



Incident Response Pocket Guide



PMS #461
NFES #1077
January 2004

REPORT ON CONDITIONS

- Incident Name
- Incident Commander
- Incident Type
 - Wildland fire, vehicle accident, HazMat, search and rescue, etc.
- Incident Status
- Location
- Jurisdiction
- Radio Frequencies
- Incident Size
- Fuel Type
- Wind Speed and Direction
- Slope and Aspect
- Best Access
- Special Hazards or Concerns
- Additional Resource Needs



A Publication of the
National Wildfire Coordinating Group

Sponsored by
United States Department of Agriculture
United States Department of the Interior
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Prepared by
Incident Operations Standards Working Team
as a subset to PMS 410-1 Fireline Handbook

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Operational Leadership

The most essential element of successful wildland firefighting is competent and confident leadership. Leadership means providing purpose, direction and motivation for wildland firefighters working to accomplish difficult tasks under dangerous, stressful circumstances. In confusing and uncertain situations, a good operational leader will:

- TAKE CHARGE of assigned resources.
- MOTIVATE firefighters with a “can do safely” attitude.
- DEMONSTRATE INITIATIVE by taking action in the absence of orders.
- COMMUNICATE by giving specific instructions and asking for feedback.
- SUPERVISE at the scene of action.

D U T Y

Be proficient in your job, both technically and as a leader

- Take charge when in charge.
- Adhere to professional standard operating procedures.
- Develop a plan to accomplish given objectives.

Make sound and timely decisions

- Maintain situation awareness in order to anticipate needed actions.
- Develop contingencies and consider consequences.
- Improvise within the leader's intent to handle a rapidly changing environment.

Ensure that tasks are understood, supervised and accomplished

- Issue clear instructions.
- Observe and assess actions in progress without micro-managing.
- Use positive feedback to modify duties, tasks, and assignments when appropriate.

Develop your subordinates for the future

- Clearly state expectations.
- Delegate those tasks that you are not required to do personally.
- Consider individual skill levels and developmental needs when assigning tasks.

R E S P E C T

Know your subordinates and look out for their well-being

- Put the safety of your subordinates above all other objectives.
- Take care of your subordinate's needs.
- Resolve conflicts between individuals on the team.

Keep your subordinates informed

- Provide accurate and timely briefings.
- Give the reason (intent) for assignments and tasks.
- Make yourself available to answer questions at appropriate times.

Build the team

- Conduct frequent debriefings with the team to identify lessons learned.
- Recognize individual and team accomplishments and reward them appropriately.
- Apply disciplinary measures equally.

Employ your subordinates in accordance with their capabilities

- Observe human behavior as well as fire behavior.
- Provide early warning to subordinates of tasks they will be responsible for.
- Consider team experience, fatigue, and physical limitations when accepting assignments.

I N T E G R I T Y

Know yourself and seek improvement

- Know the strengths / weaknesses in your character and skill level.
- Ask questions of peers and superiors.
- Actively listen to feedback from subordinates.

Seek responsibility and accept responsibility for your actions

- Accept full responsibility for and correct poor team performance.
- Credit subordinates for good performance.
- Keep your superiors informed of your actions.

Set the example

- Share the hazards and hardships with your subordinates.
- Don't show discouragement when facing setbacks.
- Choose the difficult right over the easy wrong.

Communication Responsibilities

All firefighters have five communication responsibilities:

- Brief others as needed
- Debrief your actions
- Communicate hazards to others
- Acknowledge messages
- Ask if you don't know

In addition, all leaders of firefighters have the responsibility to provide complete briefings that include a clearly stated "Leaders Intent."

- Task = What is to be done
- Purpose = Why it is to be done
- End State = How it should look when done

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

Estimate Potential Fire Behavior Hazards

- Look Up/Down/Around Indicators

Identify Tactical Hazards

- Watch Outs

What other safety hazards exist?

Consider severity vs. probability?

Step 3 Hazard Control

Firefighting Orders → LCES Checklist - MANDATORY

- Anchor Point
- Downhill Checklist (if applicable)

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

Personnel: 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

(Pay special attention to indicators in bold print.)

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

Look Up, Down and Around

(Pay special attention to indicators in bold print.)

Fire Environment Factors	Indicators
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

Common Denominators of Fire Behavior on Tragedy Fires

There are four major common denominators of fire behavior on fatal and near-fatal fires. Such fires often occur:

1. On relatively small fires or deceptively quiet areas of large fires.
2. In relatively light fuels, such as grass, herbs, and light brush.
3. When there is an unexpected shift in wind direction or in wind speed.
4. When fire responds to topographic conditions and runs uphill.

Alignment of topography and wind during the burning period should always be considered a trigger point to re-evaluate strategy and tactics.

Tactical Watch Outs

Position

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

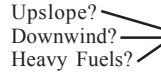
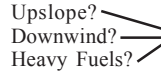
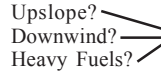
Situation

6. Small fire emerging into a larger fire or an isolated area of a large fire.
7. Suppression resources are fatigued or inadequate.
8. Assignment depends on aircraft support.
9. Night-time operations.
10. Wildland-Urban interface operations.

Each of these Watch Outs require that you implement appropriate hazard control(s).

LCES Checklist

LCES must be established and known to
ALL firefighters **BEFORE** needed.

_____ Lookout(s) _____
Experienced / Competent / Trusted
Enough lookouts at good vantage points
Knowledge of crew locations
Knowledge of escape and safety locations
Knowledge of trigger points
Map / Weather Kit / Watch / IAP
_____ Communication(s) _____
Radio frequencies confirmed
Backup procedures and check-in times established
Provide updates on any situation change
Sound alarm early, not late
_____ Escape Route(s) _____
More than one escape route
Avoid steep uphill escape routes
Scouted: Loose soils / Rocks / Vegetation
Timed: Slowest person / Fatigue & Temperature factors
Marked: Flagged for day or night
Evaluate: Escape time vs. Rate of spread
Vehicles parked for escape
_____ Safety Zone(s) _____
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? 
Heavy Fuels? 
Escape time and safety zone size requirements
will change as fire behavior changes.

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 four 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.**

CALCULATIONS ASSUME NO SLOPE AND NO WIND

<u>Flame Height</u>	<u>Distance Separation (firefighters to flame)</u>	<u>Area in Acres</u>
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 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.

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:

1. 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 better).
2. Decision will be made after proposed fireline has been scouted by supervisor(s) of involved crew(s).
3. L.C.E.S. will be coordinated for all personnel involved.
 - Crew supervisor(s) is in direct contact with lookout who can see the fire.
 - Communication is established between all crews.
 - Rapid access to safety zone(s) in case fire crosses below crew(s).
4. Direct attack will be used whenever possible; if not possible, the fireline should be completed between anchor points before being fired out.
5. Fireline will not lie in or adjacent to a chute or chimney.
6. Starting point will be anchored for crew(s) building fireline down from the top.
7. 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.

Strategy - *Direct Attack*

Advantages

- Minimal area is burned; no additional area is intentionally burned.
- It's the safest place to work; firefighters can usually escape into the burned area.
- The possibility of fire moving into the brush or crowns of trees is reduced.
- The uncertainties of burning out or back-firing can be reduced/eliminated.

Disadvantages

- Firefighters can be hampered by heat, smoke and flames.
- Control lines can be very long and irregular because the line follows the edge of the fire.
- Burning material can easily spread across mid-slope lines.
- May not be able to use natural or existing barriers.
- More mop-up and patrol is usually required.

Strategy - *Indirect Attack*

Advantages

- The line can be located along favorable topography.
- Natural or existing barriers can be used.
- Firefighters may not have to work in smoke and heat.
- The line can be constructed in lighter fuels.
- There may be less danger of slopovers.

Disadvantages

- More area will be burned.
- Must be able to trade time and space to allow line to be constructed and fired.
- Firefighters may be placed in more danger because they are distant from the fire and can't observe it.
- There may be some dangers related to burning out or backfiring.
- Burning out may leave unburned islands of fuel.
- May not be able to use line already built.

Wildland-Urban Watch Outs

- Poor access and narrow one-way roads
- Bridge load limits
- Wooden construction and wood shake roofs
- Powerlines, propane tanks, and HazMat threats
- Inadequate water supply
- Natural fuels 30' 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)

Powerline Safety

- Downed conductor on vehicle: stay in vehicle until power company arrives. If the vehicle is on fire or fire is near, jump clear, but don't hang on. Keep feet together and bunny hop away.
- Smoke, water, and retardant are all good conductors and can cause powerline to ground arcing.
- Don't operate heavy equipment under powerlines.
- Don't use rights-of-way as a jump or cargo drop spot.
- Don't drive with long antennas under powerlines.
- Don't fuel vehicles under powerlines.
- Don't stand near powerlines during retardant drops.
- Don't park under powerlines.
- Don't apply straight stream to powerlines.

Structure Assessment Checklist

Address/Property Name

- Numerical street address, ranch name, etc.
- Number of residents on site

Road Access

- Road surface driveable
- Adequate width
- Turnouts, turnarounds
- Bridges (load limits)
- Stream crossings
- Grade (greater than 15%?)

Structure/Building

- Single residence/multi complex/out building
- Exterior walls
- Large unprotected windows facing heat source
- Proximity of any above-ground fuel tanks
- Roof material
- Eaves
- Other features (wood deck, wood patio cover and furniture, wood fencing)

Clearances/Exposures/Defensible Space

- Structure location (narrow ridge, canyon, mid-slope, chimney)
- Adequate clearance-minimum of 30'
(Steep slopes = more clearance)
(Heavier fuels = more clearance)
- Trees, ladder fuel, shrubs adjacent to structure
- Other combustibles near structure (wood piles, furniture, fuel tanks)
- Adequate clearance around fuel tank
- Powerlines or transformers

Hazardous Materials

- Chemicals, pesticides, herbicides, petroleum products, paint

Water Sources

- Hydrant/standpipe, storage tank, pool, hot tub, pond, irrigation ditch

Evacuation

- Identify safe evacuation routes and refuge
- Coordinate with on-scene law enforcement and emergency services personnel.

Estimated Resources for Protection

- Number(s) and type(s) of engines, water tenders, crews, dozers, aircraft.

Structure Protection Guidelines

Firefighter safety and survival is the number one priority.

Equipment Placement

- Identify escape routes and safety zones.
- ALWAYS STAY MOBILE.
- Back equipment in for quick escape.
- Mark entrance to long driveways to show that protection is in place.
- Park in a cleared area.
- Keep egress route clear.
- Have protection line charged.
- DO NOT make long hose lays.
- Keep sight contact with all crewmembers.

