FIRE PREVENTION 1B (BRIDGE)

Approved and Adopted by the
Office of State Fire Marshal

Recommended for adoption by the Statewide
Training and Education Advisory Committee
and the
State Board of Fire Services

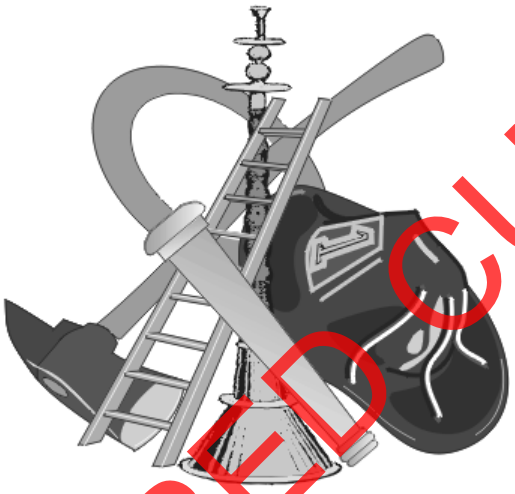
INSTRUCTOR GUIDE

January 2009

FIRE PREVENTION 1B (BRIDGE)

INSPECTION OF FIRE PROTECTION SYSTEMS AND SPECIAL HAZARDS

INSTRUCTOR GUIDE



Published by

STATE FIRE TRAINING
PO Box 944246
Sacramento, CA 94244-2460

January 2009

TABLE OF CONTENTS

Mission Statement

The mission of State Fire Training is to enable the California fire service to safely protect life and property through education, training, and certification.

California Fire Service Training and Education System

The California Fire Service Training and Education System (CFSTES) was established to provide a single statewide focus for fire service training in California. CFSTES is a composite of all the elements that contribute to the development, delivery, and administration of training for the California Fire Service. The authority for the central coordination of this effort is vested in the Training Division of the California State Fire Marshal's Office with oversight provided by the State Board of Fire Services.

The role of CFSTES is one of facilitating, coordinating, and assisting in the development and implementation of standards and certification for the California fire service. CFSTES manages the California Fire Academy System by providing standardized curriculum and tests; accredited courses leading to certification; approved standardized training programs for local and regional delivery; administering the certification system; and publishing Career Development Guides, Instructors Guides, Student Manuals, Student Supplements, and other related support materials.

This system is as successful and effective as the people involved in it are. It is a fire service system developed by the fire service, for the fire service... and we believe it is the best one in the country.

Acknowledgments

The State Fire Training Curriculum Development Division coordinated the development of the material contained in this guide. Before its publication, the Statewide Training and Education Advisory Committee (STEAC) and the State Board of Fire Services (SBFS) approved this guide. This guide is appropriate for fire service personnel and for personnel in related occupations that are pursuing State Fire Training certification.

Ruben Grijalva Director of CAL FIRE	
Kate Dargan State Fire Marshal	**Tonya Hoover** Assistant State Fire Marshal
Mike Richwine Chief, State Fire Training	**Ron Coleman** Chair, STEAC

Special acknowledgement and thanks are extended to the following members of CDF/State Fire Training Curriculum Development Division for their diligent efforts and contributions that made the final publication of this document possible.

Alicia Hamilton Fire Service Training Specialist	**Monica Miller** Office Technician

The material contained in this document was compiled and organized through the cooperative effort of numerous professionals within, and associated with, the California fire service. We gratefully acknowledge the individuals who served as principal developers for this document.

Howard Cooke
Sacramento Fire Department

Keith Marshall
Burlingame Fire Department (Retired)

Robert Marshall
Gilroy Fire Department

Rocque Yballa
Central County Fire Department

"We gratefully acknowledge the hard work and accomplishments of those before us who built the solid foundation on which this program continues to grow."

Student Profile

Target Group

Fire prevention personnel

Prerequisites

Fire Prevention 1A (Bridge)

Desired Attendance Time Frame

Within one year of completing Fire Prevention 1A (Bridge)

Class Requirements and Space

The characteristics of the classroom and supportive facilities have a great impact on the learning environment and the instructor's success or failure. For this course, it is advisable for the instructor to adhere as closely as possible to the following guidelines.

Equipment

Writing board with markers/erasers
Appropriate audiovisual equipment
Appropriate audiovisual materials

Materials

- ❑ Unit 1
  - Progress chart
  - Activity 1-1-1: Fire Prevention Checkup
- ❑ Unit 2
  - Flammable liquid safety cans for demonstration
  - BLEVE video, NFPA (optional)
  - Activity 2-1-1: Introduction To Terms
  - Activity 2-1-2: Flammable And Combustible Liquid Classifications
  - Activity 2-2-1: Allowable Containers
  - Activity 2-3-1: MSDS Information Search
  - Activity 2-6-1: Write 'Em Up
  - Activity 2-8-1: Hazard Characteristics Of Gases
- ❑ Unit 3
  - Sample resource material
  - Activity 3-1-1: Hazardous Materials Terms And Characteristics
  - Activity 3-8-1: Developing NFPA 704 Placards
  - Activity 3-10-1: Hazardous Materials Permit And Exempt Amounts"
- ❑ Unit 4
  - Different types of portable fire extinguishers
  - Activity 4-2-1: Extinguisher Placement

- ❑ Unit 5
  - Activity 5-3-1: Inspecting Fixed Fire Protection Systems
- ❑ Unit 6
  - Activity 6-1-1: Terminology Crossword
- ❑ Unit 7
  - Activity 7-3-1: Unit 7 Homework
  - Activity 7-4-1: Fire Sprinkler Systems
  - Activity 7-5-1: Sprinkler System Components
  - Activity 7-9-1: Standpipe Required Systems
- ❑ Tests
  - Test 1
  - Test 2
  - Test 3
  - Certification Exam

Introduction to the Instructor Guide

For the most part, the 2008 Edition of Fire Prevention 1B is not a complete rewrite of the 2003 Edition. In January of 2008, the International Fire Code with California amendments became effective. Although many aspects of this code and California's previous code are similar in its fire and life safety value, some aspects have changed. Where appropriate, the authors of this rewrite chose to update codes, sections, and terminology. Fire Prevention 1B is intended to be a basic fire and life safety course which provides the student an orientation of fire prevention and code enforcement.

Lesson Plans

This publication is intended to serve as an instructor guide. For each topic identified in the course outline, a lesson plan has been developed that contains: a time frame, level of instruction, authority, behavioral objective, materials needed, method of instruction, references, preparation statement, lesson content, and end page. Suggested application methods have been identified throughout the lessons for you to use during your presentation.

- **Time Frame**: The estimated duration required for in-class presentation.
- **Level of Instruction**: Identifies the instructional level that the material was designed to fulfill. You have the latitude to increase the level based on available time, local conditions, and the students' apperceptive base.
- **Authority**: Keyed, when applicable, to the appropriate Certification Training Standard task.
- **Behavioral Objective**: The behavioral objective is a statement of the student's performance desired at the end of instruction. You must ensure that enough information is given in the presentation and/or activities to enable the student to perform according to the goal.
- **Materials Needed**: This should be a complete list of everything you will need to present the lesson, including visual aids, tests, etc.
- **References**: These are the specific references the curriculum development team used when developing the lesson plan. In addition, references may be listed as additional study aids for instructors to enhance the lesson -- books, manuals, bulletins, scripts, visual aid utilization plans and the like.
- **Preparation**: The motivational statements in this section connect the student with the lesson plan topic through examples or illustrations relating to their occupation, injury, and even mortality. You may modify this section to better fit your students' environment.

- **Lesson Content**: Includes information used in the four-step method of instruction.

Technical Lesson Plans

PRESENTATION	APPLICATION
Everything you say or display Content Notes	Student Participation • Questions • Activities • Audiovisual Cues

Manipulative Lesson Plan

OPERATIONS	KEY POINTS
Specific actions to be performed by the students Begin with a verb, followed by a noun	The who, what, when, where, why, and how (the "tricks of the trade") Safety practices

Appendix A – Instructor Tests

- Course tests with answer keys.

Appendix B – Student Tests

- Test masters to copy for your students. Keep these in good condition to use for future classes. Collect these tests after they have been graded and discussed in class.
- ***Do not let the students keep them since you will be using the same tests for your next class.***

Course Outline

Course Objectives: To prepare the student to…

a) Identify the classification, properties, labeling, incidental storage, handling, and use of flammable and combustible liquids and gases.

b) Identify the classification, properties, labeling, incidental storage, handling, and use of hazardous materials, other than flammable and combustible liquids and gases.

c) Determine the principles and operational readiness of portable fire extinguishers.

d) Determine the principles and operational readiness of special fixed fire suppression systems.

e) Determine the principles and operational readiness of detection and alarm systems.

f) Determine the principles and operational readiness of sprinkler systems and fire pumps.

g) Determine the principles and operational readiness of standpipe systems.

Texts and References

- "BLEVE" video, National Fire Protection Association (NFPA)
- Barclays Official California Code of Regulations Title 19, West Group
- California Building Code, California Building Standards Commission (CBSC), 2007 Edition
- California Fire Code, CBSC, 2007 Edition
- California Health and Safety Code, Current Edition
- Code of Federal Regulations, National Archives and Records Administration
- Designs of Water-Based Fire Protection Systems, Robert M. Gagnon, 1997 Edition
- Emergency Response Guidebook, Department of Transportation (DOT), 2008 Edition
- Fire Inspection and Code Enforcement, International Fire Service Training Association (IFSTA), Sixth Edition
- Fire Protection Handbook, NFPA, 20th Edition
- Hazardous Materials Guide for First Responders, Federal Emergency Management Association (FEMA)/United States Fire Administration (USFA)
- Hazardous Materials Regulations, Response, and Site Operations, Delmar, 1999 Edition
- National Fire Alarm® Handbook (NFPA 72), NFPA, 2007 Edition, California amended
- NFPA 10: Standard on Portable Fire Extinguishers, NFPA, 2005 Edition
- NFPA 13: Standard on the Installation of Sprinkler Systems, NFPA, 2002 Edition
- NFPA 14: Standard on the Installation of Standpipe, Private Hydrant, and Hose Systems, NFPA, 2003 Edition
- NFPA 20: Standard on the Installation of Stationary Pumps for Fire Protection, NFPA, 2003 Edition
- NFPA 24: Standard on the Installation of Private Fire Service Mains and Their Appurtenances, NFPA, 2002 Edition
- NFPA 30A: Code for Motor Fuel Dispensing Facilities and Repair Garages, NFPA, 2003 Edition
- NFPA 58: Liquefied Petroleum Gas Code, NFPA, 2008 Edition
- NFPA 495: Explosive Materials Code, NFPA, 2006 Edition
- NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response, NFPA, 2001 Edition
- Private Fire Protection and Detection, IFSTA, Second Edition

Calendar of Events

DAY	TOPIC	TITLE	TIME	ACTIVITY	EVALUATION
Day 1	1-1	Orientation And Administration	2:30	1-1-1	
	2-1	Flammable And Combustible Liquids Terms And Characteristics	1:00	2-1-1 2-1-2	
	2-2	Acceptable Containers For Flammable And Combustible Liquids	0:30	2-2-1	
	2-3	Introduction To Material Safety Data Sheets	0:30	2-3-1	
	2-4	Inside Storage Of Flammable And Combustible Liquids	1:00		
	2-5	Outside Storage Of Flammable And Combustible Liquids	1:00		
	2-6	Dispensing, Using, Mixing, And Handling Flammable And Combustible Liquids	1:30	2-6-1	
		Day 1 Total	**8:00**		
Day 2			1:00		**Test #1**
	2-7	Properties Of Compressed, Cryogenic, And Liquefied Gases	1:00		
	2-8	Fire Hazards Of Compressed And Liquefied Gases	1:00	2-8-1	
	2-9	Inspecting Motor Vehicle Dispensing Stations	0:30		
	2-10	Inspecting LPG Occupancies	0:30		
	2-11	Inspecting Flammable Finish Application Occupancies	1:00		
	2-12	Methods For Controlling Ignition Sources And Explosive Atmospheres	1:00		
	3-1	Hazardous Materials Terms And Characteristics	1:00	3-1-1	
	3-2	Sources of Technical Information On Hazardous Materials	0:30		
	3-3	Regulating Hazardous Materials	0:30		
		Day 2 Total	**8:00**		
Day 3	3-4	Introduction To Hazardous Materials Management Plan (HMMP)	0:15		
	3-5	Storage And Transfer Practices Of Compressed And Liquefied Gases	1:00		
	3-6	Hazards Of Explosives And Fireworks	0:30		
	3-7	Storage Of Hazardous Materials	1:00		
	3-8	NFPA 704 Identification Systems	0:45	3-8-1	
	3-9	Classification By Hazard	0:30		
	3-10	Inspection Of The Incidental Use, Handling, And Storage Of Hazardous Materials	1:00	3-10-1	
			1:00		**Test #2**

DAY	TOPIC	TITLE	TIME	ACTIVITY	EVALUATION
	4-1	Portable Fire Extinguisher Classifications	1:00		
	4-2	Portable Fire Extinguisher Placement	0:30	4-2-1	
	4-3	Inspecting Portable Fire Extinguishers	0:30		
		Day 3 Total	**8:00**		
Day 4	5-1	Fixed Fire Protection Systems	1:00		
	5-2	Inspecting Fixed Fire Protection Systems	1:00		
	5-3	Inspecting Commercial Cooking Equipment	0:30	5-3-1	
	6-1	Detection And Alarm Systems Terms And Characteristics	0:30	6-1-1	
	6-2	Fire Alarm System Components	0:45		
	6-3	Fire Alarm Signaling System Classifications	0:30		
	6-4	Inspecting Fire Alarm Systems	0:30		
	6-5	CFC Requirements For Fire Alarm Systems	0:15		
			1:00		**Test #3**
	7-1	Water-Based Fire And Protection Systems Terms And Conditions	1:00		
	7-2	Water Supply Systems	0:30		
	7-3	Sprinkler System Benefits, Limitations, And Design	0:30	7-3-1 Homework	
		Day 4 Total	**8:00**		
Day 5	7-4	Types Of Sprinkler Systems	1:00	7-4-1	
	7-5	Sprinkler System Components	1:00	7-5-1	
	7-6	Inspecting Sprinkler Systems	1:00		
	7-7	Conducting Tests On Wet-Pipe Sprinkler Systems	0:30		
	7-8	Conducting Tests On Dry-Pipe Sprinkler Systems	0:30		
	7-9	Characteristics Of Standpipe Systems	1:00	7-9-1	
	7-10	Inspecting Standpipe Systems	1:00		
		Review And Certification Exam	2:00		**Certification Exam**
		Day 5 Total	**8:00**		

FIRE PREVENTION 1B PROGRESS CHART	BEGINNING DATE:	ENDING DATE:

CLASS SIZE LIMITED TO 40 STUDENTS STUDENT IDENTIFICATION	Activity 1-1-1	Activity 2-1-2	Activity 2-1-2	Activity 2-2-1	Activity 2-3-1	Activity 2-6-1	Activity 2-8-1	Activity 3-1-1	Activity 3-8-1	Activity 3-10-1	Activity 4-2-1	Activity 5-3-1	Activity 6-1-1	Activity 7-3-1	Activity 7-4-1	Activity 7-5-1	Activity 7-9-1
1.																	
2.																	
3.																	
4.																	
5.																	
6.																	
7.																	
8.																	
9.																	
10.																	
11.																	
12.																	
13.																	
14.																	
15.																	
16.																	
17.																	
18.																	
19.																	
20.																	

FIRE PREVENTION 1B PROGRESS CHART	BEGINNING DATE:	ENDING DATE:

CLASS SIZE LIMITED TO 40 STUDENTS STUDENT IDENTIFICATION	Activity 1-1-1	Activity 2-1-2	Activity 2-1-2	Activity 2-2-1	Activity 2-3-1	Activity 2-6-1	Activity 2-8-1	Activity 3-1-1	Activity 3-8-1	Activity 3-10-1	Activity 4-2-1	Activity 5-3-1	Activity 6-1-1	Activity 7-3-1	Activity 7-4-1	Activity 7-5-1	Activity 7-9-1
21.																	
22.																	
23.																	
24.																	
25.																	
26.																	
27.																	
28.																	
29.																	
30.																	
31.																	
32.																	
33.																	
34.																	
35.																	
36.																	
37.																	
38.																	
39.																	
40.																	

FIRE PREVENTION 1B PROGRESS CHART	BEGINNING DATE:							ENDING DATE:							
								Attendance							
CLASS SIZE LIMITED TO 40 STUDENTS				Test #1	Test #2	Test #3		Day 1 (8 hrs)	Day 2 (8 hrs)	Day 3 (8 hrs)	Day 4 (8 hrs)	Day 5 (8 hrs)		PASS/FAIL	Cert Exam
STUDENT IDENTIFICATION															
1.															
2.															
3.															
4.															
5.															
6.															
7.															
8.															
9.															
10.															
11.															
12.															
13.															
14.															
15.															
16.															
17.															
18.															
19.															
20.															

FIRE PREVENTION 1B PROGRESS CHART	BEGINNING DATE:							ENDING DATE:							
								Attendance							
CLASS SIZE LIMITED TO 40 STUDENTS				Test #1	Test #2	Test #3		Day 1 (8 hrs)	Day 2 (8 hrs)	Day 3 (8 hrs)	Day 4 (8 hrs)	Day 5 (8 hrs)		PASS/FAIL	Cert Exam
STUDENT IDENTIFICATION															
21.															
22.															
23.															
24.															
25.															
26.															
27.															
28.															
29.															
30.															
31.															
32.															
33.															
34.															
35.															
36.															
37.															
38.															
39.															
40.															

Topic: 1-1: Orientation And Administration

Time Frame: 2:30

Level Of Instruction: Level I

Authority: State Fire Marshal

Behavioral Objective:

Condition: Given an activity and oral evaluation

Behavior: The student will confirm a knowledge of the course overview and student's responsibilities

Standard: To the instructor's satisfaction according to the information contained in Fire Prevention 1B (Bridge) Student Supplement, SFT, 2009 Edition, Pages iii-vii and 1-4

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Individual Activity 1-1-1: Fire Prevention Checkup

References:

- California Fire Code, CBSC, 2007 Edition
- State Fire Training Procedures Manual, SFT

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
I. INTRODUCTIONS	
A. Introduce self and other staff	
B. Cite background	
1. Fire department experience	
2. Education	
3. Training	
4. Teaching history	
5. Phone number(s) where the instructor can be reached	
	CLASS ACTIVITY: Have the students introduce themselves.
C. Student introductions	
1. Name	
2. Department	
3. Rank	
4. Years of experience	
5. Current assignment	
6. Reason(s) for taking Fire Prevention 1B	
II. COURSE DESCRIPTION	
A. 40-hour class	
1. Considerable work	
2. Numerous activities	
3. Reading assignments	
	SLIDE: 1-1-1
B. Facilities orientation	
1. Classroom location(s)	
2. Restrooms	
3. Food locations	
4. Smoking	

PRESENTATION	APPLICATION
5. Breaks 6. Telephones 7. Parking **NOTE:** Have students note any specific information for this class on their calendar of events found in the student supplement.	What does the calendar of events tell you about your activities?
C. Calendar of events 1. Indicates a good deal of work ahead 2. Class sessions are intensive 3. Meeting dates 4. Meeting times 5. Throughout entire course there will be group discussions and group interactions 6. Questions are welcome at any time 7. Each student is required to complete all assigned student activities	
III. COURSE REQUIREMENTS	**SLIDE: 1-1-2**
A. Textbooks 1. California Fire Code, CBSC, 2007 Edition 2. Fire Inspection and Code Enforcement, IFSTA, Sixth Edition 3. Student supplement published by State Fire Training	**SLIDE: 1-1-3**
B. Participation 1. Activities a) Individual and group activities	

PRESENTATION	APPLICATION

2. Written tests
3. Absence
   a) Must attend the entire course
   b) Excused absences may be considered for emergencies

IV. STUDENT EVALUATION

SLIDE: 1-1-4

A. There will be three written tests
   1. Each will be followed by a group discussion and review
      a) Tests must be returned to the instructor after the review
   2. Test scores will count toward your final grade
   3. Must take all tests

B. Grades issued on a point system
   1. Minimum 80% required on tests
   2. Completion of activities
   3. Attendance
   4. Minimum 80% required to take certification exam

C. Progress chart
   1. Uses student identification numbers instead of names
   2. Federal law prohibits publication of identifiable student grades

D. State certification exam
   1. Is not related to the final course grade
   2. Must first pass the course before taking this exam
   3. 50 question multiple-choice test
   4. Minimum 70% required to pass certification exam

PRESENTATION	APPLICATION

V. CFSTES CERTIFICATE TRAINING TRACKS

SLIDE: 1-1-5

SLIDE: 1-1-6

SLIDE: 1-1-7

ACTIVITY 1-1-1:
Complete the activity in the student supplement.

Summary:

If these course requirements seem involved and the material that has to be covered appears like a lot in a short period, you are right. Careful attention is necessary. In addition, you should participate in the classroom exercises and group activities fully so you will obtain a greater understanding of the underlying principles being taught, and to be better prepared for the tests.

Evaluation:

The student will complete the activity at a time determined by the instructor.

Assignment:

Review your notes and study for our next session.

INDIVIDUAL ACTIVITY 1-1-1: FIRE PREVENTION CHECKUP

Time Frame:	2:00
Materials Needed:	• California Fire Code, CBSC, 2007 Edition • Pen or pencil
Introduction:	This activity provides the students the opportunity to assess their apperceptive base and retention of material presented in Fire Prevention 1A.
Directions:	1. Using the CFC, complete the following pretest. 2. You have 1 hour to complete this activity. 3. Be prepared to discuss your answers with the class.

SECTION I

Using information taken from CFC Section 202, identify the group assignments for the following occupancies:

	Type Of Occupancy	Group Classification
1.	Restaurant with occupant load of 299	***A-2***
2.	Daycare center for 30 children, ages 5 and older	***E***
3.	State prison	***I-3***
4.	Restaurant with an occupant load of 32	***B***
5.	Service station	***S-1 or M***
6.	Condominium	***R-2***
7.	Fiberglass shop where flammable liquids are used	***H-2, H-3, or F-1***
8.	College classroom with 49 occupants	***B***
9.	15-story office building	***B***
10.	150,000 square foot retail store	***M***

SECTION II

Using information taken from Table 1015.1 for Column 1 and Table 1004.1.1 for Column 2, determine the minimum egress requirement and occupant load factor for the following occupancies:

		Minimum Of 2 Means Of Egress When Occupant Load Is At Least	Occupant Load Factor
11.	Assembly area concentrated use (without fixed seats)	***50***	***7***
12.	Classroom	***50***	***20***
13.	Dance floor	***50***	***7***
14.	Day care	***11***	***35***
15.	Hotels and motels	***11***	***200***
16.	Offices	***50***	***100***
17.	Skating rink	***50***	***50 skating - 15 deck***
18.	Stores/retail sales room	***50***	***50***
19.	Kitchen/restaurant	***50***	***200***
20.	Yoga room	***50***	***50***

SECTION III

Using the information taken from Part I, answer the following questions and include the code section where you found the answer.

21. Who is responsible for enforcement of the California Fire Code?

    Fire Chief/Fire Code Official

    Section 111.2.1.1, CFC Chapter 1/Section 104.1, CFC Appendix Chapter 1

22. Can the Fire Chief prevent a family from occupying their home after a fire has occurred there?

    Yes

    Section 104.11, CFC Appendix Chapter 1

23. When a jurisdiction adopts the fire code, do they automatically adopt the Appendix as well?

    No

    Section 101.2.1, CFC Appendix Chapter 1

24. What sort of crime is a person guilty of when they violate provisions of the California Fire Code?

    Misdemeanor

    Section 111.2.1.3, CFC Chapter 1

25. Would a permit be required to ripen fruit or crops?

    Yes

    Section 105.5.18, CFC Appendix Chapter 1

Using the information taken from Part II, answer the following questions and include the code section where you found the answer.

26. Is a tent an air supported structure?

    No

    Section 2402.1

27. Is a duplex considered an apartment house?

    No

    Section 202

28. Can a "means of egress" include an area outside the building?

    Yes

    Section 1002.1

29. Does "liquid" mean flammable liquid, combustible liquid, or both?

    Both

    Section 2702.1

30. Is newsprint stacked on pallets considered high-pile storage if it is stacked 14 feet high?

    Yes

    Section 2302.1

Topic: 2-1: Flammable And Combustible Liquids Terms And Characteristics

Time Frame: 1:00

Level of Instruction: Level II

Authority: 1998 NFPA 1031: Sections 3-3.12, 4-3.9, and 5-3.8

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of flammable and combustible liquids terms and characteristics

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapters 2, 27, 34, and 43, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 5-11

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Individual Activity 2-1-1: Introduction To Terms
- Individual Activity 2-1-2: Flammable And Combustible Liquid Classifications

References:

- California Fire Code, CBSC, 2007 Edition, Chapters 2, 27, 34, and 43
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

NOTE: Individual Activities 2-1-1 and 2-1-2 can be used as an alternative to a lecture in order to cover the material in this topic.

ACTIVITY 2-1-1: Complete the activity in the student supplement.

I. TERMS

A. Boiling point[1]

1. The temperature when the vapor pressure produced by the liquid equals the atmospheric pressure
2. As atmospheric pressure decreases such as during an increase in elevation, the boiling point will also decrease
3. The boiling point germane to the fire service is the temperature at 14.7 pressure per square inch absolute (psia) (normal atmospheric pressure at sea level)

B. Closed container[2]

1. A container sealed by a lid or other device that will not allow the escape of liquid, vapor, or dust under ordinary conditions of use and handling

C. Container[3]

1. A vessel of 60 gallons or less capacity used for transportations or storing flammable or combustible liquids

D. Dispensing[4]

1. The pouring or transferring of a material from a container, tank, or similar vessel where vapors, dusts, fumes, mists, or gases could be liberated to the atmosphere

E. Fire point[5]

1. The lowest temperature of a liquid in an open container at which it will sustain burning for 5 seconds

PRESENTATION	APPLICATION

2. Not used in the classification of flammable or combustible liquids

F. Flash point[6]

1. The minimum temperature corrected to a pressure of 14.7 psia at which a liquid produces vapors in sufficient quantities to ignite (flash) when a test flame is applied
2. Flash point temperatures are determined by appropriate test procedure as specified in ASTM D 56, ASTM D 93 or ASTM D 3278

G. Liquid[7]

1. A material that has a melting point which is less than or equal to 68°F and a boiling point that is greater than 68°F at 14.7 psia

H. Liquid storage room[8]

1. A room classified as a Group H, Division 3 occupancy used for the storage of flammable or combustible liquids
2. Used to store flammable or combustible liquids in excess of the amounts allowed in common areas
3. Has a myriad of fire and life safety requirements as set forth in CFC Section 3404.3.7.1 through 3404.3.7.5.2

I. Portable tank[9]

1. Any packaging over 60 gallon capacity and designed to be movable with mechanical means

J. Safety can[10]

1. An approved closed container, of not more than 5 gallons capacity, having a spring-closing lid and spout cover

K. Storage[11]

1. The keeping, retention, or leaving of flammable or combustible liquids in closed containers, tanks, or similar vessels

PRESENTATION	APPLICATION
L. Unstable (reactive) material[12] 1. A chemical which will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shock, pressure, or temperature M. Use, closed system[13] 1. The use of a liquid hazardous material in a closed system or vessel that will not emit vapors during normal operations N. Use, open system[14] 1. The use of a liquid hazardous material in a system or vessel that is continuously open to the atmosphere during normal operations and will liberate vapors 2. Also when the product is exposed to the atmosphere during normal operations	
II. FLAMMABLE LIQUIDS[15] A. General 1. Defined as a liquid with a flash point below 100°F B. As flash points are usually less than ambient air temperatures, Class I liquids will always produce enough vapors to ignite C. DOT classification requires Class I liquids to be labeled "flammable" D. Class I-A liquids[16] 1. Flash point below 73°F 2. Boiling point below 100°F 3. The most volatile classification as both the flash and boiling points are at approximately room temperature or below	What is a flammable liquid?

PRESENTATION	APPLICATION
4. Examples a) Ether 1) Flash point = -49°F 2) Boiling point = 94°F E. Class I-B liquids[17] 1. Flash point below 73°F 2. Boiling point at or above 100°F 3. Less volatile than Class I-A as the boiling point is higher 4. Examples a) Gasoline 1) Flash point = -45°F 2) Boiling point ≈ 800°F b) Ethanol 1) Flash point = 55°F 2) Boiling point = 173°F c) Isopropyl alcohol 1) Flash point = 53°F 2) Boiling point = 180°F F. Class I-C liquids[18] 1. Flash point at or above 73°F and below 100°F 2. Boiling point is not considered in classifying Class I-C liquids	
III. COMBUSTIBLE LIQUIDS[19] A. General 1. Liquids with a flash point at or above 100°F 2. Inherently safer than flammable liquids a) Some form of heat must be applied for liquids to reach flash point	What is a combustible liquid?

PRESENTATION	APPLICATION

B. Class II liquids[20]
   1. Flash point at or above 100°F and below 140°F
   2. Examples
      a) Diesel fuel #2
         1) Flash point = 125°F
      b) Kerosene
         1) Flash point = 120°F
   3. Require a moderate amount of heat to produce enough vapors to burn

C. Class III-A liquids[21]
   1. Flash point at or above 140°F and below 200°F

D. Class III-B liquids[22]
   1. Flash point at or above 200°F
   2. Requires a considerable amount of heat to produce enough vapors to ignite
   3. Example
      a) Lubricating oil drained from automobile engines[23]

IV. WHEN MULTIPLE HAZARDS ARE PRESENT

A. All hazards of material must be addressed

B. Flammable and combustible liquids are also regulated as hazardous materials[24]

ACTIVITY 2-1-2:
Complete the activity in the student supplement.

Summary:

An understanding of the terms and characteristics relating to flammable and combustible liquids will assist you in properly regulating these liquids and locating the proper code references for the safe handling and storage. This will also provide for a fire-safe community.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapters 2, 27, 34, and 43, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 5-11 in order to prepare yourself for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 2-1-1: INTRODUCTION TO TERMS

Time Frame:	0:30
Materials Needed:	• California Fire Code, CBSC, 2007 Edition, Chapters 2, 27, 34, and 43 • Pen or pencil
Introduction:	This lesson introduces numerous terms that will be used throughout the unit. This activity provides the students the opportunity to develop competency in using Article 2 to identify or define commodities or terminology necessary to correctly interpret code sections.
Directions:	1. Using CFC Chapters 2, 27, 34, and 43, fill in the missing information for each of the following terms. 2. You have 15 minutes to complete this activity. 3. Be prepared to discuss your answers with the class.

SECTION I

1. Boiling point
   (a) The temperature when the vapor pressure produced by the liquid equals the ***atmospheric*** pressure.

2. Closed container
   (a) A container sealed by a ***lid*** or other device that will not allow the escape of liquid, vapor, or dust under ordinary conditions of use and handling.

3. Closed system use
   (a) The use of a liquid hazardous material in a closed system or vessel that will not emit ***vapors*** during normal operations.

4. Container
   (a) A vessel of ***60*** gallons or less capacity used for transporting or storing flammable and combustible liquids.

5. Dispensing
   (a) The ***pouring*** or transferring of a material from a container, tank, or similar vessel where vapors, dusts, fumes, mists, or gases could be liberated to the atmosphere.

6. Fire point
   (a) The ***lowest*** temperature of a liquid in an open container at which it will sustain burning for 5 seconds.
   (b) Not used in the classification of flammable or combustible liquids.

7. Flash point
   (a) The minimum temperature at which a liquid produces ***vapors*** in sufficient quantities to ignite (flash) when a test flame is applied.

8. Liquid
   (a) A material that has a melting point which is less than or equal to 68°F and a ***boiling point*** that is greater than 68°F at 14.7 psia.

9. Liquid storage room
   (a) A room classified as a Group H, Division 3 occupancy used for the storage of ***flammable*** or ***combustible*** liquids.
   (b) In excess of the amounts allowed in common areas.
   (c) Has a myriad of fire and life safety requirements as set forth in CFC Section 2702.1.

10. Mixing
   (a) The combining, blending, or bringing together within the same container, tank, or vessel flammable or combustible liquids whereby ***flammable*** vapors could escape to the atmosphere.

11. Open system use
   (a) The use of a liquid hazardous material in a system or vessel that is continuously open to the atmosphere during normal operations and will liberate ***vapors***.

12. Portable tank
   (a) Any packaging over ***60*** gallon capacity and designed to be movable with mechanical means.

13. Safety can
   (a) An approved closed container, of not more than ***5*** gallons capacity, having a spring-closing lid and spout cover.

14. Storage
   (a) The keeping, retention, or leaving of flammable or combustible liquids in closed ***containers***, tanks, or similar vessels.

15. Unstable (reactive) liquid
    (a) A chemical that will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shock, pressure, or ***temperature***.
    (b) Also, when the product is exposed to the ***atmosphere*** during normal operations.

SECTION II: FLAMMABLE LIQUIDS

16. Defined as a liquid with a flash point below ***100*** °F.

17. As flash points are usually ***less*** than ambient air temperatures, Class I liquids will always produce enough vapors to ignite.

18. DOT classification requires Class I liquids to be labeled ***"flammable."***

19. Class I-A liquids
    (a) Flash point below ***73*** °F.
    (b) Boiling point below ***100*** °F.

20. Class I-B liquids
    (a) Flash point below ***73*** °F.
    (b) Boiling point at or above ***100*** °F.

21. Class I-C liquids
    (a) Flash point at or above ***73*** °F and below ***100*** °F.
    (b) ***Boiling*** point is not considered in classifying Class I-C liquids.

SECTION III: COMBUSTIBLE LIQUIDS

22. Liquids with a flash point at or above ***100*** °F.

23. Class II
    (a) Flash point at or above ***100*** °F and below ***140*** °F.
    (b) Require a moderate amount of heat to produce enough vapors to burn.

24. Class III-A liquids
    (a) Flash point at or above ***140*** °F and below ***200*** °F.

25. Class III-B liquids
    (a) Flash point at or above ***200*** °F.

INDIVIDUAL ACTIVITY 2-1-2: FLAMMABLE AND COMBUSTIBLE LIQUID CLASSIFICATIONS

Time Frame:	0:30
Materials Needed:	• California Fire Code, CBSC, 2007 Edition, Chapter 34 • Pen or pencil
Introduction:	This activity provides the students the opportunity to classify flammable and combustible liquids in accordance with the CFC.
Directions:	1. Using CFC Chapter 34, classify the flammable and combustible liquids below. 2. You have 15 minutes to complete this activity. 3. Be prepared to discuss your answers with the class.

Class	Flammable And Combustible Liquid
I-B	1. Acetone, flash point: -4°F, boiling point: 133°F
I-B	2. Isopropyl alcohol, flash point: 53°F, boiling point: 181°F
II	3. Jet A fuel, flash point: 110-150°F, boiling point: 400°-550°F
I-A*/I-B	4. Jet B fuel, flash point: -10°-30°F, no information on boiling point
II	5. Blanket and roller wash, flash point: 100°F
I-B	6. Polyisocyanate activator, flash point: between 20°-73°F, boiling range: 168°-347°F
III-B	7. Epi-Cure 855, flash point: >200°F, boiling point: high boiling
III-B	8. Shell turbo oil, viscosity grade: 32, flash point: 385°F
I-B	9. Benzene, flash point: 12°F, boiling point: 176°F
II	10. Texaco charcoal lighter fluid, flash point: 105°F
II	11. Kerosene burner fuel, flash point: 100°F, boiling range: 175°-300°F
I-A*/I-B	12. Lacquer thinner, <20°F*
III-A	13. Dow brake fluid, flash point: 170°F
II	14. Diesel fuel oil No. 2-D, flash point: 125°F, boiling point: 340°-676°F
I-B	15. Gasoline, flash point: -45°F, boiling point: 100°-400°F

*In discussing these liquids, point out that while in the field, we are often confronted with insufficient information (i.e., no boiling point given). The conservative approach is to treat the liquid as a Class I-A until the business provides a material safety data sheet indicating a lesser hazard.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 2702.1
[2] California Fire Code, CBSC, 2007 Edition, Section 2702.1
[3] California Fire Code, CBSC, 2007 Edition, Section 2702.1
[4] California Fire Code, CBSC, 2007 Edition, Section 2702.1
[5] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[6] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[7] California Fire Code, CBSC, 2007 Edition, Section 2702.1
[8] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[9] California Fire Code, CBSC, 2007 Edition, Section 2702.1
[10] California Fire Code, CBSC, 2007 Edition, Section 2702.1
[11] California Fire Code, CBSC, 2007 Edition, Section 2702.1
[12] California Fire Code, CBSC, 2007 Edition, Section 4302.1
[13] California Fire Code, CBSC, 2007 Edition, Section 2702.1
[14] California Fire Code, CBSC, 2007 Edition, Section 2702.1
[15] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[16] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[17] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[18] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[19] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[20] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[21] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[22] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[23] California Fire Code, CBSC, 2007 Edition, Section 3402.1
[24] California Fire Code, CBSC, 2007 Edition, Section 2702.1

Topic: 2-2: Acceptable Containers For Flammable And Combustible Liquids

Time Frame: 0:30

Level of Instruction: Level II

Authority: 1998 NFPA 1031: Sections 3-3.12, 4-3.9, and 5-3.8

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of acceptable containers for flammable and combustible liquids

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 12-13

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Flammable liquid safety cans for demonstration
- Individual Activity 2-2-1: Allowable Containers

References:

- California Fire Code, CBSC, 2007 Edition, Chapters 2, 27, and 34
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10
- NFPA 30- Flammable and Combustible Liquids Code, 2003 Edition, Chapter 6

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
I. APPROVED AND LISTED CONTAINERS	
A. Definition	What is the difference between "approved" and "listed?"
	SLIDE: 2-2-1
1. Approved[1]	
a) Accepted by the Fire Code Official	
2. Listed[2]	
a) Equipment or materials on a published listing after being tested by a nationally recognized laboratory	
1) Underwriters Laboratory (UL)	
2) Factory Mutual (FM)	
	SLIDE: 2-2-2
B. Acceptable to the authority having jurisdiction	
1. Underwriters Laboratory (UL)	
2. Factory Mutual (FM)	
3. Office of State Fire Marshal (OSFM)	
4. National Fire Protection Association (NFPA)	
5. Other approved, recognized standards	
	SLIDE: 2-2-3
II. LIMITS FOR PORTABLE TANKS AND CONTAINERS[3]	
A. Must be vented to limit internal pressure to 10 psi or 30% of tank's bursting pressure[4]	
B. Small quantities for temporary storage	
1. Quantity is limited by the container	
C. Fusible plugs may be required in some instances	
D. Must be capable of withstanding heat without failing	
1. No soldered joints or seams	

PRESENTATION	APPLICATION
2. Listed to contain that classification of liquid E. Common containers	
	What are the characteristics of an approved safety can? **SLIDE: 2-2-4**
1. Approved safety cans a) Must have a spring closing lid and spout cover[5] 1) Functions as a 5 psi relief valve b) Must have a flame arrester c) Not to exceed 5 gallons	
	SLIDE: 2-2-5
2. Nonsafety containers/cans a) Standard metal containers[6] b) Glass containers[7] c) Plastic containers[8] 1) Must be approved and listed for Class I and Class II liquids	
	Do you often find glass containers being used illegally? **SLIDE: 2-2-6**
F. Portable tanks[9] 1. Any packaging, over 60 gallons, designed to be transported a) Does not include 1) Cargo tanks 2) Tank car tanks 3) Tank trailers	

PRESENTATION	APPLICATION
G. Drums 1. DOT specifications a) Up to 60 gallons b) Includes unvented 55 gallon drums	
	SLIDE: 2-2-7
H. Classes of commodities exempt from CFC[10] 1. When packaged according to commonly accepted practices for retail sales a) Medicines b) Alcoholic beverages c) Foodstuff d) Cosmetics	
	SLIDE: 2-2-8
III. SPECIAL EXEMPTION A. DOT Type III (polyethylene) nonreusable container B. Constructed and tested in accordance with DOT specifications C. Treated if necessary to prevent permeation D. May be used for storage of Class II and III liquids in all capacities not to exceed 2½ gallons	
	SLIDE: 2-2-9
IV. SPECIALIZED "APPROVED" CONTAINERS A. Plunger cans 1. Spring-loaded plunger with fire baffle dasher B. Bench cans 1. Handles larger parts a) Dasher submerges parts 1) Springs up to drain	

PRESENTATION	APPLICATION

C. Dispensing cans
   1. Dispenses small amounts of product on the work
   2. Spillproof
   3. Opens by finger pressure
      a) Closes automatically

D. Oily waste cans
   1. Required wherever oil-soaked cloths and rags are commonly stored
      a) Must be self-closing to contain spontaneous ignition

E. Cleaning tanks
   1. Used to clean small parts
   2. Cover opens wide for use and has fusible link to close if contents are ignited
   3. Check code for types of liquid to be used as cleaner

F. Self-closing rinse tanks
   1. Used to clean large parts
   2. Foot-operated lid closes automatically upon release
   3. Closes via fusible link if fire is involved in contents

ACTIVITY 2-2-1:
Complete the activity in the student supplement.

