# Prescribed Fire Plan Preparation

# RX-341

NFES 1624

## Student Workbook

**JUNE 2009**


# CERTIFICATION STATEMENT

**on behalf of the**

## NATIONAL WILDFIRE COORDINATING GROUP

*The following training material attains the standards prescribed for courses developed under the interagency curriculum established and coordinated by the National Wildfire Coordinating Group. The instruction is certified for interagency use and is known as:*

Prescribed Fire Plan Preparation, RX-341
Certified at Level I

This product is part of an established NWCG curriculum. It meets the COURSE DEVELOPMENT AND FORMAT STANDARDS – Sixth Edition, 2003 and has received a technical review and a professional edit.

Member NWCG and Training Working Team Liaison

Date 6/27/2009

Chairperson, Training Working Team

Date 6/23/2009

# Prescribed Fire Plan Preparation RX-341

## Student Workbook

**JUNE 2009**

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Order NFES 1624.

# PREFACE

Prescribed Fire Plan Preparation, RX-341 is a recommended training course in the National Wildfire Coordinating Group (NWCG), wildland fire curriculum. This course was developed by an interagency group of experts with direction and guidance from NWCG Training under authority of the NWCG. The primary participants in this development effort were:


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The NWCG appreciates the efforts of these personnel and all those who have contributed to the development of this training product.

# CONTENTS

Prescribed Fire Plan Preparation, RX-341

Unit 0 – Introduction

OBJECTIVES:

During this unit the instructor will:

1. Introduce the cadre and students.
2. Discuss course logistics.
3. Explain the course objectives.
4. Identify course reference materials.
5. Explain student evaluation methods.
6. Discuss the final project.
7. Review the pre-course work.

I. INTRODUCTIONS

II. COURSE LOGISTICS

III. COURSE OBJECTIVES

- Describe prescribed fire planning policies and guidelines.
- Identify and describe the processes involved in preparing a prescribed fire plan.
- Develop and defend a prescribed fire plan that safely meets management objectives.

IV. COURSE REFERENCE MATERIALS

- Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide (referred to as "The Guide" throughout the course)
- Fireline Handbook with Appendix B
- Incident Response Pocket Guide
- Student Reference Materials CD:
  - Smoke Management Guide for Prescribed and Wildland Fire
  - Aids to Determining Fuel Models for Estimating Fire Behavior
  - NWCG Prescribed Fire Complexity Rating Systems Guide
  - Red Bull Prescribed Fire Plan (used as an example throughout the course)

## V. EVALUATING STUDENT PERFORMANCE

Students' performance is evaluated by:

### A. Daily Quizzes

- A quiz is given at the end of each day of instruction (four total).
- The quizzes account for 40% of students' final grade.

### B. Final Prescribed Fire Plan Evaluation (Final Project)

- This is a cumulative project; students work in groups to create a prescribed fire plan for presentation and evaluation.
- The final project counts as 60% of students' cumulative score for the course.

### C. Overview of the Final Project Instructions and Criteria

Students will be divided into assigned groups. You will stay in your assigned group until the final evaluation (students are put into new groups for the final evaluation).

Time is allotted at the end of each day for groups to complete the elements of the prescribed fire plan taught that day. For example, at the end of instruction on day one, groups are given time to complete the objectives, description of the prescribed fire area, and preliminary complexity analysis for their assigned project. If additional time is needed, groups can work on their prescribed fire plans after scheduled course hours.

To participate in the final evaluation, each student will need a clean, final copy of their group's prescribed fire plan. Students are then assigned to a final evaluation group consisting of at least one participant from each of the original work groups.

Students must be prepared to defend all the elements of their prescribed fire plan; however, will only defend 4–5 elements. Graded elements are assigned by the cadre; students will not know which elements they are assigned until the day of the final evaluation.

Each student will read and provide the rationale for their assigned elements from their final prescribed fire plan. The rationale is not limited to the assigned element; in many cases the elements are linked, and multiple elements must be used to support a decision or rationale.

A cadre member will be assigned as a facilitator/evaluator to each final evaluation group and will complete a Final Prescribed Fire Plan Assessment Form for each member of the group. An assessment form is on the following page.

Students in each of the final evaluation groups, who are not presenting, will act as peer evaluators. Each peer evaluator is responsible for participating in the discussion of the element being presented and completing an assessment form for the presenter. This is a critical role in the evaluation process. It is important that peer evaluators provide comments to justify the given score.

## VI. REVIEW PRE-COURSE WORK

## Final Prescribed Fire Plan Assessment Form

Name of student being evaluated: _____

| Scoring criteria for burn plan elements | | | | |
|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 |
| Student was not able to explain the assigned burn plan element, or element incomplete. | Burn plan element somewhat complete, but explanation inadequate. | Burn plan element adequate, but explanation insufficient to support the element. | Burn plan element adequate and well-covered, some details non-supporting to the element. | Burn plan element adequate and well-covered, supporting details specific to the element. |

| Element Ranking | Element | Evaluator Comments | Score |
|---|---|---|---|
| Easy Complexity | #1, 2, 10, 12, 21 | | |
| Low Complexity | #4, 6, 14, 19, 20, 8 | | |
| Medium Complexity | #5, 9, 11, 13, 18 | | |
| High Complexity | #3, 7, 15, 16, 17 | | |
| | Additional Element #_____ | | |

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Unit 1 – Policies and Guidelines

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Identify the policies that direct prescribed fire planning.

2. Identify the responsibilities of the prescribed fire plan preparer, technical reviewer, and agency administrator as they relate to plan preparation.

3. Define the purpose of a prescribed fire plan.

4. Describe the processes involved in preparing the prescribed fire plan.

# I. POLICIES THAT DIRECT PRESCRIBED FIRE PLANNING

## A. Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide

"The Guide" describes the minimally acceptable components of prescribed fire planning and implementation.

It provides unified direction and guidance for prescribed fire planning and implementation for federal agencies including:

- Bureau of Indian Affairs (BIA)
- Bureau of Land Management (BLM)
- National Park Service (NPS)
- Fish and Wildlife Service (FWS)
- United States Department of Agriculture Forest Service (USDA FS)

## B. Department of the Interior, DM Part 620 - Wildland Fire Management, Chapter 4: Fuels Management and Wildland-Urban Interface Community Assistance

## C. Department of Agriculture, FSM 5100 - Fire Management, Chapter 5140: Fire Use

D. Other Policy and Guidelines

- States
- Regions
- Local government
- Non-government organizations
- Wilderness criteria
- Other compliance documents
  - National Environmental Policy Act (NEPA)
  - Endangered Species Act
  - Air quality
  - Historic preservation

## II. RESPONSIBILITIES

The responsibilities section of "The Guide" lists all the responsibilities of the positions listed below (plus others not covered here).

A. Prescribed Fire Plan Preparer

- Prepares plans according to policy.
- Coordinates with resource management and technical specialists to ensure the plan meets resource objectives.
- Interacts with technical reviewer to ensure all plan elements are adequately addressed.
- Completes and signs complexity analysis.

B. Technical Reviewer

- Ensures that plans meet policies.
- Ensures the complexity analysis accurately reflects the project(s).
- Ensures prescription parameters meet the resource and control objectives.
- Ensures ignition, holding, and contingency plans are consistent with the predicted fire behavior.
- Completes and signs the Technical Review Checklist Plan and the Prescribed Fire Plan signature page.

C. Agency Administrator

- Approves prescribed fire plans.
- Understands and approves, by signature, the complexity analysis and assigned rating.
- Determines if and when agency administrator is to be notified that contingency actions are being taken.
- Ensures the prescribed fires that receive a National Ambient Air Quality Standards Notice of Violation are reviewed according to established guidelines.

## III. THE PURPOSE OF A PRESCRIBED FIRE PLAN

Does every management ignited fire need a prescribed fire plan?

Are there instances when a prescribed fire plan could be developed other than for prescribed fires?

The prescribed fire plan is a site-specific implementation document that describes how project objectives are met.

It is a legal document that provides the prescribed fire burn boss with information needed to implement the prescribed fire.

### A. Minimum Elements Required in a Prescribed Fire Plan

1. Signature page
2. Go/No-Go Checklists
3. Complexity analysis
4. Description of the prescribed fire area
5. Objectives
6. Funding
7. Prescription (RX)
8. Scheduling
9. Pre-burn considerations
10. Briefing
11. Organization and equipment

12. Communication

13. Public and personnel safety

14. Test fire

15. Ignition plan

16. Holding plan

17. Contingency plan

18. Wildfire conversion

19. Smoke management and air quality

20. Monitoring

21. Post-burn activities

B. Required Appendices

1. Complexity analysis

2. Maps

3. Technical review checklist

4. Fire behavior modeling documentation or empirical documentation (unless it is included in the fire behavior narrative in Element 7 - Prescription).

5. Job Hazard Analysis (JHA) or other agency-specific risk analysis.

## IV. PRESCRIBED FIRE PLANNING PROCESS

For a prescribed fire to be implemented successfully, a good prescribed fire plan is needed.

### A. Timing

- Begin the planning process in advance by thinking operationally in a stress-free environment.

- Consider a range of possibilities to prepare a flexible document that can be implemented.

  – Resource objectives
  – Safety considerations
  – Personnel and logistics needs
  – Anticipated fire behavior
  – Others

- Allow time for the technical review and approval process to be completed well in advance of implementation.

- The prescribed fire plan template from "The Guide" must be used. Each element must be addressed and then assembled in the sequence identified in the template.

- When interagency mixed ownership prescribed fire plans are being prepared, all appropriate elements are developed in an interagency setting.

- For cooperative prescribed fires implemented by non-federal entities involving federal and non-federal lands (where only a small amount of federal lands are treated), the local agency administrator has discretion to use either a federal or non-federal prescribed fire plan.

B. Plan Preparation Sequence

The sequence of the planning process may vary by individual preference and often by project needs.

1. Objectives

   - Strategic and Landscape Plan(s)
   - Departmental Policy and Direction
   - NEPA documents supporting these items
   - Research for specific resource objectives

2. Project assessment and design

   - Project boundaries and layout
   - Site and project descriptors

3. Preliminary complexity analysis

   The preliminary analysis is used to prepare or revise the prescribed fire plan to mitigate or remove higher complexity issues.

4. Prescription elements

   - Environmental parameters
   - Fire behavior parameters

5. Implementation

   - Pre-burn considerations
   - Briefing
   - Organizational and equipment
   - Communication
   - Public and personnel safety
   - Test fire
   - Ignition plan
   - Holding plan
   - Contingency plan
   - Wildfire conversion
   - Smoke management and air quality plan

6. Final complexity analysis

   Finalize and approve (based on mitigation measures and actions taken throughout the plan, and completed before, during, and after prescribed fire implementation).

7. Monitoring and post-burn activities

   - Rehabilitation needs
   - Fire effects monitoring
   - Identify reports needed

8. Technical review

- This is a required step in plan development.
  - If the technical review is returned with a "Yes," move on to next step.
  - If the technical review is returned with a "No," fix identified problems.
- The technical reviewer must be someone other than the primary preparer of the plan.
  - Other specialists may review portions of the plan.
  - A primary technical reviewer must be designated as the review signatory.

9. Signatures

At a minimum, the prescribed fire plan must be signed by:

- Prescribed fire plan preparer
- Technical reviewer

  Either the prescribed fire plan preparer or technical reviewer must be currently qualified, *less physical fitness requirements*.

  This allows qualified people who may be injured or temporarily unable to pass the physical fitness requirements to perform as technical reviewer.
- Agency Administrator

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Unit 2 – Goals and Objectives

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Define land management goals and project objectives.

2. Develop S.M.A.R.T. (Specific, Measurable, Achievable, Relevant, Time Bound) objectives to meet project goals.

3. Describe how the prescribed fire plan relates to fire management plans and land management plan goals.

4. Identify information sources used to develop project goals and objectives.

# I. DEFINE LAND MANAGEMENT GOALS AND PROJECT OBJECTIVES

Land management goals are the foundation for all land management actions and project objectives. Without goals and project objectives there is no direction and no measure of success. You won't know where you are going and you won't know when you are there.

## A. Goals

A goal is a general summary of what land management actions are working to achieve; the end result defines success. Goals are primary and basic products of long-range management plans.

### 1. Goal statements should be:

- Visionary
- Relatively general
- Brief
- Measurable

### 2. Example goal statements:

- Move 90% of the foothills landscape from a fire regime condition class 3 to a condition class 2 within 10 years.

- Reduce the potential for catastrophic wildfire in the wildland urban interface through fuel reduction projects along forest boundaries.

- Restore and maintain sufficient foraging and nesting habitat for red-cockaded woodpeckers (as stated in the endangered species recovery plan).

## B. Objectives

Objectives are well-defined statements that describe what a treatment must accomplish to meet or contribute to achieving a goal. Set objectives early in the process. Failure to do so misdirects planning efforts and wastes time.

## II. DEVELOPING S.M.A.R.T. OBJECTIVES

Project objectives include resource and prescribed fire objectives. They are site and treatment specific, must use the S.M.A.R.T. concept, and are a description of the desired end condition of an action.

### A. S.M.A.R.T.

1. Specific: Relate objectives to particular desired outcomes of the prescribed fire.

   - Must define what you want to accomplish.
   - Good data is essential.

2. Measurable: Be clear and concise with measurable results.

   - Unambiguous – no question about what is being measured.
   - Concise – focuses the effort; useful in communication with others.
   - Provides a yardstick for evaluating progress.
   - A well-designed monitoring effort tells you if you are successful.

3. Achievable: If you cannot meet your objective you will fail.

4. Related or relevant: Sets realistic (useful and affordable) boundaries for management.

   - Defines geographic and temporal scope of action.
   - Focuses your effort on what exactly you want to accomplish.

5. Time-bound or time-related: Objectives must be set in a timeframe.

   - Manage smoke through the duration to the burn, or
   - Consume 10-hour fuels as measured within one year.

6. Example objectives:

   - Reduce 10-hour fuel loading in burn unit by 50% as measured within one year post-burn.
   - Retain 1-mile visibility along Route 46 during all phases of the prescribed fire.
   - Limit average crown scorch of overstory pines to 30%, as measured within 5 days of burn completion.

B. Potential Difficulties in Setting Objectives

1. Data

- Unavailable information often leads to poor objectives and implementation.

- Background/historical information is important and may influence future objective development.

2. Resource management conflicts often exist:

- Silviculture
- Cultural/historical site
- Threatened and endangered species
- Wilderness

3. Resolving conflicting objectives:

- Plans cannot be implemented when meeting one objective would cause failure to meet another objective.

- Ranking could help resolve objective priorities and help eliminate conflicts.

- Forces decisionmakers to critically examine and make a determination as to which objectives are most important.

## III. RELATING THE PRESCRIBED FIRE PLAN TO FIRE MANAGEMENT PLANS AND LAND MANAGEMENT PLAN GOALS

Prescribed fire is one component of management that supports the accomplishment of resource goals. The prescribed fire plan is the site specific implementation document.

Project objectives are what you are going to get done on the burn that are SMART and contribute to the accomplishment of the land management goals.

## IV. INFORMATION SOURCES USED TO DEVELOP PROJECT OBJECTIVES

### A. Land Management Goals

- Land management plans (fire, forestry, range, wildlife, etc.)
- Community wildfire protection plans
- NEPA (environmental assessments, environmental impact statements, categorical exclusion and accompanying decision record)
- Threatened and endangered species recovery plans
- Wilderness plans
- Fire regime condition class maps (LANDFIRE)
- Others?

### B. Project Objectives

Planners are often responsible for developing objectives, usually through working with interdisciplinary teams.

Good data and group consensus is essential to developing useful and achievable objectives.

Sources of information for project objectives:

- Previous successful prescribed fire projects
- Project specific NEPA
- Developed through resource specialists

**EXERCISE: Evaluating Goals and Objectives.**

Evaluate the following goals or objectives. Any that do not meet the SMART criteria should be rewritten.

1. Enhance pileated woodpecker habitat.

   What would make this goal become an objective?

2. Given average tree stand height of 70 feet:

   a. Limit scorch height to 50 feet within seven days after burn.

   b. Limit mortality of 30-foot understory trees to 60% within seven days after burn.

3. Reduce fuel loading of 1- and 10-hour woody fuels by a minimum 75% over 90% of the area immediately post-burn.

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Unit 3 – Description of the Prescribed Fire Area

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Identify information required to accurately describe the prescribed fire area.

2. Define the concept of project boundary as it relates to landscape prescribed fire planning.

3. Identify the mapping requirements and standards for a prescribed fire plan.

# I. DESCRIBING THE BURN UNIT

## A. Physical Description

### 1. Location

The narrative description of the prescribed fire project location includes:

- Legal description
- Universal Transverse Mercator (UTM)
- Latitude/longitude (decimal degrees, map datum, county, and state)

The narrative description provides a general written description to enable you and your team to travel to the project. It allows contingency and emergency resources to locate your fire.