Water Use Guidelines

- Keep at least 100 gallons reserve.
- Top off tank at every opportunity.
- CONSERVE WATER. Apply water only if it controls fire spread or significantly reduces heating of structure.
- Keep fire out of the heavier fuels.
- 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 Guidelines

- Direct Attack - apply to base of flame.
- Indirect Attack - lay out wet line and burn out.
- Apply to structure (roof and siding) 10-15 minutes before fire arrives.

Preparing Structure

- Determine if residents are home.
- Place ladder on side with least fire threat and away from power drop.
- Clean roof of combustible materials.
- Cover vents.
- Remove and scatter fuels away from structure (ladder fuels, wood piles, etc.).
- Clear area around above-ground fuel tank, shutting off tank.
- Place combustible outside furniture inside structure.
- Close windows and doors, including garage, leaving unlocked. AS A LAST RESORT, YOU MAY NEED TO USE STRUCTURE AS REFUGE.
- Have garden hose(s) charged.

INCIDENT COMPLEXITY ANALYSIS (TYPE 3,4,5)	Yes	No
Fire Behavior		
Fuels extremely dry and susceptible to long-range spotting or you are currently experiencing extreme fire behavior.		
Weather forecast indicating no significant relief or worsening conditions.		
Current or predicted fire behavior dictates indirect control strategy with large amounts of fuel within planned perimeter.		
Firefighter Safety		
Performance of firefighting resources affected by cumulative fatigue.		
Overhead overextended mentally and/or physically.		
Communication ineffective with tactical resources or dispatch.		
Organization		
Operations are at the limit of span of control.		
Incident action plans, briefings, etc. missing or poorly prepared.		
Variety of specialized operations, support personnel or equipment.		
Unable to properly staff air operations.		
Limited local resources available for initial attack.		
Heavy commitment of local resources to logistical support.		
Existing forces worked 24 hours without success.		
Resources unfamiliar with local conditions and tactics.		
Values to be protected		
Urban interface; structures, developments, recreational facilities, or potential for evacuation.		
Fire burning or threatening more than one jurisdiction and potential for unified command with different or conflicting management objectives.		
Unique natural resources, special-designation areas, critical municipal watershed, T&E species habitat, cultural value sites.		
Sensitive political concerns, media involvement, or controversial fire policy.		

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.

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:

1. There is a violation of safe work practices.
2. Environmental conditions make the work unsafe.
3. They lack the necessary qualifications or experience.
4. 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 (The Firefighting Orders, the 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.

Last Resort Survival

LOOK AT YOUR OPTIONS AND IMMEDIATELY ACT ON THE
BEST ONE!

UTILIZE ALL P.P.E.!
PROTECT YOUR AIRWAY!

Escape if you can:

- Drop any gear not needed for fire shelter deployment (keep your fire shelter, handtool, 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 (structures, 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.

NOTES

Vehicle Accident IC Checklist

Report on Conditions

- Hazards (fuel, electrical, traffic, access, etc.).
- Need for law enforcement, ambulance, helicopter, tow truck, extrication tools.
- Injuries (number of victims, severity).
- Vehicles (number, type).

Establish Traffic Control

- Place apparatus between oncoming traffic and rescuers. Keep exhaust from pointing at scene, victims.
- Place warning devices.
- Establish positive communications.

Assess Fire Hazard or Potential

- Take suppression action as needed if trained, equipped and authorized.
- Be aware of fuels running downgrade.

Perform Patient Assessment

- Provide first aid or triage assessment.
- If there are fatalities, do not give names or other information over radio that would reveal identity, and do not move body.

Begin Incident Report. Document All Events. Advise Agency Dispatcher of Changes

- Incident status (arrival of other units, patient transport, available on scene, etc.).

HazMat IC Checklist

Think Safety

- Assess situation.
- Safe approach, upwind/upgrade/upstream.
- Identify, isolate and deny entry.
- Notify agency dispatcher.
- Exact location, use GPS.
- Request needed assistance, identify a safe route.

Scene Management

- Goal is to protect life, environment and property.
- Attempt to identify substance using DOT North American Emergency Response Guide. Use binoculars, placards/labels, container shapes/colors, Material Safety Data Sheets (MSDS), shipping papers.
- Quantity of material involved.
- Exposures and hazards surrounding the site.

Organizational Responsibilities

- Establish chain of command.
- Develop action plan for area security and evacuation.
- Advise all on scene and responding resources of changes in situation.
- Keep dispatcher advised of changes.
- Document all actions taken:
 - Contacts
 - Employee exposures

General Guidelines For Isolation Distances

- Minor event (1 drum, 1 bag, etc.) = 150 feet
- Major event (1 drum or more, etc.) = 500 feet
- Residential and light commercial = 300 feet
- Open areas = 1000 feet
- BLEVE (Boiling Liquid Expanding Vapor Explosion) potential = 2500 feet (one-half mile)
- Stage arriving units 2500 feet upwind
- Position vehicles headed out

1-800-424-9300 - CHEMTREC

(Chemical Transportation Emergency Center)

For immediate information about a chemical or to seek assistance from a manufacturer.

1-800-424-8802 - National Response Center

To report spills of oil and Hazardous Material.

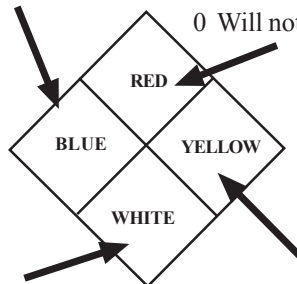
NFPA 704 HazMat Classification For Fixed Facilities

HEALTH HAZARD

- 4 Deadly
- 3 Extreme Danger
- 2 Hazardous
- 1 Slightly Hazardous
- 0 Normal Material

FIRE HAZARD

- 4 Below 73°F
- 3 Below 100°F
- 2 Above 100°F not exceeding 200°F
- 1 Above 200°F
- 0 Will not burn



SPECIFIC HAZARD

- ACID - Acid
- ALK - Alkali
- COR - Corrosive
- OXY - Oxidizer
- P - Polymerization
- ☢ - Radioactive
- W - Use no water

REACTIVITY

- 4 May detonate
- 3 Shock & heat may detonate
- 2 Violent chemical change
- 1 Unstable if heated
- 0 Stable

Major Disaster Considerations

- Assess crews for injuries.
- Move apparatus out of station if possible.
- Assess the station for damage.
- Determine if phones are working.
- Check for power - normal or auxiliary?
- Monitor phone and radio for dispatch information.
- Report by radio to dispatch or IC if established.
- Initiate a “windshield survey” of first response area.
- Do not fully commit to any incident.
 - Prioritize incidents with respect to life, hazard, property.
 - Note any damage to infrastructure (roads, bridges, etc.).
 - Check for hazardous utility situations (gas, electric, water).
 - Note structural instability/collapse of any buildings.
 - Expect malfunctioning automatic alarms.
 - Use “negative reporting.” Only report things out of the ordinary.
- Follow local disaster plans.

Structural Triage and Search Assessment Marking

Never enter a damaged structure unless trained, equipped and authorized. You may find a 2' x 2' box at the entrance (or an arrow to indicate the entrance) to the compromised structure. Orange spray paint or a lumber crayon should be used to mark hazards and condition inside the box.

- Structure is safe for Search and Rescue (SAR) (minor damage, or structure is fully collapsed).
- Structure is significantly damaged with some safe areas, but other areas which need to be shored up or braced. Falling and collapse hazards need to be removed.
- Structure is unsafe for SAR. May collapse suddenly.
- ← Entrance is located in direction of the arrow.

HM Hazardous material is present (note type of material). Consult HazMat Team and cooperate.

Time, date, specialist ID and HazMats identified should be written outside the upper right portion of the box. Building may be re-evaluated for additional hazards.

-
- / Single slash (2' long) indicates SAR Team is currently in structure conducting operations.
 - ✕ Cross/slash (2' x 2') indicates SAR Team has left structure, area.

The following information should be found in the 4 quadrants of the cross/slash:

Team ID	Left quad.
Time & date team left structure	Upper quad.
Personnel hazards	Right quad.
Number victims still inside structure	Lower quad.

(An "X" indicates no victims remaining)

Unexploded Ordnance (UXO)

- Recognizing unexploded ordnance (UXO) is the first and most important step in reducing the risk posed by UXO.
- The following types of UXO are most likely to be encountered on military, former military and non-military sites:

Small arms munitions	Projectiles
Grenades	Rockets
Mortars	Guided missiles
Bombs	Submunitions
- UXO may be found fully intact or in fragments. All UXO, whether intact or in fragments, presents a potential hazard and should be treated as such.
- Deteriorated UXO presents a particular hazard because it may contain chemical agents that could become exposed.
- UXO poses risk of injury or death to anyone in the vicinity.

UXO Safety and Reporting.

- If you see UXO, stop. Do not move closer.
- Never transmit radio frequencies (walkie talkies, citizens' band radios).
- Never remove anything near UXO.
- Never touch, move, or disturb 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.
- Report discovery of UXO to your immediate supervisor.

“IF YOU DIDN’T DROP IT, DON’T PICK IT UP!”

Evaluating Search Urgency

FACTOR	RATING
AGE	
Very Young	1
Very Old	1
Other	2-3
MEDICAL CONDITION	
Known/suspected injured, ill or mental problem	1-2
Healthy	3
Known Fatality	3
NUMBER OF SUBJECTS	
One alone	1
More than one (unless separated)	2-3
SUBJECT EXPERIENCE PROFILE	
Inexperienced, does not know area	1
Not experienced, knows area	1-2
Experienced, not familiar with area	2
Experienced, knows area	3
WEATHER PROFILE	
Past and/or existing hazardous weather	1
Predicted hazardous weather (less than 8 hours away)	1-2
Predicted hazardous weather (more than 8 hours away)	2
No hazardous weather predicted	3
EQUIPMENT PROFILE	
Inadequate for environment and weather	1
Questionable for environment and weather	1-2
Adequate for environment and weather	3
TERRAIN/HAZARDS PROFILE	
Known terrain or other hazards	1
Few or no hazards	2-3
TOTAL	

(Range = 7-21, with 7 the highest urgency and 21 the lowest urgency)

NOTES

NOTES

Patient Assessment

Patient Information:

- Name
- Sex
- Weight
- Chief complaint
- Date of Birth/Age

Oriented to:

- Person
- Time
- Purpose
- Place

Response to pain:

- Purposeful
- Unconscious
- No response
- Non-purposeful

Breathing:

- Normal
- Stridor
- Other
- Unequal
- Wheezes
- Rales
- Apnea

Skin Vitals:

Color	Moisture	Temperature
Normal	Normal	Normal
Pale/Ashen	Dry	Hot
Cyanotic	Moist	Cool
Flushed	Profuse	Cold

Pupils:

- Equal and reactive to light
- Unequal
- Fixed
- Dilated

Patient History:

- Cardiac
- Hypertension
- Unknown History
- Seizure
- Other
- Diabetes

First Aid Guidelines

LEGALITY

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

BLOODBORN 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 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 past injury away from 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 gray, cool and clammy. Rest in cool place and replace electrolytes.

