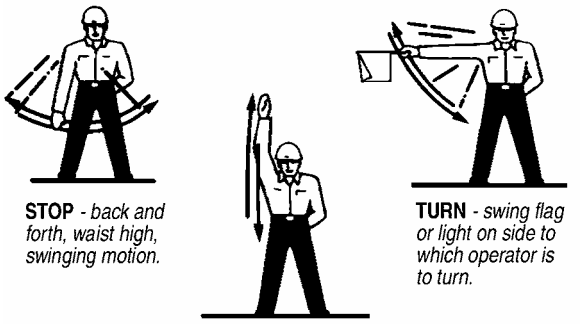
APPENDIX A – GENERAL OPERATIONAL GUIDES

CONTENTS

SAFETY FIRST—NO EXCEPTIONS

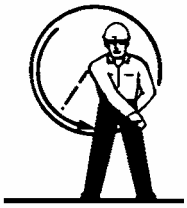
DOZER/TRACTOR HAND SIGNALS



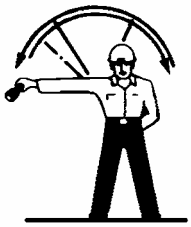
STOP - *back and forth, waist high, swinging motion.*

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

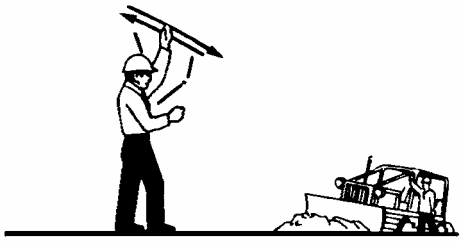
TURN - *swing flag or light on side to which operator is to turn.*



REVERSE or BACK UP - *full circle in front of spotter.*

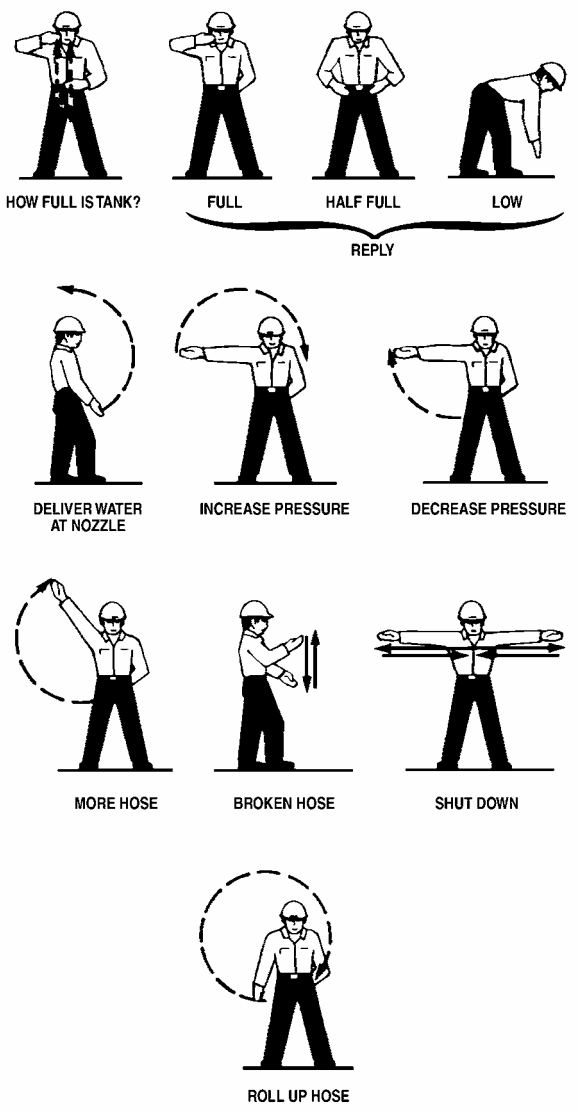


CAUTION - *wave flag or light in half circle at arm's length above head.*



ATTRACT OPERATOR'S ATTENTION - *may also use one blast on a police whistle or suitable substitute.*

WATER USE HAND SIGNALS



HELICOPTER HAND SIGNALS

CLEAR TO START ENGINE *make a circular motion above head with right arm.*

HOLD ON GROUND *extend arms out at 45, thumbs pointing down.*

MOVE UPWARD *arms extended sweeping up.*

MOVE DOWNWARD *arms extended sweeping down.*

HOLD HOVER *arms extended with clenched fists.*

CLEAR TO TAKE OFF *extend both arms above head in direction of takeoff.*

LAND HERE, MY BACK IS INTO THE WIND *extend arms toward landing area with wind at your back.*

MOVE FORWARD *extend arms forward and wave helicopter toward you.*

MOVE REARWARD *arms extended downward using shoving motion.*

MOVE LEFT *right arm horizontal, left arm sweeps over head.*

MOVE RIGHT *left arm horizontal, right arm sweeps over head.*

MOVE TAIL ROTOR *rotate body with one arm extended.*

SHUT OFF ENGINE *cross neck with right hand, palm down.*

FIXED TANK DOORS *open arms outward, close arms inward.*

RELEASE SLING LOAD *contact left forearm with right hand.*

WAVE OFF DO NOT LAND *wave arms from horizontal to crossed overhead.*

HELISPOT LOCATION AND CONSTRUCTION

A helispot is a natural or improved takeoff and landing area intended for temporary or occasional helicopter use. It may or may not have road access.

Points to consider in locating and constructing helispots are:

- Locate on exposed knobs and ridges, allowing takeoff and landing from all directions.

- Choose a spot where a drop-off exists for helicopter takeoffs. The higher the elevation, the more important the drop-off. A helicopter making a vertical takeoff uses more power, must be downloaded, and may not have an adequate margin of safety if power loss or other problems occur during takeoff.

- Locate helispot so takeoffs and landings can be made into the prevailing wind. This becomes more important with higher elevations and little to no drop-off.

- Remove all brush and trees around the landing pad for the minimum distances shown below by helicopter type to accommodate overall length, rotor blade diameter, and safety allowance. Observe local policy regarding environmental impact of cutting trees and vegetation.

  - ✓ Type 3 & 4 - 75 foot diameter.

  - ✓ Type 2 - 90 foot diameter.

- ✓ Type 1 - 110 foot diameter.
- ✓ Clear brush and trees below the landing area level.

- Construct a level touchdown pad to the dimensions and firmness shown below by helicopter type.
  - ✓ Type 3 & 4 - 15'x15' to support 6,000 pounds.
  - ✓ Type 2 - 20'x20' to support 12,500 pounds.
  - ✓ Type 1 - 30'x30' to support 12,500 pounds.

Level or Bottom-Land Locations:

- A vertical takeoff should not be considered safe at any elevation. A helicopter must be at least 300 feet above the ground to auto-rotate or glide back to the ground in the event of power failure.
- Takeoff should be into the prevailing wind.
- A safe takeoff path should be 300 feet long and slightly downhill with room to maneuver when forward flight is gained at end of takeoff path.

Lakes and wide streams:

- Areas adjacent to lakes or streams make a good base of operations for helicopters, but there is still a need for at least 300 feet of clear area over which to gain flying speed and a safe landing pad.

