Module 2: Watch Out and LCES

Topic 1: Introduction

Why is pre-deployment safety important?

Narration Script: In many wildland fires, there are no lives at risk until the first firefighters arrive at the scene. No grass, brush, timber, or structure is worth your life, and only a REASONABLE chance to save another human life is worth that risk. Until the tragedy of September 11th, the largest number of firefighters lost at a single incident occurred in a WILDLAND setting. As recently as 1994, as many as 34 wildland firefighters died in ONE year. And it's not only the fire that will get you—you use and work near dangerous tools and equipment as well! Cutting tools, mobile apparatus, heavy equipment, and aircraft all add to the risks you face.

But there are things you can do so you don't become an injury or fatality statistic! As you go through this topic, become aware of safety rules you need to remember and follow on the wildland fire ground! Doing so will help you recognize and lessen the hazards to yourself and others.

Remember and follow rules introduction

This module will introduce you to the concepts contained in a job aid that will help you remember and follow some key safety rules for wildland fire fighting. During basic wildland training, firefighters often receive a resource such as the Incident Response Pocket Guide (IRPG) containing key safety rules. In this course, we've provided a memory aid for the "remember and follow rules" that if not followed may have serious consequences. We'll cover each aspect of this job aid in this order:

- Common denominators of fire behavior on tragedy fires
- "Watch-out!" situations
- Ten standard fire fighting orders
- Lookouts, communications, escape routes, and safety zones (LCES)
- Deployment sites

Narration Script: All fireline personnel, regardless of rank or assignment, must remember and follow the key safety guidelines we will present in this module. Get one of the safety cards or the IRPG that lists these rules, and keep it with your wildland gear. It will remind you of the safety rules that you and all fireline personnel have to abide by. As you'll hear several times in this course, behind each one of these safety rules is a dead or seriously injured wildland firefighter. Learn from history, and make sure your name doesn't go down in it! So, dive in as we look into each of the sections of this job aid. Go to the references accompanying this course for a version of this card as well as a version of the IRPG.



Caption: The job aid available in the additional materials for this course. It serves as a consolidated reminder of the key safety rules firefighters should follow while working on an incident.

Safety introduction

It is an unfortunate fact that each year firefighters experience tragic deaths fighting wildland fires. The bigger tragedy is that some of those firefighters might still be alive had they remembered basic safety rules they learned in training.

Even under the best conditions, a wildland fire is unpredictable and can change for the worse—much worse—within minutes. In this topic, you'll learn some important safety rules and guidelines that could save your life.

Specifically, you'll learn about:

- Common denominators of fire behavior on tragedy fires
- "Watch-out!" situations
- Ten standard fire fighting orders

We'll try to keep this topic light hearted, but take it seriously. These are essential safety guidelines that all firefighters *must* remember. Not remembering them is not an option.

Narration Script: Wildland fire fighting is one of the world's most dangerous jobs. No doubt you're attracted to it partly because you're rugged and welcome physical and mental challenges, or perhaps you're even attracted to the danger itself. Be aware though—wildland firefighters die every year. This is not just some statistic in a government record book. What's important to know is that according to fire fighting experts, many firefighter fatalities could have been prevented by following some basic safety principles. Not only that, but some fatalities occurred where the fire appeared "innocent," in "light fuels," or during mop-up operations.

Okay. Have we got your attention? Good, because this topic is specifically geared toward keeping you safe. The good news is that those fire fighting safety rules keep getting better and more refined based on experiences in the field. What you learn here will serve you well.

Common denominators of fire behavior on tragedy fires

Case studies have shown there are several common fire behavior characteristics that have resulted in firefighter fatalities and near misses. These characteristics are called the common denominators of fire behavior on tragedy fires.

Professor Burns is here to help you to understand how each of these behaviors contributes to tragic fires. Reference each of Professor Burns's formulas to see how each factor can add up to tragedy.

Small Fires + Isolated Sections = Tragedy

Common denominator of a tragedy fire: most incidents happen on relatively small fires or on isolated sections of large fires.

Light Fuels = Tragedy

Common denominator of a tragedy fire: flare-ups generally occur in deceptively light fuels, such as grass, herbs, and light brush.

Topographic Conditions = Tragedy

Common denominator of a tragedy fire: topographic conditions affect fires. Fires move especially fast uphill in chimneys, drainages, and on steep slopes.

Wind Shifts = Tragedy

Common denominator of a tragedy fire: unexpected shifts in wind direction or speed increase fire danger. Even some suppression tools, such as helicopters or air tankers, have been known to cause flare-ups.

Narration Script: One of the sections on your job aid covers the common denominators of fire behavior on tragedy fires. These "Common Denominators" stress that you must remain alert for potentially life-threatening situations, even when a fire does not appear to be dangerous.

You are responsible for monitoring both the fire's behavior and the factors that could modify that behavior. For example, if the fire is burning in a drainage, chimney, or steep slope, radiant heat from the fire will easily preheat and dehydrate the exposed fuels immediately adjacent to it and rapidly spread the fire uphill. So, you must watch for signs of these situations developing and be prepared to modify your plans accordingly.

Fireline Handbook and Incident Response Pocket Guide

If your memory isn't as sharp as your axe, frequently review the Common Denominators list in your Incident Response Pocket Guide (IRPG) or your Fireline Handbook.

Read the following for a quick overview of each resource.

IRPG

The IRPG is the smaller of the two resources and could easily fit in your shirt pocket. It contains four color-coded sections, focusing primarily on the tactical issues of fire fighting:

- Green—these are operational guidelines, such as tactical watch-outs and last resort survival guidelines
- Yellow—these are all risk guidelines, such as the vehicle accident incident command (IC) checklist and major disaster considerations
- Red—these are first aid guidelines, such as those for patient assessment, cardiopulmonary resuscitation (CPR), and special treatments
- Blue—these are aviation guidelines, such as those for helicopter passenger briefing and longline missions

Fireline Handbook

The Fireline Handbook focuses primarily on organizational and strategic issues of fire fighting. It basically covers the same ground as the IRPG, but it goes into greater detail. Keep it on hand in your vehicle or at your duty station.

