



# Fire Protection Training

Procedures Handbook 4300

FIRE PHYSICS & CHEMISTRY

**TOPIC:** Pyrolysis, Flashover and Backdraft

**TIME FRAME:** 1 Hour

**LEVEL OF INSTRUCTION:**

**BEHAVIORAL OBJECTIVE:**

*Condition:* A written quiz

*Behavior:* The student will be able to identify pyrolysis, flashover and backdraft

*Standard:* With a minimum of 70% accuracy

**MATERIALS NEEDED:**

- Chalkboard
- Chalk
- Screen
- VCR
- TV and other appropriate visual aids

**REFERENCES:**

- IFSTA, Essentials of Fire Fighting, 2nd Edition, Chapter 2
- 2 IFSTA, Fire Ventilation Practices 6th Edition, Chapter 1
- Emergency Resources Inc., Fire Attack, 1987
- Video: Flashover, To Hell and Back
- NFPA Film, "Fire: Countdown to Disaster"

**PREPARATION:**

Flashover and backdraft are extremely dangerous conditions. The ability to recognize the warning signs of these conditions will greatly increase your chances of surviving their occurrence.



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PYROLYSIS, FLASHOVER AND BACKDRAFT

PRESENTATION	APPLICATION
<p><b>I. PYROLYSIS</b></p> <p>A. Chemical Decomposition of Substances Through the Action of Heat</p> <ol style="list-style-type: none"> <li>1. Fast or very slow reaction</li> <li>2. Release of water vapor, carbon dioxide, formic and acetic acids, results in carbon formation over long periods of time at temperatures as low as 180oF</li> <li>3. Mainly an endothermic reaction, i.e. substance absorbs heat</li> <li>4. If continued, fuel will carbonize and in combination with oxygen will ignite</li> </ol> <p><b>II. FLASHOVER</b></p> <p>A. As a Fire Burns in a Confined Space, Heated Vapors and Gases Rise to the Ceiling, Spread Out Horizontally, and Bank Down. When Other Combustible Materials Within the Room are Heated by Convection and Radiation to Their Ignition Temperature, They Release or Re-radiate Heat and Additional Gases and Vapors. Once Room Contents Exceed Their Ignition Temperature and Further Pressurize the Room with Vapors and Gases a Violent Area Ignition or Flashover May Occur</p>	<p>What is pyrolysis?</p> <p>Can you cite examples of pyrolysis?</p> <p>Answer: Attic fire associated with improper chimney installation</p> <p>What is a flashover?</p>



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<p>B. Warning Signs</p> <ol style="list-style-type: none"><li>1. Free burning fire in confined area</li><li>2. Accumulation of heated materials and gases at upper levels of room</li><li>3. Noticeable increases in smoke density and heat at all levels</li><li>4. Smoking and blistering of combustible materials removed from seat of fire<ol style="list-style-type: none"><li>a. Ignition temperatures of materials within room have tremendous influence on the probability of a flashover</li></ol></li></ol> <p>C. Flashover Prevention</p> <ol style="list-style-type: none"><li>1. Ventilation at highest safe point above the seat of the fire</li><li>2. Apply 30o fog stream to seat of fire for maximum fuel cooling</li><li>3. Apply short staccato type bursts of water in a 30o fog pattern to the heated vapors at the ceiling level to prevent or delay flashover.<ol style="list-style-type: none"><li>a. Because of the detrimental affect disruption of the thermal balance may have on an unprotected victim, caution should be exercised.</li></ol></li></ol> <p>D. Flashover Survival Actions</p> <ol style="list-style-type: none"><li>1. Exit building immediately</li><li>2. Remain as low as possible and apply narrow fog pattern, in a figure eight pattern, toward ceiling to cool, the superheated vapors.</li></ol>	

### III. BACKDRAFT



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PRESENTATION	APPLICATION
<p>A. When a Fire Burns Within a Confined Space It May Consume Sufficient Oxygen to Stop the Combustion Process (Oxygen Below 15%); If the Temperature in the Room Still Exceeds the Ignition Temperature of the Combustibles, the Process of Releasing Combustible Gases Will Continue, Thereby Pressurizing the Space; If Sufficient Oxygen Is Re-introduced into the Space At or Below the Level of the Seat of the Fire, a Violent Explosion May Occur</p> <p>B. Characteristics</p> <ol style="list-style-type: none"><li>1. Less than 15% oxygen</li><li>2. Extreme heat</li><li>3. Extreme smoke generation</li></ol> <p>C. Warning Signs</p> <ol style="list-style-type: none"><li>1. Little or no flame visible</li><li>2. Smoke grayish yellow in color</li><li>3. Swirling dense smoke within structure</li><li>4. Smoke escaping from building under pressure</li><li>5. Windows covered with liquid black residue</li><li>6. Doors and windows too hot to touch</li><li>7. Muffled fire sounds</li><li>8. Whistling sound of air being drawn in</li></ol>	<p>What is a backdraft condition?</p> <p>Information Sheet #1</p> <p>What are some warning signs of a backdraft condition?</p>



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PRESENTATION	APPLICATION
<p>9. Confined to third phase fire</p> <p>D. Prevention</p> <ol style="list-style-type: none"><li>1. Do not allow personnel to enter prior to ventilation</li><li>2. Ventilation as high as safely possible above the seat of the fire</li><li>3. Be careful, as a backdraft condition can exist in any single room in an involved structure</li></ol>	<p>What is the difference between flashover and backdraft?</p>

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## ***SUMMARY:***

Pyrolysis is a decomposition of materials via continuous or repeated heating. Flashover is the point at which items in a room are heated to their ignition temperature and ignite almost simultaneously. Backdraft conditions exist where the temperature in a room exceeds the ignition temperature of the combustibles; and if sufficient oxygen is re-introduced at or below the level of the fire a violent area ignition or explosion may occur.

## ***EVALUATION:***

A written quiz.

## ***ASSIGNMENT:***

To be determined by the instructor(s).