

Your Fire Shelter



The fire shelter is a mandatory item of personal protective equipment for all Federal wildland firefighters and must be carried on the fireline by everyone on Federal fires. State, local, and rural fire departments may have different policies.

However, no one who is required to carry a fire shelter should go on the fireline without reading, understanding, and practicing the recommendations in this booklet.

This booklet is the reference document for fire shelters. It explains how the fire shelter protects you. It explains the importance of training and knowing when and where to deploy the shelter. It tells you what to expect during an entrapment. It describes inspection procedures that will keep worn shelters off the fireline.

The booklet is not intended to stand alone. New and experienced firefighters should use it as part of a comprehensive fire shelter training program that includes facilitated discussion and hands-on training.



During training, be sure you understand the following key learning points:

- *Your highest priority is to avoid entrapment. If entrapment is imminent, escape if you can.*
- *During an escape or entrapment, protect your lungs and airways at all costs.*
- *If you are entrapped, get on the ground before the fire arrives.*
- *Dispose of fusees and other flammable items during escape.*
- *Deploy your shelter where flames will not contact it.*

The fire shelter has saved the lives of more than 250 firefighters and has prevented hundreds of serious injuries and illnesses from burns and smoke inhalation. But the shelter will not protect firefighters under *all* fire situations. Direct flame contact can destroy the shelter's protective properties. The fire shelter should *not* be deployed in areas where flame contact is likely.

NEVER go into dangerous areas or situations just because you are carrying a fire shelter.

The fire shelter should be used as a last resort if planned escape routes or safety zones become inadequate and entrapment is imminent. The shelter is not meant to allow firefighters to take chances.



Know Your Fire Shelter



Understanding how the fire shelter protects you as well as the factors that limit its performance will help you decide where and how to deploy your shelter for maximum protection. The fire shelter protects primarily by reflecting radiant heat and by trapping breathable air. It is made of aluminum foil bonded to fiberglass cloth. The foil reflects 95 percent of a fire's radiant heat (Figure 1). Only 5 percent of the radiant heat remains to raise the temperature of the shelter material and the air inside the shelter. With prolonged exposure, temperatures inside the shelter can exceed 150 °F. Firefighters can survive such temperatures—dry saunas often reach 190 °F. When you are inside a fire shelter, breathe through your mouth, stay calm, and above all, stay in your shelter.

...the right side of my shelter delaminated and the foil flipped over onto the left side.... I really started to get burned at that point because the only thing that was...on that side of my shelter was the glass mesh.... (When) there was still a tremendous amount of radiant heat coming off the surrounding area, a wind blew the shelter half back on to the other side, back to where it belonged, and it was like somebody closing a door on the oven.... The radiant heat difference that just that little piece of foil made was absolutely amazing.

Entrapment survivor

Unlike radiant heat, convective heat (from flames and hot gases) is easily absorbed by the fire shelter material and can rapidly raise its temperature. When the material reaches a temperature of about 475 °F, the glue that bonds the layers begins to break down. The layers can separate or “delaminate,”

allowing the foil to be blown about or torn by turbulent winds. Without the foil, the shelter provides far less protection. Flame contact can also cause the aluminum-foil layer to melt. Aluminum melts at 1,200 °F. Temperatures of flames in wildland fires average about 1,600 °F.

Types of Heat

Radiant Heat: Think of radiant heat as a ray or a wave. When you stand close to a campfire, radiant heat warms you. No air movement is required for radiant heat transfer.

Convective Heat: Think of convective heat as a blast of hot air. If you put your hand above a campfire, convective heat will burn you. Convective heating occurs when hot air moves past a surface, such as your hand or your fire shelter. Higher temperatures and stronger winds cause greater heating.