Case studies introduction

Throughout this topic, you will examine two of the many fires where wildland firefighters lost their lives. After reading a brief summary of each fire, you will be able to see how the guidelines you are learning relate to the incident.

Investigate two tragic incidents:

- Mann Gulch Fire, 1949
- Storm King Mountain Fire, 1994

You will investigate each incident in turn to see a summary of the incident and learn the common denominators.

Narration Script: Unfortunately, the fire service has had to learn some hard lessons from incidents that resulted in firefighter fatalities. These "hard lessons" are the reasons behind every guideline on your job aid. In this topic, honor the memory of our fallen friends by examining and learning from some of these tragic fires. Try to discover how such incidents can be prevented in the future by applying the rules covered in this topic.

Case Study—Mann Gulch Fire (1949)

On August 5, 1949, the Mann Gulch wildfire overran 16 smoke jumpers in the Helena National Forest in Montana. Only three survived—the foreman and two members of the smokejumper crew that parachuted into a small valley near the fire.

Conditions impacting the tragedy included:

- Topography: remote and difficult to traverse, no roads nearby, and 18 to 44 percent slope
- Fuels: dry heavy undergrowth, scattered timber and grass
- Weather: 97° F (36° C), less than 6 percent humidity, winds at 30 mph (48 km/h) in the open

Here are the common denominators of fire behavior that contributed to this tragedy:

- The fire appeared so unthreatening that one survivor stated, "I took a look at the fire and decided it wasn't bad."
- The firefighters moved from heavy timber into an open field of dry grass.
- The fire was moving up a steep slope.

Case Study—Storm King Mountain (1994)

On July 6, 1994, 14 firefighters lost their lives after being overrun by a fire at Storm King Mountain just outside of Glenwood Springs, Colorado. Conditions impacting the tragedy included:

- Topography: rocky footing, 33 to 50 percent slope
- Fuels: dry Gambel oak, scattered timber and grass, moisture content below 3 percent
- Weather: more than 90° F (32° C) and dry, 30 to 50 mph (48 to 80 km/h) winds

There is one of the common denominators of fire behavior that contributed to this tragedy. Due to the steep slope, heavy and dry fuels, and strong winds, the fire burned up the slope at nearly 18 mph (29 km/h) and at temperatures as high as $2,000^{\circ}$ F $(1,093^{\circ}$ C).

Narration Script: While the actual name of this fire was the South Canyon Fire, in the press it is commonly called the Storm King Fire. We will refer to it by this commonly known name from here on out.

Knowledge Check 1

Multiple choice—check the box of the answer(s) you choose.

Have you dominated the common denominators?

Identify THREE common denominators of fire behavior on tragedy fires.

Fires move especially fast uphill in chimneys, drainages, and on steep slopes.

Flare-ups generally occur in medium fuels.

Shovels, axes, and Pulaskis can adversely affect fire behavior.

Unexpected shifts in wind direction or speed increase fire danger.

Most incidents happen on relatively small fires or on isolated sections of large fires.

The correct answers are fires move especially fast uphill in chimneys, drainages, and on steep slopes; unexpected shifts in wind direction or speed increase fire danger; and most incidents happen on relatively small fires or on isolated sections of large fires.

Eighteen situations that shout "Watch Out!"

You can follow up your knowledge of the four common denominators with 18 very important "Watch-Outs!"—also found in both the IRPG and the Fireline Handbook.

Read the following for a list of *fireline* situations that may kill you. It's the product of years of experience in countless wildland fires. You can honor the fallen by familiarizing yourself with each of the 18 situations that shout, "Watch Out!"

1. Fire Not Scouted and Sized Up

You're in danger anytime your crew is assigned to fires or parts of fires where you cannot see the entire perimeter and someone from your crew has not had the opportunity to adequately perform a size-up. To provide a reasonable degree of safety, know where the fire is and what it is doing.

2. In Country Not Seen in Daylight

When you are in an area that no one from your crew has seen in daylight, you may not have the topographical information you need to work safely. The situation may be unsafe because you are unable to see the:

- Shape of the land
- Density of the vegetation
- Distances between key landmarks

3. Safety Zones and Escape Routes Not Identified

If you are on the line and don't know where your safety zones and escape routes are, *stop* what you are doing until you find out the location of these critical safety features. Obviously, use your best judgment about when and where to stop, but do it immediately.

4. Unfamiliar with Weather and Local Factors Influencing Fire Behavior

You may find the local microclimate or burning conditions different from those in other areas. Safely coping with different conditions may require a change in strategy or tactics.

5. Uninformed on Strategy, Tactics, and Hazards

Not knowing what the plan of attack is and how you fit into it can place your crew in serious jeopardy. You may be in the path of danger, such as airdrops or firing operations. Receiving assignments face to face is always best and helps provide clarity. Never, ever be shy about asking *why* you are performing a certain task.

6. Instructions and Assignments Not Clear

The results of poor communication can be both unproductive and dangerous. Once your crew is on the fireline, it may be too late to clarify orders. When in doubt, talk it out—repeat orders back to your supervisor.

7. No Communication Link with Crew Members or Supervisor

Lack of communication between crew members and supervisors can result in critical, lifesaving information not being passed up or down the chain of command. Maintain reliable communications between all levels.

8. Constructing Line Without Safe Anchor Point

A fireline should be anchored where there is a strong likelihood that it will *not* be overrun by the fire. That is the purpose of an *anchor point*. An anchor point is a natural or manmade barrier that will prevent fire spread and the possibility of a crew being flanked. Typical anchor points are roads, lakes, ponds, streams, earlier burns, rock slides, and cliffs. Obviously, it would be unsafe to construct fireline without an anchor point.

