



S-131 Unit 4: Look Up, Down and Around

Summary:

Look Up, Down and Around focuses on five environmental factors and their respective indicators that fireline personnel should recognize to predict hazardous fire behavior.

Incident Position Description (IPD) Alignment:

This unit aligns with the following FFT1 and ICT5 specific duties:

(<https://www.nwcg.gov/positions/fft1/position-ipd>)

(<https://www.nwcg.gov/positions/ict5/position-ipd>)

- Use Look Up, Down and Around in the IRPG to help maintain situational awareness. Adjust actions accordingly.
- Identify, analyze, and use relevant situational information to make more informed decisions and take appropriate actions.
- Report any changes in fire behavior or hazardous conditions.
- Gather critical information pertinent to the assignment/incident (i.e. current and forecast weather)

Objectives:

Students will be able to:

- Identify Look Up, Down and Around indicators.

Unit at a Glance:

Topics	Method	Duration
Fuel Characteristics	Presentation and Video	20 Minutes
Topography	Presentation and Video	20 Minutes
Weather	Presentation and Video	40 Minutes
Plume Dynamics	Presentation and Video	20 Minutes
Rapidly Changing Behavior	Presentation and Video	20 Minutes
Exercises	Group Activity	30 Minutes
Total Unit Duration		2 Hours 30 Minutes

Unit 4: Look Up, Down and Around

Materials:

- Incident Response Pocket Guide (IRPG), PMS 461, <https://www.nwcg.gov/publications/461>.
- Fire Weather Cloud Chart, PMS 438, <https://www.nwcg.gov/publications/438>.
- NWCG Fire Environment Poster, PMS 439, <https://www.nwcg.gov/publications/439>.
- NWCG Fireline Handbook, Appendix B: Fire Behavior (PMS 410-2).
- Ability to display images and video on large screen. Several of the videos in this unit require an active internet connection to play from within the PowerPoint presentation. If there will not be an internet connection at the point of course delivery, the videos must be downloaded prior to class. There are download links for the videos on the S-131 Course Materials page. <https://www.nwcg.gov/publications/training-courses/s-131/course-materials>.
- White board or easel access for exercise.
- Optional – Short video clips of fire behavior that reflect local conditions, for use in the exercises at the end of the unit.
- White board or easel access for exercise.

Unit 4: Look Up, Down and Around

Slide 1



Slide 2

Objective	
Students will be able to:	
<ul style="list-style-type: none">• Identify Look Up, Down and Around Indicators.	
<small>S-131 Unit 4: Look Up, Down and Around</small>	<small>2</small>

- Review unit objective.

Slide 3

Fire Environment Factors

The Five Fire Environment Factors and associated Indicators are found in the Look Up, Down, and Around section of the *Incident Response Pocket Guide (IRPG)*, PMS 461.



1. Fuel Characteristics
2. Topography
3. Weather
4. Plume Dynamics
5. Rapidly Changing Behavior

S-131 Unit 4: Look Up, Down and Around 3

- ❑ Ensure that the students have an *Incident Response Pocket Guide (IRPG)*, PMS 461, <https://www.nwcg.gov/publications/461>, to review for the upcoming discussions and videos.

Slide 4



Play Video

Title Fuel Characteristics

Summary Addresses the five indicators for Fuel characteristics that determine the potential for fire intensity and rates of spread.

Time (08:42)

Audio

Post-Video Discussion

Slide 5

Fuel Characteristics

- Fuel characteristic indicators determine the potential for fire intensity and rate of spread.
- Over time, fuel characteristics generally change slowly; however, they can change quickly depending on weather patterns and fuel transitions.

Slide 6

Fuel Characteristics

Indicators

- **Substantial amounts of cured or curing fine fuel / continuous fine fuels**
- **Heavy dead and down**
- **Tight crown spacing (< 20 feet)**
- **Unusually low live and dead fuel moisture values (locally defined)**

S-131 Unit 4: Look Up, Down and Around 6

Look for these indicators in burning fuels and fuels adjacent to the fire:

Substantial amounts of cured or curing fine fuels/continuous fine fuels.

- This is a critical indicator.
- It is associated with one of the major “Common Denominators of Fire Behavior on Tragedy Fires” listed in the IRPG, <https://www.nwcg.gov/publications/461>.
- Definition: Fast-drying, dead or live fuels that are <1/4 inch in diameter and have a time-lag of 1 hour or less. Examples include grasses, needles, and small leaves.
- Impact on fire behavior:
 - Fuels ignite readily and are consumed rapidly by fire.
 - Increases the potential for a rapid rate of spread.
 - Receptive to spotting.
 - Typically the primary carrier of fire.

Heavy dead and down fuels.

- Definition: Large load of dead material, 3 inches or larger wood, that is on the forest floor.
- Impact on fire behavior:
 - Increases potential for intense burning conditions.
 - Increased intensity can increase the potential for heat to transition from surface fuels to crowns, especially in the presence of ladder fuels.
 - Is consumed more slowly and for a longer duration than continuous fine fuels.
- Look for this indicator in:
 - Older, mature stands of trees.
 - Bug-killed trees.