### 2. Format is critical (legal, UTM, or latitude/ longitude and datum)

- It must be in the format that aerial and ground resources use on their equipment; otherwise it is of no use to them.
- Format is also important for reporting requirements.

3. Size

Area of the prescribed fire project with a breakdown by ownership if applicable.

- Area allows your fire projects to be tracked.
- Gives assigned personnel an idea of how large the project will be.

4. Topography

Identify the upper and lower range of:

- Elevation
- Slope(s)
  - Maximum/minimum
  - Average
- Aspect(s)

  Examples of aspect topography could include:

  - Drainages that affect fire/smoke behavior and represent operations challenges.
  - Creeks or rivers that are barriers or water sources for fire spread and travel.
  - Others?

B. Vegetation/Fuels Description

This is a description of current vegetation and fuels in and adjacent to the project area.

- Structure and composition of the vegetation type(s).
- Natural or activity fuels, total fuel load (both live and dead) in tons/acre.
- Dead fuel load by timelag size classes.
- Live fuel load (woody/herbaceous).
- Fuel bed depth, and vertical and horizontal arrangement.
- Percent of the unit composed of each vegetative type and the corresponding fuel model(s).
- Identify conditions (fuels, slope, and aspect) in or adjacent to boundaries that may be a potential threat for escaped fire.

C. Description of Unique Features and Resources

- Fences/power lines
- Historical/cultural sites
- Threatened and endangered species or habitat.
- Improvements or features that need to be protected.
- Others?

## II. PROJECT BOUNDARY

The project boundary defines that area where fire is ignited and may be allowed to burn.

- Describe the physical, natural, or human-made boundaries (including multiple units) of the prescribed fire project. This is done through maps and may include narratives.

- The entire prescribed fire project area must be analyzed under NEPA, where applicable.

**CLASS DISCUSSION:** Red Bull Prescribed Fire Plan, Element 4, Sections A – D.

## III. MAPPING REQUIREMENTS AND STANDARDS

At a minimum, the plan will include a vicinity and project map. The number of maps, map size and scale, legend and level of detail should be appropriate for the complexity of the project.

All maps include:

- Title
- Name of preparer(s)
- Date
- North arrow
- Scale
- Legend

### A. Vicinity Map (Required)

1. Shows prominent features including:

    - Roads
    - Streams
    - Water sources
    - Towns
    - Structures
    - Wilderness boundary

    Also shows the proximity of the burn unit(s) to these features.

2. Transportation route(s) will be identified.

3. Map scale will be such that the burn units can be located on the ground and in sufficient detail to guide implementation.

B. Project Map(s) (Required)

Project maps identify features in sufficient detail to guide and assist in operational implementation of the prescribed fire.

Topographic, vegetative, or aerial photo maps should be used as the base map.

Incident Command System (ICS) map display symbols, identified in the Fireline Handbook, should be used as appropriate.

1. Types of project maps

Project maps can vary by project and may not include all the elements listed below.

- Project boundary
- Proposed ignition sequence
- Smoke management/trajectory
- Transportation
- Emergency/evacuation
- Aviation
- Contingency
- Aerial photos
- Areas of special concern

2. Key features include:

   - Burn unit boundaries.
   - Constructed line (dozer, hand, blackline, wetline).
   - Natural barriers (rock slides, riparian, aspen stands).
   - Fuel model locations inside and outside burn unit(s).
   - Critical holding points, hazards, safety zones, escape routes.
   - Helispots, water sources, staging areas.
   - Areas of special concern and sensitive smoke receptor areas.
   - Contingency control lines.
   - Wilderness boundary.

C. Other Map Possibilities

1. Three-dimensional modeling.
2. Color digital orthophoto quarter quads (if taken in winter, these are helpful in determining overstory vegetation composition).
3. Smoke modeling and dispersion (V-smoke, etc.).
4. Three-dimensional flyover-type maps; digital elevation models.
5. GPS waypoints of important features.
6. FARSITE potential fire growth simulation.

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Unit 4 – Risk Assessment and Preliminary Complexity Analysis

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Define the risk management process and describe how it relates to the complexity analysis.

2. From the NWCG Prescribed Fire Complexity Rating System Guide:

    a. Identify the three factors of the complexity analysis.

    b. Identify the 14 elements that apply to the three risk factors of the complexity analysis.

    c. Describe how mitigation measures may change the rating of complexity element(s).

## I. DEFINE THE RISK MANAGEMENT PROCESS AND HOW IT RELATES TO COMPLEXITY ANALYSIS

Risk management is a foundation for all prescribed fire activities.

Risks and uncertainties relating to prescribed fire activities must be understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity.

The NWCG Prescribed Fire Complexity Rating System Guide defines risk as the probability or likelihood that an adverse event or situation will occur (for example, escaped fire).

### A. Risk Discussion Points

1. Risk assessment is a valuable tool in prescribed fire planning. Some agencies may require additional risk assessment beyond the complexity analysis.

2. The purpose of the risk assessment is to provide critical information to the prescribed fire plan preparer, the burn boss, and the approving official on risks and consequences.

3. The risk assessment process should start with the first site visit to the project area and should be completed early in the planning process.

4. Risk assessments are not required for prescribed fire plans, but are good situational tools for high risk project planning and implementation.

B. Identifying and Assessing Risk

1. Gather as much intelligence concerning the project and the area as you can.

2. Use the information to determine what could go wrong and what actions you might take to mitigate identified risks.

3. Learn from:

   - Your own and other's past experiences
   - Escaped fire reviews
   - After Action Reviews
   - Examples from the Wildland Fire Lessons Learned Center Web site: www.wildfirelessons.net

C. Risk Taking and Decisionmaking

Someone who has been successful in the past and has a good process for gathering and interpreting information, is often more willing to take a risk, all other things being equal.

Someone who has been unsuccessful, had a bad outcome in the recent past, or does not have a good process for gathering and interpreting information, is generally less willing to take a risk.

These considerations can affect how willing an approving official and other relevant people, groups, and organizations are to accept the same risks.

D. Comparing Risk Assessment and Complexity Analysis

1. Risk assessment is not the same as complexity analysis.

2. The risk assessment provides information needed in several elements of the complexity analysis.

3. There is duplication between elements of the risk assessment process and the complexity analysis process.

E. Steps to Integrate Risk and the Complexity Analysis into the Prescribed Fire

1. Gather intelligence and identify the points of concern.

   - Fire behavior inside and outside the burn unit.
   - Potential consequences if an escaped fire occurs.
   - Smoke impacts
   - Safety hazards
   - Others?

2. Complete a risk assessment (check agency specific requirements).

3. Complete preliminary complexity analysis.

4. Develop the other components (elements) of the prescribed fire (organization, prescription, ignition, holding and contingency, personnel and public safety, etc.).

5. Reevaluate and finalize complexity analysis to ensure accuracy.

## II. PRESCRIBED FIRE COMPLEXITY RATING SYSTEM GUIDE

### A. Purpose

The purpose of the complexity rating process is to provide:

- Assignment of a complexity rating of high, moderate, or low to the prescribed fire.
- Management and implementation personnel a relative ranking as to the overall complexity of a specific prescribed fire project.
- A process that can be used to identify prescribed fire plan elements or characteristics that may pose special problems or concerns.
- A process that identifies mitigation activities needed to reduce the risk/hazard to the implementation personnel and public as well as mitigating potential resource damage.

### B. Overview (broad concept)

1. Complexity analysis contains 14 elements with three factors to consider for each element:
    - Factor 1 is Risk (probability an adverse event will occur).
    - Factor 2 is Potential Consequences (measure of cost/result of an adverse event).
    - Factor 3 is Technical Difficulty (skill needed to implement the burn and deal with potential adverse event).
2. Values are assigned for each of the factors (low, moderate, high).
3. Evaluate elements individually by reading criteria for each of the factors and selecting the most appropriate value.

4. Ratings and rationale are documented on the worksheet.
   **Note:** At this point, the prescribed fire plan is developed.

5. Reevaluate elements and factors and complete final ratings and rationale on the worksheet for each element.

6. Complete the summary rating for each factor (risk, potential consequences, and technical difficulty) to assist in assigning overall project complexity rating.

7. Document the summary rating rationale.

C. Multiple Complexity Analyses

Separate prescriptions and/or burn organizations for different stages of implementation may result in multiple complexity analyses and ratings.

Examples:

- Planned multi-stage prescribed fires with multiple organizations. Different prescriptions/seasons/fuel conditions.

D. Instructions/Process

1. Step #1 – Preliminary Review of the Element Descriptors

   - A review of the rating descriptors prior to visiting the site will help identify the elements of most concern.

   - Alternatives and/or mitigation measures that will help reduce the final complexity rating should be considered early in the planning process.

   - Any risk analysis that was completed for the project can be reviewed and findings inserted into the complexity process at this time.

2. Step #2 – Preliminary Rating Determination

- The preliminary rating should be completed prior to or early in the development of the plan.
  - The problem areas identified may be mitigated during the planning process.
- The initial determination is often not as thorough as the final one.
  - During the initial site visit, look for trouble spots and areas of special concern, both inside and outside the project boundary.
  - Consider the prescription needed to successfully light and hold the unit while meeting the burn objectives.
- Rate the preliminary value for each factor of each element by selecting the most appropriate descriptor.
  - Circle the low, moderate, or high value on the worksheet and document the rationale for that value.
  - If mitigation is needed and opportunities exist, briefly identify them in the preliminary rationale.
- Mitigation opportunities should be developed during planning process.
  - This is the point where local management judgment and experience is most important.
  - Documentation is critical to the process; it lets the reviewer understand the thinking behind the rating and that mitigation is possible.

**EXERCISE: Preliminary Complexity Analysis**

1. Use the following materials to complete the exercise:

   - Your **printed copy** of the Red Bull Prescribed Fire Plan. Do not view the Red Bull Prescribed Fire Plan that is on your student CD!

   - Unit 4 Exercise Materials (on your student CD):
     - Red Bull Map 1 – Vicinity.pdf
     - Red Bull Map 2 – Adjacent Features.pdf
     - Red Bull Overview.ppt

2. Refer to the Preliminary Complexity Analysis on pages 4.13 – 4.26. The first one is completed as an example. The instructor will assign each group two elements.

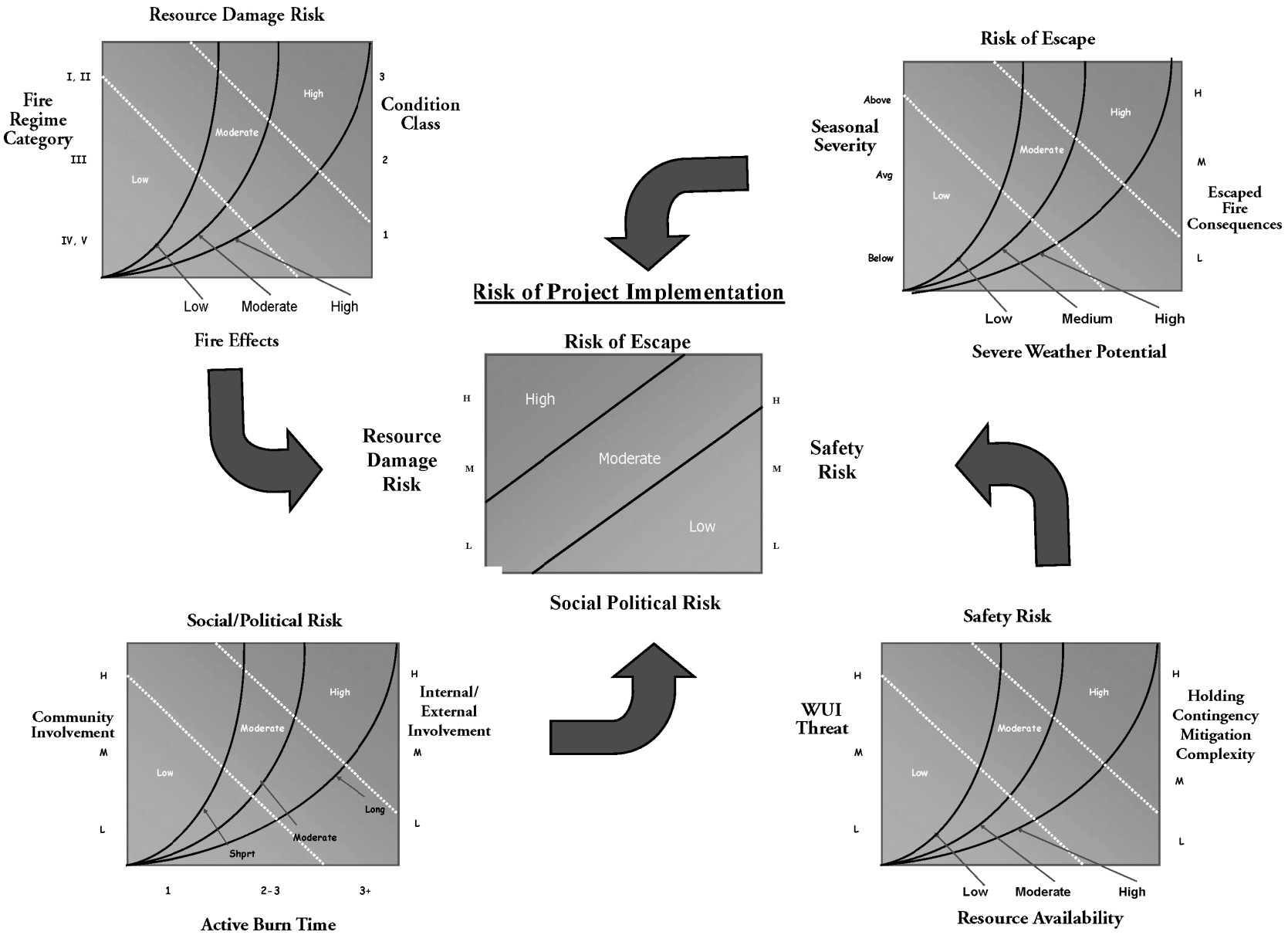
3. Complete a Preliminary Rating and Rationale for your assigned elements.

4. Review the Red Bull Overview PowerPoint slides.

5. Review the completed Element 1: Potential for Escape, from the Red Bull Prescribed Fire Plan.

6. Groups will present their element complexity determination and rationale to the class.

# Prescribed Fire Implementation Risk Assessment
# (This is an example of risk assessment that can be used)



# Escape-Risk Assessment
# (This is an example of risk assessment that can be used)

| Relative Leveling Points | 0 | 1 | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|---|---|

**A. SITE SPECIFICS**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Slope % (average) | <10 | 10-20 | 21-30 | 31-40 | 41-60 | >60 | |
| Aspect Inside Unit | ------ | N | NE,NW | E,W,Flat | SE,SW | S | |
| Fuel Model Inside Unit | ------ | 8 | 1,5 | 9 | 2,11 | 3,4,10,12 | |

**A. SUBTOTAL:** ____

**B. CONTAINMENT FACTORS FOR ESCAPED RUNNING HEAD-FIRE**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Projected Flame Len. -ft. | <1.0 | 1.0-1.5 | 1.6-2.0 | 2.1-4.0 | 4.1-8.0 | >8.0 | |
| Projected R.O.S.- ch/hr. | ------ | <2 | 2-4 | 5-7 | 8-10 | >10 | |
| Line Product Rate- ch/hr. | >20 | 19-20 | 16-18 | 13-15 | 10-12 | <10 | |
| Fireline Width-ft. | Island | >16 | 13-16 | 9-12 | 3-8 | <3 | |
| Fuel Model- Outside Unit (most prevalent) | ------ | 8 | 1,5 | 9 | 2,11 | 3,10,12 | |
| Position on Slope | ------ | Top,Flat | upper1/3 | middle 1/3 | lower 1/3 | bottom | |
| Unit Configuration |  |  |  |  |  |  | |
| Unit Size - Acres | ------ | <10.0 | 10.1-20.0 | 20.1-30.0 | 30.1-40.0 | >40.0 | |
| % Continuity of Fuel Adjacent to Burn Unit | <15 | 15-25 | 26-35 | 36-50 | 50-75 | >75 | |
| Time of Ignition | 21-0600 | 06-0800 | 08-1000 | 10-1200 | 1200-1400 | 14-1600 | |

**B. SUBTOTAL:** ____

**C. PRESCRIPTION PARAMETERS**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mid-Flame WS - mph | ------ | 3-4 | 5-6 | 7-8 | 9-15 | <3 or >15 | |
| 1 hr. Fuel Moisture-% Fuel Model 1 or 2 Only | ≥12 | 11 | 10 | 9 | 8 | <8 | |
| 1 hr. Fuel Moisture-% Fuel Model 3 Only | >25 | 22-25 | 18-21 | 14-17 | 10-13 | <10 | |
| 1 hr. Fuel Moisture-% Timber/Slash Group Only | >20 | 19-20 | 16-18 | 13-15 | 10-12 | <10 | |
| Relative Humidity-% | >75% | 56-75% | 46-55% | 36-45% | 25-35% | <25% | |
| Live Fuel Moisture-% | >300 | 201-300 | 151-200 | 101-150 | 50-100 | <50 | |
| Drought Index (KBDI) | <100 | 101-200 | 201-300 | 301-400 | 401-500 | >500 | |

