

APPENDIX A: GLOSSARY

Absolute humidity - the actual volume, by weight, of water vapor in the air. Equally as important as relative humidity in terms of ecological effects since the actual amount of water vapor in the air does affect intensity. For example, at 50° f and 50% rh there is only a third as much water in the air as 50% rh and 90° f.

Aerial fuels - All live and dead vegetation located in the forest canopy above surface fuels, Including tree branches and crowns, snags, moss, and high brush.

Anthropogenic – caused by humans

Available fuels - Those fuels which will burn during the passage of a flaming front under specific burning and fuel conditions.

Basal area – cross-sectional area of a tree stem (usually at breast height) or of a range plant stem (usually at ground height). Stand basal area is usually expressed as b.a. per unit area (e.g. a basal area of a pine stand expressed as 80/acre = 80 sq.ft. Of pines occupying that acre).

Blackline concept - Fuels that remain between the main fire and a fire line are burned out to assure safety of control forces and security of control lines.

Burning out - intentionally setting fire to fuels inside the control line to strengthen the line. Burning out is almost always done by the crew boss as a part of line construction; the control line is considered incomplete unless there is no fuel between the fire and the line.

Burning period - that part of each 24-hour period when fires will spread most rapidly. Typically, this is from mid-morning to sundown or late afternoon.

Cambium – the layer in plants which gives rise to growth.

Canopy - the stratum containing crowns of tallest vegetation (living or dead) usually including a vertical layer of approximately 20 feet.

Cold front - the leading edge of a relatively cold air mass which displaces warmer air, following a cold front passage westerly winds of '0 to 20 mph, or more, often continue for 12 to 24 hours.

Continuity - the distribution of fuel particles or extent of the fuel bed, thus affecting a fire's ability to sustain combustion and spread. This applies to aerial fuels as well as surface fuels.

Control line - an inclusive term for all constructed or natural fire barriers and treated fire edge used to control a fire.

Control line standards - the depth and width of the area in which fuels must be

treated or removed to control any portion of a wildfire perimeter.

Convection column - the thermally-produced rising column of gases, smoke and particulates.

Creeping - fire burning with a low flame and spreading slowly.

Duff - a mat of partially decomposed organic matter immediately above the mineral soil consisting primarily of fallen foliage, herbaceous vegetation and decaying wood (twigs and small limbs).

Ecotone – the transition zone between two distinctly recognizable plant communities having shared characteristics to varying degrees rather than a sharp demarcation.

Evapotranspiration – the combined moisture transferred into the atmosphere by evaporation via heating and transpiration by plants.

Fine fuel moisture - the moisture content of fuels which have a tlmelag constant of one hour or less.

Fine fuels - fuels such as grass, leaves, draped pine needles, fern, tree moss, and some kinds of slash which, when dry, ignite readily and are consumed rapidly. Also called flash fuels.

Fire duration – the length of time that combustion occurs at a given point. More commonly called residence time.

Fire interval – often noted as fire return interval. The period between recurring fires that is necessary to maintain a given fire dependent ecosystem. It is fire frequency (return) and depth to water table that govern the type of ecosystem which will occupy an area.

Fire perimeter - the outer edge or boundary of a fire.

Fire shadow – an aspect created by topographic features in relation to prevailing wind driven direction of fires. You can expect wetlands and non-combustible vegetation to favor development of vegetation, either different or different in aspect, on the leeward side of the prevailing wind in relation to a wetland, river, hammock or other fire redirecting/blocking feature.

Firebrand - any source of heat, natural or manmade, which is capable of igniting wildland fires.

Firebreak - a natural or constructed barrier utilized to stop fires. These areas often require additional work to form an effective control line.

Fireline - the part of a control line that is scraped or dug to mineral soil, sometimes called fire trail.

Flanks of a fire - the parts of a fire's perimeter that are roughly parallel to the main direction of spread.

Flash fuels - fuels such as grass, leaves, draped pine needles, fern, tree moss, and some kinds of slash that ignite readily and are consumed rapidly when dry.

Forb – a soft tissue plant other than a grass.

Fuelbreak. A wide strip or block of land on which the native vegetation has been permanently modified so that fires burning into it can be readily extinguished. It may or may not have fire lines constructed prior to fire occurrence.

Fuel loading - the oven dry weight of all existing fuels in a given area. Loading is further described by fuel size (timelag categories, etc.). Loading is often expressed in tons/acre.

Fuel moisture content - is the quantity of moisture in the fuel expressed as a percent of the oven-dry weight.

Fuel type - an identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread and behavior under specified weather conditions.

General winds - large scale winds caused by high and low pressure systems but generally influenced and modified in the lower atmosphere by terrain.

Ground fire - fire that consumes the organic material beneath the surface litter of the forest floor, such as peat fire.

Ground fuels - all combustible materials lying beneath the ground surface including deep duff, roots, rotten buried logs, peat and other woody fuels.

Head of a fire - the most rapidly spreading portion of a fire's perimeter, usually on the downwind or upslope side of the fire.

Heat transfer - the exchange of heat by radiation, conduction, or convection.

Heavy fuels - fuels of large diameter such as snags, logs, and large limbs which ignite and are consumed more slowly than flash fuels. Sometimes called coarse fuels.

Horizontal continuity - the extent or horizontal distribution of fuels at various levels or planes.

Indirect effects – alteration of habitat or other changes brought about by a fire that may impact plants or animals indirectly (e.g. loss of cover or higher soil moisture losses owing to darker, more heat conductive burned area).

Infiltration – the ease with which water can pass between soil particles.

Intensity – a general term relating to the heat energy released in a fire. Intensity should not be equated with severity as a high intensity fire can be low severity and conversely, a low intensity fire can have severe ecological effects.

Ladder fuels - fuels which provide vertical continuity between strata. Fire is able to travel from the ground through the mid story and burn crown fuels with relative ease when ladder fuels are abundant.

Lignotuber – a woody storage structure forming a swelling, more or less at ground level, from which dormant buds can develop. Most of our woody plants in fire dependent systems will develop lignotubers in the absence of fire or too infrequent fire.