Unit 4: Look Up, Down and Around

- Hurricane blowdown.
- Thinned or logged areas.

Tight crown spacing (< 20 feet).

- Impact on fire behavior.
 - Once a fire gets into tightly spaced crowns, the fire will move from crown to crown.
 - If there are high winds or steep slopes, a crown fire can move through more widely spaced vegetation.
- Important in both timber and brush fuel types.

Unusual low live and dead fuel moisture values (locally defined).

- Critical low fuel moisture thresholds are dependent on local climates and vegetation type.
- Ask local fuels experts what the critical moisture values are for both live and dead fuels in various vegetation types for the area.

Slide 7

Fuel Characteristics

Indicators (continued)

- **Special conditions**
 - **Efficient firebrand sources**
 - **Numerous snags**
 - **Preheated canopy**
 - **Frost and bug-kill**
 - **High dead-to-live ratio**

S-131 Unit 4: Look Up, Down and Around 7

Special conditions to pay attention to:

- Efficient firebrand sources are any fuel sources that efficiently carry heat to ignite spot fires. Always assess firebrand sources because:
 - Fuel type characteristics and availability may change due to local or unique conditions.
 - Identifying firebrand sources helps to anticipate future spotting problems.
- Numerous Snags. Snags are drier and usually ignite more readily.
- Preheated canopy is drier and becomes more flammable. Reburn potential in the canopy will be high, and cured leaves or needles can be efficient firebrand sources.
- Frost and bug-kill can cause an enormous amount of fuel to be available. Visual indicators include shrubs that have large areas of dead twigs that easily snap off or dried leaves still attached to the canopy. Red needles, which are very flammable, will exist on conifer trees during the early stages of tree mortality.
- High dead-to-live ratio means that dead fuels are much more numerous than live fuels and fires can burn hotter.

Slide 8

Fuel Characteristics

Review and Discussion

Look for Fuel Characteristics indicators. Think about how they may interact with other indicators. Add your observations to your mental model of the fire and predict potential fire behavior hazards.

S-131 Unit 4: Look Up, Down and Around 8

- Facilitate a discussion about the fuel characteristic indicators. Use these questions or develop your own:
 - Do you have any questions about fuel characteristic indicators?
 - What fuel characteristics do we have right now? What conditions do we expect to have in the next couple of months?
 - If you are going on an incident that is in an area you are not familiar with, what can you do to find out more about the fuel characteristics?
 - What other indicators, when combined with fuel characteristic indicators, could have a significant impact on fire behavior?

Slide 9



Show Topography video and discuss it.

Play Video

Title Topography

Summary Addresses the three indicators of topography.

Time (03:47)

Audio

Post-Video Discussion

Slide 10

Topography

- Topography has been a major factor in numerous fatality fires.
- It is one of the “Common Denominators of Fire Behavior on Tragedy Fires” listed in the IRPG.

IRPG, <https://www.nwcg.gov/publications/461>.

Slide 11

Topography

Indicators

- Steep slopes (> 45%)
- Chutes/chimneys/passess/saddles
- Box and narrow canyons

S-131 Unit 4: Look Up, Down and Around 11

Look for these three indicators of potentially hazardous conditions and their impacts on fire behavior as you assess the topography:

- Steep slopes
 - Expect rapid rates of spread due to flame contact and heat transfer.
 - Expect downhill spotting due to rollouts of burning materials and igniting fuels below.
- Chutes/chimneys/passess/saddles
 - Look for rapid upslope rates of spread in chutes and chimneys due to steep terrain and updrafts of air. This is known as the “chimney effect.”
 - Fire is pushed through passes and saddles faster due to wind channeling and less topographic resistance, compared to a full ridgeline.
- Box and narrow canyons
 - Expect air to be drawn in from the canyon bottom creating very strong upslope drafts. The result can be extreme fire behavior and can be very dangerous.
 - Rapid rates of spread and/or erratic fire behavior can occur in narrow canyons due to:
 - Radiant and convection spotting can produce multiple spot fires over short distances.
 - Slope reversal, a rapid upslope run when fire backing downhill reaches the opposite slope.
 - Wind eddies in intersecting drainages or forks in narrow canyons may cause erratic fire behavior.

Slide 12

Topography

Review and Discussion

As you scout the fire, look for these indicators. The alignment of topography and wind should always be considered a trigger point to reevaluate strategy and tactics. Continue to build your mental model of the fire.

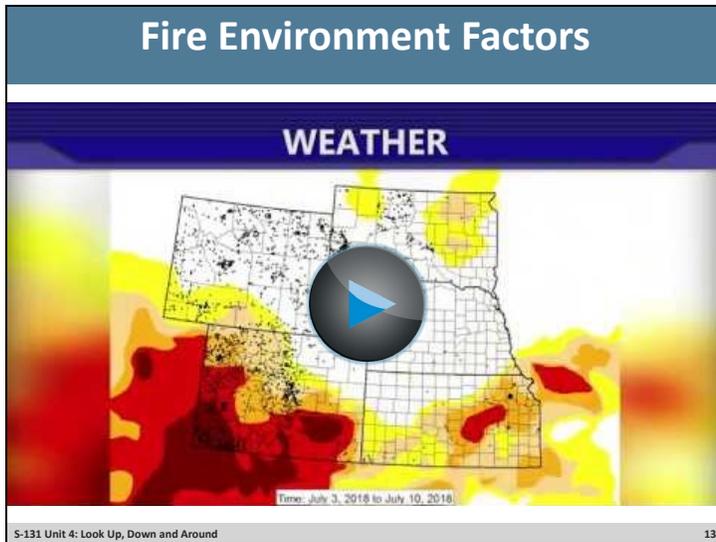
S-131 Unit 4: Look Up, Down and Around 12

- Facilitate a discussion about topography indicators. Use these questions or develop your own.
 - What topography indicators are common in this area?
 - What fires have you been on where the topography was a critical indicator of fire behavior? What other indicators were present on that fire?
 - What other indicators, when combined with topography, could have a significant impact on fire behavior?

Possible answers: wind, continuous fine fuels, relative humidity (RH), and other indicators.

- Share a story about being on the fireline and either observing or not observing topography indicators and how that impacted the decisions you made.
- Ask students if they have any questions.

Slide 13



Show Weather Indicators video and discuss.

Play Video

Title Weather

Summary Identify and describes the three weather indicators for fire behavior.

Time (11:49)

Audio

Post-Video Discussion.

Slide 14

Weather

- **Weather is a critical factor influencing fire behavior and is the most difficult of the Look Up, Down and Around indicators to predict.**
- **Wind, the main indicator for the weather, is one of the “Common Denominators of Fire Behavior on Tragedy Fires” listed in the IRPG.**

S-131 Unit 4: Look Up, Down and Around 14

IRPG, <https://www.nwcg.gov/publications/461>.

Slide 15

Weather

Indicators

- Wind
- Atmospheric Instability
- Temperature / Relative Humidity

S-131 Unit 4: Look Up, Down and Around 15

Slide 16

Weather

- **Wind**
 - **Speeds above 10 mph**
 - **Lenticular clouds**
 - **Fast-moving clouds**
 - **Cold frontal passages indicated by weak vortices and fluctuating temperatures**
 - **Cumulonimbus clouds**
 - **Dust cloud approaching**
 - **Sudden calm**
 - **Battling or shifting wind**

S-131 Unit 4: Look Up, Down and Around 16

Wind Indicators

Speeds above 10 mph. This is a critical indicator.

- Surface winds are also called eye-level winds. Forecasts will refer to 20 – foot winds. Be aware that there can be a difference in speed between the two, due to the friction of vegetation and terrain.
- One important type of surface wind is Foehn winds.
 - More commonly found in the Western United States; known by local names such as Santa Ana, Wasatch, and Chinook.
- Other important winds - Reference the “Important Winds to Firefighters” in the IRPG, <https://www.nwcg.gov/publications/461>.
- Ask local experts what important winds and wind patterns exist in the area.
- Impact of surface wind on fire behavior:
 - Increase rate and direction of spread.
 - Transport firebrands over large areas.
 - Cause wind-driven fire runs and convective heat transfer between fuels.
- Constantly assess the wind.
 - Pay attention to weather forecasts.
 - Throw dust in the air or tie a piece of flagging to your vehicle to tell wind direction.
 - Take wind readings with a handheld anemometer or other measuring devices.
 - Reference the “Beaufort Scale for Estimating Wind Speed” in the IRPG.
 - Monitor RAWS.

Lenticular clouds

- These clouds form over the crest of mountains and indicate moderate to strong high-level winds.

Unit 4: Look Up, Down and Around

- The winds may surface in the afternoon and could cause fire behavior hazards.

Fast-moving clouds

- If these clouds are moving in a direction different from surface winds, anticipate wind shifts.

Cold frontal passages indicated by weak vortices and fluctuating temperatures

- Changing wind, wind shear, and fire behavior can pick up along the leading edge of these passages.
- Cold fronts have been responsible for many erratic and extreme fire behavior events.

Cumulonimbus development

- This is the transformation from a simple cumulus cloud to a large, cauliflower looking cumulonimbus cloud. It is an indicator of an approaching thunderstorm.
- Expect strong, erratic downdraft winds and lightning, which can cause sudden and extreme fire behavior.
- If you see virga (rain that does not reach the ground), downdrafts have begun; anticipate strong and gusty winds.
- Pay close attention to the thunderstorm movement. Winds tend to be stronger along the leading edge of the moving thunderstorm.

Dust cloud approaching

- This is a suspended wall of dust reaching up a few thousand feet above the ground. It is an indicator of a downdraft or outflow.

Sudden calm

- Expect wind shifts or other changes in weather, which can increase the potential for hazardous fire conditions.
- The calming can last for several seconds up to a few minutes before the wind speeds increase and change direction.

Battling or shifting winds

- This is a critical indicator
- Expect these winds if you observe:
 - A cold front passage
 - Unstable atmosphere
 - Wind blowing through saddles
 - Wind at the confluence of a drainage
 - Local wind effects

Slide 17

Weather

Wind: Review and Discussion

- **Pay close attention to weather forecasts. When you are on the fireline, observe what the winds are doing at all times!**

- **Which sections of the IRPG can assist with your understanding of wind while on the fireline ?**

S-131 Unit 4: Look Up, Down and Around 17

- Facilitate a discussion about wind indicators. Use these questions or develop your own.
 - What type of wind conditions should we expect in this area? Do Foehn winds occur in this area?
 - What fires have you been on where the wind was the critical indicator? What happened?
 - IRPG, <https://www.nwcg.gov/publications/461>.
- Share a story about being on the fireline and either observing or not observing wind indicators and how that impacted the decisions you made.
- Ask students if they have any questions.

Slide 18

Weather

Atmospheric Instability

Stable atmosphere

- Vertical movement of air is limited. This decreases fire activity.

Unstable atmosphere

- Vertical movement of air is occurring. This tends to increase the potential for the fire to develop vertically and grow rapidly.

Slide 19

Weather

- **Atmospheric Instability**
 - **Good visibility**
 - **Battling or shifting wind**
 - **Dust devils**
 - **Cumulus clouds**
 - **Castellanus clouds in the morning**
 - **Smoke rising straight up**
 - **Inversion begins to lift**
 - **Unusually high Haines values for the local area**

S-131 Unit 4: Look Up, Down and Around 19

The eight indicators of atmospheric instability are:

1. Good visibility
 - Indicates an unstable atmosphere. Conditions won't appear hazy
2. Battling or shifting wind
 - An unstable atmosphere is a potential source for these types of winds.
3. Dust devils
 - Can make fires more dangerous by increasing spotting and starting new fires.
4. Cumulus clouds
 - The more they develop vertically, the more unstable the atmosphere.
5. Castellanus clouds in the morning
 - Could be a warning of thunderstorms in the afternoon.
6. Smoke rising straight up
 - Indicates vertical movement, a good sign of an unstable atmosphere.
7. Inversion begins to lift
 - Indicates atmosphere is becoming increasingly unstable.
 - The behavior of the fire burning beneath an inversion can change abruptly when the inversion is lifted.
8. Unusually high Haines values for the local area
 - The Haines Index measures the stability and dryness of the lower atmosphere. It can be used to predict the potential for existing fires to become large fires.
 - The higher the number (ranges between two and six), the drier and more unstable the atmosphere. Reference the IRPG (<https://www.nwcg.gov/publications/461>) for a description of Haines values.
 - Listen to weather briefings and look in the Incident Action Plan (IAP) for the Haines Index.
 - Different regions of the country have a “go-to” Haines value leading to more active fire behavior. For example, a Haines 4 reading in the Northern Rockies is like a 6 in the Southwest.

Slide 20

Weather

Atmospheric Instability: Review and Discussion

- **When you are on a fire, observe the clouds, smoke, and other instability indicators to estimate potential fire behavior hazards. These clues will help you anticipate the next big change in fire behavior.**

- **Which sections of the IRPG can assist with your understanding of atmospheric instability while on the fireline ?**

S-131 Unit 4: Look Up, Down and Around 20

- Facilitate a discussion about atmospheric instability indicators. Use these questions or develop your own:
 - Describe a situation when you observed atmospheric instability indicators. How did those observations change your mental model of the fire?
 - What does the Haines Index tell you?
- Ask students if they have any questions.

Slide 21

Weather

- **Temperature / Relative Humidity**
 - Above normal temperatures
 - Critically low humidity based on local thresholds

S-131 Unit 4: Look Up, Down and Around 21

Above normal temperatures

- Long duration periods of above normal temperatures, record heat, or heatwave events have been a precursor to extreme fire conditions.
- The fuels become drier and the atmosphere can also become more unstable, especially when abundant sunshine is present.

Relative Humidity

- Critically low humidity values are a catalyst for active fire behavior.
- Each region of the country has its critical value based on fuel type and climatology.
- Red Flag warnings issued by the National Weather Service typically have a critical humidity value attached to them. For example, 35% or lower is a critically low value for Florida while 15% is used in the Southwest.
- Pay attention to weather forecasts that mention low daytime values and poor humidity recovery at night.

Slide 22

Weather

Weather: Review and Discussion

Pay close attention to weather forecasts. When you are on the fireline, observe what the weather is doing at all times!

Three indicators for Weather

1. Wind
2. Atmospheric Instability
3. Temperature / Relative Humidity

Review “Alignments and Patterns for Dangerous Fire Behavior” in your IRPG.

S-131 Unit 4: Look Up, Down and Around 22

- Review the sections in the IRPG (<https://www.nwcg.gov/publications/461>) that can help a firefighter maintain situational awareness about the weather.
- Facilitate a discussion about the three weather indicators, and how they can interact on the fireline. Use the following or develop your own:
 - Describe a situation when you have seen the weather indicators align to cause dangerous or extreme fire behavior.
 - What are the critical weather issues that frequently influence fires in the local area?
- Share a story about being on the fireline when close observation of the weather indicators proved essential to fireline safety.
- Ask students if they have any questions.

Slide 23



- Show Plume Dynamics Indicators video and discuss it.
 - Fire is a heat source; therefore, it influences and modifies the fire environment.
 - Constantly monitor fire behavior by observing column characteristics.

Play Video

Title Plume Dynamics

Summary Identify and describes the seven indicators for Plume Dynamics.

Time (04:06)

Audio

Slide 24

Plume Dynamics

Indicators

- Well developed, nearly vertical column
- Formation of large ice cap / pyrocumulus cloud
- Thunder heard / lightning flashes
- Sprinkles of rain
- Sudden calm
- Changing column with alternating strengthening inflows and outflows
- Becoming hazy with smoke at your feet

S-131 Unit 4: Look Up, Down and Around

24

Well-developed, nearly vertical column

- Referred to as a convection column, sometimes reaches 20,000 to 30,000 feet above the ground during intense burning conditions within an unstable and dry airmass.
- Impacts to fire behavior:
 - Intense burning conditions.
 - Strong downbursts.
 - Plume-dominated fire. Inflows can strengthen as the power of the fire overcomes local winds.

Formation of a large ice cap / pyrocumulus cloud

- Condensation of water droplets or ice crystals at the top of the column.
- Strong, gusty, erratic winds can suddenly arise near a pyrocumulus cloud.

Thunder heard / lightning flashes

- Thunder/lightning from the column is indicative of pyrocumulus.
- Strong, gusty, erratic winds can result.

Sprinkles of rain

- Another indicator of a pyrocumulus cloud, with potential for strong, gusty winds.

Sudden calm

- Can be a warning that a weather change is about to take place.
- Often followed by a downburst or downdraft, with increasing outflow winds at ground level.

Changing column with alternating strengthening inflows and outflows

- Changing column is an indicator that downdrafts and outflow winds could occur.
- Significant ember showers and rapidly increasing fire intensity can occur during the downburst and outflow stage.

Becoming hazy with smoke at your feet.

Unit 4: Look Up, Down and Around

- All or part of the column can appear to be hazy or fuzzy. In some instances, smoke will appear suppressed near the ground.

Slide 25

Plume Dynamics

Review and Discussion

When on the fireline, in an aircraft, or even back at camp, look for these plume dynamics indicators.

It takes a team effort when communicating plume dynamic changes. No one person can observe and sense all of the developing indicators from one location.

S-131 Unit 4: Look Up, Down and Around

25

- Facilitate a discussion about Plume Dynamics indicators. Use these questions or develop your own:
 - Think back to previous fires you have been on:
 - What Plume Dynamics indicators did you observe?
 - Did anything happen that surprised you?
 - Were there other indicators present?
- Share a story about observing or not observing Plume Dynamics. Describe how it impacted the decisions you made.

Slide 26



- Show Rapidly Changing Behavior Indicators video and discuss.
- Play Video**

Title Rapidly Changing Behavior

Summary Lists the five rapidly changing fire behavior indicators, and how to monitor them. Describes how these indicators can be identified and what to expect on the fireline.

Time (03:02)

Audio

Slide 27

Rapidly Changing Behavior

Indicators

- Smoldering fires pick up
- Trees begin to torch
- Fire whirls beginning
- Leaning or sheared column
- Frequent spot fires

S-131 Unit 4: Look Up, Down and Around

27

- Smoldering fires pick up
 - Fire is becoming more active - monitor flame length and spread rate.
- Trees torching
 - This is a critical indicator.
 - Expect extreme fire behavior conditions if intermittent single tree torching progresses to groups of trees torching.
- Small fire whirls beginning
 - Fire is developing vertically and building intensity.
 - Potential to transport firebrands.
- Leaning or sheared column
 - The smoke column is one of the first fire behavior indicators that you will see when approaching a fire.
 - Leaning or Sheared columns can provide valuable clues to what the fire will do:
 - A leaning column is typical of wind driven fires therefore anticipate rapid rates of spread and spotting.
 - A sheared column rises straight up and then is sharply sheared off in a horizontal direction by winds aloft.
 - Long range spotting can occur.
 - Avoid working under a sheared column.
- Frequent spot fires
 - Critical indicator.
 - Anticipate fire behavior hazards.

Slide 28

Rapidly Changing Behavior

Review and Discussion

Look for rapidly changing behavior indicators. What other indicators are currently influencing fire behavior?

What indicators do you expect to influence fire behavior in the next few hours?

Add these observations to your mental model of the fire.

S-131 Unit 4: Look Up, Down and Around

28

- Facilitate a discussion about the Rapidly Changing Fire Behavior indicators. Use these questions or develop your own:
 - Think back to previous fires you have been on.
 - What rapidly changing fire behavior indicators did you observe?
 - Did anything happen that surprised you?
 - Were there other indicators present?
- Share a story about observing or not observing Rapidly Changing Behavior indicators. Describe how it impacted the decisions you made.

Slide 29

Exercises

- **You will be shown several short videos.**

- **Reference the “Look Up, Down and Around” section in your IRPG.**

- **Make note of all the Fire Environment Factors and their associated Indicators that you see.**

S-131 Unit 4: Look Up, Down and Around 29

Exercise Preparation

- Before administering the exercise, instructors should review the exercise videos and answer keys.

Exercise

Time (20:00) minutes

There are three different video scenarios.

- Fire Behavior
 - Eastern Great Basin
 - Smokejumper
- Play each video. The students should use their IRPG (<https://www.nwcg.gov/publications/461>) to identify the Look Up, Down and Around indicators.
 - At the end of each video, facilitate a discussion using the answer sheet.

Optional Scenario

The instructor may add additional scenarios if desired, using short video clips of fire activity taken from their organization to reflect the Fire Environment Factors that the students are likely to encounter.

Slide 30



❑ Play Video

Title Fire Behavior

Summary Various footage of a fire in different terrain and fuel types.

Time (02:44)

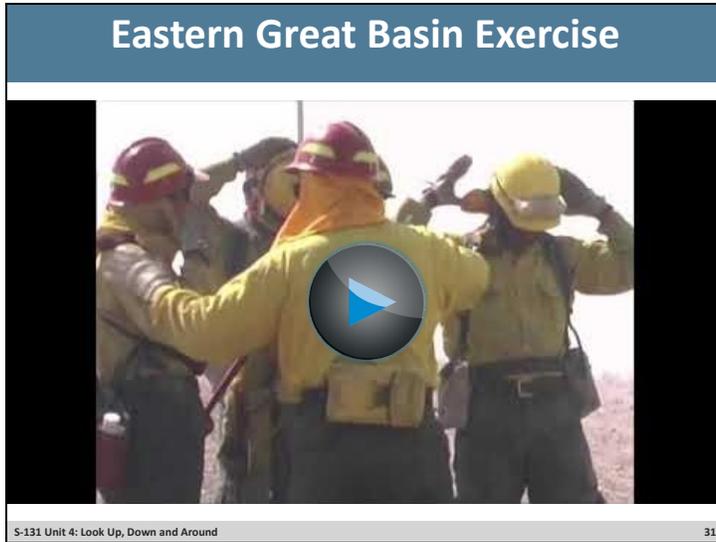
Audio

Fire Environment Factors	Indicators						
Fuel Characteristics	<input checked="" type="checkbox"/> Substantial amounts of cured or curing fine fuel/continuous <input checked="" type="checkbox"/> Heavy dead and down <input checked="" type="checkbox"/> Tight crown spacing (< 20 ft) <input type="checkbox"/> Unusual low live and dead fuel moisture values (locally defined) <input checked="" type="checkbox"/> Special conditions: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"><input checked="" type="checkbox"/> Efficient firebrand sources</td> <td style="width: 50%;"><input type="checkbox"/> Frost and bug-kill</td> </tr> <tr> <td><input type="checkbox"/> Numerous snags</td> <td><input type="checkbox"/> High dead-to-live ratio</td> </tr> <tr> <td><input checked="" type="checkbox"/> Preheated canopy</td> <td></td> </tr> </table>	<input checked="" type="checkbox"/> Efficient firebrand sources	<input type="checkbox"/> Frost and bug-kill	<input type="checkbox"/> Numerous snags	<input type="checkbox"/> High dead-to-live ratio	<input checked="" type="checkbox"/> Preheated canopy	
<input checked="" type="checkbox"/> Efficient firebrand sources	<input type="checkbox"/> Frost and bug-kill						
<input type="checkbox"/> Numerous snags	<input type="checkbox"/> High dead-to-live ratio						
<input checked="" type="checkbox"/> Preheated canopy							
Topography	<input checked="" type="checkbox"/> Steep slopes (> 45%) <input checked="" type="checkbox"/> Chutes/chimneys/passes/saddles <input type="checkbox"/> Box and narrow canyons						

Unit 4: Look Up, Down and Around

Fire Environment Factors	Indicators
Weather	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Winds <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Speeds above 10 mph <input type="checkbox"/> Lenticular clouds <input type="checkbox"/> Fast-moving clouds <input type="checkbox"/> Cold frontal passages indicated by weak vortices and fluctuating temperatures <input type="checkbox"/> Cumulonimbus clouds <input type="checkbox"/> Dust cloud approaching <input type="checkbox"/> Sudden calm <input checked="" type="checkbox"/> Battling or shifting winds <input checked="" type="checkbox"/> Atmospheric Instability <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Good visibility <input checked="" type="checkbox"/> Battling or shifting winds <input type="checkbox"/> Dust devils <input type="checkbox"/> Cumulus clouds <input type="checkbox"/> Castellanus clouds in the a.m. <input type="checkbox"/> Smoke rises straight up <input type="checkbox"/> Inversion beginning to lift <input type="checkbox"/> Unusually high Haines values for the local area <input type="checkbox"/> Temp/RH <ul style="list-style-type: none"> <input type="checkbox"/> Above normal temperatures <input type="checkbox"/> Critically low humidity based on local thresholds
Plume Dynamics	<ul style="list-style-type: none"> <input type="checkbox"/> Well developed, nearly vertical column <input type="checkbox"/> Formation of a large ice cap/ pyrocumulus cloud <input type="checkbox"/> Thunder heard/lightning flashes <input type="checkbox"/> Sprinkles of rain <input type="checkbox"/> Sudden calm <input type="checkbox"/> Changing column with alternating strengthening inflows and outflows <input type="checkbox"/> Becoming hazy with smoke at your feet
Rapidly Changing Behavior	<ul style="list-style-type: none"> <input type="checkbox"/> Smoldering fires picking up <input checked="" type="checkbox"/> Trees begin to torch <input checked="" type="checkbox"/> Fire whirls beginning <input checked="" type="checkbox"/> Leaning or sheared column <input checked="" type="checkbox"/> Frequent spot fires

