)

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Firefighting Resources

A variety of resources may be available for fire suppression, including:

- *Portable Fire Extinguishers.* Portable fire extinguishers are an invaluable tool for putting out small fires. A well-prepared home or office will have at least two.
- *Interior Wet Standpipes.* In commercial buildings and apartment buildings, interior wet standpipes should be available for use by occupants or tenants. These standpipes usually consist of about 100 feet of 12-inch jacketed hose with a 3/8-inch nozzle tip. They deliver up to 125 gallons of water per minute. **NOTE:** Always work in 3-person teams when using an interior wet standpipe. One person handles the hose, another bleeds the air from the line, and the third controls the water pressure.
- *Confinement.* In interior spaces, the ability to confine the fire by closing doors is a valuable resource. Close doors to rooms and hallways to restrict the spread of smoke and heat while you escape to the outside.
- *“Creative” Resources.* Sometimes it is necessary to make use of other materials and equipment that may be at hand. Examples include:
 - Swimming pool or spa, with buckets
 - Dirt or sand and shovels
 - Garden hose and ladders (for second floor or roof)

The type of fuel will determine which firefighting agent(s) you select.

This section will focus on portable fire extinguishers, as they are the most likely resource available in an emergency.

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Extinguisher Rating And Labeling

Portable fire extinguishers must be rated and approved by the State Fire Marshal and Underwriters' Laboratories. They are rated according to their effectiveness on classes of fire and their relative strength and capability and must be so labeled by the manufacturer. An example of a manufacturer's label is shown in the figure below.

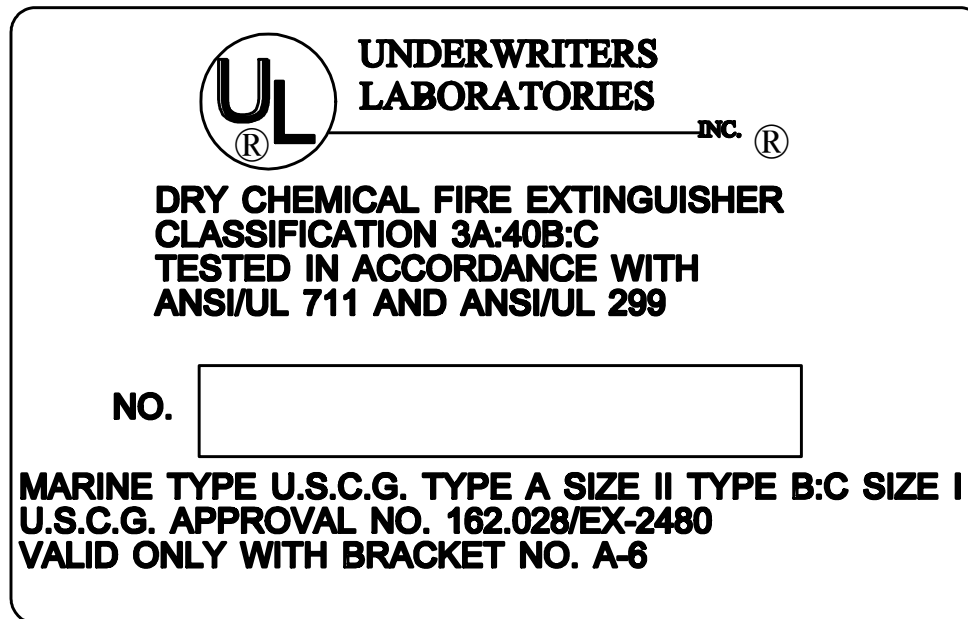


Figure II-11. Manufacturer's Label

Each manufacturer's label also displays the NFPA *rating* code for the extinguisher. The rating provides important information about the types of fires that can be extinguished using the extinguisher.

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Types Of Fire Extinguishers

There are five types of extinguishers:

- Water
- Dry chemical
- Halon
- Carbon dioxide
- Foam

It is extremely important to use the correct agent and method for the class of fire. The chart in Figure II-12 on the following page shows appropriate agents and methods for each type of fire. The characteristics of each type of fire extinguisher are listed below and on page II-25.