Canyon Bottoms:

- Beware of "dead air" holes.
- Be sure canyon does not have a down draft from a neighboring ridge.
- In deep canyons, a long forward run is needed to climb out of canyon or enough width in the canyon to allow the helicopter to circle safely.

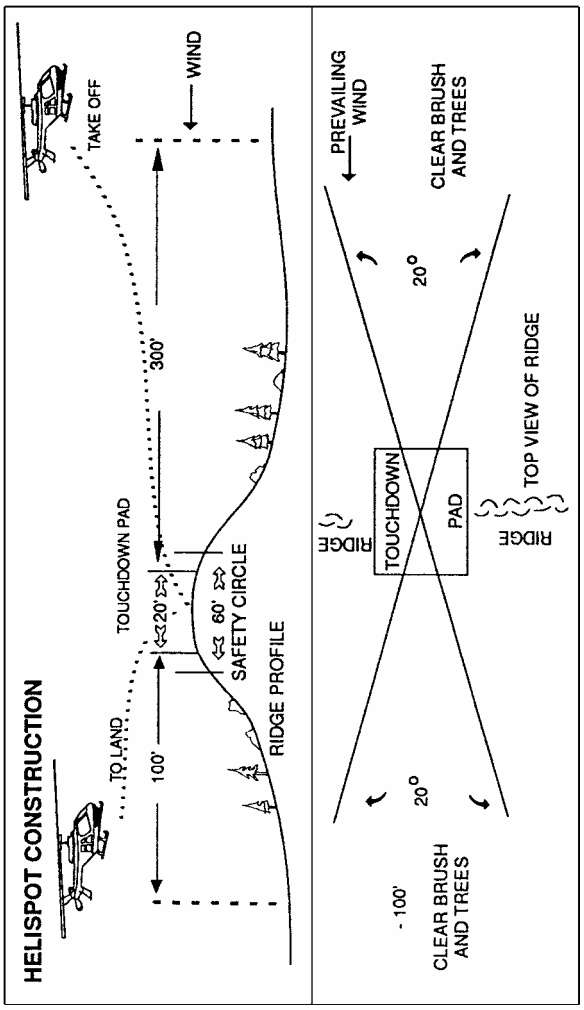
Meadows:

- Beware of meadows with high grass, which tends to dissipate the helicopter ground cushion and hide logs, rocks, or swampy areas. Dry grass can also be a fire hazard.

Roads or Truck Trails:

- Choose turnouts or parking areas that have some drop-off. If no drop-off areas are available, be certain road is long and wide enough for takeoff. When using roads or turnouts ensure adequate traffic control.

HELISPOT CONSTRUCTION DIAGRAM



PORTABLE PUMPS/HYDRAULICS

When considering the use of portable pumps and hose lays during fire suppression activities it is important to size-up the situation and do some hydraulics calculations to determine where and when to use a portable pump. Some items to consider are pump capability needed, adequacy of water source, and the type of hose lay to use.

In determining what pumping capability is needed it is necessary to consider such things as friction loss due to length and size of hose and number of fittings (appliances) used; desired nozzle pressure; number of nozzles; tip size of nozzles; and head pressure.

Formula For Determining Pump Pressure

NOTE: ALL REFERENCES TO PRESSURE (PUMP PRESSURE, NOZZLE PRESSURE, HEAD GAIN OR LOSS, FRICTION LOSS, ETC.) IS POUNDS PER SQUARE INCH (PSI).

PP = (**NP)** + **or - H** + **(FL** + **A)** where:

PP = Pump pressure at the discharge side of pump.

NP = The pressure required at the nozzle for the most efficient operation.

Remember: The larger the nozzle tip the more PP (pump pressure) is needed to maintain a given nozzle pressure.

H = Head. Add (+) if pumping uphill and subtract (-) if pumping downhill.

Remember: One PSI will raise water about 2 feet in elevation. Consequently, for every 2 foot drop in elevation about one PSI will be developed.

FL= Friction Loss

Remember: The smaller the hose the greater the friction loss and the larger the hose the lower the friction loss. For example, a 1" hose has about six times the friction loss as a 1½" hose.

A = Number of appliances used in the hose lay such as in-line T's, gated wyes, etc.

Remember: Each appliance increases the FL (friction loss) by about 5 PSI. DO NOT COUNT THE NOZZLES AS APPLIANCES.

Reminders In Using Portable Pumps And Hose Lays

- A pump can be ruined in minutes if proper operational procedures are not followed.
- Friction loss is greater in smaller hoses than in larger hoses.
- Keep your pump as close to your water source elevation as possible as the maximum vertical suction lift (water source to the pump) for most pumps is 20 feet.
- Protect your pump from drafting sand, silt, or gravel by using a screen protector and putting the suction hose intake in a pail or on a shovel.
- Minimum working nozzle pressure is about 25 PSI, but the recommended minimum is 50 PSI.
- Use a "Check and Bleeder" valve or "Gated Y" valve near the pump on the discharge side when pumping uphill to prevent draining your hose lay by backflow when the pump is not running.

Drafting Guidelines

Maximum attainable	= 29.4 feet
Excellent pump	= 28.0 feet
Good pump	= 26.0 feet
Worn pump at high elevation	= 5.0 feet

Expected Output of Commonly Used Portable Pumps

All calculations were made using 1½" hose, a Forester nozzle with 3/16" tip, and a nozzle pressure of 50 PSI.

Pump Type	Operating PSI	Maximum Lift, Feet
Waterous Floto-Pump	150	200
Mark 3	250	400
Honda WX10*	50	23
Mini Mark	25-30	10

*Note: This pump is currently being tested as of 4/03.

Atmospheric/Barometric Pressure Factors

Atmospheric Pressure at Sea Level	= 14.7 lbs./square inch (Use 15.0)
Atmospheric Pressure Variation Per 1000 Feet of Elevation	= 0.5 lbs./square inch
Barometric Pressure at Sea Level	= 29.92 inches of Hg (Hg is mercury)
One (1) inch of Hg	= 13.5 inches of water = 1.12 feet of water = 0.491 PSI (use 0.5)
One (1) pound of pressure (PSI)	= 2.302 ft. of Water Head (use 2.0 ft.) = 2.04 inches of Hg
One (1) foot of Water Head (Column of Water)	= 0.434 PSI (use 0.5)

Weight/Volume of Water

One (1) cubic foot of water	= 7.481 gallons = 62.4 pounds
One (1) U.S. gallon	= 8.34 pounds = 3.79 Liters = 231 cubic inches

Friction Loss By Hose Size And Type

	Friction Loss in lbs./100 feet of Hose				
	Hose Size (Inside Diameter) and Type				
Flow (GPM)	**5/8" GH**	**3/4" HP**	**1" CJRL**	**1 ½" CJRL**	**1 ½" Linen**
5	22	3			
10	75	13	3		1
15	155	25	6	1	2
20		42	10	1	4
25		62	15	3	6
30		86	20	4	8
40		140	34	6	13
50		215	50	8	20
60			70	11	28
70			90	15	37
80			115	19	47
90			140	23	59
100			170	30	72

Abbreviations are:

GPM = gallons per minute

GH = garden hose

HP = high pressure

CJRL = cotton jacketed, rubber lined

CSRL = cotton-synthetic jacketed, rubber lined

- Friction reducing agents which reduce losses in a given hose diameter and the hose size, weight, and cost while retaining performance are available and under evaluation.

