

COURSE: Prescribed Fire Planning and Implementation

TOPIC: Pre-Burn Planning and Preparation (Unit 3)

I. Objectives

- A. Describe the complexity analysis process and how it is used in prescribed fire planning.
- B. Describe safety aspects that must be considered in prescribed fire planning.
- C. Demonstrate how the prescribed fire organization can be expanded and contracted to meet specific situations.
- D. Discuss other aspects of prescribed fire planning which need consideration.

II. Complexity Analysis

Complexity analyses should be completed at four specific times, and you should evaluate the project complexity at every stage of the project. The first time a complexity analysis should be used is at the initial project development planning stage. The manager needs to be able to identify the scope of the project, and whether it is within his/her capability to accomplish.

The second time a complexity analysis should be completed would be as a part of the specific prescription analysis when the manager assesses and evaluates Prescribed Fire Plans. The third time a complexity analysis should be used would be for the development of staffing needs for the FIREBASE analysis. The actual complexity analysis numerical scoring will be entered into FIREBASE, and will be used for prescribed fire reporting purposes in FMIS. The fourth time the complexity analysis should be considered is on the actual burn day when the GO/NO GO analysis is being completed. *You must show evidence that you have completed an analysis of complexity prior to conducting prescribed burning.*

**The complexity analysis was not intended to be used to identify staffing need for individual prescribed fire projects (i.e., high complexity = Burn Boss 1=lots of resources, moderate = Burn Boss 2=some resources, low = Burn Boss 3=few resources).** Specific individual project staffing depends the position skills needed which can be assessed using the position task books, experience in a particular fuel type, and overall position competency (beyond minimal NWCG qualifications) which is a subjective professional assessment.

Complexity relates to (1) the risk that an adverse event or situation will occur, (2) the potential consequences in terms of dollar or other loss if the event occurs, and (3) the technical requirements necessary to mitigate the effects of the event.

For prescribed fire planning purposes, complexity analyses can be very effective in the evaluation of what prescribed fire activities (i.e., holding, ignition, aerial operations, contingency actions, etc.) contribute the greatest to potential project failure. The evaluation of each element needs to be followed with a mitigation measure designed to reduce complexity factors to as low as possible. It's not enough to know that an activity is risky, something needs to be done to lower that risk. *NOTE: When preparing the burn plan, you must explain the project complexity, and explain what mitigation you plan to employ to reduce the risk.*  
**Complexity is one of the most important parts of the project burn plan, but usually encompasses one of the smallest parts of your burn plan!**

**EXAMPLE:** On the day of the prescribed burn, you performed a complexity analysis on a proposed prescribed fire unit, and this is what you concluded:

***Good potential for multiple fire escapes. An escaped fire will exceed the capability of the holding resources on site and additional resources will need to be requested. Escaped fires will cause implementation of contingency plan and prescribed burn will be declared a wildfire. Fuel outside the burn unit is extensive and heavy, making suppression actions difficult. Prescription calls for fireline intensity and fuel moisture in the primary fuel model that are known to cause serious spotting potential. Probability of Ignition greater than 85 percent. Wind speeds at the upper end of prescription.***

A poor prescribed fire manager is asking for trouble when he/she simply records the rating score on the complexity rating sheet and sticks it back into the file, or does not allow this situation to be mitigated before burning. A good prescribed fire manager is one that recognizes the risk potential for this project and modifies the plan. Modifications could include adding additional holding forces, widening existing holding lines, increasing contingency resources, or doing all the above.

In the planning and implementation of a prescribed fire project, it is essential to evaluate the complexity elements and determine which of the elements have the potential of being an "alligator" that might get you into trouble during the implementation of the burn.

The prescribed fire complexity element rating criteria used by the Fish and Wildlife Service can be found on line NFES publications or ordered using NFES 2474. Other agencies may use other criteria. You are required to show

evidence that you have conducted a complexity analysis for your project before implementation.

### III. Pre-burn Preparations

Foresight is needed by the Planner/Burn Boss to ensure that everything is in place for successful operations on burn day. Pre-burn preparations include both on-site activities and tasks that are best conducted back at the office.

#### A. Off-site Preparations

##### 1. Burn Plan Approval

Allow adequate lead time when submitting burn plans so that required signatures can be obtained and the plan returned in time for the desired burn window. Ideally, plans should be submitted at least 90 days prior to the desired burn season. It is not acceptable to expect a plan to be approved today and returned via overnight mail so that burning can occur tomorrow (it has happened).

##### 2. Permits and Clearances

Ensure that all necessary clearances are obtained prior to burning. Examples include:

- a) Section 404 permit may be required from Corps of Engineers if burn activities involve filling of wetlands, e.g., plowing control lines or removing tree root mats.
- b) Archaeological clearances (RCRC).
- c) Section 7 process may be required if threatened or endangered species are impacted.
- d) Depending on State or local regulations, air quality clearances or permits could be required.
- e) State or county agency may require a burning permit. This may be good for a period of days or a single day only.

f) Others

Check with your Refuge Manager to determine which permits are required. In some cases, permit requirements may have already been satisfied under the umbrella of a Comprehensive Management Plan. If required at the annual burn plan level, permits can probably be obtained to cover all burns planned during the year, rather than individual burns.