Heat stroke: Skin dry, red, 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**.

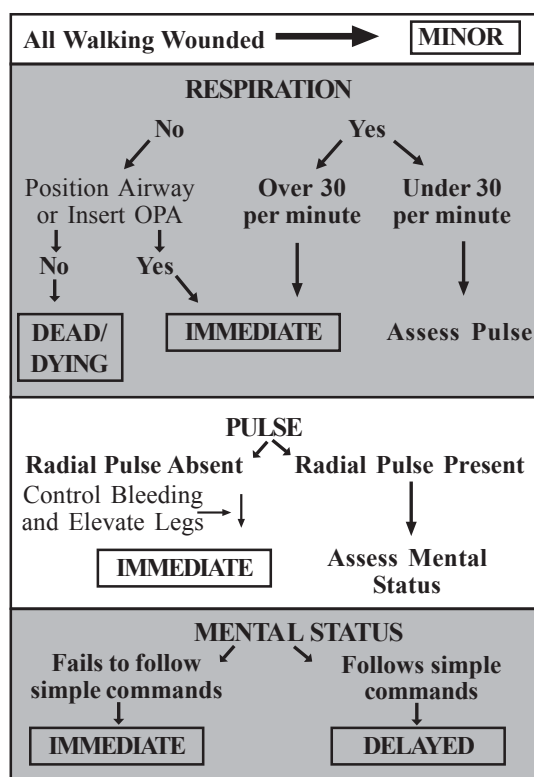
Airway - roll victim on back as a unit supporting head and neck. Open airway by head-tilt/chin-lift maneuver. Look, listen and feel for breathing for 3 to 5 seconds. If no response, go to **B**.

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 minute 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 compressions until advanced life support is available. If two rescuers are available, use a 5:1 compressions to breaths ratio. Use a 5:1 ratio for children and infants with compressions at a rate of 100 times per minute. Use a 1 to 1.5" depth for children and a .5 to 1" depth for infants.

START Triage



Disaster Size-up Information

TRIAGESYSTEM

Color	Priority	Description
Red	Immediate	Serious, salvageable, life-threatening injury or medical problem.
Yellow	Delayed	Treatment and transportation can be delayed.
Green	Minor	“Walking wounded” whose treatment can be delayed until all others are cared for.
Black	Dead/ dying	Dead or those with grave injuries likely to result in death.

Burn Injury Treatment

- Remove person from heat source, extinguish with water.
 - Provide basic first aid:
 - Maintain airway, breathing, circulation (ABCs)
 - Treat for shock by keeping person warm, feet elevated
 - Provide oxygen, if available trained to administer
 - Assess degree of burn and area affected.
 - First Degree** - affected skin's outer layer. Redness, mild swelling, tenderness, and mild to moderate pain.
 - Second Degree** - extends through entire outer layer and into inner layer of skin. Blisters, swelling, weeping of fluids, and severe pain.
 - Third Degree** - extends through all skin layers and into underlying fat, muscle, bone. Discoloration (charred, white or cherry red), leathery, parchment-like, dry appearance. Pain is absent.
- “Rule of Nine”** for determining area burned:
- | | | | |
|------------|-----|-------------|-----|
| Head | 9% | Front Torso | 18% |
| Back Torso | 18% | Left Arm | 9% |
| Right Arm | 9% | Left Leg | 9% |
| Right Leg | 9% | Perineum | 1% |
- Cut away only burned clothing. DO NOT cut away clothing stuck to burned skin.
 - Apply cool, clear water over burned area. DO NOT soak person or use cold water and ice packs. This encourages hypothermia.
 - Cover burned area with sterile dressing, moisten with saline solution, and apply dry dressing on top.
 - For severe burns or burns covering large area of body:
 - wrap in clean, sterile sheet followed by plastic sheet
 - place inside sleeping bag or cover with insulated blanket
 - Monitor ABCs and keep burn areas moist.
 - Avoid hypothermia and overheating.

NOTES

Aviation User Checklist

- Pilot's Card—qualified and current for aircraft type and mission?
- Aircraft Card—aircraft approved for mission?
- Flight Plan/Following—filed (FAA/Agency/Bureau)?
- Personal Protective Equipment (PPE)—required for missions—available and worn by all passengers and pilot?
- Pilot briefed on Mission Objectives/Parameters of Flight and Known Flight Hazards?
- Pilot briefing to passengers?

Aviation Watch Out Situations

- Is this flight necessary?
- Who is in charge?
- Are all hazards identified and have you made them known?
- Should you stop the operation or flight due to change in conditions?
 - Communications - Weather
 - Confusion - Turbulence
 - Conflicting Priorities - Personnel
- Is there a better way to do it?
- Are you driven by an overwhelming sense of urgency?
- Can you justify your actions?
- Are there other aircraft in the area?
- Do you have an escape route?
- Are there any rules being broken?
- Are communications getting tense?
- Are you deviating from the assigned operation or flight?

Flight Manager

The Flight Manager (FM) is supervised by the sending unit dispatcher until destination is reached. The FM is responsible for all personnel assigned on the manifest list. Duties are:

- To explain to all personnel at the beginning of travel, transportation arrangements, type equipment, route of travel, stopping points, ETAs, etc.
- To have multiple copies of manifests covering all personnel.
- To ensure proper flight following procedures are met.
- To have the telephone numbers of the sending and receiving dispatchers' offices when delays of more than 30 minutes occur in order to give information as to why and how long the delay will be.
- To have all personnel within the weight limitations, assembled, ready to board transportation.
- To provide for safety and welfare of each person assigned to the manifest list.
- To ensure saws and other fuel containers are purged prior to loading.
- To ensure no fuel- or lubricant-soaked items including clothing, chaps or bags are transported by aircraft.
- To check pilot card and aircraft data card for currency and qualifications.
- To ensure all passengers arrive at their destination.
- To sign the Daily Flight report/Invoices.
- To ensure all personnel have a copy of their resource order with request number and position assigned.
- For Canadian travel, to ensure proper documentation is included as outlined in the Canadian/United States Operating Agreement (chapter 40).

Helicopter Passenger Briefing

All passengers must receive a safety briefing prior to flight.

PPE - PROPER USE

- Hardhat/helmet (fitting, chinstrap)
- Nomex clothing (sleeves down, collar up)
- Leather boots and gloves.

NORMAL PROCEDURES

- **Entry and exit of aircraft**
 - Portable radio turned off
 - Approach-Departure (crouch-do not run)
 - Stay away from tail rotor
 - Approach/Exit downslope
 - As directed by pilot/helitack personnel
- **Seating in aircraft**
 - No movement inside aircraft once seated
 - Keep seatbelt fastened
 - Keep gloves and chinstraps on
- **No smoking**
- **Wait for helitack personnel to unload**
 - Leave doors closed
 - Do not unbuckle seatbelt until directed by pilot or helitack personnel

- **Loading/Unloading tools and equipment**
 - Always carry long-handled tools/equipment parallel to ground/never on shoulder
 - Secure any loose items inside cabin
 - All tools and equipment loaded/unloaded by helitack personnel
 - HazMat regulations/precautions

EMERGENCY PROCEDURES

- **Follow directions from pilot/helitack personnel**
 - Crash positions (demonstrate)
- **Location and use of:**
 - Shut-off switches
 - Fire Extinguisher
 - Survival Kit
 - Emergency Exits
 - First-Aid Kit
 - ELT/portable radios
- **Depart helicopter only after rotor blades have stopped**

Personal Protective Equipment for Flight

Agencies have personal protective equipment (PPE) requirements for most flights. When in doubt, WEAR IT.

- Above-the-ankle leather boots 8" or higher, and no metal against the skin.
- Nomex pants and shirt or flight suit buttoned or zipped to the top, collar turned up, sleeves rolled down. Pants cover the boot tops.
- Nomex or leather gloves.
- Non-synthetic (cotton, wool) outer and undergarments.
- Approved flight helmet or hard hat with chin strap (hard hats apply only to helicopter crew shuttle operations). Eye protection should be worn during takeoffs and landings. Wear eye protection when working around helicopters.
- Approved hearing protection.

Flight Following

Flight following, resource tracking, and communications are key components in employee and aircraft mission safety and efficiency. Flight following, whether performed from a dispatch office or other facility, or at a remote location in the field, must be given a high priority by all personnel involved.

Identification of Flight Following Requirements:

At the time the flight is planned, flight following requirements should be clearly identified. Requirements should identify check-in procedures, including time and locations, dispatch office(s) or other flight following facilities involved, individuals responsible for flight following, frequencies to be used, and any special circumstances requiring check-ins (for example, to military facilities within Special Use Airspace).

Check-In Requirements:

Check-in intervals or times must be specified in the agency's flight following procedures. Check-ins must be documented and provide enough information so that the aircraft can be easily located if it is overdue or missing.

Failure to Meet Check-In Requirements:

The dispatch or other flight following facility shall implement response procedures for overdue or missing aircraft.

Helicopter Landing Area Selection

Choosing a Landing Area:

- Locate a reasonably flat area.
- Choose an area clear of people, vehicles, obstructions such as trees, poles, and especially overhead wires. The area must be free of stumps, brush, posts, large rocks or anything over 18 inches high.
- Consider the wind direction. Helicopters land and take off into the wind. Choose an approach free of obstructions.
- Any obstruction should be relayed to the helicopter crew on initial radio contact.
- Remove or secure any loose items in and around the landing area such as trash, blankets, hats or equipment.
- Wet down the landing area if dusty conditions are present.

