FIREFIGHTER TOOLBOX

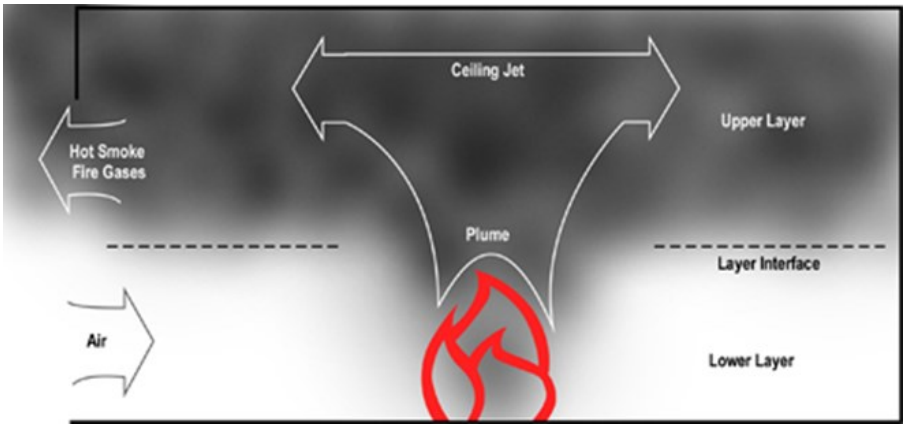
BUILDING BETTER FIREFIGHTERS & LEADERS

5 MINUTE Clinic Series™

MODERN FIRE BEHAVIOR; FIRE DEVELOPMENT

By Bryan T Smith

As a fire develops in a compartment the products of combustion, smoke and gases will form into layers according to temperature. The heated products of combustion and entrained air become more buoyant than the surrounding air and rise to the ceiling in a plume. The cool gas layer is lower in pressure, resulting in inward movement of air from outside the compartment. As the volume and temperature of the hot gas layer increases so does the pressure. The increased pressure causes the gas layer to push down within the compartment (mushrooming) and out through the openings such as a door or window.



The interface where the hot gas layer and cool gas layer meet as the hot gases exit through an opening is referred to as the **neutral plane**. The series of pictures below shows the neutral plane up high in the opening to the fire compartment in the early stages of fire development. As the fire grows increased volume and pressure created in the fire compartment will push the superheated products of combustion and the neutral plane down lower within the compartment

SIZE-UP TIP; The height and clarity of the neutral plane in an opening is a good indicator of the fires location and the stage of development the fire is in.

There are several variables within a space and compartment that will regulate a fires growth.

Fire development is defined as a function of factors including;

- Type and quantity of Fuel
- Oxygen available within the compartment (ventilation)
- Compartment and Fuel Geometry
- Location of Fire in the Compartment
- Ambient Conditions, temperature and wind etc...

Fire Development in the Modern Fire Environment;

Just like the science of a fire has not changed either has the process by which a fire develops within a compartment. What has changed about fire development is the amount of time it will take for a fire to grow and extend outside the compartment of origin. If all of the necessary elements exist and conditions within a compartment or a structure are favorable a room and content fire can reach flash-over within 3-4 minutes from the time of ignition. Even if the conditions do not support the fires growth to flashover we can expect to find zero visibility, high heat and a structure filled with pressurized fuel rich smoke and gases ready to ignite once outside air is introduced into the structure.