

<p style="text-align: center;"> DAVIE COUNTY, NC FIRE MARSHAL'S OFFICE STANDARD OPERATING GUIDELINES </p>	<p style="text-align: center;"> REVISION DATE 6/5/2018 </p>
<p style="text-align: center;"> SUB DOCUMENT STAGES OF FIRE GROWTH </p>	<p style="text-align: center;"> OPERATIONS PAGE 1 OF 5 </p>
<p style="text-align: right;">DCFM #</p>	<p style="text-align: center;">500-006</p>

1. TRADITIONAL OR LEGACY FIRES

1.1. In order to safely extinguish a fire, firefighters should be familiar with the basic concepts of fire, how fire develops and significant events which can occur during a fire. **Traditional Fire growth** in a room can be divided into three distinct stages: the growth stage (incipient), the fully developed stage (free-burning), and the decay stage (smoldering).

1.2. Growth Stage (incipient)

- During the growth stage a fire increases in size from small flames to full fire that involves the entire room. It may take several seconds to several hours for this to occur. Fire Growth is dependent on:
 - Combustible content (fuel load).
 - Oxygen supply (ventilation openings).
 - Size of room.
 - Insulation of room.
- During the growth stage, flammable gases released by the burning material collect at the ceiling level and mix with oxygen. The heated gases are pushed under pressure from the fire area into uninvolved areas. When this mixture ignites, flashes of flame can be seen in this layer of smoke. This condition is known as ***rollover***. ***Rollover*** should serve as a warning that the fire area may ***flashover***. As the fire progresses through the growth stage and into the fully developed stage the potential for flashover exists. Flashover is defined as ***the sudden involvement of a room or area in flames from floor to ceiling caused by thermal radiation feedback***. Radiation feedback from the ceiling and walls heats the smoke and gases given off by the burning materials and the combustible contents of the room. When the contents have been heated to their ignition temperature, sudden and simultaneous ignition of the area can occur.

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1.3. Fully Developed Stage (free-burning)

- In the fully developed stage the entire room and contents are involved in fire. If no efforts were made to extinguish the fire, the fire would continue to burn until the available fuel and/or oxygen in the room or area was consumed. Because of limited ventilation, *most structure fires are air regulated, not fuel regulated*. This means that fires will move into the decay stage due to insufficient oxygen. Outside fires are fuel regulated. How long and to what extent an outside fire burns is controlled by the amount of fuel available, not oxygen.

1.4. Decay Stage (smoldering)

- As available oxygen is consumed, the fire moves into the decay stage. Although some oxygen remains in the fire area, visible flames have started to diminish, and the fire continues to smolder. High heat and smoke conditions remain and the potential for a backdraft is present. A *backdraft* is a smoke explosion which can occur when additional oxygen is introduced into a smoldering fire and the heated gases enter their flammable range and ignite with explosive force. Firefighters must realize that a backdraft produces violent shock waves which can shatter windows, blow down firefighters and collapse walls.
- Warning signs of a possible backdraft include:
 - Heavy dense smoke with no visible flame in a tightly closed occupancy.
 - Black smoke pushing out around closed doors or window frames.
 - Glass stained with smoke condensation and pulsating from the pressure of the fire.
 - Reversal of air movement pulling smoke back into a building through a doorway.