**C. SUBTOTAL:** ____

| **RATIONALE:** | **<45 = LOW RISK TOTAL POINTS (A.+B.+C.) ____**<br>**45-75= MODERATE RISK**<br>**>75= HIGH RISK**<br>**FINAL ESCAPE-RISK RATING _____** |
|---|---|

## 1. Potential for Escape

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br><br>***Low <u>Moderate</u> High*** | Although holding forces have access around the entire unit, PI is at 60% at the hot end of the prescription |
| **Final Rating:**<br><br>***<u>Low</u> Moderate High*** | Ignition procedures won't create intense fire until adequate buffers are in place. Grass fuels will not hold fire longer than the day of ignition. Fire behavior calculations and procedures for ignition, holding, mopup and patrol are outlined in the burn plan. |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br><br>***Low Moderate <u>High</u>*** | Potential for multiple simultaneous spot fires can propagate at moderate rates of spread but can be held by skilled and prompt holding actions. Contingency forces must be available on call-up commensurate with local wildfire standards. |
| **Final Rating:**<br><br>***Low <u>Moderate</u> High*** | Mow lines and wet lines will be constructed around the burn unit. Fire control resources will be placed at key locations on and adjacent to residential property. Lookouts will be placed at key locations to watch for slopovers and spot fires. Slow methodical backfiring techniques will be used along all burn unit boundaries to reduce the risk of escape. Engines will patrol the area after ignition to extinguish any remaining hot spots. |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br><br>***<u>Low</u> Moderate High*** | Holding operations will be supervised at the Single Resource Boss level. The entire burn unit is accessible to holding resources. No abnormal weather is anticipated and all key implementation personnel will be from the local area or from within the Great Plains Region. |
| **Final Rating:**<br><br>***<u>Low</u> Moderate High*** | Ignition and holding procedures and organization are outlined in the burn plan. |

## 2. The Number and Dependency of Activities

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 3. Offsite Values

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 4. Onsite Values

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 5. Fire Behavior

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 6. Management Organization

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 7. Public and Political Interest

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 8. Fire Treatment Objectives

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 9. Constraints

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 10. Safety

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 11. Ignition Procedures/Methods

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 12. Interagency Coordination

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 13. Project Logistics

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

## 14. Smoke Management

| Risk | Rationale |
|---|---|
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Potential Consequences** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |
| **Technical Difficulty** | **Rationale** |
| **Preliminary Rating:**<br>***Low Moderate High*** | |
| **Final Rating:**<br>***Low Moderate High*** | |

Prescribed Fire Plan Preparation, RX-341

Unit 5 – Prescription Development and Scheduling

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Describe ranges of acceptable prescription parameters to produce fire behavior that meets fire effects objectives and control limitations.

2. Identify the components of fuels and weather that contribute to the development of the prescription.

3. Demonstrate how fire modeling outputs may be used to develop prescriptions.

4. Discuss how the assumptions and limitations in the fire spread model relate to prescribed fire.

5. List supporting documentation that may be required for the prescription.

# I. DEVELOPING PRESCRIPTION PARAMETERS

## A. What is "Prescription?"

Prescription is the measurable criteria that define a range of conditions during which a prescribed fire may be ignited and held as a prescribed fire.

- Describes a range of low to high limits for the environmental parameters (weather, topography, fuel conditions, etc.).
- Describes fire behavior parameters (flame lengths, rate of spread, spotting distance, etc.).
- Parameters are generally quantitative variables expressed as a range that meet project objectives.
- Some prescription variables (such as spotting) are expressed as a "not to exceed limit."
- A well-defined prescription is critical to success.

B. Design Prescription to Meet Project Objectives.

1. Prescription development is a four step process:

   - Identify fire and resource objectives, control limitations, and other constraints.

   - Determine parameters (fuel, weather, season, and topographic variables) that will result in desired fire behavior.

   - Develop desired fire behavior prescription to accomplish objectives.

     Compare outputs to objectives to set high and low prescription limits. For example, flame lengths (output) vs. scorch height (objective).

   - Document the prescription.

     A prescribed fire plan preparer must translate most objectives into definable fire behavior outputs.

2. In developing a prescription, ask two primary questions:

   - What weather parameters produce fire behavior that meets the objectives?

     – Short-term
     – Long-term

   - What fire behavior is needed to achieve resource management and control objectives?

## II. COMPONENTS OF FUELS AND WEATHER

Not all of the following environmental variables are required in a prescription.

The key is deciding what variables will produce the prescribed fire behavior to meet objectives.

### A. Fuel Variables

1. Dead fuel moisture content

   - Expressed as a percent of oven-dried weight of the fuel.
   - Classified by fuel size; determines how much of the fuel is available during combustion.

2. Duff moisture content

   - Expressed as a percent of oven-dried weight of the duff.
   - Influences consumption of duff and organic soils in smoldering or glowing combustion.
   - Influences duration of burn.

3. Live fuel moisture content

   - Expressed as a percent of oven-dried weight of the fuel.
   - Determines the live fuels contribution to fire behavior.
   - Determines the effect of the fire behavior on the live vegetation.

     State of development of the live vegetation has a major impact on plant response post-fire.

B. Weather Variables (inputs)

1. Temperature

- Influences how fast fuels dry, and also their moisture content.

- Influences scorch height and probability of ignition (PIG).

2. Relative humidity

Relative humidity influences fuel moisture content, especially of 1- and 10-hr fuels which are the major contributors to fire behavior.

3. Wind

Wind is often the most important fire weather variable, due to its effect on fire behavior outputs.

- Flame lengths

- Rate of spread

- Spotting distance

C. Time Variables/Seasonal Timing (scheduling)

1. Seasonal

- Season of the year influences plant condition, sprouting, seed source, and potential insect attack.

- Burning during various seasons can significantly affect plant response.

Where would you find information concerning the best time of year/season, or development stage of vegetation, to apply prescribed fire?

2. Diurnal weather patterns

Changes in temperature, relative humidity, and wind speed can significantly affect fire behavior and first order effects.

D. Tools for Identifying Desired Fuel Conditions and Scheduling Implementations

1. National Fire Danger Rating System (NFDRS)

2. Energy Release Component (ERC)

- Related to the heat release rate within the flaming front of a moving fire.

- Has low variability.

- The best fire danger component for indicating the effects of intermediate to long-term drying on fire behavior.

- Not intended for use as a drought index.

3. Burning Index (BI)

   - Function of the spread component and the energy release component.
   - Has moderate variability.
   - Sensitive to fuel models.
   - Can trace seasonal trends reasonably well for models with heavy dead or live components.
   - Very sensitive to weather observation errors.

4. Keetch Byram Drought Index (KBDI)

   - Measures moisture in deep duffs or upper soil layers.
   - Varies from 0 (wet) to 800 (dry).

5. 1000-Hour Time Lag Fuel Moisture (TLFM)

   - Dead fuel moisture responds solely to ambient environmental conditions.
   - Any use of the 1000-hr TLFM as a separate "index" must be preceded by an analysis of historical fire weather data to identify critical levels of 1000-hr TLFM.

E. Fire Behavior Variables (outputs)

1. Rate of spread

- The relative activity of a fire in extending its horizontal dimensions.
- Usually measured in chains/hour.
- Important inside a unit as an estimator of relative ease of fire spread throughout the planned area and for safety.
- Important outside the unit when contingency planning is critical to the burn.

2. Fireline intensity

- The rate of heat release per unit width of the flaming front per unit time.
- Measured in BTU/ft/sec.
- Useful in planning for control forces and their ability to attack a fire front.
- Difficult to measure, but can be closely approximated because of its strong correlation with flame length.

3. Flame length

- Correlated with fireline intensity.
- Important for predicting fire effects.
- Flame length has many uses in prescribed fire planning (type, amount of control forces needed).

4. Additional outputs

- Spotting distance
- Scorch height
- Mortality
- Probability of ignition
- Other?

## III. ASSUMPTIONS AND LIMITATIONS OF THE FIRE SPREAD MODEL

### A. Intended to Describe a Flame from Surface Fuels

Does not describe crown fire behavior which may be needed to meet prescription objectives in certain vegetation types (juniper conversion).

### B. Describes Behavior at the Head of the Fire Where the Fine Fuels are Assumed to Carry the Fire

Does not consider smoldering phase of a fire. The burnout of fuels, usually large fuels and compacted litter, behind the flame front is not described.

### C. Assumes Fuels, Weather, and Topography are Uniform and Continuous

Your prescribed fire project area may have multiple fuel models which may require multiple prescriptions or utilization of the predominant fuel model for prescription development.

D. Does not Consider the Effects of Long-Range Spotting on the Main Fire Behavior

You may need to develop a cooler prescription to eliminate or minimize spotting potential.

You may need to go into the spot module to determine potential holding problems and develop additional holding and contingency needs.

## IV. USING FIRE MODELING OUTPUTS

Due to modeling limitations, a calibration of fire behavior outputs may be required to correct over- and underpredictions of fire behavior.

When developing prescriptions, prescribed fire plan preparers should use subject matter experts such as fire behavior analysts (FBAN), long term fire analysts (LTAN), and fire ecologists.

You may also use historical fire behavior data such as previous prescribed fire plans, empirical data, post-burn reports, and other publications.

A. Description of Low to High Prescription Limits

- Describe the low to high limits required to meet prescribed fire plan objectives while meeting smoke management and control objectives.

- The description includes environmental and fire behavior parameters.

- The description may illustrate a combination of prescriptive elements that are excluded.

  For example, the prescription might accept high wind speeds and low humidity, but won't accept them at the same time.

B. Fire Behavior Predictions for Fuels Outside the Ignition Area

- When developing holding and contingency plans, consider the predicted fire behavior outside of the project boundary.

- Fire behavior characteristics for fuel models within the maximum spotting distance, or adjacent to the project boundaries, must be considered and modeled using worst-case fire behavior predictions.

- These predictions should be identified from fire behavior model runs of the hottest, driest, and windiest prescription conditions identified in the plan, along with the most extreme environmental conditions.

C. Separate Prescription for Multiple Fuel Models

- May be needed for multiple fuel model conditions to address seasonal differences and/or types of ignition (blacklining, aerial ignition, etc.).

- May result in multiple complexity ratings and burn organizations.

- May result in the need to identify multiple levels of management, organizational structures, implementation measures, and pre-burn considerations.

D. Fire Behavior Narrative

Should include a summary of the fire behavior identified in the prescription and how it will achieve the desired treatment objectives; check agency guidelines.

Suggested information:

- Fire behavior resulting from unique fuels and environmental conditions.

  For example, "Occasional torching of Rocky Mountain Juniper may be observed."

- Any historical evidence for over- or underpredictions of the fire behavior modeling program used, and the possible or probable effects to the actual fire behavior.

  For example, "Previous prescribed fires implemented in the area in like fuel type and loadings show fire behavior predictions are overpredicted by a factor of .3; therefore, actual flame lengths may be 3 feet instead of 4.2."

- Any onsite conditions that may cause over- or underpredictions vs. actual fire behavior.

  For example, "Fine grass fuel loadings are not continuous across the project area; therefore, rates of spread may be lower than modeled."

- Any ignition techniques that will be implemented to ensure prescriptive parameters are met.

## V. SCHEDULING

### A. Identify the General Ignition Timeframes

- Time of day and/or duration of ignition
- Season(s)/year(s)
- Restricted dates

At national preparedness levels 4 and 5, prescribed fire plan implementation is restricted (regardless of prescribed fire plan language).

How long is a prescribed fire plan good for?

### B. Supporting Documentation

- Required appendices include fire modeling outputs and/or historical evidence.
- Include modeling documentation (BehavePlus runs).
- Only include those modeling runs that pertain to those prescriptive elements described in the plan.
- Empirical evidence (historical evidence or researched data) and judgment may be used to identify or calibrate prescriptions.
- Any empirical evidence used must be included in the plan appendix or as a fire behavior narrative.
- Documentation of fire behavior is critical.

What element typically covers post-fire behavior documentation?

**EXERCISE: Red Bull Prescription**

Review the Prescription element in the Red Bull Prescribed Fire Plan and answer the questions.

1. From the Red Bull Prescription element narrative, how is the prescription limited?

2. How does the Red Bull prescription meet the prescribed fire plan objectives?

**EXERCISE: Prescription Development**

Prescribed Fire Plan Prescription Development:

You are developing a prescription for a rangeland and forest restoration project. The project area is located on a south aspect in a fuel model 2 with ponderosa pine. Small 3-foot tall ponderosa pine is encroaching into the rangelands. The regeneration is also scattered as an understory within the mature ponderosa pine trees.

Due to past experience with prescribed fires in the area, your fire management officer (FMO) has constrained your spot fire distance allowed to .3 mile and probability of ignition to less than 60%. Experience has also shown that when predicted mortality probability reaches above 45% an unacceptable loss in older growth trees occurs.

Resource Objectives:

- Restore the rangelands and forest structures within the project area.
- Reduce crown fire damage potential to mature ponderosa pine.
- Retain the mature tree canopy structure within the project area.

Prescribed Fire Objectives:

- Remove $\geq$ 90% of 3-foot tall or less ponderosa pine encroachment into the grasslands and within mature tree understory.
- Limit mortality of mature (10-inch or greater) ponderosa pine trees to $\leq$ 30%.
- Limit scorch height to < 35 feet.

Instructions:

Use the following BehavePlus inputs and complete the runs. Use the results from the runs to complete the missing information in the prescription table. Be prepared to discuss and justify your answers.

## Inputs: Surface, Scorch, Mortality (head fire)

### Modules: SURFACE, SCORCH, MORTALITY

| | | |
|---|---|---|
| Description | | Unit 5 RX Development : Surface Scorch Mortality |

### Fuel/Vegetation, Surface/Understory

| | | |
|---|---|---|
| Fuel Model | | 2 |

### Fuel/Vegetation, Overstory

| | | |
|---|---|---|
| Tree Height | ft | 65 |
| Crown Ratio | | .45 |
| Mortality Tree Species | | pinpon |
| D.B.H. | in | 10 |

### Fuel Moisture

| | | |
|---|---|---|
| 1-h Moisture | % | 3, 6, 9, 12, 15 |
| 10-h Moisture | % | 7 |
| 100-h Moisture | % | 9 |
| Live Herbaceous Moisture | % | 30 |
| Live Woody Moisture | % | |

### Weather

| | | |
|---|---|---|
| Midflame Wind Speed (upslope) | mi/h | 0.0, 2.0, 4.0, 6.0, 8.0, 10.0 |
| Air Temperature | oF | 70 |

### Terrain

| | | |
|---|---|---|
| Slope Steepness | % | 20 |

---

### Acceptable Fire Conditions

| | | | | |
|---|---|---|---|---|
| Surface Rate of Spread (maximum) | (ch/h) | ☐ | 0.0 | - 0.0 |
| Flame Length | (ft) | ☐ | 0.0 | - 0.0 |
| Scorch Height | (ft) | ☒ | 3 | - 35 |
| Probability of Mortality | (%) | ☒ | 0 | - 30 |

---

### Run Option Notes

Calculations are only for the direction of maximum spread [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind is blowing upslope [SURFACE].

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### Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]

(continued on next page)

## Inputs: Surface, Scorch, Mortality (backing fire)

### Modules: SURFACE, SCORCH, MORTALITY

| | | |
|---|---|---|
| Description | | Unit 5 RX Development : Surface Scorch Mortality |

### Fuel/Vegetation, Surface/Understory

| | | |
|---|---|---|
| Fuel Model | | 2 |

### Fuel/Vegetation, Overstory

| | | |
|---|---|---|
| Tree Height | ft | 65 |
| Crown Ratio | | .45 |
| Mortality Tree Species | | pinpon |
| D.B.H. | in | 10 |

### Fuel Moisture

| | | |
|---|---|---|
| 1-h Moisture | % | 3, 6, 9, 12, 15 |
| 10-h Moisture | % | 7 |
| 100-h Moisture | % | 9 |
| Live Herbaceous Moisture | % | 30 |
| Live Woody Moisture | % | |

### Weather

| | | |
|---|---|---|
| Midflame Wind Speed (upslope) | mi/h | 0.0, 2.0, 4.0, 6.0, 8.0, 10.0 |
| Air Temperature | oF | 70 |

### Terrain

| | | |
|---|---|---|
| Slope Steepness | % | 20 |

### Fire

| | | |
|---|---|---|
| Spread Direction (from upslope) | deg | 180 |

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### Acceptable Fire Conditions

| | | | | |
|---|---|---|---|---|
| Surface Rate of Spread | (ch/h) | ☐ | 0.0 | - 0.0 |
| Flame Length | (ft) | ☐ | 0.0 | - 0.0 |
| Scorch Height | (ft) | ☒ | 3 | - 35 |
| Probability of Mortality | (%) | ☒ | 0 | - 30 |

---

### Run Option Notes

Calculations are for the specified spread directions [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Wind is blowing upslope [SURFACE].