FIXED HELISPOTS

Type I Helicopters

- Safety circle 110 feet
- Touchdown pad 30 feet x 30 feet clear and level

Type II Helicopters

- Safety circle 90 feet
- Touchdown pad 20 feet x 20 feet clear and level

Type III Helicopters

- Safety circle 75 feet
- Touchdown Pad 15 feet x 15 feet clear and level

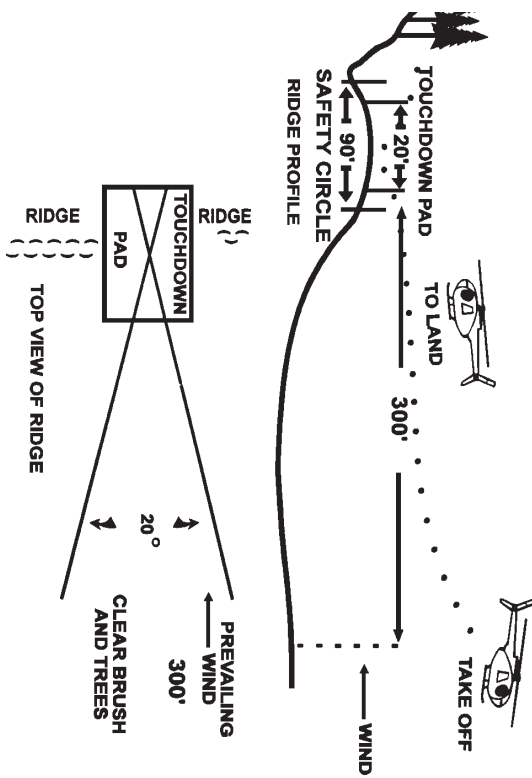
ITEMS NEEDED:

- Twenty (20) lb. fire extinguisher
- Wind Indicator
- Radio-compatible with helicopter
- Pad Marker
- Allowable Payloads (HIGE & HOGE) for all helicopters using helispot
- Passenger/Cargo Manifest Book
- Dust abatement, as needed

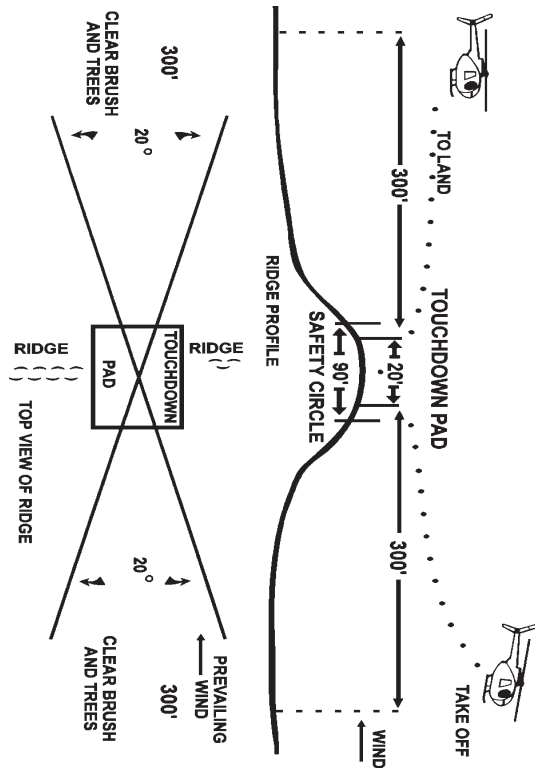
Longline Mission

- All individuals involved in longline missions will be certified annually by an instructor qualified in longline operations.
- If you are on the receiving end or the backhaul end of a longline load, you must be able to communicate to the pilot where you want the load delivered or picked up.
- Use a signal mirror to identify your position to the pilot.
- The drop-off/pick-up area should be as open and free of obstacles as possible. It is extremely difficult to hover straight down between tall trees.
- Once you have contacted the pilot by radio, give him/her all the information you can (cargo weight, wind speed and direction, etc.).
- Mark the drop-off spot with flagging (large "X" on the ground) if possible.
- Keep pilot informed of load status (height above the ground, clear of obstacles, etc.).
- Let the hook land on the ground before attaching load.
- If the electrical release does not release the load, you must manually release it; wait until the hook lands on the ground before releasing.
- For ALL backhaul, a "swivel" must be connected to the cargo/longline hook. NO EXCEPTIONS! (When you request nets, request swivels also.)
- Load cargo net with heavy items in the center, light items on top. Tape all boxes and loose items.
- Pull the "purse strings" of the cargo net to equal length and attach a swivel to the steel rings. It's not necessary to "cross" the purse strings with an overhand wrap. The preferred method is to make an oversized collar out of fiber tape that will slip down the purse strings as the load is lifted.

One-Way Helispot



Two-Way Helispot



Helicopter Hand Signals



Clear to Start
Make circular motion above head w/arm



Hold on Ground
Extend arms at 45 thumbs down



Move Upward
Arms extended sweeping up



Move Downward
Arms extended sweeping down



Hold Hover
Arms extended w/clenched fists



Clear to Take-Off
Arms extended in take-off direction



Land Here
Extend arms w/wind at back



Move Forward
Arms extended & wave copter toward you



Move Rearward
Arms downward using shoving motion



Move Left
Right arm extended left arm sweeps overhead



Move Right
Opposite of move left



Move Tail Rotor
Rotate body w/one arm extended



Shut Off Engine
Cross neck w/hand palm down



Fixed Tank Doors
Open arms outward Close arms inward



Release Sling Load
Contact forearm w/other hand



Wave Off Don't Land
Wave arms & cross overhead

Weight Estimates

(use only if scale is not available)

Item	Weight
Blevet bag	15 lbs.
Backpack pump (full)	45 lbs.
Cargo net 12x12	20 lbs.
Cargo net 20x20	45 lbs.
Cargo net (fish net)	5 lbs.
Cargo hook (1 hook)	35 lbs.
Jerry can/fuel (5 gal.)	45 lbs.
Canteen (1 gal.)	10 lbs.
Dolmar (full)	15 lbs.
Drip torch (full)	15 lbs.
Fusee (1 case)	36 lbs.
Hand tool (each)	8 lbs.
Lead line (12 ft.)	10 lbs.
Long line (50 ft.)	30 lbs.
Swivel	5 lbs.
Chain saw	25 lbs.
Hose, 1½" SYN. 100'	23 lbs.
Hose, 1" SYN. 100'	11 lbs.
Hose, ¾" SYN (1000'/case)	30 lbs.
Hose, suction, 8 ft.	10 lbs.
Mark 3 - Pump w/kit	150 lbs.
Stokes w/ backbrd.	40 lbs.
Trauma bag	35 lbs.
M.R.E., 1 case	25 lbs.
Cubee/water (5 gal.)	40 lbs.

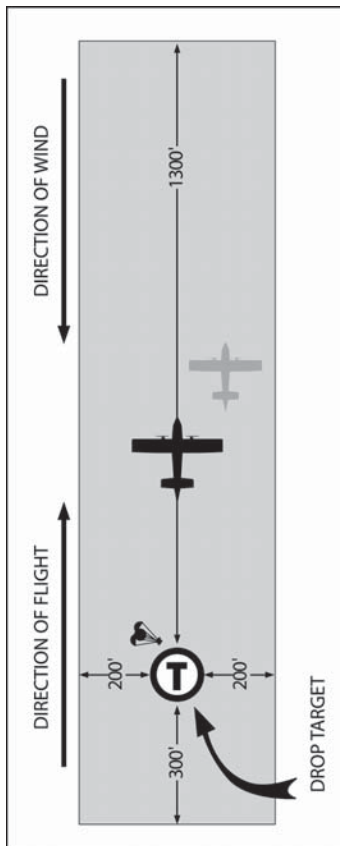
Paracargo and Aerial Retardant Operations Safety

The paracargo danger zone is a strip of 200 feet on each side of the flight path, 300 feet in the direction of approach, and 1300 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 with top of “T” into the wind. Erect paper streamer or flagging on long pole to indicate wind direction.
- An individual 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.
- Camps should be at least 600 feet from target area and outside of danger zone.
- Allow no one in danger zone until drop is complete.
- Beware of “streamers” or parachutes that don’t open.

Personnel can be injured by the impact of material dropped by aircraft. Clear personnel out of target area when drop is to be made. If you can’t escape:

- Hold your handtool away from your body.
- Lie face down with head toward oncoming aircraft and hardhat 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 should be done with caution due to slippery surfaces.



Paracargo drop zone

Principles of Retardant Application

- Determine tactics direct or indirect based on fire size-up and resources available.
- Establish an anchor point and work from it.
- Use the proper drop height.
- Apply proper coverage levels. (See next page.)
- Drop downhill and down-sun when feasible.
- Drop into the wind for best accuracy.
- Maintain honest evaluation and effective communication between the ground and air.
- Use direct attack only when ground support is available or extinguishment is feasible.
- Plan drops so they can be extended or intersected effectively.
- Monitor retardant effectiveness and adjust its use accordingly.

Directing Retardant and Bucket Drops

- **Give general location** on incident.
- **Finalize location** with:
 - Clock direction - straight in front of the aircraft is 12 o'clock, out the right door is 3 o'clock, the tail is 6 o'clock, and the left door is 9 o'clock. When giving directions, remember that helicopters and air attack generally orbit in a right-hand pattern and air tankers in a left-hand pattern.
 - Position on slope - lower 1/3, upper 1/3, midslope, top of ridge, etc.
 - Aspect - direction slope is facing.
 - Describe prominent landmarks - don't say "I have a red hardhat, I'm wearing a yellow shirt, I'm waving, I'm by the big rock," etc. Visualize what the pilot sees from the air and describe target.
 - Use signal mirrors - use smoke or fusee if mirror unavailable. Stand in drop location (when safe) for ID and move away before drop.
- **Describe target** from your location and explain mission. The pilot will decide drop technique and flight path.
- **Assure pilot** all personnel are safe and know aircraft intentions before the drop.
- **Give feedback** to pilot about drop accuracy. Be honest and constructive. Let pilot know if drop is early, late, uphill, downhill, on target, too high, too low, etc. Report low drops immediately.

Recommended Retardant Coverage Levels

Fuel Model NFDRS	FB	Coverage Level gal/100ft ²	Flow Rate Range (gal/sec)	Description
A.L.S	1	1	100-150	Annual & perennial western grasses; tundra
C	2			Conifer with grass
H.R.	8	2	151-250	Shortneedle closed conifer: summer hardwood
E.P.U	9			Longneedle conifer: fall hardwood
T	2			Sagebrush with grass
N	3	3	251-400	Sawgrass
F	5			Intermediate brush (green)
K	11			Light slash
G	10		401-600	Shortneedle conifer (heavy dead litter)
O		6	601-800	Southern rough
F.O.	6			Intermediate brush (cured); Alaska black spruce
B.O.	4	Greater	Greater	California mixed chaparral; high pocosin
J	12	than 6	than 800	Medium slash
I	13			Heavy slash

Aircraft Mishap Response Actions

Time is extremely critical when responding to an emergency. Immediate positive action is necessary; delay may effect someone's survival.

Rescue Operations

- Preserve life.
- Secure the area (deny access except to credentialed and escorted media).
- Do whatever is necessary to extricate injured occupants, and to extinguish fires, keeping in mind the necessity of protecting and preserving evidence.
- Document and/or photograph the location of any debris which must be disturbed in order to carry out rescues and/or fire suppression activities.

Site Safety Precaution

Aircraft wreckage sites can be hazardous for many reasons other than adverse terrain or climatic conditions. Personnel involved in the recovery, examination, and documentation of wreckage may be exposed to physical hazards posed by such as hazardous cargo, flammable and toxic fluids, sharp or heavy objects, and disease. It's important to exercise good judgment, use available protective devices and clothing, and use extreme caution when working in the wreckage. Do not exceed your physical limitations.