9. Building Fireline Downhill with Fire Below

Building a line downhill or making a hose lay in the green toward a fire is very dangerous. Fire normally burns faster uphill than downhill, you cannot predict how it will spread laterally, and there is a greater risk of the fire flanking crews that may be working downhill above the fire.

In this situation, it is difficult for firefighters to establish a safe anchor point, and they are not assured a safe escape from the fire if they have to escape uphill. Also, convected heat, smoke, and flame rising upslope make it difficult for you to breathe or see clearly, and you are likely to have very poor footing.

However, downhill line construction is sometimes a valid tactic, but only after carefully weighing the benefits against the risks, establishing LCES (lookouts, communications, escape routes, and safety zones), and following the downhill line construction checklist in the IRPG.

10. Attempting Frontal Assault on Fire

Attempting a frontal assault on a fire from the green puts you in a terrible position, especially if your crew has too few hoselines or hoselines that are too small. Your fire can overrun you, and flying sparks or embers may start fires (spot) behind you. Other dangers of a frontal assault are:

- No anchor point
- Lateral fire spread—you may be outflanked as a result
- Rapid movement of fire toward you or over you
- Intense heat and smoke
- Inability to get to a satisfactory escape route and safety zone

11. Unburned Fuel Between You and Fire

It is dangerous for you to be in any type of ground cover with unburned fuel between you and a fire. Any time you are in the green and attempting to move through unburned fuel to reach the burned area, you are susceptible to the fire overrunning you. Have your escape routes and safety zones readily available.

12. Cannot See Main Fire and Not in Contact with Anyone Who Can

If your crew is working out of sight of the fire and out of contact with anyone who can see the fire, an unseen blowup can put you in danger of being overrun. Post one or more lookouts who can see the progress of the fire.

13. On a Hillside Where Rolling Material Can Ignite Fuel Below

If rolling materials start spot fires below your crew, a new fire may run upslope toward you. Since fire can spread rapidly upslope, you are not likely to be able to outrun the fire.

14. Weather Becoming Hotter and Drier

Fires like hot, dry weather. That's when they are most active. To determine if the weather is getting hotter and drier, you or your supervisor can:

- Use your senses to observe fire behavior—look for more intense burning
- Get frequent weather forecasts
- Take weather measurements periodically with a weather kit

You may have to adjust tactics under these conditions:

- New smoke appearing within the burn
- Smoldering duff supporting visible flame
- Up-canyon winds starting to blow through the ravines and across control lines
- New spot fires increasing in number
- Smoldering spot fires being fanned back into life
- Crowning, or the likelihood of fire rising from ground level into the tree crowns and advancing from treetop to treetop, increases even during mop-up

15. Wind Increases or Changes Direction

Be aware of winds increasing or changing direction. Wind pushes flames into available fuels and increases the spread rate. Wind blowing from the green into the black may suddenly reverse direction and blow hot materials or flames into new fuels.

16. Getting Frequent Spot Fires Across Line

If you've got more spot fires across the line than you can handle, you won't be able to reach and contain them while they are still small. That's a problem—if you don't knock them down, they can combine to create area ignition. Spot fires can also develop into separate major fires, and you can suddenly find yourself and your equipment between two or more fires.

17. Terrain and Fuels Make Escape to Safety Zones Difficult

Sometimes you can be at some distance from the burned area or another safety zone in terrain or cover that makes travel difficult and slow. Watch out for:

- Slopes that present hazards such as falling rocks and the potential for slipping and falling
- Irregular terrain that can put you out of sight of the fire and other personnel
- Heavy cover that may restrict your ability to see the fire and may obscure escape routes

The reason this is a "Watch-out!" situation is that personnel should be able to escape the fire with *reasonable ease*. When terrain and fuels make escape difficult, you will need to increase your time estimate for escape and *trigger points* for reevaluating the situation will have to occur more frequently.

18. Taking Nap Near Fireline

Those who haven't fought a major fire laugh when they see this one. It's not so funny when you've been on the line for 20 hours of your first 24-hour operational period. You may find yourself asleep on your feet with your head on the handle of your shovel. A sleeping firefighter can be overrun by a fast-moving fire or by heavy equipment operating along the fireline.

Narration Script: The list of fireline "Watch-out!" situations that may lead to the loss of firefighters' lives is the product of years of experience in countless wildland fires. Familiarize yourself with each of the situations.

"Watch-out!" situations case study

Take another look at the Mann Gulch and Storm King Mountain fires.

The crews did not recognize some dangerous situations. Read the following to see the "Watch-out!" situations they did not recognize.

"Watch-Out!" Situations: Mann Gulch, 1949

Here are the "Watch-out!" situations that were overlooked at this tragedy:

- Situation 3: No safety zones or escape routes were identified.
- Situation 7: The crew's radio had broken during the drop.
- Situation 9: The crew was positioned above fire burning up a steep slope.
- Situation 11: There was no fireline, meaning plenty of unburned fuel existed between the crew and the fire.
- Situation 14: The weather was hot at over 97° F (36° C), and extremely dry.
- Situation 15: Just as the group deployed, wind shifted almost 180 degrees and increased to 30 to 40 mph (40 to 64 km/h), blowing the fire directly toward the crew.
- Situation 17: The only available escape for the crew was across light fuels on a windy open slope with an 18 to 44 percent grade.

"Watch-Out!" Situations: Storm King Mountain, 1994

Here are the "Watch-out!" situations that were overlooked at this tragedy:

- Situation 4: The crew was unaware of the danger posed by the dry Gambel oak and the changes in local weather conditions that occurred just prior to the blowup.
- Situation 9: The group was constructing a fireline downhill.
- Situation 11: The crew had unburned fuel between themselves and a spot fire.
- Situation 12: Although a lookout could clearly see the fire intensifying, the crew's view was obstructed by tall vegetation; thus, they were unaware of the oncoming disaster.
- Situation 14: Hot and dry weather led to moisture content below 3 percent in the surrounding fuels.
- Situation 15: Just prior to the blowup, the wind increased to 35 mph (56 km/h) and changed direction so that it was blowing the flames uphill.
- Situation 17: The rocky slope increased from 33 to 50 percent near the top, slowing down firefighters running from a fire that was increasing in speed.

