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To: Statewide Training and Education Advisory Committee
State Board of Fire Services

From: Mark Bisbee, Battalion Chief (RA)

SUBJECT/AGENDA ACTION ITEM:
CA S-290 Intermediate Fire Behavior Course

Recommended Actions:
Information Only

Background Information:

SFT staff has been approached by both instructors and students about the feasibility of a CA S-290 that would address the fuel, topography, weather, and fire behavior linked to line-of-duty-deaths in CA, and to assess the potential for hybrid/online delivery options.

To this end, SFT has:

- Audited an online S-290 given by the University of Idaho
- Partnered with the Fire Safety Research Institute (FSRI), NWCG, and the Wildfire Conservancy to explore expanded S-290 curriculum that meets the needs of our front-line personnel.

Analysis/Summary of Issue:

Chief Bret Davidson, a member of STEAC and an S-290 instructor, has agreed to attend/audit another University of Idaho S-290 delivery offered in conjunction with the National Wildfire Coordinating Group (NWCG) and Wildland Fire Information and Technology (WFIT) Wildland Fire Learning Portal. During this audit, Chief Davison plans to validate the quality, content, rigor, and interactive features of this online delivery model to determine its applicability and feasibility for the California fire service. If modifications need to be made to meet our needs, (e.g., using a belt weather kit, determining fine dead fuel moisture, etc.) SFT staff can work with S-290 delivery providers to ensure these items are part of any hybrid/online content.

SFT continues to partner with FSRI, NWCG, the CA Wildfire Conservancy, and Cal State San Marcos to build out expanded curriculum that integrates the front-line experience of California's fire suppression and prescribed fire practitioners.

The intent is to keep the NWCG course objectives intact to maintain national standards and reciprocity but expand the course to address the prevention of LODDs by focusing on critical fire behavior factors and patterns that are common in the west and in our state. This includes participating in the development of WUI structural fuel modeling and increased fire intensity due to long-term drought and climate change. Once these WUI structural fuel models have been developed, they will be integrated into CA-290 fire behavior curriculum.

The goal of the CA S-290 effort is twofold: to increase the availability of quality S-290 online/hybrid course delivery options and to provide additional critical information and knowledge to our firefighters and prescribed fire practitioners.

S290 Online - Student Overview

S290 NWCG Objectives

- Identify and describe the characteristics of fuels, weather, and topography that influence wildland fire behavior.
- Describe the interaction of fuels, weather, and topography on wildland fire behavior, fireline tactics, and safety.
- Describe the causes of extreme fire behavior conditions (long-range spotting, crowning, and fire whirls) that develop due to weather, fuels, and/or topography.
- Interpret, communicate, apply, and document wildland fire behavior and weather information.

Overview description

This course uses interactive self-paced units to present content. There is a practice assessment for each unit, and the questions from the practice assessment are pooled to form the final assessment. Each day there is a live exercise and panel discussion where you will apply what you learned in the units. At the end of the day you will complete a reflective discussion post and complete a survey.

Requirements for obtaining your certificate

1. Satisfactory performance in 4 out of 5 of the exercises
2. Submission for all discussions and surveys
3. 70% on the final assessment

Interactive self-paced units

There are two units a day. Units are a combination of narrated PowerPoint presentations, embedded videos, and content interactions. Key terms and questions are available for each unit. Fill out the key terms and questions while you go through the units. This will serve three purposes:

1. Maintain engagement
2. Prepare you for the assessment
3. Narrow your focus on the most important concepts

Each unit will have an associated practice assessment – these assessments are not counted toward your score in the class. There are 10 questions randomly selected from a pool of 15 to 20 questions. You have 2 attempts to complete the practice assessment. The final assessment is a compilation of the questions from the practice assessments.

TIP: take the practice assessment 2 times so you are exposed to more questions from the question bank. After you take the practice assessment, review your results. You are not given the correct answer – so look up the answer to questions you got wrong so that you know how to answer the question if you see it in the final assessment.

Discussion

Discussions are intended to give you an opportunity to reflect on what you learned in the units. We will review your discussion posts before the beginning of each day and answer questions posted.

1. List your major **takeaways** from today.
2. Give 2 or 3 scenarios where this information from this unit can be **applied**. Think deeply here; your ability to think about the application will help you get the most out of the material.
3. List one or two **questions** that were generated from today's material, either directly or indirectly related to the topic.