Flow-Discharge of Nozzles In Gallons-Per-Minute (GPM)

Head (PSI)	Head (ft)	Tip Orifice size (inches) and nozzle gun			
		1/8	**3/16**	**1/4**	**3/8**
10	23	2	3	6	13
20	46	2	5	8	19
30	69	3	6	10	23
40	92	3	7	12	27
50	116	3	7	13	30
75	173	4	9	16	36
100	231	5	10	19	42
125	289	5	12	21	47
150	346	6	13	23	52
200	462	7	15	26	60
250	577	7	17	30	66
300	693	8	18	32	73

Pump Pressure For 50 PSI
Nozzle Pressure

1 Inch Hose (CJRL, CSJRL & SJRL)

Length of Hose in Feet	Nozzle Above Pump in Feet	Tip Sizes in Inches				
		1/8	3/16	1/4	5/16	3/8
100	0	51	52	55	62	75
	100	94	95	98	105	118
300	0	52	56	65	86	121
	100	95	99	108	129	164
	200	139	143	152	173	208
500	0	53	60	75	110	167
	100	96	103	118	153	210
	200	140	147	162	197	254
	300	183	190	205	240	297
1,000	0	56	70	110	170	282
	100	99	113	153	213	325
	200	143	157	197	257	369
	300	186	200	240	300	
	400	229	243	283	343	
	500	273	287	327	387	
	600	316	330	370		
Discharge (GPM)		3.00	7.00	12.00	19.00	28.00
PSI Loss/100 ft.		0.30	1.80	4.70	11.0	23.0

Pump Pressure For 50 PSI
Nozzle Pressure

1½ Inch Hose (CJRL, CSJRL & SJRL)

Length of Hose in Feet	Nozzle Above Pump in Feet	Tip Size In Inches				
		1/8	3/16	1/4	5/16	3/8
100	0	51	51	51	52	53
	100	94	94	94	95	96
300	0	51	52	53	56	60
	100	94	95	96	99	103
	200	138	139	140	143	147
500	0	51	53	55	60	66
	100	94	96	98	103	109
	200	138	140	142	147	153
	300	181	183	185	190	196
1000	0	51	55	59	68	82
	200	138	142	146	155	169
	400	224	228	232	241	255
	600	311	315	319	328	342
2000	0	52	59	67	84	114
	200	139	146	155	171	201
	400	225	232	241	257	287
	600	312	319	328	344	374
	800	298	405			
3000	0	53	64	75	100	146
	200	140	151	162	187	283
	400	226	237	248	273	319
	600	313	324	335	360	
	700	356	367	378	403	
Discharge (GPM)		3	7	12	19	28
PSI Loss/100 ft		<0.1	<0.1	0.1	1.5	3.1

Data on 100 Foot Lengths of Uncoupled Hose

Type of Hose	Inside Dia. (in)	Proof Pressure (PSI)	Max Dry Weight (lb)	Water (gal)	Weight Water (lb)	Max Total Wgt. (lb)
Garden hose	5/8	125	28	1.6	13	41
High Pressure	3/4	425	50	2.3	19	69
CJRL	1	300	28	4.1	34	62
CSJRL	1	450	22	4.1	34	56
SJRL	1	450	9	4.1	34	43
Linen, Unlined	1	300	10	4.1	34	44
CJRL	1½	300	33	9.2	77	110
CSJRL	1½	450	26	9.2	77	103
SJRL	1½	450	15	9.2	77	92
Linen, Unlined	1½	300	15	9.2	77	92

Abbreviations used:

CJRL = Cotton Jacketed, Rubber-Lined
CSJRL = Cotton-Synthetic Jacketed, Rubber-Lined
SJRL = Synthetic Jacketed, Rubber-Lined

FOAM USE

Low expansion foams have proven to be valuable in the suppression of fire by increasing the effectiveness of water.

- Foam solution can be used effectively with regular nozzles, but is most effective with air aspirating nozzles or a compressed air foam system (CAFS).

- Foam has the ability to adhere to and cool fuels for a much longer period of time than water.

- Rates of application (including width and depth) depend upon wind, temperature, fuel moisture, and fuel loading.

- In general, enough foam is required to fully coat exposed fuels and to sufficiently raise fuel moistures.

Mixture Rates

- A 0.3 mixture (0.3 gallons of foam concentrate to 100 gallons of water) is the average recommended for most situations regardless of the system being used (compressed air, air aspirating nozzles, or regular nozzles). However, mixture rates may vary from .1 of 1% used during mop up to a full 1% for structure protection.

- Note: More concentrate may be required if the water has a high mineral content, but should never exceed 1%.

Mixture Rated By Application and Type of Equipment			
Application	**Foam to water mixture in %**		
Application	**Compressed Air System**	**Air Aspirating Nozzle**	**Regular Nozzle**
Direct Attack	0.3	0.3-0.5	0.3-0.5
Indirect Attack	0.3	0.3-0.5	0.3-0.5
Mop-up	0.3	0.3-0.5	0.3-0.5
Structures	0.3	0.3-0.5	0.5

Direct Attack

- Place foam directly at the base of the flame.

- Use foam to coat burning materials. Leave a foam blanket over hot fuels to continue wetting the fuels.

- When attacking the fire edge, also apply foam onto adjacent unburned fuels.

Indirect Attack

- Apply the foam directly in advance (within 5 feet) of the person setting the backfire. Some fuels require application about five minutes prior to firing.
- The foam line should be at least two and a half times as wide as the average flame height.
- Coat all sides of fuel when possible.
- The foam line can be reinforced and widened on the up wind side once the original control line has been established and backfiring or burnout has begun.

Mop-Up

- For best penetration, apply foam solution as you would a water stream.
- Use a high-pressure wet water mist to create a frothy foam for close in mop-up. This works extremely well on pitchy or punky material, duff, and litter.
- A mop-up wand is very effective with foam solution for deep-seated fires in stumps, landings, log decks, etc.
- "Forester" nozzles also work well with foam solution in mop-up.

Exposure Protection

- Foam is most effective when applied shortly before heat exposure. Apply enough foam in advance of the fire to allow penetration, yet not so long that the foam evaporates and dissipates. In general, foam applied by a compressed air system will last about one hour and foam applied by an air-aspirated nozzle about 30 minutes in hot weather.

- High quality foaming agents will leave at least ½ inch of foam on all surfaces.

- Make the foam line two and one half times as wide as the flame length when creating a foam line for backfiring or burning out.

- When coating unburned fuels, use a wet foam that will penetrate and soak fuels down to the soil.

- Foam is most effective when applied immediately prior to ignition.

- Coat exposed vertical fuels as high as the system being used will reach.

- Use a foam that clings to a vertical surface when protecting trees, snags, log decks, telephone poles, etc. Sufficient time must be allowed to thoroughly coat these fuels. Apply foam in a radius 2½ times the height of standing objects to be protected.