3. Public Contacts/Media

This will be discussed fully in section V.

4. Equipment Readiness

Burn day is not the time to discover that the dozer needs new hydraulic lines. Have all equipment checked out well in advance, so that repairs can be completed in time.

5. Issue Personal Protective Equipment (PPE)

Individuals who have been involved as burn crew members or firefighters must be equipped with required PPE-aramid clothing, leather gloves, hard hat, eye and hearing protection, fire shelter, and leather boots. Check to determine if any items are missing or need to be replaced. New employees with little or no prior fire experience may not possess all required PPE, and will need to be outfitted.

6. Purchase Supplies

Order all needed equipment parts, PPE, hand tools, and other supplies well in advance of burn day.

7. Orders Outside Resources

For various reasons you may determine that you do not have adequate resources on station to conduct a burn safely. A complexity analysis may reveal that refuge staff does not possess suitable training or experiences to fill all burn team positions. You may need a piece of specialized equipment, such as a helitorch. In these cases, the needed resources will have to be ordered from your zone dispatch center with sufficient lead time. If they are not available, your burn will have to be postponed.

## B. On-site Preparations

### 1. Fuels Treatment

Mechanical or chemical treatment of fuels may be required prior to burning. Vegetation control strategies commonly employ herbicide applications to kill undesirable plants followed by fire to reduce dead debris and prepare the seedbed for desirable growth. Heavy equipment is often used to clear standing vegetation followed by burning the cured residue. In these cases, prescribed fire is only one aspect of a larger vegetation management strategy. Close coordination among all players on the staff is necessary to ensure that all phases of the strategy are completed at the proper times and that funding and work responsibilities are clearly understood.

### 2. Recon Burn Area

It is imperative that the Planner/Burn Boss conducts a thorough reconnaissance of the area prior to burning or even completion of the burn plan. Items to check for include:

- a) Fuel types and distribution
- b) Natural barriers which can be used as control lines
- c) Escape routes/safety zones
- d) Vehicular access to the site
- e) Potential helispots (if needed)
- f) Water sources
- g) Special features needing protection
- h) Optimum locations for control lines, and equipment needed to construct them
- i) Weather monitoring site
- j) Equipment staging areas
- k) Problem areas needing correction, e.g., snag concentrations, pockets of heavy fuels, etc.

- l) Line construction standards - width, type, fuel removal
- m) Visitor and public safety concerns

### 3. Water Level Management

Prescribed burning on refuges frequently entails some form of water level manipulation. It may be necessary to draw water off a moist soil unit several weeks prior to burning to allow the vegetation to cure and the organic layer to dry. Close coordination is required with other refuge staff to ensure drawdowns occur at the appropriate times to permit burning.

Conversely, it may be necessary to hold water near a burn unit to guarantee a suitable source for mop-up and control. A short section of ditch or canal adjacent to a burn unit may have to be plugged temporarily to hold a reservoir of water. This is particularly critical if burns are conducted during the dry season under conditions of falling water tables. In areas of deep organic soils, volume pumps may be needed to move water from canals so that burn units can be inundated.

### 4. Equipment Access

Have a plan for getting engines, dozers, helicopters, or other equipment to the burn area. Are there suitable roads leading directly to the burn site, or will old trails have to be improved? Will you need to construct a helispot? Where will support vehicles (fuel trucks) be staged and where can they get to the equipment to be serviced? Are there portions of the burn perimeter where only foot travel is possible, and how will this affect line construction and holding needs? Can ATVs be used in some areas where pickups can't go? If you can't use vehicles in some areas, how will this affect logistical requirements, holding and ignition operations, mop-up, and firefighter safety?

### 5. Line Construction

Determine the amount of control line to be constructed, optimum fireline location (use natural or man-made barriers where possible), and the type of line at each location on the perimeter. Types of lines include:

a) Hand line

Best suited in areas of patchy fuel where vehicular access is difficult, in sensitive areas, in short grasslands (fuel model 1 or 2), or in forest stands of light hardwood leaf litter or conifer needles.

b) Dozer line

Can clear heavy slash or timber relatively quickly. Good for building wide lines and safety zones. May be objectionable in sensitive areas.

c) Tractor/plow line

Most common in Southeast and Lake States. Dozer pulls a plow unit. Good for establishing lines to mineral soil in forested conditions. Limited to flat or gently sloping terrain. May be environmentally objectionable due to ditching effect and soil turnover.

d) Mowed line

Used in field or grassland burning. Standard farm tractor with mower. Mowed grass may still carry fire across the line, so additional measures such as raking, hand line or wet line must be considered.

e) Wet line

Engine or portable pump is used to wet fuels prior to burning. Water is short-lived and suitable only on grasses or other fine fuels. Often used in combination with black line. Water may be enhanced by addition of foam or retardant.

f) Black line

Fire is set against the wind inside an existing barrier or preconstructed control line. Purpose is to reinforce control line by removing adjacent fuels. Black lining may be conducted ahead of burn day or as part of the burn itself. Conditions for black lining should be clearly stated in the prescription portion of the plan.

Line construction standards must be clearly explained. Include width of line, depth, vertical fuel removal (limbing).