Knowledge Check 2

Multiple choice—check the box of the answer(s) you choose.

Let's see how well you watched out for the important information we just covered.

Select THREE situations that shout, "Watch out!"

Safety zones and escape routes not identified Building a fireline downhill with fire below Communication is established between all crew members Working from the black Wind increases and/or changes directions

The correct answers are safety zones and escape routes not identified, building a fireline downhill with fire below, and wind increases and/or changes directions.

Ten standard fire fighting orders

The fire service has learned from past tragedies. Studies of firefighter fatalities, including those on Mann Gulch, led to the development of the 10 Standard Fire Fighting Orders. These orders help you identify and avoid high-risk situations, if they are followed sequentially—from the top down!

You'll consider each order separately so you will recognize when it applies to you and be able to respond correctly.

Narration Script: The "Watch-outs!" are critical, but the safety story doesn't end there. Now we'll focus on some additional hard lessons the fire service has learned—they're called the 10

Standard Fire Fighting Orders. The Orders were developed by a task force commissioned by Forest Service Chief Richard E. McArdle in 1957.

According to the task force, in the 16 tragedy fires it studied, firefighters died because they did not know or did not follow one or more of the 10 standard orders. So take the orders seriously, and follow them in the order given—from the top down. Violating this sequence, or any of the orders, could get you seriously injured or worse.

Fire Fighting Order 1

1—Keep informed on fire weather conditions and forecasts.

Use every means at your disposal to answer the following questions:

- What is the weather in the fire area?
- What is the weather likely to do?

Narration Script: Weather is a major factor in fire behavior, so stay informed of weather conditions and forecasts by asking yourself these questions:

- What is the weather in the fire area?
- Is the weather against us?
- Is this the critical burning period?
- What is the weather likely to do?
- Are we going to have winds, high temperatures, or low humidity?
- <u>Is there a chance of wind from a passing weather front or wind associated with cumulus or cumulonimbus clouds?</u>

Recognizing weather conditions

Use your senses and any other available means to determine weather conditions. Here are some tips to practice your weather forecasting skills:

Feeling

Even without the aid of a weather station, you can feel whether the temperature is increasing or decreasing. The time of day is also a good indicator of whether the temperature is likely to increase or decrease. Does your skin feel dry? Are your lips cracking? Those can be pretty good indicators that relative humidity is low.

Sight

Wind vanes and anemometers give precise wind information, but they are not necessary to determine whether the wind is blowing. Determine the direction and velocity of the wind by looking at:

- Vegetation
- A flag

- Cloud movement
- The drift of smoke or dust

Hearing

Listen to fire-weather forecasts. However, also listen to people who are familiar with the area and ask their opinions of what to expect from local weather patterns. For example, locals can confirm what kinds of winds are common in the area at a particular time of year.

Weather Kits

Portable or belt weather kits enable you to measure relative humidity, wind speed and direction, and temperature. Find these kits and practice with them. At any time, a supervisor could point at you and request a spot weather reading.

Fire Fighting Order 2

2—Know what your fire is doing at all times.

Many small fires become large ones and sometimes very quickly. Follow these guidelines:

- Personally observe the fire from a vantage point
- Personally scout ahead
- Send out reliable scouts who will then report back
- Observe the fire from a helicopter or other aircraft if available
- Inform all crew members of the current situation
- **Review the** incident action plan (IAP)
- Monitor the assigned radio frequency

Narration Script: Firefighters have died because they failed to properly size up and evaluate what confronted them based on CURRENT information or because they failed to observe the whole situation. Make sure that doesn't happen to you.

Fire Fighting Order 3

3—Base all actions on current and expected fire behavior.

The varying conditions you may encounter force you to approach every fire differently. While all fires behave according to the same principles, no two fires are exactly alike because of all the possible variations in fuel, weather, and topography.

A few questions to ask include:

- What is the fire doing now?
- What is the fire likely to do later?
- What action is the crew taking now?
- What is the weather in the fire area?

- What type of fuel is burning?
- What type of fuel is the fire heading toward?

Narration Script: Base every action you take on what a fire is doing and what you think it might do. You'll have to make an educated guess. Ask yourself these questions:

- What is the fire doing now? Can we control it with the resources at the scene or en route? Do we need to request more resources?
- What is the fire likely to do later? Can we flank it? Should we back off for an indirect attack?
- What action is the crew taking now? Are we using equipment effectively? Are we making the attack at the right spot?
- What is the weather in the fire area? What is the weather likely to do?
- What type of fuel is burning? Can we build control lines fast enough? Is the fuel a type that can cause spot fires?
- What type of fuel is the fire heading toward? Do we have the proper tools? Will we need aircraft or mechanized equipment?

Fire Fighting Order 4

4—Identify escape routes and safety zones and make them known.

Some good areas to select for safety zones are:

- Burned area—make sure it is close enough so you can reach it
- Safety zones—identify or construct them, and be sure everyone knows their location
- Natural barriers—locate rocky areas, riverbeds, streams, lakes, and slide areas; let others know about them

And make sure you have an escape route, even if you have to construct one. Mark a safe route into the burned area, or cut one if the *brush* is too thick for travel.

Narration Script: Sound familiar? Follow this order at all times and especially when your crew is traveling cross-country to a fire that has no control lines or to an area you are unfamiliar with. Look for some of the good safety zones and escapes routes you see here.



Caption: An example of a safety zone in the black.