(continued on next page)

## Inputs: Ignite

### Modules: IGNITE

Description: Unit 5 RX Development : Ignite

### Fuel Moisture

| | | |
|---|---|---|
| 1-h Moisture | % | 3, 6, 9, 12, 15 |

### Weather

| | | |
|---|---|---|
| Air Temperature | oF | 70 |
| Fuel Shading from the Sun | % | 50 |

### Acceptable Fire Conditions

| | | | | |
|---|---|---|---|---|
| Probability of Ignition from a Firebrand | (%) | X | 0 | - 60 |

### Run Option Notes

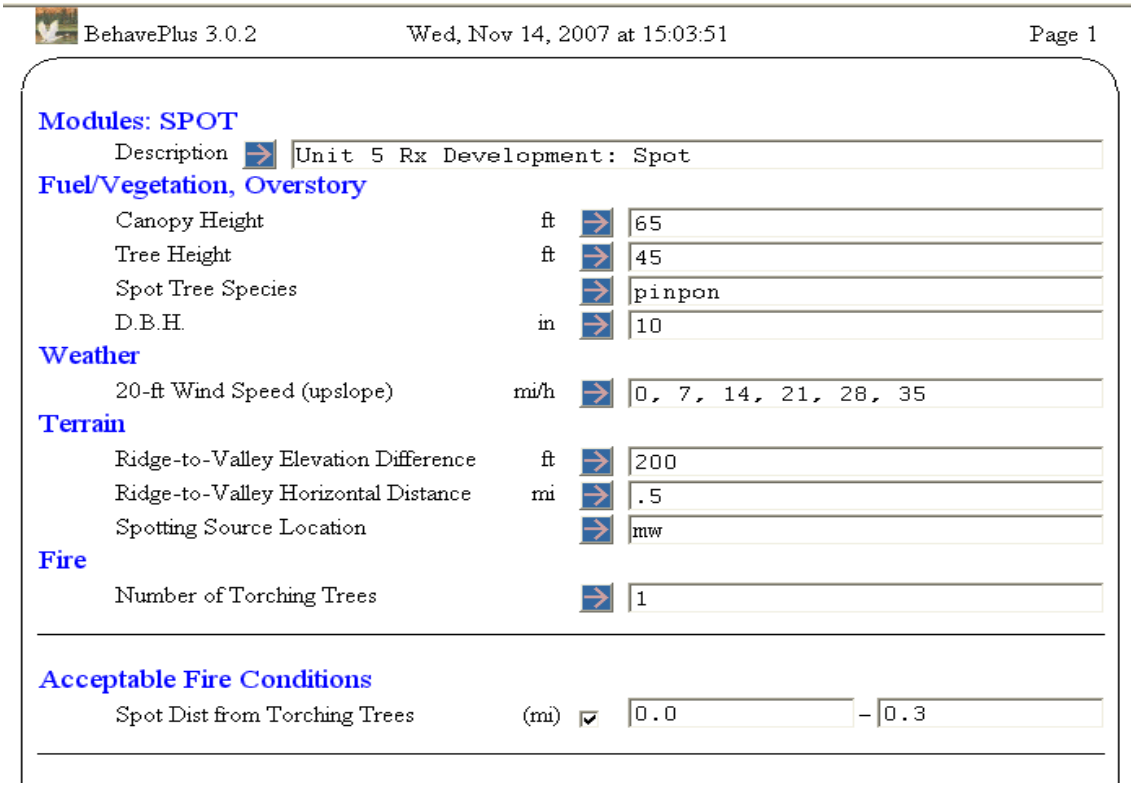
None

### Output Variables

Probability of Ignition from a Firebrand (%) [IGNITE]

### Notes

## Inputs: Spot



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**Modules: SPOT**

| | | |
|---|---|---|
| Description | | Unit 5 Rx Development: Spot |

**Fuel/Vegetation, Overstory**

| | | |
|---|---|---|
| Canopy Height | ft | 65 |
| Tree Height | ft | 45 |
| Spot Tree Species | | pinpon |
| D.B.H. | in | 10 |

**Weather**

| | | |
|---|---|---|
| 20-ft Wind Speed (upslope) | mi/h | 0, 7, 14, 21, 28, 35 |

**Terrain**

| | | |
|---|---|---|
| Ridge-to-Valley Elevation Difference | ft | 200 |
| Ridge-to-Valley Horizontal Distance | mi | .5 |
| Spotting Source Location | | mw |

**Fire**

| | | |
|---|---|---|
| Number of Torching Trees | | 1 |

**Acceptable Fire Conditions**

| | | | |
|---|---|---|---|
| Spot Dist from Torching Trees | (mi) | 0.0 | – 0.3 |

1. Use the inputs on the previous pages and the prescribed fire plan objectives to complete the prescription table (fill in shaded areas).

| Weather | Minimum Fire Behavior | Maximum Fire Behavior |
|---|---|---|
| Temperature (deg F) | N/A | 70 |
| RH (%) | N/A | 20 |
| Mid Flame Wind Speed (mph) | | |
| Wind Direction* | Upslope | Side slope, 90° or less from upslope |

*Down slope winds or side slope winds 90° or less from down slope not acceptable; too hard to control flame lengths.

| Fuel Moistures (%) | Minimum Fire Behavior | Maximum Fire Behavior |
|---|---|---|
| 1 Hr (%) | | |
| 10 Hr (%) | N/A | **7** |
| 100 Hr (%) | N/A | 9 |
| Live Herbaceous (%) | N/A | 30 |

| Fire Behavior | Minimum Fire Behavior | Maximum Fire Behavior |
|---|---|---|
| Flame Length (ft) | | |
| Rate of Spread | N/A | N/A |
| Spotting Distance (mi) | 0 | |
| Probability of Ignition (%) | N/A | |
| Scorch Height (ft) | | |
| Mortality (%) – 10” DBH trees | | |
| Mortality (%) – 3 ft trees | | |

2. Is it better to use a backing fire or a strip head fire for this project? Explain.

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6 – Smoke Management and Air Quality

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Describe the relationship between smoke management and prescribed fire objectives.

2. Identify principal smoke management mitigation strategies.

3. Describe the steps for identifying smoke concerns and mitigation techniques for managing smoke production and dispersion.

4. Identify available tools and technologies that help develop the smoke management element of the prescribed fire plan.

## I. INTRODUCTION

The following is summarized from the Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide.

Smoke Management and Air Quality:

Describe how the project will comply with local community, county, state, tribal, and federal air quality regulations.

The prescribed fire plan will identify:

- Class I air sheds
- Restricted areas
- Non-attainment areas (designated areas) and population centers that may be impacted.
- Local sensitive features such as highways, airports, and recreation sites.
- Other smoke sensitive receptors

Include modeling outputs, and mitigation strategies and techniques to reduce the impacts of smoke production, if required by State Implementation Plans (SIPs) or other state or local regulations.

For other smoke management planning suggestions and techniques for reducing or redistributing emissions, refer to the Smoke Management Guide for Prescribed and Wildland Fire (2001 Edition).

## II. IMPORTANCE OF SMOKE MANAGEMENT

- Smoke from prescribed fires will increasingly be regulated.
- Public nuisance concerns
- Transportation safety
- Particulate standards are tightening due to scientific and medical study.
- Potential liability
- Local smoke violations may affect our ability to burn on a larger scale.
- Many prescribed fire incidents are from smoke as opposed to escaped fire.

## III. SMOKE AS AN AIR POLLUTANT

The Environmental Protection Agency (EPA) established criteria pollutants that are a threat to the public's health and welfare.

Two criteria pollutants of concern from prescribed burning are:

- Carbon Monoxide (CO)
  - Potential health problems to firefighters.
- Particulate Matter (PM)
  - PM 2.5 and PM 10 (smoke is approximately 70% PM 2.5).
  - Source of potential health problems to firefighters and the public (respiratory issues).
  - Impacts visibility from the standpoint of safety and aesthetics.

## IV. EFFECTS OF SMOKE ON VISIBILITY

### A. Smoke Impacts

Smoke from prescribed fire can have significant impacts on visibility. PM and water vapor are the primary components of visibility impairments.

Impacts include reducing visibility on highways (a safety problem), and reducing visibility in areas where viewing the scenery is an important attribute and legally protected.

### B. Visibility in Scenic Areas

1. The 1977 Clean Air Act Amendments set forth a national goal for visibility that called for:

   - The prevention of any future, and the remedying of any existing impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution (CAA, Section 169(a)(1)).

   - Mandatory Class I Federal areas which include national parks and wilderness areas over certain sizes that were in existence as of August 7, 1977 (including any additions to those areas).

2. Many people claim that viewing the scenery through clean, fresh air is one of the most important attributes of parks and wilderness areas.

   Smoke from prescribed fires can significantly affect the way the public is able to view the scenery.

3. In 1999, the EPA issued regional haze regulations to manage and mitigate visibility impairment from the multitude of regional haze sources.

   Regional haze regulations call for states to establish goals for improving visibility in Class I national parks and wilderness areas and to develop long-term strategies for reducing emissions of air pollutants that cause visibility impairment.

C. Highway Safety Effects

Prescribed fire smoke, with and without fog, has been responsible for a number of safety-related accidents and fatalities.

When relative humidity is at approximately 70-80%, wood smoke particles act as condensation nuclei and can enhance the development of fog, which presents significant safety problems on highways.

## V. THE CLEAN AIR ACT AND PRESCRIBED FIRE

The Clean Air Act (as amended in 1990) is a legal system designed to protect human health and welfare.

The Clean Air Act establishes and attains major air quality goals by addressing existing and potential air pollution problems.

Major air quality goals include:

- Attaining National Ambient Air Quality Standards (NAAQS).
- Preventing significant deterioration of air quality in areas cleaner than the NAAQS.
- Protecting visibility in national parks and wilderness areas.
- Preventing harmful levels of toxic air pollutants.

A. State Implementation Plans

Each state is responsible for preparing an SIP, and if necessary, a smoke management plan to prevent deterioration of air quality and NAAQS violations.

A state may adopt and enforce standards and regulations that are more (but never less) stringent than those required by the Clean Air Act.

Certain states may have certain standards for toxic air pollutants. Prescribed fire practitioners should provide input to state regulators when the state is developing or revising their SIP.

B. Federal Agency Compliance

In general, any federal facility or authorized activity emitting air pollution, including a program of prescribed burning, must comply with all federal, state, interstate or local requirements to the same extent as it applies to any non-governmental entity.

Consequently, a federal agency may have to obtain permits, monitor impacts, reduce emissions, pay fees, and keep records, etc.

A federal agency must also not engage in, support in any way, license, or approve any activity, such as prescribed fire, which does not meet all applicable requirements of a state implementation plan.

C. Interagency Groups

In some areas, self directed interagency "groups" have been formed (Montana/Idaho Airshed Group).

EPA has encouraged the 48 contiguous states to engage in regional planning to coordinate development of strategies for controlling pollutant emissions across a multi-state region.

Groups of states are addressing groups of Class I areas through established organizations:

- The Western Regional Air Partnership
- Midwest regional Air Planning Organization
- Central Regional Air Planning Association
- Mid-Atlantic/Northeast Visibility Union
- State and Tribal Association of the Southeast

The regional planning organization information can be found at: www.epa.gov/oar/visibility/regional.html

## VI. IDENTIFYING CONFLICTING OBJECTIVES

- Writing good prescribed fire objectives does not always ensure good smoke management objectives.
  - Practitioners and authors of prescribed fire plans must never assume that the two complement one another.
  - By quantifying your smoke management objectives you may eliminate confusion between the two.
  - A separate and distinct set of smoke management objectives should be stated in the prescribed fire plan together with the production/duration prescription parameters to accomplish these objectives.

- Two examples of prescribed fire objectives that appear to conflict with the guidance for good smoke management:

  – Example 1: The prescribed fire is being done for silviculture site preparation; extensive duff reduction is a goal. Smoke management guidelines say to minimize the smoldering phase.

  – Example 2: The prescribed fire is an understory burn for hazard reduction, but the scorch on the residual trees must be strictly limited. Smoke management guidance is to burn with the highest intensity possible to develop a strong convection column.

## VII. SMOKE MANAGEMENT STRATEGIES

Three principal strategies to manage smoke from prescribed fires are:

### A. Avoidance

Considers meteorological conditions when scheduling prescribed fire projects to avoid an incursion of smoke into smoke sensitive areas.

1. Consider wind direction for:

   - Convection lift phase of the burning period.
   - Non-convective lift phase residual smoke.

2. Avoid heavy public-use periods.

3. Consider effects of inversions and subsidence.

4. Consider impacts from other burns in the same geographical area.

5. Communicate with the public to allow them to prepare for smoke impacts.

B. Dilution

Controls the rate or scheduling for dispersion to assure a tolerable concentration of smoke in designated areas.

1. Burn when weather systems are unstable, but not at extremes. Avoid burning below the inversion layer. A temperature inversion can isolate smoke originating above the stable layer from areas below the inversion.

2. Start ignitions in the morning/early afternoon. As atmospheric heating takes place, mixing will usually improve. Avoid late afternoon and evening ignitions because of increasing atmospheric stability.

3. Rotate burning opportunities between air sheds to avoid overloading natural clearance mechanisms or consecutive impacts on the same areas or drainages.

4. Establish firing patterns and tools to generate adequate heat to penetrate low level stable areas. Consider pre-burning of control lines (blacklining) to allow for hotter firing techniques.

5. Avoid days with low morning transport wind speed. Use test fire or helium balloons to measure transport winds at the burn site.

6. Be cautious of nighttime burning.

    - Inversions
    - Fog formation
    - Consider down slope, down canyon nighttime circulation.

7. Collect pre-burn meteorological information on site to understand local weather. Use spot weather forecasts.

C. Emission Reduction

Uses techniques to minimize the smoke output per unit area treated. This should be considered on all burns.

1. Reduce the number of acres burned.

   The fewer acres burned, the fewer emissions produced. This may not always be a preferred option.

   Reducing the number of acres burned may result in only delaying the release of emissions, either through prescribed burning at a later date, or as a result of a wildfire.

2. Reduce pre-burn fuel loading.

   Reducing the fuel loading reduces the available fuel for consumption during the burn.

   Accomplished by:

   - Burn outside active growing season.
   - Burn soon after harvest.
   - Burn frequently, if appropriate.

3. Reduce fuel consumption.

   This refers to reducing the proportion of biomass that is actually burned. The objective is to burn only the biomass that needs to be burned.

   Under higher fuel moisture conditions, combustion is less efficient; however, much less fuel is consumed and the total emissions produced are lower than under lower fuel moisture conditions.

4. Ignition techniques

Using different ignition techniques can lower the total emissions produced from burns.

- Pile burning
  - More fuels within piles burn during the flaming phase which has a lower emission factor.
  - Pile burns allow for burning outside primary burning season.
  - Burn piles when dry.
  - Burn clean with low mineral soil content.
  - Cover piles to keep dry to allow for late season burning.
- Backing fires
  - Backing fires consume dead fuels more completely.
  - Typically produces less smoke per unit of time.
- Head fire (high intensity)
  - Generally less consumption of fuel.
  - Typically produces more smoke per unit of time.
  - Aerial ignition can create high intensity, short duration fires, reducing the fuel consumed during smoldering phase.

## VIII. PLOTTING DOWNWIND CONCERNS (SCREENING SYSTEM)

The screening system has four steps:

- Plot direction of smoke plume.
- Identify smoke-sensitive areas (receptors).
- Identify critical smoke sensitive areas (receptors).
- Mitigate the risk.

### A. Step 1 - Plotting Trajectory of Smoke

1. Use maps showing sensitive areas, improvements (receptors), etc., which are sensitive to smoke around the burn area.

2. Plot the anticipated downwind smoke movement based on standard distances found in the Smoke Management Guide.

   General guidelines include:

   - 5 miles for grass fuels regardless of fire type.

   - 10 miles for head fires in shrub and timber models.

   - 20 miles for logging slash fires.

   Always keep in mind the size of the burn when plotting the trajectory of smoke.

3. Locate burn on map and draw a line representing the centerline of the path of the smoke plume for the distance indicated (direction of transport wind).

   If burn will last three hours or more, or will be burning/smoldering through the night, draw another line showing predicted wind direction at completion of burn.

4. To allow for horizontal dispersion of smoke, as well as shifts in wind direction, draw two other lines from the fire at an angle of 30 degrees from the centerline(s).