Additional line pre-treatment may be required following construction. Examples include setting up a sprinkler or irrigation system two days before a burn to thoroughly wet down the line, or applying retardant several hours before a burn.

#### 6. Problem Areas

Snags may need to be felled if they are close to the control line. Dozer piles or pockets of heavy fuels near the line should be broken up and scattered.

#### 7. Protection of Sensitive Features

Historic resources, archaeological sites, endangered species nest trees, and buildings and improvements are examples of features that will have to be protected from fire and associated activities. If the feature is near the burn unit but outside the area to be burned, simply flagging the area as off limits may suffice, or you may be able to station an engine nearby to protect it. If inside the burn unit, you will have to remove fuels from around the feature or apply a long-lasting foam to provide an insulating blanket. Events such as torching an eagle nest tree or burning up that new interpretive kiosk are unacceptable. Ensure that all cultural clearances have been completed and appropriate mitigation measures have been put into place.

#### 8. Public Safety

Work with other refuge staff to close refuge roads and visitor facilities near the area on burn day. If it is a State or county road and can't be closed, notify police or other officials of your plans and they may be able to assist you in traffic control. Obtain prescribed burn/smoke warning signs and assign burn team members to set up the signs and direct traffic on burn day.

#### 9. Weather Data Collection

Determine what weather and fire behavior monitoring equipment will be needed. If using portable RAWS or other automated weather station, decide on a suitable site and set up several days prior to burn day to detect weather and fuel moisture trends.

Plan procedures for collecting on-site weather and fire behavior data, as well as requesting general or spot weather forecasts.

#### IV. Safety

Safety is a major concern in all aspects of prescribed burning, and will be mentioned many times during the week that this course is presented. In spite of being a "controlled" management activity, prescribed burn case histories contain numerous examples of injuries and fatalities. Most of these could have been prevented with proper planning and leadership.

No classroom presentation on prescribed burn safety can begin to touch on all the areas where safety is a concern and mistakes can occur. Some of the more significant areas where errors can or have happened are discussed below. Some of these areas are based on analysis of FWS refuge prescribed burn accidents.

##### A. General Safety

###### 1. LCES

The LCES concept - Lookouts, Communications, Escape Routes, Safety Zones - is as pertinent to prescribed burn operations as it is to wildfires. Learn to incorporate safety zones into control line construction, and have escape routes identified. These should be identified in the burn plan. Post lookouts to watch for changes in weather and fire behavior.

###### 2. Personal Protective Equipment

- a) Hard hat - must have chin strap. No metal hats. 3-year life expectancy. Must be rated for wildfire, ANSI Z89.1-1986 rating.
- b) Aramid/nomex shirt and pants, or Aramid/nomex flight suit. Should wear with 100% cotton or other natural fiber underwear.
- c) Leather gloves
- d) Goggles
- e) Earplugs/ ear muffs around pumps, saws, heavy equipment
- f) Leather boots, minimum 8" top, leather laces, Vibram soles

Burn Boss should personally check each member of the burn team prior to burning to ensure proper PPE.

3. Fire Shelter

Shelters are required on all prescribed burns. Fire shelter deployment should be reviewed and practiced, and shelters inspected annually. Important points regarding fire shelter use:

- a) One-time use only. Replace used or defective shelters. Protect with hard plastic case.
- b) Do not carry inside pack. Attach to web gear in a location where it can be used quickly.
- c) Prepare deployment site prior to use. If no time to prepare site, hug the ground, and use shelter to deflect radiant heat.
- d) Wear leather gloves at all times. Carry water canteen inside shelter, also portable radio. Do not use wet bandana over airways.
- e) Get rid of oily gloves and packs, fuel cans, and fuses.

4. Physical Fitness

Prescribed burning is hard work, whether chasing spot fires or setting up hoselays. Strive to maintain an Arduous standard (45) on the pack test, particularly if you're a "ground pounder." Maintain a personal fitness program, including upper body strength development. Consider physical fitness of individuals when organizing your burn team.

5. Dehydration, Heat Stress

Carry plenty of water to the fire, and ensure that each individual carries several full canteens. Encourage frequent drinking breaks. Order individuals to rest in a shady spot if they exhibit signs of heat exhaustion or heat stress, and provide for first aid if needed.

6. First Aid

Provide first aid training, including CPR, or refresher to all burn team members. Carry at least one crew first aid kit to each burn. Try to have at least one person on the team trained as an EMT.

7. Medical Evacuation  
Identify EMT certified crew members and others with medical skills.  
  
Specify medical evacuation procedures including emergency communications channels/phone numbers, evacuation routes, medivac helispots, nearest hospitals and burn centers.
8. Communications  
  
Try to provide a portable radio to each team member, or at least to each supervisor. Bring spare batteries. Check radios before use. Conduct frequent briefings and be sure instructions are understood.
9. Dispatcher  
  
Have a dispatcher in the office during all burns, and ask them to maintain a radio log.
10. Equipment  
  
Maintain equipment in safe and reliable working condition.
11. Personnel Qualifications  
  
Ensure qualified personnel are available to assist in the burn.
12. Monitor Fire Behavior and Weather  
  
A Fire Behavior Analyst is an underutilized position on prescribed burns. Assign someone as a lookout to record observations. Obtain spot forecasts. Stop burning if these conditions are encountered:
  - a) Erratic fire behavior
  - b) Spot fires numerous or difficult to control
  - c) Shifting winds
  - d) Smoke not dispersing as planned
  - e) Public roads smoked in

13. Parking

Park vehicles a safe distance from the burn, pointed toward the direction you would exit if you need to depart quickly. Leave doors unlocked with keys in the ignition.