Surveys

Surveys help us understand your experience in the class so that we can make improvements during this offering and future offerings. Think constructively, give specific feedback on what worked well and what could be improved.

Exercises

Exercises will each require about 30 minutes of work PRIOR to the live session. The work you do prior will help maximize what you can accomplish in the live session. You will work with your group to accomplish an objective while building connections to others taking the class. Each person is responsible for completing and submitting the exercise. You will be marked as satisfactory based on the following criteria

- Show engagement and critical thinking
- Complete >70% of the components of the exercise

If you are marked as unsatisfactory you will be given an opportunity to resubmit your exercise.

Live panel discussion

Panel discussion are your opportunity to talk with professionals about the topics covered in the class. Come with questions and be ready to engage in discussion. The panelists can be a resource for you in and outside of the class.

Final assessment

The final assessment will be 100 questions, with 10 questions chosen at random from each of the practice assessments. You will have 2 attempts and must achieve a 70% to be eligible for your certificate.

Unit 11 Extreme Fire Behavior - Key Terms and Questions

Key terms

- Extremem Fire Behavior
- Allignment
- Passive crown fire
- Active crown fire
- Independent crown fire
- Plume dominated fire
- Wind-driven fire

Questions

1. What are the five common denominators of tragedy fires?
2. What are the most common characteristics that constitute extreme fire behavior?
3. When are spot fires considered extreme?
4. What are the factors that contribute to spot fires?
5. What contributes to crown flammability?
6. What contributes to the surface to crown heat transfer?
7. What contributes to crown to crown heat transfer?
8. What causes fire vortices?
9. What are the characteristics of the three types of verticle vortices?
10. What are the characteristics of wind-driven vs. plume-dominated fires?
11. What are the characteristics of fuels, weather, and topography that contribute to extreme fire behavior?

Discussion question

What are your major takeaways from this material?

Give 2 or 3 scenarios where this information from this unit can be applied. Think deeply here; your ability to think about the application will help you get the most out of the material.

Unit 12 Extreme Fire Behavior - Key Terms and Questions

Key terms

- Ignition Component (IC) – the probability of a firebrand causing an ignition requiring suppression action
- Spread Component (SC) – Predicted forward rate of spread of a head fire
- Energy Release Component (ERC) – Potential heat release per unit area
- Burning Index (BI) – Predicted flame length at head of fire
- WFDSS
- IFTDSS

Questions

1. “Fire is only going to change if....
2. What are the assumptions to the recommendation of using 4X the flame height to calculate the size of the safety zone?

From the [Assessing the Fire Environment to Anticipate Fire Behavior](#) Video

3. What should you do BEFORE an assignment to be prepared for possible change?
4. What should you do once you are assigned to an incident to be prepared for possible change?
5. What should you do once you are on scene to be prepared for possible change?
6. What should you do if the spot weather forecast you requested does not match the conditions you are observing?
7. What are the questions to ask yourself when assessing change?
8. What did you learn or were reminded of in each of the six categories in the [Fire Environment Poster](#)?
9. “These models are all _____ but they are still _____”

Discussion question

What are your major takeaways from this material?

Give 2 or 3 scenarios where this information from this unit can be applied. Think deeply here; your ability to think about the application will help you get the most out of the material.

<p>2. Identify the critical topographic features that is near the fire</p> <p>3. Calculate the slope in the direction of spread</p> <ol style="list-style-type: none"> a. Based on topography alone, determine the direction the fire will spread b. Measure ½ mile from the fire in the direction of spread (use the scale bar) c. Calculate the elevation change (use the topo lines) d. Calculate slope (rise [elevation] divided by run [feet]) 	<p>2. Critical topographic feature:</p> <p>3. Slope in the direction of spread:</p>
<p>Check you work</p> <ul style="list-style-type: none"> - As time allows, compare the location you plotted to where your teammate originally located the fire. 	<p>How close were the points you plotted to the points of your team mate originally marked?</p> <p>What did you learn?</p>

Day 2 Exercise – Fuels

Objective: Become familiar with different stand structures and use general terms to describe fuels and potential fire behavior.

Do BEFORE the live exercise

Directions: View the [Vegetation Structure Part 1](#) presentation. As you move through the presentation, you will be asked to evaluate conditions of the fuels and then you will submit your answer and receive an answer to the question. BEFORE hitting submit, record your answer in the column on the left. Then record the given answer in the column on the right.