Reportable Safety Concerns

If a situation appears unsafe, discuss your concern with the pilot, or immediately contact your dispatcher or agency aviation representative for assistance.

Any safety concern should be documented on a SAFECOM and forwarded through agency channels. A SAFECOM is used to report any condition, observance, act, maintenance problem, or circumstance that has the potential to cause an aviation-related mishap. This type of follow-up helps improve overall aviation safety.

If the mishap involves damage or injury, notify the Agency's Aviation Safety Office (ASO) immediately by the most expeditious means available.

**USDA-FS/USDI-OAS
24-Hour accident Reporting Hot Line
Dial 1-888-464-7427 or 1-888-4MISHAP**

OAS Web Site - www.oas.gov

USFS Visual Signal Code

Ground To Air

Require doctor, serious injury	—
Able to ride horse	2
Need stretcher crew	3
Broken leg	4
Broken arm	5
Broken back	6
Head injury	+
Puncture wound	8
Unable to diagnose	9
Jumper OK	L
Personnel OK	<u>LL</u>
Fire adequately staffed	<u>≡</u>
Change jump spot	J
Cargo drop target	T
Helicopter landing spot	H
Need cross-cut saw	S
Need power saw	SS
Need climbers	O
Need drinking water	U
Need food	F
Need radio with batteries	R
Need batteries for radio	RR
Need power pump outfit	PP
Received message	Wave streamer

Air to Ground

Received message	Rock plane
Fire here	Circle three times over spot
Will drop message	Gun motor three times

NOTES

Energy Release Component (ERC)

The Energy Release Component (ERC) is an NFDRS index related to how hot a fire could burn. It is directly related to the 24-hour, potential worst case, total available energy (BTUs) per unit area (in square feet) within the flaming front at the head of a fire.

The ERC can serve as a good characterization of a fire season as it tracks seasonal fire danger trends well. The ERC is a function of the fuel model and live and dead fuel moistures. Fuel loading, woody fuel moistures, and larger fuel moistures all have an influence on the ERC, while the lighter fuels have less influence and wind speed has none. ERC has low variability, and is the best fire danger component for indicating the effects of intermediate to long-term drying on fire behavior (if it is a significant factor) although it is not intended for use as a drought index.

Burning Index (BI)

The Burning Index (BI) is an NFDRS index relating to the flame length at the head of the fire. BI is an estimate of the potential difficulty of fire control as a function of how fast and how hot a fire could burn. It has been scaled so that the BI value divided by 10 predicts the flame length at the head of a fire. For example, a BI of 75 would predict a flame length of 7.5 feet. BI is a function of the Spread Component and the Energy Release Component, and has moderate variability. It is sensitive to fuel models, and can trace seasonal trends reasonably well for models with heavy dead or live components. Because it uses wind and relative humidity, it is also very sensitive to weather observation errors.

Haines Index (HI)

The Lower Atmosphere Stability Index, or Haines Index, is for fire weather use. It is used to indicate the potential for wildfire growth by measuring the stability and dryness of the air over a fire. It is calculated by combining the stability and moisture content of the lower atmosphere into a number that correlates well with large fire growth. The stability term is determined by the temperature difference between two atmospheric layers; the moisture term is determined by the temperature and dew point difference. This index has been shown to correlate with large fire growth on initiating and existing fires where surface winds do not dominate fire behavior. The Haines Index can range between 2 and 6. The drier and more unstable the lower atmosphere is, the higher the index.

2 - Very Low Potential (Moist Stable Lower Atmosphere)

3 - Very Low Potential

4 - Low Potential

5 - Moderate Potential

6 - High Potential (Dry Unstable Lower Atmosphere)

Lightning Activity Level (LAL)

LAL 1 – No thunderstorms.

LAL 2 – Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1-5 cloud to ground strikes in a 5 minute period.

LAL 3 – Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6-10 cloud to ground strikes in a 5 minute period.

LAL 4 – Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11-15 cloud to ground strikes in a 5 minute period.

LAL 5 – Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a 5 minute period.

LAL 6 – Same as LAL 3 except thunderstorms are dry (no rain reaches the ground). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.

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 countermeasures 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 handtools.

Severe Fire Behavior Potential Related to Relative Humidity and Fuel Moisture Content

R.H. %	1-HR F.M. %	10-HR F.M. %	Relative ease of chance ignition and spotting; general burning conditions
>60	>20	>15	Very little ignition; some spotting may occur with winds above 9 mi./h.
45-60	15-19	12-15	Low ignition hazard--campfires become dangerous; glowing brands cause ignition when relative humidity is <50 percent.
30-45	11-14	10-12	Medium ignitability--matches become dangerous; "easy" burning conditions.
26-40	8-10	8-9	High ignition hazard--matches always dangerous; occasional crowning, spotting caused by gusty winds; "moderate" burning conditions.
15-30	5-7	5-7	Quick ignition, rapid buildup, extensive crowning; any increase in wind causes increased spotting, crowning, loss of control; fire moves up bark of trees igniting aerial fuels; long distance spotting in pine stands; dangerous burning conditions.
<15	< 5	< 5	All sources of ignition dangerous; aggressive burning, spot fires occur often and spread rapidly, extreme fire behavior probable; critical burning conditions.

Windspeed Ranges

Frontal winds Too broad a range to be specific.
 Foehn 40 to 60 mi/hr common; up to 90 mi/hr reported at 20 ft.
 Land breeze 2 to 3 hours after sunset, 3 to 5 mi/hr at 20 ft.
 Pacific sea breeze 10 to 15 mi/hr at 20 ft.
 Up-valley winds 10 to 15 mi/hr, early afternoon and evening at 20 ft.
 Upslope winds as high as 4 to 8 mi/hr at midflame height.
 Downslope winds 3 to 6 mi/hr at midflame height.

BEAUFORT SCALE FOR ESTIMATING 20-FT WINDSPEED		
Wind Class	Wind Speed (mph)	Nomenclature
1	<3	Very light - smoke rises nearly vertically. Leaves of quaking aspen in constant motion; small branches of bushes sway; slender branches and twigs of trees move gently; tall grasses and weeds sway and bend with wind; wind vane barely moves.
2	4-7	Light - trees of pole size in the open sway gently; wind felt distinctly on face; loose scraps of paper move; wind flutters small flag.
3	8-12	Gentle breeze - trees of pole size in the open sway very noticeably; large branches of pole size trees in the open toss; tops of trees in dense stands sway; wind extends small flag; a few crested waves form on lakes.
4	13-18	Moderate breeze - trees of pole size in the open sway violently; whole trees in dense stands sway noticeable; dust is raised on the road.
5	19-24	Fresh - branchlets are broken from trees; inconvenience is felt in walking against wind.
6	25-31	Strong - tree damage increases with occasional breaking of exposed tops and branches; progress impeded when walking against wind; light structural damage to buildings.
7	32-38	Moderate gale - severe damage to tree tops; very difficult to walk into wind; significant structural damage occurs.
8	>39	Fresh gale - surfaced strong Santa Ana; intense stress on all exposed objects, vegetation, buildings; canopy offers virtually no protection; wind flow is systematic in disturbing everything in its path.

Source: Fire Behavior Field Reference

Relative Humidity - 1400-5000' Elevation

Relative Humidity, Percent

DRY BULB t °F	WET BULB DEPRESSION, DEGREES F.											REL T WEATHER KIT RELATIVE HUMIDITY TABLES				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
34	91	82	73	64	55	46	38	30	21	13	5					
35	91	82	74	65	56	48	40	32	24	16	8	0				
36	91	83	75	66	58	50	42	34	26	18	10	3				
37	92	84	75	67	59	51	43	35	28	20	13	5				
38	92	84	76	68	61	53	45	37	30	22	15	8	1			
39	92	84	76	69	62	54	47	39	32	24	17	10	3			
40	92	84	77	69	62	55	48	41	33	26	19	13	6			
41	92	85	77	70	63	56	49	42	35	28	22	15	8	2		
42	92	85	78	71	64	57	50	44	37	30	24	17	11	4		
43	92	86	78	71	65	58	51	45	38	32	26	19	13	7	1	
44	93	86	79	72	66	59	52	46	40	33	27	21	15	9	3	
45	93	86	79	72	66	60	53	47	41	35	29	23	17	11	5	
46	93	86	80	73	67	60	54	48	42	36	30	24	19	13	8	2
47	93	86	80	74	67	61	55	49	43	37	32	26	20	15	10	4
48	93	87	80	74	68	62	56	50	44	39	33	27	22	17	11	6
49	93	87	81	74	69	63	57	51	45	40	34	29	24	18	13	8
50	94	87	81	75	69	63	57	52	46	41	35	30	25	20	15	10
51	94	88	82	76	70	64	58	53	47	42	37	31	26	21	17	12
52	94	88	82	76	70	65	59	53	48	43	38	33	28	23	18	13
53	94	88	82	76	71	65	60	54	49	44	39	34	29	24	20	15
54	94	88	82	77	71	66	60	55	50	45	40	35	30	26	21	17
55	94	88	82	77	72	66	61	56	51	46	41	36	31	27	23	18
56	94	89	83	77	72	67	62	57	52	47	42	37	33	28	24	20
57	94	89	83	78	72	67	62	57	52	48	43	38	34	30	25	21
58	94	89	83	78	73	68	63	58	53	49	44	39	35	31	27	22
59	95	89	84	78	74	68	64	59	54	49	45	40	36	32	28	24
60	95	89	84	79	74	69	64	59	55	50	46	41	37	33	29	25
61	95	90	84	79	74	69	65	60	55	51	46	42	38	34	30	26
62	95	90	84	79	75	70	65	61	56	52	47	43	39	35	31	27
63	95	90	85	80	75	70	66	61	57	52	47	44	40	36	32	28
64	95	90	85	80	75	71	66	62	57	53	49	45	41	37	33	29
65	95	90	85	80	76	71	67	62	58	54	50	46	42	38	34	30
66	95	90	85	81	76	72	67	63	59	54	50	46	42	39	35	31
67	95	90	85	81	76	72	68	63	59	55	51	47	43	40	36	32
68	95	90	86	81	77	72	68	64	60	56	52	48	44	40	37	33
69	95	91	86	81	77	73	68	64	60	56	52	49	45	41	38	34
70	95	91	86	82	77	73	69	65	61	57	53	49	46	42	39	35
71	95	91	86	82	77	73	69	65	61	57	54	50	46	43	39	36
72	95	91	86	82	78	74	70	66	62	58	54	50	47	44	40	37
73	95	91	87	82	78	74	70	66	62	59	55	51	48	44	41	38
74	95	91	87	83	78	74	70	66	63	59	55	52	48	45	42	38
75	96	91	87	83	79	75	71	67	63	59	56	52	49	46	42	39
76	96	91	87	83	79	75	71	67	64	60	56	53	50	46	43	40
77	96	91	87	83	79	75	71	68	64	60	57	53	50	47	44	40
78	96	91	87	83	79	75	72	68	64	61	58	54	51	47	44	41
79	96	92	88	84	80	76	72	68	65	61	58	54	51	48	45	42
80	96	92	88	84	80	76	72	69	65	62	58	55	52	49	45	42
81	96	92	88	84	80	77	73	69	66	62	59	56	53	50	47	44
82	96	92	88	84	81	77	74	70	67	63	60	57	54	51	48	45
83	96	92	88	84	81	77	74	71	67	64	61	58	55	52	49	46
84	96	92	89	85	81	78	75	71	68	65	62	59	56	53	50	47
85	96	92	89	85	82	78	75	72	69	66	63	60	57	54	51	48
86	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
87	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
88	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
89	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
90	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
91	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
92	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
93	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
94	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
95	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
96	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
97	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
98	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
99	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
100	96	92	89	85	82	79	75	72	69	66	63	60	57	54	51	48
101	97	93	90	87	83	80	77	74	71	69	66	63	61	58	55	53
102	97	93	90	87	83	80	77	74	71	69	66	63	61	58	55	53
103	97	93	90	87	83	80	77	74	71	69	66	63	61	58	55	53
104	97	93	90	87	83	80	77	74	71	69	66	63	61	58	55	53
105	97	93	90	87	83	80	77	74	71	69	66	63	61	58	55	53
106	97	93	90	87	83	80	77	74	71	69	66	63	61	58	55	53
107	97	93	90	87	83	80	77	74	71	69	66	63	61	58	55	53
108	97	93	90	87	83	80	77	74	71	69	66	63	61	58	55	53
109	97	93	90	87	83	80	77	74	71	69	66	63	61	58	55	53
110	97	93	90	87	83	80	77	74	71	69	66	63	61	58	55	53