   The results of these plots are your probable daytime smoke impact area(s).

5. Identify possible nighttime smoke pooling areas or drift directional changes due to topography.

B. Step 2 - Identify Smoke Receptors

1. Identify and mark on the map any receptors such as airports, highways, communities, recreation areas, schools, hospitals and factories within the 30 degree lines plotted above. These are potential targets for smoke from your burn.

2. If **no** potential targets are found, you may burn as prescribed. Keep in mind the permit process as well as the prescribed fire plan.

3. If any targets are found, continue this screening system.

C. Step 3 - Identify Critical Smoke Receptors

1. Identify and mark critical impact receptors within the trajectory on your map.

   Critical impact receptors include:

   - Areas that already have an air pollution or visibility problem (non-attainment area).
   - Class I air sheds
   - Highways
   - Health/extended care facilities

2. Smoke receptors listed above become a critical impact receptor if they meet the following criteria:

   - Backing fires – any receptor within one mile is critical.

   - Head fires – any receptor within two miles is critical.

   - Heavy fuels or landscape scale burns – any receptor within three miles is critical.

3. If any critical impact receptors are located:

   - Amend prescription to identify a new wind direction that will avoid such areas, and return to Step 1, **or**

   - Apply a smoke management strategy that would negate adverse impacts to the critical receptors (coordinate with your respective state/local air resource manager), **or**

   - Reduce the size of the area to be burned, and aggressively mop up and monitor, **or**

   - Work with affected individuals, etc., to come up with mitigation measure(s), **or**

   - Use an alternative other than burning.

4. If no critical impact receptors are found, or smoke problem has been mitigated, continue the screening system.

D. Step 4 - Mitigate the Risk

When any receptor may be impacted by your burn, meet smoke management obligations by mitigating or minimizing possible adverse effects by doing some or all of the following:

1. Prescribe a new wind direction to avoid receptors.

2. If you cannot avoid all targets, review whether the burn can be accomplished or not.

3. Apply a different smoke modeling technique.

4. Keep smoldering phase of the burn to a short period of time.

5. Look for atmospheric conditions that are on the high end for good dispersion.

6. Look for good transport winds (10 mph or greater).

7. Public relations work (notify various media sources, public education).

If impact receptors in the overlapping trajectory are from two sources of smoke, reschedule or look closely at the combined effects of the two prescribed fires.

Interagency coordination and prioritization may be required.

## IX. AVAILABLE TOOLS AND TECHNOLOGIES

The intent of this class is NOT to teach modeling programs, but identify those that could possibly be used.

- Smoke dispersion and emissions prediction systems are valuable tools in smoke management.
  - Aid in visualizing what fuel and weather conditions are best suited for burning.
  - Can be used as communications tool to help describe potential impacts.
- Emission prediction programs can calculate the consumption of fuel and emission of particles produced by wildland fire.
  - Fire Emission Production Simulator (FEPS)
  - First Order Fire Effects Model (FOFEM)
  - Simple Approach Smoke Estimation Model (SASEM)
  - Consume

A. Three Types of Smoke Trajectory Models

1. Dispersion models – Track trajectories of individual particles or assume a pattern of diffusion.

   Plume and puff dispersion patterns are modeled:

   - Plume models – Assume that smoke travels in a straight line under steady state conditions.
     - SASEM
     - VSMOKE
     - VSMOKE GIS

     Plume models are most commonly applied in flat or gently rolling terrain, but can be used whenever a plume is expected or desired to rise above the influence of the terrain.

   - Puff models – Simulate a continuous plume by rapidly generating a series of puffs.
     - TSARS
     - CALPUFF

     Some states require that smoke dispersion modeling be completed for smoke permits.

2. Box models – Assume instantaneous mixing within a confined area such as a basin or valley.

   Flow is assumed to be down valley and smoke is assumed to fill each box segment.

   This method of estimating smoke concentrations is most useful when understanding patterns of smoke concentrations in an isolated valley is critical.

   ValBox is the most common box model.

3. Grid models – Use a fixed coordinate system that allows for evaluation of cumulative impacts from several plumes or chemical interactions of particles and gases within plumes.

   Grid models are especially useful for evaluating the impact of smoke on regional haze.

   At present, grid models are not being used for wildland fire applications.

B. Web Sites with Modeling Programs and User Guides

1. Fire Research and Management Exchange System (FRAMES): http://frames.nbii.gov (click on the "Subject Areas" tab then the "Emissions and Smoke" link)

2. Additional links to smoke management information: www.nwcg.gov

**CLASS DISCUSSION:** Refer to the Smoke Management element, Prescription element, and Smoke Vector map in the Red Bull Prescribed Fire Plan.

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Unit 7A – Implementation: Pre-burn Considerations and Briefing

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Identify on- and offsite actions that must be completed and documented prior to implementation.

2. Identify considerations that must be addressed in the prescribed fire plan.

3. Identify actions, timelines, and responsibilities for interagency and intra-agency coordination and public notifications.

4. Identify briefing criteria to be covered in the prescribed fire plan.

## I. ON- AND OFFSITE ACTIONS THAT MUST BE COMPLETED AND DOCUMENTED TO IMPLEMENT THE BURN

Where might you identify pre-burn considerations?

### A. Special Onsite Clearances

- Archeological
- Biological
- Private landowner agreements

### B. Fireline Preparation Needs

- Snags
- Fireline standards
- Mowing, plowlines, handlines
- Natural barriers (creeks or swamps)
- Difficult holding areas
- Other

### C. Pre-Positioning of Equipment

- Portable pumps, tanks, hose
- Fuel
- Smoke signs
- Weather stations
- Fuel sticks
- Repeaters
- Tools
- Drinking water and/or food
- Drop-point signs
- Miscellaneous supplies
- Other

D. Other Offsite Considerations

- Notifications
- Signing
- Logistical considerations
- Staging/helispot/safety zone construction
- Vehicle ingress/egress issues

## II. PRE-BURN CONSIDERATIONS

A. Hazards

- Fence posts or power lines.
- Tires or other hazardous materials in units.
- Identification of hazards on maps.
- Unexploded ordnance on historic or current military training sites.

B. Protection of Areas of Critical Environmental Concern

- Nesting trees
- Riparian areas
- Threatened and endangered habitat areas
- Wilderness areas

C. Onsite Weather and Fuels

- Identify the frequency and type of weather observations in the plan.
- Acquire spot or area weather forecasts.
- Fuel moisture sampling onsite.

## III. ACTIONS, TIMELINES, AND RESPONSIBILITIES FOR INTERAGENCY AND INTRA-AGENCY COORDINATION AND PUBLIC INVOLVEMENT

Develop a notification list specific to the project's implementation process to address public safety and concerns.

The list should identify:

A. Who will be Responsible for Contacts

- Ability to delegate this responsibility?
- Lowest level of delegation?

B. Documentation Needed for Contacts

- Requirements (who, when, time)
- Before (time prior, such as 24 hours, 2 weeks, etc.)
- After (When declared out? Open to public?)
- Where this may be placed (project file, dispatch?)

C. Contacts for Prescribed Fire

- Can or may get this information from:
  - Other established communications plan(s) (external affairs/ public affairs)
  - Other prescribed fire plans
  - FMP
  - Dispatch
  - Front desk

- May include, but not limited to:
  - Agency personnel/positions (Agency Administrator, supervisor's office/ regional office, front desk personnel).
  - Adjacent or potential affected federal, state, county, local, and Tribal agencies.
  - Air quality or smoke management agencies.
- Local or potential impacted publics:
  - Homeowners
  - Businesses
  - Airports
  - Radio stations
  - Television market
  - Newspapers
  - Phone trees
  - Internet sites
  - Local fire sites
  - Local agency site
  - Community boards or Web sites
  - Local topic blog pages

  Remember to update fire status information on Web sites, radio blurbs, and automatic phone messages, and to take the information off when complete (if longer than one operational shift, or as needed).

## IV. BRIEFING CRITERIA

The briefing checklist (required) should list briefing topics only, not re-state what is listed in the prescribed fire plan for that element.

- Burn organization and assignments
- Burn objectives and prescription
- Description of the prescribed fire area
- Expected weather and fire behavior
- Communications
- Ignition plan (firing sequence(s))
- Contingency plan and assignments
- Wildfire conversion
- Safety and medical plan

An Incident Action Plan (IAP) is optional, but may be required per agency policy. An IAP is recommended for large multi-day or high complexity prescribed fires.

If aerial ignition devices will be used, include an Aerial Ignition Operation Job Hazard Analysis (for assistance with this topic, consult aviation staff).

Additional reference material:

- Interagency Helicopter Operations Guide, NFES 1885
- Interagency Aerial Ignition Guide, NFES 1080

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Unit 7B – Implementation: Organization and Equipment

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Identify appropriate resources, or resources capabilities, equipment, and organization necessary to implement the prescribed fire plan.

2. Identify required staffing qualifications based on prescribed fire complexity.

## I. RESOURCES, CAPABILITIES, AND ORGANIZATION

The type and kind of organization and equipment used to safely and efficiently implement a prescribed fire can affect the written plan and implementation through nearly all the elements.

A. The complexity of each prescribed fire determines the organization capabilities needed to:

- Safely achieve the objectives specified in the prescribed fire plan.
- Hold the prescribed fire within the project boundary or burn unit boundary.

B. Specify the minimum required implementation organization to meet the capabilities by position and equipment.

A prescribed fire burn boss will be assigned to every prescribed fire. Some positions may not be filled as collateral duty.

Example: For moderate or high complexity prescribed fires, burn bosses may not function as firing and holding bosses. These positions must be identified in the plan.

The plan may specify capabilities required rather than type of equipment/personnel, such as line building production rates of a hand crew vs. engines (either may be acceptable).

Specify the supplies needed for the duration of the prescribed fire until declared out.

C. Design the organization and equipment plan to meet the operational needs of the prescribed fire.

1. Understand how the prescribed fire plan element links with ignition and holding operations.

2. Examine specific operational criteria for ignition and holding.

   - Goals and objectives
   - Prescription
   - Contingency
   - Smoke

   How does the organization and equipment element relate to the ignition, holding, and contingency elements of the Red Bull Prescribed Fire Plan?

3. Determine holding resource needs.

   In the plan, identify resources needed for the prescribed fire project based on their capabilities.

   Identify the needs for holding critical areas and sensitive resource locations.

   The capabilities of the holding resources must be adequate to meet the prescribed fire holding plan objectives and <u>should be determined by the capacity at the highest fire behavior.</u>

4. Where can you find production rates and capabilities?

   - Hauling chart
   - BEHAVE Size, Contain programs
   - Fireline Handbook/IRPG

5. Determine additional resource needs to be onsite. A project may require some specialized technical expertise to address concerns.

   - Monitors
     - Smoke emissions.
     - LTAN for long-duration prescribed fires.
   - Education mitigation specialist or public information officer.
   - Resource advisor.

6. Organizations should be flexible and adhere to standard ICS fire management principles.

   The organization should contain what is needed to implement the plan safely and efficiently during all phases of the prescribed fire.

   Different organizations may be identified for different stages of implementation.

   - Holding
   - Mopup and patrol
   - Different ignition operations

- Multiple prescriptions

  May require identifying and developing multiple organizations. For example, the plan may call for a large, highly qualified group (either initially or under high end prescriptions).

- Based on conditions (or as a large project or a multiple unit project progresses), the plan may identify the ability to downgrade to a smaller, less complex organization.

7. The equipment used to implement a project can change the characteristics of the project.

   - Consider writing the plan with the flexibility to accommodate changes.

     – Include the type and number of ignition devices and fuel needed.

     – Identify the type and amount of holding equipment.

   - Aerial ignition requires specialized equipment and organization with specialized qualifications.

     – An aerial ignition plan

     – Air operations plan

     – Special use safety plan

     – Aviation project plan

   Remember: Identify support equipment needed, especially on multiple-day projects in remote areas. May need to use a logistics or camp manager.

## II. STAFFING QUALIFICATIONS AND COMPLEXITY

### A. Staffing

On prescribed fires with large organizations, use the ICS organization and staffing commensurate with the level of complexity.

Consider using a prescribed fire manager when conducting multiple prescribed fires.

### B. Qualifications

The complexity of each prescribed fire or phase of fire(s):

- Helps determine the organizational qualifications needed to safely ignite and hold the prescribed fire.
- Ensures objectives specified in the prescribed fire plan are achieved.

Some positions on certain prescribed fires may not allow trainees. This should be documented in the plan organization.

Reference Table 1 of "The Guide" (page 9) to determine position needs related to the prescribed fire complexity.

Upon implementation (all stages) of the prescribed fire, documentation in the form of an organization chart must be completed.

Be sure that more than one blank organization chart is included in the project file or is available for the burn boss.

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Unit 7C – Implementation: Test Fire and Ignition Plan

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Describe the test fire process and documentation requirements.

2. Describe ignition strategies used to meet fire behavior objectives and control limitations.

# I. TEST FIRE

## A. Provisions

Every prescribed fire will have a test fire ignited before main project area ignition operations take place.

Provisions for a test fire must be provided in the prescribed fire plan.

The purpose of the test fire is to verify that the fire behavior will achieve the fire management, resource management and smoke management objectives.

The test fire provisions are linked to many elements within the prescribed fire plan:

- Prescribed fire objectives
- Constraints
- Prescription and environmental guidelines
- Expected fire behavior
- Smoke management
- Ignition and holding
- Mopup and patrol

## B. Location and Size

Identify the size and where the test fire will be ignited.

The test fire must be ignited in a representative location and in an area where the fire can be easily controlled or suppressed if needed.

The size of the test fire should be determined by the fuel types and objectives of the prescribed fire.

Examples:

- A project may have a single fuel type such as grass, but high winds are needed; a small test fire area next to a good barrier may need to be utilized.

- A project with more than one fuel type or where blackline operations are in different fuels may need to have test fire ignited in a larger area or small individual test fires within each fuel type.

C. Test Fire Documentation

The prescribed fire plan requires test fire documentation. Provisions for documenting the results of the test fire include:

- Location of the test fire(s)

- Date and time

- Fuels

- Weather conditions onsite

- Results (flame length, rate of spread, smoke dispersal, resource effects)

- Does the test fire meet the prescription parameters? (Yes/No)

- Results documentation is normally put on the Unit Log or Go/No-Go Checklist.

D. Multiple-Day Projects

On multiple-day projects, evaluation of current active fire behavior, in lieu of a test fire, may provide a comparative basis for continuing and must be documented.

## II. IGNITION PLAN

All prescribed fire projects, or units within a project, must have a description of the ignition procedures.

It is important to provide flexibility for the burn boss and ignition specialist to accomplish objectives.

### A. Developing the Ignition Plan

When developing the ignition plan, avoid wording and specific details that limits the options for burn personnel—allow for flexibility.

1. Ignition plan may include:

   - Firing methods
   - Devices
   - Techniques
   - Sequences
   - Anticipated patterns and sequences
   - Absolute patterns (only if necessary)
   - Ignition staffing

2. Because the prescription is driven by fire behavior, the ignition tactics and procedures play a key role in meeting prescription parameters and the prescribed fire plan objectives.

   - What are the prescribed fire objectives?

   - What fire behavior will accomplish those objectives?

   - What ignition pattern, technique, and application type will produce the desired fire behavior?

   - Are the tools needed to gain the desired fire behavior available?

3. If blacklines are needed, consider and identify blackline location and size standards.

   - Will it be allowed to burn into the unit?
   - Will moisture of extinction be used?
   - Will it be burned under a different prescription?

4. Consider the relation of ignition to holding. It is very easy to design an ignition plan that when implemented will outpace the holding forces capabilities.

5. Maps may be needed to show:

   - Proposed or required firing patterns.
   - Areas where special ignition techniques or operations need to be completed.
   - Areas of constraints or limitations.

6. Multiple prescriptions may require identifying and developing multiple ignition operations and organizations to ignite the prescribed fire. This will most likely affect the holding and contingency plan(s) as well.

7. If aerial ignition (or other aerial operations) is planned, cover aviation operations, organization, and safety within the prescribed fire plan and aerial ignition plan, or reference an agency-specific aviation operating plan.

B. Ignition Techniques

Various ignition techniques can be used to accomplish prescribed fire objectives.

1. Backing fire

A backing fire is started along a baseline or anchor point (such as a road, stream, blackline or some other barrier) and allowed to back into the wind.

- Minimizes intensity.
- Slow burn progress.
- Not flexible to changes in wind direction.
- Requires good fuel continuity to propagate ignition.

2. Strip head fire

A line of fire or series of lines are ignited at determined locations or the edge of a barrier.

The lines of fire must be ignited in such a way that each ignited strip will result in flame lengths and fire intensities within the prescription parameters.

