

Wildland Fire Observations and Origin Scene Protection for First Responders FI-110



NFES 2748

Student Workbook

MARCH, 2005



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:

Wildland Fire Observations and
Origin Scene Protection for First Responders, FI-110
Certified at Level I

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

Member NWCWG and Training Working Team Liaison

Date

3/8/05

Chairperson, Training Working Team

Date

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Date

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PREFACE

Wildland Fire Observations and Origin Scene Protection for First Responders, FI-110, is identified training in the National Wildfire Coordination Group's (NWCG), Wildland and Prescribed Fire Curriculum. This course has been developed by an interagency development group with guidance from the National Interagency Fire Center (NIFC), Fire Training Group under authority of the NWCG, with coordination and assistance of personnel from the following agencies:

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CONTENTS

PREFACE i

DETAILED LESSON OUTLINE

Unit 0: Introduction 0.1

Unit 1: Roles and Responsibilities 1.1

Unit 2: Fire Cause Categories 2.1

Unit 3: Fire Behavior 3.1

Unit 4: Responding to the Fire 4.1

Unit 5: Arrival at the Scene 5.1

Wildland Fire Observations and Origin Scene Protection
for First Responders, FI-110

Unit 0 – Introduction

OBJECTIVES:

1. Introduce the course coordinator, instructors, and students.
2. Identify and explain administrative concerns.
3. Present the course objectives.
4. Introduce the course.
5. Explain the evaluation process.

I. COURSE OBJECTIVES

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

- List various causes of wildland fires and their cause indicators.
- Perform the basic procedures and techniques needed to provide witness/observer information to fire investigators.
- Recognize and protect wildland fire origin areas.

II. COURSE INTRODUCTION

A. Wildfires occur on:

- Federal lands
- Tribal lands
- State lands
- Private lands

As of 2002, the eleven year average of responses to wildfires by all agencies was 101,780 wildfires resulting in 4,462,000 acres burned.

- 95% of wildfires are suppressed during the initial attack phase.
- The 5% of fires that escape initial attack result in millions of dollars in suppression cost and damage to natural resources and property.

Accurate determination of a wildland fire's origin and cause is no less important than the suppression of the fire.

All personnel share the responsibility for ensuring that wildland fires are properly investigated.

Proper wildland fire investigation will give agencies the information needed to develop successful fire prevention programs and establish civil and/or criminal responsibility.

B. Levels of Wildland Fire Investigators

- INF3 – Type 3 Fire Investigator
- INF2 – Type 2 Fire Investigator
- INF1 – Type 1 Fire Investigator

III. STUDENT EVALUATION

Students must obtain 70% or higher on the final exam to receive a certificate of completion for the course.

Wildland Fire Observations and Origin Scene Protection
for First Responders, FI-110

Unit 1 – Roles and Responsibilities

OBJECTIVES:

1. Describe why adequate fire cause determination is important.
2. Assemble the items needed in a wildfire origin protection kit.

I. ROLES AND RESPONSIBILITIES

Agencies are mandated to investigate fires to determine the origin and cause.

A. Reasons for Fire Cause Determination

- Preparation of an effective fire prevention program based on accurate fire cause statistics.
- Pursuit of criminal, civil, and/or administrative actions against violators.
 - Determine correct cause
 - Identify responsible party(ies)
- Collection and recovery of damages and fire suppression costs.
- Preparation of efficient pre-suppression strategic plans based on knowledge of causes and responsible persons.

Recent U.S. Supreme Court decisions and the establishment of professional standards and guidelines in NFPA 921 and 1033 documents have significantly increased the requirements involved in conducting a fire investigation.

The requirements outlined in the U.S. Supreme Court decisions and in the NFPA publications include conducting legally and scientifically sound investigations that conform to acceptable methodologies.

For these reasons, fire investigations must be conducted by trained and qualified personnel only.

The primary objectives of a First Responder are to support the fire investigation by collecting critical preliminary information for the investigator and to ensure that the origin and any related physical evidence is protected.

B. Basic Responsibilities as a First Responder

- Record observations en route to and upon arrival at the fire scene.
- Identify potential witnesses.
- Take and record weather data upon arrival.
- Identify and protect the general origin area.
- Protect any physical evidence at or near the scene (including areas outside the burned area) until a qualified Wildland Fire Investigator arrives.
- Photograph the fire scene.

II. EQUIPMENT FOR THE FIRST RESPONDER

To accomplish the responsibilities of the First Responder, some basic equipment will be needed. These items should be readily accessible.

A. First Responder's Kit

Contains the basic equipment needed to accomplish the responsibilities of the First Responder. These items should be carried in a separate pack or carrying case in the engine or vehicle.