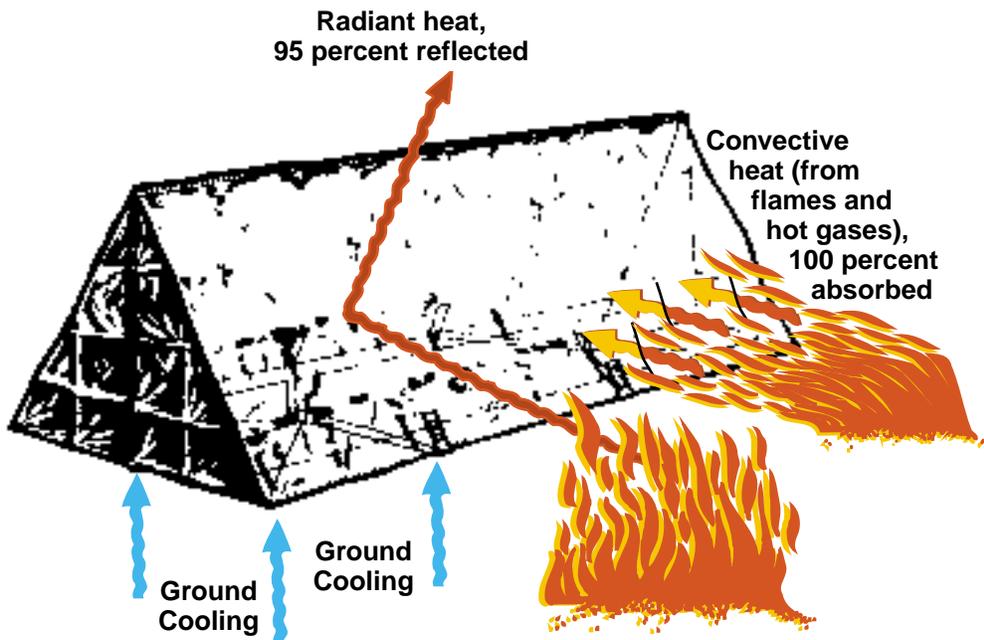


Figure 1 —The fire shelter reflects radiant heat and absorbs convective heat.



As the glue between the layers breaks down, the shelter may begin to fill with smoke and flammable gases. The gases are released more rapidly as temperatures rise. These gases can ignite and burn, especially if flames enter the shelter from the outside (Figure 2). Keep the shelter as far as possible from concentrations of natural fuels and flammable equipment. Deploying the shelter on a site that has been scraped to mineral soil helps prevent flames from contacting or entering the fire shelter. Radiant heat alone can raise the temperature of the shelter material to critical levels, but the temperature rises more slowly because most of the heat is reflected.

It is critically important to keep the fire shelter away from direct flame!

The shelter's pup-tent shape allows you to lie flat against the ground. This exposes less of your body to radiant heat and more of your body to the cool ground. With your face

pressed to the ground, you are in the best position to breathe cooler, cleaner air.

The shelter's hold-down straps and perimeter skirt make it unlikely that it would be blown away by high winds. The skirt also helps keep out smoke, heat, and flames. It is critical that the fire shelter be held down on the ground before the flame front arrives. The shelter is quickly damaged if flames or radiant heat contact its inner surface.

It is important to carry the fire shelter properly. The case should be vertical if it is worn on your side or horizontal if it is worn in the small of your back under your pack. A chest harness is now available that allows persons operating machinery to carry the shelter on their chest. Never carry your shelter inside the main body of your field pack.



Figure 2—When direct flame contacts the fire shelter, glue in the shelter material may form gases that can ignite inside the shelter.

...The shelters really do an amazing job of reflecting that radiant heat.... When that shelter lifted up and you got that radiant heat directly, and the convective heat that was coming (in), it was just an incredible change in what you felt in there.

Entrapment survivor



Training



Hands-on shelter deployment is an essential part of fire shelter training.

Firefighters have died when they were unable to deploy their shelters in time. Seconds are critical. It can take an untrained person several minutes to deploy a shelter. After three or four tries, most persons can deploy a shelter in 20 seconds or less. Practice fire shelters allow firefighters to practice frequently at a reasonable cost.

It was obvious that (the firefighters) had (trained) and that they were comfortable with the task, and it seemed to sort of calm everybody down.

Entrapment survivor

Firefighters who have been through entrapments have reported that deploying the shelter had a calming effect—they were doing something they had been trained to do. The more you practice using your shelter, the more likely you are to react correctly in an emergency.

I didn't say, "Start talking to each other," because I was thinking "Well, I need to calm these people down." I was thinking that because I was trained to do that. I had been told that in the training, "Once you're in the shelters, begin to talk to each other immediately."

Supervisor and entrapment survivor

Training Scenarios

Training should not be done (under) controlled circumstances. Catch (firefighters) when they're tired; catch them when they are off guard; it may be more similar to what it's like in the real world.