Summary:

By knowing what is an acceptable container for flammable and combustible liquids, you will be able to identify improper containers and those that are being misused. Additionally, you will be able to educate others as to the acceptable types permitted by code. This will help in minimizing the chance of fire.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 12-13 in order to prepare you for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 2-2-1: ALLOWABLE CONTAINERS

Time Frame: 0:20

Materials Needed:

- California Fire Code, CBSC, 2001 Edition, Chapters 2, 27 and 34
- NFPA 30: Flammable and Combustible Liquids Code, NFPA, 2003 Edition, Table 6.2.3 (included)
- Pen or pencil

Introduction: This activity provides the students the opportunity to read and interpret requirements regarding containers used for the incidental storage of flammable and combustible liquids.

Directions:

1. Using CFC Chapters 2, 27, and 34 and NFPA 30 Table 6.2.3, fill in the information in the chart below.
2. When the chart is completed, use that information and the CFC to answer questions 1-5.
3. You have 10 minutes to complete this activity.
4. Be prepared to discuss your answers with the class.

FLAMMABLE AND COMBUSTIBLE LIQUID WORKSHEET		Flash Point	Boiling Point	Safety Can	Approved Plastic	Polyethelyne	Nonsafety Cans-Metal	Nonsafety Cans-Glass
		MIN-MAX TEMPS		MAXIMUM ALLOWABLE SIZES (LITERS)				
Flammable Liquids	**Class I-A**	<73°F	<100°F	10 Liter	5 Liter	5 Liter	5 Liter	.5 Liter
	Class I-B	<73°F	≥100°F	20 Liter	20 Liter	20 Liter	20 Liter	1 Liter
	Class I-C	73°-99°F		20 Liter	20 Liter	20 Liter	20 Liter	5 Liter
Combustible Liquids	**Class II**	100°-139°F		20 Liter	20 Liter	450 Liter	20 Liter	5 Liter
	Class III-A	140°-199°F		20 Liter	20 Liter	450 Liter	20 Liter	20 Liter
	Class III-B	≥200°F		20 Liter	20 Liter	450 Liter	20 Liter	20 Liter

NFPA 30, Table 6.2.3 Maximum Allowable Size – Containers, Intermediate Bulk Containers, and Portable Tanks					
	Flammable Liquids			Combustible Liquids	
Type	Class IA	Class IB	Class IC	Class II	Class III
Glass	0.5 L (1.05 pt)	1 L (1.05 qt)	5 L (1.3 gal)	5 L (1.3 gal)	20 L (5.3 gal)
Metal (other than drums) or approved plastic	5 L (1.3 gal)	20 L (5.3 gal)	20 L (5.3 gal)	20 L (5.3 gal)	20 L (5.3 gal)
Safety cans	10 L (2.6 gal)	20 L (5.3 gal)	20 L (5.3 gal)	20 L (5.3 gal)	20 L (5.3 gal)
Metal drum (e.g., UN 1A1 or 1A2)	450 L (119 gal)	450 L (119 gal)	450 L (119 gal)	450 L (119 gal)	450 L (119 gal)
Approved metal portable tanks and 1BCs	3000 L (793 gal)	3000 L (793 gal)	3000 L (793 gal)	3000 L (793 gal)	3000 L (793 gal)
Rigid plastic 1BCs (UN 31H1 or 31H2) and composite 1BCs with rigid inner receptacle (UN31HZ1)	NP	NP	NP	3000 L (793 gal)	3000 L (793 gal)
Composite 1BCs with flexible inner receptacle (UN31HZ2) and flexible 1BCs (UN13H, UN13L, and UN13M)	NP	NP	NP	NP	NP
Bag-in Box Nonbulk	NP	NP	NP	NP	NP
Polyethylene UN1H1 or as authorized by DOT exemption	5 L (1.3 gal)	20 L (5.3 gal)†	20 L (5.3 gal)†	450 L (119 gal)†	450 L (119 gal)†
Fiber drum NMFC or UFC Type 2A; Types 3A, 3B-H, or 3B-L; or Type 4A	NP	NP	NP	450 L (119 gal)	450 L (119 gal)
NP = Not Permitted † For Class 1B and 1C water-miscible liquids, the maximum allowable size of plastic container is 230 L (60 gal) if stored and protected in accordance with Table 6.8.2(g).					

1. Regular unleaded gasoline (FP -40°F/BP 85°F) is being stored in 20 Liter plastic gas can. The gas can is approved and listed by UL. Is this a code violation?

   ☒ Yes ☐ No

   1-A max = 10 Liters
2. You find 20 Liters of MEK (Methyl Ethyl Ketone: FP -16°F/BP 186°F) stored in a metal container. Is this a code violation?

   ☐ Yes ☒ No

   1-B max = 20 Liters
3. While inspecting a lab, you find 20 Liters of Ethyl Ether (FP -49°F/BP 95°F) in a safety can. Is this a code violation?

   ☒ Yes ☐ No

   1-A max = 10 Liters
4. You find Isopropyl Alcohol (FP 54°F/BP 180°F) in a 1-liter glass jar. Is this a code violation?

   ☐ Yes ☒ No

   Maximum is 1 liter
5. Acetone (FP -4°F/BP 133°F) is being used in a nail shop. It is stored at every work station in a plastic 16 oz. non-listed, non-approved container. Is this a code violation?

   ☒ Yes ☐ No

   Prohibited by CFC 3404.3.1.1

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 202

[2] California Fire Code, CBSC, 2007 Edition, Section 202

[3] NFPA 30: Flammable and Combustible Liquids Code, NFPA, 2003 Edition, Table 6.2.3

[4] NFPA 30: Flammable and Combustible Liquids Code, NFPA, 2003 Edition, Section 6.2.2

[5] California Fire Code, CBSC, 2007 Edition, Section 2702.1

[6] NFPA 30: Flammable and Combustible Liquids Code, NFPA, 2003 Edition, Table 6.2.3

[7] NFPA 30: Flammable and Combustible Liquids Code, NFPA, 2003 Edition, Table 6.2.3

[8] NFPA 30: Flammable and Combustible Liquids Code, NFPA, 2003 Edition, Section 6.2.1

[9] California Fire Code, CBSC, 2007 Edition, Section 2702.1

[10] California Fire Code, CBSC, 2007 Edition, Section 2701.1 Exception 1

Topic: 2-3: Introduction To Material Safety Data Sheets

Time Frame: 0:30

Level of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of material safety data sheets

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 14-16

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Individual Activity 2-3-1: MSDS Information Search

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 27 and Appendix H
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 2-3-1
I. "EMPLOYEE RIGHT TO KNOW" LAWS	
A. Employee has the right to know the hazards of chemicals and other materials in the workplace	
B. Requirements	
1. Identify and list hazardous materials used in the workplace	
a) Continually update as needed	
	What product reference must be on site for every hazardous material?
2. Must have copies of all product MSDS on materials handled at the workplace[1]	
a) Workplace	
1) Not all MSDS pages have the same format	
3. Ensure all products are labeled accurately	
a) DOT labels are commonly used	
4. Have a written hazardous materials mitigation program	
5. Train employees about the hazards of chemicals used at the workplace	
C. Cal/OSHA enforces these regulations	
	SLIDE: 2-3-2
II. MSDS CONTENTS	
A. Cal/OSHA mandates minimum requirements	
B. Each MSDS must contain 8 sections, if applicable	
1. Manufacturer's information	
a) Name and address	
b) Emergency telephone number	
c) Information telephone number	
d) Signature and date	

PRESENTATION	APPLICATION

2. Hazardous ingredients
   a) Common name
   b) Chemical name
   c) Chemical abstract service number
   d) OSHA permissible exposure limit
   e) Threshold limit value
   f) Other exposure limits
3. Physical and chemical characteristics
   a) Boiling point
   b) Specific gravity
   c) Vapor pressure
   d) Melting point
   e) Vapor density
   f) Evaporation rate
   g) Solubility in water
   h) Appearance and odor
4. Fire and explosion hazard data
   a) Flash point
   b) Flammable limit
   c) Extinguishing media
   d) Special fire fighting procedures
   e) Unusual fire and explosion hazards

SLIDE: 2-3-3

5. Reactivity data
   a) Stability
   b) Incompatibility
   c) Hazardous decomposition or by-products
   d) Hazardous polymerization

PRESENTATION	APPLICATION
6. Health hazard data a) Routes of entry b) Health hazards (acute or chronic) c) Carcinogenicity d) National Toxicology Program (NTP) e) International Agency for Research on Cancer (IARC) f) Cal/OSHA regulated g) Signs and symptoms of exposure h) Medical conditions aggravated by exposure i) Emergency and first aid procedures 7. Precautions for safe handling and use a) Steps to be taken in case of a spill or release b) Waste disposal methods c) Handling and storing precautions d) Other precautions 8. Control measures a) Respiratory requirement, if needed b) Ventilation needed c) Protective gloves d) Eye protection e) Work/hygienic practices	
C. MSDS use 1. Not all MSDS pages are alike	Are MSDS pages standard in their content? **SLIDE: 2-3-4**

PRESENTATION	APPLICATION
a) Information not believed applicable will not be listed 1) Example • Boiling point 2. Can provide quick overview of material hazards a) Verify with at least two additional references	**ACTIVITY 2-3-1:** Complete the activity in the student supplement.

Summary:

A MSDS should be available and readily accessible for the inspector's review. MSDS pages are essential for quick identification of materials and the methods used to control an unexpected release of dangerous products. MSDS pages are also needed for classifying flammable liquids and other hazardous materials.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 14-16 in order to prepare you for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 2-3-1: MSDS INFORMATION SEARCH

Time Frame:	0:15
Materials Needed:	• MSDS for commercial propane • Pen or pencil
Introduction:	This activity provides the students the opportunity to find the relevant information listed on the MSDS that can assist the inspector when determining the regulation requirements for materials stored.
Directions:	1. Using the sample MSDS on the following pages, find the information requested below. 2. You have 10 minutes to complete this activity. 3. Be prepared to discuss your answers with the class.

1.	Chemical family	***Paraffinic hydrocarbon***
2.	Boiling point	***-44°F***
3.	Flash point	***-156°F***
4.	Flammable limits	***Lower: 2.2%*** ***Upper: 9.6%***
5.	Company phone number	***(201) 887-5300***
6.	NFPA 704 reactivity rating	***0*** ***Stable***
7.	NFPA 704 health rating	***1*** ***Slightly toxic***
8.	Ignition temperature	***920° - 1120°F***
9.	Vapor density	***1.50***
10.	First aid procedure for skin contact	***Remove victim from further exposure and into the fresh air. Provide oxygen if breathing is difficult. If victim is unconscious, get medical attention promptly.***

MATERIAL SAFETY DATA SHEET

EFFECTIVE JULY 1, 1993

AGENCY NAME AGENCY ADDRESS AGENCY CITY/STATE	TRANSPORTATION EMERGENCY NO:	CHEMTREC NO. (800) 424-9300	GENERAL INFORMATION:	SAFETY DEPT. (201) 887-5300

DANGER! Extremely flammable liquefied gas under pressure. Keep away from heat, sparks, flame, and all other ignition sources. Vapor reduces oxygen available for breathing and may cause suffocation in confined spaces. Use only with adequate ventilation. Odor may not provide adequate warning of potentially hazardous concentrations. Vapor is heavier than air and may collect at low levels. Liquid may cause freeze burn similar to frostbite. Do not get liquid in eyes, on skin, or on clothing. Avoid prolonged breathing of vapor. Keep container valve closed when not in use.

SECTION I - IDENTIFICATION

PRODUCT: Commercial Propane
SYNONYMS: Liquefied Petroleum Gas; LP-Gas; LPG
CHEMICAL FAMILY: Paraffinic Hydrocarbon
CHEMICAL FORMULA: C3H8

SECTION II - INGREDIENTS

MATERIAL	CAS NUMBER	PERCENT
ETHANE	74-84-0	0 -- 5.0
PROPANE	74-98-8	87.5 -- 100
PROPYLENE	115-07-1	0 -- 5.0
BUTANE	Various	0 -- 2.5
ETHYL MERCAPTAN	75-08-01	

SECTION III - HEALTH INFORMATION

INHALATION:	Asphyxiant in high concentrations due to dilution of available oxygen. At excessive vapor concentrations, this product has anesthetic, asphyxiating properties and may cause sleepiness. At levels above 100,000 ppm (i.e. 10%), propane is mildly irritating to the respiratory tract and may result in dizziness, headache, drowsiness, nausea, shortness of breath, lack of muscular coordination, excessive salivation, disorientation, vomiting, and excitation. In extreme cases, convulsions, unconsciousness, and death may occur because of asphyxiation. Persons with chronic respiratory disease should avoid exposure.
INGESTION:	Liquid may cause freeze burn similar to frostbite. Ingestion not expected to occur in normal use.
EYE CONTACT:	Liquid may cause freeze burn similar to frostbite.
SKIN CONTACT:	Liquid may cause freeze burn similar to frostbite.
OTHER:	Product is not listed by IARC, NTP, or OSHA as a potential carcinogen. Propane and some of the minor components have been reported to be cardiac sensitizers in experiments

SECTION IV - OCCUPATIONAL EXPOSURE LIMITS

MATERIAL	PEL/TWA	TLV/TWA
ETHANE	Not Established	Simple Asphyxiant
PROPANE	1000 ppm	Simple Asphyxiant
PROPYLENE	Not Established	Simple Asphyxiant
BUTANE	800 ppm	800 ppm
ETHYL MERCAPTAN	0.5 ppm	0.5 ppm

SECTION V - EMERGENCY AND FIRST AID PROCEDURE
For Over Exposure By

INHALATION:	Remove victim from further exposure and into fresh air. Provide oxygen if breathing is difficult. If victim is unconscious, get prompt medical attention.
INGESTION:	If swallowed, get immediate medical attention.
EYE CONTACT:	For contact with liquid, flush immediately with water. Obtain immediate medical attention.
SKIN CONTACT:	If freeze burn occurs, remove contaminated clothes, shoes and jewelry. Immerse burned area in warm (not hot) water. Keep immersed. Get prompt attention.

SECTION VI - PHYSICAL DATA

BOILING POINT:	-44°F
MELTING POINT:	N/A
VAPOR PRESSURE:	196 psig @ 100°F
SPECIFIC GRAVITY (H20 = 1):	0.504
VAPOR DENSITY (AIR = 1):	1.50
SOLUBILITY IN WATER:	Slight, 0.1 to 1.0%
APPEARANCE AND ODOR:	Colorless, odorless in natural form

ODORANT WARNING

Odorant is added to aid in detection of leaks. One common odorant is ethyl mercaptan, CAS No. 75-08-1. Odorant has a foul, skunk like odor. The odorant is effective in most instances, but not everyone can smell the odor. The ability of people to detect odors varies widely. Also, certain chemical reactions with material in the propane system can reduce the propane odor level. No odorant will be 100% effective in all circumstances. If odor level appears to be weak, notify propane supplier immediately.

SECTION VII - FIRE AND EXPLOSION HAZARDS

FLASH POINT AND METHOD USED:	-156°F
IGNITION TEMPERATURE IN AIR:	920°F – 1,120°F
FLAMMABLE LIMITS IN AIR, % BY VOLUME:	Lower: 2.2% Upper: 9.6%

NFPA RATING (Under Fire Conditions. Does not apply to exposure hazards other than during fire):

HEALTH:	1 Slighting toxic
FIRE:	4 Extremely flammable
REACTIVITY:	0 Stable

FIRE FIGHTING PROCEDURES:

Eliminate sources of ignition. Evacuate area. Notify fire department. Allow only trained, properly protected personnel in area. Shut off source of gas, if possible. Allow fire to burn itself out after gas flow is shut off. If gas flow cannot be shut off, do not extinguish fire. Allow fire to burn itself out using high volume water supply to cool heat exposed pressure containers and nearby equipment. Approach a flame-enveloped container from the side, never the head ends. Use extreme caution when applying water to a container that has been exposed to heat or flame for more than a short time. For uncontrollable fires and when flame is impinging on container, withdraw all personnel and evacuate vicinity immediately.

USUAL FIRE & EXPLOSION HAZARDS:

Fire fighters should wear self-contained breathing apparatus in the positive pressure mode with a full facepiece when there is a possibility of exposure to smoke, fumes or hazardous decomposition

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 2703.4

Topic: 2-4: Inside Storage Of Flammable And Combustible Liquids

Time Frame: 1:00

Level of Instruction: Level II

Authority: 1998 NFPA 1031: Sections 3-3.12, 4-3.9, and 5-3.8

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of inside storage of flammable and combustible liquids

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 34 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 34
- NFPA 10- Standard for Portable Fire Extinguishers, NFPA, 2005 edition
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

I. GENERAL REQUIREMENTS FOR INSIDE STORAGE

SLIDE: 2-4-1

A. Fire extinguishers

1. Provide per CFC Section 906.3 or NFPA 10[1]

   a) At least one fire extinguisher rated & located per Table 906.3(2) where flammable or combustible liquid depths of less than or equal to 0.25 inches per 100 square feet (200 square feet for person familiar with extinguisher use)

   b) Flammable or combustible liquid depths greater than 0.25 inches per 100 square feet (200 square feet for person familiar with extinguisher use) shall be placed in accordance with NFPA 10[2]

What is the maximum size for a container?

SLIDE: 2-4-2

B. Container and portable tank size limits

1. No containers exceeding 60 gallons[3]
2. No portable tanks in excess of 660 gallons
3. Tanks exceeding 660 gallons require greater protection and design requirements contained in other sections of CFC Chapter 34

SLIDE: 2-4-3

C. Empty containers and portable tanks[4]

1. Shall be stored as required for full tanks
2. Unless completely free of explosive vapors
3. All covers or plugs shall be immediately replaced in openings when emptied

SLIDE: 2-4-4

PRESENTATION	APPLICATION

D. Storage near means of egress[5]

1. Storage of Class I, II, and III liquids shall not be stored near exit-access doorways, stairways, or in locations that will impede egress

a) Includes stock for sale

SLIDE: 2-4-5

E. Shelf storage[6]

1. Wood shelving, racks, dunnage, scuffboards, floor overlay and similar installations may be used and shall be at least 1 inch (25mm) nominal thickness wood.

2. Substantially constructed

a) Adequately braced and anchored

3. Shall be wide enough and provided with a lip to prevent containers from being easily displaced

a) Except for shelves in liquid storage cabinets

4. Storage shall be neat and orderly

SLIDE: 2-4-6

II. MAXIMUM ALLOWABLE QUANTITIES[7]

A. Maximum allowable quantities are the amounts of flammable and combustible liquids allowed to be stored in each particular occupancy group

1. Amounts in excess of maximum allowable quantities, including footnotes, shall change the occupancy group to a Group H occupancy

a) Will require dramatic changes in construction, zoning, and fire protection

B. For all occupancies other than Group M wholesale and retail sales uses, indoor storage of flammable and combustible liquids shall not exceed the maximum allowable quantities set forth in CFC Table 2703.1.1(1) and shall not exceed the additional limitations set forth in the CFC[8]

PRESENTATION	APPLICATION
1. Quantities shall not exceed the amounts necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment and shall not exceed quantities set forth in CFC Table 3404.3.4.1	When is a liquid storage cabinet required? **SLIDE: 2-4-7**
C. Liquid storage cabinets[9] 1. In all occupancies, quantities of flammable and combustible liquids used for maintenance purposes shall not exceed 10 gallons per CFC 3404.3.4.4 a) Unless stored in approved liquid storage cabinets 2. The total combined quantity of all liquids in a cabinet shall not exceed 120 gallons 3. Shall have a conspicuous label stating "FLAMMABLE-KEEP FIRE AWAY" 4. Doors shall be self-closing, well fitted, and equipped with a latch 5. The bottom shall be liquid tight to a height of at least 2 inches	**SLIDE: 2-4-8**
6. Cabinets shall be listed or constructed to either a) Minimum 18-gage metal, double-walled including the door with an 1½-inch airspace, riveted or welded seams b) Minimum 1-inch exterior grade plywood, rabbited joints, and fastened with screws from two directions, painted with an intumescent-type paint	**SLIDE: 2-4-9**

PRESENTATION	APPLICATION
D. Control areas[10]	
1. Rooms of 1-hour fire barrier wall used to allow additional flammable and combustible liquid storage above the maximum allowable quantities allowed in CFC 2703.8.3.1 and CFC Table 3404.3.4.1	How many control areas can you have in a building? **SLIDE: 2-4-10**
2. May exceed maximum allowable quantities per building used for retail or wholesale sales when stored in accordance with CFC 2703.11	
3. The maximum number of control areas per floor within a building shall be in accordance with CFC Table 2703.8.3.2	
4. Class I liquids shall not be stored in basements	
5. Containers less than 30-gallon capacity shall not be stacked more than 3 feet or two containers high unless stacked on fixed shelving or otherwise secured	
6. Containers more than 30 gallons shall not be stored more than one container high	**SLIDE: 2-4-11**
7. Containers on shelves shall not exceed the storage heights stipulated in CFC Table 3404.3.6.3(1)	
8. Containers shall not be stored closer than 3 feet to any beam, chord, girder, or other obstruction and shall be at least 3 feet below sprinkler deflectors	
9. In area not accessible to the public, Class I, II, and III-A liquids shall not be stored in the same pile or rack as combustible commodities	

PRESENTATION	APPLICATION
	SLIDE: 2-4-12
E. CFC Table 2703.1.1(1) 1. Basic exempt amounts allowed for all occupancies other than Group M retail and wholesale sales uses a) Use CFC Table 3404.3.4.1 for Group M occupancies 2. Footnotes a) Basic amounts can be doubled for automatic fire sprinklers b) Amounts can be doubled again per control area	
	SLIDE: 2-4-13
F. Group M wholesale and retail uses[11] 1. Maximum allowable quantities allowed in CFC Table 3404.3.4.1 2. Footnotes a) Amounts can be doubled if storage separated by a control area b) Amounts are increased based on levels of automatic fire sprinkler protection	
	SLIDE: 2-4-14
3. Containers for Class I liquids shall be in metal containers a) Exceptions are allowed 4. Containers for Class I liquids shall not exceed 5-gallon capacity a) Exceptions are allowed	
	SLIDE: 2-4-15
5. Fire protection and storage arrangement shall be in accordance with CFC Table 3404.3.6.3(1) and	

PRESENTATION	APPLICATION

a) Combustible commodities shall not be stored above flammable or combustible liquids

b) Storage on shelves shall not exceed 6 feet in height, and shelving shall be metal

c) Storage on pallets or in piles greater than 4 feet 6 inches in height or where the ceiling exceeds 18 feet in height, shall be protected in accordance with CFC Table 3404.3.6.3(4), and the storage configuration shall be in accordance with CFC Table 3404.3.6.3(2)

d) Storage on racks greater than 4 feet 6 inches in height shall be protected in accordance with CFC Tables 3404.3.6.3(5), 3404.3.6.3(6), and 3404.3.6.3(7), and storage configuration shall be in accordance with CFC Table 3404.3.6.3(3)

e) Storage methods not in accordance with c) and d) above shall be limited in height in accordance with CFC Table 3404.3.6.3(1)

SLIDE: 2-4-16

f) Storage plans

1) Same format as a Hazardous Materials Management Plan

2) May be required by the Fire Code Official

3) Should include

- Storage and use areas
- Maximum amount of each material stored
- Range of container sizes
- Locations of isolation valves and devices
- Storage arrangement

PRESENTATION	APPLICATION

NOTE: Example found in the California Fire Code, CBSC, 2007 Edition, Appendix H.

SLIDE: 2-4-17

G. Liquid storage rooms[12]

1. Specially constructed rooms designed to store flammable and combustible liquids in amounts in excess of maximum allowable quantities per CFC 3404.3.4.1

SLIDE: 2-4-18

2. Storage and quantity limits[13]
   a) Applicable to palletized and rack storage
3. Spill control and secondary containment shall be provided

SLIDE: 2-4-19

4. Ventilation is required[14]
   a) A minimum of at least 1 cubic foot per minute (cfm) per square foot of floor area
      1) 400 square foot room = 400 cfm ventilation
   b) Shall operate continuously
   c) Shall be equipped with an emergency shut-off located outside the room

SLIDE: 2-4-20

5. Fire protection
   a) Automatic fire sprinkler systems shall be installed
   b) Designed per the appropriate CFC Tables[15]
6. Fire extinguishers
   a) At least one 20-BC or greater required

PRESENTATION	APPLICATION

7. Explosion control[16]
   a) Shall be provided if
      1) Class I-A & I-B liquids are stored in excess of exempt amounts, or
      2) Explosive vapor-air mixtures could be present under normal operating conditions
      3) Exceptions
         - Class I-C if provided with complying ventilation

Summary:

Inside storage of flammable and combustible liquids is restricted due to the extreme dangers associated with storing such materials inside the confined area of a building. You must be able to apply the limits established within CFC Article 79 to occupancies in your jurisdiction. As almost all buildings within your jurisdiction contain some amount of flammable and combustible liquids, and it is important to know which occupancies may store these materials and in what quantities. Storage cabinets and other methods can be used to increase the amounts allowed, while providing for a reasonable degree of safety.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapters 9 and 34, and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10 in order to prepare you for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 3403.2.1
[2] California Fire Code, CBSC, 2007 Edition, Section 906.3
[3] California Fire Code, CBSC, 2007 Edition, Section 3404.3
[4] California Fire Code, CBSC, 2007 Edition, Section 3404.3.3.4
[5] California Fire Code, CBSC, 2007 Edition, Section 3404.3.3.3
[6] California Fire Code, CBSC, 2007 Edition, Section 3404.3.3.5
[7] California Fire Code, CBSC, 2007 Edition, Section 3404.3.4
[8] California Fire Code, CBSC, 2007 Edition, Section 3404.4.3.2
[9] California Fire Code, CBSC, 2007 Edition, Section 3404.3.2
[10] California Fire Code, CBSC, 2007 Edition, Section 2703.8.3.1 and Table 3404.3.4.1
[11] California Fire Code, CBSC, 2007 Edition, Section 3404.3.6
[12] California Fire Code, CBSC, 2007 Edition, Section 3404.3.7
[13] California Fire Code, CBSC, 2007 Edition, Tables 3404.3.6.3(2) and 3404.3.6.3(3)
[14] California Fire Code, CBSC, 2007 Edition, Section 2704.3
[15] California Fire Code, CBSC, 2007 Edition, Chapter 9 and Tables 3404.3.6.3(4) through 3404.3.7.5.1
[16] California Fire Code, CBSC, 2007 Edition, Section 911

Topic: 2-5: Outside Storage Of Flammable And Combustible Liquids

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Sections 3-3.12, 4-3.9, and 5-3.8

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of outside storage of flammable and combustible liquids

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 34 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 34
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 2-5-1
I. GENERAL REQUIREMENTS FOR OUTSIDE STORAGE	
A. CFC Section 3404.4 regulates containers and portable tanks	
1. Vessels intended to be temporarily transported on a vehicle	
B. A fire code permit must be obtained to store[1]	
1. 10 gallons of flammable liquids	
2. 60 gallons of combustible liquids	
C. Plastic containers shall not be used to store Class I or Class II liquids unless listed for such uses	
D. Tank cars and tank vehicles shall not be used as storage tanks	
E. Plans shall be submitted when more than 5,000 gallons of liquid are stored in drums or tanks	
	SLIDE: 2-5-2
II. LOCATION ON PROPERTY[2]	
A. Amount of liquids is limited as to	
1. Maximum of liquid per pile	
a) A pile is several containers, drums, etc. stored together	
2. Minimum distance between pile	
3. Minimum distance to property lines	
4. Minimum distance to a public way	
B. Fire apparatus access roads shall be provided in accordance with Chapter 5	
	SLIDE: 2-5-3
III. STORAGE ADJACENT TO BUILDINGS	
A. Up to 1,100 gallons of liquids in containers and tanks can be stored adjacent to a building if	
1. The building is one story with noncombustible exterior walls and used for liquid storage	

PRESENTATION	APPLICATION
2. The building wall adjacent to the outdoor storage is at least a 2-hour rated wall with no openings	
	SLIDE: 2-5-4
IV. SPILL CONTROL AND SECONDARY CONTAINMENT	
A. Containers generally must be placed on approved containment pallets	
B. Portable tanks may require other secondary containment per CFC Section 3403.4	
	SLIDE: 2-5-5
V. OTHER CONSIDERATIONS	
A. Storage areas must be protected against trespassing	
B. Guard posts must be installed when storage tanks can be struck by vehicles	
C. Storage areas shall be kept free of weeds and debris	
D. Empty tanks and containers shall be stored as required for filled tanks and containers	
E. Portable tanks temporarily abandoned shall have all openings plugged, except vent lines	
VI. ABANDONMENT AND STATUS OF TANKS	
	SLIDE: 2-5-6
A. Underground tanks	
1. Temporarily out-of-service[3]	
a) Fill lines, gage opening, vapor return, and pump connections secured against tampering	
b) Vent lines shall remain open and maintained	

PRESENTATION	APPLICATION
	SLIDE: 2-5-7
2. Out-of-service for 90 days[4]	
a) Flammable and combustible liquids shall be removed	
b) Fill lines, gage opening, vapor return, and pump connections shall be capped and secured from tampering	
c) Vent lines shall be open and maintained	
	SLIDE: 2-5-8
3. Out-of-service for one year[5]	
a) Tanks shall be removed from the ground and the site restored	
b) Fire Chief may determine that tanks can be abandoned-in-place	
1) Filled with sand	
2) Filled with concrete slurry	
	SLIDE: 2-5-9
B. Aboveground tanks	
1. Temporarily out-of-service[6]	
a) All connecting lines isolated from the tank and secured against tampering	
2. Out-of-service for 90 days[7]	
a) Same requirements as underground tanks out-of-service for 90 days	
b) Or removed and disposed per relevant regulations	
3. Out-of-service for one year[8]	
a) Shall be removed	
b) Exceptions	
1) Tanks at refineries, bulk plants, and terminals that are in operation	

PRESENTATION	APPLICATION

SLIDE: 2-5-10

VII. OUTSIDE STORAGE

A. General[9]

1. Portable tanks, containers, and equipment used for storage shall be of an approved type per national standards

B. Tanks[10]

1. Cannot use tank cars and tank vehicles as storage tanks

SLIDE: 2-5-11

C. Container and portable tanks (less than 660 gallons)

1. Shall be situated in locations stipulated in CFC Table 3404.4.2
2. Secondary containment and spill control required
   a) Installed per CFC Chapter 34
3. Storage areas shall be protected against tampering by fencing or other approved methods
4. Storage areas shall be protected from vehicular damage
5. Clearance from combustibles
   a) Areas shall be kept free of all combustible materials including weeds
      1) For an area of at least 15 feet around the storage area
6. Empty tanks and containers
   a) Treated the same unless free from explosive vapors

Summary:

Outside storage of flammable and combustible liquids poses not only a significant fire risk to the occupancy, but also to surrounding businesses. A working knowledge of safe storage practices will help to minimize the risk. Storage near properly lines, adjacent to buildings and other situations must be evaluated using the requirements outlined in CFC Chapter 34. With this knowledge, you can effectively evaluate outside storage of flammable and combustible liquids.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 34 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10 in order to prepare you for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Appendix Chapter 1, Section 105
[2] California Fire Code, CBSC, 2007 Edition, Table 3404.4.2
[3] California Fire Code, CBSC, 2007 Edition, Section 3404.2.13.1.1
[4] California Fire Code, CBSC, 2007 Edition, Section 3404.2.13.1.2
[5] California Fire Code, CBSC, 2007 Edition, Section 3404.2.13.1.3
[6] California Fire Code, CBSC, 2007 Edition, Section 3404.2.13.2.1
[7] California Fire Code, CBSC, 2007 Edition, Section 3404.2.13.2.2
[8] California Fire Code, CBSC, 2007 Edition, Section 3403.2.13.2.3
[9] California Fire Code, CBSC, 2007 Edition, Section 3404.4
[10] California Fire Code, CBSC, 2007 Edition, Section 3404.2.2

Topic: 2-6: Dispensing, Using, Mixing, And Handling Flammable And Combustible Liquids

Time Frame: 1:30

Level of Instruction: Level II

Authority: 1998 NFPA 1031: Sections 3-3.12, 4-3.4, and 5-3.8

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of dispensing, using, mixing, and handling flammable and combustible liquids

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 34, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 19-29

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Group Activity 2-6-1: Write 'Em Up

References:

- California Fire Code, CBSC, 2007 Edition, Chapters 27 and 34
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
I. DANGERS OF DISPENSING AND TRANSFERRING FLAMMABLE LIQUIDS	
A. Noncompliance with local and national codes	**SLIDE: 2-6-1**
B. Factors contributing to dangers	
1. Improper methods of transferring	What methods of transferring are prohibited?
a) Gravity	
b) Electrical pumping	
2. Improper or nonexistent bonding/grounding	
3. Dispensing into improper containers	
a) Open containers	
b) Leaks	
c) Spills	
d) Lack of proper ventilation of flammable vapors	
4. Mixing operations	
a) Incompatible products	
b) Lack of proper ventilation of flammable vapors	
5. Structural considerations	
a) Product flowing into drains	
b) Electrical ignition sources through noncompliant wiring or machinery	
II. HOUSEKEEPING	**SLIDE: 2-6-2**
A. Clean up spills immediately	
1. Never use flammable liquids for cleaning	
2. Use drip pans, sand, and absorbents	
3. Use strong alkali and nonflammable solvents	

PRESENTATION	APPLICATION
B. Separate incompatible materials C. Properly dispose of rags and absorbents **III. OTHER CONSIDERATIONS**	
	SLIDE: 2-6-3
A. Venting 1. Must be present and unclogged 2. Must be of adequate size to relieve excess pressures 3. Must have a flame arrester if required	
	SLIDE: 2-6-4
B. Piping 1. Listed for the use 2. Well supported 3. Protected from corrosion 4. Protected from vehicles, including forklifts 5. Valves in proper position 6. Maintained safety devices a) Overfill b) Excess-flow valves 7. Controlled heat sources a) Smoking/matches b) Static charges c) Electrical machinery d) Heating	
	What is the approved method of transferring a liquid?
IV. TRANSFERRING CLASS I, II, AND III-A LIQUIDS A. All piping and hoses shall be approved or listed for transfer operations	

PRESENTATION	APPLICATION
	SLIDE: 2-6-5
B. Pumps[1] 1. Only positive displacement pumps with pressure relief devices 2. Advantages a) Flow can easily be controlled b) Inadvertent flow is minimized c) Are usually powered by air	
	SLIDE: 2-6-6
C. Pressurized systems[2] 1. Can only use inert gases to pressurize transfer processes a) Cannot use air or oxygen 2. Must use tanks and piping rated to withstand the maximum pressures produced	
	SLIDE: 2-6-7
D. Gravity-forced transfers[3] 1. May only be used if an approved self-closing device is used a) Self-closing devices are frequently blocked open 2. Spill control and secondary containment provided in accordance with 3403.4	
	SLIDE: 2-6-8
E. Class I, II and III liquid transfers[4] 1. From safety cans complying with UL 30 2. Through an approved closed piping system 3. From an approved pump with the suction fitting on top of the container 4. Approved engineering transfer systems	

PRESENTATION	APPLICATION
5. Class IB, IC, II and III liquids, from containers or tanks by gravity when in accordance with Section 3403.4	
F. Bonding/grounding[5]	
	When is bonding/grounding required?
1. Required when transferring Class I liquids or liquids above their flash point	
	SLIDE: 2-6-9
2. Bonding	
a) Electrical wiring connecting vessels used in transferring liquids	
b) Relieves static electricity caused by friction generated when moving the liquid	
c) Nozzle and vessel must be electrically interconnected	
	SLIDE: 2-6-10
3. Grounding	
a) Electrical wiring and rod connecting vessel and earth	
	SLIDE: 2-6-11
G. Types of vessels	
1. Glass	
	Is a glass vessel permitted?
a) Prohibited except under specific conditions	
b) Very small quantities	
2. Plastic	
	Is a plastic vessel allowed?
a) Allowed under specific conditions	

PRESENTATION	APPLICATION
b) Small vessels only c) Must be UL and SFM approved containers	
	SLIDE: 2-6-12
V. USING, DISPENSING, AND MIXING INSIDE OF BUILDINGS[6] A. Containers used for mixing Class I liquids shall be provided with self-closing, tight-fitting lids that will control a fire within the container B. Class I liquid containers shall be electrically interconnected by bond wires, ground cables, or other means to prevent static electricity charges C. Cannot use heating, lighting, or cooking appliances using Class I liquids inside of a building 1. Except in single-family dwellings D. Quantity limits are for using, dispensing, and mixing[7] 1. Maximum Allowable Quantities can be increased through the use of control rooms and automatic fire sprinkler systems 2. For most occupancies, the amount used, dispensed, or mixed can only be used for maintenance purposes, demonstration, treatment, or laboratory uses[8]	
	SLIDE: 2-6-13
E. Requirements to exceed the Maximum Allowable Quantities[9] 1. General requirements a) Room must be classified and constructed as a Group H, Division 2 or 3 occupancy b) Must have an approved automatic fire-extinguishing system c) Doors must be self-closing and fire resistive according to the CBC	

PRESENTATION	APPLICATION
	SLIDE: 2-6-14
2. Open systems[10] a) A process that can allow liquid or vapor to escape to the atmosphere b) Must be equipped with ventilation ensuring at least 1 cfm over entire floor area, including pits c) Spot ventilation required to prevent dangerous accumulations of flammable vapors d) Explosion control required if explosive vapor-air mixtures can be produced e) Spill control and secondary containment may be required	
	SLIDE: 2-6-15
3. Closed systems[11] a) A process that will not allow liquid or vapor to escape to the atmosphere under normal circumstances b) If the system is designed to be opened during normal operations, room must be ventilated as in open systems c) Explosion control required if explosive air-vapor mixtures are developed d) Spill control and secondary containment may be required	
	SLIDE: 2-6-16
VI. USING, DISPENSING, AND MIXING OUTSIDE OF BUILDINGS[12] A. Spill control and secondary containment shall be required B. Dispensing activities shall <u>not</u> be conducted 1. Within 15 feet of buildings	

PRESENTATION	APPLICATION
2. Within 25 feet of building openings, property lines, or public ways 3. Within 15 feet of storage of Class I, II, or III liquids a) Unless those liquids are stored in tanks listed and labeled as 2-hour protected tank assemblies 4. Above requirements only apply if amounts exceed the Maximum Allowable Quantities listed in Table 3405.3.8.2.	**ACTIVITY 2-6-1:** Complete the activity in the student supplement.

Summary:

Proper use, dispensing, and handling of flammable and combustible liquids are a critical fire and life safety requirement. Through proper application of the CFC, the occurrence of fires involving dispensing, use, mixing, and handling of flammable and combustible liquids can be greatly reduced.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapters 27 and 34, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 19-29 in order to prepare yourself for the upcoming test. Study for our next session.

GROUP ACTIVITY 2-6-1: WRITE 'EM UP!

Time Frame:	0:30
Materials Needed:	• California Fire Code, CBSC, 2007 Edition, Chapter 34 • Paper • Pen or pencil
Introduction:	This activity provides the students in a common scenario the opportunity to apply CFC Chapter 34 to a factual situation.
Directions:	1. Working in groups, read the scenario. 2. Answer the questions for each hint and list them on a separate sheet of paper. 3. Using the answers from the hints, determine at least three violations. 4. Find the code section in CFC Article 79 that prohibits the activities and record them. 5. List the corrective action(s) necessary for each violation. 6. You have 20 minutes to complete this activity. 7. Be prepared to discuss your findings with the class.

You go to ACME Automotive Paint Company to conduct a routine inspection. While conducting the inspection, you observe 1,000 gallons, in 5-gallon containers, of acrylic enamel reducer on display in the showroom of the store, along with 1,100 gallons of enamel paint in 1-gallon cans. In addition, stored on 8-foot wood shelves in the sales area, you find 1,500 gallons of lacquer retarder in 1- and 5-gallon metal cans. The exit door has cans of paint stored on both sides.

In a small outbuilding, you find a 55-gallon drum positioned on its side. It has a quarter-turn valve on a spigot and is used to fill 1- and 5-gallon cans with a gun cleaner for customers.

The building is Type III construction and a 25,000 square foot mercantile, with a sprinkler system with a discharge rate of 0.16 gpm/2,500 square feet. (Ordinary Hazard, Group 1)

HINT #1

What is the class of each material stored?

Acrylic enamel reducer:	**I-B**
Enamel paint:	**II**
Lacquer retarder:	**II**
Gun cleaner	**III-A**

Hint #2

What is the maximum quantity of each class allowed in a mercantile?

CFC Table 3404.3.4.1

Class I-B	
Class II	**Combined quantity of 1,600 gallons.**
Class III-A	

Footnote b: This building is not considered to be sprinklered due to design densities.

Column 2 does not apply because the sprinkler density is not high enough

Hint #3

Are the materials stored in accordance with the code?

CFC Section 3404.3.6.3

Storage height must not exceed 4 feet in unsprinklered buildings. (Table 3404.3.6.3(1))

Storage on shelves must not exceed 6 feet in height, and must be made of metal.

CFC Section 3404.3.3.3

Storage of any liquids, including stock for sale shall not be stored near a means of egress.

CFC Table 3404.3.6.3(2)

Excess storage height in sales area.

Hint #4

Is the dispensing of materials in accordance with the code?