B. Recommended Kit Contents:

- Flagging and stakes (any color flagging is acceptable)
- GPS unit or compass
- Camera (one-time use cameras are acceptable)
- Note taking materials
- Belt weather kit or digital weather instrument
- Flashlight
- Steel tape measure
- Pocketknife
- Binoculars
- Local topographical map

Wildland Fire Observations and Origin Scene Protection
for First Responders, FI-110

Unit 2 – Fire Cause Categories

OBJECTIVE:

- Describe the major wildland fire cause categories and their indicators.

I. FIRE CAUSE CATEGORIES

Agencies classify fire causes into separate categories for reporting and statistical purposes.

A variety of different classification systems exist. For the purpose of this course, we will use the system that classifies causes into nine categories.

A. Lightning

Any wildfire started as a result of lightning activity.

Often strikes trees, snags and power poles.

Look for strike marks, splintered wood, and needle shower.

B. Campfires

Any wildfire started from a campfire used for warming, light, or cooking.

Unattended, improperly extinguished and abandoned campfires may ignite a wildland fire.

The fire may escape control through spotting or creeping into adjacent or uncleared vegetation.

Look for signs of recent camping activity and a fire ring at or near the general origin area.

Secure the area around the escaped campfire and protect it.

Identify any witnesses or persons in the area.

C. Smoking

Wildfires caused by smoking activities or accessories (matches, cigarettes, cigars, lighters, etc.).

Smoking activity, particularly a carelessly discarded cigarette, is often erroneously blamed for wildland fires. The conditions necessary for a cigarette to cause a fire are very limited.

Roadside fires that do start from cigarette butts will often have an origin that is within a few feet of the road edge.

Cigarette butts and other related evidence are fragile. Keep hose streams and other suppression activity well away from the origin area.

D. Debris Burning

Wildfires caused by fires started for purposes of burning slash, stubble, fields, trash, right-of-way, or other controlled burning.

Fires escape by windblown embers or creeping into uncleared vegetation.

A debris pile or burn barrel will be present near or at the origin area.

Note and photograph hot barrels or piles without entering the origin area.

Secure the origin area. The debris pile or burn barrel may not be the “specific” point-of-origin. Secure a larger area around these objects.

E. Incendiary

Wildfires deliberately set that burns the property of another without their consent (arson).

Arson may involve a “hot set” or a time delayed device. Multiple fires may be set over a period of days or weeks with origins near roadsides or trails.

Hot sets involve direct application of flame to a fuel source by the use of such items as a match or butane lighter.

Protect the origin, tire impressions, footwear impressions and any other evidence of the cause. If the ignition source is observed, do not touch it, but do protect it from suppression activity.

F. Equipment Use

Includes fires started from any mechanized equipment excluding railroad equipment.

1. Fires may start from a variety of ignition sources:

- Exhaust particles
- Friction
- Fuel
- Fluid leaks or spills
- Malfunction
- Direct heat transfer

Equipment can range from large equipment such as bulldozers and road graders, to passenger cars, motorcycles, chain saws, pumps, and generators.

Basically any internal combustion engine that can generate heat through one of the five ignition mechanisms has the potential to be a competent ignition source.

2. Equipment use fires originate near the location where it was being operated:
 - Roads and trails
 - Construction sites
 - Logging areas
3. Look for and protect evidence of the equipment's use:
 - Tire or track impressions
 - Chain saw or other portable equipment use
 - Blade scrape or gouge marks
 - Blade strike marks
 - Equipment itself (near origin)

G. Railroad

Wildfires associated with railroad operations (including campfires, debris burning, etc.), started by employees or equipment that are engaged in railroad related activities. Special care must be taken to work safely on or near railroad right-of-ways.

Railroad operations may start fires through a variety of ignition sources:

- Exhaust carbon
- Brake failure
- Other mechanical malfunctions

- Track maintenance
- Flares
- Warming fires
- Debris burning

Note the railroad mile post marker closest to where the fire originated. The origin will most likely be on or very near the track right-of-way.

Some railroad related fires originate in ties and spread to adjacent vegetation.

Since many railroad related fires will be pursued for cost recovery, protection and recovery of the physical evidence is critical.

Some origins related to exhaust carbon may occur at much greater distances from the track right-of-way. Therefore, protecting a general origin that starts on the tracks and extends to at least 75 or 100 feet out from the track edges can be important to the investigation.

When train brakes or exhaust systems fail, multiple fires and/or origins may result. It is very important to contact someone with authority to stop the train that is suspected of starting the fire(s).