Pine and Shrub		
Question	YOUR answer	GIVEN answer
Primary fire carrier		
Fuel loading		
Arrangement of surface fuels		
Horizontal continuity of the canopy fuels		
Vertical continuity of the canopy fuels		

Light Fir Litter		
Question	YOUR answer	GIVEN answer
Primary fire carrier		
Fuel loading		
Arrangement of surface fuels		
Horizontal continuity of the canopy fuels		
Vertical continuity of the canopy fuels		

Grass		
Question	YOUR answer	GIVEN answer
Primary fire carrier		
Fuel loading		

Arrangement of surface fuels		
Horizontal continuity of the canopy fuels		
Vertical continuity of the canopy fuels		

Lodgepole		
Question	YOUR answer	GIVEN answer
Primary fire carrier		
Fuel loading		
Arrangement of surface fuels		
Horizontal continuity of the canopy fuels		
Vertical continuity of the canopy fuels		

Ponderosa Pine		
Question	YOUR answer	GIVEN answer
Primary fire carrier		
Fuel loading		
Arrangement of surface fuels		
Horizontal continuity of the canopy fuels		
Vertical continuity of the canopy fuels		

Do DURING the live exercise

Directions:

1. Discuss what you learned from the Vegetation Structure Part 1.
2. View the [Vegetation Structure Part 2](#) presentation. Use [GTR 153](#) to answer questions about fuel model and fire behavior. Use [GTR 190](#) to answer questions about fuel loading. Talk as a group about how you want to discuss the information – is one person going to pull the presentation up and share or is each person going to pull it up separately and discuss?
3. Decide on an answer as a group using the resources provided, then record the given answer. You do not need to be perfect – the intent is for you to think a little and become familiar with the resources.

Grass		
Question	YOUR answer	GIVEN answer
What is the fuel model?		
What fuel moisture is important?		
What is the fuel loading?		
What is the rate of spread?		
What is the flame length?		

Fir		
Question	YOUR answer	GIVEN answer
What is the fuel model?		
What fuel moisture is important?		
What is the fuel loading?		
What is the rate of spread?		
What is the flame length?		

Ponderosa		
Question	YOUR answer	GIVEN answer
What is the fuel model?		
What fuel moisture is important?		
What is the fuel loading?		
What is the rate of spread?		
What is the flame length?		

Day 3 Exercise – Weather

Objective: Calculate relative humidity, fine dead fuel moisture, and probability of ignition and practice effectively communicating a weather report.

Do BEFORE the live exercise

Directions: Watch the following videos and complete the weather table below

- [Look up RH and Dew Point from Dry Bulb and Wet Bulb](#)
- [Look up Fine Dead Fuel Moisture Using Temperature and RH](#)
- [Look up Probability of Ignition with Fine Dead Fuel Moisture and Temperature](#)

Dry Bulb	82	Elevation in Feet	3900
Wet Bulb	55	Elevation of Wx Obs	L
Mid-flame Wind	2-4	Shading	<50%
Gusting wind	8	Dew Point	
Wind direction	SE	Relative Humidity	
Slope	20%	FDFM (Exposed)	
Month	May	FDFM(Shaded)	
Time	1200	POI (Unshaded)	
Aspect	S	POI (Shaded)	

Do DURING the live exercise

Directions:

1. Introduce yourself
2. Complete TWO weather tables
 - a. Distribute weather tables between team members
 - b. Delete the tables that you are not doing
3. Take turns reporting the weather using the following script

Weather report script

- All resources on on the _____ fire, please stand by for your _____ weather.
- PAUSE
- Weather was taken near _____
- Temp of _____, [insert “up” or “down” a number between 1 and 5]
- RH _____, [insert “up” or “down” a number between 1 and 5, opposite direction of temp]
- Winds are _____gusting to _____ from the _____
- *****BREAK*****

- Fine Dead Fuel Moisture of _____exposed_____shaded
- Proability of ignition_____exposed_____shaded
- *****BREAK*****
- Again temp of _____ and RH of _____
- [create a message that you would likely use on a fire to draw attention to the sky and remind health and safety]

Scenario 1: Pleasant Valley Fire

Location	DP1	Aspect	E
Dry Bulb	79	Elevation in Feet	4700
Wet Bulb	54	Elevation of Wx Obs	A
Mid-flame Wind	1-3	Dew Point	
Gusting wind	5	Relative Humidity	
Wind direction	W	FDFM (Exposed)	
Slope	40%	FDFM(Shaded)	
Month	July	POI (Unshaded)	
Time	1100	POI (Shaded)	