Relative Humidity - 5000-9200' Elevation

Relative Humidity, Percent

DRY BULB (°F)	WET BULB DEPRESSION, DEGREES F.																BELT WEATHER KIT RELATIVE HUMIDITY TABLES	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
34	92	84	75	67	59	51	43	35	28	21	13							This table for Elevations 5000 to 9200 feet ATMOSPHERIC PRESSURE...23 IN.
35	92	84	76	68	60	52	45	37	30	23	16	9	2					
36	92	84	77	69	61	54	46	39	32	25	18	11	4					
37	93	85	78	70	63	55	48	41	34	27	20	13	7	0				
38	93	85	78	71	64	57	49	42	36	29	22	16	9	3				
39	93	85	78	71	65	57	51	44	37	31	24	18	12	5				
40	93	85	79	72	65	58	52	45	39	32	26	20	14	8	2			
41	93	86	79	72	66	59	53	47	41	34	28	22	16	10	4			
42	93	86	80	73	67	60	54	48	42	36	30	24	18	12	6	1		
43	93	87	80	73	67	61	55	49	43	37	31	26	20	14	8	3		
44	94	87	80	74	68	62	56	50	44	39	33	27	22	16	11	5		
45	94	87	81	74	68	62	57	51	45	40	34	28	24	18	13	7		
46	94	87	81	75	69	63	57	52	46	41	35	30	25	20	15	9	4	WET BULB DEPRESSION, DEGREES F. 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
47	94	87	81	75	70	64	58	53	47	42	37	31	26	21	17	11	6	
48	94	88	82	76	70	65	59	54	48	43	38	32	28	23	18	13	9	
49	94	88	82	76	71	65	60	54	49	44	39	34	29	24	20	15	10	
50	94	88	82	77	71	66	60	55	50	45	40	35	30	26	21	17	12	
51	94	88	83	77	72	66	61	56	51	46	41	36	32	27	23	18	14	
52	94	89	83	78	72	67	62	57	52	47	42	37	33	28	24	20	15	
53	94	89	83	78	72	67	62	57	52	48	43	38	34	29	25	21	17	
54	94	89	83	78	73	68	63	58	53	48	44	39	35	31	26	22	18	
55	95	89	84	78	73	69	63	59	54	49	45	40	36	32	28	24	20	
56	95	89	84	79	74	69	64	59	55	50	46	41	37	33	29	25	21	
57	95	89	84	79	74	69	65	60	55	51	47	42	38	34	30	26	22	
58	95	89	84	79	74	70	65	61	56	52	48	43	39	35	31	27	23	
59	95	90	85	80	75	70	65	61	57	53	48	44	40	36	32	28	24	
60	95	90	85	80	75	71	66	62	57	53	49	45	41	37	33	29	26	
61	95	90	85	80	75	71	66	62	58	54	50	46	42	38	34	30	27	
62	95	90	85	81	76	72	67	63	59	55	51	47	43	39	35	31	28	
63	95	90	85	81	76	72	67	63	59	55	51	47	43	40	36	32	29	
64	95	90	86	81	77	72	68	64	60	56	52	48	44	40	37	33	30	
65	95	91	86	81	77	73	69	64	60	56	52	49	45	41	38	34	31	
66	95	91	86	82	77	73	69	65	61	57	53	49	46	42	38	35	32	
67	95	91	86	82	77	73	69	65	61	57	54	50	46	43	39	36	33	
68	95	91	86	82	78	74	70	66	62	58	54	50	47	44	40	37	34	
69	96	91	87	82	78	74	70	66	62	58	55	51	48	44	41	37	34	
70	96	91	87	83	78	74	70	66	63	59	55	52	48	45	42	38	35	
71	96	91	87	83	79	75	71	67	63	59	56	52	49	46	42	39	36	
72	96	91	87	83	79	75	71	67	64	60	56	53	50	47	43	40	37	
73	96	91	87	83	79	75	71	68	64	60	57	53	50	47	43	40	37	
74	96	91	87	83	79	75	72	68	64	61	57	54	51	47	44	41	38	
75	96	91	87	83	80	76	72	68	65	61	58	55	51	48	45	42	39	
76	96	92	88	84	80	76	72	69	65	62	58	55	52	49	45	42	39	
77	96	92	88	84	80	76	72	69	66	62	59	55	52	49	46	43	40	
78	96	92	88	84	80	76	73	69	66	62	59	56	53	50	47	44	41	
79	96	92	88	84	80	77	73	70	66	63	60	56	53	50	47	44	41	
80	96	92	88	84	80	77	73	70	67	63	60	57	54	51	48	45	42	
81	96	92	88	85	81	77	74	71	67	64	61	58	55	52	49	46	43	
82	96	92	89	85	81	78	74	71	68	65	62	59	56	53	50	47	44	
83	96	92	89	85	81	78	74	71	68	65	62	59	56	53	50	47	44	
84	96	92	89	85	81	78	74	71	68	65	62	59	56	53	50	47	44	
85	96	93	89	85	82	79	75	72	69	66	63	60	57	54	51	48	45	
86	96	93	89	86	82	79	76	73	69	66	63	61	58	55	52	50	47	
87	96	93	89	86	83	79	76	73	70	67	64	61	58	55	53	51	48	
88	96	93	89	86	83	80	77	74	71	68	65	63	61	59	57	55	52	
89	96	93	89	86	83	80	77	74	71	68	66	63	61	59	57	55	52	
90	96	93	89	87	84	80	77	75	72	69	66	64	61	59	57	55	52	
91	96	93	89	87	84	81	78	75	72	69	67	64	61	59	57	55	52	
92	96	93	89	86	83	80	77	75	72	70	67	64	61	59	57	55	52	
93	96	93	89	86	83	80	77	75	72	70	67	65	62	60	58	56	54	
94	96	93	89	86	83	80	77	74	71	68	66	63	61	59	57	55	52	
95	96	93	89	86	83	80	77	74	71	68	66	63	61	59	57	55	52	
96	96	93	89	86	83	80	77	74	71	68	66	63	61	59	57	55	52	
97	96	93	89	87	84	81	78	75	72	70	67	64	61	59	57	55	52	
98	96	93	89	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
99	96	93	89	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
100	96	93	89	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
101	97	93	90	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
102	97	93	90	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
103	97	93	90	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
104	97	93	90	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
105	97	93	90	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
106	97	94	90	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
107	97	94	90	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
108	97	94	90	87	84	81	78	75	72	70	67	65	62	60	58	56	54	
109	97	94	91	88	85	82	79	76	74	71	68	66	63	61	59	57	55	
110	97	94	91	88	85	82	79	76	74	71	68	66	63	61	59	57	55	

Hazard Tree Safety

Environmental conditions that increase snag hazards:

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

Hazard tree indicators:

- Trees have been burning for an extended period
- High risk tree species (rot and shallow root system)
- Numerous down trees
- Dead or broken tops and limbs overhead
- Accumulation of down limbs
- Absence of needles, bark or limbs
- Leaning or hung-up trees

Procedural Chain Saw Operations

Procedural approach to cutting operations begins with assessing the situation, completing a hazard analysis, and establishing cutting area control.

Situational Assessment

- Observe tree characteristics
- Determine soundness or defects
- Analyze the tree base
- Check surrounding terrain
- Examine work area

Hazard Analysis

- Overhead hazards
- Ground hazards
- Environmental hazards
- Mental and physical hazards

Felling Operation Controls

- Observe the top
- Check for nearby hazard trees
- Assess lean(s) & lay
- Swamp out base
- Brief swamper
- Face tree with adequate stump shot
- Give warning yell
- Look up while cutting
- Complete back cut
- Use wedging procedure
- Use escape route and safe zones
- Analyze stump

Line Spike

The “Line Spike,” or “Coyote,” is a progressive line construction technique in which self-sufficient crews build fireline until the end of an operational period, remain overnight (RON) at or near that point, and then begin again the next operational period. Crews should be properly equipped and prepared to spend two or three shifts on the line with minimal support from the incident base.

Safety Considerations

- Can line spike locations maintain LCES at all times?
- Can emergency medical technicians be on the line?
- Can a timely medevac plan be implemented?
- Can daily communications (verbal and written) be maintained?
- Can food and water be provided daily?
- Is each crew boss comfortable with the assignment?

Operational Considerations

- Meals during line spike operational periods may consist of rations and/or sack lunches.
- The line spike generally will not last more than two or three operational periods for any one crew.
- Division Supervisors will be responsible for establishing on and off operational period times.
- Crews working line spike operational periods will be resupplied on the fireline as close as possible to the RON point.