> **CFC Section 3405.2.4**
>
> **Class I-B, I-C, II, and III-A liquids filled by gravity must be fitted with a self- or automatic-closing valve and be provided with a secondary containment.**

Answers

The following are possible violations the students may find. Many more possibilities must be considered. Chapter 27 may be considered as well.

- ❑ **Maximum materials stored for display must not exceed 1600 gallons. (CFC Table 3404.3.4.1)**
- ❑ **Flammable and combustible liquids must not be stored in the means of egress. (CFC Section 3404.3.3.3)**
- ❑ **Flammable and combustible liquids must not be stored on shelves exceeding 6 feet. (CFC Section 3404.3.6.3.)**
- ❑ **The tank used for dispensing the gun cleaner must be equipped with a self- or automatic-closing valve (CFC Section 3405.2.4)**
- ❑ **The filling area must be provided with spill control and secondary containment. (CFC Section 3405.2.4)**

SHERWIN-WILLIAMS --R7K211 ACRYLIC ENAMEL REDUCER

MATERIAL SAFETY DATA SHEET

NSN: 801000F024427
Manufacturer's CAGE: 54636
Part No. Indicator: A
Part Number/Trade Name: R7K211 ACRYLIC ENAMEL REDUCER

GENERAL INFORMATION

Company's Name: SHERWIN-WILLIAMS CO
Company's Street: 101 PROSPECT AVE N W
Company's City: CLEVELAND
Company's State: OH
Company's Country: US
Company's Zip Code: 44115-1042
Company's Emerg Ph #: (216) 566-2917
Company's Info Ph #: (216) 566-2902
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 002
Status: SE
Date MSDS Prepared: 01APR91
Safety Data Review Date: 12AUG92
Preparer's Company: SHERWIN-WILLIAMS CO
Preparer's St Or P. 0. Box: 101 PROSPECT AVE N W
Preparer's City: CLEVELAND
Preparer's State: OH
Preparer's Zip Code: 44115-1042
MSDS Serial Number: BNXPQ

INGREDIENTS/IDENTITY INFORMATION

Proprietary: NO
Ingredient: WEIGHT PER GALLON IN POUNDS: 6.74
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: 9999999WG

Proprietary: NO
Ingredient: TOTAL VOC LESS WATER & EXEMPT SOLVENTS: 6.74
Ingredient Sequence Number: 02
NIOSH (RTECS) Number: 9999999VO

Proprietary: NO
Ingredient: LIGHT ALIPHATIC NAPHTHA, VM & P NAPHTHA *92/2*
Ingredient Sequence Number: 03
Percent: 26%
NIOSH (RTECS) Number: 1002250AN
CAS Number: 64742-89-8
OSHA PEL: 300 PPM
ACGIH TLV: 300 PPM

Proprietary: NO
Ingredient: TOLUENE
Ingredient Sequence Number: 04
Percent: 47%
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM/150 STEL
ACGIH TLV: 50 PPM; 9293
Other Recommended Limit: 375 MG/CUM

Proprietary: NO
Ingredient: XYLENE, DIMETHYLBENZENE, XYLOL
Ingredient Sequence Number: 05
Percent: 6%
NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
OSHA PEL: 100 PPM
ACGIH TLV: 100 PPM, SKIN
Other Recommended Limit: 100 PPM

Proprietary: NO
Ingredient: SOLVENT NAPHTHA, PETROLEUM, LIGHT AROMATIC, HIGH FLASH AROMATIC NAPHTHA
Ingredient Sequence Number: 06
Percent: 3%
NIOSH (RTECS) Number: WF3400000
CAS Number: 64742-95-6

Proprietary: NO
Ingredient: SOLVENT NAPHTHA, HEAVY AROMATIC NAPHTHA
Ingredient Sequence Number: 07
Percent: 3%
NIOSH (RTECS) Number: WF3100000
CAS Number: 64742-94-5

Proprietary: NO
Ingredient: ACETONE; DIMETHYL KETONE
Ingredient Sequence Number: 08
Percent: 15%
NIOSH (RTECS) Number: AL3150000
CAS Number: 67-64-1
OSHA PEL: 1000PPM
ACGIH TLV: 750PPM/1000STEL;9293

PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: 130F
Vapor Density (Air=l): >AIR
Specific Gravity: 0.79-0.87
Evaporation Rate And Ref: SLOWER THAN ETHER
Percent Volatiles By Volume: 100%

FIRE AND EXPLOSION HAZARD DATA

Flash Point: 9F
Lower Explosive Limit: 0.7%
Upper Explosive Limit: 6.7%
Extinguishing Media: CO2, DRY CHEMICAL & FOAM
Special Fire Fighting Proc: USE SELF-CONTAINED BREATHING APPARATUS. WATER SPRAY MAY BE INEFFECTIVE. IF WATER IS USED, FOG NOZZLES ARE PREFERABLE. USE WATER USED TO COOL CLOSED CONTAINERS.
Unusual Fire And Expl Hazrds: KEEP CONTAINERS TIGHTLY CLOSED. CLOSED CONTAINERS MAY BUILD-UP PRESSURE, EXPLODE OR AUTOIGNITE WHEN EXPOSED TO EXTREME HEAT. FLAMMABLE.

REACTIVITY DATA

Stability: YES
Cond To Avoid (stability): HEAT, ELECTRICAL EQUIPMENT, SPARKS, OPEN FLAME, PILOT LIGHTS & OTHER IGNITION SOURCES
Hazardous Decomp Products: CO2, CO
Hazardous Poly Occur: NO

HEALTH HAZARD DATA

Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES

SHERWIN-WILLIAMS -- B54B11 BLACK, INDUSTRIAL PAINT

MATERIAL SAFETY DATA SHEET

ACGIH TLV: 3.5 MG/M3; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: VOLATILE ORGANIC COMPOUNDS = 3.89 LBS/GAL
Ingredient Sequence Number: 04
Percent: 3.89LB/
NIOSH (RTECS) Number: 9999999VO
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

PHYSICAL/CHEMICAL CHARACTERISTICS

Appearance And Odor: BLACK PAINT
Boiling Point: 284F,140C
Vapor Density (Air=l): >AIR
Specific Gravity: 0.96-1.14
Evaporation Rate And Ref: SLOWER THAN ETHER
Percent Volatiles By Volume: >40

FIRE AND EXPLOSION HAZARD DATA

Flash Point: 101F,38C
Flash Point Method: PMCC
Lower Explosive Limit: 1.0%
Upper Explosive Limit: 6.0
Extinguishing Media: CO2, DRY CHEMICAL, FOAM
Special Fire Fighting Proc: FIRE FIGHTERS SHOULD WEAR PROTECTIVE CLOTHING AND SELF-CONTAINED BREATHING APPARATUS.
Unusual Fire And Expl Hazrds: KEEP CONTAINERS TIGHTLY CLOSED. ISOLATE FROM HEAT, ELECTRICAL EQUIPMENT, SPARKS, & OPEN FLAME. APPLICATION TO HOT SURFACES REQUIRES SPECIAL PRECAUTIONS.

REACTIVITY DATA

Stability: YES
Cond To Avoid (Stability): KEEP AWAY FROM HEAT, SPARKS, OPEN FLAME, ELECTRICAL EQUIPMENT, & HOT SURFACES.
Materials To Avoid: STRONG OXIDIZING AGENTS.
Hazardous Decomp Products: CARBON MONOXIDE AND DIOXIDE, AND METAL OXIDES
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NONE

HEALTH HAZARD DATA

Route Of Entry -Inhalation: YES
Route Of Entry -Skin: YES
Route Of Entry -Ingestion: YES
Health Haz Acute And Chronic: ACUTE-IRRITATION OF EYES, SKIN & RESPIRATORY SYSTEM. MAY CAUSE NERVOUS SYSTEM DEPRESSION. EXTREME EXPOSURE MAY RESULT IN UNCONSCIOUSNESS AND POSSIBLY IN DEATH. CHRONIC MAY CAUSE DAMAGE TO LIVER, KIDNEY, BLOOD FORMING AND REPRODUCTIVE SYSTEM.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: RATS EXPOSED TO TITANIUM DIOXIDE DUST 250 MG/M3 DEVELOPED CANCER.
Signs/Symptoms Of Overexp: HEADACHE, DIZZINESS, NAUSEA/LOSS OF REDNESS/ITCHING/BURNING SENSATION. REPEATED/PROLONGED OVEREXPOSURE TO SOLVENTS CAUSES PERMANENT BRAIN/NERVOUS SYSTEM DAMAGE/ADVERSE AFFECTS TO THE LIVER, URINARY, & REPRODUCTIVE SYSTEMS.
Med Cond Aggravated By Exp: ALLERGIC SKIN REACTION
Emergency/First Aid Proc: INHALATION: REMOVE TO FRESH AIR, PROVIDE CPR/

STERLING LACQUER MFG --U-2707; SLOW RETARDER -LACQUER RETARDER
MATERIAL SAFETY DATA SHEET
NSN: 801000DO04796
Manufacturer's CAGE: 60003
Part No. Indicator: A Part Number/Trade Name: U-2707; SLOW RETARDER

GENERAL INFORMATION

Item Name: LACQUER RETARDER
Company's Name: STERLING LACQUER MFG. CO. INC.
Company's Street: 3150 BRANNON AVE.
Company's City: ST. LOUIS
Company's State: MO
Company's Country: US
Company's Zip Code: 63139
Company's Emerg Ph #: 314-776-4450
Company's Info Ph #: 314-776-4450
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 01JUN93
Safety Data Review Date: 22APR96
Supply Item Manager: CX
MSDS Preparer's Name: P.D.MOORE
MSDS Serial Number: BYTGY
Specification Number: NONE
Spec Type, Grade, Class: NONE
Hazard Characteristic Code: F4
Unit Of Issue: NK
Unit Of Issue Container Qty: UNKNOWN
Type Of Container: UNKNOWN
Net Unit Weight: UNKNOWN

INGREDIENTS/IDENTITY INFORMATION

Proprietary: NO
Ingredient: PROPYLENE GLYCOL MONOMETHYL ETHER ACETATE
Ingredient Sequence Number: 01
Percent: 3.7
NIOSH (RTECS) Number: AI8295000
CAS Number: 108-65-6
OSHA PEL: NOT ESTABLISHED.
ACGIH TLV: NOT ESTABLISHED.
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: VOLATILE ORGANIC CONTENT=967 G/L
Ingredient Sequence Number: 02
NIOSH (RTECS) Number: 9999999VO
CAS Number: UNKNOWN
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

PHYSICAL/CHEMICAL CHARACTERISTICS

Appearance And Odor: LIQUID; CLAR; SOLVENT ODOR.
Boiling Point: 302F, 150C
Vapor Density (Air=l): >1
Specific Gravity: 1
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref:

PRODUCT DESCRIPTION:
Sherwin-Williams® Paint Gun Cleaner is a powerful, non-hazardous paint and coating remover that is completely biodegradable and worker friendly. The cleaner is safe for use on most: substrates including: steel, aluminum, chrome, alloys, composites and paint brushes. Cleans paint from spray equipment, and is an effective dip tank solution, this cleaner is also excellent for concrete, removing grease, tar and other stains from garage floors.

TECHNICAL DATA:

Weight Solids:	12% (dissolved solids)
Volume Solids:	4% (dissolved)
VOC	215g/l(1.793lbs/gal)
Shelf Life:	1 year
Mixing Ratio:	Use at packaged consistency
Flash Point:	>80°C (>176F)
Freeze Hazard:	0C (32F)
Boiling Point	~100°C (212F)
Viscosity (cPs)	5-154 (5-15 cPs)

APPLICATION:

Spray Gun Equipment
1. Fill paint reservoir with Gun Cleaner.
2. Immediately spray cleaner through equipment into an appropriate receptacle until gun is cleaned and empty.
3. Thoroughly rinse/purge equipment and lines with thinner/solvent to remove any cleaner residue.

Dip Tank Solution
1. Fully submerge all parts to be cleaned. Use an appropriate container such as a high density polyethylene (HDPE) container. The original 5 gallon pail or 1 gallon bucket works well.
2. Let parts soak. Check repeatedly, 2 hours maximum.
3. Once paint has softened, scrape off and wash thoroughly.

NOTES:
1. Use a sponge or soft brush to remove softened surface paint if needed.
2. Avoid lower temperatures. Optimum working temperature is 85-115°.
3. Gun Cleaner may be re-used/reconstituted many times.
4. To minimize evaporation close/reseal Gun Cleaner after use.

 AS2468
Warrensville Heights, OH 44128

99a

— Section 1 —
Product Identification

WESTERN® Automotive Finishes®

Material Safety Data Sheet

Western Automotive Finishes
101 Prospect Ave. N.W.
Cleveland, OH 44115

Emergency telephone number (216) 566-2917
Information telephone number (216) 566-2902
Date of preparation August 2, 1999

HI-GLO® Synthetic Enamel Mixing Colors

W800/W4

— Section 2 —

CAS No.	Hazardous Ingredients (percent by weight)	ACGIH TLV <STEL>	OSHA PEL <STEL>	Units	Vapor Pressure (mm Hg)	W857 Aegean Blue	W860 Green	W862 Permanent Green	W880 Basecoat Fixe	W882 Brit. White Pearl	W883 Brit. Bronze Pearl	W884 Brit. Russet Pearl	W885 Blue Pearl Mica	W886 Carbazole Violet	W887 Deep Maroon	W890 Drier	W895 Polymeric Clear
64742-89-8	V. M. & P. Naphtha.	300	300 <400>	PPM	12.0	19	18	22						13	14		16
64742-88-7	Mineral Spirits.	100	100	PPM	2.0	29	29	28	8					30	28	93	31
108-88-3 §	Toluene.	50	100 <150>	PPM (Skin)	22.0	6	6	6	2	2	2	2	2	6	6		6
100-41-4 §	Ethylbenzene	100 <125>	100 <125>	PPM	7.1				8	5	5	5	5				
1330-20-7 §	Xylene.	100 <150>	100 <150>	PPM	5.9				46	31	31	31	31	1			
108-67-8 §	1,3,5-Trimethylbenzene	25	25	PPM	10.0									1			
95-63-6	1,2,4-Trimethylbenzene	25	25	PPM	2.0					1	1	1	1	2			
123-86-4	n-Butyl Acetate.	150 <200>	150 <200>	PPM	10.0	4	4	4	21					4	4		3
97-85-8	Isobutyl Isobutyrate.	Not Established			3.2					2	2	2	2				
136-52-7	Cobalt 2-Ethylhexanoate.	Not Established														1	
Unknown	Coated Mica.	3	3	Mg/M3 as Dust						20	20	20	20				
§	Manganese Compound [% Manganese]															2 [0.2]	
§	Cobalt Compound. [% Cobalt]															1 [0.2]	
	Weight per Gallon (lbs.)					7.49	7.52	7.45	7.52	9.29	9.33	9.37	9.30	7.53	7.68	6.51	7.45
	VOC (Volatile Organic Compounds) Total - lbs./gal.					4.39	4.37	4.48	6.35	4.01	4.02	4.05	4.01	4.40	4.25	6.09	4.35
	VOC Less Water & Federally Exempt Solvents - lbs./gal.					4.39	4.37	4.48	6.35	4.01	4.02	4.05	4.01	4.40	4.25	6.09	4.35
	Photochemically Reactive					No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
	Flash Point (°F)					72	72	72	77	45	45	45	40	72	72	105	72
	DOL Storage Category					1B	1B	1B	1C	1B	1B	1B	1B	1B	1B	2	1B
	Flammability Classification (Flammable - Combustible)					Flam.	Flam.	Flam.	Flam.	Flam.	Flam.	Flam.	Flam.	Flam.	Flam.	Comb.	Flam.
	HMIS (NFPA) Rating (health - flammability - reactivity)					2 - 3 - 0	2 - 3 - 0	2 - 3 - 0	2 - 3 - 0	2 - 3 - 0	2 - 3 - 0	2 - 3 - 0	2 - 3 - 0	3 - 3 - 0	2 - 3 - 0	2* - 2 - 0	2 - 3 - 0
	PAINT-SAFE® Personal Protection					J3	J3	J3	J3	J3	J3	J3	J3	J3	J3	J3	J3

PERCENT BY WEIGHT

§ Ingredient subject to the reporting requirements of the Superfund Amendments and Reauthorization Act (SARA) Section 313, 40 CFR 372.65 C

→→→ *MSDS Text Page Follows* →→→

SECTION 3 - PHYSICAL DATA

PRODUCT WEIGHT	See TABLE	EVAPORATION RATE	Slower than Ether
SPECIFIC GRAVITY	0.89-1.25	VAPOR DENSITY	Heavier than Air
BOILING RANGE	222-395°F	MELTING POINT	N.A.
VOLATILE VOLUME	55-95%	SOLUBILITY IN WATER	N.A.

SECTION 4 - FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION See TABLE FLASH POINT See TABLE LEL 0.7 UEL 13.1

EXTINGUISHING MEDIA

Carbon Dioxide, Dry Chemical, Foam

UNUSUAL FIRE AND EXPLOSION HAZARDS

Keep containers tightly closed. Isolate from heat, electrical equipment, sparks, and open flame. Closed containers may explode when exposed to extreme heat. Application to hot surfaces requires special precautions. During emergency conditions, overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent.

SPECIAL FIRE FIGHTING PROCEDURES

Full protective equipment including self-contained breathing apparatus should be used. Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat.

SECTION 5 - HEALTH HAZARD DATA

ROUTES OF EXPOSURE

Exposure may be by INHALATION and/or SKIN or EYE contact, depending on conditions of use. To minimize exposure, follow recommendations for proper use, ventilation, and personal protective equipment.

ACUTE HEALTH HAZARDS

EFFECTS OF OVEREXPOSURE

Irritation of eyes, skin, and respiratory system. May cause nervous system depression. Extreme overexposure may result in unconsciousness and possibly death.

Certain colors contain Lead (See TABLE and PRODUCT LABEL). Acute occupational exposure to Lead is uncommon, but results in effects and symptoms similar to chronic overexposure described below.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

Headache, dizziness, nausea, and loss of coordination are indications of excessive exposure to vapors or spray mists.

Redness and itching or burning sensation may indicate eye or excessive skin exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

None generally recognized.

EMERGENCY AND FIRST AID PROCEDURES

If INHALED: If affected, remove from exposure. Restore breathing. Keep warm and quiet.

If on SKIN: Wash affected area thoroughly with soap and water. Remove contaminated clothing and launder before re-use.

If in EYES: Flush eyes with large amounts of water for 15 minutes. Get medical attention.

If SWALLOWED: W880 & W890 => Never give anything by mouth to an unconscious person. DO NOT INDUCE VOMITING. Give conscious patient several glasses of water. Seek medical attention.

Other Products => Get medical attention.

CHRONIC HEALTH HAZARDS

Certain colors contain Lead and/or Chromates (See TABLE and PRODUCT LABEL).

Chronic overexposure to Lead may result in damage to the blood-forming nervous, urinary, and reproductive systems (including embryotoxic effects). Symptoms include abdominal discomfort or pain, constipation, loss of appetite, metallic taste, nauseam, insomnia, nervous irritability, weakness, muscle and joint pains, headache, and dizziness.

Chromates are listed by IARC and NTP. Although studies have associated exposure to Chromium VI compounds with an increased risk of respiratory cancer, available evidence indicates that Lead Chromate (Chrome Yellow, Molybdate Orange) DOES NOT present this hazard.

Carbon Black is classified by IARC as possibly carcinogenic to humans (group 2B) based on experimental animal data, however, there is insufficient evidence in humans for its carcinogenicity.

Cobalt and cobalt compounds are classified by IARC as possibly carcinogenic to humans (group 2B) based on experimental animal data, however, there is inadequate evidence in humans for its carcinogenicity.

Prolonged overexposure to solvent ingredients in listed products, except W890, may cause adverse effects to the liver, urinary, blood forming, cardiovascular and reproductive systems. Prolonged overexposure to solvent ingredients in W890 may cause adverse effects to the liver and urinary systems.

Rats exposed to titanium dioxide dust at 250 mg./m3 developed lung cancer, however, such exposure levels are not attainable in the workplace.
Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage.

SECTION 6 - REACTIVITY DATA

STABILITY -- Stable
INCOMPATIBILITY
Metallics contain Aluminum. Contamination with Water, Acids, or Alkalis can cause evolution of hydrogen, which may result in dangerously increased pressures in closed containers.
CONDITIONS TO AVOID
None known.
HAZARDOUS DECOMPOSITION PRODUCTS
By fire, Carbon Dioxide, Carbon Monoxide, Oxides of Metals in Section 2.
HAZARDOUS POLYMERIZATION
Will Not Occur

SECTION 7 - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Remove all sources of ignition. Ventilate and remove with inert absorbent.
WASTE DISPOSAL METHOD
Waste from these products may be hazardous as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Waste must be tested for ignitability to determine the applicable EPA hazardous waste number. Waste from products containing Lead or Chromium must also be tested for extractability.
Incinerate in approved facility. Do not incinerate closed container. Dispose of in accordance with Federal, State, and Local regulations regarding pollution.

SECTION 8 - PROTECTION INFORMATION

PRECAUTIONS TO BE TAKEN IN USE
Certain colors contain Lead (See TABLE and PRODUCT LABEL). Before initial use of Lead-containing colors, consult OSHA's standard for occupational Exposure to Lead (29 CFR 1910.1025).
Use only with adequate ventilation. Avoid breathing vapor and spray mist. Avoid contact with skin and eyes. Wash hands after using.
These products may contain materials classified as nuisance particulates (listed "as Dust" in Section 2) that may be present at hazardous levels only during sanding or abrading of the dried film. If no specific dusts are listed in Section 2, the applicable limits for nuisance dusts are ACGIH TLV 10 mg./m3 (total dust), 3 mg./m3 (respirable fraction), OSHA PEL 15 mg./m3 (total dust), 5 mg./m3 (respirable fraction).
VENTILATION
Local exhaust preferable. General exhaust acceptable if the exposure to materials in Section 2 is maintained below applicable exposure limits. Refer to OSHA Standards 1910.94, 1910.107, 1910.108.
RESPIRATORY PROTECTION
If personal exposure cannot be controlled below applicable limits by ventilation, wear a properly fitted organic vapor/particulate respirator approved by NIOSH/MSHA for protection against materials in Section 2.
When sanding, wirebrushing, abrading, burning, or welding the dried film, wear a particulate respirator approved by NIOSH/MSHA for protection against non-volatile materials in Section 2.
PROTECTIVE GLOVES
Wear gloves that are recommended by glove supplier for protection against materials in Section 2.
EYE PROTECTION
Wear safety spectacles with unperforated sideshields.

SECTION 9 - PRECAUTIONS

DOL STORAGE CATEGORY -- See TABLE
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Keep away from heat, sparks, and open flame. During use and until all vapors are gone: Keep area ventilated - Do not smoke - Extinguish all flames, pilot lights, and heaters - Turn off stoves, electric tools and appliances, and any other sources of ignition.
Consult NFPA Code. Use approved Bonding and Grounding procedures.
Keep container closed when not in use. Transfer only to approved containers with complete and appropriate labeling. Do not take internally. Keep out of the reach of children.
OTHER PRECAUTIONS
Certain colors contain Lead and/or Cadmium (See TABLE and PRODUCT LABEL) .Do not apply Lead-containing colors on toys and other children's articles, furniture, or any interior surface of a dwelling or facility which may be occupied or used by children. Do not

apply on any exterior surface of dwelling units, such as windowsills, porches, stairs, or railings to which children may be commonly exposed.
Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

SECTION 10 - OTHER REGULATORY INFORMATION

CALIFORNIA PROPOSITION 65
WARNING: These products, except W890, contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.
TSCA CERTIFICATION
All chemicals in these products are listed, or are exempt from listing, on the TSCA Inventory.
The above information pertains to these products as currently formulated, and is based on the information available at this time. Addition of reducers or other additives to this product may substantially alter the composition and hazards of the product. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 3405.2.1
[2] California Fire Code, CBSC, 2007 Edition, Section 3405.2.2
[3] California Fire Code, CBSC, 2007 Edition, Section 3406.2.5.2
[4] California Fire Code, CBSC, 2007 Edition, Section 3405.2.4
[5] California Fire Code, CBSC, 2007 Edition, Section 3405.3.2
[6] California Fire Code, CBSC, 2007 Edition, Section 3405.3
[7] California Fire Code, CBSC, 2007 Edition, Table 2703.1.1(1)
[8] California Fire Code, CBSC, 2007 Edition, 3405.3.5.2
[9] California Fire Code, CBSC, 2007 Edition, Section 3405.3.5.3
[10] California Fire Code, CBSC, 2007 Edition, Section 3405.3.7.5
[11] California Fire Code, CBSC, 2007 Edition, Section 3405.3.7.6
[12] California Fire Code, CBSC, 2007 Edition, Section 3405.3.8

Topic: 2-7: Properties Of Compressed, Cryogenic, And Liquefied Gases

Time Frame: 1:00

Level of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of properties of compressed, cryogenic, and liquefied gases

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapters 30, 32, and 38
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

I. GENERAL PROPERTIES

A. Compressed gases, cryogenics, and liquefied gases can have several hazardous properties

SLIDE: 2-7-1

1. Toxicity
   a) Chlorine
   b) Carbon monoxide
2. Reactivity
   a) Fluorine
   b) Acetylene
3. Poison qualities
   a) Hydrogen cyanide
   b) Hydrogen sulfide
4. Flammability
   a) Methane
   b) Hydrogen
5. Radioactivity
   a) Tritium
   b) Phosphorus isotope

Who has had a recent incident where a leak or spill of these compressed and liquefied gases has occurred?

SLIDE: 2-7-2

II. COMPRESSED GASES[1]

A. Vessel contains no liquid, only a gas at normal temperature (68°F)

1. These gases may or may not be capable of being liquefied at ambient temperatures
2. Volume that can be stored is minimal

PRESENTATION	APPLICATION
B. Pressure is produced by molecular activity of molecules against the containing vessel C. Pressure of a gas in a fixed vessel is dependent upon 1. Amount of gas in the vessel 2. Temperature of the gas	
	SLIDE: 2-7-3
III. CRYOGENIC FLUIDS[2] A. Product is carried at -150°F or lower in a large double-walled vessel 1. Stored far below normal temperatures B. Containers are similar to a thermos bottle C. Both liquid and gas exist at the boiling point of the product 1. Cryogens cannot exist as liquids at ambient temperatures D. Product has been produced by repeated compression-cooling cycles E. Pressures in cryogenic vessels not to exceed 40 psia F. Heat from exterior of vessel continually causes evaporation of the product 1. Venting is essential to prevent vessel rupture a) Cannot remain a cryogen indefinitely b) Pressure in vessel increases due to addition of heat c) Liquid evaporates to a gas when heat is absorbed	
	What do you do if you respond to a venting cryogenic fluid vessel?
2. Do not apply water to the vessel since water is much warmer than the cryogenic	

PRESENTATION	APPLICATION
G. Cryogens expand greatly when vaporized 1. 1 cubic foot of liquid oxygen expands to 861 cubic feet of gaseous oxygen at normal temperature and pressure 2. Liquid oxygen weighs 71 pounds per cubic foot, or 9.4 pounds per gallon 3. Gaseous oxygen weighs 0.08 pound per cubic foot at standard temperature and pressure 4. Gaseous oxygen weighs 0.3 pounds per cubic foot at the boiling point of oxygen (297°F)	**SLIDE: 2-7-4**
IV. LIQUEFIED GASES A. Vessel contains both liquid and gas at ambient temperature B. Pressure is produced by molecular activity of molecules against the containing vessel C. As gas is released or used from the vessel, the liquid phase boils off, creating more gas in the vessel D. Pressure in the vessel is independent of the amount of product in the vessel E. Pressure in the vessel is dependent only on the temperature of the gas F. Examples 1. Liquefied Petroleum Gas (LP-gas)[3] 2. Anhydrous ammonia 3. Carbon dioxide	
G. To liquefy a gas, increase the pressure of the gas	How do you liquefy a gas?

PRESENTATION	APPLICATION

V. COMMON USES FOR AND EXAMPLES OF COMPRESSED AND LIQUEFIED GASES

A. Fuels

1. Produce heat, light, or power

B. Medical

1. Anesthetics and respiratory therapy

C. Industry

1. Welding and cutting, heat treating, laboratory experimentation, chemical processing

SLIDE: 2-7-5

D. Typical compressed, liquefied, and cryogenic gases

1. Compressed
   a) Acetylene (specialized cylinder)
   b) Compressed natural gas (CNG)
   c) Ethylene
2. Liquefied
   a) Anhydrous ammonia
   b) Chlorine
   c) Liquid petroleum gas (LPG)

SLIDE: 2-7-6

3. Cryogenic
   a) Liquid natural gas (LNG)
4. Compressed or cryogenic
   a) Hydrogen
   b) Oxygen
   c) Nitrogen
5. Liquefied or cryogenic
   a) Carbon dioxide
   b) Fluorine

Summary:

Gases may be flammable, or may have other hazardous properties. Regardless of the way they are stored, the inspector must be aware of the properties of gases so they may be regulated properly.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 3002.1
[2] California Fire Code, CBSC, 2007 Edition, Section 3202.1
[3] California Fire Code, CBSC, 2007 Edition, Section 3802.1

Topic: 2-8: Fire Hazards Of Compressed And Liquefied Gases

Time Frame: 1:00

Level of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.12

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of the fire hazards of compressed and liquefied gases.

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 31-32

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audio/visual training aids and devices
- Individual Activity 2-8-1: Hazard Characteristics Of Gases
- "BLEVE" video, NFPA (optional)

References:

- "BLEVE" video, NFPA
- California Fire Code, CBSC, 2007 Edition, Chapters 30, 35, and 38
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

NOTE: Activity may be presented first and lecture used to discuss answers based upon level of audience.

I. PHYSICAL PROPERTIES

SLIDE: 2-8-1

A. Vapor density

1. The weight of a gas compared to the weight of an equal volume of air
2. A vapor density greater than 1.0 will reflect a higher hazard for combustible gases
   a) Vapor density greater than 1 is heavier than air
   b) Lighter than air gasses disperse more easily
   c) Heavier than air gasses may find sources of ignition easier
      1) Water Heater Pilot Lights
      2) Plugs, and other electrical
   d) Natural gas versus LPG
3. Density ranges from 0.1 (hydrogen) to 2.0 (butane) or higher

SLIDE: 2-8-2

B. Flammable limits

1. The upper and lower extremes of vapor concentration that can be ignited
2. Limits vary
   a) Narrow (2%-7%)
   b) Wide (2%-81%)
3. Generally, the wider the flammable range, the more dangerous the gas
   a) Wider range provides more opportunity for an explosion

PRESENTATION	APPLICATION
4. Examples a) Gasoline 1) 1.5%-7.6% b) Methane 1) 5.0%-15%	What common gas has extremely wide flammable limits?
c) Acetylene 1) 2.5%-81% d) Propane 1) 2.0%-10%	**SLIDE: 2-8-3**
C. Ignition temperature 1. The lower the ignition temperature, the greater the hazard 2. Ignition temperatures range from about 190°F (carbon disulfide) to over 600°F	
D. Water solubility 1. Permits absorption of gas into water	Why is it important to know solubility of a gas?
2. Generally, the more soluble, the more easily a cloud or leak is controlled 3. Gases range from insoluble (propane) to highly soluble (ammonia)	**SLIDE: 2-8-4**
II. HEAT SOURCES A. Compressed and liquefied gases are subject to many types of heat sources 1. Open flames a) Pilot lights	

PRESENTATION	APPLICATION
b) Welding torches c) Cooking stoves 2. Sparks a) Welding and cutting b) Metal working operations 3. Friction a) Drive belts b) Tool impact c) Bearing failure 4. Hot surfaces a) Domestic irons b) Steam pipes c) Cooking griddles d) Industrial processes 5. Electrical arcs a) Electrical overload b) Normal operation of electric switches 6. Static electricity a) Contact and separation of conductors 7. Heat of compression a) Adiabatic heating (e.g., compressor pistons)	
1) Process of heating that does not gain or lose heat from an outside source • Heat of compression most common type	What is adiabatic heating?

PRESENTATION	APPLICATION

SLIDE: 2-8-5

III. OTHER CONSIDERATIONS

A. Gases are more dangerous than liquids or solids since they are already dispersed in the air in a form that will burn

1. Ignition of a gas will usually result in explosive ignition

B. Sudden release of pressurized liquids to atmospheric pressure will cause a violent reaction called a BLEVE

1. Boiling liquid expanding vapor explosion
2. Causes of container failure
   a) Excessive pressure inside a container
      1) Causes the container to explode and rupture
   b) Inadequate venting to allow vapors to escape and burn at the vents
   c) Steel in the vapor space is softened by heat and fails

NOTE: Show "BLEVE" video (optional).

C. The best way to minimize the fire and explosion hazard of compressed and liquefied gases is to prevent the formation of flammable mixtures of these gases

1. Accomplished by ventilation
2. Accomplished by making the atmosphere inert

ACTIVITY 2-8-1:
Complete the activity in the student supplement.

Summary:

Compressed and liquefied gases pose a significant regulatory challenge to inspectors. These products are found in storage and are encountered in dispensing, blending, and related activities. A working knowledge of the physical properties of gases, as well as a grasp of Fire Code regulations covering these products is essential for successful regulation of compressed and liquefied gases. Using the knowledge gained, you will know how to evaluate hazardous gases and the processes for which they are used.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 31-32 in order to prepare yourself for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 2-8-1: HAZARDOUS CHARACTERISTICS OF GASES

Time Frame:	0:20
Materials Needed:	• Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11 • Pen or pencil
Introduction:	This activity provides the students the opportunity to increase their ability to understand and explain the basic physical characteristics of compressed and liquefied gases.
Directions:	1. Fill in the blanks below to describe the characteristics of compressed and liquefied gases. 2. You have 15 minutes to complete this activity. 3. Be prepared to discuss your answers with the class.

1. What gas is propane compared to when determining the vapor density of propane?

   Equal volume of air

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition Page 349

2. Write "less than one, one, or greater than one" next to each gas below to indicate the relative density of the gases.

   Ethyl ether: ***Greater than one (>1)*** Acetone: ***Greater than one (>1)***

   Methane: ***Less than one (<1)*** Propane: ***Greater than one (>1)***

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition Page 349

3. Name four heat sources that can cause a flammable gas to ignite.

   (1) ***Electrical arcs***

   (2) ***Hot surfaces***

   (3) ***Open flames***

   (4) ***Cutting, welding, grinding operations***

   Additional answer(s): Using impact tools and static electricity

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition Page 353

4. What does the acronym BLEVE stand for?

   Boiling Liquid Expanding Vapor Explosion

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition Page 324

5. Name three causes of container failure.

   (1) ***Excessive pressure inside a container causes the container to rupture and explode***

   (2) ***Inadequate venting to allow vapors to escape and burn at the vents***

   (3)***. Steel in the vapor space is softened by heat and fails***

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition Page 328

Topic: 2-9: Procedures For Inspecting Motor Vehicle Dispensing Stations

Time Frame: 0:30

Level of Instruction: Level II

Authority: 1998 NFPA 1031: Sections 3-3.12, 4-3.4, and 5-3.8

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of identifying the fire hazards and code violations of a motor vehicle dispensing station

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 22

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 22
- NFPA 30A: Code for Motor Fuel Dispensing Facilities and Repair Garages, NFPA, 2000 Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 2-9-1
I. GENERAL[1]	
A. Permits and plans	
1. Permit required	
2. Plans and specifications to be submitted prior to construction	
B. Emergency shutdown devices	
1. Provided for all fuel dispensers	Where are the emergency shutdown devices located?
2. Within 100 feet for exterior dispensers	
3. In approved locations for interior dispensers	
4. Devices distinctly labeled "EMERGENCY SHUTDOWN DEVICE"	
C. Supervision and duties	
1. Provided at all time when dispensing	
2. Stop operations when unsafe	
3. Have means to call fire department	
4. Know where and how to use fire extinguishers	
5. Know where and how to use emergency shutdown devices	
	SLIDE: 2-9-2
II. SAFETY	
A. Smoking and open flames prohibited	Should a vehicle engine be turned off?
B. Engines of vehicles shall be turned off	
C. Signs[2]	
1. Posted within sight of each dispenser	

PRESENTATION	APPLICATION
2. "SMOKING PROHIBITED" 3. "DISPENSING INTO UNAPPROVED CONTAINERS PROHIBITED" 4. "VEHICLE ENGINES SHALL BE STOPPED DURING FUELING" D. Portable fire extinguishers shall be provided	What should the sign state? **SLIDE: 2-9-3**
III. MAINTENANCE A. Keep weeds, brush, and trash 10 feet from fuel storage vessels and handling equipment B. Fueling systems in proper operating condition	Where can LPG dispensing stations be located? **SLIDE: 2-9-4**
IV. DISPENSING STATIONS A. LPG[3] 1. Located 25 feet or more from a) Buildings with combustible and noncombustible exterior walls b) Public streets or sidewalks 2. Vehicle impact protection to be provided B. CNG[4] 1. General a) Equipment, devices, containers, hoses, and dispensers must be approved, listed, and labeled b) Attendants should be qualified and trained in handling CNG	

PRESENTATION	APPLICATION
2. Location a) Aboveground 1) Aggregate capacity per installation not to exceed 183,000 cubic feet b) Not under power lines c) 10 feet or more from buildings, property lines, public streets and sidewalks d) 25 feet or more from railroad tracks e) 50 feet or more from main railroad tracks and transit lines f) 50 feet or more from vertical plane below overhead wire of trolley bus line	Where should the emergency shutdown device be located?
3. Emergency shutdown devices a) Within 75 feet of, but not less than 25 feet from, the dispensers b) Compressor area c) Approved "NO SMOKING" sign posted within 10 feet of cylinder support structure or appurtenance	

Summary:

With the basic understanding of code requirements for various types of motor vehicle dispensing stations, the inspection and enforcement of the code will provide for a safe working environment for employees and the public. Motor vehicle dispensing stations are in all jurisdictions. Due to the prevalence of these hazardous occupancies, you may become complacent about the hazards associated with them. Using the CFC as a guide, you can ensure community safety.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 22 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 2201
[2] California Fire Code, CBSC, 2007 Edition, Section 2205.6
[3] California Fire Code, CBSC, 2007 Edition, Section 2207
[4] California Fire Code, CBSC, 2007 Edition, Section 2208

Topic: 2-10: Procedures For Inspecting LPG Occupancies

Time Frame: 0:30

Level of Instruction: Level II

Authority: 1998 NFPA 1031: Section 4-3.6

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of identifying fire hazards and code violations associated with the storage of LPG

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 38

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 38
- NFPA 58: Liquefied Petroleum Gas Code, NFPA, 2004 Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 2-10-1
I. GENERAL[1]	
A. Permit required to store, use, handle, dispense, or install	
1. Exception	
a) Portable containers with less than 125-gallon aggregate water capacity in R-3s	
	SLIDE: 2-10-2
II. USAGE[2]	
A. In buildings	
1. Allowed for temporary heating, or use during construction	
	What area of a building is LPG not permitted?
2. Not permitted in basements or pits	
a) Exception	
1) Self-contained torch assemblies	
B. Industrial	
1. Quantities necessary to supply processing or research	
2. Manifold systems not to exceed aggregate water capacity of 735 pounds	
C. Educational	
1. Allowed for research and experimentation	
2. Containers not to exceed 50 pounds water capacity	
3. 20 foot separation required if more than one container	
	Where is LPG use not permitted?
4. Not permitted in classrooms	

PRESENTATION	APPLICATION

D. Demonstration
   1. Temporary use only
   2. Containers not to exceed 12 pounds water capacity
   3. 20 foot separation required if more than one container used

E. Miscellaneous uses
   1. May be used with approved self-contained torches
   2. Containers not to exceed 2½ pound water capacity
   3. Allowed to be used for food preparation in restaurants
   4. Allowed in attended commercial food catering operations
   5. Allowed to be used in forklifts in commercial buildings

SLIDE: 2-10-3

III. LOCATION[3]

A. Distances vary from 5-125 feet between buildings, public way, and property lines

B. Not located near exit-access doors, exits, stairways, or safe egress areas

C. Not permitted to be stored on roofs

D. Not permitted in basement or pits

E. Additional requirements found in CFC Table 3804.3

SLIDE: 2-10-4

IV. STORAGE CAPACITY

A. Quantity not to exceed 200 pounds when accessible to the public when found inside buildings accessible to the public[4]

PRESENTATION	APPLICATION

B. Quantity not to exceed 735 pounds when not accessible to the public[5]

C. If more than 735 pounds is stored on the same floor, storage areas must be separated by at least 300 feet

Summary:

Having a working knowledge of the proper locations and usage of LPG will assist you in the enforcement and education for those who use and store LPG. This will then help in reducing potential hazards or accidents. LPG emergencies are relatively common occurrences, illustrating the need for constant vigilance in the application of code requirements.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 38 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 3801
[2] California Fire Code, CBSC, 2007 Edition, Section 3803.2
[3] California Fire Code, CBSC, 2007 Edition, Section 3804
[4] California Fire Code, CBSC, 2007 Edition, Section 3809.9
[5] California Fire Code, CBSC, 2007 Edition, Section 3809.10

Topic: 2-11: Procedures For Inspecting Flammable Finish Application Occupancies

Time Frame: 1:00

Level of Instruction: Level II

Authority: 1998 NFPA 1031: Sections 3-3.12, 4-3.9, and 5-3.8

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the procedures for inspecting flammable finish application occupancies

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 15

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 15

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 2-11-1
I. GENERAL	
A. Regulated applications[1]	
1. Flammable and combustible paint	
2. Varnish, lacquer, stains	
3. Flammable and combustible liquids sprayed with compressed air	
4. Dip tank operations	
5. Combustible powders by power spray guns	
	Is a permit required?
B. Permit is required to conduct spraying or dipping operations using flammable and/or combustible liquids	
1. Not all jurisdictions require permits	
C. Smoking prohibited in area	
1. "NO SMOKING" sign to be posted	
D. Welding in prohibited	
1. "NO WELDING" sign to be posted	
	SLIDE: 2-11-2
II. SPRAY FINISHING LOCATIONS[2]	
A. Assembly, educational, institutional, or residential occupancies	
1. Spraying room only	
2. Protected by automatic sprinkler system	
3. Separated vertically and horizontally from other areas	
B. Other occupancies	
1. Conduct in spray booth, spraying area, or spray room for approved use	

PRESENTATION	APPLICATION

SLIDE: 2-11-3

What type of materials should a spray booth be constructed of?