- Apply foam to the outside walls, eaves, roofs, columns, or other threatened surfaces when protecting structures. Loft foam from a great enough distance to avoid foam breakdown.

Safety

- Maintain communications between the nozzle operator and the engine with radio or hand signals.
- Avoid contact with skin and clothes.
- Gloves and eye protection should be worn.
- If foam or foam solution gets into eyes, irrigate with water immediately.
- Follow the safety guidelines on the foam container.
- The use of Compressed Air Foam Systems (CAFS) requires special training.
- Use caution as any surface covered with foam can be very slippery.

FIRELINE EXPLOSIVES

Advantages:

- Rapid line construction with minimal personnel needs.
- Work well in steep, difficult terrain where fuels are light to moderate.

- Brush and debris is scattered rather than piled next to the line.
- Soil is loosened to facilitate line improvement and hotspotting.
- Line width is easily varied by the number of strands of explosive used.
- Produce a more environmentally acceptable fireline.

Disadvantages:

- Limited availability of trained and experienced personnel.
- Requires that all personnel working on the fire be accounted for and removed from the blasting area.
- Transporting the explosives presents unique problems.
- The need to provide security.
- Are becoming more expensive.

Note: Productivity Comparison Charts for Explosives appear later in this Appendix.

HAZMAT MATERIALS CHECKLIST FOR INCIDENT BASE MANAGEMENT

- Be able to identify what materials may be classed as hazardous.
- Be familiar with transportation and storage of HazMat.
- HazMat storage areas need to be selected and posted clearly in camp settings.
- Know local HazMat contacts and waste disposal sites, etc.
- The Supply Unit Leader needs to know that this position has the responsibility of HazMat while in a camp setting as well as items being demobed.
- It's critical that Supply Unit Leaders are in communication with Cache personnel when ordering and returning hazardous materials. Cache Demob Specialists can be resource ordered or contacted for the proper handling and returning of any hazardous materials.
- The Demob Plan needs to include specific instructions by the Supply Unit Leader for returning all hazardous materials to:
  - Cache(s)
  - Local host agency(s)
  - Local HazMat contractors
  - Hazardous waste disposal site

USE OF INMATE CREWS ON FIRES

Some states have access to inmate labor for fire operations. Situations may arise where inmates are used on fires involving personnel from many agencies.

Although each state has specific rules governing the use of inmates, the following guidelines will apply in most situations. Check with the inmate crew liaison officer, the officer-in-charge, or the appropriate agency representative for more specific information in your area.

- Crews on fireline are supervised by forest crew supervisors, resource boss or higher carded.
- Inmate crews are usually limited to use within the state where they are based although some states have interstate agreements with neighboring states.
- Contact with inmates should be done through the corrections officer-in-charge in camp.
- Contact with inmates should be done through the forest crew supervisor on the fireline.
- Consult the officer-in-charge before giving supervision to crew members over fellow inmates.
- Keep relationships with inmates on a business basis. Do not play cards with, carry messages for, bring gifts to, accept gifts from, make purchases for, etc., the inmates.

- The officer-in-charge or other inmate camp representative may act as liaison with fire overhead on all matters pertaining to inmates (food, bedding areas, etc.).

- The officer-in-charge will remain with the crew while on the fireline. Any fire suppression related problems such as pumps, tools, drinking water and fire equipment, etc., are to be taken care of by the Fire Overhead.

- Inmates should not be used in a "Squad Boss" type position, or given supervision over fellow inmates.

- Inmate crews should be provided a separate sleeping area where they can be away from other crews.

- Provide separate sleep areas for male and female, adult and juvenile crews.

- Interspersing inmate crews with civilian crews on the fireline is generally permitted (but not encouraged) provided the crew supervisor is aware of the situation at all times.

- Intermingling of inmates at the incident base with civilians should only occur at meal times.

- Inmates will be confined to the incident base or camp while off-shift.

- Inmates shall not be allowed to handle explosives and/or detonating devices.

- Civilians and inmates shall have separate schedules for bathing.

PRODUCTION TABLES

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.

Line Production Rates for Initial Action by Hand Crews in Chains per Person per Hour

Fire Behavior Fuel Model		Specific Conditions	Construction Rate in Chains per Person per Hour
1	Short Grass	Grass Tundra	4.0 1.0
2	Open Timber/ Grass Understory	All	3.0
3	Tall Grass	All	0.7
4	Chaparral	Chaparral High Pocosin	0.4 0.7
5	Brush	All	0.7
6	Dormant Brush/ Hardwood Slash	Black Spruce Others	0.7 1.0
7	Southern Rough	All	0.7
8	Closed Timber Litter	Conifers Hardwoods	2.0 10.0
9	Hardwood Litter	Conifers Hardwoods	2.0 8.0
10	Timber (Litter & Understory)	All	1.0
11	Logging Slash, Light	All	1.0
12	Logging Slash, Medium	All	1.0
13	Logging Slash, Heavy	All	0.4

NOTE: These rates are to be used for estimating initial action productivity only. Do not use these rates to estimate sustained line construction, burnout, and holding productivity. Initial action consists of scratch line construction and hotspotting.

Line Production Rates for Initial Action by Engine Crews in Chains per Crew per Hour

Fire Behavior Fuel Model	Specific Conditions	Chains per Crew Hour — Number of Persons in Crew				
		1	**2**	**3**	**4**	**5+**
1 Short Grass	Grass	6	12	24	35	40
	Tundra	2	8	15	24	30
2 Open Timber/ Grass Understory	All	3	7	15	21	25
3 Tall Grass	All	2	5	10	14	16
4 Chaparrel	Chaparrel	2	3	8	15	20
	High Pocosin	2	4	10	15	18
5 Brush (2 ft)	All	3	6	12	16	20
6 Dormant Brush/ Hardwood Slash	Black Spruce	3	6	10	16	20
	Others	3	6	12	16	20
7 Southern Rough	All	2	5	12	16	20
8 Closed Timber Litter	Conifers	3	8	15	20	24
	Hardwoods	10	30	40	50	60
9 Hardwood Litter	Conifers	3	7	12	18	22
	Hardwoods	8	25	40	50	60
10 Timber (Litter & Understory)	All	3	8	12	16	20
11 Logging Slash, Light	All	3	8	12	16	20
12 Logging Slash, Medium	All	3	5	10	16	20
13 Logging Slash, Heavy	All	2	4	8	15	20

NOTE: These rates are to be used for estimating initial action productivity only. Do not use these rates to estimate sustained line construction, burnout, and holding productivity. Initial action may consist of scratch line construction and hotspotting.

Production Rate Comparison Between a 7-Person Fireline Explosives Crew and a 20-Person Hand Crew Over a 10-Hour Shift

Fuel Type	Constructed Fireline in Chains	
	Explosives Crew	Hand Crew
Grass	360	360
Second Growth Conifers	240	180
Light Slash	210	90
Heavy Slash	120	45

Note: This is based upon Washington State Department of Natural Resources experience.