Supervisor and entrapment survivor

Each individual should practice deploying the fire shelter under the following five scenarios. It is best to train in realistic field conditions.

Remember, always train wearing gloves, a hardhat, a full pack, and if you have one, a face and neck shroud.

1. Deploy your fire shelter while standing.

If there is time during a deployment, you should clear a 4- by

8-foot site down to mineral soil (Figure 3). Practice preparing the site so you can do so quickly. Practice deploying the shelter from a standing position. The best training locations are in the field where different site selections can be discussed. Practice evaluating possible deployment sites when out on the fireline so you can recognize deployment sites quickly under stress. Be aware of the time it takes to clear a site, remove your shelter, and be fully deployed on the ground under the shelter.

2. Deploy your shelter while lying on the ground.

Practice deploying on the ground by opening your shelter and pulling it over you, head first. If the fire approaches before you are fully deployed, your most important action is to get flat on the ground (Figure 4). Temperatures just a few inches from the ground are



Figure 3—Deployment from a standing position.



Figure 4—Deployment from the ground.

dramatically higher than those at ground level. Death is almost certain if you get caught off the ground in a flame front.

3. Drop your gear and remove your shelter while escaping.

When speed is essential for escape, drop your gear and run with only your fire shelter. You are more likely to remember these steps when stress and fear set in during an escape if you practice them each year. As you are running:

- *Drop your gear.*
- *Grab your shelter.*
- *Strip off the shelter's vinyl bag.*
- *Partially unfold the shelter.*

The partially unfolded shelter can be used as a heat shield and can be fully deployed in a matter of seconds. You must take care not to catch the shelter on brush or rocks.

4. Deploy your shelter in a strong wind.

Since fires are accompanied by high winds and turbulence, it is important to practice in these conditions. Some people find it easier to deploy from the ground in strong winds. Try a variety of deployment techniques to find one that works for you. Always remove your pack at the earliest stage of deployment—it is extremely difficult to deploy a fire shelter in the wind while wearing a pack.

Note: While windstorms provide the most realistic training, you can get a good feel for wind deployments by using one or more strong fans, such as the positive ventilation fans used by structural fire departments.

5. Lie in your shelter.

Lie in your shelter and picture yourself in an actual entrapment situation. Fear of confined spaces and the dark, combined with extreme heat, turbulence, and noise, can cause panic. Imagine the sounds, heat, and fear. Imagine steeling yourself to pain and staying in your shelter no matter what. Some firefighters have suffered claustrophobia while in their shelters. Spend



enough time inside a shelter to find out if you're claustrophobic. If you are, gradually increase the time you spend inside a shelter to help you adapt.

Annual refresher training will maintain proficiency in shelter deployment.

Visualization

In addition to hands-on training, visualize yourself going through the deployment scenarios. Think of visualization as a dress rehearsal. It is a form of practice that allows you to experience events before they happen. Images have a powerful effect on us. The mind treats an imagined entrapment as if it were real. If you ever do have to drop your pack and deploy your shelter, visualization makes it more

likely that you'll react correctly, quickly, and without panic. Visualization should be used only to supplement—never to replace—hands-on training.

Picture yourself in different entrapment situations. Think your way through the entrapments and imagine yourself reacting correctly to each situation. The most important actions to visualize are:

- *Dropping your pack and tools to escape more quickly.*
- *Getting on the ground before the fire arrives.*
- *Getting under your shelter.*
- *Staying completely under your shelter even if you are being burned or the shelter starts to fail.*
- *Protecting your airways and lungs by remaining prone, with your face to the ground.*

Never Train in Live Fire

For more realism in training, some crews have occupied shelters near burning brush piles. This is unacceptable. Such training is extremely dangerous and risks firefighters' lives.

NEVER use live fire for fire shelter training.



Water Can Make the Difference



It is extremely important that you stay well hydrated when fighting fire. Drink water often, during your shift and when you are off duty. If you are well hydrated, your body can sweat and cool itself more effectively. This is particularly important in the case of an entrapment.

Do not use your water to wet your clothing or your bandanna inside the fire shelter. Wet clothing conducts heat to the skin more quickly than dry clothing, so burns are more likely. As the water on the clothing evaporates, it increases the humidity inside the

shelter. Moist air causes more damage to airways than dry air at the same temperature.

