

Flashover Recognition and Survival

Flashover Definition

- IFSTA Definition
- Flashover: Stage of a fire at which all surfaces and objects within a space have been heated to their ignition temperature, and flame breaks out almost at once over the surface of all objects in the space.



Flashover Definition

- National Fire Academy Definition
- Flashover: The ignition of combustibles in an area heated by convection and radiation, or a combination of the two. The combustible substances in a room are heated to their ignition point and almost simultaneous combustion of the material occurs.



Fire Behavior of Flashover

- Flashover is the transition between the growth stage and the fully developed stage
- During the development of a fire the upper atmosphere is heated causing radiant heating of combustible contents in room / area
- The radiant heat cause pyrolysis in the combustible contents

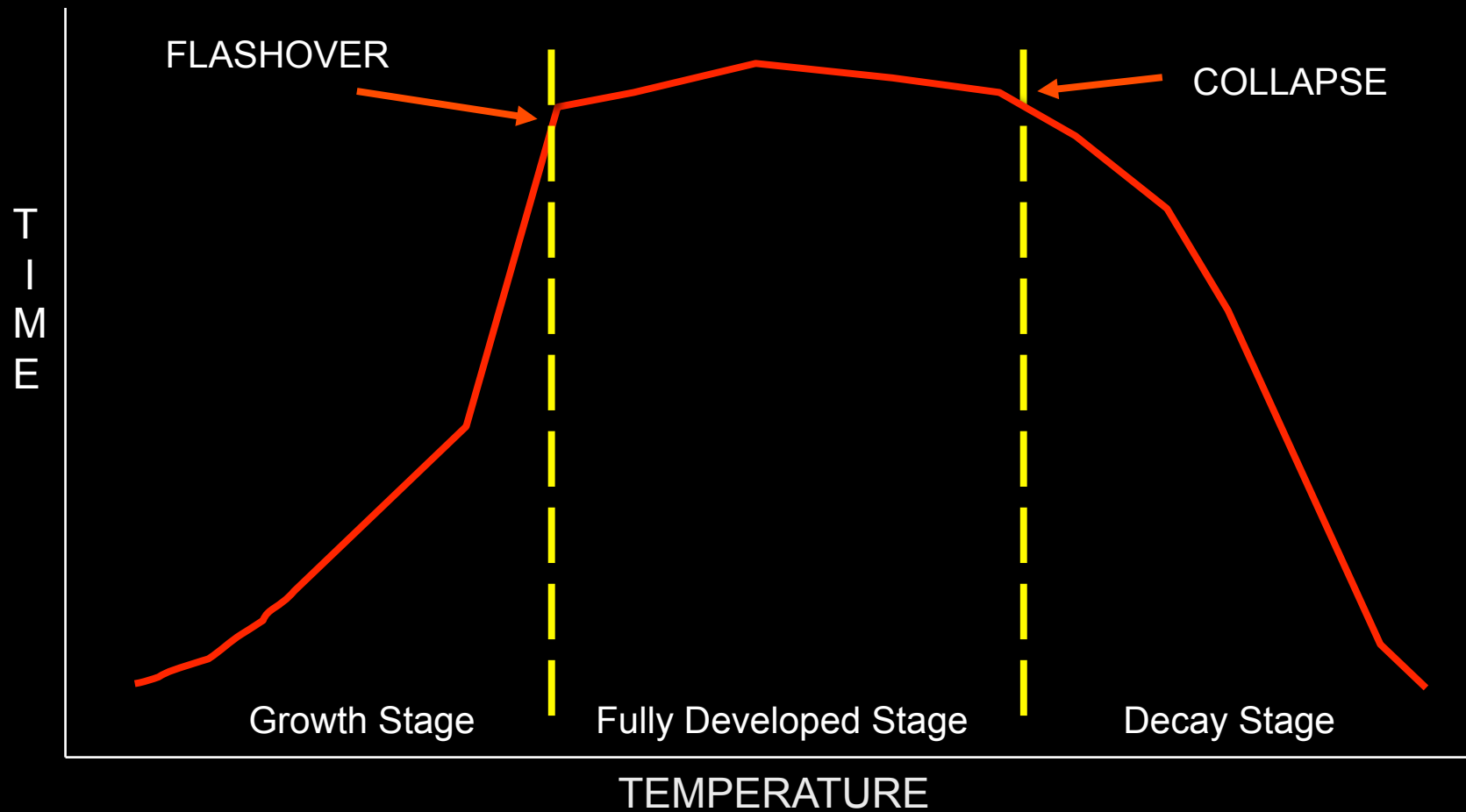


Fire Behavior of Flashover

- Fire gases produced by the heated contents reach their ignition temperature and ignite
- One of the most common gases produced by this heated process is carbon monoxide
- Ignition temperatures for fire gases range from approximately 900 – 1,200 degrees Fahrenheit