14. Hazardous Materials

Use Material Safety Data Sheets (MSDS) around hazardous materials such as gasoline, diesel, and alumagel.

15. Judgment

Don't burn if conditions aren't right. You will be under a lot of pressure on burn day to light the match. Everyone has geared up mentally for the burn, and they are interested in executing it. As hard as it may be, don't let targets, biological objectives, other staff members, or other factors pressure you to burn if everything isn't right.

16. Personal Safety

As Burn Boss, you will be concerned about ensuring everyone else's safety. Don't be so worried about everyone else that you forget your own welfare. Wear all your PPE, keep fit, drink lots of fluids, stay sharp and awake.

B. Ignition Safety

1. Aerial Ignition

The helitorch and Premo Mark III ignition devices are sophisticated machines requiring special training and certification. Unless you are certified to operate these machines, stay clear. Relay your instructions to the Ignition Specialist and leave the technical aspects of machine operation to the experts.

2. Drip Torch

Stick with the recommended torch mixture of 3 parts diesel fuel to 1 part gasoline. Higher percentage of gasoline is extremely volatile. Carry torch fuel in safety cans and keep cans away from ignition operations.

3. Terra Torch

The same guidelines stated above for aerial ignition devices applies to the Terra Torch. Training is required to operate the machine.

4. Communication

Good communications are critically important for ignition crew members. A communication breakdown can result in someone being trapped by fire. Everyone handling an ignition device must have a working radio in his/her possession.

5. Blacklining

Be careful when blacklining. Because it is not part of the main firing operation, but only a line construction tool, people tend to be complacent when putting in black line. Often it is (mistakenly) done without a prescription and without paying close attention to holding lines, fire behavior, or weather. A slight wind shift or lower than expected fuel moistures can turn a mild black lining operation into a wildfire.

6. Fuel Spills

People on the ignition crew tend to get fuel spilled on gloves, clothes, boots, and packs. These can easily catch fire during an ignition operation. Never bring fuel-soaked packs into a fire shelter. Wash clothes after each burn.

7. Power Lines

Burning under electrical transmission lines is always risky due to the potential for arcing (line to line) or flashover (line to ground) conduction from ionized gases in the smoke column.

- a) Lines 200KV or greater can cause problems.
- b) Use backing fires to minimize intensity and burn frequently to prevent heavy fuel buildup.
- c) It may be impossible to burn safely under lines in certain fuel types (shrubs, Phragmites).
- d) Use wind to move smoke away from power lines.

- e) Pretreat power line poles by burning out fuels around them or mechanically removing fuels.
- f) Consider mowing or other mechanical removal as an alternative to burning.

## C. Holding Safety

### 1. Snags

Snags are a major cause of injury and fatality on fires. Try to fell snags near the control line for personal safety as well as fire control reasons. Stay clear of snag trees at all times, consider flagging.

### 2. Smoke, Carbon Monoxide

Holders typically patrol the line on the downwind side, looking for slopovers and spots. In this location, they are subject to intense and prolonged smoke. If it's necessary to keep people in this location, try to have a large crew on hand so that people can be rotated.

Carbon monoxide is tasteless and odorless. It is of greatest concern on prolonged mop-up operations such as peat fires. Again, rotate people out of the smoke environment regularly to avoid excessive CO concentrations. Small dosimeters which measure CO exposure can be clipped to a shirt pocket and checked periodically.

Respirator use is burdened by extensive OSHA regulations and requirements, is expensive and bulky to use, impedes cardiopulmonary function when working, and may give a false sense of security by filtering out the major irritants (particulates, acroleins), but not all smoke components such as carbon monoxide. Other concerns raised by those weighing the pros and cons of respirator use include the interference of the mask with radio communications, possible claustrophobia among some individuals, and potential for causing heat stress.

### 3. Communications

All resources need to communicate frequently concerning location of spots and slopovers. Particularly on the downwind side, they need to be aware of what the head of the fire is doing and be prepared to escape if necessary.

Lookouts are strongly advised. Where spots are frequent and hot, it's easy to get in an entrapment situation.

#### 4. Heavy Equipment

Resources on a prescribed fire often work in concert with dozers or other heavy equipment. Hazards to be aware of when working in the vicinity of dozers:

- a) Backing up. The dozer may not have a working back up alarm. The operator will be concentrating on equipment and will not have time to watch out for you as well.
- b) Falling trees. A dozer may be pushing over trees and limbs which can fall in any direction.

If walking behind a dozer, maintain a respectable distance.

- c) Winch cable. Dozers get stuck from time to time and use the winch to pull themselves or others out of a hole. You may be asked to assist in setting the hook. Wear gloves to prevent metal slivers and stay well away from the cable when pulled taut.
- d) Rolling material. Be careful when a dozer is working on a slope above you. Trees and rocks will be dislodged and roll downhill.