III. SPRAY BOOTH[3]

A. Construction materials
   1. Steel not less than 0.044 inch thick
   2. Other approved noncombustible material

B. Size
   1. In a building, aggregate area not to exceed 10% of floor area
   2. Individual spray booth not to exceed aggregate size limit of 1,500 square feet

C. Interior finish surface
   1. Smooth and continuous without edges
   2. Designed to prevent pocketing of residue
   3. Allows for washing and cleaning

D. Floors
   1. Noncombustible
   2. Nonsparking

E. Baffles
   1. If installed, noncombustible material only
   2. Readily removable and accessible for cleaning
   3. Provide for even flow of air
   4. Prevent deposit of overspray before entering exhaust duct

F. Separation
   1. From other operations by a wall or partitions
   2. At least a 3-foot clearance
   3. Clear space around spray booth for cleaning
   4. Combustible storage not within 3 feet

PRESENTATION	APPLICATION
G. Portable electric lamps[4] 1. Allowed during cleaning if approved for hazardous locations 2. Not to be used during spraying operation	When are portable electric lamps allowed?
IV. LIMITED SPRAYING AREAS[5] A. The aggregate area to be sprayed shall not exceed 9 square feet. B. Spraying operation cannot be continuous	Where are limited spray areas acceptable? **SLIDE: 2-11-4**
V. STORAGE, USE, AND HANDLING OF FLAMMABLE AND COMBUSTIBLE LIQUIDS[6] A. Storage 1. If capacity of the containers exceeds 10 gallons a) Store in cabinet or liquid store room 2. Open or glass containers cannot be used B. Liquid transfer 1. Containers shall be bonded together 2. One container to be grounded	**SLIDE: 2-11-5**
VI. FIRE PROTECTION FOR SPRAY BOOTHS AND SPRAYING ROOMS[7] A. Approved automatic fire extinguishing systems B. Systems to be extended to protect 1. Exhaust plenums 2. Exhaust ducts 3. Both side of dry filter, if used C. Fire extinguishers	**SLIDE: 2-11-6**

PRESENTATION	APPLICATION

SLIDE: 2-11-7

VII. MAINTENANCE

A. Area to be kept clean at all times

B. Scheduled cleaning daily

C. Contaminated materials disposed of properly and removed from site immediately

D. Use approved metal waste cans

SLIDE: 2-11-8

VIII. DIP TANKS[8]

A. Assembly, institutional, and residential occupancies

1. Located in designed room for the purpose of housing a dip tank
2. Approved automatic sprinkler system provided
3. Area separated from other areas
   a) Vertically and horizontally

B. Mechanical ventilation required

1. System designed to stop dipping conveyor automatically upon failure of ventilation fan

C. Construction requirements

1. Noncombustible materials
2. Supports to be heavy metal, reinforced concrete, or masonry

D. Overflow requirements

1. Dip tanks over 150 gallon capacity or 10 square foot liquid surface
   a) Equipped with trapped overflow pipe to outside of building
   b) Bottom of overflow connection not less than 6 inches below top of tank

PRESENTATION	APPLICATION

E. Drain requirements
   1. Dip tanks over 500 gallons shall be equipped with automatic and manual bottom drains
   2. Arranged to quickly drain tank in case of fire
   3. Manual operations from a safe distance
   4. Drains to be trapped and discharged to a closed, properly vented salvage tank

F. Open flames or spark producing devices not permitted within 20 feet of vapor areas

G. General requirements
   1. Electrical wiring and equipment explosion proof
      a) Class I, Division I
   2. Electrical wiring and equipment outside vapor area
      a) Class I, Division 2
   3. Area to be kept clean and clear of combustible storage
   4. Metal waste cans to be used
   5. Fire extinguishers provided
   6. Automatic closing covers on dip tanks

Summary:

Finishing operations are common processes an inspector will assess. Inspectors should make sure that all potential hazards are removed, and that the area is clean and free of combustibles. The inspector should also ensure that the process has appropriate permits, and that the equipment is in proper condition. All this will help to make the workplace safe for workers and fire fighters should they respond to a call.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 15 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 1501
[2] California Fire Code, CBSC, 2007 Edition, Section 1504.2
[3] California Fire Code, CBSC, 2007 Edition, Section 1504.3.2
[4] California Fire Code, CBSC, 2007 Edition, Section 1504.6.2.4
[5] California Fire Code, CBSC, 2007 Edition, Section 1502.6
[6] California Fire Code, CBSC, 2007 Edition, Section 1503.3.1
[7] California Fire Code, CBSC, 2007 Edition, Section 1504.4
[8] California Fire Code, CBSC, 2007 Edition, Section 1505

Topic: 2-12: Methods For Controlling Ignition Sources And Explosive Atmospheres

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.8

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the methods for controlling ignition sources and explosive atmospheres

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 3 and 10

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapters 3 and 6
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 3 and 10

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

I. PREVENTING IGNITION

A. Most effective and practical methods

1. Eliminate ignition sources
2. Prevent formation of flammable vapor mixtures

SLIDE: 2-12-1

What are the corrective actions to be taken with each of the following hazards?

II. COMMON IGNITION SOURCES

A. Matches and smoking material

1. "NO SMOKING" signs

B. Open flame heating

1. Prohibit use of an open flame heating device in hazardous areas

C. Open flame from processing

1. Welding and cutting
   a) Separate welding and cutting areas from explosive atmospheres
      1) Auto body shop must separate spraying area from work area

D. Arcs

1. Lightning
   a) Grounding straps and rods
2. Electrical arcs
   a) Class I and II electrical equipment and fixtures

E. Friction heat

1. Bearings
   a) Scheduled maintenance

PRESENTATION	APPLICATION
F. Sparks from electrical equipment 1. Electric motors a) Scheduled maintenance b) Class I and II electrical equipment G. Hot surfaces 1. Cooking appliances a) Discontinue or prohibit use H. Heat of compression (adiabatic heating) 1. Remove heat source from hazardous atmosphere	
III. METHODS TO PREVENT FORMATION OF EXPLOSIVE MIXTURES A. Use of closed vessels and piping 1. Prevents contact of vapor with air B. Ventilation 1. Natural a) Sufficient openings in buildings or rooms 2. Mechanical a) HVAC or exhaust systems 3. Ventilation rate measured in air changes per hour 4. Ventilation rate measured as cubic feet per minute per square feet	**SLIDE: 2-12-2**
IV. EVAPORATION OF FLAMMABLE AND COMBUSTIBLE LIQUIDS A. Vapor and air mixtures 1. Constant and significant danger where such products are used and stored	**SLIDE: 2-12-3**

PRESENTATION	APPLICATION

B. Flammable and combustible liquids

1. Formation of vapor poses a greater hazard than ordinary combustibles
2. Liquids come to full intensity of burning within a few seconds of ignition (unlike wood)
3. Vapors can migrate, unseen, reaching ignition sources and flashing back to fuel source

NOTE: Cite example of a typical flammable and combustible liquid spill incident and related fire. Examples are everything from a simple gas can in a garage to tank cars and fueling operations.

SLIDE: 2-12-4

V. PREVENTING EXPLOSIONS AND FIRES

A. Principles used to prevent explosions and fires

1. Excluding ignition sources
2. Excluding air (oxygen)
3. Keeping liquids in closed containers or piping
4. Providing adequate ventilation of spaces where vapor may collect
5. Using inert atmospheres over flammable liquids

Summary:

Fires will not occur in flammable or combustible liquids if no heat source capable of causing ignition is present. Likewise, a flammable or combustible liquid will not ignite if ventilation is sufficient to keep the vapor concentration below its lower explosive limit.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 3 and 10 in order to prepare yourself for the upcoming test. Study for our next session.

Topic: 3-1: Hazardous Materials Terms And Characteristics

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of hazardous materials terms and characteristics

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapters 2, 13, 27, 29, 31, 37, 39, 40, 41, 43, and Appendix E, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 37-38

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Group Activity 3-1-1: Hazardous Materials Terms and Characteristics

References:

- California Fire Code, CBSC, 2007 Edition, Chapters 2, 13, 27, 29, 31, 37, 39, 40, 41, 43 and Appendix E
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

I. REFERENCES AND DEFINITIONS

A. CFC Section 2702

1. Specific terms are defined in section

B. CFC Chapter 2

1. General definitions and references

What is the definition of a hazardous material?

a) Hazardous materials[1]

1) Chemicals or substances that are physical or health hazards as defined and classified in this chapter, whether the materials are in usable or waste condition

b) Container[2]

1) Any vessel of 60 gallons or less used for transport or storage of hazardous materials

c) Control area[3]

1) Spaces within a building where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are allowed to be stored, dispensed, used, or handled

d) Outdoor control area[4]

1) An outdoor area which contains hazardous materials in amounts not exceeding the maximum allowable quantities of Table 2703.1.1(3) or 2703.1.1(4)

C. CFC Appendix E

1. Provides information, explanations and examples to illustrate and clarify the hazard categories contained in Chapter 27

PRESENTATION	APPLICATION
	What is an oxidizer? **SLIDE: 3-1-1**
II. OXIDIZERS[5] A. A material that readily yields oxygen or other oxidizing gas, or that reacts to promote or initiate combustion of combustible materials	**SLIDE: 3-1-2**
B. Physical conditions causing oxidation 1. Heat 2. Contamination a) Mixed with corrosive and/or other reactive material 3. Shock or friction a) An explosion is not likely to cause a release of oxygen	
	What are some types of oxidizers?
C. Physical states 1. Gases 2. Liquids 3. Solids	**SLIDE: 3-1-3**
D. Classifications[6] 1. Class 4 2. Class 3 3. Class 2 4. Class 1	
E. Examples of common oxidizing materials 1. Class 4 – ammonium 2. Class 3 – hydrogen **per**oxide 3. Class 2 - calcium hypochlorite 50% or less 4. Class 1 - aluminum nitrate	

PRESENTATION	APPLICATION
5. Materials with the prefix "per" indicate that the molecule in question is "loaded" with oxygen a) Allows the materials to support oxidization 6. Many classes of oxidizers are used to produce common household and industrial cleaning products	What does the prefix "per" indicate?
III. ORGANIC PEROXIDES[7] A. An organic compound that contains the bivalent -0-0- structure and that may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by an organic radical	What is an organic peroxide? **SLIDE: 3-1-4**
B. Physical states 1. Liquids 2. Pastes 3. Solids a) Fine powders	In what forms can organic peroxides be found? **SLIDE: 3-1-5**
C. Classifications 1. Class I 2. Class II 3. Class III 4. Class IV 5. Class V 6. Detonable	**SLIDE: 3-1-6**

PRESENTATION	APPLICATION
	What is a pyrophoric material? **SLIDE: 3-1-7**
IV. PYROPHORIC MATERIALS A. A chemical that will spontaneously ignite in air at or below a temperature of 130°F[8]	**SLIDE: 3-1-8**
B. Physical states 1. Gases 2. Liquids 3. Solids	
	What is a reactive material? **SLIDE: 3-1-9**
V. UNSTABLE (REACTIVE) MATERIALS A. A material, other than an explosive, which in the pure state will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent chemical changes, including explosion when exposed to heat, friction, or shock, or in the absence of an inhibitor or in the presence of contaminants or in contact with noncompatible materials[9]	
B. They are set apart from other hazardous materials in that they are capable of explosive decomposition on reaction	**SLIDE: 3-1-10**
C. Classifications 1. Class 1 2. Class 2 3. Class 3 4. Class 4 5. Unstable (reactive)	

PRESENTATION	APPLICATION
	SLIDE: 3-1-11
VI. CRYOGENIC FLUIDS	
A. A fluid that has a normal boiling point below -150°F[10]	
1. May be stored as compressed gas	
a) Ambient temperatures	
	What are some types of cryogenic fluids?
B. Types	
1. Flammable - Liquid hydrogen	
2. Oxidizer - Liquid oxygen	
3. Corrosives - Liquid fluorine	
4. Inert - Liquid nitrogen	
5. Highly toxic - Liquid carbon monoxide	
	What is a health hazard?
	SLIDE: 3-1-12
VII. HEALTH HAZARDS	
A. A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons	
B. The term "health hazard" includes chemicals that are toxic or highly toxic and corrosive	
1. The materials can be considered health hazards as well	
	SLIDE: 3-1-13
C. Levels of toxicity	
1. Acute and chronic	
	What is the difference between an acute and a chronic exposure?
2. Acute exposure is caused by a single dose of or exposure to a substance	
3. Chronic exposure is caused by repeated doses of or exposure to a substance	

PRESENTATION	APPLICATION
D. Types of toxicity 1. Toxic 2. Highly toxic	
	What is a radioactive material? **SLIDE: 3-1-14**
VIII.RADIOACTIVE MATERIALS **NOTE:** The information in this section is not found in the California Fire Code. It is regulated by the Code of Federal Regulations. A. Material that spontaneously emits ionizing radiation	
	What are the types of radioactive materials? **SLIDE: 3-1-15**
B. Types 1. Alpha particle 2. Beta particle 3. Gamma ray 4. Other a) Electromagnetic radiation (x-rays) b) Neutrons c) Fissile materials 1) Found only at reactor sites or part of nuclear weapons 2) Usually contain all forms of radiation	
	Where are radioactive materials used? **SLIDE: 3-1-16**
C. Use of radioactive materials 1. Research laboratories a) Tracing studies	

PRESENTATION	APPLICATION
2. Medical applications a) Medical isotopes 1) Iodine 2) Cesium b) Treatment of Cancer c) MRI and CT scans 1) Injectable isotopes 2) Electromagnetic Radiation from the process 3. Oil fields a) Fuel transmission plugs 4. Power plants a) Nuclear fuel 5. Licensed, sealed sources for instruments, calibration devices, and equipment a) Specialized equipment used for weights and measures b) Exit signs (Tritium)	
IX. CORROSIVES	What is a corrosive? **SLIDE: 3-1-17**
A. A chemical that causes visible destruction of, or irreversible alterations in living tissue by chemical action at the site of contact	**SLIDE: 3-1-18**
B. Types 1. Acids 2. Bases 3. Other corrosives a) Chlorine b) Ammonia	

PRESENTATION	APPLICATION

SLIDE: 3-1-19

X. COMBUSTIBLE METALS

A. Most metals will burn under certain conditions
   1. Magnesium
   2. Aluminum
   3. Titanium

XI. PLASTICS

A. A very broad group of materials made up of primarily organic substances of high molecular weight

B. Often associated with high temperatures and toxic smoke production

C. Examples
   1. Poly vinyl chloride (PVC)
   2. Expanded foam

XII. COMBUSTIBLE DUST

A. Finely divided solid material which is 420 microns or less in diameter which can be ignited by a flame, spark, or other heat source[11]

B. May be explosive when suspended in air
   1. An explosion is often followed by a second and more powerful explosion

C. Classifications
   1. Metal
   2. Nonmetals

D. Examples
   1. Saw dust
   2. Flour dust
   3. Metal dusts
      a) Aluminum
      b) Magnesium

PRESENTATION	APPLICATION
XIII.COMBUSTIBLE FIBERS[12] A. Readily ignitable and fire-burning fibers B. Examples 1. Cotton 2. Hay 3. Straw 4. Bailed waste paper	What are some examples of combustible fibers? **ACTIVITY 3-1-1:** Complete the activity in the student supplement.

Summary:

The importance of understanding the terms and characteristics of hazardous materials provides the foundation for proper inspection and regulation of facilities using these materials. Additionally, this knowledge helps you when researching the code and to assist in utilizing the proper sections that are used to ensure compliance. Many of these materials seem alike, but may have extremely different characteristics. This type of information is essential for every inspector to know and understand.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and the California Fire Code, CBSC, 2007 Edition, Chapters 2,13, 27, 29, 31, 37, 39, 40, 41, 43, and Appendix E, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 37-38 in order to prepare yourself for the upcoming test. Study for our next session.

GROUP ACTIVITY 3-1-1: HAZARDOUS MATERIALS TERMS AND CHARACTERISTICS

Time Frame:	0:30
Materials Needed:	• California Fire Code, CBSC, 2007 Edition • Pen or pencil
Introduction:	This activity provides the students the opportunity to understand the definitions, terms, and characteristics of hazardous materials.
Directions:	1. Working in pairs and using the CFC, answer the following questions. 2. You have 15 minutes to complete this activity. 3. Be prepared to discuss your answers with the class.

1. Which class of oxidizer has a "primary hazard of slightly increasing the burning rate but does not cause spontaneous ignition"?

   Class I

   California Fire Code, CBSC, 2007 Edition, Section 4002, Page 447

2. Which section of the CFC provides the definition for a highly toxic material?

   Section 3702

   California Fire Code, CBSC, 2007 Edition, Page 423

3. Which class of unstable (reactive) materials is found to be normally stable, but loses stability at elevated temperatures and pressure?

   Class I

   California Fire Code, CBSC, 2007 Edition, Section 4302, Page 463

4. Which section of the CFC provides the definition for an outdoor control area?

   Section 2702.1

   California Fire Code, CBSC, 2001 Edition, Page 313

5. Which class of organic peroxide poses the least hazard?

   Class V

   California Fire Code, CBSC, 2007 Edition, Section 3902, Page 441

6. Which section of the CFC provides the definition for a corrosive?

   Section 3102.1

   California Fire Code, CBSC, 2007 Edition, Page 357

7. Which physical state is not included in the classes of oxidizers?

   Gases

   California Fire Code, CBSC, 2007 Edition, Section 4004, Page 448

8. Which section of the CFC provides a general definition for hazardous materials?

   Section 2702

   California Fire Code, CBSC, 2007 Edition, Page 312

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 2702
[2] California Fire Code, CBSC, 2007 Edition, Section 2702
[3] California Fire Code, CBSC, 2007 Edition, Section 2702
[4] California Fire Code, CBSC, 2007 Edition, Section 2702
[5] California Fire Code, CBSC, 2007 Edition, Section 4002
[6] California Fire Code, CBSC, 2007 Edition, Section 4002
[7] California Fire Code, CBSC, 2007 Edition, Section 3902.1
[8] California Fire Code, CBSC, 2007 Edition, Section 4102.1
[9] California Fire Code, CBSC, 2007 Edition, Section 4302
[10] California Fire Code, CBSC, 2007 Edition, Section 3202
[11] California Fire Code, CBSC, 2007 Edition, Section 1302
[12] California Fire Code, CBSC, 2007 Edition, Section 2902

Topic: 3-2: Sources Of Technical Information On Hazardous Materials

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of sources of technical information on hazardous materials

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Sample resource materials

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 45
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11
- Fire Protection Guide to Hazardous Materials, NFPA, Twelfth Edition
- Hazardous Materials Guide for First Responders, FEMA/USFA
- NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response, NFPA, 2001 Edition
- North American Emergency Response Guidebook, DOT, 1999 Edition
- The Firefighter's Handbook of Hazardous Materials, Charles J. Baker, Sixth Edition

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

I. SOURCES OF TECHNICAL INFORMATION

A. Numerous sources are available to the inspector where technical information may be obtained about hazardous materials

1. Public agencies
2. Private organizations

SLIDE: 3-2-1

II. PUBLIC AGENCIES

A. American Insurance Association

B. U.S. Department of Transportation (DOT)

1. Information on compressed gas vessels
2. Information of placarding and labeling
   a) Consistent with Code of Federal Regulations Title 49

C. Environmental Protection Agency (EPA)

1. Requires a number (EPA registration number) to be placed on every pesticide offered for sale in the United States

D. U.S. Coast Guard

1. Provides certain agencies with information on hazardous materials
2. Operates the National Response Center

SLIDE: 3-2-2

III. PRIVATE ORGANIZATIONS

A. Chemical manufacturers

1. Developed the Chemical Transportation Emergency Center (CHEMTREC) in 1971

Has your department used CHEMTREC before?

PRESENTATION	APPLICATION

B. National Fire Protection Association (NFPA)
   1. Publications
      a) NFPA 704
         1) Sets standards for identification of hazardous materials
      b) Flash Point Index of Trade Name Liquids
      c) Fire Protection Handbook

C. Factory Mutual System
   1. Consists of four large mutual insurance companies
   2. Material published is usually taken from National Fire Prevention Association or Department of Transportation data

D. National Agricultural Chemicals Association
   1. Formed by representatives of pesticide manufacturers
   2. Publishes Recommended Procedures for Safe Use of Pesticides
   3. Supports the Pesticide Safety Team Network

SLIDE: 3-2-3

E. The Chlorine Institute
   1. Supplies information on chlorine and handling of chlorine emergencies nationwide
   2. Maintains the chlorine emergency plan (CHLOREP) leak control system
   3. Supplies cylinder, one ton, and tank car leak kits

F. Bureau of Explosives
   1. Publishes Recommended Practices for Handling Incidents Involving Hazardous Materials
   2. A subdivision of the Association of American Railroads

PRESENTATION	APPLICATION
G. American Petroleum Institute 1. Publishes information on petroleum products of all types	
	SLIDE: 3-2-4
IV. OTHER SOURCES	
A. Meister Publishing Company 1. Publishes the Farm Chemicals Handbook annually	
B. Internet 1. Many resource locations and manufacturers can be found on-line	
C. The Firefighter's Handbook of Hazardous Materials, Charles J. Baker, Sixth Edition	
D. MSDS pages	

Summary:

Using all available resources, the inspector can identify the type of hazardous material in use or stored and the specific information needed to regulate each.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11 in order to prepare yourself for the upcoming test. Study for our next session.

Topic: 3-3: Regulating Hazardous Materials

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of regulating hazardous materials

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 27 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 27
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11
- Hazardous Materials Regulations, Response, and Site Operations, Delmar, 1999 Edition, Chapter 1
- North America Emergency Response Guidebook, DOT, 1999 Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

What does the DOT regulate?

SLIDE: 3-3-1

I. DEPARTMENT OF TRANSPORTATION (DOT)

A. Regulates transportation of hazardous materials
   1. Roadways
   2. Railways
   3. Waterways
   4. Airways

B. Regulations are enumerated in the Code of Federal Regulations Title 49

C. Requires placards and/or labels

What is the difference between a placard and a label?

   1. Placards identify cargo in transportation units (e.g., tank trucks)
   2. Labels identify cargo in individual containers (e.g., boxes)

SLIDE: 3-3-2

   3. Color coding
      a) Orange
         1) Explosives
      b) Red
         1) Flammable and combustible
      c) Yellow
         1) Oxidizers and radioactive
      d) Black and white
         1) Hazardous to health (e.g., corrosives)
      e) Blue
         1) Water reactive

PRESENTATION	APPLICATION
	SLIDE: 3-3-3
4. Pictographs a) Explosions b) Skull and crossbones c) Radioactive propeller	
	SLIDE: 3-3-4
5. Four-digit numbers a) Used to identify commodity carried	
	SLIDE: 3-3-5
6. UN product categories a) Nine categories 1) Explosives 2) Gases 3) Flammable liquids 4) Flammable solids • Spontaneously combustible materials • Dangerous when wet materials 5) Oxidizers and organic peroxides 6) Toxic materials and infectious substances 7) Radioactive materials 8) Corrosive materials 9) Miscellaneous dangerous goods	
II. FEDERAL AND STATE LAW	
	SLIDE: 3-3-6
A. Federal law 1. Hazardous Waste Operations and Emergency Response (HAZWOPER) a) OSHA regulations	

PRESENTATION	APPLICATION
2. Clean Air Act 3. Clean Water Act 4. Superfund Amendments and Reauthorization Act (SARA)	
	SLIDE: 3-3-7
B. State law 1. Health and Safety Code 2. CCR Title 19, Division 2, Chapter 3 3. Chapter 27 of the CFC	
	SLIDE: 3-3-8
III. CFC CHAPTER 27 A. Used by the inspector to regulate hazardous materials storage, use, handling, and dispensing B. Requires permits for storage exceeding the exempt amount	
	SLIDE: 3-3-9
IV. PROHIBITED RELEASES A. Hazardous materials shall not be released in any of the following areas[1] 1. Sewers 2. Storm drains 3. Ditches 4. Drainage canal 5. Lakes, rivers, or tidal waterways 6. Ground, sidewalk, street, or highway 7. Atmosphere a) Exceptions are provided when releases are within other legal limits	

PRESENTATION	APPLICATION
B. Unauthorized discharge documentation[2] 1. Records of all unauthorized discharges must be kept by the business owner 2. Unauthorized discharges of reportable quantity must be reported to the fire department 3. The business owner must have supplies on hand to control unauthorized discharges 4. The person or business responsible for an unauthorized discharge of hazardous materials is responsible for the cleanup and mitigation of the hazard related to the release a) If the fire department initiates the mitigation and cleanup efforts, the business owner or responsible person must bear the cost incurred	What must be done when there is an unauthorized discharge? **SLIDE: 3-3-10**

Summary:

Understanding the various laws, regulations, and placarding requirements will ensure you have the authority to enforce and apply these various requirements. This will also ensure the correct information is being provided to minimize hazards and inform responding units. Both DOT placards and NFPA 704 markings provide quick references for responding emergency personnel and can provide information needed for preservation of life and health.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 27 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 2703.3

[2] California Fire Code, CBSC, 2007 Edition, Section 2703.3.1

Topic: 3-4: Introduction To Hazardous Materials Management Plan

Time Frame: 0:15

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the hazardous materials management plan (HMMP)

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 27 and Appendix H

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Barclays Official California Code of Regulations Title 19, West Group, Division 2, Chapter 4
- California Fire Code, CBSC, 2007 Edition, Chapter 27 and Appendix H
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 3-4-1
I. WHEN A HMMP IS REQUIRED	
A. State regulation[1] requires a business to create a HMMP when they handle hazardous materials in quantities	
1. Equal to or greater than 500 pounds of hazardous material or gas, or 200 cubic feet of hazardous gas	
2. Equal to or greater than federal threshold planning quantity (TPQ) for an extremely hazardous substance	
3. Radioactive materials that are handled in quantities requiring a HMMP by federal regulations[2]	
B. CFC Chapter 27	
1. When required by the Fire Code Official[3]	
	How many of you have access to the HMMP at your fire station or on your apparatus?
II. HMMP DOCUMENT[4,5]	
	SLIDE: 3-4-2
A. Businesses required to have a HMMP must	
1. Submit a copy to the local fire department and the Certified Unified Program Agency (CUPA) or Administrative Agency (AA)[6]	
2. Submit a copy annually on or before March 1st	
3. Use forms listed in Barclays Official California Code of Regulations or a version developed by the local agency[7]	
a) Alternative forms are found in the CFC Appendix H	

PRESENTATION	APPLICATION
	SLIDE: 3-4-3
B. Site or area plan must designate 1. Storage and use areas 2. Maximum amount of each material stored or used in each area 3. Range of container sizes 4. Locations of emergency and mitigation valves and devices	
	SLIDE: 3-4-4
5. Product conveying piping holding liquids or gases, other than utility owned fuel gas lines and low-pressure fuel gas lines 6. On and off positions for self-indicating type valves 7. Storage plan showing the intended storage arrangement a) Including the location and dimensions of aisles 8. Plan shall be legible and approximately to scale 9. Hazardous materials inventory statements are required when required by the Fire Chief	

Summary:

Ensuring that a HMMP is provided as required can assist engine company personnel who respond to incidents at these facilities. The inspector must ensure that a HMMP is completed and updated as needed.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 27 and Appendix H in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] Barclays Official California Code of Regulations Title 19, West Group, Section 2729.1

[2] Code of Federal Regulations, National Archives and Records Administration, Chapter 10

[3] California Fire Code, CBSC, 2007 Edition, Section 2701.5.1

[4] California Fire Code, CBSC, 2007 Edition, Section 2701.5.1

[5] Barclays Official California Code of Regulations Title 19, West Group, Section 2729.4

[6] Barclays Official California Code of Regulations Title 19, West Group, Section 2729.4

[7] Barclays Official California Code of Regulations Title 19, West Group, Section 2729.4

Topic: 3-5: Storage And Transfer Practices Of Compressed And Liquefied Gases

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of storage and transfer practices of compressed and liquefied gases

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapters 30, 35, and 38
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

I. INSTALLATION AND USE GUIDELINES

SLIDE: 3-5-1

A. Installation

1. Vessels and fittings must be of a type approved for such use
2. Relief devices must be provided to protect vessels or trapped portions of piping
3. Vessels must be identified with product inside
4. Electrical installations must be Class I around flammable gases

Where can we find the general requirements for the use and application of compressed liquid gases?

SLIDE: 3-5-2

B. General rules for gas and liquid usages

1. Comply with CFC Chapters 30, 35 and 38
2. Cylinders containing gases with different chemical and physical properties should be stored appropriately[1]
3. Pressure vessels must be of a type approved for the gas contained[2]
4. Relief devices must be provided and be adequate to relieve the pressures within the vessels[3]
5. Name of the product in the vessel must be shown on the vessel

SLIDE: 3-5-3

6. Cylinders must be secured to prevent falling over or being knocked over[4]
7. Valves on compressed gas vessels shall be shut-off at the end of the each day's operation

PRESENTATION	APPLICATION
8. "NO SMOKING" signs shall be posted around flammable gases[5]	
9. Maximum allowable volume of gases and liquefied gases in one area shall not be exceeded[6]	
10. Minimum distance for vessels from buildings and streets must be observed[7]	
11. Tanks holding compressed or liquefied gases cannot be abandoned	
a) They must be taken out-of-service properly[8]	
	At what location is compressed gas usually transferred?
	SLIDE: 3-5-4
II. TRANSFER OF PRODUCT	
A. Compressed gases are not frequently transferred except at bulk handling areas	
	Who has bulk plants in their jurisdiction?
B. Liquefied gases such as LPG are frequently transferred at smaller facilities	
C. All heat sources must be eliminated if product is flammable	
D. Training of employees will assist in avoiding mishaps	
1. Gloves and goggles must be used when transferring liquefied gases	
E. Scales are necessary to accurately determine the amount of product transferred	
	SLIDE: 3-5-5
III. CONTROL OF PRODUCT LEAKAGE	
A. Most leaks occur in conjunction with product transfer operations	

PRESENTATION	APPLICATION
B. Proper employee training helps ensure that leaks will not occur C. Appropriate, well-maintained equipment is vital to spill and leak protection 1. Excess flow valves 2. Approved hoses and fittings D. Proper ventilation must be provided during product transfer E. Leak kits are available for various commodities 1. Chlorine 2. Ammonia 3. Check with local hazardous materials team	Does your department have leak kits available?

Summary:

Inspectors, as well as employees working with compressed and liquefied gases, must be well informed to reduce the incidence of accidents with these commodities. It is important to be familiar with the code sections and methods required to ensure the safe storage and transfer practices of compressed and liquefied gases. Transfer processes are dangerous because flammable gases are released into the surrounding environment. Hazardous conditions are limited by proper ventilation, control of ignition sources, and proper equipment. An inspector must ensure that these safety measures are in place and used.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11 in order to prepare you for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 3003.7.1
[2] California Fire Code, CBSC, 2007 Edition, Section 3003.2
[3] California Fire Code, CBSC, 2007 Edition, Section 3003.3
[4] California Fire Code, CBSC, 2007 Edition, Section 3003.5.3
[5] California Fire Code, CBSC, 2007 Edition, Section 3503.1.4.2
[6] California Fire Code, CBSC, 2007 Edition, Section 3503.1
[7] California Fire Code, CBSC, 2007 Edition, Section 3504.2.1
[8] California Fire Code, CBSC, 2007 Edition, Section 3810

Topic: 3-6: Hazards Of Explosives And Fireworks

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of hazards of explosives and fireworks

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 33 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Barclays Official California Code of Regulations Title 19, West Group, Chapters 6 and 11
- California Fire Code, CBSC, 2007 Edition, Chapter 33
- California Health and Safety Code, Current Edition, Sections 12000-12401
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11
- NFPA 495: Explosive Materials Code, NFPA, 2006 Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
I. EXPLOSIVES	What is an explosive? **SLIDE: 3-6-1**
A. Defined as a compound, mixture, or device, the common purpose of which is to function by explosion	**SLIDE: 3-6-2**
B. Power depends upon the rate of burning of the product 1. Detonation a) Burn rate faster than the speed of sound 2. Deflagration a) Burn rate slower than the speed of sound	
C. Sensitivity to heat is an important characteristic of an explosive 1. Some explosives are shock sensitive	
D. Brisance is the measure of the "shattering" effect of an explosive 1. Determined by how quickly explosive reaches its maximum power	
	When was the last time you had an aerial or static fireworks display in your area? What types of storage facilities were provided for the fireworks? **SLIDE: 3-6-3**
II. EXPLOSIVE MAGAZINES[1]	
A. Needed to provide security for explosives and fireworks	

PRESENTATION	APPLICATION
1. Magazines provide security from a) Bullets b) Fire c) Theft d) Effects of weather 2. Require two locks with two separate keys B. Six types of magazines recognized by CCR Title 19[2] **NOTE:** Detailed requirements for magazines are found in NFPA 495.	What are the security requirements for magazines?
III. REGULATING FIREWORKS A. Regulated by the California Health and Safety Code and California Code of Regulations Title 19 1. Section 12702(b) of the California Health and Safety Code deals with fireworks 2. Chapter 6 of CCR Title 19 regulates fireworks B. California Health and Safety Code supersedes the California Fire Code 1. Chapter 33 in the CFC (covering fireworks) is not applicable in California	Why can't the CFC be used in California to enforce fireworks? **SLIDE: 3-6-4**
IV. REGULATING EXPLOSIVES A. National 1. Department of Transportation (DOT) a) Classification and placarding requirements	Who regulates explosives? **SLIDE: 3-6-5**

PRESENTATION	APPLICATION

B. State

1. California Health and Safety Code

C. Local

1. California Fire Code Chapter 33 may be adopted, amended, or a local ordinance may be authored and adopted
2. Local ordinances

SLIDE: 3-6-6

V. SOURCES OF TECHNICAL INFORMATION

A. Federal law

1. U.S. Department of Transportation (DOT)
2. Code of Federal Regulations Title 49 (CFR 49), Parts 172, 173, and 177
3. Explosive Laws and Regulations, Bureau of Alcohol, Tobacco and Firearms

B. State law and regulations

1. California Health and Safety Code, Sections 12000 et seq
   a) Supercedes the CFC
2. California Code of Regulations
   a) Title 8
      1) Industrial safety orders
   b) Title 13
      1) Motor vehicle transportation
   c) Title 19
      1) Chapter 10, SFM regulations
         - Explosives
      2) Chapter 6, SFM regulations
         - Fireworks

SLIDE: 3-6-7

PRESENTATION	APPLICATION
3. California Fire Code a) Chapter 33 1) Explosives 2) Fireworks 4. California Vehicle Code, Division 12, Sections 27903 and 31600 5. Laws and Regulations for Transportation, Use and Storage of Fireworks in California, SFM	**SLIDE: 3-6-8**
C. Recommended standards 1. NFPA a) NFPA 495 b) Fire Protection Handbook 2. American Association of Railroads a) Emergency Handling of Hazardous Materials in Surface Explosives 3. Federal Bureau of Investigation a) Bomb data center	

Summary:

CFC Chapter 33, along with CCR Title 19, are the resources needed by the inspector to determine the methods for safe use, handling, and storage of explosives and fireworks. Using this knowledge, an inspector can ensure that a community is protected from the hazards associated with these extremely dangerous products.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 33 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 3301

[2] CCR Title 19, Chapter 10, Sub Chapter 3, Article 5

Topic: 3-7: Storage Of Hazardous Materials

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of storing hazardous materials

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 27 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 27
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

When are hazmat storage cabinets used?

SLIDE: 3-7-1

I. HAZARDOUS MATERIALS STORAGE CABINETS[1]

A. Used to increase exempt amounts or as required by the CFC

B. Construction

1. Must be metal and lined/coated with materials that will not react to the materials stored
2. Must be listed for use, or constructed as required below
   a) Steel having a thickness of no less than 18 gage
   b) The cabinet and cabinet doors must be double walled
      1) Airspace must be less than 1½-inch in width
   c) Joints must be riveted or welded and shall be tight fitting
   d) Doors must be self-closing and self-latching
   e) The bottoms of cabinets used for liquid storage shall be liquid tight and must be a minimum of 2 inches in height

SLIDE: 3-7-2

SLIDE: 3-7-3

II. GENERAL SAFETY PRECAUTIONS

A. Personnel training

1. Persons working in areas where hazardous materials are used or stored must be trained in the mitigation actions necessary in the event of a fire, leak, or spill

PRESENTATION	APPLICATION
2. There shall be a designated person or persons responsible for aid to the fire department in pre-incident emergency responses and other hazard mitigation needs	
B. Adequate security must be provided for hazardous materials storage or use areas	
1. Guard posts or other approved means shall be provided to protect storage tanks, piping, and fittings	
a) Construction of guard posts shall be as follows	
1) 4-inch diameter steel tubing, concrete filled	
2) 4 feet between posts on center	
3) Set at least 3 feet deep in concrete footings not less than 15 inches in diameter	
4) Top of post must be not less than 3 feet aboveground	
5) Not less than 5 feet from tank	
C. Separation of incompatible materials[2]	
1. When materials are stored in containers having a capacity of more than 5 pounds or ½ gallon	What methods can be used to separate incompatibles?
2. Separation of incompatibles must be at least 20 feet or	
3. Isolation by use of noncombustible partitions extending not less than 18 inches above and to the sides of the material or	
4. Use hazardous materials storage cabinets	
a) Materials that are incompatible may not be stored within the same cabinet	

PRESENTATION	APPLICATION
D. Shelf storage 1. Shelves must be of adequate construction for stored materials and must be braced and anchored in accordance with the CBC 2. Shelves shall be provided with a lip or guard when used for storage of individual containers	SLIDE: 3-7-4

Summary:

Inspectors are confronted with the issue of proper hazardous material storage methods. Knowing where to find and then how to implement these requirements is important in order to reduce the hazards to life and property. Hazardous materials are stored in all occupancies within your jurisdiction. Both a grocery store and the local doctor's office store hazardous materials. All occupancies must be inspected to ensure that storage conditions do not endanger the occupants and your community.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 27 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 10 and 11 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 2703.8.7

[2] California Fire Code, CBSC, 2007 Edition, Section 2703.9.8

Topic: 3-8: NFPA 704 Identification Systems

Time Frame: 0:45

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of NFPA 704 identification systems

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 27 and Appendix F, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10, and Activity Sheet 3-8-1, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 45-55

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Activity Sheet 3-8-1:Developing NFPA 704 placards

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 27 and Appendix F
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10
- NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response, NFPA, 2001 Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	How does NFPA 704 differ from placards and labels? **SLIDE: 3-8-1**
I. NFPA 704 APPLICATION A. Rating system for identification of hazards within fixed facilities 1. Uses a rating system or a diamond shaped sign with four quadrants a) Red (top) quadrant is for flammability b) Yellow (right) quadrant is for reactivity c) White (bottom) quadrant is for special hazards 1) Example • Water reactive d) Blue (left) quadrant is for health hazard 2. Numeric values 0-4 are used to classify the level of hazard a) 0 - no hazard b) 1 - low hazard c) 2 - moderate hazard d) 3 - severe hazard e) 4 - extreme hazard	**SLIDE: 3-8-2** Where should the marker be placed? **SLIDE: 3-8-3**
B. NFPA 704 markers 1. Should be affixed to any building, tank, or other fixed facility that stores hazardous materials a) Should be on the side of the building that is nearest to the direction of response b) May have a sign on multiple sides	

PRESENTATION	APPLICATION
2. Are not designed for transportation of hazardous materials 3. Are of limited value a) Do not identify the specific chemical(s) or quantity b) The numbers on the sign reflect the highest hazard of all materials on site 1) The number in yellow may be the highest hazard for one chemical, while the number in blue may be from a different material	**SLIDE: 3-8-4**
C. Hazard classification is the responsibility of the occupant, though an inspector may assist 1. References a) NFPA's Fire Protection Guide To Hazardous Materials b) MSDS or other information from a manufacturer 2. Inspector should verify the information presented by the business	**SLIDE: 3-8-5** **ACTIVITY 3-8-1:** Complete the activity in the student supplement.