Water Extinguishers

Water extinguishers are among the most commonly used. They are excellent for heat removal on Class A fires. Extreme caution should be exercised when using a water extinguisher to ensure that the water, which is under extreme pressure, does not scatter lightweight materials and spread the fire. Common characteristics for water fire extinguishers are:

- *Capacity.* Standard size is 22 gallons.
- *Range.* 30-40 feet.
- *Pressure.* 110 pounds per square inch (psi).

Types Of Fire Extinguishers (Continued)









FIRE TYPE	EXTINGUISHING	
	AGENT	METHOD
ORDINARY SOLID MATERIALS  	WATER FOAM	REMOVES HEAT REMOVES AIR AND HEAT
	DRY CHEMICAL	BREAKS CHAIN REACTION
FLAMMABLE LIQUIDS  	FOAM CO ₂	REMOVES AIR
	DRY CHEMICAL HALON	BREAKS CHAIN REACTION
ELECTRICAL EQUIPMENT  	CO ₂	REMOVES AIR
	DRY CHEMICAL HALON	BREAKS CHAIN REACTION
COMBUSTIBLE METALS  	SPECIAL AGENTS	USUALLY REMOVE AIR

Figure II-12. Fire Types, Extinguishing Agents, And Methods

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Dry Chemical Extinguishers

Dry chemical extinguishers are also commonly used. Regular dry chemical extinguishers have a sodium bicarbonate base and are effective on Class B and C fires. Multipurpose dry chemical extinguishers have a monoammonium phosphate base and are effective for Class A, B, and C fires. Both types of dry chemical extinguishers are nontoxic. Both should be inverted monthly to prevent caking. Common characteristics for dry chemical extinguishers are:

- *Capacity.* Approximately 10-20 seconds discharge time.
- *Range.* 8-12 feet.
- *Pressure.* 175-250 psi.

Other Types Of Extinguishers

Although still in use, carbon dioxide, halon, and foam extinguishers are becoming less common.

- *Carbon Dioxide Extinguishers* are used primarily on Class C fires and are also effective on Class B fires. They have limited use on Class A fires because of reflash potential. They suppress fire by displacing or diluting oxygen levels.
- *Halon Extinguishers* are best used on Class B or C fires. Halon is a clean agent and is nontoxic when used in low concentrations or in nonconfined areas. However, halon extinguishers are being phased out because of potential impact on the environment.
- *Foam Extinguishers* are used for special applications and are less common.

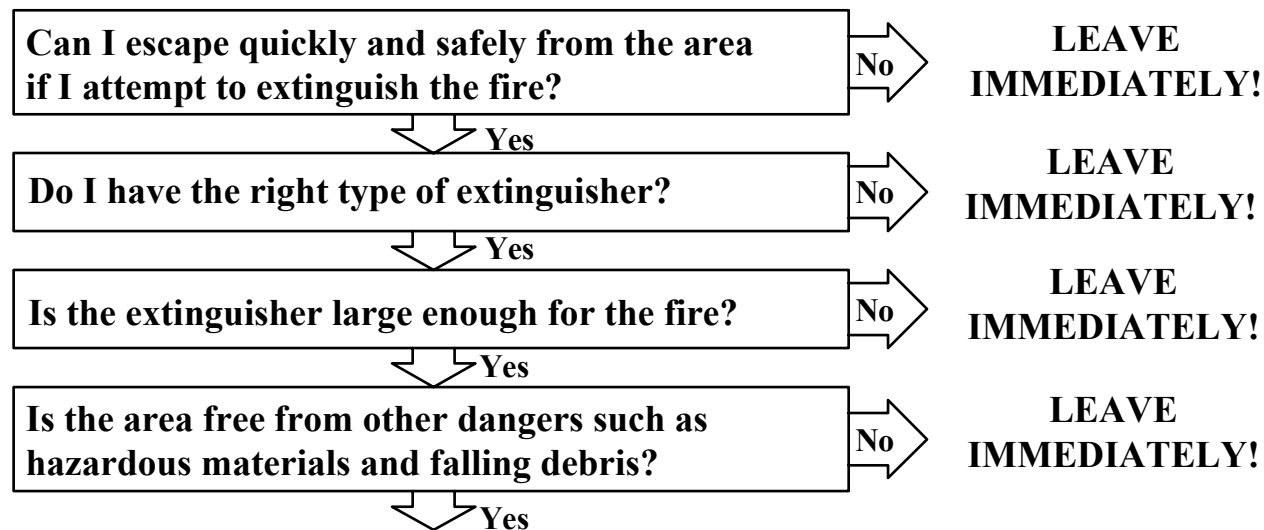
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Deciding To Use A Fire Extinguisher

Below is a decision making guide for using a portable fire extinguisher during a fire in a disaster. Ask yourself each of the questions before attempting to extinguish a fire. If you answer “NO” to any of these questions:

- Leave the building immediately.
- Shut all doors as you leave to slow the spread of the fire.