- Allows for wide range of intensities.
- Flame length is the prime criteria.
- Distance between strips must be adjusted constantly for changes in stand density, size and crown base of leave trees, fuels continuity and arrangement, and weather conditions.
- Most widespread ignition method.
- Quick ignition and burnout of the project or unit.
- Allows for accommodating moderate wind shifts.

3. Head fire

A line of fire is ignited at the downwind end of the project or unit from a barrier. The fire is allowed to burn across the unit.

- Highest fire intensities can be achieved.
- Requires a good barrier at upwind side of the unit.
- Quickest of ignition methods for large areas.
- Used for light fuel loading conditions.
- Used for maximum reduction of fuel in some fuel types.

4. Flank fire

Lines of fire are ignited directly into the wind; the lines spread at right angles to wind.

- Can produce low, moderate, or high fire intensities.
- Requires good knowledge of fire behavior.
- Used often to secure the flanks of a strip-head fire or to supplement a backing fire.
- Can be used to burn a large area in a relatively short time when a head fire may be too intense.
- Cannot stand much variation in wind direction.

5. Dot or point source

A series of small spot fires are ignited, which generally spread in all directions as they burn together (similar to a series of strip head fires).

- Can produce fire intensities greater than a backing fire, but not as much as a strip head fire.
- Requires some experience to know when to tip the torch.

- Ignition spacing requires monitoring and adjusting to achieve desired fire behavior.
  - Close spacing produces fires that burn into each other before the flame length and intensity level is reached.
  - Be aware that a large number of small fires burning simultaneously can produce the same intensity as a large head fire.
- Wind direction can be variable.
- Used with aerial ignitions, large areas can be safely ignited.

6. Ring or center fire

   Fire is ignited on the downwind edge against a barrier; when secured, the entire perimeter of the unit or project is ignited and the flame fronts allowed to converge.

   One or more spot fires are often ignited in the center of the area and allowed to develop before the perimeter of the unit or project is ignited.

   - Burn intensity can be high to extreme.
   - Used on level ground or where a slight slope will aid in creating a convection column.
   - Convective column can create spotting risk.
   - Used mostly in light and variable or no wind conditions.

C. Helpful questions and hints to generate linking the ignition plan to other elements:

1. What are the capabilities of ignition personnel compared to the size of project?

   Strip head firing a wide unit with very narrow spacing between strips can quickly tire out ignition personnel.

   Consider the following:

   - Aerial ignitions.
   - Breaking the project into units.
   - ATV use? If ATVs are used with torches, or to support ignition operations, you must ensure safe use (may not be a good idea in rough terrain).

2. Are there smoke management or air quality impacts and issues? How do the ignition patterns and techniques affect them?

3. Are there ignition situations that need special consideration in the JHA or during briefing?

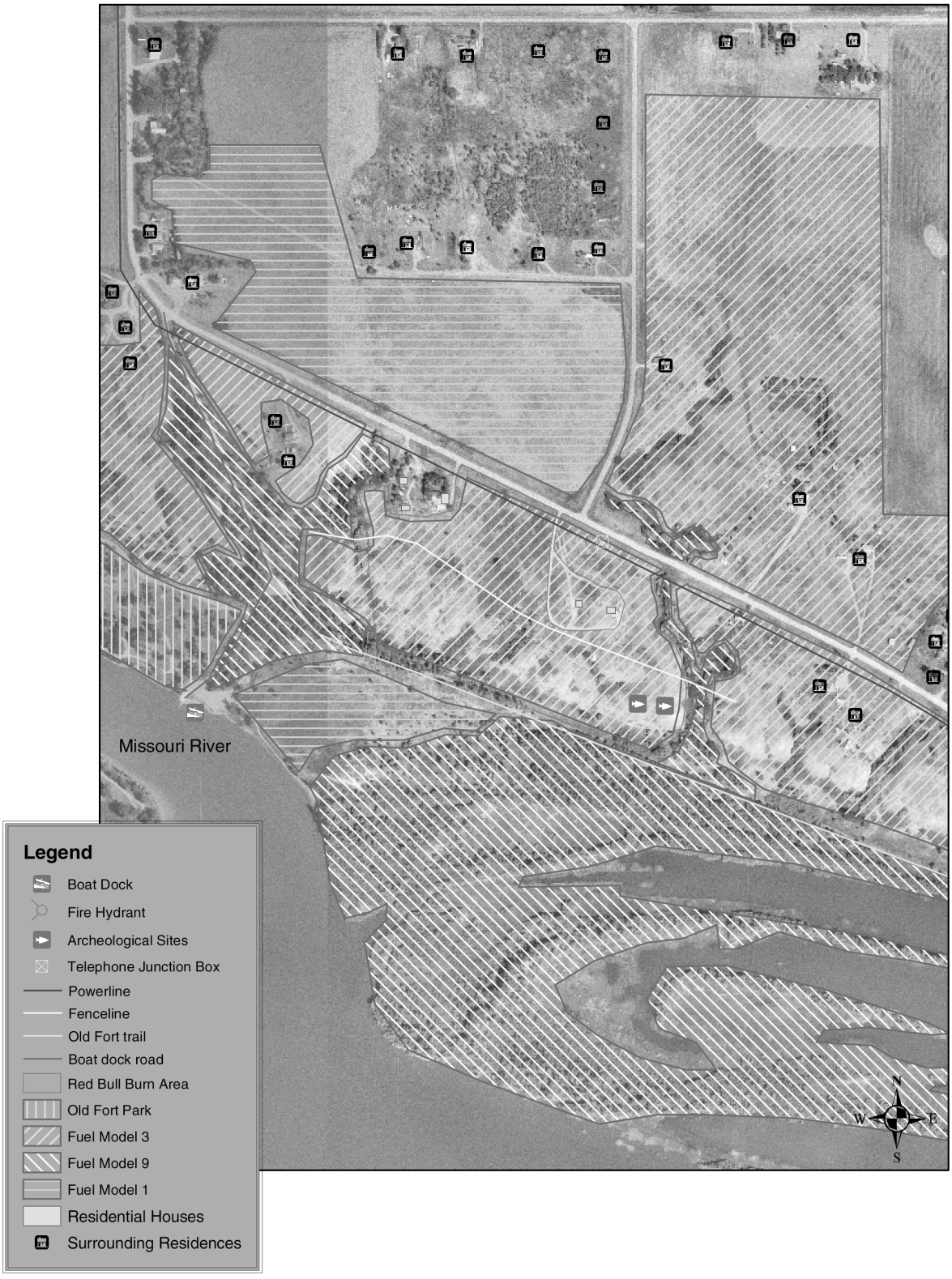
4. How does the contingency plan relate to the ignition and holding?

5. Will constant communication be available with all the ignition personnel?

**EXERCISE: Ignition Sequence**

Use the map on the next page to formulate possible ignition sequences, techniques, and patterns.

**Crow Creek Agency**
**Red Bull Prescription Burn**
**Burn Unit and Adjacent Features Map**



Prescribed Fire Plan Preparation, RX-341

Unit 7D – Implementation: Holding Plan

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Describe general procedures to be used for operations to maintain the fire within prescription and project area, until the fire is declared out.

2. Describe critical holding points and potential mitigation actions.

# I. GENERAL PROCEDURES

## A. Holding Plan

A holding plan identifies efforts involved in maintaining the fire within the identified plan parameters.

- The plan is developed in response to the ignition plan, and is designed to maintain the prescribed fire within prescription and project boundary.

- The holding plan should identify locations, quantity, type and kind (capabilities) of all the required resources, their assignments, and other general procedures.

- The holding plan should cover all phases of implementation until declared out.

- May need to develop different organizations for varying stages of implementation (holding vs. mopup and patrol, different ignition operations, different prescriptions).

- Multiple prescriptions may require identifying multiple complexity ratings and developing multiple holding organizations.

- The pre-burn considerations section of the prescribed fire should address any holding preparation activities that are required to implement the holding plan.

- Holding plans can be very detailed and structured, or a simple narrative.

B. Considerations in Developing a Holding Plan

Must take into account all the variables addressed in the prescribed fire:

- Fuels (**inside and outside the units**) and anticipated fire behavior will help determine capabilities of resources.
  - Consider worst case prescribed fire behavior (including spotting).
- Designation of contingency lines or a project boundary.
- Availability of holding resources and support for those resources.
- Vehicle access.
- Specific protection needs for private property, cultural sites, and other sensitive features.
- Considerations that may determine mopup and patrol requirements (smoke, risk associated with weather conditions, land use impacts).
- Fire control lines.
- Water sources.
- Helispots
- Critical holding points in the control lines.
- Other features pertinent to the holding operation requiring protection.
- Initial resource and equipment placement.

C. Sequence and Deployment of Resources for Holding Activities

The sequence and/or location of activities to be undertaken in support of the ignition operation must be identified in the plan.

- Identify the deployment of resources for protection of:
  - Critical holding points
  - Structures
  - Utilities
  - Other sensitive features
- Take care of spot fires and slopovers.

D. Safety

- The holding operation can frequently pose the highest risk of injury and exposure to smoke.
- The holding plan, and the public and personnel safety medical element, must address safety issues related to the holding operation by identifying and mitigating:
  - Any communication gaps
  - Accessibility concerns
  - LCES
  - Physical demands
  - Heat and smoke exposure concerns

Where else can safety concerns for holding be addressed?

E. Mopup Components

- Process of making a fire area safe (firefighter and public safety).
- Process of containing a fire to eliminate escape.
- Process of mitigating smoke hazards.

F. Mopup and Patrol

- Clearly identify who is responsible for mopup and patrol; frequently it is the burn boss or holding boss.
- Specify the:
  - Anticipated number and type of resources.
  - Duration of patrol.
  - Conditions for mopup and patrol.
- The prescribed fire plan may include general standards for mopup.
- The burn boss or holding boss will make specific mopup and patrol assignments once holding objectives have been achieved.

G. Duration of Mopup and Patrol

- The burn boss is responsible for the prescribed fire from the pre-burn activity phase, up until the point he/she (or designee) declares the burn "out" or turns the burn over to the local agency.
- The prescribed fire plan may identify the criteria that will be used by the burn boss to determine when the burn can be declared out.

## II. CRITICAL HOLDING POINTS

### A. Indicators of Critical Holding Points

- Snags, ladder fuels, jackpots, flashy fuels near or along control lines.
- Fuels outside control lines that would contribute to increased fire behavior or control problems.
- Private property, cultural sites, and other sensitive features.
- Side-slope control lines on top side of burn units.
- Other factors that may contribute to slopover.

### B. Potential Mitigation Measures

- Fall snags, clear back ladder fuels, and jackpots.
- Blackline, wetline, wider control line.
- Modify burn prescription to minimize slopover or spotting.
- Stage resources at sensitive sites.
- Minimize side-slope doglegs in control lines.

### C. Minimum Organization

Should match Element 11 of burn plan.

Where else should the critical holding points and mitigation measures be documented?

**CLASS DISCUSSION:**

Refer to the Holding Plan element of the Red Bull Prescribed Fire Plan.

1. How does the plan address slopovers or spot fires?

2. What personnel and public safety features are identified in the plan?

3. What are the pre-burn considerations that will aid in implementing the holding plan?

Prescribed Fire Plan Preparation, RX-341

Unit 7E – Implementation: Contingency Plan and Wildfire Conversion

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Identify the importance of the contingency plan as it relates to risk management and burn objectives.

2. Identify contingency plan elements.

3. Describe the concepts of trigger points for contingency planning.

4. Describe the process of converting a prescribed fire to a wildfire.

## I. RELATING THE CONTINGENCY PLAN TO RISK MANAGEMENT AND BURN OBJECTIVES

The contingency plan identifies possible (but unlikely) events, and the contingency resources and actions needed to mitigate those events.

A. Contingency plans are developed to:

- Identify the unexpected.
- Answer the "what ifs."
- Mitigate or manage risk.

In prescribed fire, we all recognize there are risks and that our best plans do not always result in a desired outcome.

Contingency actions are required to be taken when a project exceeds (or may exceed) its planned intent.

These actions are taken to return the project to its intended design and to reduce the chances of unfavorable consequences of anticipated or unanticipated event(s).

Contingency planning is like providing for adequate initial attack.

B. Considerations for contingency planning:

- Requires verified availability of specified contingency resources.
- Sizeup of your unit (helps to identify contingency needs).
- Fire history and lessons learned.
- Fuel and terrain: line locations, critical holding points, snags, jackpots or ladder fuels near lines.
- Access: transportation routes, water locations.
- Barriers: rock slides, outcrops, snowline, vegetation changes (aspen stands, riparian).
- Special hazards: fuels outside units, power lines, structures.
- Weather: wind events/switches, RH drops.
- Safety: LCES, smoke issues, slash loading (inhibits walking or creates fire behavior changes).

C. Contingency planning may be incorporated into all implementation phases of prescribed fires.

- Ignition
- Holding
- Mopup and patrol (until the burn is declared out)

D. When are the contingency actions implemented?

- When established prescription parameters, trigger points, or limits are exceeded.
- Prescription elements not being met (over- or underachieving fire behavior or other objectives).
- Safety violations, serious accidents/injury.
- Smoke sensitive sites impacted.
- Historic/archeological/hazmat sites discovered.
- Unplanned, independent events such as wildfire activity that requires contingency resources to be pulled.
- Insufficient time to complete prescribed fire operations.

Contingency plans or actions can be implemented anytime during a prescribed fire and do not constitute a wildfire declaration.

E. Relation to Risk Management

In any project where an element of a risk exists, proper planning often reduces or manages the risk.

## II. COMPONENTS OF THE CONTINGENCY PLAN

- Identify who initiates contingency actions.
- Trigger points.
- Actions needed to ensure fire continues to meet resource and control objectives.
- Contingency resource needs (or capabilities) and response times or locations.
- Containment opportunities/tactics, location of natural barriers, roads, riparian areas, etc.
- Notifications (who, when, how, by whom), with the ordering and deployment of contingency resources.

## III. TRIGGER POINTS

A trigger point is a geographic or temporal limit that initiates a pre-determined management response.

The contingency plan establishes trigger points or limits that indicate when additional holding resources and actions are needed to ensure the fire continues to meet resource and control objectives.

Contingency planning and trigger points are an “if/then” decisionmaking process.

A. Trigger Point Considerations

1. Threats to burn unit or project boundaries.

   An escaped prescribed fire must be declared a wildfire when the fire has spread outside the project boundary, or is likely to do so, and cannot be contained by the end of the next burning period.

2. Approaching prescription limits (top and bottom, over- or underachieving).

3. Risk to adjacent ownerships, sensitive areas, and fuels.

4. Smoke management issues.

5. Other issues based on objectives, current management policy and external events.

6. In developing trigger points, expected fire behavior and other management activity(s) should be strongly considered.

   Examples:

   - If the visibility on Highway 48 is less than ½ mile, the burn boss contacts State Highway Patrol to manage traffic.

   - If holding forces are managing three spot fires simultaneously, ignition will stop. Ignition personnel assist with holding operations.

   - Wildfires or other prescribed fires within jurisdictional boundaries, Geographic Area Coordination Centers, etc.

B. Resource Considerations

1. Resource availability and travel times

2. Resource capabilities

3. Shift length and numbers of shifts

4. Budgetary constraints

5. Contingency resources

- Contingency resources, if identified as required in the plan, have to be verified available to arrive by the time specified (per "The Guide"); usually done by burn boss or designee.

- If contingency resources are on scene, they must be performing non-essential functions so they may continue to be available for contingency actions.

- If your contingency resources become unavailable, actions must be taken to secure operations until identified contingency resources (or capabilities) are replaced.

- An action taken by contingency resources on a prescribed fire is usually managed with the prescribed fire organization.

  Actions taken after a prescribed fire is converted to a wildfire are managed with the ICS organization.

## IV. WILDFIRE CONVERSION

The person(s) identified in the plan must declare a prescribed fire a wildfire when they determine that contingency actions have failed, or are likely to fail, and cannot be mitigated within the next burning period.

Depending on individual agency policy, a prescribed fire can be converted to a wildfire for reasons other than an escape. After a wildfire declaration, an escaped RX fire cannot be returned to RX fire status.

Wildfire conversion element includes:

- Wildfire declaration (the prescribed fire plan specifies who has the authority to declare a wildfire).
- Incident Commander assignment (the prescribed fire plan identifies an incident commander for the declared wildfire).
- Interactions between prescribed fire and suppression resources (will onsite resources assist with the suppression or be released?).
- Notifications (dispatch, Agency Administrator, adjacent landowners, region, etc.).
- Extended attack actions and opportunities to aid in fire suppression.

Good contingency planning precludes/minimizes the need for wildfire declaration; pay now or pay later.

**EXERCISE: Contingency Resource Calculations (pages 7E.11 – 7E. 19)**

## Exercise: Contingency Resource Calculations

Scenario information:

Available resources: Type 2 hand crew, Type 3 dozer, 3 Type 6 engines, all with one hour response time.

