

INSTRUCTOR GUIDE

COURSE: FIREFIGHTER PRE-BASIC

SESSION REFERENCE: 1

TOPIC: ORIENTATION AND FIRE BEHAVIOR

LEVEL OF INSTRUCTION:

TIME REQUIRED: THREE HOURS

MATERIALS: APPROPRIATE AUDIO VISUAL AIDS

REFERENCES: ESSENTIALS OF FIRE FIGHTING, FOURTH EDITION,
IFSTA, CHAPTERS 1 AND 2
MINIMUM PRE-BASIC TRAINING PROGRAM FOR
FIREFIGHTER TRAINEES IN MARYLAND, MARYLAND FIRE-
RESCUE EDUCATION AND TRAINING COMMISSION

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PREPARATION:

MOTIVATION:

OBJECTIVE (SPO): The firefighter will demonstrate a basic understanding of the organization and operation of a fire department and the concept and principles of fire behavior.

OVERVIEW:

Orientation and Fire Behavior

- * Fire department organization
- * Fire department operations
- * Fire behavior

SESSION 1

ORIENTATION AND FIRE BEHAVIOR

SPO The firefighter will demonstrate a basic understanding of the organization and operation of a fire department and the concept and principles of fire behavior.

EO 1-1 Explain the general organizational structure of a fire department.

EO 1-2 Explain the general operational structure of a fire department.

EO 1-3 Explain the concept of fire and the principles related to fire behavior.

This drill is designed to provide a new firefighter with a basic understanding of his or her fire department and its operation. The drill also includes some basic information on fire behavior and the concept of what makes a fire. This drill should be localized for each individual department. It is expected that each of the items will be discussed in some level of detail to assist the new firefighter in becoming acclimated to the department.

I. FIRE DEPARTMENT ORGANIZATION (1-1)

A. Fire Department History

1. When organized
2. Why organized
3. First apparatus
4. Significant accomplishments (station construction, increases in services provided, etc.)
5. Types of service provided

B. Department Organization

1. Constitution and by laws
2. House and running rules
3. Departmental orders
4. Administrative structure
5. Operational structure
6. County and state fire service organizations that suppose the fire department

C. Basic Terminology

1. Department - an organization comprised of one or more stations or companies
2. Company - an individual type of service (engine, truck, squad) or an individual station
3. Engine - a piece of motorized apparatus carrying at least 500 gallons of water, 1,200 feet of supply hose, and 400 of attack hose, some tools, ground ladders, and equipped with a fire pump capable of pumping at least 750 GPM of water (also called a pumper)

NOTE: Be prepared to explain any local variations such as an engine-tanker, rescue engine, or mini-pumper

4. Truck - a piece of motorized apparatus carrying multiple ground ladders, tools, and equipped with an aerial device such as a ladder or platform

NOTE: Be prepared to explain any local variations such as a tower or quint

5. Squad - a piece of motorized apparatus carrying an assortment of tools and rescue equipment such as that used in vehicle extrication (may need to clarify any differences between a squad and a rescue if both terms are used)
6. Tanker - a piece of motorized apparatus carrying at least 1,500 gallons of water and equipped with a pump of at least 500 GPM; generally used for water transport
7. Brush Unit - a piece of motorized apparatus designed for off-road operation at fires in fields and woods; carrying a small amount of water and hose and some tools and equipped with a small fire pump
8. Ambulance - a unit carrying certain medical equipment and designed for providing emergency medical care and transport; unit may be used as a basic life support unit for basic medical care or advanced life support where the personnel are trained to administer drugs and perform other advanced procedures

II. FIRE DEPARTMENT OPERATIONS (1-2)

A. Training Requirements

1. Firefighter I for firefighting operations
2. First Responder (basic medical training) for firefighting operations
3. Emergency Care Basic for basic life support operations
4. Rescue Technician or similar training for vehicle extrication operations
5. Hazardous Materials Operations for anyone responding on emergency alarms

B. Station Operations

1. Watch office operations including the base radio station, if present
2. Location of equipment and apparatus
3. Apparatus dispatching
 - a. Local alarms (brush, trash, automatic alarms)
 - b. Structural alarms (single-family, multiple family, commercial)
 - c. Medical emergencies
 - d. Other types of alarms
4. Apparatus staffing
5. Apparatus boarding and safe riding

C. Emergency Scene Operations

1. Standard operating procedures
 - a. Fires
 - b. Medical emergencies
 - c. Other types of incidents
 - d. Personnel accountability system
 - e. Personal safety (protective clothing)
2. Incident command system overview
 - a. Five major areas
 - 1) Command - strategic planning and overall incident responsibility
 - 2) Operations - tactical planning and operational management
 - 3) Planning - research and incident analysis
 - 4) Logistics - supply and scene support
 - 5) Finance/Administration - recordkeeping

and administrative support

b. Staff positions

- 1) Information - public relations and media coordination
- 2) Safety - scene safety
- 3) Liaison - coordination with non-fire agencies

III. FIRE BEHAVIOR (1-3)

A. Introduction to Fire Behavior

1. Fire is rapid oxidation accompanied by light and heat
2. Combustion is a rapid chemical reaction that gives off energy or products that cause further reaction
3. Products of combustion
 - a. Smoke which contains carbon particles
 - b. Heat - thermal and radiant
 - c. Gases - carbon monoxide, carbon dioxide, hydrogen cyanide, water vapor