Logistical Considerations:

- Bringing toothbrush/paste, extra socks/underwear, light coat, double lunch, space blanket, etc.
- Considering early in the operational period where the crew(s) will RON, and that the location provides for safety and logistical needs of the crew (main fire poses no threat, helicopters can long-line or land at site, personnel are provided semi-flat ground to sleep on, adequate firewood exists for warming fires, etc.).
- Anticipating resupply needs and placing those orders early in the operational period. Crew leaders should make arrangements to have qualified individuals at RON locations to accept those orders by long-line or internal helicopter operations.
- Taking measures to prevent problems with food, trash, etc. in areas where bears are a concern. It's a common practice to leave one or more individuals with radio communications at the RON location to coordinate the "back haul" of trash or the pre-positioning of reusable supplies to advanced RON locations.
- How crew time and commissary items will be managed. Normally this function can be provided by using in-/out-bound helicopter flights at the RON location, or the time is turned in upon returning to the incident base.
- How medical emergencies will be managed. An emergency medical technician may be needed at the RON location.

Minimum Impact Suppression Tactics

The intent of minimum impact suppression tactics is to suppress a wildfire with the least impact to the land. Fire conditions and good judgment dictate the actions taken. Consider what is necessary to halt fire spread and contain it within the fireline or designated perimeter boundary.

A. Safety

- **Safety is of utmost importance.**
- **Constantly review and apply the “Watch Out Situations” and “Firefighting Orders.”**
- **Be particularly cautious with:**
 - Unburned fuel between you and the fire.
 - Burning snags allowed to burn.
 - Burning or partially burned live and dead trees.
- **Be constantly aware of surroundings, expected fire behavior, and possible fire perimeter 1 or 2 days hence.**

B. Fire Lining Phase

- **Select procedures, tools, equipment that least impact the environment.**
- **Seriously consider using water as a firelining tactic (fireline constructed with nozzle pressure, wetlining).**
- **In light fuels, consider:**
 - Cold-trail line.
 - Allowing fire to burn to natural barrier.

- Burning-out and use of gunnysack or swatter.
 - Constantly rechecking cold-trailed fireline.
 - If constructed fireline is necessary, using minimum width and depth to check fire spread.
- **In medium/heavy fuels, consider:**
 - Using natural barriers and cold-trailing.
 - Cooling with dirt and water, and cold-trailing.
 - If constructed fireline is necessary, using minimum width and depth to check fire spread.
 - Minimizing bucking to establish fireline. Preferably move or roll downed material out of the intended constructed fireline area. If moving or rolling out is not possible, or the downed log/bole is already on fire, build line around and let material be consumed.
- **Aerial fuels -- brush, trees, and snags:**
 - Adjacent to fireline: Limb only enough to prevent additional fire spread.
 - Inside fireline: Remove or limb only those fuels that if ignited would have potential to spread fire outside the fireline.
 - Brush or small trees that are necessary to cut during fireline construction will be cut flush with the ground.

- **Trees, burned trees, and snags:**
 - MINIMIZE cutting of trees, burned trees, and snags.
 - Live trees will not be cut, unless determined they will cause fire spread across the fireline or endanger workers. If tree cutting occurs, cut the stumps flush with the ground.
 - Scrape around tree bases near fireline if hot and likely to cause fire spread.
 - Identify hazardous trees with either an observer, flagging, and/or glow-sticks.

- **When using indirect attack:**
 - Do not fall snags on the intended unburned side of the constructed fireline, unless they are a safety hazard to crews.
 - On the intended burn-out side of the line, fall only those snags that would reach the fireline should they burn and fall over. Consider alternative means to falling (fireline explosives, bucket drops).
 - Review items listed above (aerial fuels, brush, trees, and snags).

C. Mop-Up Phase

- **Consider using “hot-spot” detection devices along perimeter (aerial or hand-held).**
- **Light fuels:**
 - Cold-trail areas adjacent to unburned fuels.
 - Do minimal spading; restrict spading to hot areas near fireline.

- Use extensive cold-trailing to detect hot areas.
- **Medium and heavy fuels:**
 - Cold-trail charred logs near fireline; do minimal scraping or tool scarring.
 - Minimize bucking of logs to check for hot spots or extinguish fire; preferably roll the logs and extinguish the fire.
 - Return logs to original position after checking or ground is cool.
 - Refrain from making boneyards; burned/partially burned fuels that were moved should be arranged in natural position as much as possible.
 - Consider allowing larger logs near the fireline to burnout, instead of bucking into manageable lengths. Use lever, etc., to move large logs.
- **Aerial fuels – brush, small trees, and limbs.**
 - Remove or limb only those fuels that if ignited, have potential to spread fire outside the fireline.
- **Burning trees and snags.**
 - See Section B

**Sustained Line Production Rates of
20-Person Crews for Construction,
Burnout, and Holding in Chains/Hour**

	Fire Behavior Fuel Model	Specific Conditions	Crew Type	
			Type I	Type II
1	Short Grass	Grass Tundra	30 9	18 5
2	Open Timber/ Grass Understory	All	24	16
3	Tall Grass	All	5	3
4	Chaparral	Chaparral High Pocosin	5 4	3 2
5	Brush	All	6	4
6	Dormant Brush/ Hardwood Slash	Black Spruce Others	7 6	5 4
7	Southern Rough	All	4	2
8	Closed Timber Litter	Conifers	7 40	5 24
9	Hardwood Litter	Conifers Hardwoods	28 40	16 24
10	Timber (Litter & Understory)	All	6	4
11	Logging Slash, Light	All	15	9
12	Logging, Slash Medium	All	7	4
13	Logging Slash, Heavy	All	5	3

NOTE: Allowances have been made in production rates for rest periods and cumulative fatigue.

Dozer Fireline Construction Rates for Single Pass in Chains/Hour

NOTE: Prediction rates vary with conditions. The higher rate can be used for newer dozers (1975 and later).

Fire Behavior Fuel Model	Up or Down Slope	Slope Class			
		1 0-25%	2 26-40%	3 41-55%	4 56-74%
Type III Dozer 1,2	Up	55-90	30-55	8-30	0-8
	Down	90-110	90-110	20-90	0-20
3,5,8	Up	45-70	25-45	2-25	0-2
	Down	70-80	65-80	0-65	0
4,00	Up	20-35	10-20	0-10	0
	Down	35-40	25-40	0-25	0
6,7,9	Up	35-55	15-35	0-15	0
	Down	55-60	40-60	0-40	0
11,12	Up	15-25	7-15	0-7	0
	Down	25-30	10-30	0-10	0
10,13	Up	8-15	3-8	0-3	0
	Down	10-15	5-10	0-5	0
Type II Dozer 1,2	Up	85-125	60-85	30-60	0-30
	Down	125-145	130-145	75-130	0-75
3,5,8	Up	70-105	45-70	15-45	0-15
	Down	105-120	105-120	55-105	0-55
4,00	Up	35-60	20-35	2-20	0-2
	Down	60-75	65-76	20-65	0-20
6,7,9	Up	50-85	30-50	7-30	0-7
	Down	85-100	85-100	40-85	0-40
11,12	Up	25-40	15-25	1-15	0-1
	Down	40-55	45-55	0-45	0
10,13	Up	10-20	7-10	0-7	0
	Down	20-25	20-25	0-20	0
Type I Dozer 1,2	Up	100-140	70-100	35-70	0-35
	Down	140-155	140-155	85-140	0-85
3,5,8	Up	75-110	50-75	20-50	0-20
	Down	110-130	110-130	55-110	0-55
4,00	Up	45-70	30-45	8-30	0-8
	Down	70-80	75-85	25-75	0-25
6,7,9	Up	65-95	40-65	15-40	0-15
	Down	95-110	90-110	50-90	0-50
11,12	Up	35-55	20-35	3-20	0-3
	Down	55-65	55-65	6-55	0-6
10,13	Up	20-35	9-20	0-9	0
	Down	35-40	30-40	0-30	0

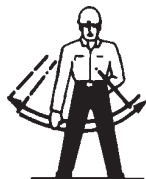
Tractor-Plow Fireline Production Rates In Chains Per Hour

(drag or mounted plow, appropriate blade, level to rolling terrain)

Fire Behavior Fuel Model	Tractor Plow Type					
	1	2	3	4	5	6
	(165 HP) D-7, JD-850 TD-20 & Larger	(140 HP) D-6, JD-750, TD-15, Case 1450	(120 HP) D5H, D4H, TD-12, Case 1150	(90HP) D-4, JD-650, TD-9, D5C	(70-80 HP) JD450, D4C, TD-8	(42-60 HP) JD350, D3, JD-400, TD-7
1	240	240	240	200	180	80
2	180	180	180	140	120	80
3	180	180	180	120	100	70
4	80	80	60	40	20	0
5	160	160	160	100	80	40
6	120	120	100	60	40	20
7	160	160	160	120	100	60
8	180	180	180	120	100	70
9	180	180	180	120	100	70
10	100	100	80	50	40	20
	Mountainous Terrain, 60% or less slope, front and rear mounted plow, downhill plowing					
8	--	--	--	50	40	20
9	--	--	--	50	40	20
	Mountainous terrain, 60% or less slope, using ripper attachment, up/down slope fireline construction					
1, 2, 3	20/30	10/30	0/30	--	--	--
4, 6, 12, 13	10/20	5/10	0/5	--	--	--
5, 7, 8-10, 11	12/25	8/15	0/10	--	--	--

*Minimum standards for personnel with dozers may differ depending on fuel type, terrain, and resource configuration. Dozer strike teams may use team leader in place of additional personnel per dozer. Fuel requiring burnout and terrain that requires scouting demands two personnel per dozer.

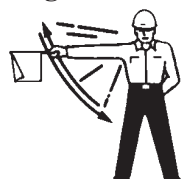
Dozer Use Hand Signals



STOP - Back and forth, waist high, swinging motion.



COME AHEAD - Up and down in front of spotter, from waist to arm's length above head.



TURN - Swing flag or light on side to which operator is to turn.



REVERSE OR BACKUP - Full circle in front of the spotter.



CAUTION - Wave flag or light in half circle at arm's length above head.



ATTRACT OPERATOR'S ATTENTION - May also use one blast on a whistle, horn, or other suitable device.



SIGNALS GIVEN BY OPERATOR

- **CAN'T SEE SPOTTER** - Gun motor twice.
- **WANT DOZER HELPER TO COME TO DOZER** - Gun motor once.

