



MODERN FIRE BEHAVIOR; STAGES OF FIRE DEVELOPMENT

By Bryan T Smith

INCIPIENT- Early stage in fires development where the fires progression is limited to a single fuel source. The heat produced is not able to transfer to adjacent fuel sources.

GROWTH- Stage of fire development when an incipient fire has increased to the point where the heat transferred from the fire and the combustion products begin pyrolyzing adjacent fuel sources.

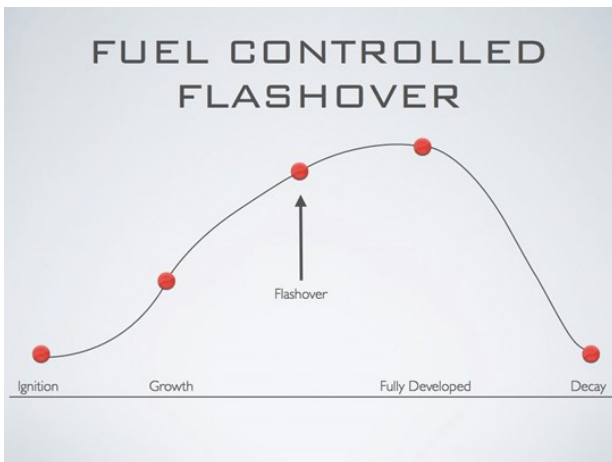
FLASHOVER- Transitional phase in fire development when all surfaces within a compartment are exposed to thermal radiation and reach their ignition temperature simultaneously, fire spreads rapidly throughout the space resulting in total room involvement.

FULLY DEVELOPED- Stage of fire development when the fire has reached its peak heat release rate within a compartment. This usually happens after flashover.

DECAY- Stage of fire development within a compartment characterized by a decrease in the fuel load or available oxygen to support combustion.

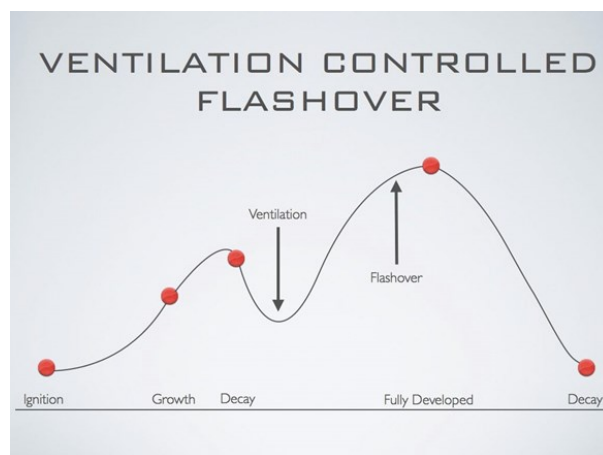
STAGES OF FIRE DEVELOPMENT IN THE MODERN FIRE ENVIRONMENT

One of the major changes to fire development in the modern fire environment is the addition of an **EARLY DECAY** stage. During the combustion process the modern fuels rapidly consume all of the available oxygen during the incipient and growth stages. The fire, unable to entrain more air to support its continued growth will begin to decay. Once ventilation occurs, naturally or tactically the fresher cooler air entering the structure will increase the heat release rate of the fuels allowing the fire to transition to flashover making it ventilation controlled.



The graphic on the left depicts the traditional stages of fire development when the fires heat release rate and growth were controlled primarily by the fuel. There was adequate oxygen to support combustion but the legacy fuels (those made from natural products) burned slower and did not produce heat as rapidly as modern plastic fuels. **Increased ventilation will not have an effect on fire development when confronted with a fuel controlled fire.**

The graphic on the right depicts the stages of fire development for modern fire behavior where the fires heat release rate and growth are controlled primarily by the available oxygen. There is an abundance of super heated rapid burning fuels but not enough air available within the space to support the fires continued growth. **Increased ventilation will have an immediate effect on the fires development when confronted with a ventilation controlled fire.**



RESEARCH AND SCIENCE SUPPORT THE FINDINGS

Both NIST and the ATF as well as other independent groups have conducted a great deal of studies and experiments on the modern fire environment, and all agree on one important fact. The vast majority of fires we face today and in the future are VENTILATION CONTROLLED.