FIRELINE HANDBOOK

CHAPTER 1—
FIREFIGHTING SAFETY

CONTENTS

SAFETY FIRST—NO EXCEPTIONS

RISK MANAGEMENT

FIREFIGHTER AND PUBLIC SAFETY IS THE FIRST PRIORITY OF THE WILDLAND FIRE MANAGEMENT PROGRAM.

Remember To:

- Follow the Standard Firefighting Orders (inside front cover).
- Recognize the Watch Out Situations (inside back cover).
- Recognize the Common Denominators of Fire Behavior on Tragedy Fires (inside front cover).
- Follow the Risk Management Process.

The Risk Management Process

Step 1 - Situation Awareness

- Gather Information
  - ✓ Objective(s)
  - ✓ Previous Fire Behavior
  - ✓ Communication
  - ✓ Weather Forecast
  - ✓ Who's in Charge
  - ✓ Local Factors
- Scout the Fire

Step 2 - Hazard Assessment

- Eliminate Potential Fire Behavior Hazards.
  - ✓ Look Up, Down and Around Indicators (see page 7)
- Identify Tactical Hazards.
  - ✓ Watch-Outs (see page 8)
- What other safety hazards exist?
- Consider severity vs. probability.

Step 3 - Hazard Control

- Firefighting Orders → LCES Checklist – MANDATORY
  - ✓ Anchor Point
  - ✓ Downhill Checklist (if applicable; see page 17)
- What other controls are necessary?

Step 4 - Decision Point

- Are controls in place for identified hazards?

  NO – Reassess situation
  YES – Next question

- Are selected tactics based on expected fire behavior?

  NO – Reassess situation
  YES – Next question

- Have instructions been given and understood?

  NO – Reassess situation
  YES – Initiate action

Step 5 - Evaluate

- Self: Low experience level with local factors?
  - Distracted from primary tasks?
  - Fatigue or stress reaction?
  - Hazardous attitude?

- The Situation: What is changing?
  - Are strategy and tactics working?

Look Up, Down and Around Indicators

Fire Environment Factors	Indicators
Fuel Characteristics Assess	**Continuous fine fuels** Heavy loading of dead and down Ladder fuels Tight crown spacing (<20 ft.) Special Conditions: Firebrand sources Numerous snags Preheated canopy Frost and bug kill Unusual fine fuels High dead to live ratio
Fuel Moisture Feel and Measure	**Low RH (<25%)** Low 10 hr FMC (<6%) Drought conditions Seasonal drying
Fuel Temperature Feel and Measure	**High temps (>85F)** High % of fuels w/direct sun Aspect fuel temp. increasing
Terrain Scout	**Steep slopes (>50%)** **Chutes – Chimneys** Box canyons Saddles Narrow canyons
Wind Observe	**Surface winds above 10 mph** Lenticular clouds High, fast-moving clouds Approaching cold fronts Cumulonimbus development Sudden calm Battling or shifting winds
Stability Observe	Good visibility Gusty winds and dust devils Cumulus clouds Castellatus clouds in the a.m. Smoke rises straight up Inversion beginning to lift Thermal belt
Fire Behavior Watch	Leaning column Sheared column **Well-developed column** **Changing Column** Trees **torching** Smoldering fires picking up Small firewhirls beginning Frequent spot fires

Tactical Watch-Outs

Position

- Building fireline downhill.
- Building underslung or mid-slope fireline.
- Building indirect fireline or unburned fuel remains between you and the fire.
- Attempting frontal assault on the fire, or you are delivered by air to the top of the fire.
- Terrain and/or fuels make escape to safety zones difficult.

Situation

- Small fire transitioning to a larger fire or an isolated area of a large fire.
- Suppression resources are fatigued or inadequate.
- Assignment depends on aircraft support.
- Nighttime operations.
- Wildland-Urban interface operations.

EACH OF THESE WATCH-OUTS REQUIRES THAT YOU IMPLEMENT APPROPRIATE HAZARD CONTROL(S).

The safety hazards that exist in a typical protection of structures from wildland fire assignments are significant. In addition to applying **THE STANDARD FIREFIGHTING ORDERS** and avoiding **THE WATCH OUT SITUATIONS**, good judgment and planning are extremely important because of the presence of homeowners and their families, the media, pets and livestock, traffic, and unfamiliar combustibles.

Wildland-Urban Watch-Outs

- Poor access and narrow one-way roads
- Bridge load limits
- Wooden construction and wood shake roofs
- Power lines, propane tanks, and HazMat threats
- Inadequate water supply
- Natural fuels 30 feet or closer to structures
- Structures in chimneys, box canyons, narrow canyons, or on steep slopes (30% or greater)
- Extreme fire behavior
- Strong winds
- Evacuation of public (panic)

Safety While Protecting Structures From Wildland Fires

Structures exposed to wildland fire in the urban interface can and should be considered as another fuel type. Size-up and tactics should be based upon fuels, weather, and topography, just as those criteria would be applied to a wildland fire.

LCES Checklist

In the wildland fire environment, Lookouts, Communications, Escape Routes, Safety Zones (LCES) is key to safe procedures for firefighters. The elements of LCES form a safety system used by firefighters to **PROTECT THEMSELVES AND WORK AS A TEAM WITH OTHERS**. This system is put in place before fighting the fire: select a lookout or lookouts, set up a communication system, choose escape routes, and select a safety zone or zones.

LCES IS A SELF-TRIGGERING MECHANISM. Lookouts assess and reassess the fire environment and communicate threats of safety to firefighters. Firefighters use escape routes to move to safety zones.

LCES is built on two basic guidelines:

1. Before safety is threatened, each firefighter must be informed how the LCES system will be used, and

2. The LCES system must be continuously re-evaluated as conditions change.

Lookouts

- Experienced/Competent/Trusted
- Enough lookouts at good vantage points
- Knowledge of crew location
- Knowledge of escape and safety locations
- Map/Weather Kit/Watch/IAP

Communications

- Radio frequencies confirmed
- Backup and check-ins established
- Update on any situation change
- Sound alarm early, not late

Escape Routes

- More than one escape route
- Avoid uphill escape routes
- Scouted: Loose soils/rocks/vegetation
- Timed: Slowest person/fatigue and temperature factors
- Marked: Flagged for day or night (NFES 0566)
- Evaluate: Escape time vs. rate of spread
- Vehicles parked for escape

Safety Zones

- Survivable without a fire shelter
- Back into clean burn
- Natural Features: Rock areas/water/meadows
- Constructed Sites: Clearcuts/roads/helispots
- Scouted for size and hazards
- Upslope? = more heat impact = larger safety zone
- Downwind? = more heat impact = larger safety zone
- Heavy fuels? = more heat impact = larger safety zone

Escape time and safety zone size requirements will change as fire behavior changes.

Escape Routes and Safety Zones

An **Escape Route** is "a preplanned and understood route firefighters take to move to a Safety Zone or other low-risk area."

A **Safety Zone** is "a preplanned area of sufficient size and suitable location that is expected to protect fire personnel from known hazards without using fire shelters."

Identification of Escape Routes and Safety Zones is one of the primary responsibilities of any wildland firefighter working on or near the fireline. The following guidelines can be used when selecting Safety Zones:

- Calculations indicate that for most fires, Safety Zones must be wider than 164 feet to ensure firefighter survival.

- The calculation to determine Safety Zone radius is four times the maximum flame height plus 50 square feet per firefighter, or an additional four feet of radius per firefighter. This calculation provides the radius of the Safety Zone, meaning the Safety Zone diameter should be twice the value of the above formula.

- If potential for the fire to burn completely around the Safety Zone exists, the diameter should be twice the values indicated above.

- Factors that will reduce Safety Zone size include reduction in flame height by thinning or burnout operations, shielding the Safety Zone from direct exposure to the flame by locating it on the lee side of ridges or other geographic structures, or reducing flame temperatures by applying fire retardant to the area around the Safety Zone.

- All firefighter PPE must be worn.

- Keep in mind that these guidelines do not address convective energy.