If you answer “YES” to all of the questions, you may attempt to extinguish the fire. If you feel unable to extinguish the fire, however, leave immediately.



EXTINGUISH THE FIRE!

Courtesy of Public Education Specialist, City of Colorado Springs Fire Department

Figure II-13. Deciding To Use A Fire Extinguisher

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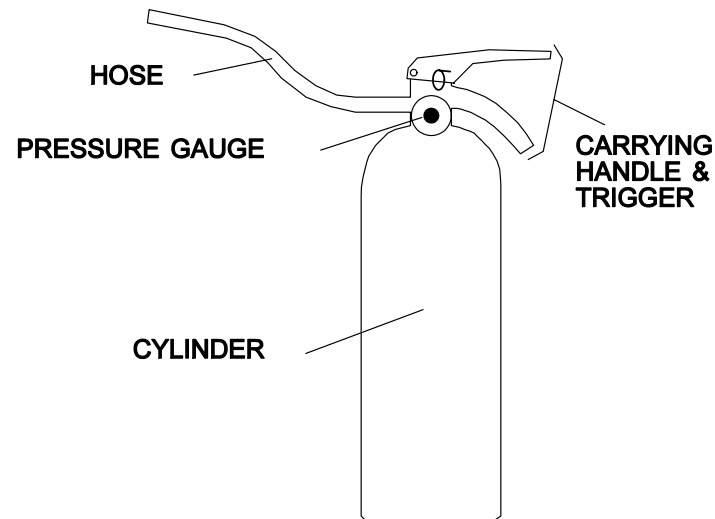
Operating A Fire Extinguisher

A portable fire extinguisher includes the following components:

- Pressure gauge.
- Hose.
- Cylinder.
- Carrying handle and trigger.

These components are shown in the figure below.

Figure II-14.
Portable Fire



**Components Of A
Extinguisher**

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Operating A Fire Extinguisher (Continued)

Always operate extinguishers in an upright position. As shown in the figure below, the acronym to remember when operating a portable extinguisher is *P.A.S.S.*: *Pull*, *Aim*, *Squeeze*, *Sweep*. Aim at the base of the fire.

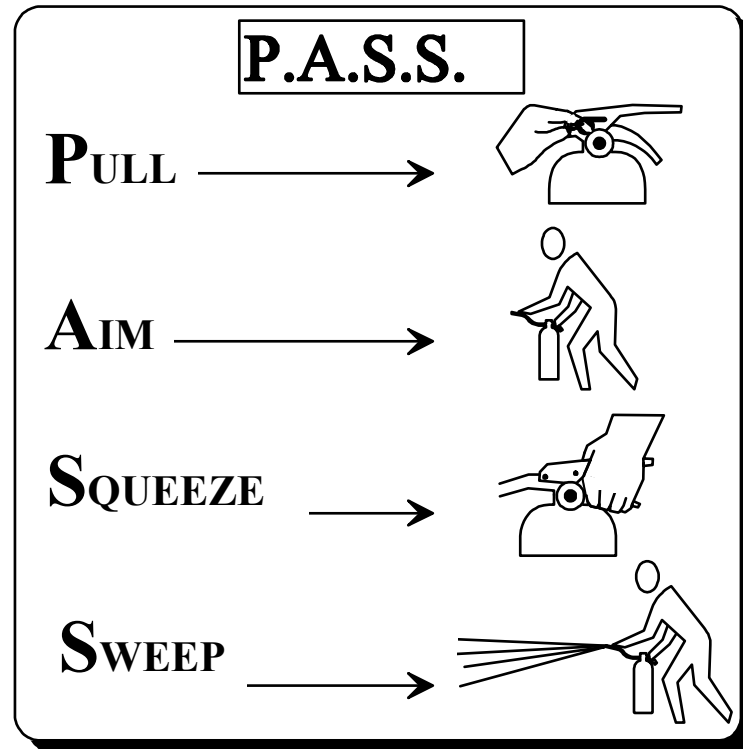


Figure II-15. P.A.S.S.