#### D. Aircraft Safety

##### 1. Fixed-wing Aircraft

All flights will be above 500 feet AGL (above ground height), and no PPE is required, but suggested. A pre-flight briefing is required before all flights, and basic aviation safety training is required.

##### 2. Rotor-wing Aircraft

A pre-flight briefing is required before all flights, and basic aviation safety training is required. Follow recommended safety procedures when boarding or leaving helicopters.

- a) For all prescribed fire operations, a flight helmet will be worn by all personnel. For point-to-point transport, a hard hat with chin strap is acceptable.
- b) Wear aramid/nomex PPE, and 8" tall leather boots.
- c) Approach to the front of a helicopter and from downhill-- never from rear or uphill.
- d) Tie down all tools and cargo per the pilots instructions.
- e) Fasten seat belts, and no smoking allowed onboard.
- f) Stay clear of helicopter water bucket or fixed-wing retardant drops.
- g) Be aware that retardant is slippery.

## V. Media/Public Contacts

### A. Public Involvement in Burn Planning

As mandated by the National Environmental Policy Act (NEPA), the Fish and Wildlife Service has adopted procedures that integrate public involvement with the planning process. Environmental Assessments (EA's) and, if necessary, Environmental Impact Statements (EIS's), are prepared before making any land use decision including proactive fire management. These documents, with their sections detailing potential alternatives and environmental consequences, are to be made available to the public for comment.

The usual procedure for ensuring public involvement and participation in the prescribed fire planning process is to complete an Environmental Assessment for the Prescribed Fire portion of the refuge Fire Management Plan. All EAs should include the process of soliciting and considering public input. An E.A. or E.I.S. completed for a refuge Comprehensive Conservation Plan may suffice if sufficient prescribed fire details are included; however, most may be too general to be useful. It should not be necessary to conduct an E.A. for an individual prescribed burn unless it is not covered in the Fire Management Plan or is unusually complex or sensitive in nature.

### B. Media

1. Place prescribed burn announcements in the local newspaper several weeks or months before the expected burn date. This will explain the purpose of the burn and begin to generate public interest and support.
2. Invite interested press and VIPs to observe and film the burn. This will get them involved in a positive sense, rather than in a negative, reactive manner and give you an opportunity to promote your program. Be sure to assign the job of press/VIP liaison to a designated Information Officer, you will be too preoccupied managing the burn to be distracted. Issue PPE if they are going on the line or riding in a helicopter.
3. Show the results of previous successful prescribed burns to illustrate why you are burning.
4. Helpful tips on dealing with the media in fire management situations can be found in the videotaped program Strategic Communications for Wildland Fire Management, available from the Publications Management System at NIFC (NFES 2252, 2253, 2254, 2265, 2266, and 2267).

C. Inform Neighbors

1. Distribute information door-to-door or by mailing list for adjacent landowners who may be affected by your fire or smoke.
2. Learn special concerns and problems by talking to your neighbors, e.g., Are there any elderly people with respiratory problems near your burn? Try to mitigate concerns if possible.

D. Inform Cooperators and Other Pertinent Agencies

1. Police will need to know about possible highway impacts from smoke and closings which may be needed.
2. Adjacent Federal land management agencies
3. State Forestry/Department of Natural Resources officials
4. Local city and volunteer fire departments
5. Smoke management regulatory boards, if applicable
6. Airports

7. Coordinate with zone fire dispatch center or Regional Fire Management Coordinator before burning as specified in the Regional Fire Dispatch Plan. Under high geographic area or national preparedness levels, burns must be reported daily to ensure availability of contingency forces. Under extreme preparedness levels (Level 4 or 5), burning may be curtailed completely because resources are tied up in wildland fire suppression.

## VI. Communication and Coordination

Poor communications are probably the most significant underlying factor contributing to accidents, injuries, and escaped prescribed fires. Too often this aspect of fire planning is given insufficient attention or taken for granted. Make the communications plan an integral part of your prescribed burn plan.

### A. Issuing Radios

It is absolutely critical that portable and/or mobile radios are available at all times to the following individuals on the burn:

1. Burn Boss
2. Ignition Specialist and all igniters
3. Resources holding the line
4. Aircraft Observer, if used
5. Prescribed Fire Behavior Analyst or Weather Observer
6. Lookouts

It is recommended that all crew members on the burn carry portable radios if feasible. In addition, several extra radios should be carried to the burn site as spares in the event of equipment malfunction.

Determine the number of radios available at your station in working condition. If using cooperators, encourage them to bring their radios as well. You will need to have a common frequency you can both use. On large, complex burns it may be necessary to order a Division Radio Kit (16 radios) from your geographic area interagency cache. These kits are in great demand, however, and may not be available depending on suppression needs.

## B. Radio Maintenance and Use

1. Carry extra charged batteries or AA batteries for King clamshells.
2. Check radios thoroughly before using; clone or program frequencies if needed.
3. Keep transmissions short and to the point.
4. Speak in clear text; avoid 10 codes and acronyms.
5. Cellular phones are another communication option which some refuges are using, particularly those lacking the means to purchase sophisticated radio equipment.

## C. Frequencies

1. One good radio communications setup for a refuge consists of a system with a minimum of two assigned operating channels. A repeater channel would be used for normal refuge operations, and a talk-around or crew net or project channel would be used at the burn site. The repeater channel would be used by the Burn Boss to communicate with refuge headquarters, but communications within the burn team would be on talk-around.
2. Additional frequencies would be needed for ground-to-air communications, cooperator agency contacts (need letter of authorization to use cooperator frequencies), police and fire/rescue. The larger and more complex the burn, the greater the need for additional frequencies, e.g., holding crew may need their own channel.
3. Be sure frequencies are assigned and known before burn day so crew members can program their radios. Review procedures and check radios one final time on burn day during the pre-burn briefing.

## D. Contact Procedures

1. Establish protocol between the dispatcher and Fire Behavior Analyst or Weather Observer for requesting weather information, spot weather forecasts, etc.
2. Establish procedure for notifying headquarters (Refuge Manager) of go/no-go decision and contingency needs.

3. Establish procedure for notifying state DNR, police, and local fire department of go/no-go decision and contingency needs. Have dispatcher maintain a radio log.

## VII. Ignition

Pages 20-28 of the NWCG publication PMS 431-2, A Guide For Prescribed Fire in Southern Forests, will be used as reference text and lesson plan for this unit. There will be no separate lesson plan provided as a handout. The instructor presentation will consist of briefly summarizing principal ignition patterns with emphasis on pros and cons of each, communication and safety considerations.

## VIII. Holding

The holding function on prescribed fires is loosely defined as the containment of the burn within predetermined control lines, including the management of spot fires or slopovers within acceptable (quantified) limits so that a wildfire situation does not develop. Holding may also include patrolling the lines and mopping up afterward. Holding resources are under the supervision of the Burn Boss, although on small, uncomplicated burns, the same individual may also function as the Ignition Specialist or the Burn Boss.

Types of holding resources may include:

### A. Single Individuals

A single person with a hand tool is often used to patrol the line during a burn to watch for spots and suppress if necessary. Usually individuals are combined into:

### B. Crews or Squads

A hand crew is typically made up of 20 individuals supervised by a Crew Boss/Crew Supervisor. Each crew is divided into squad, with Squad Bosses assigned to each squad. Three or four squads may be combined into a 20-person crew supervised by a Crew Supervisor. They may carry an assortment of hand tools including shovels, pulaskis, rakes, swatters, backpack pumps, and chainsaws. Frequently they are also used to lay hose and deliver water to the burn perimeter from a:

### C. Pump or Engine

Portable pumps, such as the Wajax-Pacific Mark III, are often used to supply hoselays during and after the burn. Water can be used to wet down the line immediately before burning, control hot points on the line

during the burn, and mop up after. Engine units are frequently used as mobile water sources and are particularly effective in light, flashy fuels.

D. Dozer and Tractor/Plow

Dozers can be used in any fuel type but are invaluable in woody slash, debris, and heavy timber fuels. Their value lies in constructing and reinforcing control lines, mechanically manipulating fuels, and constructing safety zones.

Tractor/plows are most often used in forested or brush conditions, primarily in the Southeast and Lake States. They are effective in constructing and reinforcing lines and containing spot fires.

E. Aircraft

Values and resources at risk may justify the expense of using fixed-wing retardant aircraft to reinforce control lines or contain slopovers. More common is the use of helicopters with water buckets to wet down sensitive areas, contain spots, or protect dozers and engines.

F. Mop-Up

Immediately following burn operations, the holding resources are usually put to work on mop-up which is "extinguishing or removing burning material near control lines, felling snags, and trenching logs to prevent rolling after an area has burned, to make it safe, or to reduce residual smoke" (Society of American Foresters 1990). Elimination of residual smoke is critically important because if fires are allowed to smolder during the night, stable air conditions cause smoke to hug the ground and obscure highway visibility.

Mop-up standards should be specified in the Prescribed Burn Plan, and the degree of mop-up required will depend on fuels and proximity of smoke-sensitive targets. A major highway near a burn area may require 100% extinguishment of all smoldering fuels. A less sensitive area may simply require extinguishment of all fuels and felling all snags within one chain of the control line. Many of our refuges burn primarily in fine fuels which may require little (if any) mop-up.

G. Foam

Class A foam is an important tool for the firefighter. Foam has many applications in prescribed burning, including:

- 1) Protection of items within the burn area such as nest trees, bluebird boxes, visitor kiosks, boardwalk trails, fence posts, and power poles. A heavy, long-lasting foam should be used for these applications.
- 2) Water expansion properties allow more efficient use of limited water supplies on engines.
- 3) Thick, heavy foams can be used to burn from when black lining. If the foam is too thin, it will evaporate quickly and fail to contain the burn.
- 4) Thin foams or wetting agents in water serve as surfactants, allowing better penetration of water during mop- up. Foam also insulates fuels and restricts oxygen supply.

Foams promise to be helpful tools in the holding aspects of prescribed burning. Until more research studies on the effects of foam on the environment are finalized, they should be used with caution. They have been shown to have detrimental effects on many wetland species when applied directly into the water source. Care is needed when applying foam to keep it away from sensitive areas.

#### H. Safety Considerations

Safety considerations in the holding function were addressed in a previous unit. To summarize:

- 1) Guard against heat stress, smoke, and carbon monoxide inhalation. Rotate firefighters out of the hot line at regular, frequent intervals. Provide lots of water for drinking.
- 2) Physical fitness is necessary for the holding job and should be maintained through regular exercise programs.
- 3) Individuals should work in small groups or squads under proper supervision.
- 4) Use ATVs or engines whenever possible to minimize fatigue. Remember, only properly trained personnel should use ATV's. They are dangerous.
- 5) Be sure all individuals know the escape routes, safety zones, and layout of the area. Provide all crewmembers with a burn map.

- 6) Hold frequent briefings and try to get a portable radio for each crewmember. If not available, prearrange communications procedures such as hand signals, shouting, etc.
- 7) Keep abreast of the weather and fire behavior, both current and expected, and position resources accordingly.
- 8) Familiarize all crewmembers, especially supervisors, with the contingency plan in the event of an escape.

## X. Prescribed Fire Organization

The following positions described below are positions used in typical prescribed fire operations. A Burn Boss Type 3 will not be utilizing all of these positions, due to the complexity level. There has not been as much standardization of prescribed burn positions as there has been for wildland fire, but this situation is now changing. The National Wildfire Coordinating Group has assumed the task of deriving standard position descriptions which would be used by member agencies on interagency burn projects. In addition, a few of the other wildland fire agencies have adopted the concept of the Fish and Wildlife Service's Prescribed Fire Burn Boss Type 3 position for use on low complexity projects.

The following list of positions and tasks is not all-inclusive for use on prescribed fire incidents.

### A. **Firefighter (Prescribed Fire) (FFT2)**

A FFT2 is the basic resource used in wildland firefighting, and the execution of a prescribed fire, and works as an individual or as a member of a crew under the supervision of a higher qualified individual.

1. Review Agency policies and procedures.
2. Follow instructions and learn to care for and operate portable or mobile radios.
3. Identify and minimize safety hazards, know safety zones and escape routes, utilize proper PPE, practice safe tool use, and describe first aid procedures.
4. Construct, hold, and patrol control lines.
5. Read and interpret maps.
6. Ignite fuels according to instructions.

**B. Ignition Specialist Type 1 and 2 (RXI1 or RXI2)**

A RXI1 or 2 is responsible for supervising and directing ground and/or aerial ignition operations according to established standards in the prescribed fire plan.

1. Review agency procedures, policies, and regulations.
2. Review burn plan and conduct recon of burn area prior to implementation.
3. Advise Burn Boss of ignition process, conditions affecting fire behavior, equipment problems, and safety of assigned personnel.
4. Advise crewmembers of potential or impending safety hazards.
5. Recognize and seek to correct staffing deficiencies.
6. Direct and instruct personnel in lighting procedures, coordinate with holding specialist, evaluate fire behavior and make needed adjustments, complete test fire, recognize and respond to weather changes on-site, change firing plan to meet dynamics of the situation, and coordinate with fire behavior specialist.
7. Determine correct tool and equipment mix for crews, inspect mechanical equipment, identify and minimize safety hazards.
8. Demonstrate communication skills, articulate performance requirements to subordinates, recognize personnel fatigue symptoms, complete administrative documentation, evaluate on-the-job performance, develop subordinates through training and coaching, brief subordinates on operational procedures and hazards.
9. Identify impacts of ignition on control and desired fire effects.

**C. Prescribed Fire Manager Type 1 & Type 2 (RXM1, RXM2)**

A RXM1 or 2 implements and coordinates assigned prescribed fire activities. A Prescribed Fire Manager may be assigned during periods when multiple simultaneous prescribed fire are being conducted, multiple prescribed fires will be conducted within a short time frame, or there is a complex interagency involvement.

10. Obtain briefings from ordering official and /or prior Prescribed Fire Manager. Review prescribed fire plans prior to implementation and assess situation.
2. Act as liaison between Prescribed Fire Burn Bosses, other offices, agencies, air quality authorities, news media, transportation agencies, and safety officials.
3. Obtain and interpret long term weather information.
4. Conduct strategy meetings and/or briefings as needed.
5. Set priorities for allocation of resources.
6. Brief Prescribed Fire Burn Bosses and direct operational assignments according to agency specific policies and standards identified in prescribed fire plans.
7. Monitor prescribed fire operations.
8. Ensure all operations are conducted in a safe manner and in accordance with the prescribed fire plans.
9. Ensure the completion of all required documentation including the evaluation and documentation of accomplishments, immediate fire behavior and fire effects, operational procedures and cost summaries.

D. **Prescribed Fire Burn Boss (RXB1/RXB2)**  
**Prescribed Fire Burn Boss 3 (RXB3) (Fish and Wildlife Service only)**  
(The duties and responsibilities for a RXB3 may vary slightly

between

responsible to the agency administrator or Prescribed Fire Manager for implementing a prescribed fire plan.

1. Review the burn plan prior to ignition and ensure all burn plan requirements are met.
2. Recon burn unit.
3. Act as liaison/coordinator between interdisciplinary managers and specialists.