Escape route cautions

When you are attempting to determine safety zones and escape routes, consider these cautions:

- Get with your supervisor and make sure the entire crew knows where the escape routes are, how to travel to them, and what to do when you get to a safety zone
- Use extreme caution if an escape route passes through a chute, drainage, saddle, or any involved area that is not completely burned out
- Be aware of necessary changes to the escape route that may have to be made (maybe more than once!) as a fire progresses

Fire Fighting Order 5

5—Post lookouts when there is possible danger.

Make sure you have lookouts in place when:

- The head of the fire is not visible to the crew
- Felling snags
- Personnel and mechanized equipment are working closely together
- Falling rocks could strike someone or burning material could cross the control line
- An obvious hazard such as a snag cannot be felled
- Airdrops are being made nearby
- Firing operations are being conducted nearby

Narration Script: As you learned earlier, lookouts must be in constant communication with firefighters or supervisors. Use a system of visual signals if radios are not available. Also, use enough lookouts to maintain visual contact with both the fire and the crew.

Fire Fighting Order 6

6—Be alert. Keep calm. Think clearly. Act decisively.

When faced with a possible life-threatening problem, everyone—you, other crew members, and your supervisors—should keep calm and analyze what is happening. Panic can endanger the supervisor as well as the crew. After evaluating the situation, supervisors should decide how to deal with it, and then *do it!*

Factors that can affect decision making include:

- Fatigue—try to stay in shape, eat right, and get your sleep—and while on the fireline, drink lots of fluids
- Heat stress—do all the same things you'd do for fatigue, and remember to drink!
- Smoke (carbon monoxide)—try to reduce your exposure to it
- Stress—know and understand the life-threatening situation you are in

Warning

If your decision-making ability becomes impaired on the fireline, you could be putting your crew members as well as yourself in jeopardy. To increase your decision-making ability:

- Maintain self-control
- Develop contingency plans
- Become more cautious
- Monitor the situation more closely
- Double-check critical information
- Seek information and advice from others
- Know your own limitations

Narration Script: There's a lot to this one. Staying calm is not the same as moving slowly—do whatever you must to save yourself and your crew, and do it quickly! It is better to run five minutes too soon than five seconds too late.

Fire Fighting Order 7

7—Maintain prompt communication with your forces, your supervisor, and adjoining forces.

Adequate communication is essential to fireline safety. Always maintain good communication:

- Within your unit
- Between your unit and any scouts or lookouts

• With other fire fighting units and adjoining forces—obviously you need to know who they are and what they're up to

Communication during a wildland incident may be face to face or by radio, telephone, or any other reliable means.

Fire Fighting Order 8

8—Give clear instructions and ensure they are understood.

The likelihood of accidents occurring increases dramatically if supervisors give vague or ambiguous instructions. Although most instructions are given orally, there is also a place for concise, written instructions.

Have your supervisor verify the following when you are given an assignment:

- What to do—what is the objective
- How to do it
- Where to go
- Where to finish
- When to finish
- Whom to coordinate with
- Who the supervisor on the line is
- Who the relieving person is
- What the expected duration of attack is
- What the available transportation to and from the fireline is
- What the other pertinent information is, such as emergency procedures and safety considerations

Narration Script: Oral instructions are sometimes incomplete and are more likely to be misinterpreted or forgotten. Supervisors must verify the information listed here before executing an assignment. You see who, what, where, and how, but you don't see "why." It's implied by the objective, but a good supervisor will always take time to tell a crew how they fit into the overall plan.

Fire Fighting Order 9

9—Maintain control of your forces at all times.

Supervisors and crew leaders should be the ones in control at all times. Tips for them to follow include:

- Consider the capabilities and limitations of crew members when making work assignments—is the crew rested and ready to work, or are they already exhausted from a previous assignment?
- Inspect tools, coordinate work with available equipment, and make provisions for safety

- Exhibit command presence
- Follow the chain of command for the incident
- Ensure that assignments and instructions are clear and understood
- Establish and maintain communication
- Know the location of your crew members at all times
- Know the current status of the fire

Fire Fighting Order 10

10—Fight fire aggressively, having provided for safety first.

Aggressive action is the key to a successful *fire-suppression* operation; however, safety is the first priority. Supervisors should analyze the situation and make an attack consistent with accepted practices and methods under the existing conditions.

Narration Script: All fire attacks are a balancing act of risk and reward. Sure fire fighting is hazardous, but no stand of trees or housing development is worth your life. As you're probably heard before, trees and houses will grow back.

Sequence for the 10 Standard Fire Fighting Orders

Now you know what the 10 Standard Fire Fighting Orders are. Being able to recite them isn't enough. You need to know *why* one order follows another. Understand, these 10 orders are literally your rules of wildfire engagement—following them in the *proper sequence* is what will keep you safe. So let's review it.

The sequence makes sense once you see how the orders are grouped. Think for a second. A fire's behavior must be understood *before* fireline safety can be secured, right? And safety is secured *before* the fire is attacked, right?

This is how the 10 Orders are grouped:

- Fire Behavior = Orders 1 through 3
- Fireline Safety = Orders 4 through 6
- Organizational Control = Orders 7 through 9
- Overall Intent = Order 10

You will investigate each group of fire orders in the pages that follow.

Narration Script: Okay, you say you have the 10 Standard Orders memorized? That's a start, but let's make sure you understand their intent. There is a darn good reason why each Order appears where it does. And the reason is that the Orders represent the *process* you'll follow when you arrive at an incident. The Orders are your *rules of wildfire engagement*, and when they are followed sequentially, from one to ten, they are designed to keep you safe. To help you remember the sequence—and to make sense of it—we've organized the 10 Orders into four groups. Consider how the Orders are grouped. Then we'll talk briefly about each one.

Fire Behavior: Orders 1-3

Standard Fire Fighting Orders 1 through 3 are grouped under the heading, *Fire Behavior*. That's because when you arrive at an incident, you need to know what the fire is doing and what it might do *before* you establish things like safety zones and escape routes. Elementary, Watson.