Remember: Think SAFETY at all times!

H. Children

Wildfires started by persons 12 years of age or younger.

Many children experiment with fire; sometimes this leads to an uncontrolled wildland fire.

Because many of these fires occur in residential areas, they are quickly detected and suppressed and the origin areas are often disturbed during initial control actions.

Fires started by children often exhibit obvious indicators:

- They occur in places frequented by children.
- The children may try to suppress the fire themselves.
- Burned toys, cardboard boxes, fireworks and/or multiple matches may be present at or near the origin.

Attempt to identify, or be able to describe any children leaving or at the scene of the fire.

Look for and protect the origin area and any physical evidence at or near the origin.

Children start fires out of both normal curiosity motives and from more serious pathological reasons. It is important to identify the responsible child and have them referred to juvenile authorities for counseling.

I. Miscellaneous

Fires from ignition sources that do not fit in any of the other categories are classified in the miscellaneous category.

This includes ignition sources such as:

1. Powerlines

Fires that start from powerlines will usually originate in close proximity to the lines or poles.

Evidence at the origin may include:

- Charred tree limbs
- Dead birds
- Squirrels
- Downed conductor
- Fuses
- Insulators
- Hardware laying on the ground near the origin
- Transformers

It may not be possible to prevent utility company employees from making necessary emergency repairs to the powerline; however, they are not allowed to take evidence. It is legal to prevent them from doing so.

Secure and protect the origin area and any physical evidence. Photograph the condition of the conductors, pole hardware, and right-of-way or any other relevant evidence, particularly if arriving prior to the utility company repair crews.

Many power line related fires will be pursued for cost recovery.

Use extreme caution around and under power lines! Any conductor line lying on the ground should be treated as “live” until a power company employee arrives and confirms the line is “dead.”

2. Fireworks

Fireworks start many wildland fires annually.

Many of these fires occur around a holiday or other celebration.

May be used by arsonists as an incendiary device.

Evidence that may be observable near the origin:

- Spent fireworks
- Wrapping paper
- Packages
- Chemical residue

3. Cutting, welding, and grinding

Fires start from sparks or hot metal fragments during welding operations.

Evidence at or near the origin may include:

- Welding debris
- Cart wheel marks
- The material that was being cut or welded

4. Firearms and ammunition

Firearms related fires are an infrequent occurrence. Bullet strikes from steel core ammunition are one of the more common ignition sources in this category. Tracer and incendiary rounds also start fires.

Look for evidence of firearms use near the origin such as:

- Empty shell casings
- Target materials
- Bullet holes or strike marks
- Empty shell boxes
- Steel core ammunition boxes

5. Spontaneous heating

Most wildland fires started from spontaneous heating originate from inside chip piles, saw dust waste, green slash piles, baled green hay, or hay stacks.

Look for evidence of the pile at the origin; do not suppress the origin area.

6. Electric fences

Electric fences occasionally start wildfires; the origin will be along the fence line.

Protect the origin, including the fence line itself. Do not let the owner attempt to make repairs to the fence.

7. Blasting

8. Structure fires

9. Vehicle fires

10. Woodstove ashes

Wildland Fire Observations and Origin Scene Protection
for First Responders, FI-110

Unit 3 – Fire Behavior

OBJECTIVE:

- Apply the basic principles of fire behavior and describe their influence on wildfire burn patterns and indicators.

I. FIRE BEHAVIOR

Correctly identifying and protecting the general origin area of a wildland fire is a primary responsibility.

Understanding fire behavior is important in helping to identify this area. It is recommended that a basic fire behavior course be taken either before or after this course.

This unit will examine the effect that wind and slope have on fire behavior and how that may affect the preliminary spread and shape of the fire.

When a fire first ignites, it will burn outward in a circular fashion until wind or slope begin to influence it.

Once wind or slope begins to affect the fire, it will burn predominantly in one general direction faster than the others. This effect will give a fire its general shape or “personality.”

A. Influences that affect fire behavior:

1. Topography

- Slope
- Aspect
- Shape of land

2. Fuels

- Fuel size
- Fuel moisture content (combustibility)
- Fuel continuity

3. Weather
 - Wind
 - Dryness
 - Air stability
 - Temperature

B. These effects will cause the fire to form:

- An advancing area (head)
- A backing area (heel)
- Two areas of lateral spread (flanks)

Advancing areas are characterized by greater intensity, faster rates of spread and more noticeable damage.

The backing areas are characterized by less intensity, slower rates of spread and less damage.

The lateral areas usually exhibit fire behavior characteristics that fall in between those in the advancing and backing areas.