B. Definitions

1. Flash point - point at which there is sufficient fuel and oxygen vapors to form an ignitable mixture - gasoline has a flash point of $\approx 45^{\circ}\text{F}$
2. Ignition temperature - point at which fuel vapors ignite automatically with sufficient oxygen - gasoline has an ignition temperature of 536°F
3. Flammable range - range in which there is sufficient fuel vapors to form an ignitable mixture with oxygen - gasoline has a flammable range of 1.4% to 7.6% by volume mixed with air
4. Specific gravity - weight of a liquid or solid in relation to an equal volume of water with water having a weight of one - gasoline has a specific gravity of 3 to 4
5. Vapor density - weight of fuel vapor in relation to air with air having a weight of one - gasoline

has a vapor density of .8

C. Fire Tetrahedron

1. Oxygen

- a. Air contains 21% oxygen
- b. At least 16% required to sustain life and combustion
- c. Also referred to as an oxidizer

2. Fuel

- a. All fuels must be converted to vapor to burn
- b. Solid fuels convert to vapor through pyrolysis
- c. Liquid fuels convert to vapor through vaporization
- d. Gases already exist in vapor form
- e. Proportion of vapors must be in proper flammable range to burn
- f. Surface-to-mass ratio can affect how quickly something will ignite or burn (smaller materials ignite quicker but burn out quicker)
- g. Size and arrangement of fuel can affect the ability to ignite and burn (materials that are tightly packed are harder to ignite and burn)
- h. Fuel energy is measured in British thermal units or BTUs

3. Heat

- a. Needed to produce vapor in solid or liquid fuels
- b. Sources of heat include mechanical processes, chemical reactions, electrical resistance, solar energy, and nuclear releases
- c. Heat is measured in degrees fahrenheit or celsius

4. Self-sustained chemical reaction

- a. Fuel in a vapor state, an oxidizer, and heat energy come together in a very specific way
- b. Combustion can only continue when enough heat energy is produced to cause continued development of fuel vapors

D. Methods of Heat Transfer

1. Convection - transfer of heat through liquids or gases, including smoke
2. Conduction - transfer of heat through solid surfaces such as metal pipes or ductwork
3. Radiation - transfer of heat through electromagnetic waves which are absorbed by opaque surfaces

E. Stages of Fire

1. Ignition

- a. Point at which fire starts
- b. Ignition sources include matches, smoking materials, overheated electrical wiring or equipment, chemical reactions, solar heat
- c. Plenty of oxygen, little heat and smoke
- d. Fire is small and generally confined to the fuel first ignited

2. Growth

- a. Heat and smoke levels increase
- b. Oxygen level decreases
- c. Fuel being dried out (cold smoldering)
- d. Hot gases rise to the ceiling and spread outward to the walls
- e. Continues if enough fuel and oxygen are available

f. Fire is fuel controlled

3. Flashover

- a. Transition between growth and fully developed stages and is not a specific event
- b. Plenty of heat and smoke which indicate rapidly changing conditions
- c. May involve all exposed combustibles
- d. Increasing levels of smoke with decreased visibility
- e. Gases generated are heated by radiant energy from the gas layer at the ceiling

4. Fully developed

- a. All combustibles are involved in fire
- b. Maximum amount of heat being released
- c. Heat release and volume of fire dependent on number and size of ventilation openings
- d. Unburned fire gases begin flowing to adjacent spaces and ignite as they enter a space where air is more abundant

5. Decay

- a. Intensity of fire decreasing due to lack of available fuel
- b. Most of fuel consumed
- c. Effort concentrated on cooling down remaining fuel

F. Fire Extinguishment Theory

1. Temperature reduction

- a. Using water to reduce temperature of fuel to a point where it does not produce sufficient vapors to burn
- b. Can be used on solids and liquids with high flash points

- c. Must be applied in sufficient quantity to absorb the heat being generated

2. Fuel removal

- a. Accomplished by removal of fuel or by stopping flow of fuel
- b. Also accomplished by allowing fuel to be consumed

3. Oxygen exclusion

- a. On small cooking stove fires, accomplished by placing a lid on the container
- b. Accomplished by flooding the area with an inert gas which is heavier than air such as carbon dioxide
- c. Blanketing the fuel with foam excludes oxygen

4. Chemical reaction inhibition

- a. Accomplished using extinguishing agents such as dry chemical
- b. Effective on gas and liquid fuels

G. Classes of Fuel

1. Class A

- a. Ordinary combustibles such as wood, cloth, paper, rubber, and many plastics
- b. Water used to cool

2. Class B

- a. Flammable and combustible liquids and gases such as gasoline, oil, lacquer, paint, mineral spirits, and alcohol
- b. Generally requires the use of special extinguishing agents such as foam
- c. Small fires can be extinguished with portable extinguishers

3. Class C

- a. Energized electrical equipment such as household appliances, computers, transformers, and overhead transmission lines
- b. Requires use of non-conducting extinguishing agents such as dry chemical or carbon dioxide

4. Class D

- a. Combustible metals such as aluminum, magnesium, titanium, zirconium, sodium, and potassium
- b. Requires special extinguishing agents for the material burning

REVIEW:

Orientation and Fire Behavior

- * Fire department organization
- * Fire department operations
- * Fire behavior

REMOTIVATION: It is important that the material in this session serve as a motivator for subsequent training. If the new firefighter does not have a good foundation of the organization and operation of the department, he or she may have difficulty becoming a part of that organization.

ASSIGNMENT:

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EVALUATION: