

U.S. Fire Administration / National Fire Academy

Coffee Break Training

Topic: Fundamental Fire Physics

Learning objective: The student shall be able to explain the terms heat release rate, heat of combustion, and pyrolysis.

Fire protection personnel must understand fundamental fire physics if they want to know how building and fire codes should be applied and how fire protection systems work.

Three key terms in fire dynamics are

1. **Heat Release Rate**--a measurement of the energy released from a burning material over a specific time period. It describes the material's potential fire severity. Heat release rate is described in watts, British Thermal units (Btu's) per second or joules per second. For example, a burning upholstered chair has a heat release rate between 80kW and 2.5 MW.
2. **Heat of Combustion**--the total potential heat output from a fire, measured in Btu's or joules. For example, wood and cellulose products have a heat of combustion of about 8,000 Btu's per pound, while hydrocarbons have a range from 16,000 to 24,000 Btu's per pound.
3. **Pyrolysis**--the heat-created decomposition of combustible materials into simpler compounds that can be ignited. It is the process of converting solid materials into combustible vapors.



For additional information, refer to the *SFPE Handbook of Fire Protection Engineering*, the *NFPA Fire Protection Handbook*, or perform a keyword search for these terms on the World Wide Web.