The areas in between these distinct types of fire spread are referred to as “transition zones.”

By understanding this basic principle of fire spread, it will be easier to identify the general origin area.

II. ORIGIN

The precise location where the ignition source comes into contact with the materials first ignited is called the “point of origin.”

Ensure that all people and suppression action are kept away from this point and the area surrounding it.

The area immediately around the point of origin, where the fire spreads more or less evenly (before wind or slope influence it), is called the “specific origin area.” This area is approximately a 5' x 5' area.

Soon after a fire ignites, it develops a direction of travel (from a wind or slope influence), the area burned at this point is referred to as the “general origin area.”

The “general origin area” is the area that the first responder needs to protect and keep secured.

This area can range from as small as 10' x 10' to over one-half acre, depending upon the fuels and fire behavior conditions.

When determining an area to protect, it is better to secure too large an area, rather than too small an area.

III. FIRE SPREAD

A. The two major factors that govern fire spread are slope and wind.

1. Slope

A wildfire will burn upslope faster than in a flat area and the rate of spread will be slower yet when burning downslope. Rolling embers may ignite downslope fuels below the fire perimeter.

Therefore, when trying to identify the general origin area, consider securing an area that includes the point of the fire that is lowest on the slope.

Generally, a fire will burn outwards and uphill in a “V” or “U”-shaped pattern.

The origin will normally be in the bottom of the “V” or “U.”

2. Wind

The second major influence on fire spread and shape is the wind. A fire will normally advance with the wind.

The origin area will normally be upwind from the advancing area of fire spread.

Wind can also influence the preliminary shapes of the burned area in the early stages of the fire.

Under moderate to strong wind conditions, the origin will be much closer to the heel.

In light or no-wind conditions, the origin will normally be closer to the center of the burned area.

B. Transition Zones

Another fire behavior condition that can help to correctly identify the general origin area is to look for the transition zones between different areas of fire spread.

The most obvious transition is the change in fire intensity when the fire begins to advance under the influence of slope or wind and at the same time back into the wind and/or downslope.

The best way to determine this zone is to look for the difference in the degree of damage to surrounding fuels.

These are the same indicators the investigators will use to locate the actual point of origin, but as a First Responder, they can be used to help identify the general origin area.

The zones of advancing fire will reflect the higher degree of intensity associated with them.

C. Fire direction indicators to look for:

- An angle of char in tree and brush crowns that is steeper than the slope.
- Deeper charring on the sides of objects that face the direction the fire came from. The opposite sides will be “protected” and show less damage.
- Obvious “foliage-freezing” that is consistent with wind direction.
- Grass stems completely consumed in advancing areas. Unburned, toppled grass stems on the ground in the backing areas, the heads pointing towards the origin.
- In areas of frontal fire spread, carbon stains and “soot” will be deposited on the origin side of rocks, fence wire, metal items, and other residual objects.

By using the techniques examined in the preceding section, it will be possible to correctly identify and protect the general origin areas on most fires.

Wildland Fire Observations and Origin Scene Protection
for First Responders, FI-110

Unit 4 – Responding to the Fire

OBJECTIVES:

1. Identify the principles of fire detection and describe the fundamentals of fire reporting and dispatch.
2. Make observations that may be encountered en route to and upon arrival at a wildland fire.

I. RESPONDING TO THE FIRE

A. Fires are discovered and reported in different ways:

- Telephone
- Radio
- Lookout towers
- Aircraft
- Passersby

B. When taking a report directly from the person who discovers the fire, ensure the following basic information is obtained:

- Their name
- Phone number
- Address
- If they know how the fire started
- Location of the fire

C. As a first responder, the following information will also be important to the report:

- The time the fire was reported
- How it was reported/who reported it
- Weather conditions
- Access
- Jurisdiction
- Other units responding

This information applies to aerial personnel as well as ground personnel.

II. OBSERVATIONS EN ROUTE TO THE FIRE

En route to the fire, be aware of noting important observations that will greatly assist the fire investigators. Record times for all observations.

Take note of the smoke column (photograph if possible):

- Size
- Direction of drift
- Color
- Volume
- Changes in any of the above

III. INFORMATION CONCERNING PERSONS OR VEHICLES LEAVING THE FIRE SCENE OR AT THE FIRE SCENE UPON ARRIVAL

When arriving upon the fire scene, note persons or vehicles at the fire scene or leaving the fire scene. Note location observed and direction of travel.