Summary:

NFPA 704 markings are widely used and provide a readily useable warning of potential hazards. Each inspector should appreciate the need for NFPA 704 markings on all fixed facilities

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

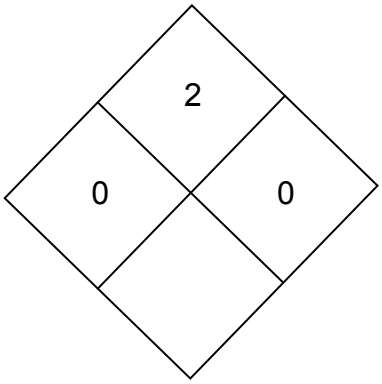
Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 27 and Appendix F, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 45-55 in order to prepare yourself for the upcoming test. Study for our next session.

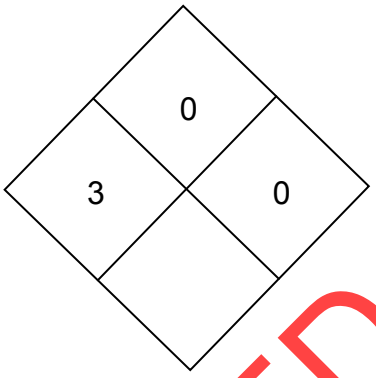
INDIVIDUAL ACTIVITY 3-8-1: DEVELOPING NFPA 704 PLACARDS

Time Frame:	0:30
Materials Needed:	• California Fire Code, CBSC, 2007 Edition, Chapters 27 and Appendix F • Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 10 • Material Safety Data Sheets for Benzoyl Peroxide, Sodium Hydroxide, Arsine, Calcium Carbide, and Ammonia (included) • Pen or pencil
Introduction:	This activity provides the students the opportunity to determine the appropriate designations for an NFPA 704 placard.
Directions:	1. Review CFC Appendix F. 2. Using the information given to you in each question, fill in the appropriate ratings for the NFPA placards. 3. You have 20 minutes to complete this activity. 4. Be prepared to discuss your answers with the class.

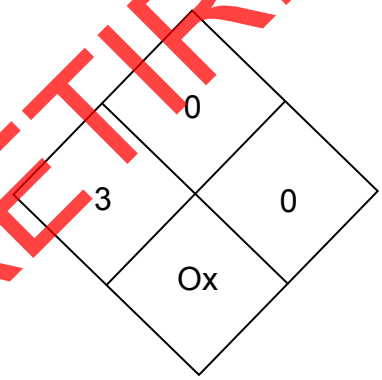
1. A building containing a flammable solid. ***CFC Appendix F, Table F101.2***



2. A structure with a toxic substance. ***CFC Appendix F, Table F101.2***

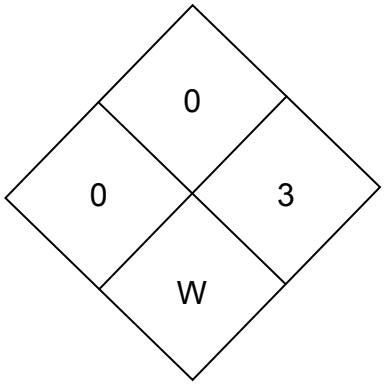


3. A hospital outbuilding containing liquid oxygen. ***CFC Appendix F, Table F101.2***

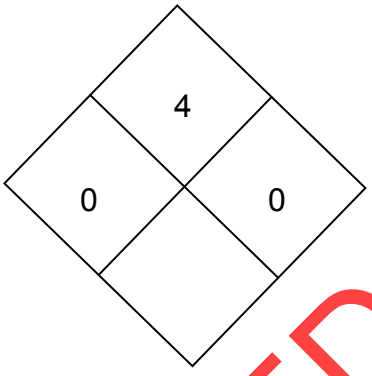


Liquid Oxygen is a cryogenic oxidizing in Table F101.2

4. A shed containing a water reactive 3 material. ***CFC Appendix F, Table F101.2***

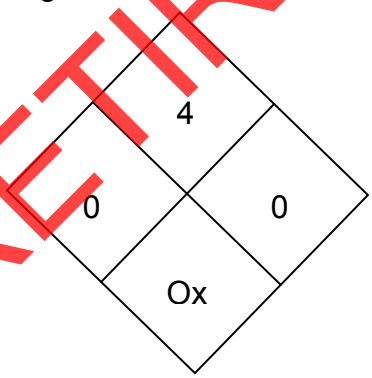


5. A warehouse containing a Class IIIA and a Class IA liquid. ***CFC Appendix F, Table F101.2***



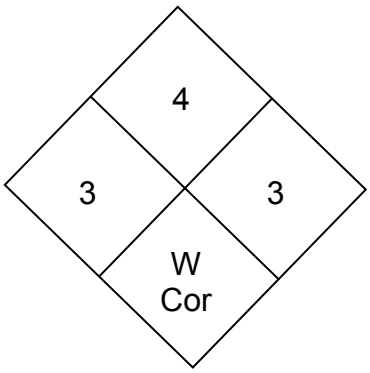
Class IIIA is F3
Class IA is F4
F4 is highest hazard, so it goes into the diamond

6. A repair garage containing Class II liquids, Class IC liquids, and an oxy-acetylene welding torch. ***CFC Appendix F, Table F101.2***



Class II is F2, Class IC is F3
Acetylene, a flammable gas, is F4
Oxygen, an oxidizing gas, is Ox

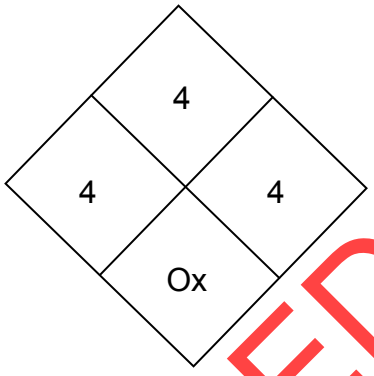
7. A chemical warehouse containing an organic peroxide II, a corrosive, a flammable cryogenic, and a water reactive 3. ***CFC Appendix F, Table F101.2***



Organic Peroxide II is F3, R3
Corrosive is H3, Cor
Cryogenic Flammable is F4, H3
Water Reactive 3 is W, R3
Highest of each is H3, F4, R3, W, Cor

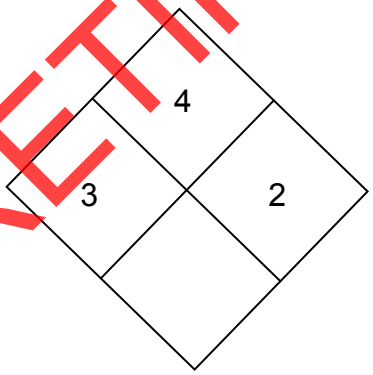
For questions 8 and 9, use the attached MSDS for Benzoyl Peroxide (Wet).

8. Building A contains wet benzoyl peroxide, sodium hydroxide, and arsine. ***MSDS***



Wet Benzoyl Peroxide is H2, F4, R4 (instability) Ox
Hydrogen Peroxide is H3, F0, R1
Arsine is H4, F4, R0

9. Building B contains calcium carbide and ammonia. ***MSDS***



Calcium Carbide is H1, F4, R2
Ammonia is H3, F1, R0

Material Safety Data Sheet
Benzoyl Peroxide (Wet)
ACC# 02782

Section 1 - Chemical Product and Company Identification

MSDS Name: Benzoyl Peroxide (Wet)
Catalog Numbers: AC211780000, AC211780010, AC211780050, AC211780100, AC211781000, 8274-1LB, NC9747998
Synonyms: Dibenzoyl peroxide; benzoic acid peroxide; benzoyl superoxide
Company Identification: Fisher Scientific, 1 Reagent Lane, Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
CHEMTREC assistance, call: 800-424-9300
International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
94-36-0	Benzoyl peroxide	67-75	202-327-6
7732-18-5	Water	25-33	231-791-2

Section 3 - Hazards Identification

Emergency Overview

Appearance: white powder.
Danger! Risk of explosion by shock, friction, fire or other sources of ignition. Organic peroxide. Heat or contamination may cause hazardous decomposition. Peroxides and decomposition products are flammable and can ignite with explosive force if confined. Strong oxidizer. Contact with other material may cause a fire. Mutagen. Causes eye and skin irritation. May cause respiratory and digestive tract irritation. May cause sensitization by skin contact.
Target Organs: Eyes, skin.

Potential Health Effects

Eye: Causes eye irritation. Causes redness and pain.
Skin: Causes skin irritation. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis. May be harmful if absorbed through the skin.
Ingestion: May cause irritation of the digestive tract. May be harmful if swallowed. May cause human systemic effects by ingestion: hallucinations, distorted perceptions, nausea or vomiting and kidney, ureter and bladder changes.
Inhalation: May cause respiratory tract irritation. May be harmful if inhaled. Decomposition products are toxic, and inhalation of these products can produce life threatening health effects.
Chronic: Laboratory experiments have resulted in mutagenic effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion: Never give anything by mouth to an unconscious person. Get medical aid immediately. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures
General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Will burn if involved in a fire. This material poses an explosion hazard when dry. This material is an explosion hazard when exposed to heat, mechanical shock, friction or when agitated.
Extinguishing Media: Use water spray to cool fire-exposed containers. Use water spray, dry chemical, carbon dioxide, or chemical foam. Do NOT use halogenated agents.
Flash Point: Not applicable.
Autoignition Temperature: 380 deg C (716 deg F)
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (Estimated) Health: 2; Flammability: 4; Instability: 4; Special Hazard: OX

Material Safety Data Sheet
Product No. 19539 Sodium Hydroxide
Issue Date (03-03-03)
Review Date (09-29-03)

Product and Company Identification

Product Name: Sodium Hydroxide
Synonym: Caustic soda, lye, sodium hydrate.

CAS#	Percent	OSHA PEL mg/m3	ACGIH TLV mg/m3	NTP	IARC	OSHA Regulated
1310-73-2	100	2	2	No	No	No

Hazard Identification

Emergency Overview
Appearance: White deliquescent pellets, flakes or granules with no odor.
Immediate effects: Danger! Poison! Causes severe respiratory tract, eye and skin burns. May be fatal if swallowed. Harmful if inhaled. Cause damage to the following organs: Respiratory tract, skin, eye lens or cornea.

Potential Health Effects

Primary Routes of Entry: Absorbed through skin, eye contact, inhalation, ingestion.
Signs and Symptoms of Overexposure: Causes severe bums on contact with any body tissue. Vapor is irritating to the eyes and respiratory passages.
Eyes: Extremely hazardous in case of eye contact (corrosive). Causes severe eye bums.
Skin: Extremely hazardous in case of skin contact (corrosive). Skin contact produces severe burns. Hazardous in case of skin contact (permeator).
Ingestion: Extremely hazardous in case of ingestion. May be fatal if swallowed.
Inhalation: Extremely hazardous in case of inhalation (lung corrosive). Hazardous in case of inhalation.
Chronic Exposure: Extremely toxic and corrosive.
Chemical Listed As Carcinogen Or Potential Carcinogen: No.
See Toxicological Information

Physical and Chemical Properties

Appearance and Physical State:	White solid (flakes, pellets or granular)
Odor (threshold):	Odorless
Specific Gravity (H20=1):	2.13
Vapor Pressure (mm Hg):	NA
Vapor Density (air=1):	NA
Percent Volatile by Volume:	NA
Evaporation Rate (butyl acetate=1):	NA
Boiling Point:	1390.04°C (2534.1°F)
Freezing point 1 melting point:	318.38°C (605.1°F)
pH:	ND
Solubility in Water:	Soluble
Molecular Weight:	40.00 g/mole

Transportation Information

US DOT Information: Proper shipping name: Sodium Hydroxide, solid

Hazard Class:	8
Packaging group:	II
UN Number:	UN1823
Limitations:	RQ: 1000 lbs (453.6 Kg)

IATA: Proper shipping name: Sodium Hydroxide, solid

Hazard Class:	8
Packing group:	II
UN Number:	UN1823
Limitations:	ND
Domestic shipments only:	ND

IMO: Proper shipping name: Sodium Hydroxide, solid

Class:	8
UN Number:	UN1823
Packing group:	II
EMS:	ND
MFAG:	ND
Marine Pollutant:	No
Canadian TDG:	ND

Section 16: Other Information

Label Information: Toxic, Corrosive
European Risk and Safety Phrases: R35-Cause severe burns.
European symbols needed: ND
Canadian WHMIS Symbols: ND
NFPA Hazard Rating: Health: 3; Fire: 0; Reactivity: 1
(O=least, 1=Slight, 2=Moderate, 3=High, 4=Extreme)

Abbreviations used in this document

NE= Not Established
NA= Not Applicable
NIF= No Information Found
ND= No Data

Material Safety Data Sheet
Product Name: Arsine

Route of Entry:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	No	Yes	No	Yes

Health Effects:

Exposure Limits	Irritant	Sensitization
Yes	Yes	No
Teratogen	**Reproductive Hazard**	**Mutagen**
No	No	No
Synergistic Effects: None Reported		

Carcinogenicity: NTP: No IARC: Yes OSHA: No

Eye Effects: No adverse effects anticipated.
Skin Effects: Dermatitis is associated with exposure to other arsenic compounds but not necessarily arsine.
Ingestion Effects: Ingestion is unlikely.
Inhalation Effects:
The symptoms of inhalation of this mixture are not well known. However, ARSINE IS AN EXTREMELY TOXIC GAS that destroys red blood cells and can cause widespread organ injury. Inhalation may cause headache, delirium, nausea, vomiting, general malaise, tightness in the chest, and pain in the abdomen and loins. Arsine may discolor urine to red or a darkened color, and the skin to a bronze or jaundiced color. Symptoms may not occur until several hours after exposure.

Arsine is listed by the International Agency for Research on Cancer as a Group 1 Carcinogen (see Arsenic and Certain Arsenic Compounds).

NFPA HAZARD CODES HMIS HAZARD CODES RATINGS SYSTEM

NFPA Hazard Codes	HMIS Hazard Codes	Ratings System
Health: 4	Health: 4	0 = No Hazard
Flammability: 4	Flammability: 4	1 = Slight Hazard
Reactivity: 0	Reactivity: 0	2 = Moderate Hazard
		3 = Serious Hazard
		4 = Severe Hazard

4. First Aid Measures
Eyes: Flush contaminated eye(s) with copious quantities of water. Part eyelids to assure complete flushing. Continue for a minimum of 30 minutes. See a physician for follow up treatment as soon as possible.
Skin: Flush affected area with copious quantities of water. Remove affected clothing as rapidly as possible.

Material Safety Data Sheet
Calcium Carbide

Section 1: Chemical Product and Company Identification

Product Name: Calcium carbide
Catalog Codes: SLC3934
CAS#: 75-20-7
RTECS: EV9400000
TSCA: TSCA 8(b) inventory: Calcium carbide
CI#: Not available.
Synonym: Calcium acetylide
Chemical Formula: CaC2

Contact Information: Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396
US Sales: 1-800-901 -7247
International Sales: 1-281-441-4400
Order Online: ScienceLab.com
CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Name	CAS #	% by Weight
Calcium carbide	75-20-7	100
Toxicological Data on Ingredients: Calcium carbide LD50: Not available. LC50: Not available.		

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).
Potential Chronic Health Effects:
Carcinogenic Effects: Not available.
Mutagenic Effects: Not available.
Teratogenic Effects: Not available.
Developmental Toxicity: Not available.
The substance is toxic to lungs, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

NFPA Hazard Codes	HMIS Hazard Codes	Ratings System
Health: 1	Health: 1	0 = No Hazard
Flammability: 4	Flammability: 4	1 = Slight Hazard
Reactivity: 2	Reactivity: 2	2 = Moderate Hazard
		3 = Serious Hazard
		4 = Severe Hazard

Material Safety Data Sheet
Ammonia

Route of Entry:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	No	Yes	Yes	No

Health Effects:

Exposure Limits	Irritant	Sensitization
Yes	Yes	No
Teratogen	**Reproductive Hazard**	**Mutagen**
No	No	Yes
Synergistic Effects: None Reported		

Carcinogenicity: NTP: No IARC: No OSHA: No

Eye Effects: Mild concentrations of product will cause conjunctivitis. Contact with higher concentrations of product will cause swelling of the eyes and lesions with a possible loss of vision.
Skin Effects: Mild concentrations of product will cause dermatitis or conjunctivitis. Contact with higher concentrations of product will cause caustic-like dermal burns and inflammation. Toxic level exposure may cause skin lesions resulting in early necrosis and scarring.
Ingestion Effects: Since product is a gas at room temperature, ingestion is unlikely.
Inhalation Effects:
Corrosive and irritating to the upper respiratory system and all mucous type tissue. Depending on the concentration inhaled, it may cause burning sensations, coughing, wheezing, shortness of breath, headache, nausea, with eventual collapse.

Inhalation of excessive amounts affects the upper airway (larynx and bronchi) by causing caustic-like burning resulting in edema and chemical pneumonitis. If it enters the deep lung, pulmonary edema will result. Pulmonary edema and chemical pneumonitis are potentially fatal conditions.

NFPA Hazard Codes	HMIS Hazard Codes	Ratings System
Health: 3	Health: 3	0 = No Hazard
Flammability: 1	Flammability: 1	1 = Slight Hazard
Reactivity: 0	Reactivity: 0	2 = Moderate Hazard
		3 = Serious Hazard
		4 = Severe Hazard

Topic: 3-9: Classification by Hazard[1]

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of hazard classification

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Section 2701.2 and Appendix E

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Section 2701.2 and Appendix E

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 3-9-1
I. HAZARD CATEGORIES	
A. Physical hazard[2]	
1. Examples	
a) Explosives and blasting agents	
b) Compressed gases	
c) Flammable and combustible liquids	Can a physical hazard also present a health hazard?
2. May also present a health hazard	
B. Health hazard[3]	
1. Examples	
a) Highly toxic and toxic materials	
b) Radioactive materials	
c) Carcinogens, irritants, sensitizers, and other health hazards	
2. May also present a physical hazard	
II. EVALUATION OF HAZARDS[4]	**SLIDE: 3-9-2**
A. Degree of hazard	
1. Chemical properties	
a) Each material should be carefully researched to determine its hazard properties and how it will react with other materials present	
2. Physical properties	
a) Solid, liquid, or gas	
b) Temperatures and pressures used to store the material in various forms	
c) Specific gravity and vapor density	

PRESENTATION	APPLICATION
d) Flammable limits, boiling point, flash point, etc. 3. Amount and concentration a) How much and what concentration can effect hazard of material 1) Hydrogen peroxide at 90% concentration can explode 2) Hydrogen peroxide at 30% concentration is highly corrosive to the skin 3) Hydrogen peroxide at 3% concentration is used as a mouth wash b) Mixture 1) Some gases are harmless at low levels and highly toxic at higher levels 4. Actual use or activity a) How the product is used and any additional products used in the process will affect how hazardous the material may be 1) Open system versus closed system 5. Surrounding conditions a) Construction type of the structure b) Fire protection systems c) Occupancy type d) Temperature and weather conditions	What questions should be asked when evaluating a product? **SLIDE: 3-9-3**

PRESENTATION	APPLICATION

B. Evaluation questions

1. What is the material?
2. What is the concentration and strength?
3. What is the physical form of the material?
4. What is the quantity of the material present?

SLIDE: 3-9-4

5. What other materials are close enough to interact with the material?
6. What are the likely reactions?
7. What is the activity involving the material?
8. How does the activity involving the material impact hazardous characteristics of the material?

SLIDE: 3-9-5

9. What must the material be protected from?
10. What effects of the materials must people and the environment be protected from?
11. What must be done to ensure proper containment?

C. Hazard evaluation is often an extremely subjective process and requires a thorough knowledge of the material(s) in question

1. The fire department may require the building owner or developer to hire an expert and conduct tests to assist the inspector(s) in determining the necessary requirement for a given material or process

Summary:

Classifying a hazardous material is the first step in inspecting storage, use, and display of such products. Using the CFC, an inspector can classify a material and determine the best methods of protecting such occupancies.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Section 2701.2 and Appendix E in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 2701.2

[2] California Fire Code, CBSC, 2007 Edition, 2701.2.2.1

[3] California Fire Code, CBSC, 2007 Edition, Section 2701.2.2.2

[4] California Fire Code, CBSC, 2007 Edition, Appendix E, section E-103

Topic: 3-10: Inspection Of The Incidental Use, Handling, And Storage Of Hazardous Materials

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.13

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of retail and wholesale storage and display of hazardous materials

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapters 27 and 34, and Appendices Chapter 1 and E, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 57-63

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Individual Activity 3-10-1: Hazardous Materials Permit and Maximum Allowable Quantities

References:

- California Fire Code, CBSC, 2007 Edition, Chapters 27 and 34, and Appendices Chapter 1 and E
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	What is a "maximum allowable quantity?"
	SLIDE: 3-10-1
I. MAXIMUM ALLOWABLE QUANTITY	
A. Quantity of a hazardous materials that may be used, handled, stored, or displayed in a control area of an occupancy other than Group H (commonly called MAQs)	
	SLIDE: 3-10-2
II. HOW TO ESTABLISH PERMITTED AND MAXIMUM ALLOWABLE QUANTITIES	
B. Use Appendix E to classify the product to a hazard category	
C. Compare quantity to CFC Appendix Chapter 1, Section 105.6 and Table 105.6.20	
D. Compare quantity to CFC Section 2703.1 and Tables 2703.1.1(1) through 2703.1.1(4)	
1. Inventory quantities exceeding the MAQs will cause the occupancy to be reclassified as a Group H	
2. If quantity is below the MAQ per control area, the occupancy remains its original designator	
	SLIDE: 3-10-3
E. Group M occupancy storage and display	
1. See CFC Section 2703.11	
F. Group S occupancy storage	
1. See CFC Section 2703.11	
G. Limitation for indoor storage and use	
1. See CFC Sections 2704 and 2705	

PRESENTATION	APPLICATION
	SLIDE: 3-10-4
III. FIELD METHODOLOGY FOR CHECKING FOR COMPLIANCE (RED FLAGS) A. Review disclosure and permit for classification and quantities 1. Verify quantities match actual inventory 2. Verify location of inventory 3. Verify classification matches actual inventory 4. Verify disclosure matches actual inventory 5. If any discrepancy a) Compare to CFC Tables 2703.1.1(1) through 2703.1.1(4)	
	SLIDE: 3-10-5
B. Review MSDS 1. Spot check most hazardous for use, handling, and storage 2. Compare against actual inventory for b) Housekeeping c) Ignition sources d) Compatibility e) Security f) Secondary containment g) Signage	
	SLIDE: 3-10-6
C. NFPA 704 placards 1. Up-to-date 2. Visible on approach	
	ACTIVITY 3-10-1: Complete the activity in the student supplement.

Summary:

Due to the prevalence of hazardous materials in our communities, you may become complacent about the hazards associated with them. With a basic understanding of the basic permit and exempt amounts of hazardous materials, the inspection and enforcement of the CFC will provide for a safe working environment for employees and the public.

In addition, code compliance for hazardous materials in all occupancies will provide a safer environment for the first responders.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapters 27 and 34, and Appendices Chapter 1 and E, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 11, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 57-63 in order to prepare yourself for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 3-10-1: HAZARDOUS MATERIALS PERMIT AND MAXIMUM ALLOWABLE QUANTITIES

Time Frame:	1:00
Materials Needed:	• MSDS for calcium hypochlorite • California Fire Code, CBSC, 2007 Edition, Chapters 27 and 34, and Appendices Chapter 1 and E • Pen or pencil
Introduction:	This activity provides the students the opportunity to determine permit and Maximum Allowable Quantities of hazardous materials.
Directions:	1. Using the CFC and MSDS answer the following questions. 2. You have 40 minutes to complete this activity. 3. Be prepared to discuss your answers with the class.

	Permit Amount CFC AC1, 105.6.20	Maximum Allowable Quantity Tables 2703.1.1(1) through 2703.1.1(4)
1. Chloric Acid (liquid), Class 3 oxidizer, stored outdoors	***1 gallon (With exceptions. See footnote a)***	***40 pounds***
California Fire Code, CBSC, 2007 Edition, Tables A105.6.20 and 2703.1.1(3)		
2. Sulfur, flammable solid, indoor storage/sprinklered building	***100 pounds***	***250 pounds***
California Fire Code, CBSC, 2007 Edition, Tables A105.6.20 and 2703.1.1(1)		
3. Potassium hydroxide (solid), toxic material, indoor storage	***100 pounds***	***500 pounds***
California Fire Code, CBSC, 2007 Edition, Tables A105.6.20 and 2703.1.1(2)		
4. Nitric acid (liquid), corrosive, outdoor storage	***55 gallons***	***2000 pounds***
California Fire Code, CBSC, 2007 Edition, Tables A105.6.20 and 2703.1.1(4)		
5. Vinyl acetate, (liquid) unstable materials, Class 2, indoor use, nonsprinklered building	***5 gallons***	***50 pounds***
California Fire Code, CBSC, 2007 Edition, Tables A105.6.20 and 2703.1.1(1)		
6. White phosphorous (solid), pyrophoric, use-closed system, nonsprinklered building	***Any amount***	***Not permitted***
California Fire Code, CBSC, 2007 Edition, Tables A105.6.20 and 2703.1.1(1) footnote g		

7. What is the main ingredient listed on the MSDS?

Calcium Hypochlorite

MSDS

8. What is the percentage by weight of the main ingredient?

65%

MSDS

9. What is the DOT hazard class?

   5.1 (oxidizer)

   MSDS

10. What is the physical state?

    Solid

    MSDS

11. What is the hazard category according to the CFC?

    Class 3 oxidizer

    California Fire Code, CBSC, 2007 Edition, Appendix E, Section E102.1.7.1

12. What is the permit amount for calcium hypochlorite?

    10 pounds

    California Fire Code, CBSC, 2007 Edition, Table 105.6.20

13. What is the MAQ for calcium hypochlorite used in an open system, outdoors?

    4 pounds

    California Fire Code, CBSC, 2007 Edition, Table 2703.1.1(3)

14. What is the MAQ for calcium hypochlorite stored in a sprinklered building?

    20 pounds

    California Fire Code, CBSC, 2007 Edition, Table 2703.1.1(1) (including footnote D)

15. What is the MAQ for calcium hypochlorite used in an open system in a nonsprinklered building?

    2 pounds

    California Fire Code, CBSC, 2007 Edition, Table 2703.1.1(1)

Material Safety Data Sheet
Omega Chemistries
7623 North 67th Avenue, Suite 301
Glendale AZ 85301

PRODUCT NAME:	PPG CALCIUM HYPOCHLORITE TABLETS
DATE:	05/20/96
EDITION:	003
TRADE NAME:	CALCIUM HYPOCHLORITE TABLETS
CHEM NAME/SYN:	PPG 3" CALCIUM HYPOCHLORITE TABLETS, CAL HYPO
CHEMICAL FAMILY:	HYPOCHLORITE
FORMULA:	CA(OCL)2
CAS NUMBER:	007778-54-3
U.S. DOT SHIPPING NAME:	CALCIUM HYPOCHLORITE, HYDRATED
U.S. DOT HAZARD CLASS:	5.1 (OXIDIZER)
SUBSIDIARY RISK:	N/A
I.D. NUMBER:	UN2880
PACKING GROUP:	II
REPORTABLE QUANTITY:	10 LBS/4.5 KG
IMO DESCRIPTION:	CALCIUM HYPOCHLORITE, HYDRATED, CLASS 5.1, UN2880, PACKING GROUP II, RQ.

SECTION 1 - PHYSICAL DATA

BOILING POINT @ 760 MM HG:	DECOMPOSES @ 180°C
VAPOR DENSITY (AIR=1):	N/A
SPECIFIC GRAVITY (H_2O=1):	N/A
PH OF SOLUTIONS:	ALKALINE
FREEZING/MELTING POINT:	N/A
SOLUBILITY (WEIGHT % IN WATER):	217 G/L @ 27°C
BULK DENSITY:	N/A
VOLUME % VOLATILE:	N/A
VAPOR PRESSURE:	N/A
EVAPORATION RATE:	N/A
HEAT OF SOLUTION:	SLIGHTLY EXOTHERMIC
APPEARANCE AND ODOR:	WHITE TABLETS WITH SLIGHT CHLORINE ODOR

SECTION 2 - INGREDIENTS

MATERIAL	PERCENT
CALCIUM HYPOCHLORITE (65% AVAILABLE CHLORINE)	65
INERT (INCLUDES 5.5 - 10% MOISTURE)	35

SECTION 3 - FIRE/EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED): NONE
FLAMMABLE LIMITS IN AIR (% BY VOLUME) LEL: N/A UEL: N/A
EXTINGUISHING MEDIA: WATER ONLY. SMOTHERING INEFFECTIVE. PRODUCT SUPPLIES OWN OXYGEN. SPECIAL FIRE FIGHTING PROCEDURES: FIRE FIGHTERS MUST WEAR NIOSH/MSHA APPROVED, PRESSURE DEMAND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACE PIECE FOR POSSIBLE EXPOSURE TO HAZARDOUS GASES.
UNUSUAL FIRE AND EXPLOSION HAZARDS: DECOMPOSES AT 180 C RELEASING OXYGEN GAS; CONTAINERS MAY RUPTURE.

SECTION 4 - HEALTH HAZARD DATA

TOXICITY DATA:

LC50 INHALATION:	(RAT) NO MORTALITY @ 3.5 MG/L (1 HR)
LD50 DERMAL:	(RABBIT) >1000 MG/KG
SKIN/EYE IRRITATION:	SEE SECTION 5
LD50 INGESTION:	SEE SECTION 5
FISH, LC50	(LETHAL CONCENTRATION): TLM 96 HR.: 10-1 PPM

CLASSIFICATION:

INHALATION:	IRRITATING
SKIN:	SLIGHTLY TOXIC
SKIN/EYE:	CORROSIVE
INGESTION:	SLIGHTLY TOXIC
AQUATIC:	HIGHLY TOXIC

SECTION 5 - EFFECTS OF OVEREXPOSURE

IS CHEMICAL LISTED AS A CARCINOGEN OR POTENTIAL CARCINOGEN?
NTP - NO IARC - NO OSHA - NO
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: NONE KNOWN
PERMISSIBLE EXPOSURE LIMITS: NONE ESTABLISHED BY OSHA OR ACGIH FOR THIS PRODUCT.
PPG INTERNAL PERMISSIBLE EXPOSURE LIMIT (IPEL): 1 MG/CU.M., 8-HOUR TWA (TIME WEIGHTED AVERAGE); 2 MG/CU.M. STEL (SHORT-TERM EXPOSURE LIMIT).

ACUTE:

INHALATION: INHALATION OF CALCIUM HYPOCHLORITE DUST AND DEPOSITION OF PARTICLES IN THE RESPIRATORY TRACT CAN LEAD TO IRRITATION OF THE TISSUE AND CAUSE A VARIETY OF EFFECTS. THESE EFFECTS ARE DEPENDENT ON CONCENTRATION AND INCLUDE: UPPER RESPIRATORY TRACT IRRITATION, NASAL CONGESTION, COUGHING, SORE THROAT, LARYNGITIS, AND SHORTNESS OF BREATH. IN OPERATIONS WHERE THERE ARE HIGH CONCENTRATIONS OF RESPIRABLE PARTICULATES, PULMONARY EDEMA (FLUID IN THE LUNG) MAY BE PRODUCED. IF NOT TREATED IMMEDIATELY, PULMONARY EDEMA CAN BE LIFE THREATENING. SINCE THIS PRODUCT IS IN TABLET FORM, PARTICLES OF RESPIRABLE SIZE ARE NOT GENERALLY ENCOUNTERED.

EYE/SKIN: CALCIUM HYPOCHLORITE IS CORROSIVE TO THE EYES. CONTACT OF CALCIUM HYPOCHLORITE DUST WITH THE EYES, EVEN A MINUTE AMOUNT FOR A SHORT DURATION, CAN CAUSE SEVERE IRRITATION AND EVEN BLINDNESS. CONTACT WITH THE SKIN MAY CAUSE SEVERE IRRITATION, BURNS, OR TISSUE DESTRUCTION.

IN STUDIES UTILIZING RABBITS, THE SKIN IRRITATION SCORE WAS 8/8 AND THE EYE IRRITATION SCORE WAS 98.5/110. THE CLASSIFICATION FOR BOTH OF THESE IS CORROSIVE.

INGESTION: CALCIUM HYPOCHLORITE, IF SWALLOWED, CAUSES SEVERE BURNS TO THE DIGESTIVE TRACT AND CAN BE FATAL.

CHRONIC:

GENOTOXICITY: CALCIUM HYPOCHLORITE PRODUCED POSITIVE RESPONSES IN IN-VITRO ASSAYS USING BACTERIAL SYSTEMS (THE AMES TEST) AND CHROMOSOMAL ABERRATIONS IN CHINESE HAMSTER FIBROBLASTS. IN A WHOLE ANIMAL EXPERIMENT (MOUSE MICRONUCLEUS TEST), EXPOSURES RANGING FROM 20 TO 160 MG/KG PRODUCED NO COMPOUND RELATED CHROMOSOMAL ABNORMALITIES.

CARCINOGENISIS: ALTHOUGH NO STUDY HAS BEEN CONDUCTED WITH CALCIUM HYPOCHLORITE, THE CARCINOGENIC POTENTIAL OF SODIUM HYPOCHLORITE WAS STUDIED IN F344 RATS. AFTER 104 WEEKS OF DRINKING WATER CONTAINING UP TO 2000 PPM SODIUM HYPOCHLORITE, THERE WAS NO EVIDENCE THAT THIS CHEMICAL PRODUCED ANY CARCINOGENIC RESPONSE. IN ADDITION, THIS EXPOSURE DID NOT RESULT IN ANY ADVERSE EFFECTS IN BLOOD, CLINICAL CHEMISTRY, OR OTHER TARGET ORGANS.

ONE OF THE MAJOR USES OF CALCIUM HYPOCHLORITE IS AS A SOURCE OF CHLORINE FOR WATER SANITIZATION IN DRINKING AND RECREATIONAL WATER. STUDIES HAVE BEEN CONDUCTED TO DETERMINE THE LONG-TERM EFFECTS OF CHLORINATED DRINKING WATER. SEVEN GENERATIONS OF RATS WERE GIVEN 100 PPM CHLORINE IN THEIR DRINKING WATER. NO DIFFERENCE IN FERTILITY, GROWTH, BLOOD PARAMETERS, OR SPECIFIC ORGAN TOXICITY WAS OBSERVED BETWEEN CONTROL AND EXPOSED ANIMALS. TWO SEPARATE ANIMAL STUDIES CONDUCTED BY DIFFERENT GOVERNMENT AGENCIES DETERMINED THAT THE CHLORINATION OF MUNICIPAL DRINKING WATER DID NOT RESULT IN TOXICITY TO THE DEVELOPING MOUSE FETUS.
SAFE HANDLING OF THIS MATERIAL ON A LONG-TERM BASIS SHOULD EMPHASIZE MINIMIZING REPEATED ACUTE EXPOSURES.
EMERGENCY AND FIRST AID PROCEDURES
INHALATION: REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN. CALL A PHYSICIAN.
EYE OR SKIN CONTACT: FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES, WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. FOR EYE CONTACT, GET IMMEDIATE MEDICAL ATTENTION. IF SKIN IRRITATION OCCURS, GET MEDICAL ATTENTION.
INGESTION: IF CONSCIOUS, DRINK LARGE QUANTITIES OF WATER AND ANY COMMON COOKING (VEGETABLE) OIL, IF AVAILABLE. DO NOT INDUCE VOMITING. TAKE IMMEDIATELY TO A HOSPITAL OR PHYSICIAN. IF UNCONSCIOUS, OR IN CONVULSIONS, TAKE IMMEDIATELY TO A HOSPITAL. DO NOT ATTEMPT TO INDUCE VOMITING OR GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.
NOTES TO PHYSICIAN (INCLUDING ANTIDOTES): TREAT SYMPTOMATICALLY.

SECTION 6 - REACTIVITY DATA

STABILITY: UNSTABLE
CONDITIONS TO AVOID: CONTAMINATION OR EXCESSIVE HEAT ABOVE 177°C
HAZARDOUS POLYMERIZATION: WILL NOT OCCUR
CONDITIONS TO AVOID: NONE - WILL NOT POLYMERIZE
INCOMPATIBILITY (MATERIALS TO AVOID): ACIDS, COMBUSTIBLE MATERIALS, ORGANICS, REDUCING AGENTS
HAZARDOUS DECOMPOSITION PRODUCTS: ACIDS OR AMMONIA CONTAMINATION WILL RELEASE TOXIC GASES. EXCESSIVE HEAT WILL CAUSE DECOMPOSITION RESULTING IN THE RELEASE OF OXYGEN AND CHLORINE GAS.

SECTION 7 - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS SPILLED OR RELEASED:
NOTE: USE EXTREME CAUTION IN HANDLING SPILLED MATERIAL. CONTAMINATION WITH ORGANIC OR COMBUSTIBLE MATERIAL MAY CAUSE FIRE OR VIOLENT DECOMPOSITION. IF FIRE OR DECOMPOSITION OCCURS IN AREA OF SPILL, IMMEDIATELY DOUSE WITH PLENTY OF WATER. OTHERWISE, SWEEP UP ALL VISIBLE MATERIAL USING A CLEAN, DRY SHOVEL AND BROOM AND DISSOLVE MATERIAL IN WATER. DISPOSE OF WASTE MATERIAL AS OUTLINED BELOW.
WASTE DISPOSAL METHOD: SPILLED MATERIAL THAT HAS BEEN SWEPT UP AND DISSOLVED IN WATER SHOULD BE USED IMMEDIATELY IN THE NORMAL APPLICATION FOR WHICH CALCIUM HYPOCHLORITE IS BEING CONSUMED. IF THIS IS NOT POSSIBLE, CAREFULLY NEUTRALIZE DISSOLVED MATERIAL BY ADDING HYDROGEN PEROXIDE (ONE PINT OF 35% HYDROGEN PEROXIDE SOLUTION PER POUND OF CALCIUM HYPOCHLORITE TO BE NEUTRALIZED)THEN DILUTE THE NEUTRALIZED MATERIAL WITH PLENTY OF WATER AND FLUSH TO SEWER. NOTE: ONLY PROPERLY NEUTRALIZED MATERIAL SHOULD BE FLUSHED TO SEWER. UNNEUTRALIZED MATERIAL CAN CAUSE ENVIRONMENTAL DAMAGE TO RECEIVING WATER OR CAN INTERFERE WITH TREATMENT PLANT OPERATION. FOR ON-SITE NEUTRALIZATION, CAREFULLY AND SLOWLY POUR THE APPROPRIATE QUANTITY OF 35% HYDROGEN PEROXIDE SOLUTION OVER ALL SPILLED MATERIAL THEN FLUSH

AREA WITH PLENTY OF WATER. COMMENTS: CARE MUST BE TAKEN WHEN USING OR DISPOSING OF CHEMICAL MATERIALS AND/OR THEIR CONTAINERS TO PREVENT ENVIRONMENTAL CONTAMINATION. IT IS YOUR DUTY TO DISPOSE OF THE CHEMICAL MATERIALS AND/OR THEIR CONTAINERS IN ACCORDANCE WITH THE CLEAN AIR ACT, THE CLEAN WATER ACT, THE RESOURCE CONSERVATION AND RECOVERY ACT, FIFRA, AS WELL AS ANY OTHER RELEVANT FEDERAL, STATE, OR LOCAL LAWS/REGULATIONS REGARDING DISPOSAL.

SECTION 8 - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: IF DUSTY CONDITIONS ARE ENCOUNTERED, USE NIOSH/MSHA APPROVED RESPIRATOR WITH ACID GAS CARTRIDGE AND DUST PREFILTER. THE RESPIRATOR USE LIMITATIONS SPECIFIED BY NIOSH/MSHA OR THE MANUFACTURER MUST BE OBSERVED. RESPIRATORY PROTECTION PROGRAMS MUST BE IN ACCORDANCE WITH 29 CFR 1910.134.
VENTILATION (TYPE): NONE, UNLESS DUSTY CONDITIONS ARE ENCOUNTERED.
EYE PROTECTION: CHEMICAL SAFETY GOGGLES
GLOVES: NATURAL OR SYNTHETIC RUBBER
OTHER PROTECTIVE EQUIPMENT: BOOTS, APRONS, OR CHEMICAL SUITS SHOULD BE USED WHEN NECESSARY TO PREVENT SKIN CONTACT. PERSONAL PROTECTIVE CLOTHING AND USE OF EQUIPMENT MUST BE IN ACCORDANCE WITH 29 CFR 1910.132 (GENERAL REQUIREMENTS), .133 (EYE & FACE PROTECTION) AND .138 (HAND PROTECTION).