Fire Behavior = Orders 1 through 3:

- 1. Keep informed on fire weather conditions and forecasts.
- 2. Know what your fire is doing at all times.
- 3. Base all actions on current and expected fire behavior.

Narration Script: The first three Standard Fire Fighting Orders are in the group called "Fire Behavior." Before you do anything else, you need to know *what* the fire is doing and what it *might* do. Until you assess the fire's behavior, you can't make informed decisions on things such as escape routes and lookouts.

Fireline Safety: Orders 4-6

Once you know what the fire is doing, you have the information you need to establish your fireline safety. For that reason, the group *Fireline Safety* comes next. This group includes the Standard Fire Fighting Orders 4 through 6.

Fireline Safety = Orders 4 through 6:

- 4. Identify escape routes and safety zones, and make them known.
- 5. Post lookouts when there is possible danger.
- 6. Be alert. Keep calm. Think clearly. Act decisively.

<u>Narration Script: Now that you have a handle on the fire's behavior, you can make intelligent</u> decisions about your fireline safety, such as where escape routes and safety zones will be placed.

Organizational Control: Orders 7-9

Orders 7 through 9 fall under the category of *Organizational Control*:

- 7. Maintain prompt communications with your forces, your supervisor, and adjoining forces.
- 8. Give clear instructions and ensure they are understood.
- 9. Maintain control of your forces at all times.

Narration Script: Okay. You know what the fire is doing and what it might do, and escape routes have been identified and lookouts posted. You are calm and alert. The Standard Fire Fighting Orders seven through nine cover organizational control. This is when prompt communication is established, clear instructions are given, and control is maintained.

Overall Intent: Order 10

So now you know what the fire is doing and what it might do (Fire Behavior—Orders 1 through 3). Escape routes have been identified and lookouts posted (Fireline Safety—Orders 3 through 6). Crew members are in good communication with one another, and you have clear instructions on what you need to do (Organizational Control—Orders 7 through 9). What's left?

Fight the fire aggressively. This is Order 10, and it falls under the heading Overall Intent.

Overall Intent = Order 10

10. Fight the fire aggressively, having provided for safety first.

Narration Script: Now that you have sized up the fire, established fireline safety, and are part of organizational control, there's only one thing left for you to do: fight the fire aggressively, yet safely. As a matter of fact, you can do this if and ONLY if the previous nine orders have been followed to the letter. Fighting the fire aggressively and safely is your "overall intent," and that is the heading for Order 10.

10 Standard Fire Orders case study

Look again at the Mann Gulch and Storm King Mountain fires. The outcome of these incidents may have been different if some of the 10 standard fire orders had been known and followed. Read the following to see which fire orders were ignored.

Fire Orders: Mann Gulch, 1949

Here are the fire order breakdowns that contributed to this tragedy:

- Fire Orders 1 and 7: Without a radio, the crew was unable to be informed of the changing wind direction and speed.
- Fire Order 4: No safety zones or escape routes were identified before deployment.
- Fire Orders 6 and 9: The foreman survived by moving into the black area of an escape fire he lit; none of his crew obeyed his order to enter the black area, and only two of them survived.

Fire Orders: Storm King Mountain, 1994

Here are the fire order breakdowns that contributed to this tragedy:

- Fire Order 1: The crews were not informed of changing weather conditions including a cold front that moved in, increasing wind speed, and changing wind direction.
- Fire Order 4: Although escape routes had been identified, all but two of the firefighters failed to use them.
- Fire Orders 6 and 9: Most of the crew reacted slowly to evacuation orders, walking initially, and did not drop their packs and tools. Many experts believe most of the dead would have been able to escape had they dropped their tools and run when ordered to do so.

Knowledge Check 3

Sequencing question—select the number from the pull down list to put the items in the correct sequence.

The 10 Standard Fire Orders are organized in a deliberate and sequential way to be implemented systematically.

Arrange the first six Standard Fire Orders into the correct order.

Be alert. Keep calm. Think clearly. Act decisively.
Keep informed on fire weather conditions and forecasts
Identify escape routes and safety zones, and make them known
Post lookouts when there is possible danger
Know what your fire is doing at all times
Base all actions on current and expected fire behavior

The correct order is as follows:
Keep informed on fire weather conditions and forecasts
Know what your fire is doing at all times
Base all actions on current and expected fire behavior
Identify escape routes and safety zones, and make them known
Post lookouts when there is possible danger
Be alert. Keep calm. Think clearly. Act decisively.

Summary

Your safety and the safety of your crew members depends on learning and applying all of the safety guidelines we've just discussed:

- Common denominators of fire behavior on tragedy fires
- "Watch-out!" situations
- 10 standard fire fighting orders

You might not be the most experienced wildland firefighter—not yet, at least—but what you lack in experience you are now gaining in knowledge, so get to know and understand these guidelines. Together, these lists provide a formula for survival as well as general guidelines for field operations.

Two great job aids you should carry and study from are the IRPG and the Fireline Handbook.

Narration Script: It can seem overwhelming just how much studying is required before joining a wildland fire fighting crew. It's in your best interest to take all this information to both heart and brain. As you grow in experience, the standard fire fighting orders, watch-outs, and common denominators will be ingrained in your memory—but as we said, even the most seasoned of firefighters carry and refer back to their IRPGs and Fireline Handbooks—and you should too.

Topic 3: LCES

LCES

In the Safety Topic of this module, we took a hard and fast look at the Standard Fire Fighting Orders. These orders provide the basic rules of engagement for all personnel operating at an *incident*. Within the Orders is another crucial safety tool dubbed "LCES" by *Paul Gleason*, a leadership icon who changed the way we view wildland fire fighting safety.

LCES is an acronym representing the four key operational components of the Orders:

- Lookouts
- Communications
- Escape routes
- Safety zones

LCES serves to remind *crew* leaders, supervisors, and all firefighters of the essential elements that keep *fireline* crews safe.