Inside burn unit: FM 5, 25% slope, windward side of hill, 100 acres and road at ridge break along top of burn unit.

Adjacent to burn unit: House ¼ mile away from and above the burn unit on flat ground in FM 2 open ponderosa pine stand, average 50 trees/acre and 60 feet tall.

Refer to the BehavePlus runs (pages 7E.13 – 7E.19) for additional information.

1. Where would you go to get production rates for the assigned resources?

2. What are the production rates for each assigned resource, given the fuel models and environmental data?

   Type 2 Handcrew:
   Fuel Model 2:
   Fuel Model 5:

   Type 6 Engine with 2 personnel:
   Fuel Model 2:
   Fuel Model 5:

   Type 3 Dozer:
   Fuel Model 2:
   Fuel Model 5:

3. When calculating your contingency resource needs, what fuel model should you use? Explain.

4. Given the containment runs on pages 7E.13 – 7E.19, what would you recommend as contingency resource needs for this scenario?

5. What mitigation measures could you take to negate/minimize the threat to this adjacent housing?

## Modules: IGNITE

| Description | | Unit 7E Contingency Exercise |
|---|---|---|
| **Fuel Moisture** | | |
| 1-h Moisture | % | 8, 10, 12, 14, 16 |
| **Weather** | | |
| Air Temperature | oF | 45, 50, 55, 60, 65 |
| Fuel Shading from the Sun | % | 10 |

## Unit 7E Contingency Exercise

### Probability of Ignition from a Firebrand (%)

| 1-h Moisture | Air Temperature oF | | | | |
|---|---|---|---|---|---|
| % | 45 | 50 | 55 | 60 | 65 |
| 8 | 36 | 37 | 38 | 39 | 40 |
| 10 | 27 | 27 | 28 | 29 | 30 |
| 12 | 19 | 20 | 20 | 21 | 22 |
| 14 | 14 | 14 | 15 | 15 | 16 |
| 16 | 9 | 10 | 10 | 11 | 11 |

## Modules: SURFACE

| | | |
|---|---|---|
| Description | | Unit 7E Contingency Exercise - Inside Unit |

### Fuel/Vegetation, Surface/Understory

| | | |
|---|---|---|
| Fuel Model | | 5 |

### Fuel Moisture

| | | |
|---|---|---|
| 1-h Moisture | % | 8, 10, 12, 14, 16 |
| 10-h Moisture | % | 9 |
| 100-h Moisture | % | |
| Live Herbaceous Moisture | % | |
| Live Woody Moisture | % | 50 |

### Weather

| | | |
|---|---|---|
| Midflame Wind Speed (upslope) | mi/h | 0.0, 2.0, 4.0, 6.0, 8.0, 10.0 |

### Terrain

| | | |
|---|---|---|
| Slope Steepness | % | 25 |

## Unit 7E Contingency Exercise - Inside Unit

### Surface Rate of Spread (maximum) (ch/h)

| 1-h Moisture | Midflame Wind Speed (upslope) mi/h | | | | | |
|---|---|---|---|---|---|---|
| % | 0.0 | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 |
| 8 | 5.5 | 16.0 | 33.2 | 54.3 | 78.4 | 105.0 |
| 10 | 5.3 | 15.4 | 31.9 | 52.1 | 75.3 | 100.9 |
| 12 | 4.7 | 13.7 | 28.5 | 46.5 | 67.2 | 90.0 |
| 14 | 1.5 | 4.5 | 9.3 | 15.2 | 22.0 | 25.0 |
| 16 | 1.3 | 3.7 | 7.7 | 12.5 | 16.1 | 16.1 |

## Unit 7E Contingency Exercise - Inside Unit

### Flame Length (ft)

| 1-h Moisture | Midflame Wind Speed (upslope) mi/h | | | | | |
|---|---|---|---|---|---|---|
| % | 0.0 | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 |
| 8 | 3.2 | 5.2 | 7.3 | 9.1 | 10.8 | 12.3 |
| 10 | 3.1 | 5.0 | 7.0 | 8.8 | 10.4 | 12.0 |
| 12 | 2.8 | 4.6 | 6.4 | 8.0 | 9.5 | 10.8 |
| 14 | 1.0 | 1.6 | 2.3 | 2.9 | 3.4 | 3.6 |
| 16 | 0.8 | 1.4 | 1.9 | 2.4 | 2.7 | 2.7 |

## Modules: SPOT

| | | |
|---|---|---|
| Description | | Unit 7E Contingency Exercise - Spot |
| **Fuel/Vegetation, Overstory** | | |
| Canopy Height | ft | 0 |
| **Weather** | | |
| 20-ft Wind Speed (upslope) | mi/h | 0, 5, 10, 15, 20, 25 |
| **Terrain** | | |
| Ridge-to-Valley Elevation Difference | ft | 600 |
| Ridge-to-Valley Horizontal Distance | mi | 0.5 |
| Spotting Source Location | | mw |
| **Fire** | | |
| Flame Length | ft | 1, 2, 3, 4, 5, 6, 7, 8, 9, |
| **Acceptable Fire Conditions** | | |
| Spot Dist from Wind Driven Surface Fire | (mi) X | 0.0 - 0.2 |

## Unit 7E Contingency Exercise - Spot

### Spot Dist from Wind Driven Surface Fire (mi)

| Flame Length | 20-ft Wind Speed (upslope) mi/h | | | | | |
|---|---|---|---|---|---|---|
| ft | 0 | 5 | 10 | 15 | 20 | 25 |
| 1.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 |
| 2.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| 3.0 | 0.0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 |
| 4.0 | 0.0 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 |
| 5.0 | 0.0 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 |
| 6.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 |
| 7.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.4 |
| 8.0 | 0.0 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 |
| 9.0 | 0.0 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 |
| 10.0 | 0.0 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 |
| 11.0 | 0.0 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 |
| 12.0 | 0.0 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 |

## Modules: SURFACE

| | | |
|---|---|---|
| Description | | Unit 7E Contingency Exercise - Outside Unit |

## Fuel/Vegetation, Surface/Understory

| | | |
|---|---|---|
| Fuel Model | | 2 |

## Fuel Moisture

| | | |
|---|---|---|
| 1-h Moisture | % | 8, 10, 12, 14, 16 |
| 10-h Moisture | % | 9 |
| 100-h Moisture | % | 10 |
| Live Herbaceous Moisture | % | 50 |
| Live Woody Moisture | % | |

## Weather

| | | |
|---|---|---|
| Midflame Wind Speed (upslope) | mi/h | 0.0, 2.0, 4.0, 6.0, 8.0, 10.0 |

## Terrain

| | | |
|---|---|---|
| Slope Steepness | % | 5 |

### Unit 7E Contingency Exercise - Outside Unit
Surface Rate of Spread (maximum) (ch/h)

| 1-h Moisture | Midflame Wind Speed (upslope) mi/h | | | | | |
|---|---|---|---|---|---|---|
| % | 0.0 | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 |
| 8 | 2.6 | 9.4 | 26.8 | 53.3 | 88.5 | 131.8 |
| 10 | 2.3 | 8.4 | 23.9 | 47.6 | 79.0 | 117.7 |
| 12 | 1.9 | 6.7 | 18.9 | 37.7 | 62.5 | 93.2 |
| 14 | 1.0 | 3.6 | 10.4 | 20.7 | 34.3 | 51.0 |
| 16 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

### Unit 7E Contingency Exercise - Outside Unit
Flame Length (ft)

| 1-h Moisture | Midflame Wind Speed (upslope) mi/h | | | | | |
|---|---|---|---|---|---|---|
| % | 0.0 | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 |
| 8 | 1.9 | 3.4 | 5.5 | 7.6 | 9.6 | 11.5 |
| 10 | 1.8 | 3.1 | 5.1 | 7.0 | 8.8 | 10.6 |
| 12 | 1.4 | 2.6 | 4.2 | 5.8 | 7.3 | 8.7 |
| 14 | 0.8 | 1.5 | 2.5 | 3.4 | 4.3 | 5.1 |
| 16 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

## Modules: SURFACE, SIZE, CONTAIN

| | | |
|---|---|---|
| Description | | Unit 7E Contingency Exercise - Surface, Size, Con |

## Fuel/Vegetation, Surface/Understory

| | | |
|---|---|---|
| Fuel Model | | 2 |

## Fuel Moisture

| | | |
|---|---|---|
| 1-h Moisture | % | 8 |
| 10-h Moisture | % | 9 |
| 100-h Moisture | % | 10 |
| Live Herbaceous Moisture | % | 50 |
| Live Woody Moisture | % | |

## Weather

| | | |
|---|---|---|
| Midflame Wind Speed (upslope) | mi/h | 0.0, 2.0, 4.0, 6.0, 8.0, 10.0 |

## Terrain

| | | |
|---|---|---|
| Slope Steepness | % | 5 |

## Fire

| | | |
|---|---|---|
| Elapsed Time | h | 1 |

## Suppression

| | | |
|---|---|---|
| Suppression Tactic | | Rear |
| Line Construction Offset | ch | 0 |
| Resource Line Production Rate | ch/h | 16, 21, 60 |
| Resource Arrival Time | h | 1 |
| Resource Duration | h | 10 |

## Unit 7E Contingency Exercise - Surface, Size, Contain
### Area (ac)

| Midflame Wind Speed | Resource Line Production Rate ch/h | | |
|---|---|---|---|
| mi/h | 16.0 | 21.0 | 60.0 |
| 0.0 | 1.1 | 1.1 | 1.1 |
| 2.0 | 6.1 | 6.1 | 6.1 |
| 4.0 | 32.3 | 32.3 | 32.3 |
| 6.0 | 97.2 | 97.2 | 97.2 |
| 8.0 | 217.1 | 217.1 | 217.1 |
| 10.0 | 406.4 | 406.4 | 406.4 |

## Unit 7E Contingency Exercise - Surface, Size, Contain
### Perimeter (ch)

| Midflame Wind Speed | Resource Line Production Rate ch/h | | |
|---|---|---|---|
| mi/h | 16.0 | 21.0 | 60.0 |
| 0.0 | 12 | 12 | 12 |
| 2.0 | 28 | 28 | 28 |
| 4.0 | 69 | 69 | 69 |
| 6.0 | 128 | 128 | 128 |
| 8.0 | 203 | 203 | 203 |
| 10.0 | 293 | 293 | 293 |

## Unit 7E Contingency Exercise - Surface, Size, Contain

### Contain Status

| Midflame Wind Speed | Resource Line Production Rate ch/h | | |
|---|---|---|---|
| mi/h | 16.0 | 21.0 | 60.0 |
| 0.0 | Contained | Contained | Contained |
| 2.0 | Withdrawn | Withdrawn | Contained |
| 4.0 | Withdrawn | Withdrawn | Withdrawn |
| 6.0 | Withdrawn | Withdrawn | Withdrawn |
| 8.0 | Withdrawn | Withdrawn | Withdrawn |
| 10.0 | Withdrawn | Withdrawn | Withdrawn |

## Unit 7E Contingency Exercise - Surface, Size, Contain

### Contained Area (ac)

| Midflame Wind Speed | Resource Line Production Rate ch/h | | |
|---|---|---|---|
| mi/h | 16.0 | 21.0 | 60.0 |
| 0.0 | 12.7 | 9.6 | 5.8 |
| 2.0 | -1.0 | -1.0 | 50.7 |
| 4.0 | -1.0 | -1.0 | -1.0 |
| 6.0 | -1.0 | -1.0 | -1.0 |
| 8.0 | -1.0 | -1.0 | -1.0 |
| 10.0 | -1.0 | -1.0 | -1.0 |

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Unit 7F – Implementation:  Communication

OBJECTIVE:

Upon completion of this unit, students will be able to:

- Identify the communications needs to implement a prescribed fire plan.

## I. COMMUNICATION NEEDS

Identify and assign command, tactical, and air operations frequencies as needed. Consider using ICS Form 205 as a template.

### A. Radio Considerations

Identify:

- Potential radio blind spots by walking the area.
- Potential repeater sites (human or other).
- Outside resources (ensure frequencies are listed in the communication plan and communication can be maintained).
- If holding and ignition will be working on different channels.
- Crew net use.
- Tactical frequency for operational use.
- Aerial ignition use.
- Emergency traffic use.
  - Identify life emergency vs. medical transport.
  - Aircraft emergency channel.
- Address narrow vs. broadband issues if applicable.
- After hours procedures (for visiting resources and operations if needed).
- Unit names and station identifiers.
- Use simple text or local numbering.

B. Other Communication Considerations

- Cell phone use (coverage availability).
- Appropriate use of cell phones (tactical issues should be discussed on radio, unless plan specifies otherwise).
- Phone lists (include operational resources, dispatch, administrative, after hours, etc.).

**CLASS DISCUSSION:** Refer to element 12 of the Red Bull Prescribed Fire Plan.

1. What about element 12 do you like?

2. What would you do differently?

3. Is the communication plan clear?

# INCIDENT RADIO COMMUNICATIONS PLAN

| 1. INCIDENT NAME | 2. DATE/TIME PREPARED | 3. OPERATIONAL PERIOD DATE/TIME |
|---|---|---|
| | | |

4. BASE RADIO CHANNEL UTILIZATION

| SYSTEM/CACHE | CHANNEL | FUNCTION | FREQUENCY/TONE | ASSIGNMENT | REMARKS |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

5. PREPARED BY (COMMUNICATIONS UNIT)

205 ICS (9/66) NFES 1330

7F.5

7F-1-RX341-SR

Prescribed Fire Plan Preparation, RX-341

Unit 7G – Implementation: Public and Personnel Safety, Medical

OBJECTIVE:

Upon completion of this unit, students will be able to:

- Describe considerations for personnel and public safety, and emergency procedures.

## I. PERSONNEL/PUBLIC SAFETY AND EMERGENCY PROCEDURES

### A. Fireline Personnel Safety

1. Describe provisions to be made for personal safety.

2. Require all personnel who are within the active burn area to wear personal protective equipment (PPE).

3. Identify safety hazards (including smoke exposure) and measures taken to mitigate those hazards. Examples may include:

   - Falling of hazard trees along egress routes or workable areas within the burn.

   - Rotation of personnel on smoke side of prescribed fire.

   - Timing of the prescribed fire and length of shift (work/rest ratio).

4. Specify emergency medical procedures, evacuation routes, and emergency facilities to be used. This section of the prescribed fire plan was previously referred to as the "medical plan."

5. Reference to an established medical plan, such as a unit dispatch medical plan.

6. If no medical plan exists, consider using ICS 206 as a template.

7. A job hazard analysis (or other agency specific risk analysis) is required for each prescribed fire project.

   The JHA or risk analysis is attached to the prescribed fire plan as an appendix.

B. Public Safety

1. Assign a public safety specialist or qualified personnel as necessary.

   - Law Enforcement
   - Federal, State, County
   - Tribal
   - Local

2. Post necessary signage

   - Smoke ahead, low visibility
   - Workers on road
   - Prescribed fire ahead – do not report

3. Follow local signage regulations

   - Sign size
   - Location
   - Readability

4. Use “universal design” sign for:

   - Non-English
   - Non-reading public
   - Flagging

5. Post-burn considerations

   - Removal of posted signs
   - Removal of flagging

C. Highly Visible Burns

1. Use a public information officer (PIO) for:

   - Public information
   - Education needs
   - Direct contact with public and media

2. Use prescribed fire as an educational tool to assist in long-term understanding of prescribed fire and its effects.

   Participants may include front desk personnel, external affairs, etc.

D. Closures

1. Are closures needed for the area(s)?

2. How long is the anticipated need for closures?

3. Will permitee be allowed to cross during ignition?

4. Can you keep a road open, but close off the burn area outside the road?

5. Can lead vehicles be used to facilitate traffic movement?

6. Should barriers be used to deter stopping or site visits?

E. Safety-related Web Site

Six Minutes for Safety:
http://www.nifc.gov/sixminutes/dsp_sixminutes.php

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Unit 8 – Monitoring

OBJECTIVE:

Upon completion of this unit, students will be able to:

- Identify and discuss the four levels of monitoring and what needs to be covered in the prescribed fire plan.

# I. THE FOUR LEVELS OF MONITORING

Prescribed fire monitoring is defined as the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting resource and control objectives.

Monitoring should include local unit standards and data collection requirements that fit into local, regional, and national monitoring programs.

Why do we monitor?

What is the cost of not monitoring?

## A. Level One: Environmental Data Monitoring

### 1. Weather

- Long- and short-term trends of precipitation, temperature, wind, etc.
- Often use indices such as Keetch Byrum Drought Index, Energy Release Component, or Burn Index.
- Onsite weather conditions
  - Temperature
  - Relative humidity
  - Wind speed and direction (timing)
  - Cloud cover
  - Atmospheric stability

This information is required to obtain a spot weather forecast.

2. Fuel moisture monitoring

Usually monitor trends up to a few weeks before the burn using weather stations, forecasts, site observations, and NFDRS stations.