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN DURING HANDLING AND STORING:
DO NOT GET IN EYES, ON SKIN OR ON CLOTHING.
KEEP IN ORIGINAL CONTAINER IN A COOL, DRY PLACE.
KEEP CONTAINER CLOSED WHEN NOT IN USE.
KEEP AWAY FROM HEAT SOURCES, SPARKS, OPEN FLAMES AND LIGHTED TOBACCO PRODUCTS. USE ONLY A CLEAN, DRY SCOOP MADE OF METAL OR PLASTIC EACH TIME THIS PRODUCT IS TAKEN FROM CONTAINER.
DO NOT ADD THIS PRODUCT TO ANY DISPENSING DEVICE CONTAINING REMNANTS OF ANY OTHER PRODUCT. SUCH USE MAY CAUSE VIOLENT REACTION LEADING TO FIRE OR EXPLOSION. ADD THIS PRODUCT ONLY TO WATER.
MAY CAUSE FIRE OR EXPLOSION IF MIXED WITH OTHER CHEMICALS.
FIRE MAY RESULT IF CONTAMINATED WITH ACIDS OR EASILY COMBUSTIBLE MATERIAL SUCH AS OIL, KEROSENE, GASOLINE, PAINT PRODUCTS AND MOST OTHER ORGANIC MATERIALS.
WASH HANDS AFTER HANDLING
DO NOT REUSE CONTAINER. RESIDUAL MATERIAL REMAINING IN EMPTY DRUM CAN REACT TO CAUSE FIRE. THOROUGHLY FLUSH EMPTY CONTAINER WITH WATER THEN DESTROY BY PLACING IN TRASH COLLECTION. DO NOT CONTAMINATE WATER, FOOD, OR FEED BY STORAGE OR DISPOSAL.
OTHER PRECAUTIONS:
KEEP OUT OF REACH OF CHILDREN.
STRONG OXIDIZER - FIRE MAY RESULT FROM CONTACT WITH HEAT, ACIDS, ORGANIC OR COMBUSTIBLE MATTER.
MAY BE FATAL OR HARMFUL IF SWALLOWED.
MAY CAUSE CHEMICAL BURNS.
IRRITATING TO NOSE AND THROAT - AVOID BREATHING DUST.
COMMENTS:
TSCA-CALCIUM HYPOCHLORITE IS ON THE TSCA INVENTORY UNDER CAS #7778-54-3. SARA TITLE III - A) 311/312 CATEGORIES - ACUTE AND REACTIVITY, B) NOT LISTED IN SECTION 313, C) NOT LISTED AS AN "EXTREMELY HAZARDOUS SUBSTANCE" IN SECTION 302.
CERCLA - LISTED IN TABLE 302.4 OF 40 CFR PART 302 AS A HAZARDOUS SUBSTANCE WITH A REPORTABLE QUANTITY OF 10 POUNDS. RELEASES TO AIR, LAND OR WATER WHICH EXCEED THE RQ MUST BE REPORTED TO THE NATIONAL RESPONSE CENTER, 800-424-8802.

RCRA - WASTE CALCIUM HYPOCHLORITE AND CONTAMINATED SOILS/MATERIALS FROM SPILL CLEANUP ARE D001 HAZARDOUS WASTE AS PER 40 CFR 261.21(A)(4) AND MUST BE DISPOSED OF ACCORDINGLY UNDER RCRA.
FIFRA - CALCIUM HYPOCHLORITE IS REGISTERED WITH EPA AS A PESTICIDE (EPA REG. NO. 748-295). NSF - PPG CALCIUM HYPOCHLORITE IS CERTIFIED FOR MAXIMUM USE AT 46 MG/L UNDER ANSI/NSF STANDARD 60.

For Additional Information:
Contact: MSDS Coordinator - Omega chemistries.
During business hours, Pacific Time - 623-842-9304
NOTICE
Omega chemistries, expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.
Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information, refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your local Omega chemistries Sales Office.
All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Omega chemistries make no representations as to its accuracy or sufficiency. Conditions of use are beyond Omega chemistries control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein. This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process.

Topic: 4-1: Portable Fire Extinguisher Classifications

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.7

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of portable fire extinguisher classifications

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Different types of portable fire extinguishers

References:

- California Fire Code, CBSC, 2007 Edition, Sections 904 and 906
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8
- NFPA 10: Standard on Portable Fire Extinguishers, NFPA, 2005 Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
I. TYPES OF EXTINGUISHERS	What are the different types of portable fire extinguishers? **SLIDE: 4-1-1**
A. Stored pressure 1. Both the extinguishing agent and the expelling gas are in a single chamber 2. Nearly all have a pressure gauge near the control valve 3. Can only be recharged by a licensed repair firm	
4. Found in a) Schools b) Stores c) Offices	Where is this type of extinguisher found? **SLIDE: 4-1-2** **SLIDE: 4-1-3**
B. Cartridge pressure 1. Agent in one container and expelling gas in separate cartridges 2. Expellant must be released into the agent container before unit will operate a) Requires a separate action to charge extinguisher 3. No pressure gauge 4. Found in high risk areas a) Industry b) Transportation	**SLIDE: 4-1-4**

PRESENTATION	APPLICATION
	SLIDE: 4-1-5
C. Pump	
1. Internal pump develops pressure by adding air pressure into storage container	
2. Limited to Class A extinguishers	
3. To recharge	
a) Refill container with water	**SLIDE: 4-1-6**
D. Hand propelled	
1. 2½-3 gallon water buckets hung on or in a 55 gallon barrel	
2. Buckets filled with "dry" sand	
a) Agent applied with a scoop	
3. Used on flammable metal fires	
4. Not very common, but still in use	
II. PORTABLE FIRE EXTINGUISHER RATINGS	
A. Ratings by class of fire	
	What is a Class A fire?
	SLIDE: 4-1-7
1. Class A	
a) Ordinary combustibles	
1) Wood	
2) Paper	
3) Cloth	
4) Plastic	
b) Identified by a green triangle with the letter "A" in it	
c) Pictograph is a picture of a flaming waste basket and trash pile	

PRESENTATION	APPLICATION
	What is a Class B fire? **SLIDE: 4-1-8**
2. Class B a) Flammable or combustible liquids, greases, or gases 1) Gasoline 2) Cooking oil 3) Grease, etc. b) Identified by a red square with the letter "B" in it c) Pictograph is a picture of a flaming gasoline can	
	What is a Class C fire? **SLIDE: 4-1-9**
3. Class C a) Live electrical equipment b) Fuel involved is Class A and/or B c) Agent is nonconductive of electricity d) Identified by a blue circle with the letter "C" in it e) Pictograph is a picture of a flaming electrical plug and outlet	
	What is a Class D fire? **SLIDE: 4-1-10**
4. Class D a) Flammable and combustible metals 1) Magnesium, titanium, zirconium, etc. b) Identified by a yellow star with the letter "D" in it c) Pictograph is a fire under a drill press	

PRESENTATION	APPLICATION
	SLIDE: 4-1-11
5. Class K a) Fires in cooking appliances that involve combustible cooking media (vegetable or animal oils and fats) 1) In recent years there has been a trend for commercial kitchens to start using much more efficient cooking appliances and unsaturated cooking oils that operate at much higher temps than the previous oils and appliances 2) Class K extinguisher was developed to combat this new hazard b) Most Class K extinguishers can safely be used on Class A, B, and C fires 1) Does not have a special pictograph 2) Only indicates effectiveness on Class A, B, or C fires c) Range is 10-12 feet d) Will last for about 40 seconds	
	What does the rating on a Class A or Class B extinguisher identify?
B. Class rating system 1. Class A and B extinguishers are rated by the amount of fire they can be expected to extinguish	
	SLIDE: 4-1-12
2. Class A rating system a) Class A extinguishers are rated from 1-A to 40-A	
	How is a rating of 1-A achieved?

PRESENTATION	APPLICATION
b) Rating a 1-A extinguisher 1) Requires 1¼ gallons of water 2) Extinguishes fifty 2"x2"x18¾" pieces of wood built into a crib shape or 3) Wood panel 8"x8" square or 4) Six pounds of packing excelsior in a 2'10"x5'8" pile	What is needed to achieve a rating of 2-A?
c) Rating a 2-A extinguisher 1) Extinguishes twice as much as a 1-A rated extinguisher	**SLIDE: 4-1-13**
3. Class B rating system a) Class B extinguishers are rated from 1-B to 640-B	What does a "B" rating indicate?
b) The number is an approximate indication of area, in square feet, of burning flammable liquids that can be extinguished	What does it take to achieve a 1-B rating?
c) Rating a 1-B extinguisher 1) Extinguishes an area approximately 1 square foot by an inexperienced operator 2) Extinguishes an area of approximately 2½ square feet by an experienced operator	
d) Rating a 2-B extinguisher 1) Extinguishes twice as much as a 1-B rated extinguisher	

PRESENTATION	APPLICATION
4. Class C rating system a) Tested on electrical nonconductivity b) No numerical rating	What does a Class C rating indicate? **SLIDE: 4-1-14**
5. Class D rating system a) No numerical rating b) Each type of agent is specific for a certain type of material c) Check faceplate of extinguisher for details on what it can be used for	What does a Class D rating indicate?
6. Class K rating system a) No numerical rating 1) Numerical rating provided for Class A, B, or C fires only b) Required in all kitchens within 30 feet of commercial food heat-processing equipment	What does a Class K rating indicate? **SLIDE: 4-1-15**
7. Multiple class rating a) Many agents can extinguish more than one class of fire	**SLIDE: 4-1-16**
1) Class B:C • Nonconductive agent for use on flammable liquids	If an extinguisher is rated a B:C, what does that mean?

PRESENTATION	APPLICATION
2) Class A:B:C • Nonconductive agent for use on ordinary combustibles and flammable liquids 3) Class A:B • Foam or aqueous film forming foam (AFFF) for use on ordinary combustibles and flammable liquids 4) Class A:B:C:K	
III. EXTINGUISHING AGENTS	
	What is effective on a Class A fire? **SLIDE: 4-1-17**
A. Water 1. Use on Class A fire only 2. May have an antifreeze added 3. May have a wetting agent added 4. Operated as a stored pressure or hand pump extinguisher	
	On what class fire will AFFF be effective? **SLIDE: 4-1-18**
B. Aqueous film forming foam (AFFF) 1. Use on Class A or B fires 2. Operated as a stored pressure extinguisher	
	On what kind of fire will CO_2 be effective?
C. Carbon dioxide (CO_2) 1. Use on Class B or C fires 2. Is an inert gas that will not support combustion 3. Operated as a self-expellant extinguisher	

PRESENTATION	APPLICATION
	On what kind of fire will Halon be effective? **SLIDE: 4-1-19**
D. Halogenated agents 1. Used primarily on Class B or C fires 2. Interrupts the chemical chain reaction needed for combustion 3. Halon 1211 and Halon 1301 are no longer manufactured, but many are still in use a) Examples 1) Ansul Inc. 2) Amerex Corp. 3) PyroChem 4. Operated as a self-expellant extinguisher	
	SLIDE: 4-1-20
E. Dry chemical 1. Used on Class A, B, and/or C fires 2. Several agents may be used	
	What are some of the common agents found in dry chemical extinguishers?
a) Sodium bicarbonate b) Potassium bicarbonate c) Ammonium bicarbonate d) Potassium chloride 3. Interrupts the combustion process by breaking the chemical chain reaction 4. Operated as stored pressure or cartridge	

PRESENTATION	APPLICATION
	SLIDE: 4-1-21 On what type of fires is a dry powder used?
F. Dry powder 1. Used on Class D fires only 2. Powders used for different metals a) MET-L-X® b) G-2	
G. Wet chemical 1. Potassium carbonate 2. Interrupts the chemical chain reaction	**SLIDE: 4-1-22**
H. Wet potassium acetate 1. Low pH agent 2. Discharged in a fine mist 3. Prevents splashing 4. Creates an effective saponification (soapy) foam-type blanket 5. Used in Class K extinguishers	**SLIDE: 4-1-23**
IV. OPERATION A. Instructions are on every extinguisher B. Extinguishers have the same basic method of operation 1. PASS method 2. Pull a) The pin, ring, or break the seal on the handle 3. Aim a) The nozzle at the fire b) Stand 6-10 feet away	

PRESENTATION	APPLICATION

4. Squeeze
   a) The handle to discharge the agent
   b) Release the handle to shut-off discharge
5. Sweep
   a) The nozzle back and forth
   b) At the base of the flames

Summary:

Portable fire extinguishers are the most common type of fire protection in use. The inspector must know the fire extinguisher classes to match the correct extinguisher to the occupancy to be protected.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8 in order to prepare yourself for the upcoming test. Study for our next session.

Topic: 4-2: Portable Fire Extinguisher Placement

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.7

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of the considerations given when distributing and locating portable fire extinguishers

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 65-66

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Individual Activity 4-2-1: Extinguisher Placement

References:

- Barclays Official California Code of Regulations Title 19, West Group, Chapter 3
- California Fire Code, CBSC, 2007 Edition, Section 906
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 4

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
I. LEGAL REQUIREMENTS	
	Where are the legal requirements for extinguishers found?
	SLIDE: 4-2-1
A. CFC Section 906.2	
	SLIDE: 4-2-2
B. California Code of Regulations (CCR) Title 19 1. State Fire Marshal property a) Schools b) Jails c) Assemblies d) Apartments/houses 2. CCR Title 19, Chapter 3 a) Spacing b) Type c) Hazard rating	
	SLIDE: 4-2-3
C. Federal regulations 1. Federal property a) Post offices b) Military installations 2. OSHA regulations 3. DOT regulations	
	SLIDE: 4-2-4
D. Insurance regulations 1. May require more stringent fire extinguisher regulations than other laws or regulations	

PRESENTATION	APPLICATION

II. EXTINGUISHER HAZARDS AND SPACING REQUIREMENTS

SLIDE: 4-2-5

A. Class A

1. Light (low) hazard occupancies
   - a) Public assemblies
   - b) Offices
   - c) Residential buildings
   - d) Hospitals
   - e) Schools

How is extinguisher spacing determined?

   - f) Spacing requirements
     1) 2-A minimum rated single extinguisher
     2) Maximum floor area per unit of A = 3,000 square feet
     3) Must be at least one extinguisher per floor
     4) Maximum travel distance from any point of the floor to an extinguisher shall not be more than 75 feet

SLIDE: 4-2-6

2. Ordinary (moderate) hazard occupancies
   - a) Mercantile occupancies
   - b) Places where paper or plastic stock loading is moderate to heavy
   - c) Spacing requirements
     1) 2-A minimum rated single extinguisher
     2) Maximum floor area per unit of A = 1,500 square feet

PRESENTATION	APPLICATION
3) Must be at least one extinguisher per floor 4) Maximum travel distance from any point of the floor to an extinguisher shall not be more than 75 feet	**SLIDE: 4-2-7**
3. Extra (high) hazard occupancies a) 4-A minimum rated single extinguisher b) Maximum floor area per unit of A = 1,000 square feet c) Maximum travel distance from any point of the floor to an extinguisher shall not be more than 75 feet	**SLIDE: 4-2-8**
4. Additional requirements for Class A extinguishers a) On the stage of a theater b) In the basement below a stage c) Under the stage d) In hallways to dressing rooms e) Workrooms	What are examples of Class B fire hazards that may require an extinguisher? **SLIDE: 4-2-9**
B. Class B 1. Fire hazards a) Dip tanks b) Cooking equipment c) Spray booths d) Transform rooms	

PRESENTATION	APPLICATION
2. Spacing requirements a) One 10-B:C unit required when travel distance is not more than 30 feet b) One 20-B:C unit required when travel distance is between 30 and 50 feet	What are some specific hazard occupancies that require additional extinguishers? **SLIDE: 4-2-10**
3. Additional requirements for specific occupancies a) In every fan motor room b) Two units of 10-B:C in each motion picture projection room c) One 2-A:20-B:C extinguisher within 75 feet of any fuel pump or dispenser, at fuel dispensing stations d) One Class K extinguisher shall be located within 30 feet of cooking equipment e) Two smaller extinguishers cannot be used to substitute for a required larger unit	
C. Both Class A and B hazards exist 1. Separate extinguishers are provided for each hazard 2. Square footage protection for Class A hazards may be doubled if maximum travel distance is no more than 50 feet	**SLIDE: 4-2-11**
D. Class C 1. Extinguisher and nozzle cannot conduct electricity 2. No number assigned to this rating	

PRESENTATION	APPLICATION
3. Spacing requirements a) Required as needed for protection of electrical equipment	
	Where is a Class D extinguisher needed? **SLIDE: 4-2-12**
E. Class D 1. Fire hazards a) For specific metals 1) Must be able to handle a fire in the specific metal for which it is designed 2. Spacing requirements a) Must be within 75 feet of hazard area	
	Where is a Class K extinguisher needed? **SLIDE: 4-2-13**
F. Class K 1. Fire hazards a) Hazards where there is potential for fire involving combustible cooking media 1) Vegetable or animal oils and fats 2. Spacing requirements a) Must be within 30 feet of hazard area	
	Where should extinguishers be mounted? **SLIDE: 4-2-14**
III. LOCATION OF EXTINGUISHERS[1] A. Near the exits B. Maximum of 5 feet from the floor to the top of extinguisher 1. Unit under 40 pounds	

PRESENTATION	APPLICATION
C. Maximum of 3½ feet from the floor to the top of extinguisher 1. Unit over 40 pounds	**ACTIVITY 4-2-1:** Complete the activity in the student supplement.

Summary:

If a fire extinguisher is to do its job, it must be matched to the proper hazard. It must also be of sufficient size to deal with the type of fire that could be expected in that area. It must also be in a place that is easily available to all occupants.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

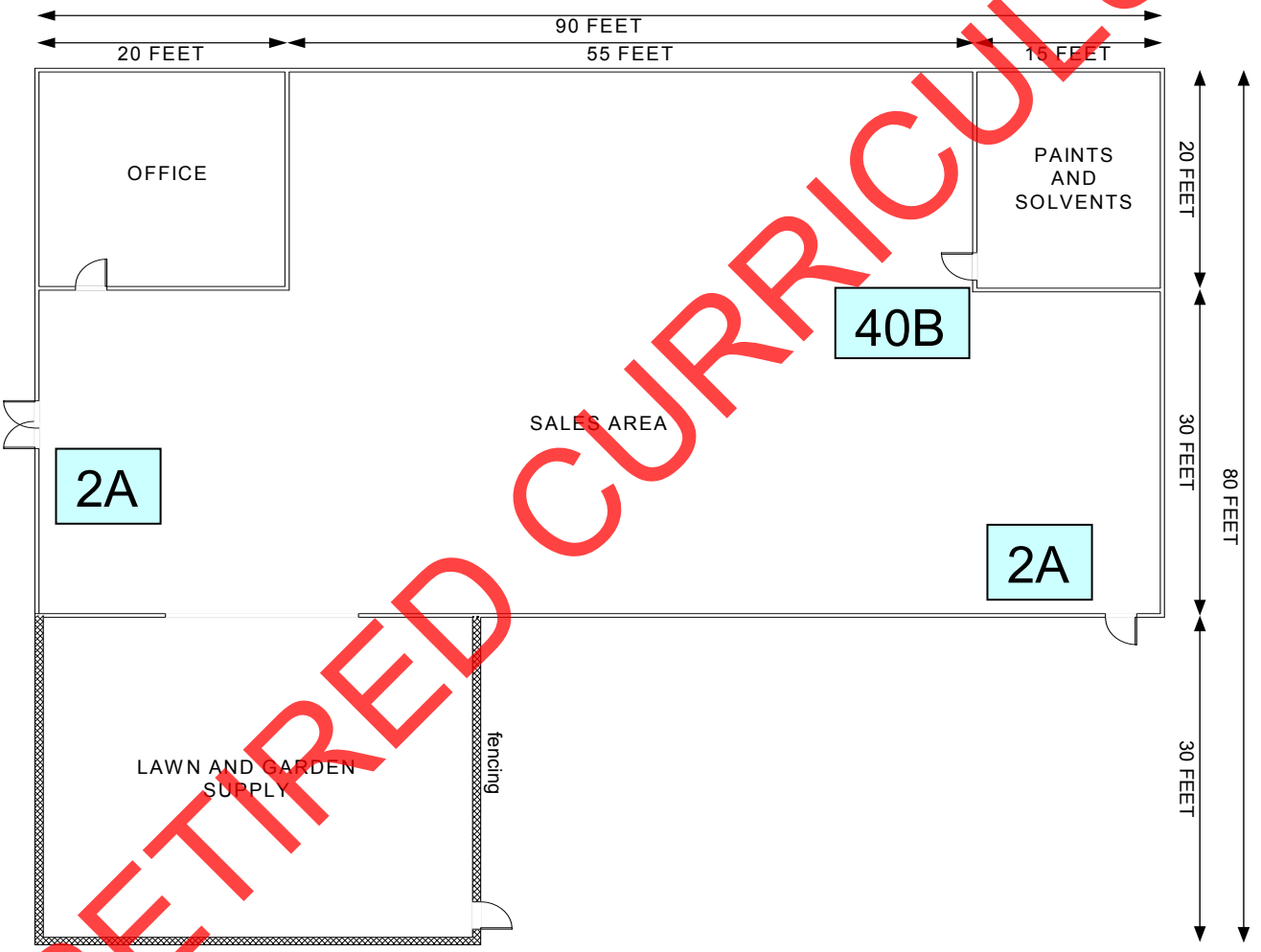
Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 65-66 in order to prepare you for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 4-2-1: EXTINGUISHER PLACEMENT

Time Frame:	0:15
Materials Needed:	• California Fire Code, CBSC, 2007 Edition, Section 906 • Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8, Tables 8.1 and 8.2 • Pen or pencil
Introduction:	This activity provides the students the opportunity to determine fire extinguisher size and placement location.
Directions:	1. Review Tables 8.1 and 8.2. 2. Use the floor plan the Close Hardware Company on the following page. 3. Identify the minimum number of extinguishers required. 4. Mark the location for the proper placement of the extinguisher(s). 5. You have 10 minutes to complete this activity. 6. Be prepared to discuss your answers with the class.
Note:	**Table 8.1 has an error. Minimum rating for extra (high) hazard occupancy is 4-A, not 40A.**

EXTINGUISHER PLACEMENT EXERCISE

You are an inspector checking Close Hardware Company, a new business in town. Using information found in your IFSTA manual and the CFC, indicate on the floor plan below the type of extinguishers you will require and where they will be placed. Be prepared to explain your decision.



instructor note:

There are multiple answers possible. Stress the following:

- ❑ A 40-B extinguisher required for extra hazard (within 30 feet).
- ❑ One 2-A unit per 1,500 square feet for ordinary hazard. Total square feet above = 2,750; at least two units are required.
- ❑ 2-A units should be placed within 75 feet of travel from all areas.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 906.9

Topic: 4-3: Procedures For Inspecting Portable Fire Extinguishers

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.5

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the procedures for inspecting portable fire extinguishers

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Barclays Official California Code of Regulations Title 19, West Group, Chapter 3
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 4

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 4-3-1
I. EXTINGUISHER READINESS	
A. Depends on many factors	
1. Hazard being protected	
2. Classification of extinguisher	
3. Condition of the extinguisher	
B. Usually the responsibility of the owner and/or occupant of the occupancy	
C. Extinguishers may or may not be required by the fire code	
	Do all extinguishers have to comply with the fire code?
1. Any extinguisher that is available to the occupants must be in compliance with the CFC	
a) Even if the unit is in addition to the minimum code requirements	
2. May be required per other regulations	
a) Insurance company	
b) Cal/OSHA	
	What items should be inspected?
	SLIDE: 4-3-2
II. MAINTENANCE INSPECTION[1]	
A. General appearance	
1. Obvious physical damage	
2. Corrosion	
3. Leakage	
4. Clogged nozzle	
B. Located in the designated place	
C. No obstructions to access or visibility	

PRESENTATION	APPLICATION
	SLIDE: 4-3-3
D. Nameplate 1. Operation instructions legible and facing outward 2. Rating and classification 3. UL mark	
E. Safety seals and tamper indicators not broken or missing 1. Must be a manufacturer's seal, not a "homemade" seal	
F. Pressure gauge reading or indicator in the operable range or position	
	SLIDE: 4-3-4
G. Determine fullness by hefting 1. By weight, if needed	
H. Condition of wheeled units 1. Tires 2. Wheels 3. Carriage 4. Hose 5. Nozzle	
	SLIDE: 4-3-5
III. SERVICE STATUS TAGS	
A. Tag can only use OSFM's format	What information must be on the OSFM tag?
B. Both the license and certificate numbers must be on the tag	
C. Tag must be signed by a technician	

PRESENTATION	APPLICATION

D. Service must be current

1. Service date is the date when service was last done, not when it is next due for service
2. Within last 12 months
   a) Service required annually[2]

E. Tag must be affixed to the extinguisher

F. Extinguisher Recharging[3]

1. Each extinguisher shall have a tag or label securely attached that indicates
   a) The month and year recharging was performed
   b) The person performing the service
2. A "Verification of Service" (maintenance or recharging) collar shall also be attached to the extinguisher
   a) Exception #1
      1) Liquefied gas, Halogenated agent, and carbon dioxide extinguishers that have been recharged without valve removal do not require a "Verification of Service"
   b) Exception #2
      1) Cartridge/cylinder-operated extinguishers do not require a "Verification of Service" collar
3. "Verification of Service" collar
   a) Each extinguisher that has undergone maintenance that includes internal examination or that has been recharged shall have a collar located around the neck of the container

PRESENTATION	APPLICATION
b) Exception #1 1) Fire extinguishers undergoing maintenance before January 1, 1999 c) Exception #2 1) Cartridge/cylinder operated fire extinguishers do not require a "Verification of Service"	How often do extinguishers have to be hydrostatical tested? **SLIDE: 4-3-6**
IV. HYDROSTATIC TEST STATUS A. Five-year intervals 1. CO_2 units 2. Soldered brass dry chemical units 3. Stainless steel dry chemical units 4. Cartridge operated water units 5. Any extinguisher carried on a vehicle	**SLIDE: 4-3-7**
B. Ten-year intervals 1. Nitrogen cylinders used as an extinguisher expellant C. Twelve-year intervals 1. Brazed brass dry chemical units 2. Mild steel dry chemical units 3. Aluminum shell water or dry chemical units	

PRESENTATION	APPLICATION
V. EXTINGUISHER ACCESS A. Hanger secure B. Unit easily removed C. Extinguisher signs or other indicators present D. Protected from freezing, if needed E. Not mounted higher or lower than required	What needs to be inspected to assure access to the extinguisher? **SLIDE: 4-3-8**

Summary:

The fire extinguisher can be as important as the automatic fire sprinkler system. Oftentimes, the extinguisher is overlooked as "not important." Since the extinguisher is the first appliance used to extinguish a fire, it must be inspected properly to determine its condition and usability. When inspecting various types and classes of extinguishers, the inspector uses many reference materials. This information allows the inspector to interpret referenced standards and regulations.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8 in order to prepare you for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] Barclays Official California Code of Regulations Title 19, West Group, Section 574

[2] Barclays Official California Code of Regulations Title 19, West Group, Section 574

[3] Barclays Official California Code of Regulations Title 19, West Group, Section 596

Topic: 5-1: Fixed Fire Protection Systems

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.5

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of fixed fire protection systems

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 5

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	How many types of fixed fire protection systems are there? **SLIDE: 5-1-1**
I. FIVE MAIN TYPES OF SYSTEMS A. Foam 1. Used with flammable liquids B. Carbon dioxide 1. Used to protect areas where dry chemical agents cannot be used C. Halon/clean agent 1. Used to protect electronic equipment	**SLIDE: 5-1-2**
D. Dry chemical 1. Used with flammable liquids E. Wet chemical 1. Used with kitchen protection systems where there is grease	What are the different types of system configurations? **SLIDE: 5-1-3**
II. SYSTEM CONFIGURATIONS A. Local application 1. Used where only a portion of room, building, or a specific hazard is to be protected a) Dry or wet chemical hood system in a restaurant b) Dip tank in a garage 2. Includes hand-hose systems	

PRESENTATION	APPLICATION

B. Total flooding

1. Used where an entire room or building must be protected
2. Entire area is filled with agent and sealed to ensure that all fire is out
3. Example
   a) Computer room for a Halon or CO_2 system
   b) Rolled paper warehouse using a high expansion foam system

C. Pre-engineered systems

1. Designed to protect against a predetermined hazard
2. Calculated to provide adequate protection for a one-of-a-kind hazard
   a) Specific model of dip tank
   b) Certain type or size of commercial kitchen layout

SLIDE: 5-1-4

III. FOAM EXTINGUISHING SYSTEMS

Where are foam systems most likely found?

A. Areas of use

1. Found most frequently where flammable liquids are being used
   a) Aircraft hangers
   b) Loading facilities
   c) Storage facilities
   d) Dip tanks
2. Found in areas used to protect high-piled stock by flooding the area with high expansion foam
   a) Rolled paper storage, baled material

PRESENTATION	APPLICATION
	SLIDE: 5-1-5 What are the three categories of foam? **SLIDE: 5-1-6**
B. Three categories of foam 1. Protein a) Primarily used with stabilizing additives and inhibitors diluted in water b) Rarely used anymore 2. Fluoroprotein a) Similar to protein foam but contains a synthetic fluorinated surfactant additive b) Forms a foam blanket and a vaporization film to help cool the fuel surface c) Most effective on jet fuel d) Common fixed system at storage facilities 3. Synthetic a) Most common type is used with fixed systems b) Also used on alcohol fires if so designated c) Examples 1) Aqueous film forming foam and high-expansion foam	
	SLIDE: 5-1-7
C. Foam proportioning 1. Foam concentrate must be mixed with water at the proper ratio to be useful	

PRESENTATION	APPLICATION
	What are the methods of proportioning foam? **SLIDE: 5-1-8**
NOTE: The source of information for methods of proportioning foam is Private Fire Protection and Detection, IFSTA, Second Edition, Page 174. 2. Six methods of proportioning foam a) Line eductor 1) In-line most common b) Balanced pressure proportioners c) Around-the-pump proportioners	**SLIDE: 5-1-9**
d) Pressure proportioning tank system e) Coupled water-motor proportioning	What are some different types of application devices? **SLIDE: 5-1-10**
D. Application devices 1. Foam nozzle a) Eductor type b) Foam-aspirating nozzles 2. Foam sprinklers a) Resemble aspirating nozzles b) An AFFF system may use ordinary sprinkler heads 3. Foam monitor nozzle a) Fixed position b) Manually directed c) Automatically oscillated d) Remotely controlled	

PRESENTATION	APPLICATION
e) 250-4,000 gpm f) Usually found protecting bulk storage tanks 4. Foam towers a) Used on storage tank fires 5. Outdoor tank fixed outlets a) Subsurface injection b) Moeller tube outlets c) Foam trough d) Side baffle outlet e) Side dump outlet f) High-expansion foam generators	**SLIDE: 5-1-11**
E. Fixed foam systems 1. Permanently mounted to provide protection of a specific hazard 2. Complete system includes a) Automatic detection b) Activation c) Foam delivery d) Piping for fire departments to attach their foam equipment	What are the two types of semi-fixed foam systems? **SLIDE: 5-1-12**
F. Two types of semi-fixed systems 1. Type A a) Foam discharge piping is in place but is not attached to a permanent source of foam	

PRESENTATION	APPLICATION
b) A mobile foam apparatus must respond to the site and be hooked-up to the system piping	
	SLIDE: 5-1-13
2. Type B	
a) Provides a foam solution source which is piped throughout the location much like a water system	
b) Foam solution is delivered to foam hydrants for connection to portable foam application devices	
	SLIDE: 5-1-14
G. Foam-water systems	
1. Basically a deluge sprinkler system with foam introduced into it	
a) Used in applications where there is a limited foam supply, but unlimited water supply	
b) Once the foam supply depleted, the system will continue to function as a conventional deluge sprinkler system	
	What are some of the components of high-expansion foam systems?
	SLIDE: 5-1-15
H. High-expansion foam systems	
1. Designed for local or total flooding application	
2. System components	
a) Automatic detection and manual actuation system	
b) Foam generator(s)	
c) Piping for water and foam supply	

PRESENTATION	APPLICATION
3. In a total flooding system the building will fill with foam a) Usually in under four minutes	
	What are the different types of carbon dioxide systems? **SLIDE: 5-1-16**
IV. CARBON DIOXIDE SYSTEMS A. Four types of systems 1. Total flooding a) Discharges CO_2 into an enclosed space or area 2. Local application a) Discharges directly on burning material 3. Hand hoseline a) Located next to the hazard b) Hoseline is extended to the fire c) Manually discharged 4. Standpipe with mobile supply a) Fixed hoseline(s) and/or nozzles b) May be either local or total flooding c) A mobile supply of CO_2 must be delivered to the connection before use	
	SLIDE: 5-1-17
B. System applications 1. Used where dry chemical agents cannot a) Electrical equipment b) Archival material 2. Being used more, in light of possible environmental problems with Halon systems	

PRESENTATION	APPLICATION
	How is CO_2 stored? **SLIDE: 5-1-18**
C. Two ways to store CO_2 1. High-pressure system a) Uses banks of rechargeable CO_2 cylinders 1) Has one pilot cylinder bank that will discharge first 2) Has one slave cylinder bank that will discharge if fire re-ignites or there is a second fire before the pilot cylinders are recharged b) Liquid CO_2 is stored under pressure 1) Normal pressure is 850 psi at 70°F c) When liquid CO_2 hits the atmosphere, it vaporizes into a gas	**SLIDE: 5-1-19** **SLIDE: 5-1-20**
2. Low pressure system a) Uses refrigerated pressure vessels b) Capacity of 500 pounds to 125 tons c) Maintains a pressure of 300 psi at 0°F d) Usually found at operations that use a large amount of CO_2 in their manufacturing process	**SLIDE: 5-1-21**
D. Systems components 1. Containers 2. Actuators 3. Nozzles 4. Detectors 5. Manual release 6. Control panel	

PRESENTATION	APPLICATION
	How are CO_2 systems activated?
	SLIDE: 5-1-22
E. System activation equipment	
1. Smoke detectors	
2. Electronic heat detectors	
3. Manual pull stations	
4. Fusible links	
5. Other components that may be activated	
a) Pre-activation alarm	
b) HVAC shut-off	
c) Power shut-off	
d) Window and/or door closures	
	SLIDE: 5-1-23
V. HALON/CLEAN AGENT SYSTEMS	
A. Two types of systems	
1. Total flooding	
a) Discharges into an enclosed space/area	
2. Local application	
a) Discharges directly onto burning material	
	What are the two most commonly used Halon agents?
B. Two kinds of agents	
1. Halon 1211, bromochlorodifluoromethane	
2. Halon 1301, bromotrifluoromethane	
	SLIDE: 5-1-24
C. System applications	
1. Same as CO_2 systems	

PRESENTATION	APPLICATION
2. Although still in use, no more Halon is being produced a) Replaced with environmentally friendly materials (clean agent products)	How are Halon agents stored? **SLIDE: 5-1-25**
D. Two storage systems 1. Self-contained a) Each unit has a storage cylinder, activation device, and nozzle b) Use in small room or for local application to a specific area 2. Flooding system a) Remote storage of agent b) Complete system of nozzles, piping, activation devices, etc.	What are the components of a Halon system?
E. System activation equipment 1. Same as CO_2 systems	**SLIDE: 5-1-26**
F. Clean agent products 1. Halon replacement agents a) FM-100 b) FM-200 c) FE 25 d) Inergen (IG-541) e) CO_2 2. Not a "pound-for-pound" replacement a) Up to 20 times more agent required	

PRESENTATION	APPLICATION
	SLIDE: 5-1-27
	What are the different types of dry chemical systems?
	SLIDE: 5-1-28
VI. DRY CHEMICAL SYSTEMS	
A. Two types of systems	
1. Total flooding	
a) Discharges agent into an enclosed space or area	
2. Local application	
a) Discharges directly on burning material	
	SLIDE: 5-1-29
B. System applications	
1. Areas of use	
a) Flammable liquids and gases	
b) Greases	
c) Electrical	
2. Same agents as those used in dry chemical extinguishers	
	What is the greatest disadvantage?
3. Can cause a major cleanup problem	
a) Not usually used around sensitive electronic equipment	
	SLIDE: 5-1-30
C. System components	
1. System activation equipment	
a) Electronic heat detectors	
b) Manual pull stations	
c) Fusible links	

PRESENTATION	APPLICATION
2. Agent storage a) Vessel is similar to a dry chemical extinguisher in appearance b) Has a nitrogen or CO_2 gas cylinder to expel agent	**SLIDE: 5-1-31**
3. Other components that may be activated a) Pre-activated alarm b) HVAC shut-off c) Power shut-off d) Window and/or door closures 4. Nozzles 5. Piping	
VII. WET CHEMICAL SYSTEMS A. System applications	Where would you find a wet chemical system? **SLIDE: 5-1-32**
1. Areas of use a) Flammable liquids and gases b) Greases 1) Most effective c) Ordinary combustibles 2. Agent used is an aqueous solution of potassium carbonate or potassium acetate a) Potassium acetate = Class K extinguisher 3. When solution comes in contact with animal fat or vegetable oil, it forms a soap foam called saponification that puts fire out by a) Removing the fuel b) Cooling the fire area	

PRESENTATION	APPLICATION
c) Smothering the fire area d) Inhibiting the flames	**SLIDE: 5-1-33**
B. System components 1. System activation equipment a) Electronic heat detectors b) Manual pull stations c) Fusible links 2. Agent storage a) Vessel is similar to a pressurized water extinguisher in appearance b) Has a nitrogen or CO_2 gas cylinder to expel agent	**SLIDE: 5-1-34**
3. Other components that may be activated a) HVAC shut-off b) Power shut-off 4. Nozzles 5. Piping C. Most UL 300 systems are wet chemical 1. Designed to control vegetable oil fires with higher ignition temperatures than traditional animal fats	

Summary:

Fixed fire protection systems are everywhere and range from small to complex systems. One of the responsibilities of an inspector is to inspect many of these systems. To properly perform these inspections, an inspector needs a working knowledge of how these systems operate and their components. In addition to the six common types of systems, unusual conditions or exotic materials can require a special system to be designed.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8 in order to prepare yourself for the upcoming test. Study for our next session.

Topic: 5-2: Procedures For Inspecting Fixed Fire Protection Systems

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.5

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the procedures for inspecting fixed fire protection systems.

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 9 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 9
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 5

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
I. DRY CHEMICAL SYSTEMS A. Semiannual service test B. Expellant gas 1. Pressure 2. Weight C. Dry chemical agent 1. Visual check of agent level 2. Weight D. Semiannual checks 1. Size or nature of hazard has not changed 2. Examine all components thoroughly 3. No pipe damage or obstructions 4. No caking or reduction of flow capabilities of agent	What items should be checked when inspecting a dry chemical system? **SLIDE: 5-2-1**
II. WET CHEMICAL SYSTEMS' A. Same as dry chemical B. Semiannual service test C. Wet chemical agent 1. Checked for liquid level D. Semiannual checks 1. Hoseline cracking and attachment 2. Nozzle damage or obstructions	What items should be checked on a wet chemical system? **SLIDE: 5-2-2**

PRESENTATION	APPLICATION
	SLIDE: 5-2-3 What items should be inspected on a Halon/clean agent system? **SLIDE: 5-2-4**
III. HALON/CLEAN AGENT SYSTEMS A. Posted semiannual service tag B. Inspection report with recommendations shall be filed with owner C. Agent quantity and pressure of refillable containers	
1. Recharge or replace container when either of the following occur a) At 5% loss in weight b) At 10% loss in pressure	When should containers be recharged or replaced?
D. Weight or pressure shall be recorded on a tag attached to container	
	SLIDE: 5-2-5 **SLIDE: 5-2-6** What items should be inspected on a CO_2 system? **SLIDE: 5-2-7**
IV. CARBON DIOXIDE SYSTEMS A. Installed in accordance with NFPA 12 B. Tested annually	
1. Suitable discharge test shall be made when an inspection indicates a need 2. Cylinders are tested semiannually	

PRESENTATION	APPLICATION
C. High-pressure cylinders shall be weighed and the date of the last hydrostatic test noted during service 1. Recharge at a loss of 10% by weight	When should a carbon dioxide cylinder be recharged or replaced?
D. Level gauges of low-pressure container shall be inspected and recorded by the building occupant weekly	
E. System hoses shall be examined during service test 1. 2,500 psi for high-pressure system 2. 900 psi for low-pressure system	What items should be checked when inspecting a foam system?
V. FOAM SYSTEMS	**SLIDE: 5-2-8**
A. Inspect every 3 months 1. Foam producing equipment a) Inspect proportioning devices 2. Piping is free of damage and/or corrosion 3. Strainers are clean 4. Control valves operate freely 5. Foam concentrate a) Inspect for sludge or deterioration	
B. Service tested every 5 years	**SLIDE: 5-2-9**

Summary:

As you have seen, there are many different items to inspect on fixed systems. Every on of these items must be properly inspected at regular intervals to ensure that when needed, the system will operate as it was designed.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 9 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8, and in order to prepare yourself for the upcoming test. Study for our next session.

Topic: 5-3: Procedures For Inspecting Commercial Cooking Equipment

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.5

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of the procedures for inspecting commercial cooking equipment

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 4 and 8, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 70-72

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Individual Activity 5-3-1: Inspecting Fixed Fire Protection Systems

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 9
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 4 and 8
- NFPA 96: Standard on Ventilation Control and Fire Protection of Commercial Cooking Operations, NFPA, 2001 Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
I. KITCHEN FIRE PROTECTION SYSTEMS	**SLIDE: 5-3-1**
A. Required per California Fire Code, CBSC, 2007 Edition, Section 904	
B. May be one of several different types of built-in extinguishing systems providing full coverage	What types of fire protection systems are available for commercial kitchens?
1. Dry chemical a) Ansul R-101 system 2. Wet chemical a) Ansul R-102 system 3. Carbon dioxide a) Rare 4. Sprinkler system 5. In general, systems installed since 1998 must be rated as UL 300	
	SLIDE: 5-3-2
C. Cooking hoods 1. Class I a) For grease laden vapors 2. Class II a) For odors only D. Ductwork, plenum, and flue 1. Must have tightly welded seams E. Portable fire extinguisher(s) 1. K minimum rating 2. Within 30 feet of the hazard area	

PRESENTATION	APPLICATION
	SLIDE: 5-3-3
II. INSPECTING COMMERCIAL KITCHENS	
A. Fire safety procedures	
1. Operation of fans under fire conditions	
a) Must shut fans off if a carbon dioxide system is used	
b) Fans are to be left on for other systems	
2. Emergency training for kitchen workers	How can you check to see if an employee has been trained in the use of fire protection systems?
a) Quiz the workers to confirm if they know how to manually activate the system	
	SLIDE: 5-3-4
B. Equipment	
1. Periodic cleaning of plenums, ducts, etc.	
a) Inspect prior to restaurant's opening for the day	
b) Once the grease is hot, it will flow and look better than it really is	
2. Check for State Fire Marshal's service tag[1]	
3. Check for correct type of portable fire extinguisher(s)	
a) B:C classification only	
1) A:B:C classification not allowed	Why is only a B:C extinguisher allowed near a hood system?
• May interfere with the saponification process	
b) 40-B:C minimum rating requirements if less than 30 feet away	

PRESENTATION	APPLICATION
c) 80-B:C if between 30-50 feet away d) CFC 2001 Edition now requires a Class K extinguisher for deep fat fryer appliance protection 4. Check for correct construction materials near the hood a) No combustible hood components b) Must comply with NFPA 96: Standard on Ventilation Control and Fire Protection of Commercial Cooking Operations, NFPA, 2001 Edition 5. Check for adequate clearance to combustibles from cooking surfaces and ductwork a) Generally 18 inches 1) Unless listed for less clearance b) Must comply with NFPA 96: Standard on Ventilation Control and Fire Protection of Commercial Cooking Operations, NFPA, 2001 Edition	
6. Hood filters should be cleaned at least weekly a) May require more frequent cleaning	How often should hood filters be cleaned? **ACTIVITY 5-3-1:** Complete the activity in the student supplement.

Summary:

Fire in commercial kitchens can be prevented if construction is adequate, if maintenance is performed properly, and if sufficient fire protection hardware is furnished. An inspector must be able to verify these conditions and any actions required for compliance. Several tests are necessary to ensure that these systems operate as designed.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 4 and 8, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 70-72 in order to prepare yourself for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 5-3-1: INSPECTING FIXED FIRE PROTECTION SYSTEMS

Time Frame:	0:20
Materials Needed:	• Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapters 4 and 8 • California Fire Code, CBSC, 2007 Edition, Chapter 9 • Pen or pencil
Introduction:	This activity provides the students the opportunity to increase their knowledge of special fixed fire protection systems.
Directions:	1. Using the referenced resources, answer the questions below. 2. You have 15 minutes to complete this activity. 3. Be prepared to discuss your answers with the class.

1. List the appropriate NFPA standard used to design and install fixed fire protection systems.

Carbon dioxide	NFPA	***12***	*IFSTA, Page 254*
Dry chemical	NFPA	***17***	*IFSTA, Page 249*
Wet chemical	NFPA	***17A***	*IFSTA, Page 252*
Clean agent	NFPA	***2001***	*IFSTA, Page 236*
Foam	NFPA	***11***	*IFSTA, Page 258*

2. What is the criterion for determining when a gaseous extinguishing system, such as CO_2 or clean agent, must be replenished?

   Must be replenished when the net weight of the gas has dropped more than 10%

   IFSTA, Page 253

3. At what frequency must a preengineered system be service tested?

   Every 6 months

   California Fire Code, CBSC, 2007 Edition, Section 904.11.6.4 page 100

4. What section of the CFC regulates the cleaning of hoods and grease filters?

   Section 904.11.6.3

   California Fire Code, CBSC, 2007 Edition page 100

5. What two electrical devices must be shut-off when a hood extinguishing system operates?

   (1) ***Cooking appliances powered by electricity***

   (2) ***Electrical receptacles under the hood***

   California Fire Code, CBSC, 2007 Edition, Section 904.11.2 page 100

6. What fire code section requires that a manual fire activation device (pull station) be provided at a hood extinguishing system?

   Section 904.11.1

   California Fire Code, CBSC, 2007 Edition, Section 904 page 100

7. A record of hood and duct cleaning shall be available at restaurants for fire department inspection. Name three items that must be included on this record.

   (1) ***Extent of cleaning***

   (2) ***Time of cleaning***

   (3) ***Date of cleaning***

   California Fire Code, CBSC, 2007 Edition, Section 904.11.6.3 page 100

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] Barclays California Code of Regulations Title 19, West Group, Chapter 5, Article 6

Topic: 6-1: Detection And Alarm Systems Terms And Characteristics

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.6

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of the terminology relating to detection and alarm systems

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapters 2 and 9, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 73-75

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Group Activity 6-1-1: Terminology Crossword

References:

- California Fire Code, CBSC, 2007 Edition, Chapters 2 and 9
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8
- Fire Protection Handbook, NFPA, Eighteenth Edition, Chapter 1, Section 5
- NFPA 72: National Fire Alarm Code, NFPA, 2002 Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

I. TERMINOLOGY AND DEFINITIONS

A. Acceptance test[1]

1. Every initiating device
   a) Receives stimulus
   b) Design sequence of operation verified
2. Recorded
3. Repetitive
4. Conducted after a new system is installed

B. Fire alarm control unit[2]

1. Unit comprising the controls, relays, switches, and associated circuits necessary to
   a) Distributes power to a fire alarm system
   b) Receives signals from alarm-initiating devices and transmits them to alarm-signaling devices and accessory equipment
   c) Electrically supervises the system circuitry
2. Also known as a fire alarm control panel (FACP)

C. Alarm signal[3]

1. Audible or visual signal (or both) indicating the existence of an emergency fire condition
2. Audible devices may be bells, horns, chimes, speakers, or similar devices
3. Voice alarms and their messages shall be approved
4. Requires immediate action

D. Alarm notification appliance

1. Equipment that produces an approved alarm
   a) Audible
   b) Tactile

PRESENTATION	APPLICATION

c) Visible

d) Combination

E. Fire alarm system[4]

1. Combination of approved compatible devices with the necessary electrical interconnection and energy to provide an alarm signal in the event of fire or system activation

2. Initiating device + FACP + notification device

F. Zone[5]

1. Defined area of a building as approved for purposes of identifying alarm-initiating locations

G. Annunciator[6]

1. Equipment that indicates the zone or area of a building from which an alarm has been initiated or the location of an alarm-initiating device and the operational condition of the alarm circuits of the system

H. Approved[7]

1. Acceptable to the Fire Code Official

I. Automatic[8]

1. As applied to fire protection devices, is a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise, or combustion products

J. Inspection

1. Visual

2. No requirement for operation

3. Written record

K. Reacceptance test

1. After modifications

PRESENTATION	APPLICATION
2. Scope is limited a) Modified components b) Components effected by modification c) 10%-50% maximum of unaffected initiating devices	
L. Supervisory signal 1. Indicates an action is needed in connection with the operation of other fire protection systems being monitored by the fire alarm system	What type systems may be monitored by the fire alarm system?
a) Sprinkler system b) CO_2 systems c) Dry chemical systems	
M. Test 1. Stimulus 2. Written record a) Observation b) Functionality	
N. Trouble signal 1. Indicates fire alarm system problems in a circuit, component, or power supply	**ACTIVITY 6-1-1:** Complete the activity in the student supplement.

Summary:

Terminology is important when you are reading, interpreting, and enforcing the fire code. An inspector can use Chapter 2 and 9 of the CFC to help define the terminology associated with detection and alarm systems.

Evaluation:

The student will complete the activity and a formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapters 2 and 9, Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8, and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 73-75 in order to prepare yourself for the upcoming test. Study for our next session.

GROUP ACTIVITY 6-1-1: TERMINOLOGY CROSSWORD

Time Frame:	0:30
Materials Needed:	• California Fire Code, CBSC, 2007 Edition, Chapters 2 and 9 • Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8 • Pen or pencil
Introduction:	This activity provides the students the opportunity to become familiar with the terms relating to detection and alarm systems.
Directions:	1. Divide the students into six groups. 2. Complete the crossword puzzle using the clues. 3. All possible answers to the clues are listed below the puzzle. 4. You have 20 minutes to complete this activity. 5. Be prepared to discuss your answers with the class.

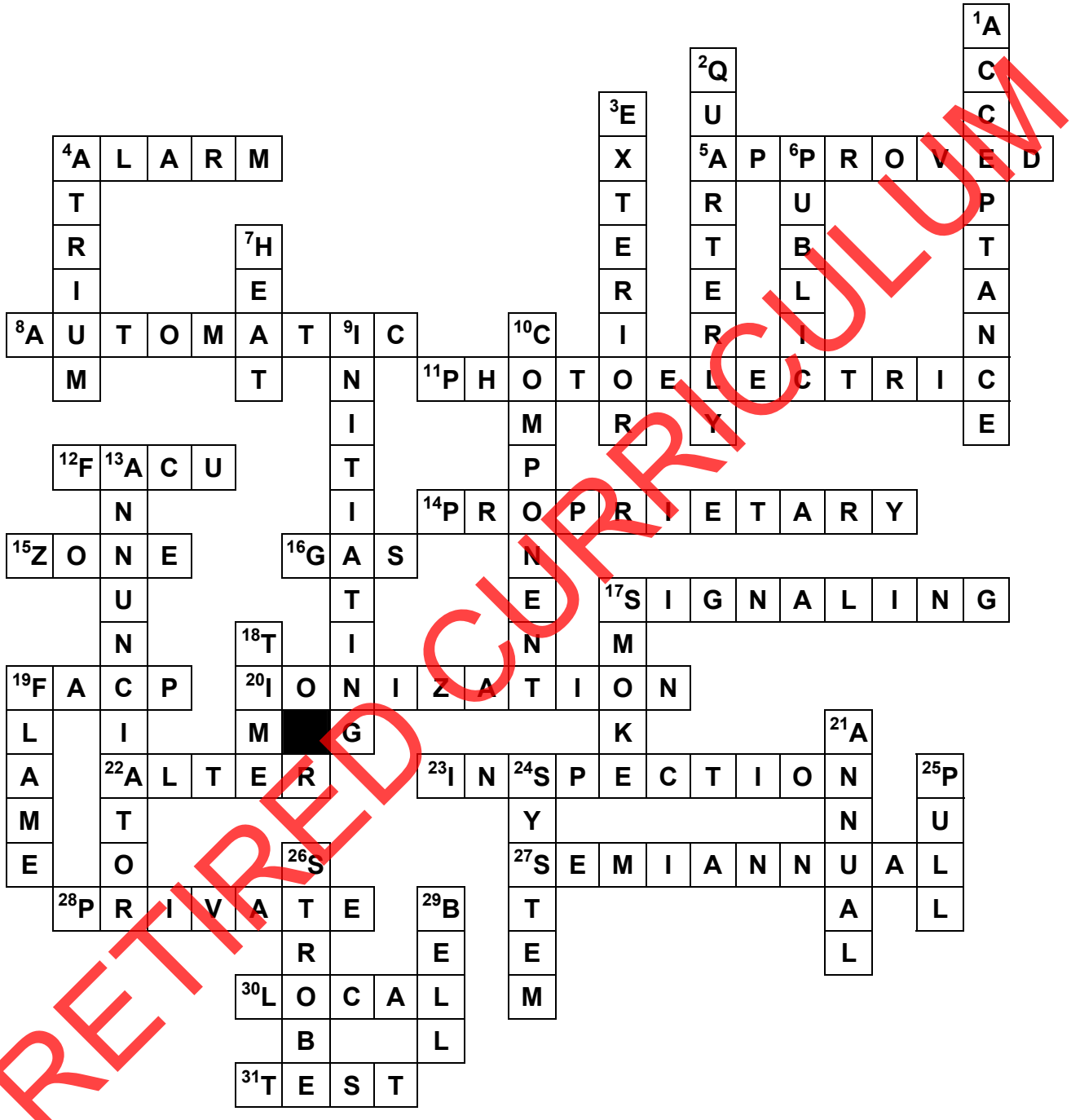
CLUES ACROSS

4. Signaling of information that a fire condition exits
5. Equipment that has passed tests by a technical organization
8. A fire alarm system that detects a fire and alerts the occupants
11. Smoke detector effective for smoldering fires
12. The "brains" of the alarm system (abbreviation)
14. A system that sends an alarm to a private fire brigade
15. A defined area for identifying alarm-initiating locations
16. Detectors that measure the oxygen content of a room
17. This device is equipment that produces an approved alarm signal
19. Fire alarm control panel (abbreviation)
20. Smoke detector effective for flaming fires
22. Any change, addition, or modification in construction or occupancy

23. A visual review of equipment and systems
27. Occurs twice a year
28. An operating mode that alerts employees only
30. This system can only be heard by the building occupants
31. The introduction of a stimulus to an initiating device

CLUES DOWN

1. A test performed after the installation of new equipment
2. Occurs four times a year
3. The outside of a building
4. An opening through two or more floor levels with a ceiling
6. An operating mode that alerts all occupants
7. Detectors that are the slowest to respond
9. This device sends information to the alarm control unit
10. A part of a fire alarm system
13. Equipment that indicates the zone of alarm
17. A detector designed to protect people when they are sleeping
18. "Bought" with detection and alarm systems
19. This detector comes in both the IR and UV varieties
21. Occurs once a year
24. A combination of compatible interconnected alarm devices
25. The action required to initiate an alarm from a fire alarm box
26. A common visual signaling device
29. A common audible signaling device



- ACCEPTANCE
- ALARM
- ALTER
- ANNUAL
- ANNUNCIATOR
- APPROVED
- ATRIUM
- AUTOMATIC
- BELL
- COMPONENT
- EXTERIOR
- FACP
- FACU
- FLAME
- GAS
- HEAT
- INITIATING
- INSPECTION
- IONIZATION
- LOCAL
- PHOTOELECTRIC
- PRIVATE
- PROPRIETARY
- PUBLIC
- PULL
- QUARTERLY
- SEMIANNUAL
- SIGNALING
- SMOKE
- STROBE
- SYSTEM
- TEST
- TIME
- ZONE

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 907.17
[2] California Fire Code, CBSC, 2007 Edition, Section 902.1
[3] California Fire Code, CBSC, 2007 Edition, Section 902.1
[4] California Fire Code, CBSC, 2007 Edition, Section 902.1
[5] California Fire Code, CBSC, 2007 Edition, Section 902.1
[6] California Fire Code, CBSC, 2007 Edition, Section 902.1
[7] California Fire Code, CBSC, 2007 Edition, Section 202
[8] California Fire Code, CBSC, 2007 Edition, Section 902.1

Topic: 6-2: Fire Alarm System Components

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.6

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of fire alarm system components

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 76-84

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8
- Fire Protection Handbook, NFPA, Eighteenth Edition, Section 5, Chapter 1-4
- NFPA 72: National Fire Alarm Code, NFPA, 2002 Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 6-2-1
I. FIVE BASIC COMPONENTS OF A FIRE ALARM SYSTEM A. Fire alarm control panel (FACP) B. Power supply C. Initiating devices D. Notification devices E. Interface	
	SLIDE: 6-2-2
II. FIRE ALARM CONTROL PANEL A. May be referred to as 1. FACP 2. Fire alarm control unit (FACU) 3. Annunciator panel B. The "brain" of the system 1. Processes the signal from the initiating device 2. Transmits signal to notification system devices	
	SLIDE: 6-2-3 **SLIDE: 6-2-4**
C. Need for additional annunciator panels 1. In complex systems, initiating devices are wired into zones	
	What is the reason for dividing a system into "zones"?
a) For ease of installation b) For clarity of identifying alarm signals c) For clarity of identifying trouble signals	
2. Locations of initiating zones may be displayed on one or more annunciator panels	

PRESENTATION	APPLICATION
	How does the FACP provide information to the occupant or responder? **SLIDE: 6-2-5**
D. Displays system information 1. Type of display a) Indicator lamps (older panels) b) LED (light-emitting diode) 1) More common 2) More reliable c) Textual 2. Type of signal a) Alarm b) Supervisory c) Trouble 3. Zone of initiating device	
	SLIDE: 6-2-6
E. Other features 1. Reset button 2. Silence switch 3. Power supply a) Battery often inside	
	Where should the annunciator be located? **SLIDE: 6-2-7**
F. Location and design is vital 1. Must be easily seen by responding fire units 2. Must be located in a place of authority or security a) School office	

PRESENTATION	APPLICATION
b) Office building command center c) Lobby area 3. If numbers are used on a panel, an explanatory directory must be displayed 4. Panel must indicate the nature of the initiating device a) Manual pull station b) Detector c) Water flow switch	**SLIDE: 6-2-8**
G. Access to annunciator panel face 1. If panel can be opened, fire department must have a key or other means of access 2. Panel must be safeguarded from vandalism	Where do most systems get their power? **SLIDE: 6-2-9**
III. POWER SUPPLY A. Two sources required B. Primary 1. Usually the building's main connection to local public utility 2. Engine drive generator may be used a) Multiple engine driven generators with at least one always set for automatic starting 3. Must be supervised by the system a) Should signal alarm if power supply is interrupted	

PRESENTATION	APPLICATION
C. Secondary	What is the most common secondary source?
1. Storage battery and charge	
a) Most common secondary source	
2. Load requirements based upon system design	
a) Minimum of 24 hours of battery power must be provided	
	SLIDE: 6-2-10
IV. INITIATING DEVICES	
A. Connected to control unit	
1. Hard wired	
2. Radio controlled	
B. Manual	
1. Provided for occupant use	
2. May sound local alarm, supervisory alarm, or both	
3. Commonly called	
a) Pull box	
b) Pull station	
4. Have plastic covers with tamper alarms used to reduce false alarms	
	SLIDE: 6-2-11
C. Automatic	
1. Monitors atmosphere for products of combustion	
a) Sends signal to control panel	

PRESENTATION	APPLICATION
	What are the some types of automatic detectors?
2. Four basic types a) Heat b) Smoke c) Flame d) Gas sensory	**SLIDE: 6-2-12**
3. Selection a) Based on potential fire b) Design goals of the system c) Size of the area to be protected d) Use of the area to be protected e) Ambient conditions	**SLIDE: 6-2-13**
	SLIDE: 6-2-14
D. Heat detectors 1. Lowest false alarm rate 2. Slowest response time	
	What are the different types of heat detectors available?
3. Types a) Fixed temperature 1) Relatively inexpensive 2) Poor performance with respect to life safety • Many die with no exposure to heat	

PRESENTATION	APPLICATION
b) Rate-of-rise 1) Detect changes in temperature within a short time span 2) Relatively inexpensive 3) More flexibility of protection than fixed temperature detectors 4) Allows protection in hot or cold environments 5) Sometimes referred to as heat activated device (HAD) c) Combined rate-of-rise and fixed temperature 1) Combines the features of both fixed temperature and rate-of-rise devices 2) Very common type of detector	**SLIDE: 6-2-15** **SLIDE: 6-2-16**
E. Smoke detector 1. Benefits a) Most effective and most common 1) Smoke is usually the first sign of fire b) Faster than heat detectors c) Better suited to protect large, open spaces	What types of smoke detectors are available? **SLIDE: 6-2-17**
2. Photoelectric a) Best for smoldering and low temperature fires b) Operates on one of two principles 1) Projected beam type 2) Refraction type	

PRESENTATION	APPLICATION
3. Ionization a) Ionization useful for flaming fires b) Samples the air to identify the ionized molecules present in the products of combustion c) Most common type in residential occupancies	
	SLIDE: 6-2-18
F. Flame detector 1. General a) Extremely fast response for flaming fires 1) Responds to radiant energy (light) 2) Must have line of sight b) High false alarm rate 1) Sunlight 2) Lightning 3) Welding c) Slower than smoke detectors d) Faster than heat detectors e) Expensive f) Explosion-proofing possible	
	SLIDE: 6-2-19
2. Types a) Ultraviolet 1) Effective with hydrogen fires b) Infrared 1) Effective with hydrocarbon fires c) Combination 1) Detects both types of light	

PRESENTATION	APPLICATION
	SLIDE: 6-2-20
G. Gas sensory detectors	
1. General	
a) Slower than smoke detectors	
b) Faster than heat detectors	
c) Monitors levels of CO and CO_2	
d) Not as common as other types	
	SLIDE: 6-2-21
H. Combination detectors	
1. Combine technologies	
a) Heat/smoke detectors	
b) Smoke/gas detectors	
	SLIDE: 6-2-22
V. NOTIFICATION DEVICES	
A. General	
1. Will influence occupant response and reaction	
2. Selection based upon use of occupancy, occupant characteristics, ambient conditions	
	What are the methods a system can use to notify occupants of an alarm?
3. Audible or visual signaling	
	SLIDE: 6-2-23
B. Audible signaling	
1. Most common	
2. Tone, bell, horn, speakers (for PA or voice)	
3. Audibility goals	
	How loud does an alarm have to be?
a) Above ambient noise	

PRESENTATION	APPLICATION
b) Designed for specific occupant needs c) Testing critical d) More may be better e) Minimum and maximum decibel requirements	**SLIDE: 6-2-24** **SLIDE: 6-2-25**
C. Visible signaling 1. Augments audible 2. Hearing impaired 3. Strobe lights most common 4. Must be located in obvious places 5. More is not necessarily better a) More than three in the same area must be synchronized b) May induce grand mal seizures	**SLIDE: 6-2-26** **SLIDE: 6-2-27** **SLIDE: 6-2-28**
D. Operating modes 1. Private a) Used most commonly in Group I occupancies b) May be used partially in amusement buildings c) Sends signal to constantly attended location on the premises d) Prevents panic	

PRESENTATION	APPLICATION
2. Public a) Most common b) Visual and audible notification c) Audible to all occupants in the protected area	When would you not want building occupants to know about an alarm?
VI. FIRE ALARM SYSTEM INTERFACES A. May be interconnected 1. Water supply 2. Other automatic suppression systems 3. Building operations and control systems B. Sprinkler systems 1. Most common connection 2. Water flow 3. Supervision of valves 4. Tamper and trouble alarms C. Other automatic suppression systems 1. Hood and duct 2. Halon 3. Pumps D. Building operations and control systems 1. Fire door releases 2. Shut down HVAC 3. Close dampers	What are some common fire alarm system interfaces? **SLIDE: 6-2-29**

PRESENTATION	APPLICATION

4. Shut-off fuel supplies
   a) Natural gas or propane
   b) Electricity
5. Activate extinguishing systems
   a) Pre-action
   b) Deluge
   c) Fixed
      1) Dry chemical
      2) CO_2
      3) Halon

SLIDE: 6-2-30

E. Other system interfaces
   1. Fan control
   2. Door control
   3. Smoke control
   4. Elevator recall and shutdown
   5. Other FACP

Summary:

Fire alarm systems are comprised of extremely complex electronic components. If an inspector understands how these components are interconnected and the minimum requirements for each, he or she can evaluate the systems installed in your jurisdiction. As an example, all systems must have, at a minimum, an initiating device, FACP, and notification device.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 76-84 in order to prepare yourself for the upcoming test. Study for our next session.

Topic: 6-3: Fire Alarm Signaling System Classifications

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.6

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of fire alarm signaling system classifications

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 9
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8
- Fire Protection Handbook, NFPA, Eighteenth Edition, Section 5
- National Fire Alarm Code® Handbook, NFPA, 2002 Edition, Chapter 5
- NFPA 72: National Fire Alarm Code, NFPA, 2002 Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 6-3-1
I. SINGLE STATION ALARM	
A. Early warning system for dwelling units	
B. A smoke detector that incorporates	
1. Sensor	
2. Control components	
3. Alarm notification	
4. Power supply	
a) In the unit	
b) Obtained at point of installation	
C. Commonly used in household fire protection	
1. Found in more than 93% of all American homes	
D. Not considered a fire alarm system	
E. Regulated under NFPA 72 (National Fire Alarm Code)	
1. Adopted and amended by the OSFM[1]	
	SLIDE: 6-3-2
II. FIRE ALARM SYSTEM	
A. A system or portion of a combination system that consists of components and circuits arranged to monitor and annunciate the status of the fire alarm or supervisory signal initiating devices and to initiate the appropriate response to those signals	
	How does a fire alarm system differ from a single station alarm?
	SLIDE: 6-3-3
B. An alarm system interconnects the detection, reporting, and alerting devices by means of a control panel	
1. A single station alarm does not have a panel	

PRESENTATION	APPLICATION
	What are the various types of alarm signaling systems? **SLIDE: 6-3-4**
III. ALARM SIGNALING SYSTEMS A. Five basic types 1. Local 2. Auxiliary 3. Remote station 4. Central station 5. Proprietary	**SLIDE: 6-3-5**
B. Local alarm system 1. Alerts the building's occupants to ensure their safety 2. Activated by manual and/or automatic detection devices 3. Sounds alarm on premises only a) Visible and audible 4. Does not notify local fire department	What is an auxiliary alarm system? **SLIDE: 6-3-6**
C. Auxiliary alarm system 1. Transmits alarm signals directly to a fire agency through municipal alarm lines 1) Street boxes 2. System with an occupancy attached directly to the municipal fire alarm box system 3. Becoming less common today	

PRESENTATION	APPLICATION
4. Examples a) Large plant sends alarm signal to nearest street box where it is sent to fire department b) School alarm signal is sent directly to fire dispatch	
	What is a remote station system? **SLIDE: 6-3-7**
D. Remote station system 1. Alarm signals may be transmitted to a constantly supervised location a) Law enforcement dispatch b) Fire department dispatch c) Other approved answering service 2. Provides supervision of alarm systems a) Does not provide same level of services as a central station 3. Common in areas not serviced by central station systems	
	SLIDE: 6-3-8
E. Proprietary system 1. Provides a collection point for many fire alarm signals within large commercial and industrial buildings, high rises, and groups of commonly owned facilities in a single location 2. Signals for in-plant fire alarm systems are transmitted to a company-owned signal receiving location	
	What is an example?
3. Examples a) An oil refinery with an in-plant fire brigade	

PRESENTATION	APPLICATION
b) A large corporation with several buildings in different cities all monitored at a company-owned supervisory station	
	What is a central station system?
	SLIDE: 6-3-9
F. Central station system	
1. Basically the same as a proprietary system	
a) Difference is the receiving point is private company	
2. Provides a reliable method of transmitting alarm signals to a fire agency	
a) Alarm is transmitted from the protected premises to a private alarm company, which notifies the appropriate fire agency	
3. Most common system in use today	

Summary:

There are five basic types of alarm signaling systems commonly in use today: local, proprietary, central station, remote station, and auxiliary. Each system has unique characteristics. When these systems are installed, each inspector must verify that the correct system is being used. Then, ongoing inspections must ensure that the appropriate system continues to be used.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read in your Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Chapter 45

Topic: 6-4: Procedures For Inspecting Fire Alarm Systems

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.6

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the procedures for inspecting fire alarm systems

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 9
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8
- Fire Protection Handbook, NFPA, Eighteenth Edition, Section 5, Chapter 5
- NFPA 72: National Fire Alarm Code, NFPA, 2002 Edition, Chapter 7

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	Where is our authority to inspect a system derived from? **SLIDE: 6-4-1**
I. TESTING REQUIREMENTS A. No statewide law requires testing of alarm systems other than in occupancies regulated by the OSFM B. Local ordinances may be more restrictive to include all occupancies C. Insurance requirements 1. Building or plant owners' insurance company may be the most restrictive in requiring testing and maintenance of alarm systems	
II. TESTING AND MAINTENANCE PROCEDURES	**SLIDE: 6-4-2**
A. Testing 1. Not usually performed by the fire department a) Fire personnel may witness 2. Must be performed by a qualified person a) Alarm company b) Building maintenance	**SLIDE: 6-4-3**
B. Maintenance and service 1. Maintenance inspections may be conducted by anyone	Who is authorized to service a system?
2. Service must be completed by a qualified, licensed contractor or under the supervision of such a person a) Electrical (C-10) contractor 3. Results must be recorded and retained on site	

PRESENTATION	APPLICATION
	SLIDE: 6-4-4
III. INSPECTION	
A. Maintenance, inspection, and testing documentation	
1. Considered presumptive evidence	
B. Operational readiness	
	What specific items on an alarm should be inspected?
	SLIDE: 6-4-5
C. Initiating devices	
1. No missing devices	
2. Clean	
a) Free of dirt and dust	
b) Free of paint	
c) No pests, bugs, bird's nest, etc.	
3. In good repair	
4. Building is fully covered and protected	
5. No exposed wires or connectors	
6. Pull stations not obstructed	
	SLIDE: 6-4-6
D. Notification (sounding) devices	
1. No missing devices	
2. Clean	
a) Free of dirt and dust	
b) Free of paint	
c) No pests, bugs, bird's nests, etc.	
3. In good repair	
4. Building is fully covered and protected	
a) A partial system will fail	

PRESENTATION	APPLICATION
b) False sense of security 5. No exposed wires or connectors 6. Clearly audible in all areas	Why might a partial system be worse than no system at all?
E. FACP 1. Lights a) All work b) Operational lights on c) No trouble lights on 2. Batteries a) Available and ready b) Charged c) System runs off battery power for some period of time d) Documentation available e) System properly supervised	**SLIDE: 6-4-7** What items on the control panel should be inspected?

Summary:

Properly inspecting a fire alarm system helps ensure its readiness if an emergency strikes. System testing and ongoing maintenance is the responsibility of the building owner. Without inspections, this process will not likely continue and false alarms will increase.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 8 in order to prepare yourself for the upcoming test. Study for our next session.

Topic: 6-5: CFC Requirements For Fire Alarm Systems

Time Frame: 0:15

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.6

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the CFC requirements for fire alarm systems

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 9

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Barclays Official California Code of Regulations Title 19, West Group, Chapter 4
- California Fire Code, CBSC, 2007 Edition, Chapter 9

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 6-5-1
I. SCOPE[1]	
A. Existing buildings	
B. New construction	
	SLIDE: 6-5-2
II. PLANS (CONSTRUCTION DOCUMENTS)	
A. Prior to installation[2]	
1. Must be reviewed by the fire department	
	After installation of a new system, what should the installer leave behind?
B. After installation, when required by the AHJ, installer must leave the following information behind[3]	
1. "As built" drawings	
2. Operating, testing, and maintenance instructions	
3. Equipment specifications	
4. Kept in an approved location	
	SLIDE: 6-5-3
III. INSTALLATION ACCEPTANCE TESTING[4]	
A. Testing requirements[5]	
1. Upon completion of the installation	
2. All functions of the system or alteration shall be tested	
B. CFC provides authority	
C. References	
1. Nationally recognized standards	
a) NFPA 72	

PRESENTATION	APPLICATION
	What maintenance considerations are necessary when inspecting an existing alarm system?
	SLIDE: 6-5-4
IV. MAINTENANCE[6]	
A. Systems shall be maintained in an operative condition at all times	
B. Systems shall be replaced or repaired when defective	
C. System coverage and spacing shall be maintained according to original installation standards	
1. Such systems shall be extended or augmented as necessary to maintain and continue protection whenever any building so equipped is altered, remodeled, or added to	
2. Additions, repairs, alterations, and servicing shall be in accordance with NFPA 72	
	SLIDE: 6-5-5
V. PERIODIC INSPECTION AND TESTING[7]	
A. CFC requires annually or	
1. As determined by the AHJ if more restrictive	
B. Records of tests shall be maintained	
1. On the premises	
2. Available on request	
	SLIDE: 6-5-6
VI. SYSTEMS OUT-OF-SERVICE [8]	
A. AHJ shall be notified when	
1. Equipment is out-of-service	
2. When it is restored	

PRESENTATION	APPLICATION
B. Problematic system[9] 1. Failure of system 2. Excessive false alarms 3. Requires firewatch personnel until the system is repaired and restored	What is a problematic system? **SLIDE: 6-5-7**
VII. OBSTRUCTION OR IMPAIRMENT OF FIRE ALARM SYSTEMS[10] A. Components concealed B. Components obstructed C. Components removed or damaged D. Incomplete coverage	
VIII. REQUIRED INSTALLATIONS[11] A. By occupancy classification and construction type	What special uses or conditions would you expect to find? **SLIDE: 6-5-8**
B. By uses or conditions[12] 1. Amusement buildings 2. High-rise buildings 3. Atriums 4. High-piled combustible storage 5. Special egress control devices 6. Corridors in office uses	**SLIDE: 6-5-9**
7. Aerosol storage uses	

PRESENTATION	APPLICATION

8. Smoke control systems
9. Lumber, plywood, and veneer mills

SLIDE: 6-5-10

IX. GENERAL SYSTEM DESIGN AND INSTALLATION REQUIREMENTS[13]

A. System layout and operations
B. Alarm initiation and signal
C. Monitoring
D. Acceptance tests and certification

Summary:

During an inspection of a fire alarm system, you will primarily be using Chapter 9 Section 907 to cite violations. Requirements specific to alarm systems will be found in CFC Section 907.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Sections 901 through 909 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 901.1
[2] California Fire Code, CBSC, 2007 Edition, Section 901.2
[3] California Fire Code, CBSC, 2007 Edition, Section 901.6.2
[4] California Fire Code, CBSC, 2007 Edition, Section 901.5
[5] California Fire Code, CBSC, 2007 Edition, Section 901.5
[6] California Fire Code, CBSC, 2007 Edition, Section 901.6
[7] California Fire Code, CBSC, 2007 Edition, Section 907.20.2
[8] California Fire Code, CBSC, 2007 Edition, Section 901.7
[9] California Fire Code, CBSC, 2007 Edition, Section 901.7
[10] California Fire Code, CBSC, 2007 Edition, Section 901.8
[11] California Fire Code, CBSC, 2007 Edition, Section 907.2
[12] California Fire Code, CBSC, 2007 Edition, Section 907
[13] California Fire Code, CBSC, 2007 Edition, Section 907

Topic: 7-1: Water-Based Fire Protection Systems Terms And Characteristics

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Sections 4-3.5 and 5-3.4

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of water-based fire and protection systems terms and characteristics

Standard: With a minimum 80% accuracy according to the information contained in the California Fire Code, CBSC, 2007 Edition, Chapter 9 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Chapter 9
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7
- NFPA 13: Standard on the Installation of Sprinkler Systems, NFPA, 2002 Edition
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapters 1 and 2

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

I. GENERAL TERMS

SLIDE: 7-1-1

A. Combined systems

1. The water piping serves both outlets for fire department use and outlets for automatic fire sprinkler

SLIDE: 7-1-2

B. Design area

1. An area whose size is related to the occupancy
2. Where all sprinklers in the area are expected to actuate

SLIDE: 7-1-3

C. Design density

1. The quantity of water per square foot of design area that has been found by experience to be effective in controlling a fire

SLIDE: 7-1-4

D. Extra hazard occupancies[1]

1. Occupancies or portions of other occupancies where
   a) Quantity and combustibility of contents is very high
   b) Flammable and combustible liquids, dust, lint, or other materials are present
   c) Probability of rapidly developing fires with high rates of heat release

SLIDE: 7-1-5

2. Extra hazard (Group 1)[2]
   a) Includes occupancies or portions of other occupancies where the quantity of combustible contents is very high

PRESENTATION	APPLICATION

b) Probability of rapidly developing fires with high rates of heat release, but with little or no combustible or flammable liquids

c) Examples include occupancies having uses and conditions similar to

1) Aircraft hangars

- Except as governed by NFPA 409, standard on aircraft hangars

2) Combustible hydraulic fluid use areas

3) Die casting

4) Metal extruding

5) Plywood and particle board manufacturing

6) Printing

- Inks having a flash point below 100°F

7) Rubber reclaiming, compounding, drying, milling, vulcanizing

8) Saw mills

9) Textile picking, opening, blending, garneting or carding, combining of cotton, synthetics, wood shoddy, or burlap

10) Upholstering with plastic foams

SLIDE: 7-1-6

3. Extra hazard (Group 2)[3]

a) Includes occupancies with moderate to substantial amounts of flammable or combustible liquids or occupancies where shielding of combustibles is extensive

PRESENTATION	APPLICATION

b) Examples include occupancies having uses and conditions similar to
   1) Asphalt saturating
   2) Flammable liquids spraying
   3) Flow coating
   4) Manufactured home or modular building assemblies
      - Where finished enclosure is present and has combustible interiors
   5) Open oil quenching
   6) Plastics processing
   7) Solvent cleaning
   8) Varnish and paint dipping

SLIDE: 7-1-7

E. Light hazard occupancies[4]
   1. Occupancies or portions of other occupancies where
      a) Quantity and/or combustibility of contents is low
      b) Fires with relatively low rates of heat release are expected
   2. Examples include occupancies having uses and conditions similar to
      a) Churches
      b) Clubs
      c) Eaves and overhangs, if of combustible construction with no combustibles beneath
      d) Educational
      e) Hospitals
      f) Institutional
      g) Libraries, except large stack rooms

PRESENTATION	APPLICATION
h) Museums i) Nursing or convalescent homes j) Offices, including data processing k) Residential l) Restaurant seating areas m) Theaters and auditoriums, excluding stages and prosceniums n) Unused attics	**SLIDE: 7-1-8**
F. Ordinary hazard occupancies 1. Ordinary hazard (Group 1)[5] a) Occupancies or portions of other occupancies where 1) Combustibility is low 2) Quantity of combustibles is moderate 3) Stockpiles of combustibles do not exceed 8 feet 4) Fires with moderate rates of heat release are expected b) Examples would include occupancies having uses and conditions similar to 1) Automobile parking and showrooms 2) Bakeries 3) Beverage manufacturing 4) Canneries 5) Dairy products manufacturing and processing 6) Electronic plants 7) Glass and glass products manufacturing 8) Laundries 9) Restaurant service areas	

PRESENTATION	APPLICATION

SLIDE: 7-1-9

2. Ordinary hazard (Group 2)[6]
   a) Occupancies or portions of other occupancies where
      1) Quantity and combustibility of contents is moderate to high
      2) Stockpiles do not exceed 12 feet
      3) Fires with moderate to high rates of heat release are expected
      4) Examples would include occupancies having uses and conditions similar to
         - Cereal mills
         - Chemical plants - ordinary
         - Confectionery products
         - Distilleries
         - Dry cleaners
         - Feed mills
         - Horse stables
         - Leather goods manufacturing
         - Libraries - large stack room areas
         - Machine shops
         - Metal working
         - Mercantile
         - Paper and pulp mills
         - Paper process plants
         - Piers and wharves
         - Post offices
         - Printing and publishing
         - Repair garages

PRESENTATION	APPLICATION
5) Resin application area 6) Stages 7) Textile manufacturing 8) Tire manufacturing 9) Tobacco products manufacturing 10) Wood machining 11) Wood product assembly	**SLIDE: 7-1-10**
G. NFPA 13 1. Standard for the installation of sprinkler systems	**SLIDE: 7-1-11**
H. NFPA 25 1. Recommended practice for the inspection, testing, and maintenance of sprinkler systems	**SLIDE: 7-1-12**
I. NFPA 14 1. Standard for the installation of standpipes, private hydrants, and hose systems	**SLIDE: 7-1-13**
J. Private fire service main 1. Piping on private property between a source of water and a sprinkler system, standpipe system, and hydrants 2. When connected to a public water system, the private fire service main begins at a point designated by the public water utility a) Usually at a manually operated valve near the property line	**SLIDE: 7-1-14**

PRESENTATION	APPLICATION
K. Room design method 1. A design area where only the sprinklers in a particular room need to be calculated	
	SLIDE: 7-1-15
L. Standpipe system 1. A wet or dry system of piping, valves, outlets, and related equipment designed to provide water at specified pressures and installed exclusively for the fighting of fires	
	SLIDE: 7-1-16
a) Class I 1) A dry standpipe system without a directly connected water supply and equipped with 2½" outlets for use by the fire department or trained personnel	
	SLIDE: 7-1-17
b) Class II 1) A wet standpipe system directly connected to a water supply and equipped with 1½" outlets and hose intended for use by the building occupants	
	SLIDE: 7-1-18
c) Class III 1) A combination standpipe system directly connected to a water supply and equipped with both 1½" outlets for use by the building occupants and 2½" outlets for use by the fire department or trained personnel, or 2½" and 1½" outlets when a 1½" hose is required 2) Hose connections may be made through 2½" hose valves with easily removable 2½" by 1½" reducers	

PRESENTATION	APPLICATION
	SLIDE: 7-1-19
M. Yard hydrant 1. Located on a yard system a) Large industrial complex b) Shopping mall	
	SLIDE: 7-1-20
N. Yard system 1. Underground piping located in a large private complex for fire protection a) Consists of yard hydrants	

Summary:

Knowledge of the technical terms related to water-based fire protection systems is required for the inspector to effectively evaluate a system's capabilities and to determine if all system components are installed in accordance with regulations and manufacturer's specifications.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read the California Fire Code, CBSC, 2007 Edition, Chapter 9 and Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] NFPA 13: Standard on the Installation of Sprinkler Systems, NFPA, 2002 Edition

[2] NFPA 13: Standard on the Installation of Sprinkler Systems, NFPA, 2002 Edition, Sections 5-4.1 and A-5-4.1

[3] NFPA 13: Standard on the Installation of Sprinkler Systems, NFPA, 2002 Edition, Sections 5-4.2 and A-5-4.2

[4] NFPA 13: Standard on the Installation of Sprinkler Systems, NFPA, 2002 Edition, Sections 5-2 and A-5-2

[5] NFPA 13: Standard on the Installation of Sprinkler Systems, NFPA, 2002 Edition, Sections 5-3.1 and A-5-3.1

[6] NFPA 13: Standard on the Installation of Sprinkler Systems, NFPA, 2002 Edition, Sections 5-3.2 and A-5-3.2

Topic: 7-2: Water Supply Systems

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 4-3.5

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will recall the components and common deficiencies of public and private water supply systems

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Section 508
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7
- NFPA 20: Standard on the Installation of Stationary Pumps for Fire Protection, NFPA, 2003 Edition
- NFPA 24: Standard on the Installation of Private Fire Service Mains and Their Appurtenances, NFPA, 2002 Edition
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 1

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	SLIDE: 7-2-1
I. SYSTEM COMPONENTS	
A. Water supply source	
1. Surface supplies	
a) Rivers	
b) Lakes	
2. Ground supplies	
a) Wells	
b) Springs	
c) Aquifers	
B. Processing or treatment facilities	
C. Distribution systems	
1. Means or methods of moving the water	
D. Delivery system, including storage	
	SLIDE: 7-2-2
II. TYPES OF DISTRIBUTION SYSTEMS	
A. Gravity system	
1. Delivers water from the source to the distribution system without pumping equipment	
2. The supply source must be located well above the area being served	
B. Direct pumping system	
1. Used when elevation alone cannot provide sufficient pressure	
2. Large pumps create pressure within the system	
	What is a combination system?
C. Combination system	
1. Uses both gravity and direct pumping	
2. Most common method	

PRESENTATION	APPLICATION

3. Water is pumped through the distribution system and into elevated storage tanks
4. When consumption demand exceeds pumping rate, water flows from the tanks into distribution system
5. When demand is less, water flows back into the storage tanks

III. DISTRIBUTION SYSTEM COMPONENTS

SLIDE: 7-2-3

A. Water mains/lines
   1. Layout may be referred to as a "grid"
   2. Three types of water mains/lines
      a) Primary feeders
         1) Largest pipes (mains)
            - 16+ inches
         2) Convey large quantities of water to various points in the system
      b) Secondary feeders
         1) Intermediate pipes within the primary feeder network
            - 12+ inches
         2) Reinforce the grid with a concentrated supply of water
      c) Distributors
         1) Smallest main
            - Minimum size is usually six inches[1]
            - Eight-inch minimum is becoming more common
         2) Used to serve individual fire hydrants and consumers

PRESENTATION	APPLICATION
	SLIDE: 7-2-4
3. Influences to flow rates a) Friction loss 1) Pressure loss that occurs due to the movement of water against the inside of a pipe b) Obstructions 1) Encrustation • Tubercular corrosion or rust • Chemical constituents of water • Biological or organism growth • Biodegradation of water agents and pipe materials 2) Sedimentation deposits • Sedimentary decay (mud, clay, leaves) • Foreign matter other than sediment (stones, tools, wood, or lead) 3) Valves • Closed • Partially closed	
	SLIDE: 7-2-5
B. Fire hydrants 1. Provides access to the underground water system 2. Two types a) Dry barrel 1) Used in areas subject to freezing temperatures b) Wet barrel 1) Used in mild climates	

PRESENTATION	APPLICATION
3. Influences to flow a) Location 1) Dead-end hydrant • Receives water from only one side • Less available water than a fire hydrant supplied from two or more directions 2) Circulating or looped feed hydrant • Receives water from two or more directions b) Encrustation c) Deposits d) Closed/partially closed supply valves	
C. Valves 1. Control water flow 2. Indicating a) Shows whether the gate valve seat is open, closed, or partially closed b) Valves used in private fire protection systems are usually indicating c) Common examples include PIV and OS&Y 3. Nonindicating a) Commonly used in public water systems b) Usually buried or installed in manholes c) May be operated through a valve box by a special valve key d) May be gate valves or butterfly valves e) Partially closed valves may not be noticed during normal use of water, however high friction loss may prevent the availability of sufficient water to combat a fire	**SLIDE: 7-2-6**

PRESENTATION	APPLICATION

SLIDE: 7-2-7

IV. DELIVERY SYSTEMS

A. Connection to public systems shall be controlled by post indicator valves (PIVs) of an approved type[2]

1. Located not less than 40 feet from the buildings protected
2. If this cannot be done, the PIVs shall be placed where they will be readily accessible in case of fire and not liable to injury
3. Where PIVs cannot readily be used, as in a city block, underground valves shall conform to these provisions and their locations and direction of turning to open shall be clearly marked

B. Storage facility

1. Gravity, pressure, or suction tanks
   a) Tanks shall be installed in accordance with NFPA 24[3]
2. Penstocks or flumes, rivers, or lakes
   a) Arranged to avoid mud and sediment
   b) Must be provided with approved double removable screens or approved strainers installed in an approved manner[4]

C. Fire pumps[5]

1. Components
   a) Pump
   b) Driver
   c) Suction supply
2. Considered to make a good supply
   a) When of adequate capacity and reliability
   b) Properly located
3. Must be installed in accordance with NFPA 20

PRESENTATION	APPLICATION
D. Private mains	
E. Yard hydrants	
1. Developer to install as required by fire department	When is a private hydrant required to be installed?
2. Required when any portion of a building being protected exceeds 150 feet from a water supply on a public street	
3. Must be a type approved by the fire department	What is the minimum main size required for a yard hydrant?
4. Supplied with at least a 6-inch main	
5. Tested annually	
F. Fire department connections[6]	
1. A connection through which the fire department can pump water into the sprinkler, standpipe, or other system furnishing water for fire extinguishment	
2. Can make a desirable auxiliary supply	
a) For this purpose, one or more FDCs shall be provided	
b) Omission of FDCs shall be permitted when approved by the authority having jurisdiction	
3. There shall be no shut-off valve in the FDC[7]	
4. Must be equipped with standard threads or threads compatible with those used by the jurisdiction[8]	
a) Must be equipped with standard caps[9]	
1) Properly secured and arranged for easy removal by fire departments	

PRESENTATION	APPLICATION

b) Location[10]
   1) The street side of buildings
   2) Arranged so that hoselines can be readily and conveniently attached to the inlets without interference from any nearby objects including buildings, fences, posts, or other fire department connections

c) Signs[11]
   1) Letters at least 1 inch in size
   2) Cast on a plate or fitting
   3) Purpose designated
      - "AUTO SPKR" or "OPEN SPKR" or "STANDPIPE"

Why must the readiness of a system be monitored by the fire department?