Mesic – moderately moist, neither wet nor dry consistently.

Mineral soil – soil beneath the litter layer or organic veneer. Soil lacking organics so not at all combustible.

Percolation – the rate at which water will pass through the soil; the actual movement of water through the soil.

Ph – logarithmic scale used to express acidity or alkalinity. Values less than 7 are acidic; greater than 7 are alkaline. Ph of soil controls what will grow there and fire can, in the short term, elevate ph.

Phenology – plant response to climate/weather; usually refers to blooming period.

Pyrogenicity - the ease with which a plant or cast off portions of a plant (e.g. pine needles) will ignite and support fire. Many plants have volatile oils and resins as well as structural features that encourage ready ignition and continued combustion while others may have non-conductive tissue, waxy coverings or leathery leaves that retard ready ignition.

Rate of spread – the activity of a fire in extending its horizontal dimensions. Often described in chains per hour or acres per hour for a specific time period in the fire's history. Eighty chains per hour = 1 mph. A block of land 10 chains x 10 chains = 10 acres.

Relative humidity - the ratio of the actual amount of moisture in the air to the amount of moisture which the air could hold at saturation (100%rh). Usually expressed as a percent.

Residence time – the time period during which a heat pulse is affecting a given area and plant tissues. This is the most important factor in achieving desired effects as well as the cause of negative impacts. Residence time is controlled by knowing the rate of spread of fire under various weather and soil/duff moisture conditions.

Running – a term used to describe a rapidly spreading fire with a well defined head.

Senescent – old and nearing its expected lifespan. Many grasses become prematurely senescent owing to too infrequent fire then, when burned in such a weakened state, may suffer high mortality or become f weaker and unable to regenerate.

Serotiny – persistent fruit/seed capsules that do not open and release seeds unless some stress induces release. In the case of pines, both pond pine and sand pine require the heat of a fire to melt the resins on cones and release seeds.

Severity – degree to which a site has been altered or disrupted by fire; also used to describe the product of fire intensity and residence time.

Slash - debris left after logging, pruning, thinning, or brush cutting; also debris resulting from wind, fire or other natural events. It includes logs, chunks, bark, branches, stumps, and broken understory vegetation.

Snag - a standing dead tree or part of a dead tree from which the leaves and smaller branches have fallen. Sometimes called a stub when the height is less than 20 feet.

Surface fuels – All material lying on or immediately above the ground including needles or leaves, grass, small dead wood, downed logs, stumps, large limbs, low brush, and reproductive parts.

Timelag – an expression of the rate at which a given fuel approaches its equilibrium moisture content. Typical ‘classes’ include one hour, ten hour, 100 hour and 1,000 hour fuels.

Top-kill – killing of aboveground tissues of plants without killing underground parts from which the plants can produce new stems and leaves.

Transpiration – the passage of water from foliage into the air in the form of water vapor.

Vertical arrangement - the relative heights of fuels above the ground and their vertical continuity. Vertical arrangement determines how different vegetation levels or strata interact during a fire under given environmental conditions. Common fuel strata include ground, surface, mid story and crown.

Wildfire – (1) a fire requiring suppression action, as contrasted with a prescribed fire burning with prepared lines, within a designated area under predetermined conditions. (2) a free burning fire, unaffected by fire suppression action.

Xeric – having very little moisture; tolerant of, or adapted to, dry conditions.

APPENDIX B: WEB SITES AND CONTACTS

Web Sites

Training:

FFS: <http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Education/For-the-Community/Withlacoochee-Training-Center-WTC>
US Forest Service: <http://gacc.nifc.gov/sacc/administrative/training/training.htm>
National Training Net: <http://www.nationalfiretraining.net/>
National Park Service: <http://www.nps.gov/fire/wildland-fire/workforce-development/training.cfm>
US Fish and Wildlife: <http://www.fws.gov/southeastfire/>

Educational:

Florida Publications: <http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Forests-Wildfire-Publications>
USFS Publications: <http://www.treesearch.fs.fed.us/pubs/>
National Interagency Fire Center: <http://www.nifc.gov/>
National Wildfire Coordinating Group: <http://www.nwcg.gov/>

Weather:

FAWN: <http://fawn.ifas.ufl.edu/>
MesoWest (Improved ROMAN): <http://mesowest.utah.edu/index.html>
RAWS Archive: <http://www.wrcc.dri.edu/wraws/>
FFS Fire Weather: http://www.floridaforestservice.com/fire_weather/index.html
FFF Spot Forecast <http://flash.floridaforestservice.com/spot-weather/spot-weather.shtml>
National Weather Service (general): <http://www.weather.gov/>
National Weather Service (fire): <http://radar.srh.noaa.gov/fire/>
National Hurricane Center: <http://www.nhc.noaa.gov/>

Tools:

FFS Smoke Screening Tool: http://tlhfor013.doacs.state.fl.us/fmis_sst/
Simple Smoke Screen Tool: <http://shrmc.ggy.uga.edu/maps/screen.html>
Behave Plus: <http://www.fire.org>
Live Fuel Moisture: <http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Wildfire/Resources/Live-Fuel-Moisture-Collections>

General Information:

Southern Fire Exchange Resource Center: <http://www.southernfireexchange.org/>
Fire Mapping System: <http://tlhfor013.doacs.state.fl.us/fmisdataviewer/>
Fire Risk Assessment: <http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Wildfire/Resources/Fire-Tools-and-Downloads/Florida-s-Wildland-Fire-Risk-Assessment-System-FRAS>
Firewise Org: <http://www.firewise.org/>
Good Fires Org: <http://www.goodfires.org/>

FLORIDA FOREST SERVICE DISTRICT OFFICES

Blackwater Forestry Center; **Escambia, Santa Rosa, and Okaloosa Counties**
11650 Munson Highway
Milton, FL 32570
Telephone: 850/957-6140 Fax: 850/957-6143

Chipola Forestry Center; **Bay, Calhoun, Gulf, Holmes, Jackson, Walton, and Washington Counties**
715 West 15 Street
Panama City, FL 32401
Telephone: 850/872-4175 Fax: 850/872-4879