Safety Zone Guidelines

- Avoid locations that are downwind from the fire.
- Avoid locations that are in chimneys, saddles, or narrow canyons.
- Avoid locations that require a steep uphill escape route.
- Take advantage of heat barriers such as lee side of ridges, large rocks, or solid structures.
- Burn out safety zones prior to flame front approach.
- For radiant heat only, the distance separation between the firefighter and the flames must be at least 4 times the maximum flame height. This distance must be maintained on all sides, if the fire has ability to burn completely around the safety zone. **Convective heat from wind and/or terrain influences will increase this distance requirement. The calculations in the following table assume no slope and no wind.**

Flame Height	Distance Separation (firefighters to flame)	Area in Acres
10 ft.	40 ft.	1/10 acre
20 ft.	80 ft.	1/2 acre
50 ft.	200 ft.	3 acres
75 ft.	300 ft.	7 acres
100 ft	400 ft.	12 acres
200 ft.	800 ft.	50 acres

Distance Separation is the radius from the center of the safety zone to the nearest fuels. When fuels are present that will allow the fire to burn on all sides of the safety zone this distance must be doubled in order to maintain effective separation in front, to the sides, and behind the firefighters.

Area in Acres is calculated to allow for distance separation on all sides for a three person engine crew. One acre is approximately the size of a football field or exactly 208 feet x 208 feet.

Last Resort Survival

Look at your options and immediately act on the best one!

Utilize all Personal Protective Equipment!

Protect your airway!

Escape if you can:

- Drop any gear not needed for fire shelter deployment (keep your fire shelter, hand tool, quart of water, and radio).

- You may be able to use the fire shelter for a heat shield as you move.

- In LIGHT FUELS, you may be able to move back through the flames into the black.
- If you are on the flank of the fire, try to get below the fire.
- Consider vehicles or helicopters for escape.

Find a survivable area:

- Stay out of hazardous terrain features.
- Use bodies of water that are more than 2 feet deep.
- In LIGHT FUELS, you may be able to light an escape fire.
- In other fuels, you may be able to light a backfire.
- Call for helicopter or retardant drops.
- Cut and scatter fuels if there is time.
- Use any available heat barriers (structure, large rocks, dozer berms).
- Consider vehicle traffic hazards on roads.

Pick a fire shelter deployment site:

- Find the lowest point available.
- Maximize distance from nearest aerial fuels or heavy fuels.
- Pick a surface that allows the fire shelter to seal and remove ground fuels.

- Get into the fire shelter before the flame front hits.
- Position your feet toward the fire and hold down the fire shelter.
- Keep your face pressed to the ground.
- Deploy next to each other and keep talking.

Expect:

- Extremely heavy ember showers.
- Superheated air blast to hit before the flame front hits.
- Noise and turbulent powerful winds hitting the fire shelter.
- Pin holes in the fire shelter that allow fire glow inside.
- Heat inside the shelter = Extreme heat outside.
- Deployments have lasted up to 90 minutes.
- When in doubt wait it out.

Downhill Checklist

Downhill fireline construction is hazardous in steep terrain, fast-burning fuels, or rapidly changing weather. Downhill fireline construction should not be attempted unless there is no tactical alternative. When building downhill fireline, the following is required:

- Crew supervisor(s) and fireline overhead will discuss assignments prior to committing crew(s). Responsible overhead individual will stay with job until completed (TFLD or ICT4 qualified or higher).

- Decision will be made after proposed fireline has been scouted by supervisor(s) of involved crew(s).

- LCES will be coordinated for all personnel involved.

  - ✓ Crew supervisor(s) is in direct contact with lookout that can see the fire.

  - ✓ Communication is established between all crews.

  - ✓ Rapid access to safety zone(s) in case fire crosses below crew(s).

- Direct attack will be used whenever possible; if not possible, the fireline should be completed between anchor points before being fired out.

- Fireline will not lie in or adjacent to a chute or chimney.

- Starting point will be anchored for crew(s) building fireline down from the top.

- Bottom of the fire will be monitored; if the potential exists for the fire to spread, action will be taken to secure the fire edge.

Common Denominators of Fire Behavior on Tragedy Fires

- Incidents happen on smaller fires or on isolated portions of larger fires.
- Fires look innocent before "flare-ups" or "blow-ups." In some cases, tragedies may occur in the mop-up stage.
- Flare-ups generally occur in deceptively light fuels.
- Fires run uphill surprisingly fast in chimneys, gullies, and on steep slopes.
- Wind direction or wind speed unexpectedly shifts.

Thunderstorm Safety

Approaching thunderstorms may be noted by a sudden reverse in wind direction, a noticeable rise in wind speed, and a sharp drop in temperature. Rain, hail, and lightning occur only in the mature stage of a thunderstorm.

Observe the 30/30 rule: a) If you see lightning and hear thunderclaps within 30 seconds take storm counter-measures identified below. b) Do not resume work in exposed areas until 30 minutes after storm activity has passed.

- Take shelter in a vehicle or building if possible.

- If outdoors, find a low spot away from tall trees, wire fences, utility lines, and other elevated conductive objects. Make sure the place you pick is not subject to flooding.

- If in the woods, move to an area with shorter trees.

- If only isolated trees are nearby, keep your distance twice the tree height.

- If in open country, crouch low minimizing contact with the ground. You can use a pack to sit on, but never lay on the ground.

- If you feel your skin tingle or your hair stand on end, immediately crouch low to the ground. Make yourself the smallest possible target and minimize your contact with the ground.

- Don't group together.

- Don't stay on ridgetops, in wide open areas, near ledges or rock outcroppings.

- Don't operate land line telephones, machinery, or electric motors.

- Don't handle flammable materials in open containers or metal hand tools.

- Handheld radios and cellular telephones can be used.

Clothing and Personal Protective Equipment (PPE)

- All PPE must meet or exceed NFPA 1977 Standard on Protective Clothing and Equipment for Firefighters (current edition).
- Wear hard hat while on the fireline.
- Wear 8-inch laced all-leather boots with slip- and melt-resistant soles and heels.
- Wear flame-resistant clothing while on the fireline and when flying in helicopters. Do not wear clothing, even undergarments, made of synthetic materials which can burn and melt on your skin. Roll down sleeves to the wrist.
- Use leather gloves to protect hands.
- Use eye and face protection whenever there is a danger from material being thrown back in your face.
- Determine and comply with host agency requirements regarding fire shelters on fireline suppression assignments or follow your own agency's requirements if they are more restrictive. The fire shelter is a tool of last resort, not to be used tactically.
- Use hearing protection when working with high noise-level firefighting equipment, such as helicopters, air tankers, chain saws, pumps, etc.

- When operating chain saws, sawyers and swampers will wear additional safety equipment including approved chaps, gloves, hard hat, eye and ear protection.

- Recommend use of an approved dust/smoke mask when in heavy smoke and dusty environments. Use of a dust/smoke mask is not a PPE requirement for all agencies at this time.

- Face and neck protection (Nomex shrouds) are not required PPE. If used, they must meet NFPA 1977. If issued, shrouds should be deployed only in impending flash fuel or high radiant heat situations and not routinely worn throughout the operational period, due to an unacceptable increase in physiological heat stress.

- PPE clothing will be cleaned or replaced whenever soiled, particularly with oils. PPE will be replaced when the fabric is so worn as to reduce fire resistance capability of the garment.

How to Properly Refuse Risk

Every individual has the right and obligation to report safety problems and contribute ideas regarding their safety. Supervisors are expected to give these concerns and ideas serious consideration. When an individual feels an assignment is unsafe they also have the obligation to identify, to the degree possible, safe alternatives for completing that assignment. Turning down an assignment is one possible outcome of managing risk.

A "turn down" is a situation where an individual has determined they cannot undertake an assignment as given **and** they are unable to negotiate an alternative solution. The turn down of an assignment must be based on an assessment of risks and the ability of the individual or organization to control those risks.