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Fire Suppression Safety

As in all emergency operations, safety is key when fighting fires. CERT teams should use the following guidelines when approaching and suppressing a fire.

- Do *not* attempt to suppress a fire that is clearly too large for the equipment at hand.
- Use safety equipment (helmet, goggles, dust mask, all-leather work gloves, heavy shoes).
- Work in a buddy system.
- Have a backup team when possible.
- Always have two ways to exit the fire area.
- Approach smoke-filled areas correctly. The primary component of smoke is carbon monoxide. Without proper self-contained breathing apparatus, firefighting will be limited. Use extreme caution when entering smoke-filled areas.
 - Feel closed doors with the back of the hand, working from the bottom of the door up. If the door is hot, there is fire behind it.
 - Confine the fire whenever possible by keeping doors closed.
 - Stay low to the ground.
 - Always know a second escape route.
 - Use natural ventilation techniques to clear smoke:
 - Open windows if possible.
 - Create cross-ventilation by channeling natural wind flow.
- Maintain a safe distance. Remember the effective extinguisher range.
- Move around the perimeter of the fire to maximize coverage of the extinguisher agent.

II. Disaster Fire Suppression

Fire Suppression Safety (Continued)

- Overhaul ensures that every piece of burning material is completely extinguished. To prevent rekindling of the fire:
 - Locate hidden burning material. Extinguish and safely remove it.
 - Remove heat by cooling.

Wear safety equipment: helmet, goggles, dust mask, gloves, and boots.

Summary

Introduction

Effective fire suppression depends on an understanding of:

- The elements required for fire to exist.
- The class of fire.
- The type of material involved.
- The resources required to extinguish each type of fire.
- Fire suppression techniques.

The Fire Triangle

Fires require three elements to exist:

- Heat
- Fuel
- Oxygen

If any of the elements are missing or can be suppressed, the fire can be extinguished.

II. Disaster Fire Suppression

Classes Of Fire

There are four types of fire:

- Class A. Ordinary combustibles.
- Class B. Flammable liquids.
- Class C. Electrical equipment.
- Class D. Combustible metals.

It is extremely important to identify the class of fire so that you can select the proper means of extinguishing the fire.

Hazardous Materials

To help understand the types of materials, several organizations have developed placarding systems for hazardous and nonhazardous materials being stored or transported.

- The NFPA 704 diamond system uses a combination of colors and numbers to placard stored materials according to the type of hazard and level of danger they present.
- Several organizations have developed placarding systems for transported materials:
 - Like the NFPA 704 diamond, the DOT placard uses numbers and colors to identify placard-transported materials according to type of hazard and level of danger.
 - UN and NA placards use numbers to identify specific types of hazards.

When approaching accidents involving materials that are placarded as hazardous—or when the material is unknown—*keep away and call for professional help immediately*. Do *not* attempt to deal with the hazard yourself. NFPA 704 Diamond system and UN and NA placards are “stop signs” to CERT teams.

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Firefighting Resources

While there are many resources available for extinguishing fires, the resource that you will use most frequently is the portable fire extinguisher. Portable extinguishers are labeled according to:

- The class(as) of the fire against which they are effective.
- The fire area that they can suppress.

Water and dry foam extinguishers are the most commonly used. Water extinguishers are effective for Class A fires. Regular dry foam extinguishers are effective for Class B and C fires. Multipurpose dry foam extinguishers, however, are effective for Class A, B, or C fires.

Other types of portable fire extinguishers that are less commonly used are carbon dioxide extinguishers, halon extinguishers, and foam extinguishers.

Fire Suppression Techniques

When using a portable fire extinguisher, remember to use the *P.A.S.S.* method: Pull, Aim, Squeeze, Sweep. You will have the opportunity to practice using a portable fire extinguisher during the classroom session.

Assignment

Before the next session:

- Read and familiarize yourself with Chapter III: Disaster Medical Operations—Part I.

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Assignment (Continued)

- Purchase the following items:
 - 1 box of 4 x 4 bandages
 - 1 triangular bandage
 - 1 roll of roller gauze
 - 1 medical mask
 - 1 pair of latex examination gloves
- Bring a blanket to the next session.
- Wear comfortable clothes, since you will be practicing medical techniques.