Firing Techniques as Applied Fire Behavior

Present and Predicted Fire Behavior Influences
- Fire behavior will determine / influence:
  - Firing technique
  - Fire intensity
  - Rate of firing
  - Required depth of burn zone
  - Resource needs
  - Control issues
  - Timing / burn window
  - Success or failure

Fire Behavior Factors:
- Fuel
  - Type of fuel - timber, brush, grass
  - Fuel loading
  - Moisture content, live & dead
  - Continuity & arrangement

Fire Behavior Factors:
- Topography
  - Slope (steepness)
  - Aspect (exposure)
  - Elevation

Fire Behavior Factors:
- Weather
  - Wind (speed & direction)
  - Temperature
  - Relative humidity
  - Atmospheric stability
  - Solar radiation (time of day / exposure)

Consider the Total Fire Behavior Situation
- Obtain and maintain the big picture
  - Monitor for increased fire activity
  - Monitor convection column
  - Spotting activity: frequency, distance, intensity
- What changes in fire behavior will your operation cause?

SL 3-1-1

SL 3-1-2

SL 3-1-3

SL 3-1-4

SL 3-1-5

SL 3-1-6
Anticipate and Plan for Changes

- Wind
- Relative humidity
- Slope
- Aspect (solar radiation)
- Fuel (especially moisture)
- Orientation of lit fire to slope / wind

Be alert to changes in fire behavior as conditions or line orientation changes

Fire Behavior as it Relates to Basic Firing Patterns

Three Types of Fire Spread

- Head – A fire front spreading with the wind
- Backing – A fire front spreading against the wind or slope
- Flanking – A fire set along a control line parallel to the wind and slope and allowed to spread at right angles to it

Firing Patterns

- Includes one or more of the three types of fire spread
- Are described by orientation relative to the control line

Edge or Perimeter Firing

- Set along the edge of the control line
  - With favorable wind or slope
    - Head fire will result
    - Fast burnout times
    - May generate large amount of heat
    - May lead to control problems if conditions change

SL 3-1-7
SL 3-1-8
SL 3-1-9
SL 3-1-10
Edge or Perimeter Firing (cont.)

**Edge Firing**
- Against wind or slope
  - Backing fire will result
  - Slow burnout time
  - Low heat generation
  - Possibility of spotting across line
- May not achieve desired result in time available

**Strip Firing**
- Strips of fire set parallel to but away from the control line
  - Used when slope or wind are not favorable
  - Works best in light flashy fuels
  - Rate of firing and depth of strips are varied to control intensity
Firing Techniques

Strip Firing Ignition Pattern

Spike Firing
- Lines of fire set into the influence of the wind or slope
  - Results primarily in a flanking fire
  - May create head or backing fire if conditions change
  - Monitor fire intensity
  - Spikes will influence each other and perimeter fire
  - Used to increase rate of consumption without creating a “wall of fire”

“S” Pattern Firing
- “S” pattern of fire set parallel to the control line
  - Creates multidirectional fire
  - Use is similar to spike fire
  - Size of pattern can be changed to increase / decrease intensity
**Dot Firing**

- Similar to strip fire using dots instead of a strip of fire
- Dots will interact with each other
- Decreases fire line intensity compared to strip fire

**Basic Ignition Patterns**

- Edge
- Strip
- Spikes
- Dots
- "S" or Zig-zag

**Conduct Line-Based Firing Operations from Completed Control or Wet Line (cont.)**

- Wet-line/foam line
  - Control fire edge with water/foam
    - Water/foam leads lighter
    - Lighter leads water/foam
  - Do not overextend the distance between nozzle and lighter

**Wet-line Firing, Water/Foam Leading**

**Wet-line Firing, Torch Leading**
Wet-line Firing, Torch Leads

Wet-line Firing, Burn-through

The Wet-line Firing Operation is Lost

Regulating Fire Intensity

- General principals of fire intensity control
  - Control amount of fire lit
    - More fire = greater intensity
  - Regulate size of the flame front
    - Long / wide = more intensity
    - Narrow / short = less intensity

Reducing Fire Intensity

- Use a backing or flanking fire
- Slow pace of firing operations
- When Strip firing, use narrow strips
Reducing Fire Intensity (cont.)
- When spike or dot firing
  - Spread out ignition line / points to reduce heat exchange
  - Consume area more slowly
- When “S” firing
  - Lengthen out the pattern
  - Create backing fire away from trees or “jackpots” of fuel

Increasing Fire Intensity
- Use head fire
- Increase rate of firing
- When strip firing use wider strips
- When spike or dot firing
  - Light so fires interact (closer)
  - Involve more area at one time

Increasing Fire Intensity (cont.)
- Modify the fuel bed
  - Crush or rail heavy fuels
  - Stack cut fuels
- Use hotter firing devices
  - Terra Torch
  - Aerial ignition device
  - Fire Quick devices

Environmental Conditions
- To increase fire intensity, burn during the heat of the day
  - Lower RH
  - Higher temperature
  - Stronger winds

Regulating Fire Intensity - Conclusion
- Your fire should be hot enough to achieve desired results within the time frames available without losing control
  - Requires constant observation and modification
  - Avoid torching, sheeting, or other extreme fire behavior
  - Plan ahead and constantly re-evaluate your operation

Air Flow in the Fire Area Has Three Main Contributors
- Fire-induced in draft
- Ambient wind
- Interaction of the wind with the convection column
Predicting the Potential for Spot Fires

- Probability of Ignition
  - Evaluates the ease of ignition of the receiving fuel bed
  - Shaded / exposed
  - Fine dead fuel moisture
  - Dry bulb temperature
  - PI charts / Behave+

Probability of Ignition (cont.)

- A PI of 40% roughly separates likely from un-likely ignition
- Estimating PI potential from relative humidity (Rule of Thumb)
  - In grass or litter RH of < 30% - spotting likely
  - In heavier fuels RH of < 20% - spotting likely

Fire Brand Sources and Production

- Torching crown foliage is a common source of fire brand production
  - Aided by low fuel moisture / die back
  - Aided by concentrations of dead fuels near the base