Dozer Fireline Construction Rates (Single Pass) in Chains per Hour

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

Dozer Fireline Construction Rates (Single Pass) in Chains per Hour *(continued)*

Note: Production rates are not precise, but vary with conditions. The higher rate can be used for newer dozers (1975 and later), dozers in excellent operating condition, most qualified operators, temperatures below 90 degrees, moist soil, few or no rocks, no lost time, indirect fireline, average fire behavior, daylight operations, and less resistive vegetative types within each fire behavior model.

Dozer	Horse Power	Examples
Type I	**HEAVY** 200 Minimum Horse Power	D-8H, D-7H, JD-850
Type II	**MEDIUM** 100 Minimum Horse Power	D-5H, JD-650
Type III	**LIGHT** 50 Minimum Horse Power	D-46, JD-550, D-3

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.

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 CREW STANDARDS FOR NATIONAL MOBILIZATION

Minimum Standards	Type 1[1]	Type 2 with IA Capability	Type 2	Type 3
Fireline Capability	Initial attack/ can be broken up into squads, fireline construction, complex firing operations (backfire)	Initial attack/ can be broken up into squads, fireline construction, firing to include burnout	Initial attack, fireline construction, firing to include burnout	Fireline construction, fireline improvement, mop-up and rehab
Crew Size	18-20	18-20	18-20	18-20
Leadership Qualifications	Permanent Supervision Superintendent: TFLD, ICT4 Asst Supt: STCR, ICT4 3 Squad Bosses: CRWB(T), ICT5	CRWB and 3 ICT5	CRWB and 3 FFT1	CRWB & 3 FFT 1
Bilingual Requirement	CRWB and FFT1's must be bilingual (able to read and interpret) in language of crew.	CRWB and FFT1's must be bilingual (able to read and interpret) in language of crew.	CRWB and FFT1's must be bilingual (able to read and interpret) in language of crew.	CRWB and FFT1's must be bilingual (able to read and interpret) in language of crew.
Experience	80% 1 season or more	60% 1 season or more	40% 1 season or more	20% 1 season or more
Full Time Organized Crew	Yes	No	No	No
Communications	5 programmable radios	4 programmable radios	4 programmable radios	4 programmable radios
Sawyers	3 agency qualified	3 agency qualified	0	0

MINIMUM CREW STANDARDS FOR NATIONAL MOBILIZATION (*continued*)

Minimum Standards	Type 1[1]	Type 2 with IA Capability	Type 2	Type 3
Training	80 hours annual training	Basic firefighter training and/or annual firefighter safety refresher	Basic firefighter training and/or annual firefighter safety refresher	Basic firefighter training and/or annual firefighter safety refresher
Fitness	Arduous	Arduous	Arduous	Arduous
Logistics	Self-sufficient	Not self-sufficient	Not self-sufficient	Not self-sufficient
Maximum Weight	5100 lbs	5100 lbs	5100 lbs	5100 lbs
Dispatch Availability	1 hour	Variable	Variable	Variable
Production Factor	1.0	0.8	0.8	N/A
Transportation	Own transportation	Transportation needed	Transportation needed	Transportation needed
Tools & Equipment	Fully equipped	Not equipped	Not equipped	Not equipped
Personal Gear	Arrives with: crew first aid kit, personal first aid kit, headlamp, 1 qt canteen, web gear, sleeping bag	Arrives with: crew first aid kit, personal first aid kit, headlamp, 1 qt canteen, web gear, sleeping bag	Arrives with: crew first aid kit, personal first aid kit, headlamp, 1 qt canteen, web gear, sleeping bag	Arrives with: crew first aid kit, personal first aid kit, headlamp, 1 qt canteen, web gear, sleeping bag

MINIMUM CREW STANDARDS FOR NATIONAL MOBILIZATION (*continued*)

Minimum Standards	Type 1[1]	Type 2 with IA Capability	Type 2	Type 3
PPE	Arrives with: hard hat, fire resistant shirt/ pants, 8″ leather boots, leather gloves, fire shelter, hearing/eye protection	Arrives with: hard hat, fire resistant shirt/ pants, 8″ leather boots, leather gloves, fire shelter, hearing/eye protection	Arrives with: hard hat, fire resistant shirt/ pants, 8″ leather boots, leather gloves, fire shelter, hearing/eye protection	Arrives with: hard hat, fire resistant shirt/pants, 8″ leather boots, leather gloves, fire shelter, hearing/eye protection

[1] Interagency Hotshot Crews (IHC) are a Type 1 crew that exceeds the Type 1 Standards as required by the National IHC Operations Guide (2001) in the following categories:

- Permanent Supervision with seven career appointments (Superintendent, Assistant Superintendent, 3 Squad Bosses)
- IHC's work and train as a unit 40 hours per week
- IHC's are a national resource

Engines (Minimum Requirements)

Components	Structure Engines		Wildland Engines				
	1	**2**	**3**	**4**	**5**	**6**	**7**
Pump Rating min. flow (GPM)	1000+	250+	150	50	50	30	10
at rated pressure (PSI)	150	150	250	100	100	100	100
Tank Capacity Range (Gallons)	400+	400+	500+	750+	400-750	150-400	50-200
Hose, 2½" (feet)	1200	1000	--	--	--	--	--
Hose, 1½" (feet)	400	500	500	300	300	300	--
Hose, 1" (feet)	--	--	500	300	300	300	200
Ladders	48’	48’	--	--	--	--	--
Master Stream (GPM)	500	--	--	--	--	--	--
Personnel (Minimum)	4	3	3	2	2	2	2

Common Additional Needs - Request as Needed.

- All-Wheel Drive
- Pump & Roll
- High Pressure Pump
  (Minimum 40 gpm @ 250 psi)
- Class A Foam Proportioner
- Compressed Air Foam System (CAFS)
  with Minimum 40 cfm Compressor
- Additional Personnel

Water Tenders

Components	Water Tender Types		
	1	**2**	**3**
Tank Capacity (Gallons)	5000+	2500+	1000+
Pump Capacity (GPM)*	300+	200+	200+
Off Load Capacity (GPM)	300+	200+	200+
Max. Refill Time (Minutes)	30	20	15

*Portable pump acceptable.

Air Tankers

Resource	Components	Minimum Standards for Type			
		1	2	3	4
Air Tankers	Minimum Capacity (Gallons)	3000	1800	800	100
	Examples:	C-130 P-3 DC-7	DC-7 SP2H P2U	S-2 CL-215T CL-415	Thrush Air Tanker Dromader

Helicopters

Components	Type 1	Type 2	Type 3
Allowable Payload @ 59 F.° @ Sea Level	5000	2500	1200
Passenger Seats	15 or more	9-14	4-8
Retardant or Water Carrying Capability (Gallons)	700	300	100
Maximum Gross Takeoff/Landing Weight (lbs)	12501 +	6000-12,500	Up to 6000
Examples	Bell 214	Bell 204, 205, 212	Bell 206
Helitanker	- Fixed Tank - Air Tanker Board Certified - 1,100 Min. Gal. Capacity		

CLEAR TEXT GUIDE

Words and Phrases	**Application - Examples**
***Standard Replies*:**	
• Affirmative	Yes
• Can Handle	Used with the amount of equipment needed to handle the incident. EX: "Waverly 3 can handle with units now at scene."
• Copy, Copies	Used to acknowledge message received. EX: "Engine 3 copies."
• Disregard	Self-explanatory
• Proceed	Indicates another unit may transmit. EX: "Go ahead Essex 50."
• How do you copy?	Request for report on transmission quality.
• Loud and Clear	Self-explanatory
• Negative	No
• Repeat	Self-explanatory
• Standby	Self-explanatory
• Unreadable	Signal received is not clear.
***Status Reporting*:**	
• At scene	Used when units arrive at the scene of an incident.
• Available (location)	Ready to respond to calls. Location is optional.
• Available at residence	Used to indicate personnel are available and on-call at home.
• Available at scene	No longer needed at scene and are available to respond to other calls.