Time / Temperature Curve



Methods of Heat Transfer

- Conduction – The transfer of heat through a solid medium
- Convection – The transfer of heat by the movement of heated liquids or gases
- Radiation – Transfer of heat by electromagnetic wave without an intervening medium
- In a flashover, re-radiated heat increases room temperature causing contents to reach ignition temperature quicker



Flammable Gases of Smoke

- Carbon Monoxide (CO) primary component of incomplete combustion (smoke)
- Flammable gases collect up near ceiling level
- Thick dark pressurized smoke reaches ignition temperature
- Ignition temperature of CO – 1128 degrees Fahrenheit



Flammable Range

- Upper Explosive Limit (UEL)
- Above the UEL, fire cannot occur because there is too much fuel and not enough oxygen
- Lower Explosive Limit (LEL)
- Below the LEL, fire cannot occur because there is not enough fuel and too much oxygen
- Combustion occurs between the UEL and LEL



Flammable Range of CO

- Upper Explosive Limit (UEL)
- 74% - 100%
- Lower Explosive Limit (LEL)
- 0% - 12.5%
- Combustion occurs between the 12.5% and 74%
- 1% = 10,000 PPM
- 12.5% = 125,000 PPM



Increased Exposure to Flashover

- Better personal protective equipment
- Faster notification
- Better insulated buildings and energy efficient windows
- Combustible contents have changed from wood to plastics / synthetics



Flashover Variables

- Room size – the smaller the room the faster the fire will develop
- Openings in room – the number and size of openings will allow heat to escape possibly delaying or preventing a flashover
- Heat released – the amount of BTU's given off by burning materials



Flashover Variables

- Insulation qualities – walls, ceilings, and windows are energy efficient to allow heat from escaping, with flashover these insulation qualities keeps heat in
- Combustible contents – contents and wall surfaces allow for rapid fire development due to their physical properties, wood vs. plastic



Flashover Variables

- Ceiling height – low ceilings allow heat and smoke to build quicker whereas high ceilings may allow the flashover to go undetected without the indicators of rapid rise in heat and build-up of thick smoke
- Ventilation – venting to delay a flashover allowing gases to escape, not venting may starve the fire from oxygen and delaying the build-up



Signs of Flashover

- Free-burning fire in a contained area or compartment within a structure
- Free-burning fire of rooms contents
- Rapid rise in heat (Intense)
- Thick, dark, pressurized smoke
- Rollover / Flameover
- “Snakes, ribbons” of flame in smoke



Rollover / Flameover

- Flames move through or across the unburned gases during a fire's progression
- Distinguished from flashover by involvement only with the fire gases and not the contents of the room / area
- Flameover / Rollover occurs during growth stage as hot gases form near upper portions of room / area



Attacking Flashover

- Size-up and evaluate room or area involved – forecast for potential rapid fire development
- Determine the safest most effective route for fire attack in relation to current and predicted flame spread area
- Protect entry / egress route



Attacking Flashover

- Maintain constant awareness of your surroundings (six sided approach)
- Survey room / area for victims



Reality of Flashover

- Occupants who have not escaped from fire room / area before flashover occurs are **NOT** likely to survive
- Increased risk to firefighters operating in this environment
- Search and rescue without the protection from a hoseline is extremely dangerous
- Flashover is unpredictable



Penciling Technique

- Short duration bursts of water using a straight stream directed at the upper portions of the walls and ceilings
- Penciling technique allows for temperature reduction in fire area not allowing fire gases to reach ignition temperature



Penciling Technique

- Preventing a flashover from occurring using the penciling technique allows suppression crews to advance to the seat of the fire and enable personnel to direct water at the base of the fire achieving knockdown / extinguishment



Penciling Technique

- **CAUTION!** The penciling technique is used to **PREVENT** a flashover and should **NOT** be used as a primary means of fire attack



Using T.I.C. to Detect Flashover

- Detect high heat and gases accumulating in voids, high ceilings, smoke filled rooms / areas
- Use T.I.C. from an area of safe haven to scan ahead to detect heat and flame



Delay / Prevent Flashover

- Apply water – **WATER KILLS FLASHOVER!** Applying water into the superheated atmosphere may delay or eliminate to progression of rapid fire development
- Ventilate – create openings in room / area allowing hot fire gases to escape
- Get out! – immediately leave area / room



Point of No Return

- Firefighter in full PPE without a hoseline can travel approximately 2.5 feet per second
- Escape time during a flashover is no more than 2 seconds
- Maximum safe distance to entry and search is 5 feet
- Full room / area involvement of flame causes firefighter to become disoriented



Survival Techniques

- Recognize warning signs
- Use defensive search procedures to protect against flashover
- Avoid disorientation
- Note secondary escape routes
- Enter / leave thru same door
- Remain calm
- DO NOT remove your facepiece
- Wear full PPE



References

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