Slide 31



❑ Play Video

Title Eastern Great Basin Exercise

Summary Mud Flat Fire footage over time with various crews working the fire with various suppression efforts.

Time (02:48)

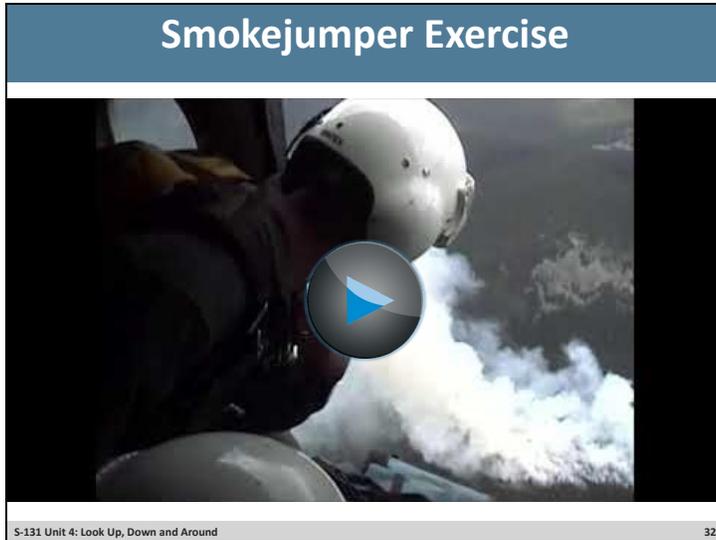
Audio

Fire Environment Factors	Indicators						
Fuel Characteristics	<input checked="" type="checkbox"/> Substantial amounts of cured or curing fine fuel/continuous <input type="checkbox"/> Heavy dead and down <input type="checkbox"/> Tight crown spacing (< 20 ft) <input type="checkbox"/> Unusual low live and dead fuel moisture values (locally defined) <input type="checkbox"/> Special conditions: <table border="0" style="width: 100%;"> <tr> <td><input type="checkbox"/> Efficient firebrand sources</td> <td><input type="checkbox"/> Frost and bug-kill</td> </tr> <tr> <td><input type="checkbox"/> Numerous snags</td> <td><input type="checkbox"/> High dead-to-live ratio</td> </tr> <tr> <td><input type="checkbox"/> Preheated canopy</td> <td></td> </tr> </table>	<input type="checkbox"/> Efficient firebrand sources	<input type="checkbox"/> Frost and bug-kill	<input type="checkbox"/> Numerous snags	<input type="checkbox"/> High dead-to-live ratio	<input type="checkbox"/> Preheated canopy	
<input type="checkbox"/> Efficient firebrand sources	<input type="checkbox"/> Frost and bug-kill						
<input type="checkbox"/> Numerous snags	<input type="checkbox"/> High dead-to-live ratio						
<input type="checkbox"/> Preheated canopy							
Topography	<input type="checkbox"/> Steep slopes (> 45%) <input type="checkbox"/> Chutes/chimneys/passes/saddles <input type="checkbox"/> Box and narrow canyons						

Unit 4: Look Up, Down and Around

Fire Environment Factors	Indicators
Weather	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Winds <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Speeds above 10 mph <input type="checkbox"/> Lenticular clouds <input type="checkbox"/> Fast-moving clouds <input type="checkbox"/> Cold frontal passages indicated by weak vortices and fluctuating temperatures <input checked="" type="checkbox"/> Cumulonimbus clouds <input type="checkbox"/> Dust cloud approaching <input type="checkbox"/> Sudden calm <input checked="" type="checkbox"/> Battling or shifting winds <input checked="" type="checkbox"/> Atmospheric Instability <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Good visibility <input checked="" type="checkbox"/> Battling or shifting winds <input checked="" type="checkbox"/> Dust devils <input type="checkbox"/> Cumulus clouds <input checked="" type="checkbox"/> Castellanus clouds in the a.m. <input type="checkbox"/> Smoke rises straight up <input type="checkbox"/> Inversion beginning to lift <input type="checkbox"/> Unusually high Haines values for the local area <input type="checkbox"/> Temp/RH <ul style="list-style-type: none"> <input type="checkbox"/> Above normal temperatures <input type="checkbox"/> Critically low humidity based on local thresholds
Plume Dynamics	<ul style="list-style-type: none"> <input type="checkbox"/> Well developed, nearly vertical column <input type="checkbox"/> Formation of a large ice cap/ pyrocumulus cloud <input type="checkbox"/> Thunder heard/lightning flashes <input type="checkbox"/> Sprinkles of rain <input type="checkbox"/> Sudden calm <input type="checkbox"/> Changing column with alternating strengthening inflows and outflows <input type="checkbox"/> Becoming hazy with smoke at your feet
Rapidly Changing Behavior	<ul style="list-style-type: none"> <input type="checkbox"/> Smoldering fires picking up <input type="checkbox"/> Trees begin to torch <input checked="" type="checkbox"/> Fire whirls beginning <input checked="" type="checkbox"/> Leaning or sheared column <input type="checkbox"/> Frequent spot fires