- Individuals may turn down an assignment as unsafe when:
  - ✓ There is a violation of safe work practices.
  - ✓ Environmental conditions make the work unsafe.
  - ✓ They lack the necessary qualifications or experience.
  - ✓ Defective equipment is being used.
- Individual will directly inform their supervisor that they are turning down the assignment as given. The most appropriate means to document the turn down is using the criteria (Standard Firefighting Orders, 18 Watch Out Situations, etc.), outlined in the Risk Management Process.
- Supervisor will notify the Safety Officer **IMMEDIATELY** upon being informed of the turn down. If there is no Safety Officer, notification shall go to the appropriate Section Chief or to the Incident Commander. This provides accountability for decisions and initiates communication of safety concerns within the incident organization.

- ✓ If the supervisor asks another resource to perform the assignment, they are responsible to inform the new resource that the assignment has been turned down and the reasons that it was turned down.

- ✓ If an unresolved safety hazard exists or an unsafe act was committed, the individual should also document the turn down by submitting a SAFENET (ground hazard) or SAFECOM (aviation hazard) form in a timely manner.

These actions do not stop an operation from being carried out. This protocol is integral to the effective management of risk, as it provides timely identification of hazards to the chain of command, raises risk awareness for both leaders and subordinates, and promotes accountability.

After Action Review

What was planned?

- Review the primary objectives and expected action plan.

What actually happened?

- Review the day's actions:

  - ✓ Identify and discuss effective and non-effective performance.

  - ✓ Identify barriers that were encountered and how they were handled.

- ✓ Discuss all actions that were not standard operating procedure, or those that presented safety problems.

Why did it happen?

- Discuss the reasons for ineffective or unsafe performance. Concentrate on **WHAT**, not **WHO**, is right.

What can we do next time?

- Determine lessons learned and how to apply them in the future.

FIREFIGHTER HEALTH

Fatigue – Work and Rest

- Establish record-keeping systems that track crew work time.
- Plan and strive to provide one hour of sleep or rest for every two hours worked.
- When deviating from work/rest guidelines, the agency administrator or incident commander (IC) must approve in writing.
- Start each operational period with rested crews.
- Provide an adequate sleep environment.
- Monitor individuals for sleep deprivation.

The pulse is a good way to gauge fatigue. The pulse should recover in one minute or less to 110 beats per minute, or, if not, a longer break is needed. A firefighter's wake-up pulse can signal potential problems. If it is 10% or more above normal, it can mean fatigue, dehydration, or even a pending illness.

Food and Nutrition

Nutritious food can be a morale booster, but more importantly, it fuels muscles for hard work and internal organs for health and fitness. A firefighter may burn 5,000 to 6,000 calories a day. These calories must be replaced to avoid cramping, fatigue, and impaired judgment. Government-provided food must be low in fats and high in complex carbohydrates.

Drinks provided must replace essential fluids lost from the body during exercise. On a normal fireline assignment, firefighters may replace 12 or more quarts of fluids a day. In some cases, firefighters may need to replace one to two quarts of fluids per hour. Water is an excellent way to replenish fluid loss. Natural juices and sport drinks contain energy-restoring glucose. Avoid caffeinated, carbonated, and "diet" drinks.

Firefighter Rehabilitation

Areas designed for resting, eating, and sleeping should be located in a safe, shady area away from smoke, noise, running fire, falling trees and snags, rolling rocks, moving vehicles, aircraft, and packstock. Provide reasonable rest periods, especially at high elevations and on hot days.

Driving Limitations

Drivers operating vehicles that require a Commercial Drivers License (CDL) are regulated by the Federal Motor Carriers Safety Regulations Part 393.3 and any applicable State Laws.

All governmental fire agencies are exempted from several requirements of CDL regulation under Department of Transportation 49 CFR but are subject to the NWCG National Incident Operations Driving Standards.

These standards address driving by personnel actively engaged in wildland fire or all risk response activities, including driving while assigned to a specific incident or during initial attack fire response (includes time required to control the fire and travel to a rest location). In the absence of more restrictive agency policy, these guidelines will be followed during mobilization and demobilization as well. Individual agency driving policies shall be consulted for all other non-incident driving.

1. Agency resources assigned to an incident or engaged in initial attack fire response will adhere to the current agency work/rest policy for determining length of duty day.

2. No driver will drive more than 10 hours (behind the wheel) within any duty day.

3. Multiple drivers in a single vehicle may drive up to the duty-day limitation provided no driver exceeds the individual driving (behind the wheel) time limitation of 10 hours.

4. Drivers shall drive only if they have had at least 8 hours off duty before beginning a shift.

   Exception to the minimum off-duty hour requirement is allowed when essential to:

   a. Accomplish immediate and critical suppression objectives, or

   b. Address immediate and critical firefighter or public safety issues.

5. Documentation of mitigation measures used to reduce fatigue is required for drivers who exceed 16-hour work shifts. This is required regardless of whether the driver was still compliant with the 10-hour individual (behind the wheel) driving limitations.

First Aid

Prompt first aid must be given for all injuries. First aid facilities should be made available in proximity to the fireline and at incident base and camp(s). When activated, the Medical Unit is responsible for all medical emergencies involving assigned incident personnel. Each crew should carry a first aid kit and all supervisory personnel should be trained in basic emergency first aid. While help is on the way, be prepared to move the patient in case of unexpected fire movement.

First Aid Guidelines

Legality:

- Do only what you know how to do and keep records of actions.

Bloodborne Pathogens:

- Personal protective equipment (pocket mask, latex gloves and goggles) should be worn if contact with body fluids is possible.

Treatment Principles:

- Think: prevent further injury; remove from danger. No liquids for the unconscious.
- Fast Exam: airway, breathing and circulation.
- Thorough Exam: head to toe and side to side (symmetry).
- Keep readable records and send a copy with the patient when transporting or evacuating.

Specific Treatments:

- Bleeding: Direct pressure, elevate, and pressure point.
- Shock: Lay patient down, elevate feet, keep warm and replace fluids if conscious.
- Fractures: Splint joints above and below injury and monitor pulse beyond the injury away from the trunk of the body.

- Bee Sting (anaphylaxis): Life-threatening; see if the patient has a sting kit and transport immediately.

- Burns: Remove heat source, cool with water, dry wrap, and replace fluids.

- Diarrhea: Drink fluids in large quantities.

- Eye Injuries: Wash out foreign material, don't open swollen eyes, leave impaled objects, and pad and bandage both eyes.

- Heat Exhaustion: Skin is gray, cool, and clammy. Rest in cool place and replace electrolytes.

- Heat Stroke: Skin is dry, red, and temperature hot. Cool and transport immediately.

CPR

Determine responsiveness – Gently shake shoulder and shout: "Are you OK?" If no response, call EMS. If alone, call EMS before starting **ABCs**.

Airway: Roll victim on back as a unit supporting head and neck. Open airway by head-tilt/chin-lift maneuver. Look, listen, and feel for breathing for 3 to 5 seconds. If no response, go to **B.**

Breathing: Pinch victim's nose shut. Put mouth over victim's making a tight seal. Give 2 slow breaths. If chest does not rise, reposition and try again. If breaths still do not go through, use abdominal thrusts to clear airway. If chest does rise, go to **C**.

Circulation: Check carotid pulse for 5 to 10 seconds. If there is a pulse but no breathing, give 1 breath every 5 seconds until victim is breathing or help arrives. If no pulse, begin chest compressions.

One/Two Rescuer CPR – Perform 15 external chest compressions at the rate of 80 to 100 times per minutes to a 1.5 to 2″ depth. Reopen airway and give 2 full breaths. After 4 cycles of 15:2 (about 1 minute), check pulse. If no pulse, continue 15:2 cycle beginning with chest compression until advanced life support is available. If two rescuers are available, use 5:1 compressions to breaths ratio. Use a 5:1 ration for children and infants with compressions at a rate of 100 times per minutes. Use a 1 to 1.5″ depth for children and a .5″ to 1″ depth for infants.