Select a representative site to consistently monitor. The prescription identifies the fuel classes that need to be monitored.

- 1-hour fuels

  Best monitored on day of burn using onsite weather conditions.

- 10-hour fuels

  Best monitored on day of burn, but can be monitored up to two days before the burn.

- 100-hour fuels

  Can be monitored using fire danger trends/indices up to two weeks preceding the burn. Can also be monitored on the day of the burn.

- Large woody and live fuels

  Should monitor seasonal and drought trends/indices. These fuels are critical to monitor to assess short- and long-term fire effects.

3. Soil/duff moisture

   - Soil moisture may be critical if you are concerned about duff and organic fuel consumption.
   - Soil moisture can be monitored with sampling or by using indices.

4. Fuel conditions

   - Loading by size class
   - Continuity (vertical and horizontal)
   - Fuel depth
   - Other fuel characteristics

B. Level Two: Fire Behavior Monitoring

1. Describe fire behavior/fire intensity and smoke.

   It is critical that fire behavior is monitored to evaluate if the operation is meeting objectives (related to the prescription and holding plan) for all phases of the burn.

2. Describe what fire behavior factors are important to monitor.

   - Flame length/height/depth
   - Rate of spread
   - Torching, crowning, spotting

3. Describe who will monitor fire behavior and how the data will be recorded.

   - Use FEMOs, collateral duty for qualified personnel.
   - Data is usually recorded on weather/fire observation forms.
   - Recorded fire behavior is usually descriptive.

4. Monitor and document smoke production and dispersion. May also be covered in the smoke management section of the prescribed fire plan.

   - Datarams
   - Observers
   - Visibility
   - Flights

C. Level Three: Short-Term Change Monitoring (typically through the next growing season)

Detects first order fire effects such as:

- Crown or vegetation scorch
- Bark or vegetation char
- Fuel consumption by size class
- Duff or organic layer consumption
- Vegetation consumption

D. Level Four: Long-Term Change Monitoring

Measures changes over long periods of time, often including many management activities (fire, mechanical, etc.).

It is usually not included in a prescribed fire plan, but references to ongoing level four monitoring may be included.

## II. MONITORING ELEMENTS REQUIRED FOR THE PRESCRIBED FIRE PLAN

A. The intensity of monitoring is determined by:

- Agency direction
- NEPA requirements
- Threatened and endangered species concerns
- Cultural/archaeological concerns
- Goals and objectives

B. The plan should identify who, when, and how the monitoring should be completed during all phases of the project.

- Fuels information required and procedures (Level 1 monitoring).
- Weather (forecast and observed) monitoring required and procedures (Level 1 monitoring).
- Fire behavior monitoring required and procedures (Level 2 monitoring).
- Monitor to ensure prescribed fire plan objectives are met (Level 2, 3, and 4 monitoring).
- Smoke dispersal monitoring required and procedures (Level 2 monitoring).

**CLASS DISCUSSION:** Refer to element 20 of the Red Bull Prescribed Fire Plan.

1. Is it flexible?

2. What are the constraints? Thorough? Excessive?

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Unit 9 – Funding, Post-Burn Activities (Rehabilitation and Reports), and Appendices

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Identify the funding source(s) and estimated costs for all phases of the prescribed fire.

2. Identify post-burn rehabilitation to be detailed in the prescribed fire plan.

3. Identify required and optional reports to be completed for the prescribed fire plan.

4. Identify required and optional appendices to be attached to the prescribed fire plan.

5. Describe the prescribed fire plan project file requirements.

## I. FUNDING SOURCE(S) AND ESTIMATED COSTS

### A. Why would you need to know your funding source(s)?

- Project implementation costs money and somebody has to pay for it. A funding source and an allocated budget are needed.
- Knowing project costs and sources enables costs to be estimated for the next project.
- When writing a prescribed fire plan for multiple units in a landscape, individual unit costs may need to be broken out.

### B. Possible Funding Sources

- Hazardous fuels program
- Timber sales
- Stewardship contracting
- FWS endangered species recovery plans
- Non-government organizations
- National Resources Conservation Service
- Resource programs
- Others?

C. Cost Development Considerations

- Project costs based on listing types and amounts of resources, equipment, and supplies needed (wildland fire situation analysis, fire program analysis, budget requests).

- Collect costs from past projects and use to estimate future projects. Obtain data from your unit's budget analyst, budget tracking systems.

- National Fire Plan Operations Reporting System (NFPORS)

D. Funding Section Example:

- Funding Source: Wildland Urban Interface
- Estimated Cost: $15,000
  - Preparation: $ 2,500
  - Implementation: $10,000
  - Monitoring: $ 2,500

## II. POST-BURN REHABILITATION

- Identify any rehabilitation to be accomplished, who will do it, and when it will be completed.

  This may include:

  – Rolling berms back
  – Installing water bars
  – Covering firelines with slash/debris
  – Falling snags
  – Trash removal
  – Sign removal

- Burned Area Emergency Rehabilitation (BAER)/Emergency Stabilization and Rehabilitation (ESR) type activities should not be planned or funded for prescribed fire projects.

  If these activities are needed, they must be funded from non-ESR subactivities.

- Prescribed fire rehabilitation plan example:

  Dozer firelines will be rehabilitated, including installing water bars and pulling berms back onto the line, as directed by the burn boss.

## III. REPORTS

- Reports that may need to be identified in the prescribed fire plan:
  - NFPORS (or other accomplishment summary, as required for the program funding)
  - Individual Fire Report Instructions
  - Wildland Fire Management Information
  - Post-Burn Summary
  - Monitoring Report

- Additional reports that may be added post-implementation:
  - www.wildfirelessons.net
  - SAFECOM, SAFENET, accident reports, etc.
  - Post-Burn Investigation Report (required for escaped fires – per agency policy)

- Report element example:

  The burn boss completes all necessary sections in Part II Individual Fire Report and the attached Post-Burn Summary form within one week following the burn.

  All pre-burn, implementation, and monitoring documentation is placed in the project file.

  Note: Only one Individual Fire Report per project area per season, even if ignition occurs over several days.

## IV. APPENDICES

### A. Required Appendices

- Maps
- Technical Review Checklist
- Complexity Analysis
- Job Hazard Analysis or agency-specific risk analysis
- Fire Behavior Modeling Documentation or Empirical Documentation

### B. Optional Appendices

- Aviation Plan
- Medical Plan
- Risk Assessment
- Phone number list
- Cost breakdown

Contracts, NEPA, etc., are not part of the fire plan, they are part of the project file.

## V. PROJECT FILE REQUIREMENTS

### A. Project File Information

All prescribed fire project files contain the following information:

- Prescribed fire plan
- Monitoring data including weather, fire behavior, and fire effects observations.
- Weather forecasts
- Notifications
- Documented prescribed fire organization(s).
- Any agreements related to implementation.
- Multiple-day Go/No-Go Checklist(s), if applicable.
- Revalidation of the Agency Administrator pre-ignition approval checklist, if applicable.

Agencies and administrative units may require additional information.

B. Optional Information

Depending on the scope and complexity of the prescribed fire, optional information and further documentation may be included in the project file:

- After Action Review
- Incident action plans, Unit Logs (ICS 214)
- Press releases, etc.
- Implementation costs
- Actual ignition patterns and sequences used
- Smoke dispersal information
- Agency individual fire occurrence form
- Post-burn report
- NEPA documentation
- Permits

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Unit 10 – Final Complexity Rating

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. From the NWCG Prescribed Fire Complexity Rating System Guide:

    a. Describe how to develop the summary complexity rating and the rationale for that rating.

    b. Describe the process of finalizing the complexity analysis.

## I. COMPLEXITY ANALYSIS COMPLETION

- Reevaluate elements and factors, and complete final ratings and rationale on the worksheet for each element.

- Complete the summary rating for each factor (risk, potential consequences, and technical difficulty) to assist in assigning overall project complexity rating.

- Document the summary rating rationale.

## II. INSTRUCTIONS/PROCESS

### A. Final Value Determination of Factors for the Elements

Near completion of the prescribed fire planning phase, the complexity analysis elements are again rated against risk, potential consequences, and technical difficulty factors on the same form, using the same analysis process, and circling the final rating in the space provided.

Again, local management judgment and experience are called for.

Items that can't be mitigated are clearly identified in the final complexity rationale and may influence the final complexity determination.

The final determination is based on reevaluating the elements after the plan is prepared.

Mitigation measures should lower the final rating. In some instances, information learned during the planning process may actually increase the final rating.

In some situations, the rating may stay the same. The rationale for each value in the final rating should describe the mitigation measures or new information that resulted in a change from the initial rating.

For values that don't change between preliminary and final, indicate 'no change.'

A primary concern in this step is documenting elements that have been changed from the preliminary rating because of planned mitigation, site conditions, or other situations that have occurred.

Document the steps taken to mitigate risk and how those steps actually lowered risk. The final element ratings provide the foundation for the summary rating.

B. Summary Rating Determination

Recognize that complexity rating is an inherently subjective process.

Only a few elements can be objectively measured and assigned clear breakpoints between low, moderate, and high.

The complexity analysis element descriptions were designed to minimize subjectivity. Supporting documentation also aids in minimizing subjectivity.

To develop final summary ratings by complexity factors, look over all the elements. Each project usually has elements and complexity factors that are critical to project success.

Use lessons learned from previous projects to help with summary ratings. The values of critical elements should be given greater weight in deciding what the overall summary rating will be.

The summary complexity rating rationale will clearly justify the summary rating for prescribed fire organization and prescribed fire burn boss level.

It must also identify risks from the complexity analysis that are rated high, cannot be mitigated, and provide a discussion of the risks associated.

Generally, since all mitigating measures have been applied, the highest rating from the value of any single element may provide the foundation for the summary rating of risk, potential consequences, and technical difficulty.

The rationale for the summary rating should be brought forward from the elements that establish that rating level.

The completed complexity analysis should be included in the package sent to the technical reviewer.

C. Agency Administrator Approval

The summary complexity rating and rationale for the project provides the administrator critical facts to make a decision.

For anything unique or abnormal about a project, brief the agency administrator prior to submitting for approval.

The administrator reviews the rating material and, if in concurrence, approves and dates the document.

Include the summary page and rationale in the final prescribed fire plan as element #3.

**EXERCISE: Final Complexity Analysis**

Part 1:

1. Refer back to the preliminary complexity analysis elements you completed in Unit 4.

2. Complete the final rating and rationale for the elements you were assigned in Unit 4.

   **Note:** Use your printed copy of the Red Bull Prescribed Fire Plan.

3. When finished, groups will present their final element complexity determination and rationale to the class.

Part 2:

1. Review the completed complexity analysis summary for the Red Bull Prescribed Fire Plan, using your printed copy of the plan.

2. Complete the complexity rating summary on the next page.

3. When finished, groups will present their final complexity rating summary and rationale to the class.

## Element 3: Complexity Analysis Summary

| PRESCRIBED FIRE NAME | | | |
|---|---|---|---|
| **ELEMENT** | **RISK** | **POTENTIAL CONSEQUENCE** | **TECHNICAL DIFFICULTY** |
| 1. Potential for escape | | | |
| 2. Number and dependence of activities | | | |
| 3. Offsite values | | | |
| 4. Onsite values | | | |
| 5. Fire behavior | | | |
| 6. Management organization | | | |
| 7. Public and political interest | | | |
| 8. Fire treatment objectives | | | |
| 9. Constraints | | | |
| 10. Safety | | | |
| 11. Ignition procedures/methods | | | |
| 12. Interagency coordination | | | |
| 13. Project logistics | | | |

| COMPLEXITY RATING SUMMARY | |
|---|---|
| | **OVERALL RATING** |
| **RISK** | |
| **CONSEQUENCES** | |
| **TECHNICAL DIFFICULTY** | |
| **SUMMARY COMPLEXITY DETERMINATION** | |
| **RATIONALE:** | |

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Unit 11 – Reviews, Approvals, and Signature Page

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Describe the prescribed fire plan review and approval process.

2. Explain the amendment process.

3. Describe the importance and process of the Agency Administrator Pre-Ignition Approval Checklist and the Prescribed Fire Go/No-Go Checklist.

# I. REVIEW AND APPROVAL PROCESS

## A. Signature Page

1. The signature page should include:

   - Administrative unit name
   - Prescribed fire unit (burn unit/ project name)

2. At a minimum, three dated signatures are required:

   - Prescribed fire plan preparer
   - Technical reviewer
   - Agency Administrator

   Additional signatures may be included as required by the individual unit.

3. Final determined complexity rating(s)

## B. Technical Review

Every prescribed fire plan must receive a technical review.

- Agency or individual unit policy may dictate additional reviews.
- Interagency prescribed fire plans require approval from all appropriate Agency Administrators and a technical review.
- The technical review is a required and necessary step in plan development.

C. Technical Reviewer/Prescribed Fire Plan Preparer Qualifications

- Must be qualified or have been previously qualified as a prescribed fire burn boss at an experience level equal to or higher than the complexity being reviewed.

  – Either the prescribed fire plan preparer or the technical reviewer must be currently qualified, *less physical fitness requirements*.

    This allows qualified people who may be injured, or temporarily unable to pass the physical fitness requirements, perform as technical reviewer.

  – NWCG qualifications are accepted.

  – Only a prescribed fire burn boss Type 1 (RXB1) can review plans at high complexity.

  – An RXB2 can review plans of moderate to low complexity.

  – An RXB3 is not allowed to function as a technical reviewer.

- The technical reviewer should have local knowledge of the area, experience burning in similar fuel types, or conduct an on-site review.

  – Must be someone other than the primary preparer of the plan.

  – Off-unit technical reviews provide an additional independent perspective.

– Specialists may review certain portions of the plan.

  Example: A fire behavior analyst may review the fire behavior calculations, the aviation manager may review the air operations plan, or a resource specialist may review impacts to their resource of interest.

– A primary technical reviewer must be designated as the signatory.

– It is recommended that at least once every year, each unit send a moderate or high complexity prescribed fire plan off-unit for technical review.

D. Technical Reviewer Responsibilities

- Ensure that prescribed fire plans meet agency policy and direction.
- Ensure that the complexity analysis accurately represents the project.
- Check the prescription parameters against the fuel types.
- Ensure the fire behavior calculations and prescription parameters are appropriate and within the acceptable range.
- Ensure that the ignition, holding and contingency plans are consistent with the predicted fire behavior.
- Complete and sign the technical review checklist and the prescribed fire plan signature page.

## II. AMENDMENTS

Amendments are changes to the prescribed fire plan that require an Agency Administrator signature.

### A. Common Reasons for Amendments

- Changes to objectives.
- Changes to fire behavior prescription parameters.
- Changes to project area boundaries resulting in either increase or decrease in area.
- Reduction in resource capabilities identified as required in the plan.
- Major changes to ignition methods:
  - Ground ignition to aerial ignition.
  - Aerial ignition to hand ignition.
  - Hand drip torch ignition to use of terra torch ignition (includes ATV-mounted ignition devices).
  - Hand or hand ignition from roadways to hand ignition from boats or other watercraft.

B. The Amendment Process

- Fix the problems.
- Discuss the need for a technical review with your Agency Administrator.

  If your Agency Administrator determines a technical review is not required, a justification statement must be made and included as part of the prescribed fire plan amendment.
- If required, get a new technical review.
- Re-sign signature page.

C. Planning With Flexibility

All acceptable options should be covered in the plan prior to signature. This may include:

- Different seasonal burning
- Multiple prescribed fire complexity ratings
- Multiple organizations
- Using wetlines or snow banks

Even with built-in flexibility, there may be a need to make amendments to the plan.

When building flexibility, the range of identified options must remain within the scope of the complexity analysis.

Examples of flexibility can be found on page 16 of "The Guide."

## III. AGENCY ADMINISTRATOR PRE-IGNITION APPROVAL CHECKLIST AND PRESCRIBED FIRE GO/NO-GO CHECKLISTS

### A. Agency Administrator Pre-Ignition Approval Checklist

- Evaluates whether compliance requirements, prescribed fire plan's elements, and internal and external notification have been completed.

- Expresses the Agency Administrator's intent to implement the prescribed fire plan.

- An Agency Administrator may add items to the checklist.

- Establishes the expiration date of the implementation of the prescribed fire plan.

  If ignition of the prescribed fire is not initiated prior to expiration date determined by the Agency Administrator, a new approval is required.

- An 'acting' Agency Administrator may sign the Agency Administrator pre-ignition approval checklist, if authority to do so has been delegated.

### B. Prescribed Fire Go/No-Go Checklist

- The Prescribed Fire Go/No-Go Checklist from "The Guide" is a minimum standard. You can add items to the checklist.

- For all multiple-day prescribed fires, a separate daily Prescribed Fire Go/No-Go Checklist is required (must be signed for implementing separate prescriptions regardless of the complexity).