CLEAR TEXT GUIDE
(*continued*)

• En route (location)	Used to designate a non-emergency destination. En route is not substitute for responding.
• In-quarters (location)	Used to indicate that a resource is at station. EX: "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.

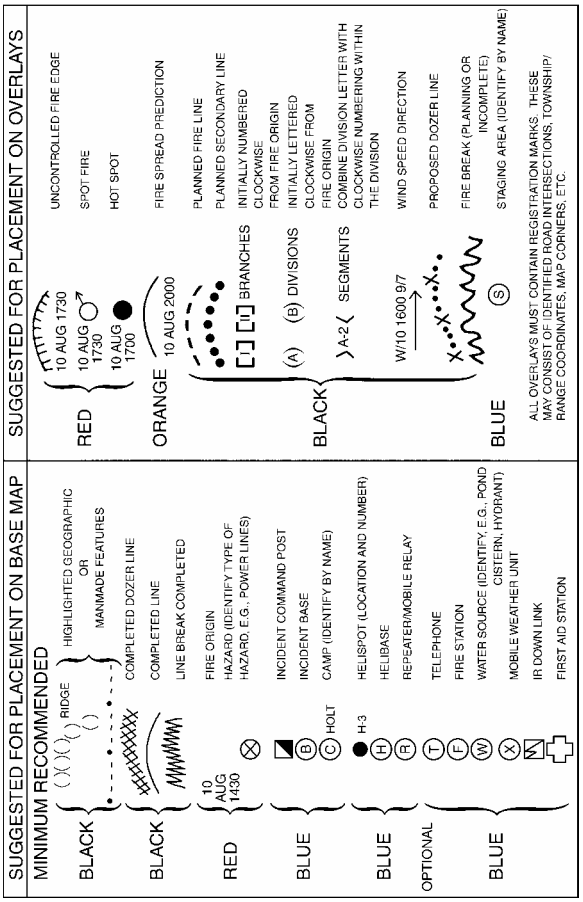
CLEAR TEXT GUIDE
(*continued*)

• 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

INTERNATIONAL
PHONETIC ALPHABET

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

ICS MAP DISPLAY SYMBOLS



CONVERSION FACTORS FOR MAP SCALE

Representative Fraction	Inches/ Mile	Inches/ Chain	Feet/Inch
1:253,440	1/4	0.00312	21,120
1:126,720	l/2	0.00625	10,560
1: 63,680	1	0.0125	5,280
1: 31,680	2	0.025	2,640
1: 24,000	2 5/8 or	0.0328	2,000
1: 21,120	2.64	0.375	1,760
1: 15,840	3	0.05	1,320
1: 7,920	4	0.10	660
	8		

FORMULA FOR AREA AND CIRCUMFERENCE OF A CIRCLE

Circle, Area = 3.1416 x $\frac{\text{diameter squared}}{4}$

or

= 3.1416 x radius squared

Circle, Circumference = 3.1416 x diameter

ACREAGE
DETERMINATION FACTORS

Perimeter Chart

Acres	Perimeter in Minimum	Chains Usual	Max.	Acres	Perimeter in Minimum	Chains Usual	Max
1	11	17	22	700	300	450	600
2	16	24	32	800	320	475	625
3	19	29	39	900	340	500	675
4	22	34	45	1,000	350	525	700
5	25	38	50	1,200	400	600	775
7	30	45	59	1,400	425	625	850
10	36	53	71	1,600	450	675	900
15	45	65	85	1,800	475	725	950
20	50	75	100	2,000	500	750	1,000
25	55	85	110	2,400	550	825	1,100
30	60	90	125	2,800	600	875	1,175
40	70	105	140	3,200	625	950	1,275
50	80	120	160	3,600	675	1,000	1,350
75	100	150	190	4,000	700	1,075	1,425
100	110	170	220	5,000	800	1,200	1,600
150	140	200	280	6,000	850	1,300	1,700
200	160	240	320	7,000	950	1,400	1,900
300	200	300	400	8,000	1,000	1,500	2,000
400	225	350	450	9,000	1,050	1,600	2,100
500	250	375	500	10,000	1,100	1,700	2,250
600	275	425	550	12,000	1,250	2,000	2,500

Instructions For the Use of This Table

- Use this table as a guide to estimate areas and perimeters. Remember that results are approximate values only and have been rounded off.
- Fires that are roughly circular in shape will have perimeters that approach Minimum values.
- Fires that are very long and narrow or with many fingers will have perimeters that approach or possibly exceed Maximum values.
- Values in the Usual column will represent fires that are oval or wedge shaped.

Area in Acres

The following table is to help you estimate the area of a fire. To use it, pace the distance around the fire in chains (1 chain = 66 feet) and determine the general shape of the fire. Select the column (1-6) that best fits the fire's shape and read the acreage for the paced perimeter shown in the left column.

Explanation of columns representing shapes of fires:

1. Fire in the general shape of a circle.

2. Fire in the shape of either a square or rectangle that is not more than twice as long as it is wide with a moderately irregular perimeter.

3. Fire in the shape of a rectangle, about three times longer than it is wide. This column also gives the area of a triangle with a moderately irregular perimeter.