Carbon Monoxide Poisoning

Carbon monoxide (CO) is an odorless, tasteless, invisible gas by-product emitted from combustion of forest and range fuels, internal combustion engines, and a variety of other sources. In a wildfire, heavy concentrations of CO can co-exist with smoke. The body at a rapid rate absorbs CO for the first hour of exposure, after which the rate drops slightly for the next 4 to 8 hours**. IT TAKES ABOUT 8 HOURS IN AN UNCONTAMINATED ENVIRONMENT TO PURGE CO FROM THE BODY**.

To manage CO exposure:

- Monitor workers, particularly pump and chain saw operators, for symptoms/behavior associated with CO exposure.

BLOOD CO LEVEL	SYMPTOM	BEHAVIOR
Moderate	Possible headache, nausea, and increasing fatigue.	Increasing impairment of alertness, vision discrimination, judgment of time, physical coordination. Becomes increasingly complacent.
High	Headache, fatigue, drowsiness, nausea, vomiting, dizziness, convulsions, cardiorespiratory difficulty.	Above behavior becomes more acute to extreme.

- Remove workers from work site to "CO free areas" when performance and safety are compromised by symptoms/behavior described above.

- When possible, select strategy and tactics that minimize worker exposure to smoke concentrations (indirect attack). Expect higher CO concentrations in the following:

  - ✓ Near an active flame front.

  - ✓ Working around heavy equipment, especially in ground support.

  - ✓ Heavy smoke concentrations during inversions or areas downwind of the fire.

  - ✓ Mop-up (prolonged exposure to low-moderate smoke level).

- ✓ Topographic features that concentrate smoke (head of canyon, ravines, saddles or passes, depressions or basins).

- Periodically rotate workers from work sites with moderate-high smoke levels to areas of less smoke or smoke free areas.

- If necessary, order additional personnel to relieve crews assigned to high smoke level areas.

- Instruct personnel to take breaks in smoke-free or low-smoke areas, when possible.

- Locate incident base and camp(s) in areas free of smoke and air pollution to maximize recovery from CO exposure.

- Encourage smokers to terminate or reduce smoking during fire assignment. Smoking significantly increases blood CO levels.

- Restrict workers from driving a vehicle if they display the symptoms or behavior outlined above.

- Personnel who display the symptoms or behavior outlined above should be evaluated and determined fit for duty before next work assignment.

Hypothermia

Hypothermia can be life threatening! Signals include lower than normal body temperature, shivering, slurred speech, apathy, disorientation, drowsiness, and unconsciousness.

- Move victim into warm or sheltered area immediately.
- Check pulse and breathing.
- Get victim out of wet clothes and replace with dry clothes, sleeping bag, or blankets.
- Have victim drink a warm, nonalcoholic beverage if conscious.

Heat Stress

Heat stress disorders are divided into four categories. They are:

Heat Cramps - May be caused by lack of fitness or failure to replace salt lost in sweating.

- *Symptoms* are painful muscle cramps.
- *Treat* by resting and drinking lightly salted water or lemonade, tomato juice, or athletic drinks.

Heat Exhaustion - Caused by failure to replace water.

- *Symptoms* are weakness, unstable gait or extreme fatigue; wet, clammy skin; headache; nausea; collapse.
- *Treat* by drinking fluids and rest in a shaded area.

Dehydration Exhaustion - Caused by failure to replace water losses over several days.

- *Symptoms* are weight loss and excessive fatigue.

- *Treat* by increasing fluid intake and provide rest until body weight is restored.

Heat Stroke - Caused by total collapse of the body's temperature regulating mechanisms. **REQUEST EMERGENCY MEDICAL ASSISTANCE AT ONCE AS HEAT STROKE IS A LIFE THREATENING MEDICAL EMERGENCY. BRAIN DAMAGE OR DEATH CAN RESULT IF TREATMENT IS DELAYED.**

- *Symptoms* are hot, often dry skin; high body temperature (106° F or higher); mental confusion, delirium, loss of consciousness, convulsions.

- *Treat* by cooling the victim immediately, either by immersing in cold water or soaking clothing with cold water and fanning to promote cooling. Continue until temperature drops below 102° F. **TREAT FOR SHOCK ONCE TEMPERATURE IS LOWERED**.

Burn Injury Treatment

Good on-scene emergency treatment can help prevent a burn injury from getting worse, minimize complications, and improve a person's chance of surviving a serious burn.

- Remove person from heat source, extinguish with water.

- Provide basic first aid:
  - ✓ Maintain airway, breathing, and circulation (ABCs).
  - ✓ Treat for shock by keeping person warm and feet elevated.
  - ✓ Provide oxygen, if available and trained.
- Assess degree of burn and area affected:
  - ✓ Burns are rated as 1st, 2nd, or 3rd degree.

1st Degree	Affect skin's outer layer. Redness, mild swelling, tenderness, and mild to moderate pain.
2nd Degree	Extends through entire outer layer and into inner layer of skin. Blister formation, swelling, weeping of fluids, and severe pain.
3rd Degree	Extends through all skin layers and into underlying fat, muscle, and bone. Discoloration (charred, white, or cherry red), leathery, parchment like, dry appearance. Pain is absent.

- Treatment of burn:

  - ✓ Cut away only burned clothing. **DO NOT** remove clothing stuck to burned skin.

  - ✓ Apply cool clean water over burned area to stop the burning process. **DO NOT** soak person or use cold water and ice packs as this will encourage hypothermia to set in. (See page 33 for hypothermia.)

Burn Notification Procedures

- Notify your immediate supervisor, providing the following information:

  - ✓ Number of injured. **DO NOT** give out names over radio.

  - ✓ Degree and severity of burn injury (2nd and 3rd degree over 30% of upper body).

  - ✓ Location of injured.

- Cover burned area with sterile dressing, moisten with normal saline solution and apply another dry dressing on top.

- If person is burned severely or over a large area:

  - ✓ Wrap in clean/sterile sheet followed by a plastic sheet.

  - ✓ Place inside sleeping bag or cover with insulated blanket.

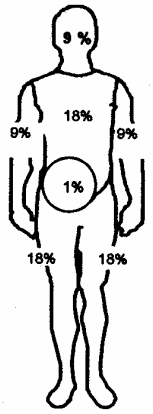
  - ✓ Monitor ABCs and keep burn areas moist.

- ✓ Avoid hypothermia and overheating (especially on hot days).

Rule of Nine

"Rule of Nine" for determining area burned:

Percentage of Body Surface Area	
Head	9%
Front of Torso	18%
Back of Torso	18%
Left Arm	9%
Right Arm	9%
Left Leg	18%
Right Leg	18%
Perineum (Scrotum in males, vulva in females)	1%
	100%



Injury/Fatality Procedures

Serious Injury

- Give first aid - call for medical aid and transportation if needed.
- Do not release victim's name except to authorities.
- **NEVER BROADCAST VICTIM'S NAME ON THE RADIO**.

- Do not allow unauthorized picture taking or release of pictures.

- Notify Incident Commander, who will:

  - ✓ Assign a person to supervise evacuation, if necessary, and stay with the victim until under medical care. In rough terrain, at least 15 workers will be required to carry a stretcher.

  - ✓ Assign person to get facts and witness statements and preserve evidence until investigation can be taken over by the Safety Officer or appointed investigating team.

  - ✓ Notify the Agency Administrator.

Fatality

- Do not move the body unless it is in a location where it could be burned or otherwise destroyed. Secure accident scene.

- Do not release victim's name except to authorities.

- **NEVER BROADCAST VICTIM'S NAME ON AIR.**

- Do not allow unauthorized picture taking or release of pictures.

- Notify Incident Commander, who will:

  - ✓ Assign person to start investigation until relieved by appointed investigating team.

- ✓ Notify Agency Administrator and report essential facts. The Agency Administrator will notify proper authorities and next of kin as prescribed by agency regulations.

- ✓ If requested, assist authorities in transporting remains. Mark location of body on ground. Note location of tools, equipment, or personal gear.

ENTRAPMENT

Firefighter Entrapment

Entrapment: A situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes or safety zones are absent, inadequate, or compromised. An entrapment may or may not include deployment of a fire shelter for its intended purpose. These situations may or may not result in injury. Entrapments also include situations involving engines, dozers, and tractor/plows. They include “near misses.”