Tallahassee Forestry Center; **Leon, Jefferson, Wakulla, Gadsden, Liberty and Franklin Counties**
865 Geddie Road
Tallahassee, FL 32304
Telephone: 850/681-5950 Fax: 850/681-5975

Perry District Office; **Dixie, Lafayette, Madison and Taylor Counties**
618 Plantation Road
Perry, FL 32348
Telephone: 850/838-2299 Fax: 850/838-2284

Suwannee Forestry Center; **Baker, Columbia, Suwannee, Hamilton, Bradford and Union Counties**
137 SE Forestry Circle
Lake City, FL 32055
Telephone: 386/758-5700 Fax: 386/758-5725

Jacksonville District; **Clay, Duval, and Nassau Counties**
Big 7247 Big Oaks Road
Bryceville, FL 32009
Telephone: 904/ 266-5001 FAX: 904/ 266-5018

Waccasassa Forestry Center; **Alachua, Putnam, Gilchrist, Marion and Levy Counties**
5353 N.E. 39th Ave
Gainesville, FL 32609
Telephone: 352/955-2005 Fax: 352/955-2125

Bunnell District; **Flagler, St. Johns and Volusia Counties**
5001 US Highway 1, North
Bunnell, FL 32110
Telephone: 386/446-6785 Fax: 386/446-6789

Withlacoochee Forestry Center; **Citrus, Hernando, Lake, Pasco, and Sumter Counties**
15019 Broad Street
Brooksville, FL 34601-4201
Telephone: 352/797-4110 Fax: 352/797-4103

Orlando District; **Seminole, Orange, Osceola and Brevard Counties**
8431 S. Orange Blossom Trail

Orlando, Florida 32809
Telephone: 407/856-6512 Fax: 407/856-6514

Lakeland District; **Polk, Hillsborough, and Pinellas Counties**
5745 S. Florida Ave.
Lakeland, FL 33813
Telephone: 863/648-3163 Fax: 863/648-3169

Myakka River. District; **Manatee, Desoto, Hardee, Sarasota and Charlotte Counties**
4723 53rd Ave., E.
Bradenton, FL 34203
Telephone: 941/ 751-7627 Fax: 941/751-7631

Okeechobee District; **Okeechobee, St. Lucie, Martin, Highlands, Indian River, and Glades Counties**
5200 Hwy. 441 North
Okeechobee, FL 34972-8697
Telephone: 863/462-5160 Fax: 863/462-5162

Caloosahatchee Forestry Center; **Lee, Collier, and Hendry Counties**
10941 Palm Beach Blvd.
Ft. Myers, FL 33905
Telephone: 239/690-3500 Fax: 239/690-3504

Everglades District; **Palm Beach, Broward, Miami-Dade, and Monroe Counties**
3315 S.W. College Ave.
Davie, FL 33314
Telephone: 954/475-4120 Fax: 954/475-4126

APPENDIX C

Planning for Initial Attack



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Planning for INITIAL ATTACK

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Comments regarding the content of this publication should be directed to: National Interagency Fire Center, BLM National Fire & Aviation Training Support Group, 3833 South Development Avenue, Boise, Idaho 83705.
email: nwcg_standards@nifc.blm.gov

Additional copies of this publication may be ordered from: National Interagency Fire Center, ATTN: Great Basin Cache Supply Office, 3833 S. Development Avenue, Boise, Idaho 83705. Order NFES # 1515.

Preface

Definition of Initial Attack

Initial attack is the action taken by resources which are first to arrive at an incident. All wildland fires that are controlled by suppression forces undergo initial attack. The number and type of resources responding to initial attack varies depending upon fire danger, fuel type, values at risk and other factors. Generally, initial attack involves relatively few resources, and incident size is small.

Characteristics of an Initial Attack Incident

✓Resources vary from a single resource to several single resources, possibly a single task force or strike team.

✓Normally limited to one operational period - at least the contain phase. Mop up may extend into multiple periods.

✓Normally does not require a written incident action plan.

✓The initial attack incident commander is normally the most experienced firefighter on the scene and is responsible for performing all command and general staff functions.

This publication is designed to give the Initial Attack Incident Commander a *checklist for gathering information and making correct decisions* from the time the fire is reported until the first crew goes to work. This involves **planning for initial attack**: knowing the environmental factors affecting a wildland fire, knowing the local area, and knowing the resources available for dispatch. Planning for initial attack will allow sizeup and tactical decisions to be efficiently, effectively and safely. This publication does not teach strategies and tactics.

a "chain" or another specific length of fireline with your crew and equipment. If not, make some dry runs in different fuel and terrain situations and determine average time needed.

Check the readiness of equipment. Be sure that everything is operating satisfactorily. Is there sufficient fuel, water, etc.? How about radio, personal protective equipment? Are personnel trained? *Double check!* Don't wait until the fire is reported.

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The Fire Day

10:00--18:00-- Fire burns intensely, difficult to control (hottest part of the day)

18:00--04:00--Fire slows down gradually, becomes easier to control (night)

04:00--06:00--Fire at its lowest intensity; easy to control (coolest)

06:00--10:00--fire speeds up, becomes more difficult to control (temperature rising)

✓ Fuels

FUEL TYPE: An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of spread or resistance to control under specified weather conditions.

FUEL TYPE CLASSIFICATION: Division of wildland areas into fire hazard classes.

FLASH FUELS: Fuels such as grass, leaves, draped pine needles, fern, tree moss and some kinds of slash, which ignite readily and are consumed rapidly when dry.

Know the areas that have excessive buildup of fuels. Remember that these fuels will burn hotter than other fuels.

- ▶ heavy fuel: the more fuel burning, the hotter the fire will burn.
- ▶ dry fuel
- ▶ flashy fuel
- ▶ draped fuel
- ▶ aerial fuel
- ▶ certain fuel types burn hotter because of their flammable oils.
- ▶ size and arrangement of fuels affect fire behavior.