4. Fire in the shape of a rectangle about four times longer than it is wide and having a fairly irregular perimeter.

5. Fire which is long and narrow with an irregular perimeter.

6. Fire with two or three long fingers or a very irregular perimeter.

Area in Acres

Perimeter in Chains	1	2	3	4	5	6
						
1	.01	.01	.01	.01	.01	.01
2	.03	.02	.02	.02	.01	.01
3	.06	.05	.04	.04	.03	.02
4	.11	.10	.08	.06	.05	.03
5	.17	.15	.12	.10	.07	.05
6	.25	.22	.18	.14	.11	.07
7	.34	.29	.24	.20	.15	.10
8	.45	.38	.32	.26	.19	.13
9	.57	.49	.40	.32	.24	.16
10	.7	.6	.5	.4	.3	.2
12	1.0	.8	.7	.6	.4	.3
14	1.4	1.2	1.0	.8	.6	.4
16	1.8	1.5	1.3	1.0	.8	.5
18	2.3	1.9	1.6	1.3	1.0	.6
20	2.8	2.4	2.0	1.6	1.2	.8
22	3.4	2.9	2.4	1.9	1.4	1.0
24	4.0	3.5	2.9	2.3	1.7	1.2
26	4.7	4.1	3.4	2.7	2.0	1.3
28	5.5	4.7	3.9	3.1	2.3	1.6
30	6.3	5.4	4.5	3.6	2.7	1.8
32	7.2	6.1	5.1	4.1	3.1	2.1
34	8.1	6.9	5.8	4.6	3.5	2.3
36	9.1	7.8	6.5	5.2	3.9	2.6
38	10.1	8.7	7.2	5.8	4.3	2.9
40	11.2	9.6	8.0	6.4	4.8	3.2
42	12.	11.	9.	7.	5.	3.5
44	14.	12.	10.	8.	6.	4.
46	15.	13.	11.	8.5	6.	4.
48	16.	14.	11.5	9.	7.	4.5
50	17.	15.	12.	10.	7.	5.
60	25.	21.	18.	14.	11.	7.
70	34.	30.	25.	20.	15.	10.
80	45.	38.	32.	26.	19.	13.
90	57.	49.	40.	32.	24.	26.
100	70.	60.	50.	40.	30.	20.

CONVERSION FACTORS

Linear Measure		
— Chain	=	66 feet
	=	100 links
	=	20.1168 meters
— Foot	=	12 inches
	=	0.3048 meters
— Inch	=	2.54 centimeters
— Kilometer	=	0.62317 statute miles
	=	1,093.6 yards
	=	3,280.8 feet
— Link	=	0.66 feet
	=	7.92 inches
	=	0.2012 meters
— Meter	=	3.2808 feet
	=	39.37 inches
— Mile, statute	=	5,280 feet
	=	1,760 yards
	=	80 chains
	=	1.60934 kilometers
	=	0.8684 nautical miles
— Mile, nautical	=	6,080 feet
	=	2,026.7 yards
	=	92.12 chains
	=	1.8532 kilometers
	=	1.1515 statute miles
— Yard	=	3 feet
	=	36 inches
	=	0.9144 meters

CONVERSION FACTORS
(*continued*)

Square (Area) Measure		
— Acre	=	43,560 square feet
	=	4,840 square yards
	=	10 square chains
	=	208.7 x 208.7 feet
	=	0.405 hectares
— Hectare	=	10,000 square meters
	=	2.4 acres
	=	328.1 x 328.1 feet
— Square foot	=	144 square inches
— Square mile	=	640 acres
— Township	=	36 square miles
	=	6 x 6 miles
— Square Yard	=	9 square feet
	=	1296 square inches
Cubic (Volume) Measure		
— Cubic foot	=	7,4805 gallons
	=	1728 cubic inches
	=	28.316 liters
— Cubic yard	=	27 cubic feet
	=	200.3 gallons
	=	764.53 liters
Liquid Measure		
— Cup	=	8 ounces
— Gallon	=	8.33717 pounds
	=	0.133680 cubic feet
	=	4 quarts
	=	128 ounces
	=	3.7853 liters
— Liter	=	0.264179 gallons
	=	1.567 quarts
	=	1.568 33.8144 ounces
— Pint	=	2 cups
	=	16 ounces
	=	0.47315 litters
— Quart	=	2 pints
	=	32 ounces
	=	0.9463 liters

INCIDENT COMMAND SYSTEM FORMS

Forms that are routinely used in the incident Command System are listed below. Those marked with an (*) are commonly used in written Incident Action Plans.

CS Form Number	Form Title
201	Incident Briefing
202 (*)	Incident Objectives
203 (*)	Organizational Assignment List
204 (*)	Division Assignment List
205 (*)	Incident Radio Comm. Plan
206 (*)	Medical Plan
207	Organizational Chart
209	Incident Status Summary
210	Status Change Card
211	Check-in List
212	Vehicle Demob Inspection
213	General Message Form
214	Unit Log
215	Operational Planning Worksheet
216	Radio Requirements Worksheet
217	Radio Frequency Assignment
218	Support Vehicle Inventory
219	Resource Status Card
220 (*)	Air Ops Summary Worksheet
221	Demobilization Checkout
224	Crew Performance Rating
225	Incident Personnel Rating

RESOURCE STATUS CARD (Colors and Uses)

Card Color Number	Kind of Resource	Form
Gray	Headers	219-1
Green	Hand Crews	219-2
Rose	Engines	219-3
Blue	Helicopters	219-4
White	Personnel	219-5
Orange	Aircraft, Fixed Wing	219-6
Yellow	Dozers, Tractor-Plows	219-7
Tan	Misc. Equipment and Task Forces	219-8

DISTANCES AND FORMULAS FOR ESTIMATING FIRE SIZE

Distances

1. 1 Pace = 2 Normal Steps
2. 11-13 Level Paces = 1 Chain
3. 66 Feet = 1 Chain
4. 80 Chains = 1 Mile
5. 10 Square Chains = 1 Acre
6. 1 Acre = Approx. 220 x 220 Feet
7. 1 Acre = 43,560 Square Feet
8. 640 Acres = 1 Square Mile

Formulas

1. Area of squares and rectangles = L x W

2. Area of triangles = ½ (L x W)

3. Area of circles = $\prod R^2$
   ($\prod$ = 3.14, R= Radius of circle)

4. Compute acres =

$$\frac{\text{Average chains wide x average chains long}}{\text{10 Square Chains}} = \text{Acres}$$

AVERAGE INITIAL RATE OF SPREAD[1] ACCORDING TO FUEL TYPE, SLOPE STEEPNESS, AND SPREAD INDEX AT SITE OF FIRE[2]

Fuel rate of Spread Type	Slope Steepness[3] (percent)	Spread Index									
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
		Perimeter increase in chains per hour									
Low	0-10	0	1	1	1	2	2	2	3	3	4
	11-25	1	1	1	2	2	3	3	4	5	6
	26-50	1	2	2	3	3	4	4	5	6	9
	51-75	2	3	3	4	5	6	6	8	10	14
	Over 75	3	4	5	6	7	8	9	12	16	21
Medium	0-10	1	1	1	2	2	2	3	3	4	5
	11-25	1	1	2	2	3	3	4	5	6	7
	26-50	2	2	3	3	4	5	6	7	8	11
	51-75	3	3	4	5	6	7	8	11	13	17
	Over 75	4	5	6	8	9	11	14	17	21	27
High	0-10	1	2	3	4	5	6	7	8	10	13
	11-25	1	3	4	6	7	8	10	12	14	18
	26-50	2	4	6	8	9	11	14	16	20	25
	51-75	3	6	9	12	15	18	22	26	30	40
	Over 75	6	10	15	19	24	28	35	42	49	63
Extreme	0-10	3	4	5	6	7	9	12	14	17	20
	11-25	4	6	7	9	10	13	17	20	23	28
	26-50	6	8	10	12	15	19	23	28	33	40
	51-75	9	11	16	19	23	30	36	44	53	62
	Over 75	16	20	25	30	37	46	58	71	84	97
Flash	0-10	6	12	15	18	23	28	33	40	50	61
	11-25	8	18	21	26	32	39	48	58	69	84
	26-50	11	25	30	37	45	55	67	81	97	119
	51-75	18	39	48	58	71	88	106	128	155	188
	Over 75	29	62	75	92	113	138	168	202	244	300

[1]Average initial rate of spread refers to perimeter increase between discovery of fire and first attack. This rate of spread may be anticipated during the first 4 to 5 hours.