Fire Shelter Deployment

Following the Risk Management Process, the "Standard Firefighting Orders" and recognizing the "Watch Out Situations" should prevent you from getting into a situation that requires a shelter deployment. When threatened by an unexpected change in fire behavior, follow proven escape procedures first before considering a fire shelter deployment.

Drop your pack as soon as you realize your escape may be compromised. Take water and your fire shelter. Take your hand tool if you think you will need to clear a deployment site. You can run 15-30% faster without the weight of your pack.

When on the fireline, **YOU MUST CARRY YOUR SHELTER WITH YOU AT ALL TIMES**. It should not be stored in the main body of your pack. It should be in a location for quick access.

If you are a crewmember, your supervisor will decide when and where to deploy your shelter. Supervisors should pre-identify escape routes and safety zones-the best areas for deploying a fire shelter. When deciding to deploy, supervisors must identify a safe area and provide adequate time for deployment to occur. If you are not with a crew, you must rely on your own judgment where to deploy.

Choosing Deployment Area

- Direct flame contact is the biggest threat to your shelter. Deploy where flame contact is minimized.

- Look for natural firebreak, wide dozer line, low spots, wide streambed, lee side of ridge top, uphill side of road, burned over area, and rockslides. Low spots will have less heat and smoke exposure.

- Avoid areas with heavy brush, trees with low hanging branches, logs, snags, and flammable materials.

- Keep away from narrow draws, chutes, and chimneys as they tend to funnel smoke, flame, and hot gas.

Shelter Deployment

- Crew must stay together and maintain communication with each other and follow chain of command.

- Clear an area 4 by 8 feet (larger if time allows) down to bare mineral soil.

- Keep a firm grip on shelter. Otherwise, you may lose it in the high winds generated by the approaching flame front.

- Get on the ground before the flame front arrives.

- Position shelter so your feet are toward the approaching flame front. The foot end will become the hottest spot while in shelter and it is easier to hold down using your feet.

- Position shelter so hold-down straps are beneath you when you lie prone. Push sides of shelter away from body to provide air gap. Hold shelter down with feet, legs, elbows, and hands.

- Items to wear and take into the fire shelter:

Gloves	Without gloves, it will be very difficult to hold on to the shelter while inside.
Hard hat	Provides head protection.

Radio	Supervisors must maintain communications with those outside the area of shelter deployment.
Water	Drink water so you continue to sweat, which aids body cooling. **NEVER** wet clothing, as wet clothes will rapidly conduct heat.

- Leave hand tools outside shelter. Toss any hazardous items like gasoline and fusees well away from the deployment area.

- Never plan to share a shelter unless someone is without one.

While Inside Shelter

- You must protect your airway and lungs from the fire's hot gases. Keep your nose pressed to the ground as much as possible. Use a dry bandanna to protect your airway. **NEVER USE A WET BANDANNA! (Discuss with your agency using a dust/smoke mask.)**

- During high winds that should be expected as the flame front approaches and passes through, it will take all your effort to hold down the shelter. Wear your gloves at all times while inside.

- Your shelter may have pinholes or cracks along the folds. These pinholes do not reduce your protection. No matter how big a hole or tear is to your shelter, you are still better off inside the shelter.

- Talk to each other. Remember: the noise can be deafening as the fire passes through, and you may not be able to hear anyone.

- Do not move unless it's absolutely necessary. If you must move, crawl on your belly, keeping the shelter edges close to the ground.

How Long To Stay Inside Your Shelter

- Once you commit yourself to the shelter, stay there. No matter how hot it may get inside, it's much worse outside your shelter. **DO NOT PANIC**!

- There is no fixed time to stay inside the shelter. Leaving a shelter too soon can expose lungs to super-heated air or dense smoke.

- A drop in noise, wind, heat, and change in color are indicators that it's safe to leave the shelter. **DO NOT LEAVE YOUR SHELTER UNTIL INSTRUCTED TO DO SO BY YOUR SUPERVISOR.**

Building Refuge

Seeking refuge in a building or structure is an option supervisors may want to consider for crew protection when a change in fire behavior prevents reaching an escape route or safety zone. Agency guidelines **MUST** be considered when deciding to use a building or structure as crew protection.

- Advise immediate supervisor (Strike Team Leader, Division/Group, etc.) of the situation.

- If time allows, remove combustible materials (lawn furniture, wood piles, etc.) and vegetation away from structure and propane tank, shutting off gas.

- Close windows and heavy drapes. Take down light curtains and secure exterior doors.

- Bring into structure fire extinguishers and back pumps, charged hose line if available.

- Fill all sinks, bathtubs, and any available buckets with water, soaking towels, etc., to put out small fires and to place against exterior door jams.

- **KEEP AWAY** from windows and exterior doors as fire passes.

- **STAY OUT** of basement and upper floors.

Vehicle Refuge

If you find yourself in a fire entrapment situation where a shelter deployment is not possible, using a vehicle for refuge may be an option. Agency guidelines **MUST** be considered when deciding to seek refuge in a vehicle.

- Park vehicle in an area void of vegetation; fire out around vehicle if there is time. Park behind a natural barrier or structure.

- **DO NOT** park on the downhill side of road, under power lines or over hanging vegetation. Stay out of saddles or draws.

- Position vehicle in a direction that provides the area occupied by crew with maximum protection from approaching flame front.

- Set parking brake, leave motor running at high RPM, and keep vehicle lights on.

- Roll up windows. **DO NOT** lock doors. Someone else may need to get in.

- Cover windows with fire shelters with reflective material placed against window.

- **YOU MUST PROTECT YOUR AIRWAY**. Remain as low in vehicle as possible; use a dry bandanna to cover your nose and mouth. Cover up with turnouts and use SCBA's if available.

- While inside vehicle expect:

  - ✓ Temperatures may reach 200 degrees F.

  - ✓ Smoke and sparks may enter the vehicle.

  - ✓ Plastic parts may start to melt and give off fire gases.

  - ✓ Windows may start to crack.

  - ✓ Exposed skin may receive radiant heat burns.

- If the vehicle catches fire or windows blow out and you have to exit before the fire has passed:

  - ✓ Each crewmember covers themselves with a fire shelter.

- ✓ Exit the vehicle from the side away from greatest heat.

- ✓ **STAY TOGETHER** and as low to ground as possible, moving away from vehicle.

- ✓ Deploy shelter in a safe area.

- After fire passes, check for injuries and treat. Inspect vehicle for fire, extinguish if possible.

ORGANIZATIONAL

Observe the following basic safety principles on all fires, regardless of size or staffing except where provided otherwise through local cooperative agreements.

General Responsibilities

Personal actions describe safety more effectively than written plans or "rule books." Firefighters' actions tell what they consider important. Supervisors shall maintain accountability of assigned personnel as to exact location, personal safety, and general welfare at all times, especially when working in and around incident operations.

Qualifications

Assign fireline assignments only to people who are properly qualified and physically fit for the job.

Training

- Inform firefighters about hazards and safe working practices before starting work.

Supervisors have responsibility to issue clear instructions and ensure instructions are understood. Those instructions must be followed at all times, but if you feel unsafe or unsure, those instructions should be questioned for clarification.

Supervision of Other Firefighters

Supervision of other firefighters' work includes:

- Setting a personal example of safe behavior and enforcing safe practices and procedures.
- Evaluating firefighters' physical and mental condition.
- Analyzing work situations to eliminate or avoid hazards. Discussing safety at the beginning of each shift or new work assignment.
- Becoming immediately involved whenever injury occurs, ensuring that medical treatment is provided in a timely manner, and investigating the accident with persons involved.
- Monitoring work to be sure it is done safely and efficiently.
- Monitor and enforce work/rest guidelines.

- Providing leadership in applying corrective action aimed at eliminating causes of accidents and instilling a safe work attitude.

- Protecting employees from reprisal for reporting unsafe conditions.