✓ Weather

Unlike fuel and topography, weather changes by the minute and these changes directly affect the behavior of the fire. Know what it was yesterday and what is forecast for today. The higher the danger rating, the more important weather factors are in tactical decisions. Consider the latest weather information. The more important weather factors are wind speed and direction, temperature, drought situations, and fuel moisture.

- ▶ fast winds: the faster the wind, the faster the fire spreads.
- ▶ high temperatures: warm air absorbs more moisture, dries and preheats fuels.
- ▶ drier air: cause the fuel to dry out quicker and the fire

to burn hotter because more of the fuel is burning.

- ▶ drought conditions: prolonged dry out spells can create extreme fire danger.
- ▶ unstable atmosphere: indicators are gusty wind, dust devils, good visibility.
- ▶ Wind:
 - ✓ causes a fire to spread fast & unevenly, and to burn more intensely
 - ✓ dries out damp fuel
 - ✓ carries sparks that start spot fires

✓ Topography

Know the "lay of the land." Know the location of steep slopes, ridges, swamps, and creeks that will affect the behavior of the fire, as well as suppression tactics.

Know where fire barriers are located. Know effective places to establish control lines.

Factors that cause a fire to burn "hotter" or "faster":

- steep slopes
- south and southwest facing slopes: aspect
- gaps or saddles
- chimneys, canyons, coves
- fire burns more rapidly uphill than down: preheats fuel in its path more quickly.
- burning chunks roll downhill starting new fires.
- the steeper the slope, the faster the fire spreads uphill.
- a change in the topography causes a change in the behavior of the fire.

□ Fire Control Strategies

ANCHOR POINT: An advantageous location, usually a barrier to fire spread, from which to start constructing a fireline. The anchor point is used to minimize the chance of being flanked by the fire while the line is being constructed.

The strategy(s) used to control a fire depends on the rate of spread, intensity, spotting potential, values at risk, size, type of available resources, and other factors. Anchor control lines to an existing barrier such as a road, creek, burned area, etc. to minimize the chance of being flanked by the fire. Attack may involve one or more of the following strategies:

✓ Direct Attack

DIRECT ATTACK: Any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or by physically separating the burning from unburned fuel.

Control efforts, including line construction, are conducted at the fire perimeter, which becomes the control line. The burned area is kept to a minimum.

✓ Used when fire perimeter is burning at low intensity and fuels are light, permitting safe operation at the fire edge.

✓ Often used where high value resources or improvements are threatened.

✓ Where possible, keep one foot in the black.

✓ An anchor point is required.

✓ Exceptions to attacking the head:

- Fire intensity is such that work at the head of the fire is unsafe.

- Fire is burning toward a natural barrier that will check the spread.
- A high value resource must be protected along another portion of the fire perimeter.
- The fire is likely to burn into volatile fuels along another area of the fire perimeter that will result in an increased rate of spread.

✓ Indirect Attack

INDIRECT ATTACK: A method of suppression in which the control line is located some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks or fuelbreaks and favorable breaks in the topography. The intervening fuel is usually backfired; but occasionally the main fire is allowed to burn to the line, depending on conditions.

Control line is located along natural firebreaks, favorable breaks in topography, or at considerable distance from the fire. The intervening fuel is burned out.

If indirect attack is necessary, the fire may be moving rapidly to extended attack. Be alert to this possibility.

Applications include fast moving ground fires too intense for crew, crown fires, steep terrain, or areas with pre-planned or natural barriers.

✓ Flanking Attack

FLANKING FIRE SUPPRESSION: Attacking a fire by working along the flanks either simultaneously or successively from a less active or anchor point and endeavoring to connect two lines at the head.

FLANKS OF A FIRE: The parts of a fire's perimeter that are roughly parallel to the main direction of spread.

BURN OUT: Setting fire inside a control line to consume fuel between the edge of the fire and the control line.

This method is used for moderately intense fires moving at a moderate rate of spread.

A flanking action should always be preferred, especially when the fire is in light, uniform fuel. If you can see the entire fire and if there is an obvious place to stop the head, a quick sizeup and analysis of a few seconds to a minute is all that's needed. You are ready to make initial attack.

A flanking action must be used on a fast moving fire, particularly when you haven't seen all of the fire and you don't know what's in its path. Your first sizeup in this case should be just enough to give you enough information to report the situation and determine what additional forces are needed. Then you should make a more complete sizeup and analysis of the situation after requesting the help needed by scouting the fire to determine the rate of spread, control time and forces needed, and location of the control line.

✓ May be *either direct or indirect* and the distance the control line is from the fire edge usually is dependent on fire intensity.

✓ The strip of unburned fuel between the line and fire edge is burned out as soon as possible during fireline construction.

□ Fire Control Tactics

TACTICS: Deploying and directing resources on an incident to accomplish the objectives designated by strategy.

✓ Principles of Fireline Location

CONTROL LINE: An inclusive term for all constructed or natural barriers and treated fire edges used to control a fire.

FIRELINE: The part of a control line that is scraped or dug to mineral soil. Also called fire trail.

DOZER LINE: Fireline constructed by the front blade of a dozer.

PLOW LINE: Fireline constructed by a fire plow, usually drawn by a tractor or other motorized equipment.

SCRATCH LINE: An unfinished preliminary control line hastily established or constructed as an emergency measure to check the spread of fire.

SECONDARY LINE: Any fireline constructed at a distance from the fire perimeter concurrently with or after a line already constructed on or near to the perimeter of the fire. Generally constructed as an insurance measure in case the fire escapes control by the primary line.

FUELBREAK: A natural or manmade change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled.

FUELBREAK SYSTEM: A series of modified strips or blocks tied together to form continuous strategically located fuel breaks around land units.

HAZARD: A fuel complex defined by kind, arrangement, volume, condition, and location that forms a special threat of ignition and resistance to control.

HAZARD REDUCTION: Any treatment of living and dead fuels that reduces the threat of ignition and spread of fire.

HEAD OF A FIRE: The most rapidly spreading portion of a fire's perimeter, usually to the leeward or up slope.