Scenario 2: Bald Hill RX

Location	SE corner	Aspect	W
Dry Bulb	72	Elevation in Feet	1600
Wet Bulb	50	Elevation of Wx Obs	L
Mid-flame Wind	2-4	Dew Point	
Gusting wind	6	Relative Humidity	
Wind direction	N	FDFM (Exposed)	
Slope	5%	FDFM(Shaded)	
Month	May	POI (Unshaded)	
Time	1600	POI (Shaded)	

Scenario 3: Juniper Fire

Location	DP2	Aspect	S
Dry Bulb	95	Elevation in Feet	2400
Wet Bulb	60	Elevation of Wx Obs	L
Mid-flame Wind	3-5	Dew Point	
Gusting wind	7	Relative Humidity	
Wind direction	SE	FDFM (Exposed)	
Slope	15%	FDFM(Shaded)	
Month	July	POI (Unshaded)	
Time	1200	POI (Shaded)	

Scenario 4: Telephone Fire

Location	West Flank	Aspect	Flat (use S)
Dry Bulb	82	Elevation in Feet	400
Wet Bulb	67	Elevation of Wx Obs	L
Mid-flame Wind	6-8	Dew Point	
Gusting wind	10	Relative Humidity	
Wind direction	SW	FDFM (Exposed)	
Slope	0	FDFM(Shaded)	
Month	June	POI (Unshaded)	
Time	1300	POI (Shaded)	

Scenario 5: Hadley RX

Location	NE corner	Aspect	W
Dry Bulb	63	Elevation in Feet	1100
Wet Bulb	49	Elevation of Wx Obs	L
Mid-flame Wind	2-5	Dew Point	
Gusting wind	7	Relative Humidity	
Wind direction	SE	FDFM (Exposed)	
Slope	10%	FDFM(Shaded)	
Month	Oct	POI (Unshaded)	
Time	1000	POI (Shaded)	

Scenario 6: Bear Fire

Location	Goat Lookout	Aspect	E
Dry Bulb	89	Elevation in Feet	2400
Wet Bulb	61	Elevation of Wx Obs	L
Mid-flame Wind	5-7	Dew Point	
Gusting wind	12	Relative Humidity	
Wind direction	W	FDFM (Exposed)	
Slope	45%	FDFM(Shaded)	
Month	August	POI (Unshaded)	
Time	1200	POI (Shaded)	

Scenario 7: Tamarack RX

Location	Entrance Rd	Aspect	E
Dry Bulb	75	Elevation in Feet	800
Wet Bulb	55	Elevation of Wx Obs	L
Mid-flame Wind	2-4	Dew Point	

Gusting wind	8	Relative Humidity	
Wind direction	SE	FDFM (Exposed)	
Slope	5%	FDFM(Shaded)	
Month	Feb	POI (Unshaded)	
Time	1400	POI (Shaded)	

Scenario 8: Sunset RX

Location	DP1	Aspect	S
Dry Bulb	55	Elevation in Feet	2100
Wet Bulb	45	Elevation of Wx Obs	L
Mid-flame Wind	1-2	Dew Point	
Gusting wind	-	Relative Humidity	
Wind direction	N	FDFM (Exposed)	
Slope	15%	FDFM(Shaded)	
Month	April	POI (Unshaded)	
Time	1800	POI (Shaded)	

Scenario 9: Juniper Fire

Location	Stagging	Aspect	W
Dry Bulb	82	Elevation in Feet	4500
Wet Bulb	55	Elevation of Wx Obs	B
Mid-flame Wind	2-4	Dew Point	
Gusting wind	8	Relative Humidity	
Wind direction	NE	FDFM (Exposed)	
Slope	29%	FDFM(Shaded)	
Month	Aug.	POI (Unshaded)	
Time	1200	POI (Shaded)	

Scenario 10: Witches Hat RX

Location	DP4	Aspect	N
Dry Bulb	65	Elevation in Feet	1800
Wet Bulb	50	Elevation of Wx Obs	L
Mid-flame Wind	2-4	Dew Point	
Gusting wind	-	Relative Humidity	
Wind direction	SE	FDFM (Exposed)	
Slope	29%	FDFM(Shaded)	
Month	March	POI (Unshaded)	
Time	1300	POI (Shaded)	