Safety Officer (SOF1/2/3)

A Safety Officer, a member of the Command Staff, should be assigned to large or potentially hazardous fires to monitor and assess hazardous situations and develop measures for ensuring safety of personnel. Additional assistant safety officers should be assigned to sections of fireline that warrant special safety considerations.

REMEMBER: EACH INDIVIDUAL, AND ESPECIALLY SUPERVISORS, HAVE AND MUST RECOGNIZE THEIR SAFETY RESPONSIBILITIES.

Fire Behavior Analyst (FBAN)

Where extreme fire behavior potential exists, consider assigning a Fire Behavior Analyst to identify hazardous situations.

OPERATIONAL GUIDELINES

Safety Briefing

Incident Commanders, supervisors, and firefighters must ensure that safety factors are covered with incident personnel at all operational briefings and that safety briefings occur throughout the fire organization.

Safety factors should include the following:

- Define assignment.
- Apply the five-step Risk Management Process (see page 4).
  - ✓ Situation Awareness
  - ✓ Hazard Assessment
  - ✓ Hazard Control
  - ✓ Decision Point
  - ✓ Evaluate
- Address basic firefighter safety and health issues.

Fire Weather Forecast

Forecasts reflecting general weather changes, as well as local weather affecting the immediate fire area, should be studied, understood, and used by overhead on the fire. Disseminate to all fireline personnel.

NOAA Weather Radio forecasts should not be substituted for fire weather forecasts. NOAA Weather Radio may not broadcast fire weather forecasts, only forecasts directed to the general public.

Spot weather forecast should be requested for fires that have potential for extreme fire behavior, exceed initial attack, or located in areas for which a **FIRE WEATHER WATCH** or warning has been issued.

Fire Danger Rating

Know and understand locally accepted Fire Danger Rating Indices and components. Find out what this season's trends are doing compared to the historic average and historic maximums.

Safety Precautions Under Extreme Fire Behavior

Be Alert to Indicators of Sudden Weather Changes

- Trees torching out inside fireline.
- Smoldering fires beginning to burn actively.
- Approaching thunderheads with dark clouds beneath.
- Presence of dust devils and whirlwinds.
- Increased spotting.
- Sudden calm.
- High clouds moving fast in direction different from surface wind.

Be Aware of "Watch Out" Working Situations

- Building fireline down into where the fire is burning.
- Building fireline on hillside beneath fire.

- Building fireline through heavy cover at considerable distance from fire.

- Building fireline in country not seen in daytime.

Have Clear-Cut Plan of Action for Potential Extreme Fire Behavior Conditions

- Advise personnel of escape routes and make necessary provisions to ensure the route is clearly marked and accessible for foot or vehicle traffic.

- Give crew frequent rest periods, making sure adequate amounts of water are consumed.

- Ensure chain of command and firefighter accountability system are in place.

- Know location of rockslides, open hillsides, streams, etc.

- Post lookouts to alarm firefighters who are working where they cannot directly observe danger points (fire behavior, rolling material, etc.).

- Consider possibility of retreating into burn.

- When crossing fire edge into burn, have crew protect faces and hold breath, if possible.

- Do not travel in direction of fire spread unless certain a safe spot can be reached.

- Carry fusees to burn out "safety zones."

Night Operations

Every effort shall be made to orient work crews scheduled for night operations during daylight hours and provide adequate lights and communication. A knowledgeable day operations representative should remain on site to properly orient and brief night operations crews, particularly about line location and boundaries, terrain features, hazards, and control problem areas.

Personnel Transportation

- Overhead should have a driver whenever possible.
- All passengers in vehicles shall be seated and seat-belted with arms and legs inside vehicle.
- Personnel and unsecured tools will not be transported together.
- Driver must be qualified for the vehicle and operating conditions. If not, remove them from driving duties.
- When traveling to a fire, observe all traffic signals, safe speed limits, and safety rules.
- Driver should walk around vehicle to make sure all is clear before departure.
- Driver is responsible for arrangements to ensure that if chock blocks are provided, they are in place before loading, unloading, or when parked.

- When transporting personnel, the driver shall not leave his/her seat until the vehicle is securely chocked. **NEVER** load or unload personnel from an **UNCHOCKED VEHICLE**.

- Driver shall conduct a daily mechanical check of vehicle before driving. Unsafe equipment should be removed from service and reported to the Ground Support Unit for repair.

- Driver should use spotter outside of vehicle when backing or turning around.

- Recommend that vehicles be operated with headlights on at all times.

Foot Travel

- Carry firefighting tools safely—down at your side and on the downhill side. Never on your shoulder except for properly guarded power saws.

- Going to and from the fireline keep at least 10 feet apart and walk single-file.

- Walk, do not run.

Line Scouting

- When scouting or working ahead of a crew in brushy terrain, carry a cutting tool and clear any vegetation that might hamper escape.

- A lookout should be posted to warn of danger when personnel are scouting in unburned areas of dense vegetation.

Line Construction

- Make sure of secure footing and follow safe working positions. Walk, **DON'T** run.

- Personnel or equipment should not work directly above one another or at close intervals when working on steep slopes.

- When there is a danger of rolling rocks or logs, supervisors should:

  - ✓ Post a lookout to watch and warn crew of rolling materials.

  - ✓ Spread crew out farther than 10 feet apart.

  - ✓ Stagger crew so they are not working or walking directly below each other or close to working equipment.

- Brief crew on what to do when a warning for falling or rolling objects is given.

  - ✓ Quickly move behind the protection of the nearest large tree or other stable barrier.

  - ✓ If such protection is not close, quickly move into an opening offering maximum upslope visibility, stand facing the oncoming rolling material, and be prepared to react instantly.

- Loose rocks along dozer breaks should be stabilized before crew works below them.

- Pass a burning or fire-weakened tree only on the uphill side, or above the lean, and watch it closely.

- In fast-burning fuels (grass, one-hour fuels, etc.), watch out for fast runs in any direction, at any time of the day or night. If cutting across the front involves difficult access and retreat, control by flank attack, starting at a safe anchor point. Have an escape route and safety zone identified.

- Watch below for spot fires from hot material rolling downhill.

- **PANIC LEADS TO TROUBLE**. Keep a clear mind and act calmly.

Firefighters should never try to outrun the head of a fast moving fire. Try to get to a safety zone or into the burned area. If in danger of being overtaken by a fast moving fire, drop tools and move as rapidly as possible to a safety zone.

Safety Flagging Standards

- Yellow-black striped ribbon denotes hazards.

  - ✓ Remove the yellow-black striped ribbon when the hazard is abated. If feasible, write on the ribbon the nature of the hazard; i.e., "snags - 200 feet up slope."

  - ✓ Hot pink color marked ESCAPE ROUTE in black lettering denotes safety zones and escape routes.

Note: Firefighters should check with state and agency policy to verify flagging standards and interagency agreement.

Firing Equipment

- Only trained personnel should use firing equipment.
- Use only approved equipment and qualified personnel when firing from helicopters.
- Use no more than one part gasoline to three parts diesel (or heavier fuel) in flamethrower or drip torches. Observe manufacturers' recommendations.
- When operating ground based firing equipment that utilizes jellied gasoline, to avoid back splatter, do not direct the stream of burning material into the tops of nearby trees or tall brush.
- Properly ground firing equipment when fueling.
- Maintain constant radio communications between the firing operation and other appropriate fireline personnel.

Chain Saws

- Stop engine when carrying, making adjustments, repairing, or cleaning a chain saw.
- Use bar guards when carrying saw in rough country.

- Cool engine before refueling. Fill on bare ground and move at least ten feet from fueling area before starting.

- Use proper safety equipment such as chaps, gloves, hard hat, and eye and ear protection.

Hazard Trees

- Trees have been burning for an extended period.

- High-risk tree species (rotten and shallow root system).

- Numerous down trees.

- Dead or broken tips and limbs overhead.

- Accumulation of down limbs.

- Absence of needles, bark, or limbs.

- Leaning or hung-up trees.

- Presence of snags in the fire area.

