TOPIC: Fire Suppression Systems

TIME FRAME: 3 Hours

LEVEL OF INSTRUCTION:

BEHAVIORAL OBJECTIVE:

Condition: A written quiz.

Behavior: The student will list and describe the types of common fire suppression systems.

Standard: With a minimum of 70% accuracy

MATERIALS NEEDED:

- Appropriate visual aids
- Audio visual equipment

REFERENCES:

- NFPA Fire Protection Handbook, 16th Edition

PREPARATION: The purpose of fire suppression systems is to provide a means by which fires may be controlled prior to fire department intervention. Fire companies will frequently be called upon to check, reset or respond to an activated fire suppression system. A basic understanding of these systems is essential.

PRESENTATION	APPLICATION

I. FIRE SUPPRESSION SYSTEM ACTUATION DEVICES

A. Electrical

1. Solenoid or electrically initiated squib

a. Energized by detection system

(1) Thermostats

(2) Rate of rise detectors

(3) Smoke detectors

B. Pneumatic

1. Activated by changes in air pressure

a. As air temperature rises pressure within activator increases

b. As pressure increases it activates the suppression system

C. Fusible Link

1. Increased temperature due to fire melts fusible link

2. Melting link releases tension on cable which causes discharge of suppression systems

D. Manual

1. Pulling cable either locally or at remote will activate system

2. Push button which will:

a. Electrically activate system

b. Release air which activates system

PRESENTATION	APPLICATION

II. SUPPRESSION SYSTEM EXTINGUISHING AGENTS

A. Carbon Dioxide

1. Storage

   a. Low pressure system

      (1) Refrigerated CO_2 in tanks in liquid form

      (2) Working pressures generally 325 P.S.I.

   b. High pressure storage

      (1) Series of 50-100 pound metal cylinders

      (2) Working pressures approximately 850 P.S.I. at 70ºF.

2. Application techniques

   a. Flooding confined space and displacing O_2 with CO_2

   b. Local application directly on fire and/or burning fuel

   c. Continued discharge

      (1) Initially floods entire space

      (2) Intermittently discharges volume of CO_2 to maintain CO_2 concentration

   d. Hand held discharge hoselines

   e. Mobile supply

PRESENTATION	APPLICATION
(1) Move CO_2 into position once fire detected to activate localized piping system	
3. Advantage of CO_2 systems	
a. Relatively inert, odorless, non-toxic and non-corrosive	
b. Can extinguish open or closed flammable liquid container	
c. Effective for flooding confined areas	
d. Leaves little residue	
e. Non-conductor of electricity	
4. Disadvantages	
a. Will not lower fuel temperature	
(1) Re-ignition after dissipation of CO_2	
(2) Marginal effect on Class A fires	
b. Displacement of oxygen can cause asphyxiation	
(1) Personnel entering area must wear SCBA	
c. Limits visibility in confined space	
d. Causes condensation on equipment	
e. Somewhat expensive	
f. Discharge can cause frost bite type injury	
B. Dry Chemical	
1. Types	

PRESENTATION	APPLICATION
a. Regular B, C dry chemical	
b. Tri-class A, B, C dry chemical	
2. Application techniques	
a. Total flooding	
(1) Predetermined amount of dry chemical discharged into a confined space	
b. Local application	
(1) Agent discharged on fire directly or on fuel	
(2) Methods of applying	
(a) Fire extinguishers	
(b) Hand held line on fixed systems	
(c) Mobile storage container with reel lines	
3. System expellants	
a. Nitrogen	
b. Carbon dioxide	
4. Advantages	
a. Fast knockdown and extinguishment	
b. Non-toxic	
c. Non-conductor of electricity	
d. Can be used to extinguish Class B & C fires	

PRESENTATION	APPLICATION
(1) Tri-class dry chemical can also extinguish Class A fires	
5. Disadvantages	
a. Some dry chemical compounds cannot be mixed	
b. The powder residue often causes a problem in electrical equipment	
c. There may be a brief release of thermal energy (i.e., flare up)	
d. Does not reduce fuel temperature therefore the material may reignite	
e. Requires an expellant to discharge the dry chemical	
C. Foams	
1. Types	
a. Protein foams	
(1) Proportioned with water into 3% or 6% concentrations	
(2) Air added to increase effectiveness	
(3) Working range is 20ºF to 120ºF	
(4) Is non-toxic	
b. Aqueous film forming foam (AFFF)	
(1) Composed of fluorocarbon based chemicals	
(2) Used largely on Class B fires	
(3) Floats on hydrocarbon fuels	