You will investigate each element in turn to learn how LCES keeps you safe on the fireline.

Narration Script: Set firmly within the heart of the 10 standard fire fighting orders is an operational component known as LCES. LCES stands for Lookouts, Communications, Escape Routes, and Safety Zones. Supervisors and firefighters should always check tactical plans against LCES to make sure that these safety considerations have been taken into account. If they have not been, the validity of the plan should be questioned, and crews should hold off on assignments until LCES is included.

In this topic, you'll investigate each aspect of LCES. The safety zone discussion will require most of your time.

Lookouts

Supervisors should post one or more *lookouts* to continuously monitor the progress of the fire. This is especially critical when crews are working in drainages or other areas where they cannot see the fire but the *fire front* is relatively close by.

Lookouts should be able to see both the fire and firefighters and understand the fire behavior they are seeing. If there is a sudden or unexpected change in fire behavior that might threaten the crew, the lookout must notify the crew in time for it to retreat to a *safety zone* or leave the threatened area. Lookouts must also have plans in place for communications, *escape routes*, and safety zones.

However, it is also every crew member's responsibility (including yours) to watch for hazards, such as *blowups*, rolling rocks, and falling *snags*, and to warn the crew.

Communications

Some form of absolutely reliable communication is required between:

- Lookouts and the crew
- Adjacent divisions and Operations and Command

Supervisors must verify communications at the beginning and throughout the work shift. This is most often done by radio, but radios are not always reliable in some areas. In these cases, direct voice communication is best, but using a system of hand signals, signal flags, or signal mirrors can work if the signals used are clearly understood.

Narration Script: Communication with the ICS organization and with crew members is critical at all times. And although we tend to take radios for granted, they may not work in hilly terrain or if traffic is heavy, or operational channels get messed up. Try another form of communication if radios aren't available or don't work. You might even try cell phones and pagers if you can get reception.

Escape routes

Be sure you know the escape routes for every incident you work on. An escape route is the route firefighters take to reach a safety zone, or safe area, when they are threatened by an advancing fire.

Here are the action steps for supervisors to take:

- Identify and mark escape routes well before they are needed
- Identify at least two escape routes
- Inform all crew members of escape route locations
- Don't place escape routes above a fire burning uphill on a slope
- Make escape routes lead to a safety zone in the *black* or farther into the *green* away from the fire
- Constantly reassess identified escape routes as the fire front progresses
- Mark new escape routes and communicate the change to the crews

Narration Script: Supervisors must identify escape routes before requiring firefighters to work in the green near the fireline, especially if there is unburned fuel between them and a fire. Escape routes should be marked with hot-pink flagging tape, which is actually the most visible in all wildland settings.

Escape time

Not all firefighters are created equal. Some run faster than others. Always consider escape time—the time it takes for all crew members to make it to a safety zone—when selecting escape routes.

Consider these escape time variables:

- How long it would take the slowest person to escape
- Fatigue and temperature factors
- Barriers that may increase travel time, such as hills, loose soils, rocks, and vegetation
- How long or short the route is
- Escape time versus the fire's rate of spread (ROS)
- How close your vehicles are

And remember this crucial rule: if you are running, and the fire is gaining on you, drop any gear you don't need, except your fire shelter! Never ever discard your fire shelter!

Narration Script: Just because firefighters are fit doesn't mean they are all fast or invulnerable to fatigue. When it comes time to high-tail it along an escape route, some firefighters may lag behind their colleagues.

When there is more than one escape route option, choose those with the fewest escape time barriers, like hills or rocks. Consider how fast the fire is moving and how long it would take the slowest or most fatigued firefighter to escape. And if the flames are catching up with you, drop all your gear—except your fire shelter—and keep moving! Remember, never, under any circumstances, should you discard your fire shelter!

Knowledge Check 4

Multiple choice—check the box of the answer(s) you choose.

Can you find your safety route when the time comes?

Identify THREE true statements about escape routes.

Always place escape routes above a fire burning uphill on a slope Always identify at least two escape routes Inform all crew members of escape route locations Only the supervisor needs to know the location of established escape routes Constantly reassess identified escape routes as the fire front progresses

The correct answers are always identify at least two escape routes, inform all crew members of escape route locations, and constantly reassess identified escape routes as the fire front progresses.

Safety zones

Safety zones must contain little or no combustible vegetation. To be effective, safety zones should have a radius equal to at least four times the *flame length* present in the fire, ensuring that flames and *radiant heat* will not reach personnel in the safety zone. When you have to work in *heavy fuels*, maintain a safety zone as close by as possible in case of a blowup.

We'll be covering the details in the next few screens, but in the field, you can always refer to the safety zone guidelines in your Incident Response Pocket Guide (IRPG).

You can use the following locations for potential safety zones:

- The burn
- Natural areas
- Constructed areas

Here's a warning to see where and where *not* to put safety zones. Never put safety zones in areas where the topography lends itself to faster fire spread, such as slopes, saddles, chutes, or drainages. Also, most roads are not wide enough to be effective safety zones.

Determine the size of the area needed for a safety zone by its fuel types, its location relative to topographic features, observed fire behavior, and number of personnel the safety zone needs to accommodate.

Narration Script: Depending on the situation and the resources available, the larger the safety zone, the better it is. High winds, steep slopes, or heavy fuel loads may increase the area needed for a safety zone. The safety zone must be large enough so that your survival will NOT depend on deploying your fire shelter. If the safety zone is large enough and the fuels light enough, you should be able to simply watch the fire burn by you. As far as locations go, your best bet is to designate a safety zone that takes advantage of natural or constructed features or to put the safety zone in the black where there is no reburn potential. You'll get into safety zone location details in the next subject.

Natural and constructed areas as safety zones

If you use the black for a safety zone, be sure the area has been fully burned out and is free of fuels. Natural and constructed safety zones are open areas clear of available fuel. Use hand tools to improve the area, if necessary.