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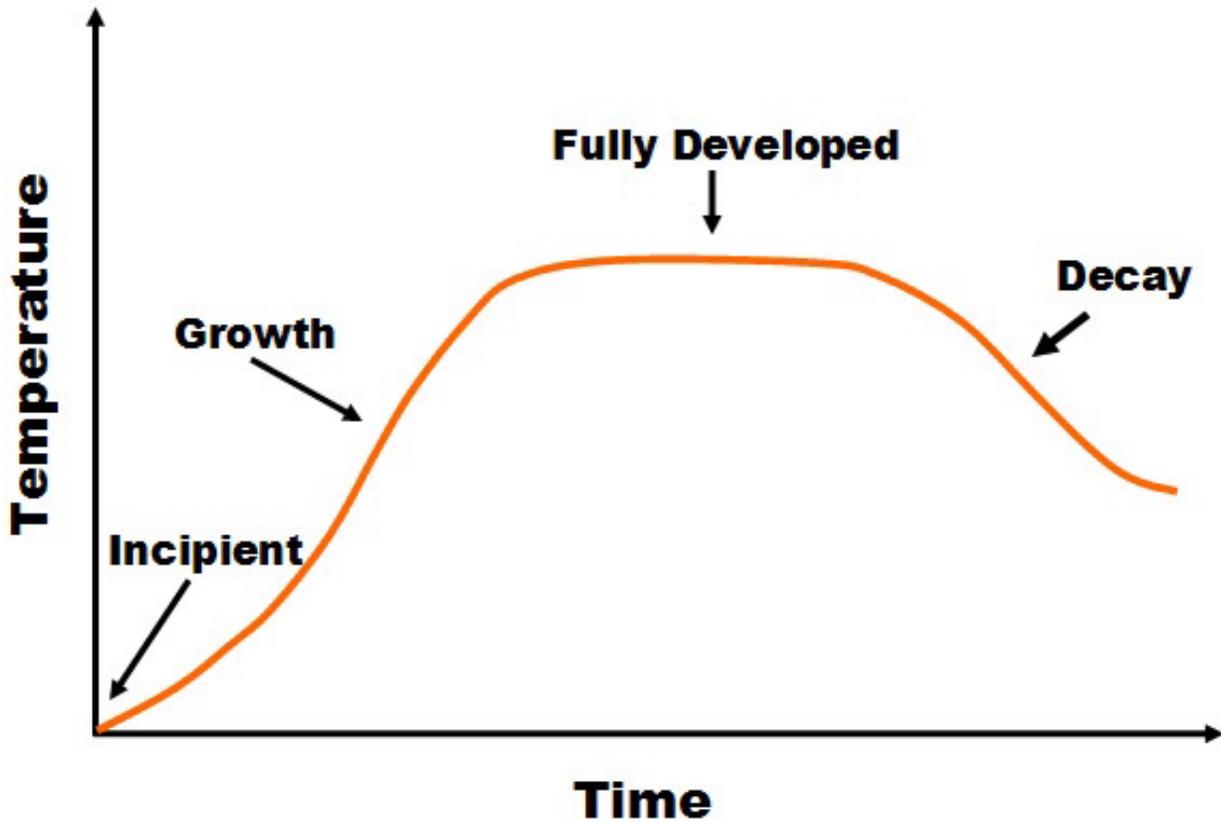
2. MODERN CONTENT FIRES

- 2.1. Modern content fires are largely comprised of hydrocarbons and synthetics which rapidly consume the available oxygen in the air as they burn at a greater rate than legacy content fires.
- 2.2. Modern content fires quickly become ventilation limited fires due to their higher fuel load. An additional contributing factor is the energy efficient construction of buildings, which limit the amount of available oxygen within the fire area.
- 2.3. Modern content fires enter an early decay stage due to the limited available oxygen, producing heavy smoke and varying heat conditions.
- 2.4. The needed oxygen to support rapid fire expansion can be provided by improper ventilation tactics or if the windows fail. If indications of an early decay stage exist upon arrival, uncontrolled and/or uncoordinated ventilation can have tragic implications for both civilians and operating members.
- 2.5. The progression of modern content fires differs from the traditional fire development curve as follows. (Figure 2)
 - Incipient stage
 - A rapid Growth stage that consumes the available oxygen very quickly.
 - Since modern content fires rapidly consume the available oxygen within the fire area, they enter into an earlier oxygen limited Decay stage when compared to traditional or legacy fires, and will remain in the Decay stage if no additional oxygen is added to the fire area.
 - When units encounter this earlier decay stage, they shall control the ventilation of windows and maintain control of the door to the fire area. These actions will limit the in-flow of additional air into the space so as not to provide additional oxygen to the fire. The fire will pull the in-flow of any additional air towards the fire area. Wind blowing in towards a ventilation opening will increase the air flow towards the fire area. If additional oxygen is admitted to the heated atmosphere through ventilation openings, the following can occur:
 - The fire regains its energy, increases its heat release rate and enters into a rapid second growth stage, generating more heat and increased smoke production.
 - This may be followed by a ventilation induced flashover and transition into the fully developed stage.
 - It ends in a second decay stage as the fuel load is depleted or the fire is