The best way to use your water is to drink it. Take canteens into your fire shelter if you have time. Continue to sip the water to replace lost fluids.



Escape



If entrapment seems likely, attempt planned escape procedures first. If there is reasonable doubt, take your shelter out of its case, pull one of the red rings, and remove the plastic bag. If time is critical, leave your gear and run with the shelter in your hands. If escape plans fail or become impossible to execute, use your shelter.

The fire shelter is a last resort. If you are threatened with entrapment, your first priority must be escape. All firefighters must know the location of their escape routes and safety zones at all times. Remember—in a true safety zone you do not need a fire shelter to protect you from heat and smoke. Follow the *10 Standard Fire Orders* and be aware of the *18 Watch Out Situations*. Continually reevaluate the effectiveness of your *Lookouts, Communications, Escape Routes, and Safety Zones (LCES)*. Crew supervisors **must** identify escape routes and safety zones, and make sure they are known by their crews. Remember that changing conditions may compromise planned escape routes

and safety zones, requiring that new escape routes and safety zones be identified if work in the area is to continue.

If you feel that entrapment is imminent, you will have to decide quickly whether or not you have time to escape. You will have to recognize when deployment of your fire shelter is your only option. If you cannot reach a safety zone, do not pass through an effective shelter deployment site only to get caught later in a more hazardous area. You must be decisive. If you are with a crew, follow the orders given by your supervisor. If you are in charge, be sure to give clear instructions and make sure they are understood.

Drop Gear for Speed

Since 1990, 23 firefighters have perished carrying packs and tools while moving uphill to escape fires. Some of these firefighters probably would have lived if they had dropped the extra weight. You can run 15 to 30 percent faster without the weight of your tools and pack. **Drop your pack as soon as you realize your escape may be compromised. Time is critical.** If you are escaping over uncleared ground, keep your tool. You may need it to clear a deployment site. Toss your gear well away from fire shelters so it does not ignite and burn a shelter.

Use Your Face and Neck Shrouds

Face and neck shrouds offer additional protection against radiant heat during escape. Shrouds should not be used to go into areas where you would not go without them. If shrouds are worn, they should be attached to the hardhat for quick deployment when they are needed. **Do not rely on shrouds to protect your airways from hot gases.**

Discard Your Fusees

Fusees are the most dangerous items you carry (Figure 5). When wearing shrouds and long-sleeved T-shirts, firefighters have worked close enough to radiant heat to melt goggles and hardhats. These plastics melt at around 320 °F. Fusees ignite at 375 °F. This temperature can occur under escape conditions. Fusees are one of the reasons you should drop your pack as soon as you recognize danger. In an entrapment situation, you do not have time to think about items in your pack that could be dangerous.

Do not take fusees into your fire shelter. Throw them as far away as possible.



Figure 5—Never take fuseses into a fire shelter.

Stay Alert

When you are escaping an entrapment, you need to stay alert and be prepared to act. If the fire is closing in behind you, get your shelter out and partially unfold it. Use the shelter as a shield if you need one (Figure 6). Be careful not to drop the shelter, allow it to blow away, or allow it to snag on brush. Be ready to grab the shelter by an edge and get into it.

Be alert for signs of hot gases. Hot gases may have little smoke or color. Your only warning may be air movement, an increase in temperature, and embers blowing past. If gases get hot enough to burn you, it is time to get under your fire shelter.

As you move along your escape route, stay alert and talk to other crew members. Talking helps relieve stress and ensures that hazards will be communicated



Figure 6—If necessary, use your shelter as a heat shield during escape.

quickly. Be alert for deployment areas as you move. If it becomes apparent that you are not going to reach a safety zone, keep in mind how long it will take you to deploy your shelter. Deployment takes 20 seconds under ideal conditions, 30 to 40 seconds in turbulence, and 40 to 80 seconds in turbulence while you are wearing a pack. When time is critical, get rid of your pack and start to deploy on the move. Leave enough time to get on the ground and under your shelter before the heat arrives.

While the fire shelter is considered a last resort, it can also protect you from falling embers or help you escape through thick smoke. You should not hesitate to use your shelter to protect yourself. Your safety is always the highest priority. Do not worry about the cost of using a fire shelter. They are less costly than fire-resistant clothing or a visit to the hospital for smoke inhalation.