A few of the natural areas you can use as safety zones include:

- Green meadows
- Naturally barren areas, such as rock slides or cliffs
- Streams or other bodies of water
- Areas of sparse vegetation

When no natural safety zones are at hand, you can construct a safety zone by scraping away surface fuels down to mineral soil. To construct a safety zone:

- Use mechanized equipment in areas with heavy fuels
- Consider burning out a safety zone, but keep the additional safety concerns in mind

Narration Script: If the worst happens, make sure you can get to a suitable natural or constructed safety zone. Natural areas suitable for safety zones include green meadows or areas of bare ground. You can also use bodies of water, but you must consider the possibility of people

drowning. Burned-over areas make some of the best safety zones once they are cooled sufficiently. The area must be large enough to accommodate personnel, and firefighters must not have to pass through the flame front to get there. If fuels are light, the black cools rather quickly. If fuels are heavy, it may take much longer. You will probably need to use mechanized equipment if you have to construct your own safety zone, You can also create a safety zone by burning an area out. Be very careful with this method because burning out can create additional safety problems such as drawing the fire to your location more rapidly or putting other firefighters at risk. Whether you use a burned-out area or a constructed area for a safety zone, you may need to improve the area with your hand tools as well.

Safety zone size

Your IRPG has specific distance recommendations for how far to separate firefighters from the nearest fuels to reduce the effects of radiant *heat transfer*. However, determining the actual size of a safety zone is no easy task. There is no one-size-fits-all answer to determine how big a safety zone must be in order to be effective.

Keep in mind that the IRPG's specific distance recommendations are based on the assumption that there is no slope and no *convective* heat transfer from *wind*. In addition, you need to keep in mind the influences of *firewhirls* and *topography* (terrain) that may significantly *increase* the total heat transfer to firefighters.

In other words, to put yourselves out of harm's way, you will have to greatly expand the size of your safety zone when wind, convection, and certain landscape features come into play.

Narration Script: Your Incident Response Pocket Guide gives you some practical guidelines about safety zone size, especially as it relates to radiant heat transfer. But you'll also want to keep other important factors in mind as well, including slope, wind, convective heat transfer, and topography.

Safety zones vs. deployment sites

Safety zones are *not* the same as deployment sites. Safety zones are SAFE—deployment sites make you wish you had become a tax attorney.

A safety zone is a location where a threatened firefighter may find refuge from danger without the aid of a fire shelter. Not so with a deployment site. A deployment site has two key characteristics:

- It is used when your escape routes and safety zone have been compromised.
- It is your location of last resort, may be covered with *light fuels*, and will require a fire shelter to aid your survival.

Narration Script: So there's no confusion, safety zones are not the same as deployment sites. A safety zone is the *first* place firefighters want to go when the "heat hits the fan." It's the place you'll be free from danger *without* having to use your fire shelter.

A deployment site is different, and less desirable. It's where you go when things turn bad—for example, when your escape routes have been cut off and your safety zone has been compromised. It's the area of last resort, where you will have to use your fire shelter to stay alive. You'll be able to learn more about deployment sites in the Fire Shelter Module.

Escaping to a safety zone

Knowing *when* to seek refuge in a safety zone might not always be obvious. This may be especially true as you move along the fireline and fire conditions change.

To know when refuge should be sought:

- Stay alert to changing fire conditions and safety zone locations
- Be aware that as fireline construction proceeds, your position will change in relation to established safety zones and the escape route
- Establish quality LCES in the first place—it will help ensure timely warnings and adequate escape times

Narration Script: It can also be confusing to know *when* you should seek shelter in a safety zone. Working along the fireline is hard, busy, focused work, and when you finally come up for air, you might not notice that your location has changed relative to escape routes and your safety zone. To know when you should seek shelter, stay aware of changing fire conditions and the location of safety zones. Know that as the fireline is constructed, your location near escape routes and the safety zone will also change. Make sure quality LCES is established from the beginning. This will help ensure everyone is warned in time and has time to escape.

Knowledge Check 5

Multiple choice—check the box of the answer(s) you choose.

When no natural safety zones are at hand, you can construct your own.

Identify THREE true statements about constructing safety zones.

Use hand tools to improve a constructed safety zone, if necessary Use hand tools to create a safety zone Engage mechanized equipment to construct a safety zone Burn out an area large enough for a safety zone Wet grassy areas using hoselines to create a safety zone

The correct answers are use hand tools to improve a constructed safety zone, if necessary; engage mechanized equipment to construct a safety zone; and burn out an area large enough for a safety zone.

Knowledge Check 6

Multiple choice—check the box of the answer(s) you choose.

LCES is a foundational principle. Let's see how good your memory is.

What do the letters in the LCES acronym mean?

Lookouts, crews, emergencies, safety Lookouts, communications, escape routes, safety zones Last, chance, escape, soon Look, communicate, evacuate the public, safety

The correct answer is lookouts, communications, escape routes, safety zones.

"Watch-out" and LCES summary

As a novice or relatively new wildland firefighter, you may have yet to see extended action in the field. Nevertheless, the knowledge you're gaining right now is highly practical and will serve you well—it's based on the hard, and sometimes tragic, experience of your predecessors.

So learn these guidelines. Together, they provide a formula for survival. Your safety and the safety of your fellow crew members will depend on your being able to apply them instinctively when you are "under fire."

In this module, you've learned about:

- Common denominators of fire behavior on tragedy fires
- "Watch-out!" situations
- 10 standard fire fighting orders
- LCES
- Deployment sites

Again, a great job aid to ask your supervisor for is the IRPG.

Narration Script: Remember, the guidelines we just covered are also listed on the card we referred to in the beginning of this module. It is a good idea to review this job aid while waiting for deployment in staging areas or while en route to a fire. All wildland firefighters need to know these safety and survival guidelines. Become an expert in pre-deployment safety and learn from the mistakes of the past so that tragedies like Mann Gulch and Storm King Mountain never happen again.