Slide 32



❑ Play Video

Title Pack Trail Smokejumper Exercise

Summary Experience fire from the perspective of a smokejumper following them from the plane to the ground and what fire behavior they witness.

Time (03:55)

Audio

Fire Environment Factors	Indicators						
Fuel Characteristics	<input type="checkbox"/> Substantial amounts of cured or curing fine fuel/continuous <input checked="" type="checkbox"/> Heavy dead and down <input checked="" type="checkbox"/> Tight crown spacing (< 20 ft) <input type="checkbox"/> Unusual low live and dead fuel moisture values (locally defined) <input checked="" type="checkbox"/> Special conditions: <table border="0" style="width: 100%; margin-left: 20px;"> <tr> <td><input checked="" type="checkbox"/> Efficient firebrand sources</td> <td><input type="checkbox"/> Frost and bug-kill</td> </tr> <tr> <td><input checked="" type="checkbox"/> Numerous snags</td> <td><input type="checkbox"/> High dead-to-live ratio</td> </tr> <tr> <td><input type="checkbox"/> Preheated canopy</td> <td></td> </tr> </table>	<input checked="" type="checkbox"/> Efficient firebrand sources	<input type="checkbox"/> Frost and bug-kill	<input checked="" type="checkbox"/> Numerous snags	<input type="checkbox"/> High dead-to-live ratio	<input type="checkbox"/> Preheated canopy	
<input checked="" type="checkbox"/> Efficient firebrand sources	<input type="checkbox"/> Frost and bug-kill						
<input checked="" type="checkbox"/> Numerous snags	<input type="checkbox"/> High dead-to-live ratio						
<input type="checkbox"/> Preheated canopy							
Topography	<input type="checkbox"/> Steep slopes (> 45%) <input checked="" type="checkbox"/> Chutes/chimneys/passes/saddles <input type="checkbox"/> Box and narrow canyons						

Unit 4: Look Up, Down and Around

Fire Environment Factors	Indicators
Weather	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Winds <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Speeds above 10 mph <input type="checkbox"/> Lenticular clouds <input type="checkbox"/> Fast-moving clouds <input type="checkbox"/> Cold frontal passages indicated by weak vortices and fluctuating temperatures <input checked="" type="checkbox"/> Cumulonimbus clouds <input type="checkbox"/> Dust cloud approaching <input type="checkbox"/> Sudden calm <input type="checkbox"/> Battling or shifting winds <input type="checkbox"/> Atmospheric Instability <ul style="list-style-type: none"> <input type="checkbox"/> Good visibility <input type="checkbox"/> Battling or shifting winds <input type="checkbox"/> Dust devils <input checked="" type="checkbox"/> Cumulus clouds <input type="checkbox"/> Castellanus clouds in the a.m. <input type="checkbox"/> Smoke rises straight up <input type="checkbox"/> Inversion beginning to lift <input type="checkbox"/> Unusually high Haines values for the local area <input type="checkbox"/> Temp/RH <ul style="list-style-type: none"> <input type="checkbox"/> Above normal temperatures <input type="checkbox"/> Critically low humidity based on local thresholds
Plume Dynamics	<ul style="list-style-type: none"> <input type="checkbox"/> Well developed, nearly vertical column <input type="checkbox"/> Formation of a large ice cap/ pyrocumulus cloud <input type="checkbox"/> Thunder heard/lightning flashes <input type="checkbox"/> Sprinkles of rain <input type="checkbox"/> Sudden calm <input type="checkbox"/> Changing column with alternating strengthening inflows and outflows <input type="checkbox"/> Becoming hazy with smoke at your feet
Rapidly Changing Behavior	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Smoldering fires picking up <input checked="" type="checkbox"/> Trees begin to torch <input type="checkbox"/> Fire whirls beginning <input checked="" type="checkbox"/> Leaning or sheared column <input checked="" type="checkbox"/> Frequent spot fires

Slide 33

Objective	
Students will be able to:	
<ul style="list-style-type: none">• Identify Look Up, Down and Around Indicators.	
<small>S-131 Unit 4: Look Up, Down and Around</small>	<small>33</small>

- Review unit objective.