Water Delivery Information

GPM for nozzles

Forester	3/16 tip: 10 gpm (50 psi nozzle pressure)
	3/8 tip: 30 gpm (50 psi nozzle pressure)
Variable Pattern	One inch: 20 gpm (100 psi nozzle pressure)
	1½ inch: 60 gpm (100 psi nozzle pressure)

Maximum efficient flow

One inch hose: 30 gpm
1½ inch hose: 100 gpm

Useful Information

- Test for flow (gpm) by time required to fill a fedco (5 gal. in 15 sec.=20 gpm)
- Maximum vertical height for drafting = 12 ft. (Mark 3)
- Loss of one foot draft per 1000 feet elevation
- Head pressure loss or gain: 5 psi per 10 feet elevation
- Friction loss for one inch hose:
 - 10 gpm = 4 psi per 100 ft.
 - 20 gpm = 12 psi per 100 ft.
 - 30 gpm = 26 psi per 100 ft.
- Friction loss for 1½" hose:
 - 10 gpm = 5 psi per 100 ft.
 - 20 gpm = 2 psi per 100 ft.
 - 30 gpm = 4 psi per 100 ft.
 - 60 gpm = 13 psi per 100 ft.
- Use check valve for pumping uphill to overcome back pressure at pump.
- Avoid use of hard suction for tandem pumping. Not designed to withstand positive pressures.
- Pump pressure = nozzle pressure + friction loss of hoselay + head pressure + appliance friction loss.
- A double hose lay will reduce friction loss 1/4 of a single hoselay.
- Friction loss for gated wye: 5 psi
- Use of two suction hoses on intake will increase gallons per minute.
- Maximum horizontal distance-pumping
 - Single Mark 3 pump, 1½" hose, 50 psi nozzle pressure
 - 10 gpm: 40,000 ft.
 - 20 gpm: 10,000 ft.
 - 30 gpm: 4,000 ft.
 - 60 gpm: 800 ft.
- Maximum vertical distance-pumping
 - Single Mark 3 pump, 1½" hose, 50 psi nozzle pressure
 - 10 gpm: 400 ft. (Friction loss for hose not included)
 - 20 gpm: 400 ft.
 - 30 gpm: 350 ft.
 - 60 gpm: 200 ft.

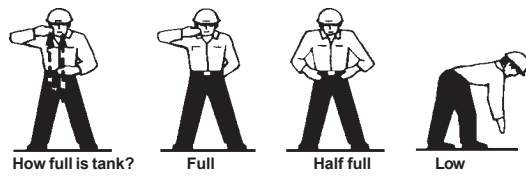
GALLONS OF WATER

	5	10	50	100	150	200	250	300	350	400	450	500
1.	0.5 OZ	1	6	13	19	25	32	38	45	51	58	0.5 GAL
2.	1 OZ	2.5	13	25	38	51	0.5 GAL	76	89	0.8 GAL	0.9 GAL	1 GAL
3.	2 OZ	4	19	38	58	76	.75 GAL	0.9 GAL	1.0 GAL	1.2 GAL	1.3 GAL	1.5 GAL
4.	2.5 OZ	5	26	51	76	0.8 GAL	1.0 GAL	1.2 GAL	1.4 GAL	1.6 GAL	1.8 GAL	2.0 GAL
5.	3 OZ	6	32	0.5 GAL	.75 GAL	1.0 GAL	1.25 GAL	1.5 GAL	1.75 GAL	2.0 GAL	2.25 GAL	2.5 GAL
6.	4 OZ	8	38	0.9 GAL	1.25 GAL	1.5 GAL	1.75 GAL	2.0 GAL	2.5 GAL	2.75 GAL	3.0 GAL	3.0 GAL
7.	4.5 OZ	9	45	1.0 GAL	1.5 GAL	1.75 GAL	2.0 GAL	2.5 GAL	2.75 GAL	3.0 GAL	3.0 GAL	3.5 GAL
8.	5 OZ	10	51	0.8 GAL	1.2 GAL	1.6 GAL	2.0 GAL	2.5 GAL	2.75 GAL	3.0 GAL	3.5 GAL	4.0 GAL
9.	5.5 OZ	12	58	0.9 GAL	1.4 GAL	1.75 GAL	2.25 GAL	2.75 GAL	3.0 GAL	3.5 GAL	4.0 GAL	4.5 GAL
10.	6 OZ	13	0.5 GAL	1.0 GAL	1.5 GAL	2.0 GAL	2.5 GAL	3.0 GAL	3.5 GAL	4.0 GAL	4.5 GAL	5.0 GAL

**F O A M
M
%
Concentrate to Add**

One gallon (GAL) is equal to 128 ounces (OZ) and one quart is equal to 32 ounces.

Wildland Water Use Hand Signals

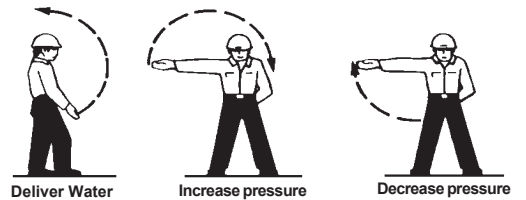


How full is tank?

Full

Half full

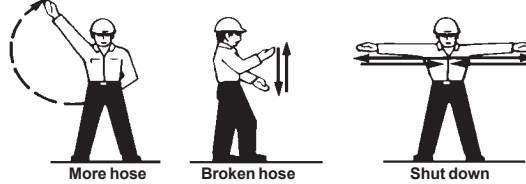
Low



Deliver Water

Increase pressure

Decrease pressure



More hose

Broken hose

Shut down



Roll up hose

Average Perimeter in Chains

Acres	Perimeter	Acres	Perimeter
1	17	100	170
2	24	150	200
3	29	200	240
4	34	300	300
5	38	400	350
7	45	500	375
10	53	600	425
15	65	700	450
20	75	800	475
25	85	900	500
30	90	1,000	525
40	105		
50	120		
75	150		

One chain = 66 feet

Fire Size Class

Class	Size
A	0-1/4 acre
B	1/4 - 10 acres
C	10 - 99 acres
D	100 - 299 acres
E	300 - 999 acres
F	1000 - 4999 acres
G	5000+ acres

Fire Cause Determination Checklist

- Take essential investigation materials to the incident.
- Make notes of all your actions and findings including:
 - Time fire was reported.
 - Name and identification of reporting party.
 - En route observations - people and vehicles.
 - Name and identification of persons or vehicles in vicinity of fire origin.
 - Record the weather.
- Locate and protect fire origin.
- Search fire origin area for physical evidence of fire cause.
- Protect evidence. **Do not remove** unless necessary to prevent destruction.
- Make sketches of origin area with measurements of relative locations of all evidence.
- Take photographs from all angles including long and medium distance, and close-up views of fire origin area and evidence.
- Turn over all notes, information, and physical evidence to the responsible law enforcement representative, or make your notes part of the official fire record.

Media Interviews

- Prepare. Know the facts. Develop 2-3 key messages and deliver them. Prepare responses to potential tough questions. If possible, talk to reporter beforehand to get an idea of subjects, direction and slant of the interview.
- Be concise. Give 10-20 second, simple answers, and when you're done, be quiet. If you botch the answer, simply ask to start again.
- Be honest, personable, professional, presentable (remove sunglasses and hats).
- Look at the reporter, not the camera.
- Ensure media are escorted and wearing PPE when going to the fireline or hazardous sites.
- Ensure local Public Affairs office is aware of media visits.
- NEVER talk "off the record," exaggerate, or try to be cute or funny.
- DON'T guess or speculate or say "no comment." Either explain why you can't answer the question or offer to track down the answer.
- DON'T disagree with the reporter. Instead, tactfully and immediately clarify and correct the information.
- DON'T speak for other agencies or offices; or use jargon or acronyms.

Phonetic Alphabet

	Law Enforcement	International
A	Adam	Alpha
B	Boy	Bravo
C	Charles	Charlie
D	David	Delta
E	Edward	Echo
F	Frank	Foxtrot
G	George	Golf
H	Henry	Hotel
I	Ida	India
J	John	Julliett
K	King	Kilo
L	Lincoln	Lima
M	Mary	Mike
N	Nora	November
O	Ocean	Oscar
P	Paul	Papa
Q	Queen	Quebec
R	Robert	Romeo
S	Sam	Sierra
T	Tom	Tango
U	Union	Uniform
V	Victor	Victor
W	William	Whiskey
X	X-Ray	X-Ray
Y	Young	Yankee
Z	Zebra	Zulu

Standard Tones/Frequencies

TONES		TACTICALS	AIR/ GROUND	
1	110.9		167.95	
2	123.0			
3	131.8			
4	136.5			
5	146.2			
6	156.7			
7	167.9	COMMAND		
8	103.5	FREQUENCY	SIMPLEX	REPEAT
9	100.0	1		
10	107.2	2		
11	114.8	3		
12	127.3			

Local Frequencies

SIMPLEX	REPEAT	TONE

Contact List/Phone Numbers

Position/Name	Agency	Phone#/ Radio Freq.
FIRE/CRASH RESCUE		
Fire Rescue		
MEDICAL		
Ambulance Air Ambulance Hospital Hospital Burn Center Poison Center		
LAW ENFORCEMENT		
Police Police Site Security		
ACCIDENT INVESTIGATION		
24-hr. Reporting Safety Mgr.		

NOTES

NOTES

BRIEFING CHECKLIST

Situation

- Fire name, location, map orientation, other incidents in area
- Terrain influences
- Fuel type and conditions
- Fire weather (previous, current, and expected)
Winds, RH, Temperature, etc.
- Fire behavior (previous, current, and expected)
Time of day, Alignment of slope and wind, etc.

Mission/Execution

- Command
 - Incident Commander/Immediate supervisor
- Leader's intent
 - Overall strategy/objectives
- Specific tactical assignments
- Contingency plans

Communications

- Communication plan
 - Tactical, Command, Air-to-ground frequencies
 - Cell phone numbers
- Medevac plan

Service/Support

- Other resources
 - Working adjacent and those available to order
 - Aviation operations
- Logistics
 - Transportation
 - Supplies and equipment

Risk Management

- Identify known hazards and risks
- Identify control measures to mitigate hazards/reduce risk
- Identify trigger points for re-evaluating operations

Questions or Concerns?

STANDARD FIREFIGHTING ORDERS

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 behavior of the fire.
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.
7. Maintain prompt communications with your forces, your supervisor and adjoining forces.
8. Give clear instructions and insure they are understood.
9. Maintain control of your forces at all times.
10. Fight fire aggressively, having provided for safety first.

WATCH OUT SITUATIONS

1. Fire not scouted and sized up.
2. In country not seen in daylight.
3. Safety zones and escape routes not identified.
4. Unfamiliar with weather and local factors influencing fire behavior.
5. Uninformed on strategy, tactics, and hazards.
6. Instructions and assignments not clear.
7. No communication link with crew members or supervisor.
8. Constructing line without safe anchor point.
9. Building fireline downhill with fire below.
10. Attempting frontal assault on fire.
11. Unburned fuel between you and fire.
12. Cannot see main fire; not in contact with someone who can.
13. On a hillside where rolling material can ignite fuel below.
14. Weather becoming hotter and drier.
15. Wind increases and/or changes direction.
16. Getting frequent spot fires across line.
17. Terrain and fuels make escape to safety zones difficult.
18. Taking a nap near fireline.