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extinguished.

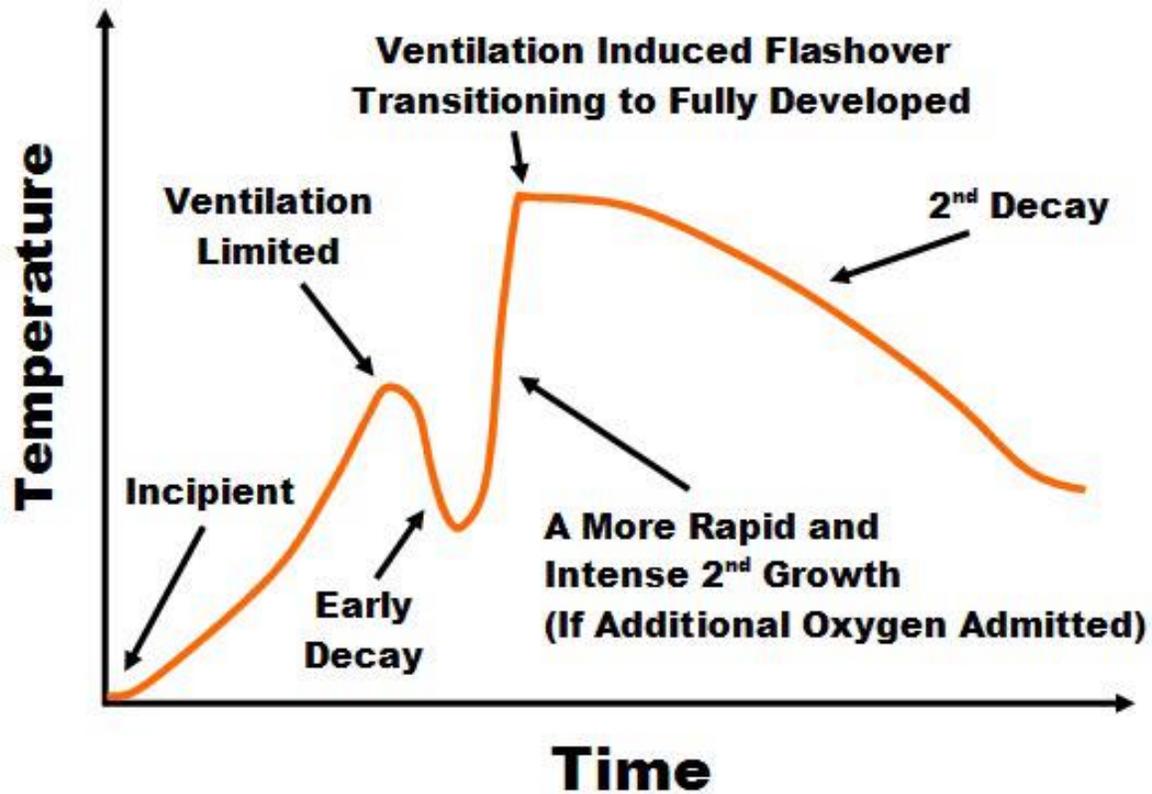
TRADITIONAL FIRE BEHAVIOR



(Figure 1)

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MODERN CONTENT FIRE BEHAVIOR



(Figure 2)