PRESENTATION	APPLICATION
(4) Seals self when disrupted	
c. Fluoroprotein foam	
(1) Combination	
(a) Protein foam	
(b) Fluorocarbon foam	
d. Synthetic foam	
(1) Variety of types	
(2) Multi-use synthetic effective on	
(a) Hydrocarbon fuels	
(b) Polar solvents	
e. Polar solvent foams	
(1) Effectively used on	
(a) Water soluble flammable liquids	
(b) Water miscible flammable liquids	
(c) Polar solvents	
2. Suppression characteristics	
a. Exclude oxygen from flammable vapors	
b. Prevent vapor release from the fuel surface	
c. Cool the fuel below ignition temperature	
3. Application	
a. Systems	

PRESENTATION	APPLICATION
(1) Type B - permanently mounted system designed to combat a specific hazard. Capable of	
(a) Detecting	
(b) Activating	
(c) Delivery	
(2) Type A - semi-fixed system	
(a) Delivery system in place	
(b) Mobile apparatus to generate foam	
4. Advantages of foam	
a. Effective on variety of Class B fires	
b. Little foam goes a long way	
(1) Low expansion foam 3% to 6% concentration	
(2) High expansion foam as much as 1000 to 1 expansion ratio	
c. Break surface tension for better penetration	
d. Self sealing if ruptured	
e. Foam concentration can be adjusted to fire needs	
5. Disadvantages of foam	
a. Cannot be used in extreme cold	
b. Not compatible with some dry chemicals or other extinguishing agents	

PRESENTATION	APPLICATION
c. May cause corrosion problems	
d. Not effective on water reactive substances	
e. Not effective on unconfined or pressurized fuel fires	
f. Limited effectiveness on three dimensional fires	
g. Aggressive direct application will churn fuel and increase fire intensity	
h. If flammable liquid is above 212º foam will boil upon contacting surface and frothing action will intensify fire	
i. Foam hinders visibility and makes rescue more difficult	
j. Disruption of foam blanket may result in trapping personnel in event of re-ignition	
D. Halogenated Hydrocarbons (HALONS)	
1. Types	
a. Halon 1301 - bromotrifluoromethane	
b. Halon 1211 - bromochlorodifluoromethane	
2. Application	
a. Total flooding	
(1) Fixed system discharges halon into confined area	
b. Local	
(1) Generally via fire extinguisher	

PRESENTATION	APPLICATION

3. Advantages
   a. High expansion ratio
   b. Provides own expellant pressure
      (1) Generally given nitrogen boost for optimal effect
   c. Nonconductor
4. Disadvantages
   a. Not effective in unconfined space
   b. Generally halon concentrations of up to 10 percent pose no threat to human life
   c. Tests have shown that concentrations of 20 percent can be hazardous
   d. Tests have also shown that products of combustion and decomposition of halon are toxic
   e. Linked with depletion of the ozone layer
      (1) Especially in total flooding systems

E. Fixed Water Spray Systems

1. The term "water spray" refers to the use of water in a form having a predetermined:
   a. Pattern
   b. Particle size
   c. Velocity and density
2. The "water spray" is discharged from specially designed nozzles
3. Advantages

PRESENTATION	APPLICATION

a. Absorbs a large amount of heat

(1) At 212ºF one unit of water expands approximately 1700 times its original volume

(2) Approximately 8000 B.T.U.s per gallon

(a) BTU is the amount of heat required to raise 1 pound of water 1ºF

b. Plentiful

c. Relatively cheap

d. Non-toxic

e. Easily transported and/or stored

f. Can be used with specialized agents

4. Disadvantages

a. Conductor of electricity

b. High surface tension

c. Freezes at or below 32ºF

d. Reacts violently with certain chemicals

e. Weight

f. Needs expellant

SUMMARY:

The purpose of fire suppression systems is to provide a means by which fires may be controlled prior to the fire department's arrival. Upon arrival fire department personnel must be able to recognize the system being used and take appropriate action to support the system without compromising their safety.

EVALUATION:

A written quiz.

ASSIGNMENT:

To be determined by instructor(s).