TRENCH: A small ditch often constructed below a fire on sloping ground (undercut or underslung line) to catch rolling material.

UNDERCUT LINE: A fireline below a fire on a slope. Should be trenched to catch rolling material. Also called underslung line.

Locate line, after consideration of the following:

- Provide for safety of personnel.
- Locate line adequate distance from fire so it can be completed, burned out and held with predicted rate of spread and fire behavior.
- Allow adequate time to permit forces to build lines and also do other needed work, such as snag falling and burning out, in advance of severe burning conditions.
- Make line as short and straight as practical. Use topography to your advantage.
- Use easiest routes for control without sacrificing: Holding practicability.
Too much area or resource value.
- Eliminate possible hazards from fire area and provide adequate safe distance between lines and hazards that must be left in the fire area.
- Avoid undercut lines and sharp turns in the line.
- Use existing natural and person-made barriers.
- Use heavy equipment, where appropriate, for line construction.
- Encircle area where spot fires are so numerous that they are impractical to handle as individual fires.
- Burn out unburned fuels.
- Consider environmental effects and agency policy.
- Refer to Downhill/Indirect Line Construction Guidelines.

✓ Principles of Line Construction

FIRE EDGE: The boundary of a fire at a given moment.

- Make line no wider than necessary, consider height of vegetation.
- Clean all lines to mineral soil, where practical.
- Discard unburned line construction material outside of the fireline.
- Scatter charred or burning material inside burned area.
- Construct trenched lines on steep slopes to catch rolling material below the fire.
- Increase effectiveness of line width by cooling down adjacent fire with dirt or water.
- Cover uncharred, rotten logs and stumps just outside the line with dirt or wet down.
- Fall or line snags near line before burnout, if time permits.
- Build fireline as close to fire edges as conditions safely permit. Burn out fireline as control line proceeds.
- Keep one foot in the black, where possible.

✓ Downhill/Indirect Line Construction Guidelines

Downhill/Indirect line construction in steep terrain and fast burning fuels should be done with extreme caution. Direct attack methods should be used whenever possible. The following guidelines should be followed:

- The decision is made by a qualified supervisor after evaluating the situation.
- Downhill line construction should not be attempted when fire is present directly below the proposed anchor point.
- The fireline should not lie in or adjacent to a chimney or chute that could burn out while crew is in area.
- Communication is established between the crew working downhill and crews working toward them from below. When neither crew can adequately

observe the fire, communications will be established between the crews, supervising overhead, and a lookout posted where the fire can be seen.

- The crew must be able to rapidly reach a safety zone from any point along the line if the fire unexpectedly crosses below them.
- A downhill line should be securely anchored at the top. Avoid underslung line if at all possible.
- Line firing should be done as the line progresses, beginning from the anchor point at the top. Go as fast as is safe. The burned out area provides a continuous safety zone for the crew and reduces the likelihood of fire crossing the line.
- Be aware of and avoid the: "WATCHOUT SITUATIONS."
- Maintain full compliance with "THE STANDARD FIRE ORDERS."

✓ Principles of Dozer and Tractor Plow Use

DOZER: Any tracked vehicle with a front mounted blade used for exposing mineral soil.

TRACTOR PLOW: Any tractor with a plow for constructing fireline by exposing mineral soil. Also as a resource for typing purposes, a tractor plow includes the transportation and personnel for its operation.

EQUIPMENT OPERATORS SHALL BE EQUIPPED WITH PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Allow no one, other than the operator, to ride on equipment.
- Assure that all personnel are aware of location of working equipment.
- Be certain all dozers or tractors used are in good mechanical condition, have approved spark arresters, have safety canopy, have a clean belly pan and have been signed up under rental agreement, if required.

- Insure equipment operators have required communications with incident.
- Take advantage of favorable fuels and topography.
- Consider working equipment in tandem especially when working near a fast moving fire for increased production and safety.
- Buck logs and fall trees or snags in fireline as needed.
- Push flammable material to outside of line.
- Burning material should be pushed well inside the fireline and scattered.
- During mop-up:
Rehab Lines - water bar where necessary.
Scatter large logs or hot piles into burned area.
Scatter piles on outside of line.

✓ Principles of Water Use

- Use water sparingly when it is in short supply.
- Direct water at base of flame.
- Have hand tool personnel work with nozzle personnel to make most effective use of water, especially during mop-up.
- Require good communications between nozzle personnel and water source.
- Plan for ample water supply--request water tenders as needed.
- Coordinate so all units do not run out of water at once during critical period.
- Do not block roads.
- Keep engines pointed in a direction for quick escape.
- After direct attack with water, follow up with a fireline to mineral soil around the entire fire.
- Provide eye protection to the nozzle operator.
- Use foam or other water additives to increase

effectiveness and save water.

✓ Principles of Aerial Retardant Application

- Determine tactics (direct/indirect) and strategy 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.
- Drop downhill and down-sun when feasible.
- Drop into wind for best accuracy.
- Maintain effective communication between the ground and the air.
- Use direct attack only when ground support is available.
- Plan drops so that they can be extended or intersected effectively.
- Honestly evaluate and monitor retardant effectiveness and adjust its use accordingly.

✓ Principles of Foam Use

FOAM: The aerated solution created by forcing air into, or entraining air in water containing a foam concentrate by means of suitably designed equipment or by cascading it through the air at a high velocity. Foam reduces combustion by cooling, moistening and excluding oxygen.

The addition of Class-A foam concentrate to water enhances water's natural ability to extinguish fires burning in Class-A combustibles only. Generally speaking, Class-A foams can be safely used on combustibles that leave an ember when consumed by fire. Class-A foams work by cooling combustibles below ignition temperature.

Class-A foams reduce the surface tension of plain water which provides for deeper penetration into fuels.

Mixture rates for Class-A foam may vary depending on the application from .1% to 1%.

Class-A foams can be generated in dry or wet consistencies depending on the mixture rates and degree of aeration.

Class-A foams may be introduced into water streams by any of the following methods:

- Batch mixing directly into a water tank or water supply.
- Through the discharge/intake side of the pump proportioning utilizing the Venturi principle.
- Positive pressurization which injects foam into the water stream.

Class A foams are subjected to tests for approval of acceptable corrosion levels and to establish toxicity levels.

Only approved foams should be used.

✓ Burning Out

BURN OUT: Setting fire inside a control line to consume fuel between the edge of the fire and the control line.

(Create a black line.) Burning out removes the danger of fuel near the line burning at a later date when no one is around or when conditions are such that flare-ups near the line would spot across the line.

✓ Helicopter Use

Helicopters may be the first unit to arrive at the fire. They are often used to drop water, foam, or fire retardants. The initial attack incident commander should integrate this resource into the control action.

Helicopters may be used for reconnaissance work.

Helicopters may be used to transport equipment, supplies or personnel.

✓ Principles of Mop-Up

MOP-UP: Extinguishing or removing burning material near control lines, felling snags, and trenching logs to prevent rolling after an area has burned, to make a fire safe, or to reduce residual smoke.

COLD TRAILING: A method of controlling a partly dead fire edge by carefully inspecting and feeling with the hand for heat to detect any fire, digging out every live spot, and trenching any live edge.

- Start mop-up as soon as line construction and burnout are complete.
- Mop-up most threatening situations first.
- Allow fuel to burn up if it will do so promptly and safely.
- Mop-up entire area, if practical, on small fires.
- Mop-up on large fires far enough inside the fireline to be sure that no fire can blow out, spot, or burning materials roll over the fireline under the anticipated worst possible conditions.
- Fell only those snags which could result in spotting or fire spread across the line.
- Search for smoldering spot fires.
- Consider potential for problems from snags, punky logs, and fuel concentrations outside the control line.
- Search for and dig out burning fuels to reduce heat and danger of spotting.
- Trench below, block, or turn heavy logs, stumps, or material so they cannot roll.
- Cold trailing: Feel with the back of your hands for possible smoldering spots close to the line (use care, go slow).
- Use water in conjunction with hand tools. Use water sparingly, but use enough to do the job. Match the

amount of water to the job.

- When using water to mop up deep-burning fuels such as peat, duff, or needles, scrape or stir the fuel while applying water.
- Adding wetting agents or foam to water will greatly increase effectiveness of water, especially in deep burning fuels.
- In dry mop-up, stir and mix hot embers with dirt.

WHEN FIRE IS REPORTED

DISPATCH: The implementation of a command decision to move a resource or resources from one place to another.

DISPATCHER: A person who receives reports of discovery and status of fires, confirms their locations, takes action promptly to provide people and equipment likely to be needed for control efforts.

DISPATCH CENTER: A facility from which resources are assigned to an incident.

✓ Obtain incident information:

- Person reporting the fire--Dispatcher, "John Citizen, Mill Road, 555-1234"
- Location of fire--"north slope Bald Mountain"
- Best access--"Farm Road off Smith Road"
- Landowner/Jurisdiction-- "Smith", "BLM"
- Size--"about 1 acre"
- Fuel type
- Rate of Spread--"creeping around on the ground"
- Suspected cause--"campers"
- Values to be protected --"neighbor's home within 1/2 mile"
- **Most recent Fire Weather Forecast.** Remember, NOAA weather radio forecasts do not replace a fire weather forecast, only supplement it.
- **Fire Behavior:** Pay particular attention to all fire behavior information, especially predicted fire weather.

✓ Use Maps To:

- Determine and mark the location
- Locate values threatened
- Determine the best route to the fire. **Travel Safely! Don't speed!**

✓ **Advise dispatcher** or home office before leaving for the fire location.

ENROUTE TO THE FIRE

✓ Review Initial Attack Safety Checklist

✓ Consider what you know about the fire area

- Fuels and terrain
- Access
- Barriers to fire spread
- Ownership
- History of fires in the area and cause
- Resources enroute
- Backup forces available
- Weather
- Time of day

✓ Think about Fire Behavior

- Consider fuels, topography and weather
- How will this fire burn compared to others in similar areas?
- Is the fire danger increasing or decreasing?
- Think about recent fire behavior. Considering fuels, terrain, and today's weather, how do you expect this fire to burn compared to recent fires in similar areas?

✓ Look for local current weather indicators.

- Check the wind. Is it faster or slower than forecasted? Is it from the same direction?
- Are there whirlwinds, dust devils, or gusty winds that would indicate possible erratic fire behavior?
- Are unfavorable weather changes imminent?
- What impact are diurnal winds likely to have?
- IF WEATHER CONDITIONS ARE MUCH DIFFERENT FROM PREDICTED, ESPECIALLY WIND SPEED OF MORE THAN 5 MPH OR FROM A DIFFERENT DIRECTION, REQUEST A SPOT WEATHER FORECAST.

APPROACHING THE FIRE SCENE

- ✓ Sight the Smoke Column
 - Check size, height, color, direction and shape (these are indicators of fire behavior.)
 - Verify your expected behavior of fire and resulting smoke column.
 - Inversion: no wind, stable conditions.
 - Small fire, light wind, clear upward motion of air current, neutral conditions.
 - Gusty wind, cumulus clouds, unstable conditions.
- ✓ Use caution in approaching scene.
- ✓ Determine escape routes.
- ✓ Look for alternate access routes.
- ✓ Look for evidence of where and how the fire may have started and protect origin. Watch for people leaving the fire area and write down vehicle license numbers and any other identifying features and information.

ARRIVING AT THE FIRE SCENE

FIRES SHOULD BE FOUGHT AGGRESSIVELY, BUT THE SAFETY AND PROTECTION OF PERSONNEL AND EQUIPMENT MUST BE THE FIRST CONCERN. REMEMBER:

FIRE ORDERS

WATCHOUT SITUATIONS

LCES

- First arrival -- sizeup fire and report to dispatch
- Do not cross the head of the fire unless it can be done safely.
- Vehicles should be parked in a safe, accessible location pointing away from the fire with windows closed, doors unlocked and keys left in the ignition.
- Make sure that all roads are open for traffic.

Step 1: Determine an initial attack plan immediately upon arrival at the fire. This should be done quickly and be based on your *initial sizeup* of the fire. The intent is to get work started in suppressing the fire as soon as possible.

✓ SIZEUP

The first thing to do at the scene of the fire is to *sizeup* or assess the entire situation and determine the best suppression tactics.

View fire from a point where a complete picture of the fire can be obtained. Study the fire's various parts and special problems that may be connected with them. If you cannot see all of the fire or if you don't know what's in its path, travel far enough to find out. On a small, slow moving fire, the entire assessment can be made very quickly while standing at or near the perimeter. On a large, and/or more rapidly spreading fire, a view from a high point or a helicopter may be needed.

1. Estimate probable spread and behavior of fire.

Calculate forward rate of spread. Determine the distance the head of the fire travels in 1 minute and project to control time.

Consider behavior of fire at planned control line: Will it be hotter, spreading faster, etc.?

Determine possible danger spots. Look closely for areas of flashy light fuels, snags, large amounts of fuel, bogs, etc., in general area of control line.

2. Estimate time needed to construct control line.

Length of Control Line

Look at the head of the fire and estimate the length of control line needed to stop forward spread. Be sure to state at a good anchor point and allow enough time and distance from fire.

Type of Control Line

Will the control line need to be doubled? Tripled? Should it be fired out?

Time Needed

Knowing the construction and holding rate of the resources with you, estimate time it will take to complete the type and length of line needed to flank the fire and safely move across head of fire to hold it.

3. Determine location of control line.

Two factors have already been determined: 1) The projected location of the fire's perimeter, 2) The time and resources needed to construct and hold a control line.

Now, allowing some extra distance to take care of unforeseen circumstances, determine the distance from the fire the control line should be and locate on the ground. Avoid large volumes of fuel or other danger spots.

Consider anchor points of easy construction.

• **Factors to consider**

size of fire, location of head
point of origin and cause
time of day
resources in path of fire
topography
available resources, experience of resources
safety-watch for danger areas and evaluate escape routes.
weather
fire behavior—as expected?
fire intensity and rate of spread
fuel type—at location, in proximity
length of fire perimeter

• **Decisions to make**

WHERE to attack the fire: head or flank

HOW to attack fire: direct, indirect

LOCATION of control line

Good anchor points such as roads, burned area, etc.

How will topography affect fire behavior?

LOCATION of escape routes and safety zones.

Special hazards such as burning snags, power lines, etc.

Are there existing barriers that can be used?

TYPE of control line: width, doubled, burnout

RESOURCES needed to construct and hold control line

When will the next units arrive?

Additional resources needed?

Locate and preserve point of origin

Give **STATUS REPORT** to dispatch

Step 2: Brief the crew and begin work. Make sure crew understands their work assignment. PROMPT, DECISIVE ACTION DURING THE EARLY STAGES OF A FIRE OFTEN DETERMINES THE SUCCESS OR FAILURE OF THE INITIAL ATTACK.

When safe, begin the attack at the head of the fire to quickly stop the spread. Establish anchored control line. Exceptions to attacking the head:

- Fire intensity is such that work at the head of the fire is unsafe.
- Fire is burning toward a natural barrier that will check the spread.
- A high value resource must be protected along another portion of the fire perimeter.
- The fire is likely to burn into volatile fuels along another area of the fire perimeter that will result in an increased rate of spread.

Step 3: After resources have been deployed and control action started, continue assessment of the fire, and gather information for determining fire cause.

Step 4: Review Initial Attack Safety Checklist as needed or as conditions change.

INITIAL ATTACK SAFETY CHECK LIST

Review and use the checklist while enroute to the fire, after control action has begun, and whenever there is a change in fireline conditions or predicted conditions.

yes	no	Have you sized up the fire?
yes	no	Do you have a current fire weather forecast for fire location?
yes	no	Is the observed fire weather consistent with the forecast?
yes	no	Can you control the fire with the resources available (on the incident and/or soon to be on the incident) under expected conditions?
yes	no	Have you developed a plan to attack the fire? (Direct or indirect, anchor points, escape routes, head or flank attack, priority areas.) Have you communicated this to all personnel assigned to the incident, including new arrivals?
yes	no	Lookouts in place or you can see all of the fire area?
yes	no	Can you communicate with everyone on the fire and with dispatch?
yes	no	Escape routes and safety zones are established. If you are using the black, is it completely burned and without a reburn potential?
yes	no	Safety and the standard fire orders are being followed?
yes	no	Have you reported the status of the fire to dispatch?
yes	no	Will you control the fire before the next operational period?
yes	no	Do you have a complete list of what resources have been ordered for the fire?
yes	no	If the fire will not be controlled before the next operational period or the size of the organization exceeds the IC's capability to manage, have you informed agency headquarters?

If the answer is NO to any of the above questions, you must take corrective action IMMEDIATELY.

EVALUATE INITIAL ATTACK PLAN

Is the initial attack plan working? If not, why?

Are additional resources needed?

How much time will it take to construct control line?

Will changes in weather, fuel, or topography significantly impact fire behavior prior to control?

Is rate of spread or intensity higher than expected? If so, advise dispatch.

If the initial attack plan is working, continue. If not change it and implement the changes. Inform agency dispatch if fire complexity exceeds your management capability. Ask for help if needed.

REPORTING ON CONDITIONS

At the earliest opportunity, report conditions to the agency dispatch and continue to keep the dispatcher informed of any significant changes and progress on the fire.

Incident Type: vegetation fire, vehicle accident, hazmat incident, etc.

Incident Status: fire behavior: smoldering, creeping, running, spotting, crowning.

Location: Exact. Use landmarks, legal and latitude/longitude.

Jurisdiction: Agency having jurisdiction.

Incident size: actual, potential (how large will/may fire get), rate of spread

Fuel Type

Wind speed and direction

Slope and Aspect

Best Access

Special hazards or concerns

Name of incident and who is IC

Cause (known, suspected)

Values threatened

Anticipated time of control

Weather

Resources on the scene

Additional resource needs

Specialty positions needed

FIRE ORDERS

Fight fire aggressively but provide for safety first.
Initiate all action based on current and expected fire behavior.