Hazard Tree Safety

Environmental conditions that increase snag hazards:

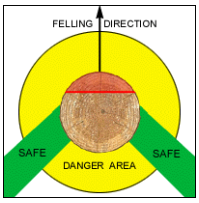
- Strong winds
- Night operations
- Steep slopes
- Diseased or bug-kill areas

Felling

Felling of snags or large trees (over 20 inches DBH) shall be done by a qualified Class B or C faller. Personnel felling trees less than 20 inches DBH shall be supervised by certified personnel. Tree/snag falling shall meet specific agency faller qualification requirements.

Select a clear escape route(s) before starting the cut.

- The area opposite the planned fall of the tree may be the most dangerous. An escape route at right angles to the planned direction of fall, preferably on the contour, should be chosen, unless special circumstances exist.



- If possible, stand behind another tree of sufficient size to provide protection.

- Watch for whiplashed branches and other broken tree parts.

- Stay clear of the butt—be aware of a tree "kicking back" as it falls.

- Watch for falling branches; continue to watch until all broken branches have fallen.

- Be aware of other nearby crews. Notify crewmembers not on the felling team when tree felling will be occurring in their work area.

- Do not fell trees up hill (or upslope) of other crews.

- When felling trees, station a lookout to assist with cutting area control, and to watch and warn the sawyer of falling limbs and tops. Due to power saw noise provide the lookout with a system, such as portable air horn, to signal the sawyer in the event of danger.

Engine Operations

- All vehicles going to fires should stop for traffic lights and stop signs, even when using emergency warning lights, siren, and air horns. Watch for oncoming traffic.

- Mark vehicles parked on highway at fires by flags or warning lights in front and back to warn motorists of presence of equipment and personnel.

- An engine operator, a hose puller, and a nozzle operator are desirable for effective use of engines in performing fire suppression operations.

- Park engines on the side of road away from oncoming fire to reduce heat exposure on equipment and to allow other vehicles to pass. **DO NOT BLOCK ROAD WITH YOUR ENGINE**.

- Engine will be positioned for a quick get-away.

- Engines should be attended at all times.

- Nozzle operators should wear eye protection.

- When fires make hot runs upslope, it is safer to draw back to the flanks and let the fire cross the road than to attempt a frontal assault.

- Adequate supervision and good communications, including hand signals, are necessary for safe, effective engine work. (See Appendix A for hand signals.)

Dozer/Tractor-Plow Operations

- Load/unload equipment from the transport in a safe manner on a level, stable surface.

- Park transport in an area free of fuel. Clear an area if needed to protect parked equipment.

- Do not sit or bed down near equipment.

- Walk around equipment before starting or moving it.

- Lower the dozer blade and/or fire plow to the ground when the equipment is idling or stopped.
- Do not get immediately in front or behind equipment in operation.
- When working with a dozer or tractor-plow unit, stay at least 100 feet in front or 50 feet behind.
- Allow no one but the operator to ride on the equipment.
- Never get on or off of moving equipment.
- Provide front and rear lights for equipment working at night or in heavy smoke.
- Provide lights and fluorescent vest to personnel working with dozer/tractor-plow units to ensure visual contact with the operator.
- Use hand signals for direction and safety. (See Appendix A for hand signals.)
- Do not use a dozer or tractor-plow without a canopy, brush guard, and radio communications.
- Operators will wear required safety clothing and carry a fire shelter.
- Be aware of different fuel types and their flammability.

- Watch out for wetlands, steep slopes, rocks, ditches, and other obstacles that might stop the equipment.

- Do not get too far ahead of a firing crew during firing operations.

- Anchor the line to a secure firebreak and create a black line (burn out) until fire is completely enclosed.

- Tractor-plow operators should wear headgear protection for head, face, eyes, and ears while also providing radio reception and ventilation capabilities.

- Tractor-plow crew should consist of a minimum of two people.

When dozer or plow is equipped with a hand-clutch lever, always take equipment out of gear when mounting or dismounting.

Safety Guidelines

Equipment Placement

- Identify escape routes and safety zones and make them known to all crewmembers.

- Stay mobile; keep equipment running, emergency red lights on. Keep egress route clear; park extra equipment on street.

- Mark entrance to long driveways to show protection is in place (multiple ribbons at end of drive on street, ribbon/flagging across drive entrance, sign, or other predetermined signal).

- Back in equipment for quick escape.
- Park in a cleared area (watch for overhead hazards).
- Protect your equipment; park behind structure, placing structure between equipment and fire front.
- Watch for hazards (drop-offs, potholes, above-ground fuel storage, chemicals, septic tanks, etc.).
- Coil a short 1½ inch charged line with fog nozzle on your engine for safety and quick knock-down.
- Use short hose-lays. Keep hose off driveway.
- Know turnouts and bridge limits.
- Check roads before the fire hits.
- Try to keep sight contact with all crewmembers.

Water Use

- Maintain adequate water supply for engine protection.
- Top off tank at every opportunity; use garden hose.
- Draft from swimming pool, hot tub, pond, etc.

- **DO NOT** hook up to hydrant except to refill tank (hydrant may not always work if system is powered by electricity and power is lost in area).

- Conserve water, avoid wetting down an area. Apply water only if it controls fire spread or significantly reduces heating of structure being protected.

- Keep fire out of the heavier fuels.

- Extinguish fire at its lowest intensity, not when it is flaring up.

- Knock down fire in the lighter fuels.

- Have enough water to last duration of main heat wave and to protect crew.

Class A Foam Use

- Direct attacks—apply to base of flame.

- Indirect attacks—lie out wet line and burn out.

- Apply to structure (roof and siding) 10-15 minutes before fire arrives.

Safety Zone

- Follow the Standard Firefighting Orders.

- Always stay oriented to a safety zone (and alternate as needed).

- If you need to drive to the safety zone, ensure that:
  - ✓ Someone is watching the escape route.
  - ✓ You have a "trigger point" that will cause a retreat with adequate time for travel.
  - ✓ You have absolute communication ability with your lookout(s).
  - ✓ You have the ability to control civilian traffic that could obstruct your escape route.

Develop a Travel LCES

- To assignment and between assignments:
  - ✓ Predict fire spread.
  - ✓ Leader or lead engine scout route and potential safety zones.
  - ✓ Lookout to observe all blind areas.
  - ✓ Communication.
- At assignment:
  - ✓ Predict fire behavior.
  - ✓ Determine need for protective action.
  - ✓ Implement or coordinate with lead engine.
  - ✓ Decide on safety zone option.

- ✓ Identify any hazards.

- ✓ Brief crew on safety zone plan, tactical plan, escape plan (to safety zone and for refuge).

- ✓ Crew stays close to structure.

Power Line Hazards

If possible, the power company should deactivate lines in the fire area that may endanger firefighters. All personnel should be cautioned against directing water streams or aerial retardant into high-tension lines. They should also be made aware that the smoke may become charged and conduct the electrical current.

Deactivated transmission and distribution lines may continue to pose a hazard due to conduction.

- Identify, map, and discuss at briefings all electrical lines on the incident.

- When around power lines:

  - ✓ If a power line falls on your vehicle, **DON'T** leave vehicle until the power company arrives. If the vehicle is on fire or fire is near, jump clear, **DON'T** hang on, keep feet together and bunny hop away.

  - ✓ Minimize operation of heavy equipment under power lines.

  - ✓ **DON'T** drive under power lines with long antennas.

- ✓ **DON'T** fuel vehicles under power lines.
- ✓ **DON'T** stand near power lines during air tanker or helicopter drops.
- ✓ **DON'T** go near or move downed power lines.
- ✓ **DON'T** direct fire retardant or water on power lines.
- ✓ **DON'T** stand or work in dense smoke near power lines.

Suspected Hazardous Materials

Hazardous materials are being encountered with increasing frequency in wildfire situations. Hazardous materials may be industrial or agricultural chemicals, explosive substances, military ordnance, drug labs, etc.

Since many wildland fire personnel are neither trained nor equipped to identify and deal with hazardous materials, your primary responsibility is to prevent yourself and others from being adversely affected or injured. Constantly watch for suspicious activities and people; report to supervisor.