A. Note vehicle identification information on a note pad or pocket tape recorder:

- Make
- Model
- Year
- Color
- License plate number
- Number of occupants
- Any cargo on board
- Damage to the vehicle
- Any unusual or obvious accessories
- Direction of travel
- Speed of travel

B. Note subject description information on a note pad or pocket tape recorder.

1. Fixed traits (traits that change very slowly or not at all):

- Sex
- Race
- Height
- Hair color
- Weight
- Age

2. Unfixed traits (traits that are easily changed or altered):

- Clothing
- Facial hair
- Glasses
- Scars/tattoos
- Eye color

3. Unique characteristics (characteristics that are unique to an individual):

- Facial features
- Deformities
- Limp
- Speech
- Hairstyle

C. Look for and make other observations such as:

1. Condition of gates

- Open
- Closed
- Locked

2. Tire, footwear, or horseshoe impressions on roads/trails.

3. Vehicles parked in an unlikely spot.

Any other items at or near the fire scene that appear out of place and might be potential evidence of the fire's cause.

PRACTICAL EXERCISE

Slides 14-17:

What is the responder looking for at this point?

Observations:

Slides 18 and 19:

What is the responder looking for at this point?

Observations:

Wildland Fire Observations and Origin Scene Protection
for First Responders, FI-110

Unit 5 – Arrival at the Scene

OBJECTIVES:

1. Perform the proper steps to be taken upon arrival as a first responder to a wildland fire.
2. Perform the proper steps to be taken while in a wildland fire area, during demobilization and post fire.

I. ARRIVAL AT THE SCENE

Upon arrival at the scene, there will be several tasks to accomplish. Fire suppression duties must be performed, but on scene observations and scene protection must also be accomplished.

A. Identify and Secure the General Origin Area Along with Suppression Duties.

1. Use techniques described in Unit 4 to correctly identify the origin area.
 - Fire behavior
 - Burn patterns
 - Witness information
 - Personal observations
 - Possible cause indicators

2. Secure the area.
 - Document the perimeter of the fire on arrival.
 - Photograph scene on arrival.
 - Secure with flagging or rope.
 - Post guard as necessary until the investigator arrives.
 - Keep suppression activity away.
 - Park emergency response vehicles so that potential evidence is not destroyed.
 - Keep all other unauthorized persons out.
 - Consider and note effects of weather.

B. Identification of Witnesses

Identify any witnesses in the area that might have information about how the fire started. Have them wait for the investigator if possible.

Obtain the following identification information so the investigator can contact them later:

- Name
- Address
- Phone number
- Vehicle license numbers and descriptions for all vehicles at the scene.

C. Record Weather Data

Take on-scene weather readings and provide them to the investigator. This information may be critical for corroborating cause determination.

- Take weather readings in an area that is generally consistent with the conditions at the origin.
- Use a belt weather kit or digital weather instrument.
- Record the data.

D. Protection of Physical Evidence

1. Look for and protect physical evidence that is outside the origin area (outside the black) that might be related to the fire cause.
2. Photograph vehicles and/or people at the scene.
3. Do not pick up or touch any evidence unless absolutely necessary to prevent its destruction. This can include any of the following:
 - Tire impressions.
 - Footwear impressions.
 - Any foreign objects (beverage containers).
 - Any obvious evidence of the cause or ignition source.
4. Write down license numbers and descriptions of vehicles that drive by the origin area more than once.
5. Note descriptions of any persons that seem to be unusually interested in the fire or that try to assist with the suppression or investigation.

E. Fire Behavior Observations

1. Make note of general fire behavior conditions observed on arrival (fire size, direction of travel, and wind shifts).
 - Photograph the fire scene if possible.
 - Sketch the fire scene.
2. Obtain GPS readings of the general origin area. Note:
 - Wind direction
 - Wind speed
 - Flame height and length
 - Overall fire intensity
 - Direction of spread
 - Suppression tactics, such as areas of direct attack, burn out, water drops, etc.
 - Any indicator of possible cause.

Remember: Access to the area is to be protected from disturbance.

II. POST RESPONSE PHASE

Once you have accomplished your primary duties as a First Responder, your responsibility does not normally end.

A. Continuing Responsibilities

- Continue to keep the origin and any relevant evidence secured until the investigator arrives.
- Make personnel available to guard the origin if the investigator requests them.
- Once the investigator arrives, pass all your information on.
- Turn over any notes and film to the investigator.
- Be available for additional interviews if requested.
- Remain vigilant for any rumors or facts regarding the cause of the fire and report them to the investigator.

B. Additional Information

Ensure that investigators receive any additional information requested.

- Fire reports
- Dispatch logs

Do not discuss the investigation or any information related to the investigation with others, especially the public and the media, without prior approval from the investigator and public information officer.