Recognize current weather conditions and obtain forecasts.
Ensure instructions are given and understood.

Obtain current information on fire status.

Remain in communication with crew members, your supervisor, and adjoining forces.

Determine safety zones and escape routes.

Establish lookouts in potentially hazardous situations.

Retain control at all times.

Stay alert, keep calm, think clearly, act decisively.

Common Denominators of Fire Behavior on Tragedy Fires

Most incidents happen on the smaller fires or on isolated portions of larger fires.

Most fires are innocent in appearance before unexpected shifts in wind direction and/or speed results in "flare-ups" or "extreme fire behavior." In some cases, tragedies occur in the mop-up stage.

Flare-ups generally occur in deceptively light fuels, such as grass and light brush.

Fires run uphill surprisingly fast in chimneys, gullies, and on steep slopes.

Some suppression tools, such as helicopters or air tankers, can adversely affect fire behavior. The blasts of air from low flying helicopters and air tankers have been known to cause flare-ups.

WATCHOUT 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/supervisor.
8. Constructing fireline without safe anchor point.
9. Building fireline downhill with fire below.
10. Attempting frontal assault on fire.
11. Unburned fuel between you and the fire.
12. Cannot see main fire, not in contact with anyone who can.
13. On a hillside where rolling material can ignite fuel below.
14. Weather is getting 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 the fireline.

LCES Checklist

Briefing

- All personnel need to be informed, updated throughout the operational period.
- preplanned LCES
- adhere to tactical guidelines

Lookouts/Communications

- experienced, competent and trusted individuals?
- Communications
 - radio/frequencies/backups/checkins?
- map/weather kit/watch?
- knowledge of personnel locations?
- established LCES for lookouts: good vantage point and safe location?

Escape Routes

- more than one escape route
- scouted: soils/rocks/steepness/vegetation
- timed: slowest person/fatigue/temperature/time of day
- marked: day or night?
- away from fire head?

Safety Zones

- survivable without a fire shelter
- natural: clean burn/water/rocks
- man-made: constructed sites/roads/clearcuts
- vehicle for escape
- scouted: size and hazards
- close enough considering escape time
 - consider anticipated rate-of-spread
- large enough?
 - consider number of people
 - consider fuels/flame length
- terrain
 - avoid saddle, chutes, box canyons
- avoid hazardous terrain, snags, rolling rocks

Line Scouting

- When scouting or working ahead of a crew in brushy terrain, carry a cutting tool and clear any vegetation which might hamper escape.
- A lookout should be posted to warn of danger when personnel are scouting in unburned areas of dense vegetation.

Thunderstorm Safety

The mature stage of a storm may be marked on the ground by a sudden reversal of wind direction, a noticeable rise in wind speed, and a sharp drop in temperature. Heavy rain, hail, and lightning occur only in the mature stage of a thunderstorm. During a storm:

- Stay out of dry creek beds.
- Do not use radios or telephones.
- Put down all tools and remove caulk boots.
- Sit or lie down if in open country.
- Avoid grouping together.
- Do not handle flammable materials in open containers.
- Stay in your vehicle. Take shelter in vehicles if possible.
- Turn off machinery, electric motors.
- When there is no shelter, avoid high objects such as lone trees. If only isolated trees are nearby, the best protection is to crouch in the open, keep a distance of twice the height of the tree away. Keep away from wire fences, telephone lines, and electrically conductive elevated objects.
- Avoid ridge tops, hilltops, wide-open spaces, ledges, rock outcroppings, exposed shelters.
- Advise crew that if they feel an electrical charge - if their hair stands on end or their skin tingles - lightning may be about to strike. Drop to the ground immediately.

International Phonetic Alphabet

	A - Alpha
	B - Bravo
C	C - Charlie
C	D - Delta
ca	E - Echo
ca	F - Foxtrot
	G - Golf
W	H - Hotel
	I - India
S	J - Juliett (Jooleeyet)
A	K - Kilo (Keelo)
C	L - Lima
	M - Mike
C	N - November
	O - Oscar
D	P - Papa
Pr	Q - Quebec
H	R - Romeo
L	S - Sierra
N	T - Tango
R	U - Uniform
St	V - Victor
U	W - Whiskey
S	X - X-ray
A	Y - Yankee
A	Z - Zulu

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Il. quarters (quarters)	Example: "Engine 7 in quarters, Charlottesville."
In-service	Unit is operating, but not in response to a dispatch.

Off duty (location)	Used to sign off when going off duty and are unavailable for calls.
Out-of-Contact (location)	Indicates unit is still on duty, but out of radio contact at the location specified.
Out-of-Service (location is optional)	Indicates unit is not available due to mechanical problems.
Respond, responding	Used in dispatch - proceed to or proceeding to an incident. EX: "Salem 4, responding to....." or "Salem 4, respond to....."
Return to, returning to	Used to direct units that are available to a station or other location.

INFORMATIONAL:	
Burning Operation (specify if illegal)	Indicates a legal fire unless specified otherwise.
Call _____ by phone.	Self-explanatory
Contact _____ message.	Relay message to person named.
Emergency Traffic	Used to gain control of the radio frequency to report an emergency in progress or a new incident. Used by base.
False Alarm	Self-explanatory
Fire	Fire emergency requiring a response. Specify structure, field, forest, etc.
Fire Under Control	Self-explanatory
Is _____ available for a phone call?	Self-explanatory
Let me talk to _____	Self-explanatory
No smoke or fire	Response to Report of Conditions, if appropriate.
Report on Conditions	Specify location if needed. EX: "Wise 3 to Lee 2, Report on conditions, Jonesville Fire."
Resume normal traffic	Self-explanatory. Used by base.
Signing on, signing off	Self-explanatory. Used by base.
Smoke	Suspected or unconfirmed fire.
Weather	Specify report or forecast.
What is your location?	Self explanatory