4. Given current and predicted environmental conditions (such as weather, smoke management forecasts, fuel moisture), air quality clearance, resources status (staffing and equipment, and national, regional, and local preparedness levels), make "go/no-go" decision.
  5. Obtains a weather forecast, updates, and advisories from a meteorologist.
  6. Ensure pre-burn coordination and communication with the public and other agencies according to the burn plan; ensure necessary agreements are implemented.
  7. Conduct the test burn and evaluate results.
  8. Conduct operations according to agency-specific policies and standards, emphasizing safety and meeting of plan objectives.
  9. Direct specific resources to complete operational assignments.
  10. Provide for monitoring of smoke emissions for health, safety, and vista impairment effects.
  11. Remain in communication with crewmembers and adjoining forces.
  12. Act as liaison/coordinator between the burn organization and other offices, agencies, air quality authorities, news media, transportation agencies, safety officials, and interested publics.
  13. Declare the prescribed fire out. Determine when the prescribed fire exceeds prescription parameters or burn objectives.
  14. Evaluate and document the accomplishment of fire objectives, operational procedures, and assigned personnel.
  14. Ensure post-burn narrative, equipment and time reports, cost summaries, and unit logs are completed as necessary.
  15. Monitor implementation costs and make appropriate notifications.
5. **Fire Effects Monitor (FEMO)**  
The FEMO is responsible for collecting the on-site weather, fire behavior, and fire effects information needed to assess whether the fire is achieving established resource management objectives.
1. Review the monitoring plan prior to implementation.

2. Monitor, obtain, and record weather data.
3. Monitor and record fire behavior data throughout the fire management operation.
4. Recon the burn unit/area assigned.
5. Plot the burn area and perimeter on a map.
6. Monitor and record smoke management information.
7. Monitor first order fire effects.
8. Collect and record environmental data.
9. Provide monitoring summary of the fire.

6. **Long Term Assessment Analyst (LTAN)**

The LTAN is responsible for acquisition and analysis of environmental and fire behavior information to develop recommendations and issue forecasts with short and long-range projections. The position can be used for wildland fire or prescribed fire situations.

1. Obtain briefing from supervisor.
2. Coordinate weather data collection systems and resources, including Meteorologist, Weather Observers, and Fire Effects Monitors.
3. Acquire, manipulate, and interpret historical weather data.
4. Collect, review, and compile fire history, fuel data and information about topography and fire barriers.
5. Participate in planning meetings.
6. Evaluates, displays, and interprets the risks and uncertainty that a fire will reach a point of concern or cause critical events.
7. Supports fire use decision making and fire use implementation actions for strategic planning and implementation plan development.

8. Use the "Rare Event Risk Assessment Process" (RERAP) for long range fire planning and interpret the results.
9. Input data into FARSITE (Fire Area Growth Simulator), run the fire growth model, and interpret and refine the results.
10. Develop and prepare written tactical fire behavior forecasts.
11. Attend operational briefings and provide site specific fire behavior predications, as requested.
12. Establish weather security watch and monitor actual fire behavior to validate predictions, documents fire behavior, and anticipates potential safety problems.
13. Inform personnel of changes in predicted conditions.

## XI. Unit Map

Maps are an important component of every burn prescription. It is worth the time and effort to produce high quality maps for several reasons:

- A. Good maps allow the fire manager to better evaluate the proposed burn plan.
- B. The Burn Boss may not have been involved with the fire planning process, and may be unfamiliar with the site.
- C. The prescription is a legal document which may ultimately be reviewed by any number of people; the quality of the maps reflect your preparedness and professionalism.
- D. The maps may be used by your burn crew members to better understand their roles and respond to emergencies that may arise.

When preparing maps, keep these basics in mind:

- a. Be sure your maps follow a logical sequence, so that you progress from a general site locator map to the most specific burn unit maps.
- b. Use an appropriate scale, and mark the scale on the map.
- c. Always use an arrow to indicate due North, and try to place North at the top of the page.

- d. Try to fit each map onto a standard 8.5 X 11 sheet of paper.
- e. Use a highlighter to emphasize and clarify important features, such as unit boundaries, rare plant populations, or smoke sensitive areas.
- f. Label significant points on the map with letters (A,B,C, etc.) to refer to in the narrative sections of your prescription. In an irregularly shaped unit, it is often clearer to refer to "line A-B" than to "the northwest line." It can also be useful for crew members to use these same reference points during the burn.
- g. Label every map so that it could stand independent of your prescription. As a minimum, the following items should be depicted on all burn maps:
  - 1. Ignition sequence
  - 2. Position of holding crew and equipment
  - 3. Prescribed wind direction
  - 4. Location and type of control lines
  - 5. Sensitive features to be protected
  - 6. Weather monitoring station
  - 7. Parking and staging areas
  - 8. Helispots
  - 9. Water sources
  - 10. Pre-established safety zones and escape routes

Maps should be copied and distributed to each member of the burn team (not just supervisors). This must be done no later than the pre-burn briefing on burn day.

Handout 2 for this unit depicts standardized map symbols adopted by the Incident Command System for use on wildfires or other incidents. These are also found on page A-31 of your Fireline Handbook dated January 1998. Additional symbols recommended for prescribed fire maps are included on the bottom of the page. Since most of the symbols are color-coded, remember to include the colors when distributing maps to crew members.