If you encounter what you suspect may be hazardous materials, generally:

- Stay upwind, uphill, and avoid breathing smoke.
- Isolate the area - deny entry.

- Warn others in the immediate vicinity.

- Notify your supervisor of the potential problem so hazardous materials specialists can be brought in to evaluate and abate the problem.

- Unless properly trained, do not get involved. Remember, if you don't know, don't go, it may blow.

If safe, attempt to identify material, and pass information on.

Incident-Generated HAZMAT

Firefighters, supervisors, and agency representatives are not necessarily aware of the dangers of transporting hazardous materials. Many of these materials, used frequently on the fire job, are not considered hazardous by firefighters.

Petroleum products, especially gasoline, are prohibited from public transportation vehicles because of the obvious danger. Crews should not transport petroleum products on aircraft or on buses. Gasoline should be purged from all gas cans, chain saws, etc., before transport.

Other items such as ignition devices, fusees, explosives, and mineral spirits should not be placed on aircraft or other public transportation.

Supply and Ground Support Unit Leaders should be well trained in handling of hazardous materials and should make provisions at the incident to cause petroleum containers to be purged and fusees to be left at the incident for safe return to the cache.

Supply and Ground Support Unit Leaders should be made aware of standard transportation rules regarding materials. For instance, oxidants, such as fertilizer, should not be transported with flammables. Be careful not to mix incompatible materials (ammonia should not be transported with chlorine). All packages and containers should be checked thoroughly for damage and leaks. Some spills can be more dangerous than expected.

Incident needs may require transportation of hazardous materials from base or camp to the fireline. Basic knowledge of how to safely handle a variety of flammables, oxidants, cleaners, etc., should be taught to all fire personnel.

Unexploded Ordinance (UXO)

Millions of acres in the United States contain unexploded ordinance (UXO), most a result of weapons system testing and troop training activities conducted by the Department of Defense. This property includes active military, formerly used defense (FUD), and base realignment and closure (BRAC) sites. The risks posed by property containing UXO could be great depending on the types and amount of UXO present and how the property is or may be used.

UXO Safety and Reporting

UXO, whether present in an area by design or by accident, poses the risk of injury or death to anyone in the vicinity.

- "**IF YOU DIDN'T DROP IT, DON'T PICK IT UP**!"
- When you see UXO, stop. Do not move closer.
- Never transmit radio frequencies (including handie-talkies, citizens' band radios).
- Never attempt to remove anything near a UXO.
- Never attempt to touch, move, or disturb a UXO.
- Clearly mark the UXO area.
- Avoid any area where UXO is located.
- Keep a minimum of 500 feet away from any UXO that is on fire.

Helicopter Transportation

- Follow instructions of helicopter personnel at all times when around helicopter.
- Helicopter personnel will provide detailed briefings on helicopter safety procedures to all personnel prior to loading.

- Stay at least 50 feet away from small helicopters and 100 feet away from large helicopters, unless authorized by the pilot or other helicopter personnel.

- Always approach or leave from front or from side near front, in full view of pilot.

- Never approach or leave helicopter up slope from helicopter when rotors are turning.

- Do not watch landings, takeoffs, or hovering helicopters unless equipped with eye protection.

- Minimum required personal protective equipment (PPE) for helicopter flights include: hard hat w/chin strap, Nomex shirt and pants, leather boots, leather or Nomex gloves, and hearing protection.

- Keep safety harness fastened at all times, except when instructed to release it by pilot or helicopter crew member.

- When leaving the helicopter, stoop-walk immediately away to front or side until at least 50 feet away from the rotors.

- Stay away from tail rotors at all times, and see that others do likewise.

- Carry all tools horizontally at your side when around helicopters.

- Do not smoke within 50 feet of helicopter, fuel storage, or fueling equipment.

- Never stand directly beneath hovering helicopter unless trained in and performing sling load hookup operations.

- Show wind direction for landing helicopter with flag, hand signal, or other visual indicator.

- Keep helicopter facilities clear of unauthorized personnel, equipment, and loose objects (paper products, etc.).

Aerial Retardant/Helibucket Operations

Personnel can be injured by the impact of retardant/water dropped by aircraft. Clear personnel out of target area when drop is to be made. If an individual is unable to retreat to a safe place, the safest procedure to minimize injury from the drop is to:

- Hold on to your hand tool away from your body.

- Lie face down, with head toward oncoming aircraft and hard hat in place. Grasp something firm to prevent being carried or rolled about by the dropped liquid.

- Do not run unless escape is assured.

- Get clear of dead snags, tops, and limbs in drop area.

- Working in an area covered by wet retardant or Class A foam should be done with caution due to slippery surfaces.

- Wash retardant or Class A foam off skin, if possible. May irritate.

Paracargo Operations

The danger zone is a strip 200 feet on each side of the flight path, 300 feet in the direction of approach, and 1,300 feet in the direction of the aircraft when it leaves the target. The following should be observed at all times:

- Mark target area with white or orange "T" in open or cleared area. Erect paper streamer on long pole to indicate wind direction.

- A person trained in paracargo operations should be in charge at drop site.

- All persons, vehicles, and animals should be cleared from the danger zone prior to arrival of the cargo aircraft.

- Camp should be at least 600 feet from target area and outside of danger zone.

- Allow no one in danger zone until drop is complete.

Managing Vehicle Traffic Under Severe Smoke Conditions

Smoke has the potential to cause severe safety hazards to vehicle traffic in the vicinity of active fires, especially at night.

- When potential smoke-related problems are identified:
  - ✓ Advise the Agency Administrator that severe smoke conditions exist.
  - ✓ Implement preplanned actions such as posting "smoke warning" signs.
  - ✓ Ensure proper equipment is ready and appropriate personnel are briefed on contingency plans and are available to control traffic.
  - ✓ Notify local law enforcement units of potential problem.
- Establish periodic patrols to monitor smoke impacted areas.
- When smoke-related traffic problems occur, first person on the scene must maintain traffic control until relieved. He or she should take immediate action to prevent injuries and damages by:
  - ✓ Establishing control points on both sides of the impacted area.

- ✓ Slowing or stopping traffic entering the area and advising drivers of alternate routes.

- ✓ Assigning a person to keep a log of what actions are taken.

- ✓ Ensuring warning signs are in place and any other preplanned actions have been implemented.

- ✓ Notifying personnel who have been identified and equipped to direct traffic and notify other local units having responsibilities for traffic control.

- ✓ Implementing radio and television traffic advisories for the impacted area.

- Smoke moving unexpectedly into an area may be an indication of changing burning conditions. All traffic should be excluded until this change can be evaluated.

- When smoke-related traffic accidents occur, fire personnel on the scene should:

  - ✓ Make all efforts to assist and protect people.

  - ✓ Notify, if necessary, appropriate medical units and request assistance.

  - ✓ Notify appropriate law enforcement units.

  - ✓ Provide additional personnel for traffic control, if necessary.

- ✓ Notify Agency Administrator who may assign local safety and tort claims personnel to the scene.

- Assign an individual (preferably a law enforcement official) to record facts about the accident, including names, addresses, and statements of witnesses (if given willingly). At a minimum, record license plate identification on all vehicles in the vicinity of the accident. Coordinate efforts with local law enforcement personnel.

  - ✓ Fire personnel at accident scene, if questioned by someone other than law enforcement officers, should only state that their involvement was in fire suppression activities in the vicinity.

- Involved personnel should, immediately after being released from the accident scene, submit written reports of their actions and observations.

Essential Incident Response Driving

"ARRIVE ALIVE!"

Always drive defensively

Reducing response vehicle speed can prevent rollovers

Red traffic signals and stop signs mean complete STOP

Insist that vehicle occupants use seat belts

Verify vehicle occupants are seated and belted

Evaluate road surface and weather conditions

Abide by federal and state motor vehicle laws

Lengthy response distances require frequent rest stops

Initiate standard vehicle backing operating procedures

Value occupant and public safety versus time and speed

Enter dangerous curves and intersections cautiously