[2]This table was based on table A-16, NRM Station paper No. 29, Fire Behavior, by J. S. Barrows. Changes were made using the relationship of the burning index vs. the national spread index (timber). The original data were used as presented in Station paper No. 29. Conversion work done in 1963 by NFFL, Barney & Stockstead.

[3]General descriptions used in slope descriptions are: level, 0 to 10 percent; gentle, 11 to 25 percent; moderate, 26 to 50 percent; steep, 51 to 75 percent; very steep, over 75 percent.

WHAT THE COLOR AND COLUMN OF SMOKE MAY MEAN	
What you see	**What it may mean**
The smoke column is thin, rising lazily, and the color is light blue to gray.	Probably a campfire.
The smoke column is narrow, thin, and dark gray to black.	Could be diesel-powered heavy logging or construction equipment.
The smoke column is small, thick, and white in color.	This may mean a small grass fire. If the smoke puffs up every so often, it may mean someone is burning leaves or grass and "feeding" it.
The smoke is widening at the base; it is predominantly white, but starting to turn brown or black on its downwind side.	This may indicate the fire is spreading in grass and moving unto heavier fuels. Dead brush will burn with a dark brown color, brush with a higher oil content will burn black.
The column of smoke is thick and black, with no spread to the base.	This could be a structure or vehicle fire. It may also be tires.
The smoke is black, but some white or light brown is showing away from the main column.	This may mean your vehicle or structure fire has moved into the grass.
The column is going straight up.	There is little or no wind on the fire.
The column is going up, but the top of the smoke is bent over.	There is little surface wind, but there is wind where the smoke bends. Beware; that wind may surface at any time.
The smoke is bent over at the ground and building in volume and intensity.	The fire is wind-driven with a good fuel supply.
The smoke has built to several thousand feet and a small white cloud has formed on the top.	Don't plan on days off. You are going to be quite busy.

FIRE SUPPRESSION INTERPRETATIONS FROM FLAME LENGTH	
Flame Length	**Interpretations**
Less than 4 feet	Fires can generally be attacked at the head or flanks by firefighters using hand tools. Handline should hold fire.
4 to 8 feet	Fires are too intense for direct attack on the head with hand tools. Handline cannot be relied on to hold the fire. Bulldozers, engines, and retardant drops can be effective.
8 to 11 feet	Fire may present serious control problems: torching, crowning, and spotting. Control efforts at the head will probably be ineffective.
over 11 feet	Crowning, spotting, and major fire runs are probable. Control efforts at the head of the fire are ineffective.

REPORT ON CONDITIONS/ SIZE UP REPORT

Incident Name – All incidents.

Incident Commander – All incidents.

Incident type – Wildland fire, vehicle accident, hazardous materials (HazMat), search and rescue, etc.

Incident Status – Fire – creeping, running, spotting, crowning; Vehicle – blocking road, over side, etc.

Location – Use landmarks, legal and lat/long.

Jurisdiction – Agency with jurisdiction.

Radio Frequencies – All incidents.

Incident Size – Fire and HazMat.

Fuel Type – Fire incident only.

Wind Speed and Direction – Fire, HazMat, All-risk, SAR.

Slope and Aspect – Fire and HazMat.

Best Access – All types.

Special Hazards or Concerns – For air and ground units.

Additional Resource Needs – Personnel, equipment.

OPERATIONAL LEADERSHIP GUIDE

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 confusion 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 commander'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.

INTEGRITY

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.

GUIDE TO COMPLETING THE INCIDENT COMPLEXITY ANALYSIS (TYPE 1, 2)

1) Analyze each element and check the response, Yes or No.

2) If positive responses exceed, or are equal to, negative responses within any primary factor (A through G), the primary factor should be considered as a positive response.

3) If any three of the primary factors (A through G) are positive responses, this indicates the fire situation is or is predicted to be of Type 1 complexity.

4) Factor H should be considered after numbers 1–3 are completed. If more than two of the items in factor H are answered yes, and three or more of the other primary factors are positive responses, a Type 1 team should be considered. If the composites of H are negative, and there are fewer than three positive responses in the primary factors (A-G), a Type 2 team should be considered. If the answers to all questions in H are negative, it may be advisable to allow the existing overhead to continue action on the fire.

INCIDENT COMPLEXITY ANALYSIS (TYPE 1, 2)		Yes	No
A. Fire Behavior Observed or Predicted			
1.	Burning index (from on-site measurement of weather conditions) predicted to be above the 90% level using the major fuel model in which the fire is burning.		
2.	Potential exists for extreme fire behavior (fuel moisture, winds, etc.)		
3.	Crowning, profuse or long-range spotting.		
4.	Weather forecast indicating no significant relief or worsening conditions.		
	Total		
B. Resources Committed			
1.	200 or more personnel assigned.		
2.	Three or more divisions.		
3.	Wide variety of special support personnel.		
4.	Substantial air operation which is not properly staffed.		
5.	Majority of initial attack resources committed.		
	Total		
C. Resources Threatened			
1.	Urban interface.		
2.	Developments and facilities.		
3.	Restricted, threatened, or endangered species habitat.		
4.	Cultural sites.		
5.	Unique natural resources, special-designation areas, wilderness.		
6.	Other special resources.		
	Total		

Incident Complexity Analysis (Type 1,2) ***(Continued)***		Yes	No
D. Safety			
1.	Unusually hazardous fireline construction.		
2.	Serious accidents or fatalities.		
3.	Threat to safety of visitors from fire and related operations.		
4.	Restrictions and/or closures in effect or being considered.		
5.	No night operations in place for safety reasons.		
	Total		
E. Ownership			
1.	Fire burning or threatening more than one jurisdiction.		
2.	Potential for claims (damages).		
3.	Different or conflicting management objectives.		
4.	Disputes over suppression responsibility.		
5.	Potential for unified command.		
	Total		
F. External Influences			
1.	Controversial fire policy.		
2.	Pre-existing controversies/relationships.		
3.	Sensitive media relationships.		
4.	Smoke management problems.		
5.	Sensitive political interests.		
6.	Other external influences.		
	Total		

Incident Complexity Analysis (Type 1,2) *(Continued)*		Yes	No
G. Change in Strategy			
1.	Change in strategy to control from confine or contain		
2.	Large amounts of unburned fuel within planned perimeter.		
3.	WFSA invalid or requires updating.		
	Total		
H. Existing Overhead			
1.	Worked two operational periods without achieving initial objectives.		
2.	Existing management organization ineffective.		
3.	Overhead overextended mentally and/or physically.		
4.	Incident action plans, briefings, etc. missing or poorly prepared.		
	Total		

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.		

Incident Complexity Analysis (Type 3,4,5) (*Continued*)	Yes	No
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.		

If you have checked "Yes" on 3 to 5 of the analysis boxes, consider requesting the next level of incident management support.