V. PRIVATE WATER SUPPLY SYSTEM READINESS[12]

A. Private systems have the same operational concerns as public systems
   1. Are not tested or supervised by water department
   2. Must be maintained by the property owner

SLIDE: 7-2-8

B. Inspection procedure
   1. Check fire department approval of private system
   2. Obtain data on private system
      a) Required gpm
      b) Area flow
   3. Check extent and features of system
      a) Storage facilities
         1) Flow tested
         2) Checked for leaks

PRESENTATION	APPLICATION
4. Check presence and strength of water supply	How can you determine the strength of the water supply system?
a) Conduct a flow test	
b) Check presence and position of public/private system interconnected valves	
	What are some of the reasons why a system may fail?
	SLIDE: 7-2-9

VI. COMMON REASONS FOR FAILURE

A. Supply valves
   1. Connection to public system never made
   2. Connection made, but valve not on or only partially on
   3. Private side of system valve closed or only partially on
   4. Check valves
      a) Wrong direction
      b) Leaking

B. Water mains
   1. Smaller than indicated on plans
   2. Excessive sedimentation and/or debris in mains
   3. Serious underground leaks

C. Other causes
   1. Inoperative hydrants
   2. Freeze damage

Summary:

An inspector must be able to determine the adequacy of private water supply systems. Knowing how and why these systems fail, and the need for fire protection water will assist you in ensuring that protection systems work as designed.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 in order to prepare you for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] NFPA 24, NFPA, 2002 Edition, Section 5.2.1
[2] NFPA 24, NFPA, 2002 Edition, Section 5.5
[3] NFPA 24, NFPA, 2002 Edition, Section 5.7
[4] NFPA 24, NFPA, 2002 Edition, Section 5.8
[5] NFPA 24, NFPA, 2002 Edition, Section 5.6
[6] NFPA 24, NFPA, 2002 Edition, Section 5.9.1
[7] NFPA 24, NFPA, 2002 Edition, Section 5.9.3.2
[8] NFPA 24, NFPA, 2002 Edition, Section 5.9.2.1
[9] NFPA 24, NFPA, 2002 Edition, Section 5.9.1.4
[10] NFPA 24, NFPA, 2002 Edition, Section 5.9.5
[11] NFPA 24, NFPA, 2002 Edition, Section 5.9.5.3
[12] California Fire Code, CBSC, 2007 Edition, Section 503

Topic: 7-3: Sprinkler System Benefits, Limitations, And Design

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031 5.3.4

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of a sprinkler system's benefits, limitations, and design

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 90-92

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Individual Activity 7-3-1: Unit 7 Homework

References:

- Designs of Water-Based Fire Protection Systems, Robert M. Gagnon, 1997 Edition, Chapter 5
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7
- NFPA 13: Standard on the Installation of Sprinkler Systems, NFPA, 2002 Edition
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 2

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	What are some of the benefits of having a building protected by a sprinkler system? **SLIDE: 7-3-1**
I. BENEFITS A. Life safety 1. Loss of life in a building protected by sprinklers is minimal 2. Less than 1% of fire fatalities occur in sprinklered buildings 3. There has never been a major loss of life in a fire in a building fully protected by a properly maintained sprinkler system in the United States	**SLIDE: 7-3-2**
B. Property protection 1. Fire loss in sprinklered occupancies is a small fraction of that in unprotected properties 2. Large loss fires generally do not occur in buildings protected by well-maintained sprinkler systems 3. Insurance rates for sprinklered properties are much less than for nonsprinklered properties	**SLIDE: 7-3-3**
C. Other factors 1. Business interruption is minimized or eliminated with sprinklers 2. Water damage is usually less than that suffered from manual hose streams that have to be applied to a fire in a nonsprinklered area 3. Spontaneous sprinkler discharge is extremely rare	

PRESENTATION	APPLICATION
a) Some manufacturers state about 1 in 14 million heads 4. Freeze damage can be a major problem if not properly protected	How often do sprinkler heads spontaneously discharge?
II. LIMITATIONS	**SLIDE: 7-3-4**
A. Physical features of a building may limit effectiveness of system operations 1. High ceilings 2. Concealed spaces 3. Platforms, tables, etc., which shield sprinkler effectiveness	
B. Occurrence of a flood, earthquake, or explosion may limit effectiveness	
C. An underdesigned system may be "overpowered" by the combustibility of the contents it protects	What are some of the reasons that a system may be overpowered?
1. System underdesigned for building use 2. Fuel load 3. High-piled stock 4. Flammable liquids 5. Chemicals and explosives 6. Aerosol cans 7. Arson with multiple fires set	
D. Water supply may be inadequate for building or type of system 1. Underdesigned water system 2. Poorly maintained public water supply	

PRESENTATION	APPLICATION
E. Inadequate maintenance may render system inoperative or ineffective 1. Closed valves are the most common problem a) System valves b) Street valves 2. System frozen 3. Antiquated system 4. Painted sprinkler heads F. Fire department or building occupants may disable the system 1. System shut-off after leaks 2. System shut-off prematurely during a fire	How can these identified limitations be overcome? **SLIDE: 7-3-5**
III. OVERCOMING SYSTEM LIMITATIONS A. Provide adequate system design B. Provide adequate water supply C. Match hazard with correct type of sprinkler system D. Educate fire department personnel and building occupants regarding proper use of sprinkler systems E. Watch for new occupants in an existing building with a system designed specifically for the previous occupant	**SLIDE: 7-3-6**
IV. SYSTEM DESIGN A. Requirements determined by occupancy hazard group 1. Light hazard 2. Ordinary hazard a) Groups 1 and 2	What are the four hazard groups?

PRESENTATION	APPLICATION
3. Extra hazard a) Groups 1 and 2 4. Special occupancy hazard	What are these occupancy hazard groups used for?
5. Occupancy hazard groups used for sprinkler installations and water supply only B. Water demand requirements 1. Pipe schedule method a) Oldest method 1) Infrequently used b) Permitted for additions or modifications to existing pipe schedule systems 2. Hydraulic calculation method a) Most common method b) Methods used 1) Area/density 2) Room design c) Establish minimum requirements for water supply C. NFPA 13 requirements 1. Plans must be submitted a) Also a CFC requirement 2. Acceptance testing required 3. Maintenance and certification of systems shall be provided D. Design standardization 1. Establishes minimum criteria for life and safety protection 2. Maintains a minimum level of sprinkler system performance 3. Maintains single baseline reference and use of latest technologies	

PRESENTATION	APPLICATION
4. Provides minimum level of protection for fire service personnel 5. Maintains public trust a) Public expects system to work 6. Provides a reference for the AHJ to ensure that minimal requirements are met E. System information	
1. Placard a) Located on riser b) States how designed 1) Pipe schedule 2) Hydraulically designed c) Number of sprinkler heads on system/area d) Basis of design 1) Occupancy hazard • Light, ordinary, extra, or special 2) Discharge density (gpm/square foot) • Discharge minimum water over specified area 3) Calculation numbers	**SLIDE: 7-3-7**
F. Importance of data 1. System tailored to a given occupancy and use 2. Change of occupancy a) System design may be inadequate 3. System may not control fire	**SLIDE: 7-3-8** **ACTIVITY 7-3-1:** Complete the activity in the student supplement as homework.

Summary:

From a life safety standpoint, economic, and business standpoint, fire sprinklers are extremely effective. However, like any mechanical system, they have their shortcomings, which can reduce their effectiveness. These factors must be known for the inspector to make an appropriate inspection.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 90-92 in order to prepare you for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 7-3-1: UNIT 7 HOMEWORK

Time Frame:	Homework
Materials Needed:	• California Fire Code, CBSC, 2007 Edition, Chapter 9 • Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 • Pen or pencil
Introduction:	This activity provides the students the opportunity to become familiar with water-based fire protection systems.
Directions:	1. Using your textbooks, answer the following questions. 2. Be prepared to discuss your answers with the class.

1. According to the CFC, when must a fire sprinkler system be electronically monitored?

   Any time, unless it meets the exceptions

   California Fire Code, CBSC, 2007 Section 903.4

2. All control valves on fire protection equipment must be which type of valve?

   Indicating

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 163

3. List three things that must be checked when inspecting OS&Y valves.

   (1) ***Damage***

   (2) ***Fully open***

   (3) ***Accessible***

   Additional Answer(s): Secured and/or supervised, stem is clean, operating wheel backed off ¼ turn
   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 170-171

4. How may a sprinkler in an area subjected to corrosive vapors be protected?

   Special protective coating

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 167

5. List two things an inspector should do before inspecting a fire sprinkler system.

   (1) ***Review records***

   (2) ***Obtain permission***

   Additional Answer(s): Wear appropriate clothing, schedule building rep to perform the actual test
   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 166

6. How can a sprinkler head be protected from mechanical damage?

   Use a guard or cage

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 166

7. List three changes that may occur during the life of a building that would require the replacement of sprinkler heads with those of a different type or rating.

   (1) ***Occupancy***

   (2) ***Fire hazards***

   (3) ***Wall placement***

   Additional Answer(s): Partitions, HVAC equipment, lighting fixtures, mechanical equipment
   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 166-169

8. What should happen to sprinkler heads that are corroded, painted, or loaded with foreign material?

   Replaced

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 167

9. List three common reasons that fire sprinkler systems fail.

   (1) ***Improper maintenance***

   (2) ***Water supply shut-off***

   (3) ***Incorrect design***

   Additional Answer(s): Inadequate water supply, obstructions, partial protection
   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 159

10. What is the minimum number of spare sprinkler heads that should be kept on site at any time?

    Six

    Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 167

11. List two things that should be checked when inspecting sprinkler piping and hangars.

    (1) ***Corrosion***

    (2) ***Damage***

    Additional Answer(s): Piping not being used as support, proper support, loose hangers
    Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 168

12. According to the CFC, what is the minimum clearance (measured from the deflector) that must be maintained under sprinkler heads?

    18 inches

    California Fire Code, CBSC, 2007 Edition, Section 315.2.1

13. List three common objects that may block water distribution in a sprinkler system.

    (1) ***Partitions***

    (2) ***Stock***

    (3) ***Lights***

    Additional Answer(s): Hanging displays
    Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 167

Topic: 7-4: Types Of Sprinkler Systems

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 5.3.4

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of the different types of sprinkler systems

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Page 93

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Individual Activity 7-4-1: Fire Sprinkler Systems

References:

- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	How many sprinkler systems are there? **SLIDE: 7-4-1**
I. TYPES OF SPRINKLER SYSTEMS A. Four basic types 1. Wet-pipe 2. Dry-pipe 3. Preaction 4. Deluge B. Those used in dwellings	
	What is a wet-pipe system? **SLIDE: 7-4-2**
II. WET-PIPE SYSTEMS A. Water under pressure at all times and connected to a water supply B. Most reliable type in use C. Piping contains water that will discharge immediately when a sprinkler activates D. System cannot be used where temperatures fall below freezing for sustained periods of time 1. Alcohol or antifreeze solutions may be used in piping to allow use in areas subject to freezing	
	SLIDE: 7-4-3 What is a dry-pipe system? **SLIDE: 7-4-4**
III. DRY-PIPE SYSTEMS A. Has air under pressure in piping 1. Piping is identical to wet-pipe system except pipes are filled with compressed air or nitrogen	

PRESENTATION	APPLICATION
B. A dry-pipe valve is required at the riser 1. Allows water to flow into piping in response to opening of one or more sprinklers C. Used in freezing climates, cold storage rooms, unheated warehouses, etc. D. Less reliable than wet-pipe systems	
	SLIDE: 7-4-5 What are preaction systems used for? **SLIDE: 7-4-6**
IV. PREACTION SYSTEMS A. Used for special applications 1. Water sensitive equipment rooms 2. Computer control rooms B. Three types 1. Noninterlocking 2. Single interlock 3. Double interlock	
	SLIDE: 7-4-7 **SLIDE: 7-4-8** **SLIDE: 7-4-9**
C. Typical description 1. Air is maintained in the piping at atmospheric pressure a) Water is controlled by a deluge valve connected to detection system 2. Activation of a detector or manual pull station causes the deluge valve to open, admitting water to the piping a) Water will then be discharged after a sprinkler has been activated	

PRESENTATION	APPLICATION
	SLIDE: 7-4-10
3. Used where premature water discharge cannot be tolerated on such items as a) High-value stock b) Computers c) Electronics	
4. These systems are costly and complex with a higher failure rate than wet-pipe systems	
	What is a deluge system?
	SLIDE: 7-4-11
V. DELUGE SYSTEMS	
A. Used in high hazard areas that requires flooding the area to suppress a fire	
B. Similar to the preaction system except all sprinkler heads are open	
C. Used where fast moving, high intensity fires are anticipated	
D. Designed for high water flows since all sprinklers discharge at once	
	SLIDE: 7-4-12
	SLIDE: 7-4-13
	SLIDE: 7-4-14
VI. SPRINKLER SYSTEMS FOR RESIDENTIAL OCCUPANCIES	
A. Are life safety systems, not extinguishing systems	
1. Prevent flashover	
2. Limit carbon monoxide levels	
B. Installed only where people live	
1. Can exclude attics and garages	

PRESENTATION	APPLICATION
C. NFPA 13D 1. Designed for 1 an 2 family dwelling units 2. Sprinkler heads are designed to UL Standard 1626 D. NFPA 13R 1. Designed for residential buildings up to 4-stories in height	**SLIDE: 7-4-15**
E. Maximum flow from two sprinklers F. Typical system cost is $1.00-$2.00 per square foot	**SLIDE: 7-4-16**
G. System components 1. Combination domestic water and sprinkler system shut-off valve a) No separate sprinkler system valve 2. Riser 3. Piping a) Steel, copper, or chlorinated polyvinyl chloride (CPVC) plastic 4. Check valve 5. Drain valve 6. Gauge	**SLIDE: 7-4-17**
7. Inspector's test valve 8. Hangers 9. No fire department connection	**ACTIVITY 7-4-1:** Complete the activity in the student supplement.

Summary:

There are five types of sprinkler systems in use today - wet-pipe, dry-pipe, preaction, deluge, and those used in dwellings. Using this knowledge of sprinkler system types, the inspector can understand the differences between the systems and ensure that the appropriate system has been installed in an occupancy.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Page 93 in order to prepare you for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 7-4-1: FIRE SPRINKLER SYSTEMS

Time Frame:	0:15
Materials Needed:	• Pen or pencil
Introduction:	This activity provides the students the opportunity to become familiar with the different types of fire sprinkler systems.
Directions:	1. Using the information in your notes, answer the following questions. 2. You have 5 minutes to complete this activity. 3. Be prepared to discuss your answers with the class.

1. What are the four basic types of sprinkler systems?

   (1) ***Wet-pipe*** (3) ***Dry-pipe***

   (2) ***Preaction*** (4) ***Deluge***

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 162

2. What is the most reliable type of sprinkler system?

   Wet-pipe

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 169

3. Which sprinkler system has air under pressure in its piping system?

   Dry-pipe

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 162

4. Which sprinkler system uses open sprinklers?

   Deluge

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 162-163

5. Which sprinkler system is designed for life safety, not extinguishment?

   Dwelling (NFPA 13D)

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition

Topic: 7-5: Sprinkler System Components

Time Frame: 0:45

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 5-3.4

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of the components of an automatic sprinkler system

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 94-95

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Sample sprinkler heads
- Individual Activity 7-5-1: Sprinkler System Components

References:

- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7
- NFPA 13: Standard on the Installation of Sprinkler Systems, NFPA, 2002 Edition
- Private Fire Protection and Detection, IFSTA, Second Edition

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

SLIDE: 7-5-1

SLIDE: 7-5-2

I. SPRINKLERS

A. Discharge water after the release of a cap or plug that is activated by the heat responsive element

1. Fixed-spray nozzle
2. Operated individually by a thermal detector

B. Commonly identified by the temperature at which they are designed to operate

What are the colors that indicate each sprinkler temperature rating?

1. Uncolored or black
   a) Classification: Ordinary
   b) Temperature rating: 135°F - 170°F
   c) Maximum ceiling temperature: 100°F
   d) Glass bulb: Orange or red
2. White
   a) Classification: Intermediate
   b) Temperature rating: 175°F - 225°F
   c) Maximum ceiling temperature: 150°F
   d) Glass bulb: Yellow or green
3. Blue
   a) Classification: High
   b) Temperature rating: 250°F - 300°F
   c) Maximum ceiling temperature: 225°F
   d) Glass bulb: Blue
4. Red
   a) Classification: Extra high
   b) Temperature rating: 325°F - 375°F

PRESENTATION	APPLICATION
c) Maximum ceiling temperature: 300°F d) Glass bulb: Purple 5. Green a) Classification: Very extra high b) Temperature rating: 400°F - 475°F c) Maximum ceiling temperature: 375°F d) Glass bulb: Black 6. Orange a) Classification: Ultra high b) Temperature rating: 500°F - 575°F c) Maximum ceiling temperature: 475°F d) Glass bulb: Black 7. Orange a) Classification: Ultra high b) Temperature rating: 650°F c) Maximum ceiling temperature: 625°F d) Glass bulb: Black	What are some of different ways sprinklers are activated? **SLIDE: 7-5-3**
C. Release mechanisms 1. Fusible link a) Involves a frame that is screwed into the sprinkler piping b) Two levers press against the frame c) A cap over the orifice in the frame holds back the water d) The fusible link holds the levers together until the link is melted during a fire	

PRESENTATION	APPLICATION

e) The water pushes the levers and cap out of the way

1) Strikes the deflector on the end of the frame

f) The deflector converts the standard ½-inch stream into a water spray

2. Frangible bulb

a) Small bulb filled with liquid and an air bubble to hold the orifice shut

1) Liquid is color-coded to designate the breaking temperature

b) Heat expands the liquid until the bubble is absorbed into the liquid

c) Internal pressure increases

d) Bulb shatters at the proper temperature

1) Breaking temperature regulated by the amount of liquid and the size of the bubble

e) When the bulb shatters, valve cap is released

3. Chemical pellet

a) A pellet or solder (under compression) within a small cylinder

b) Melts at a predetermined temperature

c) Plunger moves down and releases the valve cap parts

SLIDE: 7-5-4

D. Positions

1. Pendent

a) Most common type in use

b) Extends down from the underside of the piping

PRESENTATION	APPLICATION
c) Sprays a stream of water downward into a deflector 1) Breaks the stream into a hemispherical pattern 2. Upright a) Sits on top of the piping b) Sprays water into a solid deflector 1) Breaks the stream into a hemispherical pattern 2) Redirected to the floor 3. Sidewall a) Extends from the side of a pipe b) Used in small rooms c) Branch lines runs along a wall d) Has a special deflector that creates a fan-shaped pattern of water 4. Special-purpose a) Used in specific applications b) Unique characteristics	
E. Recent changes regarding sensitivity of sprinklers 1. Old commercial sprinklers are relatively insensitive 2. "Fast response" commercial sprinklers operate more quickly 3. Residential sprinklers are fast acting and relatively new technology 4. Some sprinkles now shut-off after fire is knocked down 5. There are also "on" and "off" heads	**SLIDE: 7-5-5** What are some of the recent changes regarding sprinkler heads?

PRESENTATION	APPLICATION
	SLIDE: 7-5-6
F. Clearance of sprinklers to obstructions is critical 1. Standard clearance a) 18 inches 2. Clearance required in some cases a) 36 inches	
	SLIDE: 7-5-7
II. PIPES AND HANGERS A. Pipes 1. Construction a) Metal b) Plastic 1) Polybutylene 2) CPVC 2. Sprinkler risers a) Vertical sections of pipe that connect to the feeder main b) Contains the system control valve and associated hardware 1) Used for testing, alarm activation, and maintenance	
	SLIDE: 7-5-8 **SLIDE: 7-5-9** **SLIDE: 7-5-10**
B. Hangers 1. Used to suspend sprinkler piping from approved structural members 2. Listed and approved type required	

PRESENTATION	APPLICATION
	SLIDE: 7-5-11
III. CONTROL VALVES	
A. Used to control supply of water to sprinkler systems	
B. Must be indicating valves	
C. Types of valves	
	What is an OS&Y valve?
	SLIDE: 7-5-12
1. Outside screw and yoke (OS&Y) valve	
a) An aboveground valve	
b) Has a yoke on the outside with a threaded stem	
c) Controls opening and closing of the gate	
1) Water supplied to automatic sprinkler systems	
d) Threaded portion of the stem is out of the yoke when the valve is open	
e) Threaded portion of the stem is inside the yoke when the valve is closed	
	SLIDE: 7-5-13
2. Post indicator valve (PIV)	
a) An underground gate valve	
b) Hollow metal post that is attached to the valve housing	
1) Valve stem is inside this post	
c) A movable target is on the stem	
	SLIDE: 7-5-14
1) Words "OPEN" and "SHUT" at the opening	
	SLIDE: 7-5-15
3. Wall post indicator valve (WPIV)	
a) Similar to PIV	

PRESENTATION	APPLICATION
b) Extends through the wall with the target and valve operating nut on outside of building 4. Post indicator valve assembly (PIVA) a) Similar to PIV	What is the difference?
b) Uses a butterfly valve instead of a gate valve c) Does not use target words 1) Has a sight area that is open when the valve is open and closed when the valve is closed	What is the difference?
IV. OPERATING VALVES A. Sprinkler systems employ various valves 1. Alarm test valve 2. Automatic drain valve 3. Check valve 4. Globe valve 5. Inspector's test valve 6. Main drain valve 7. Stop or cock valve B. Alarm test valve 1. Located on a pipe that connects the supply side of the alarm check valve to the retard chamber a) Catches excess water from momentary water pressure surges 2. Simulates the actuation of the system by allowing water to flow into the retard chamber 3. Operates the water flow alarm devices	**SLIDE: 7-5-16**

PRESENTATION	APPLICATION
C. Inspector's test valve 1. Located in a remote part of the sprinkler system 2. Equipped with the same size orifice as one sprinkler 3. Simulates the activation of one sprinkler 4. Water should drain to the outside of the building	
D. Main drain valve 1. Every sprinkler system riser has this valve 2. Drains water from the system for maintenance purposes 3. Can also be used to check the system water supply a) Because of the large volume of water that flows when the main drain valve is opened	
V. FIRE DEPARTMENT CONNECTION (FDC)	What is a fire department connection? **SLIDE: 7-5-17**
A. An inlet appliance that has one or more 2½" inlets or one large-diameter inlet	
B. Fire apparatus can boost the pressure or amount of water flowing through a sprinkler or standpipe system	What is the purpose of the FDC?
C. High-rise buildings having two or more zones require a FDC for each zone	
D. Standard requirements 1. Shall be no shutoff valve between the FDC and the standpipe riser a) Gate valves are provided at the bases of individual risers in a multi-riser system	

PRESENTATION	APPLICATION
2. Hose connections to the FDC must be female and equipped with standard caps 3. Hose couplings threads conform to those used by the local fire department 4. Must be designated by a raised-letter sign on a plate or fitting reading "STANDPIPE" a) Must indicates which floors are serviced if the FDC does not service the entire building 5. Check valve in line to prevent backflow E. Not present in single residential automatic sprinkler system	
	SLIDE: 7-5-18 **SLIDE: 7-5-19** **SLIDE: 7-5-20** **SLIDE: 7-5-21** **SLIDE: 7-5-22** **SLIDE: 7-5-23**
VI. WATER FLOW ALARMS A. Systems are designed so that water flow actuates an alarm 1. Accomplished by installing an alarm check valve or a water flow indicator in the main riser B. Check valve 1. Water flow lifts a clapper valve 2. Allows water to flow into piping leading to an alarm device 3. Retard chamber a) A false alarm prevention device b) Water chamber must be filled with water before water will flow into the water motor gong	

PRESENTATION	APPLICATION
c) Equipped with a ball check valve leading to a drain d) Water surges will partially fill the chamber, but will subsequently drain 1) Preventing false alarms C. Normally operated either hydraulically or electrically 1. Hydraulic a) Local alarm b) Used to alert the personnel in a sprinklered building 2. Electric a) Employed to alert building occupants b) Can be arranged to notify the fire department D. Water flow indicator 1. Consists of a vane (paddle) that protrudes through the riser into the waterway 2. Vane is connected to an alarm switch located on the outside of the riser	
3. Movement of the vane caused by flowing water operates the switch and initiates an alarm	How does a water flow indicator work? What other supplemental system components must be considered? **SLIDE: 7-5-24**
VII. SUPPLEMENTAL SYSTEM COMPONENTS A. Exhausters B. Accelerators C. Hangers D. Earthquake bracing is required in California sprinkler systems	

PRESENTATION	APPLICATION
E. Supplemental water supplies 1. Gravity tanks 2. Pressure tanks 3. Ground level reservoirs F. Fire pumps may be required to make up pressure deficiencies G. Excess pressure valve	What are supplemental water supplies? **ACTIVITY 7-5-1:** Complete the activity in the student supplement.

Summary:

Automatic fire sprinkler systems are supplied through a valve from public mains or private water resources. Fire department connections may be used to supplement these supplies. Major components such as the riser, cross mains and branch lines distribute water to the sprinkler heads. Sprinkler heads are color coded to indicate activation temperatures. Several types are available including upright, pendent, sidewall, residential, and special purpose. Some systems have supplemental components such as exhausters, accelerators, and supply fire pumps.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 94-95 in order to prepare yourself for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 7-5-1: SPRINKLER SYSTEM COMPONENTS

Time Frame:	0:20
Materials Needed:	• Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 • Pen or pencil
Introduction:	This activity provides the students the opportunity to become familiar with the different types of sprinkler systems components.
Directions:	1. Using the information in Chapter 7 and your notes, answer the following questions. 2. You have 10 minutes to complete this activity. 3. Be prepared to discuss your answers with the class.

1. What are the three most common types of sprinkler heads?

   (1) ***Upright***

   (2) ***Pendent***

   (3) ***Sidewall or flush mount***

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 160

2. What determines the temperature rating for a sprinkler head?

   Installation location

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 160

3. What are three commonly used release mechanisms used with sprinklers?

   (1) ***Fusible links***

   (2) ***Glass bulbs***

   (3) ***Chemical pellets***

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 161

4. What is the temperature rating of an ordinary sprinkler head and what color code is used on the frame arms to identify this rating?

   (1) ***135°-170°F***

   (2) ***Uncolored***

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 162

5. Match the following acronyms to their appropriate description.

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 163

(1)	PIVA	***3***	Post indicator valve
(2)	OS&Y	***4***	Fire department connection
(3)	PIV	***1***	Post indicator valve assembly
(4)	FDC	***2***	Outside screw and yoke

Topic: 7-6: Procedures For Inspecting Sprinkler Systems

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.5

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the procedures for inspecting sprinkler systems

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- California Fire Code, CBSC, 2007 Edition, Section 901.6
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 1

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

SLIDE: 7-6-1

I. INSPECTING A SPRINKLER SYSTEM

A. Reasons to make an immediate inspection of a sprinkler system

1. Changes occur in
   a) Occupancy
   b) Combustibles, fire load, fire hazards
   c) Wall placement
   d) Partitions
   e) HVAC equipment
   f) Lighting fixtures
   g) Mechanical equipment
2. These changes may require the installation of different types or ratings of heads

What should the inspector do before inspecting a system?

SLIDE: 7-6-2

B. Prior to inspection

1. Review the records of prior inspections
   a) Identify the make
   b) Identify the model
   c) Identify the type
   d) Identify the area of protection
2. Obtain permission from and schedule inspection with the occupant or owner
3. If occupant or owner is not able to accompany the inspector a responsible party must be identified
   a) Fire department personnel should never personally operate the equipment during an inspection

PRESENTATION	APPLICATION
1) Occupant or owner's responsibility 2) Only in an emergency or planned training session	
C. Inspector to notify their agency dispatch of test D. Owner or occupant to notify alarm-monitoring organization before and after testing 1. After testing a) Should confirm that alarm equipment function as designed b) If no alarm was received, inspector should investigate alarm serviceability	Who needs to be notified before testing the system?
II. SPRINKLER HEADS A. Clean B. Not damaged C. Free from corrosion, paint, and foreign material D. Replace if needed E. Deflectors in proper position F. Guards for protection against mechanical damage	What should be inspected on the sprinkler heads? **SLIDE: 7-6-3**
G. Heads subject to high temperatures should be carefully examined for evidence of weakness 1. Indicated by creeping or cold flow a) Sliding apart of fusible link or leakage round sprinkler orifice b) Caused by repeated heating of the head to near operating temperature	**SLIDE: 7-6-4**

PRESENTATION	APPLICATION
c) Cold flow problems can be eliminated by the use of higher temperature rated sprinklers or frangible bulb heads	
H. Heads subject to corrosive atmospheres should have a special protective coating	
	How much clearance must be maintained below the heads?
	SLIDE: 7-6-5
I. Clearance below heads	
1. At least 18 inches under heads to stock	
a) 24 inches from ceiling to stock in unsprinklered buildings	
b) 36 inches in high-piled storage areas	
2. Measured from the deflector	
3. Exception	
a) An 18-inch storage height below sprinkler heads does not apply to shelving against walls	
J. Extra supply of sprinkler heads maintained in the building	
1. Various designs	
2. Various temperature ratings	
3. Special deflectors	
	SLIDE: 7-6-6
	When inspecting piping, what should you look for?
	SLIDE: 7-6-7
III. PIPING AND HANGERS	
A. Corrosion	
B. Areas subject to physical damage	
C. Leaks	

PRESENTATION	APPLICATION
D. Not used as a support 1. Ladders 2. Stock 3. Other materials E. System should be properly supported 1. Produces very significant forces F. Report all bent and damaged pipes and/or missing hangers G. Report all loose hangers H. Ensure that pipes are protected against freezing in freezing climates	**SLIDE: 7-6-8**
IV. FREQUENCY OF INSPECTIONS[1] A. Quarterly inspections B. Annual inspections C. Five year service required per CCR Title 19, Chapter 5, SFM tag attached	
V. INSPECTING A WET-PIPE SYSTEM A. Primary concerns 1. Valves 2. Sprinklers 3. Piping 4. Water supply	What should you look for when inspecting control valves? **SLIDE: 7-6-9**
B. Control valves 1. Each valve shall be identified and have a sign indicating what it controls 2. In the open position a) If valves are closed, find out why	

PRESENTATION	APPLICATION
3. Properly sealed, locked, and supervised 4. Accessible 5. Appropriate wrenches on hand 6. Free from external leaks 7. Valve and its parts are not subjected to mechanical damage a) Provide a guard if necessary	What should be checked on PIVs? **SLIDE: 7-6-10**
C. PIVs 1. Fully opened and locked a) With wrench, feel spring of rod when the valve is fully opened 2. Target (open/shut sight) is properly adjusted 3. Cover glass in place and clean 4. PIV bolts are tight 5. Barrel casing is intact 6. Screw is backed off about one-quarter turn from fully opened	**SLIDE: 7-6-11** What should be inspected on an OS&Y valve? **SLIDE: 7-6-12**
D. OS&Y 1. Fully opened and locked 2. Operating wheel is backed off one quarter turn from fully opened	**SLIDE: 7-6-13**

PRESENTATION	APPLICATION
	What should be inspected on the drains? **SLIDE: 7-6-14**
E. Drains 1. Main drain, auxiliary drains, and the inspector's test valve are closed 2. Ball drip valve in FDC a) Moves freely b) Allows trapped water to seep out 3. Velocity drip valve a) Moves freely b) Allows trapped water to seep out of the retard chamber	
	SLIDE: 7-6-15
VI. INSPECTING A DRY-PIPE SYSTEM	What *additional* items need to be inspected when checking a dry-pipe system? **SLIDE: 7-6-16**
A. Air pressure readings correspond to previously recorded readings	
	What does it mean if both pressure gauges show the same pressure?
1. If both gauges read equal pressure, the system has been tripped B. FDC threads are in good condition 1. Caps in place C. Drain drum drip valves D. During freezing weather, check heating device in dry-pipe valve enclosure	

PRESENTATION	APPLICATION
	SLIDE: 7-6-17
E. Priming water is at the correct level	
F. If the system is equipped with a quick-opening device, opening the priming water test line could trip the system	
G. Air pressure maintained at 15-20 psi above the trip point	
1. No air leaks	
	SLIDE: 7-6-18
	SLIDE: 7-6-19
	SLIDE: 7-6-20
VII. INSPECTING DELUGE AND PREACTION SYSTEMS	
A. Follow the same guidelines as those performed on wet and dry systems	
B. Main supply control valves	
1. Fully opened	
2. Supervised and locked	
C. Valve lines are fully opened	
D. Alarm by-pass valve is closed	
E. Pressure gauges are indicating adequate pressure	
1. Water	
2. Air	
F. Check ball drip valves for proper operation	
	SLIDE: 7-6-21
G. No air leaks in pneumatic detection systems	
H. Detection devices are not damaged or corroded	
I. Air maintenance equipment is working properly	
J. No air leaks in preaction system piping	
K. No water leaks from preprimed deluge system sprinkler plugs or caps	
	SLIDE: 7-6-22

Summary:

It is important that the inspector thoroughly inspect each sprinkler system to ensure that all valves, heads, and pipes are in good working condition and therefore, will work properly under a fire situation. Although these tests seem tedious, they are necessary to ensure that systems will operate as designed. Without this knowledge, an inspector cannot evaluate the readiness of a system. The inspector may only observe maintenance personnel conducting these tests; however, tests must be witnessed if they are to be conducted as required.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 in order to prepare yourself for the upcoming test. Study for our next session.

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 901.6

Topic: 7-7: Procedures For Conducting Tests On Wet-Pipe Sprinkler Systems

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 4-3.4

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the procedures for conducting tests on wet-pipe sprinkler systems

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 1

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION

I. ALARM TEST

A. Should be conducted only during nonfreezing weather

1. Ice formation on sidewalks and roadways
2. Pipe damage

B. All components should be checked visually during the test

SLIDE: 7-7-1

C. Procedure

1. Open alarm bypass valve to test alarm without unseating valve
2. Pressure gauge readings should not change significantly
   a) Water should flow to retard chamber (if equipped) and then to alarm line
3. Water gong or electric alarm should sound
4. Close bypass valve
   a) Systems with a retard chamber, the drain should empty the chamber when bypass valve is closed
   b) If no retard chamber, the alarm line should be drained at the conclusion of the test

II. WATER FLOW ALARM TEST

A. Simulates the operation of a single sprinkler and ensures that the alarm will operate even if only one sprinkler is fused in a fire

B. Inspector's test valve is used

1. Older systems have this valve at the most remote branch line and requires two people to perform the test
2. Newer systems have this valve located near the sprinkler riser so one person can perform the test

PRESENTATION	APPLICATION
	SLIDE: 7-7-2
C. Procedure	
1. With an observer at the riser, another individual opens the inspectors test valve	
2. The alarm should sound	
3. A slight variation in pressure should be observed at the riser	
4. After the alarm operates, close the inspector's test valve	
III. MAIN DRAIN TEST	
A. Conducted quarterly per NFPA 25	
B. Detects impairments	
1. Closed valves	
2. Obstructions	
3. Gradual deterioration in the water supply	
	SLIDE: 7-7-3
	SLIDE: 7-7-4
C. Procedure	
1. Observe and record the pressure on the gauge at the system riser	
2. Fully open the main drain slowly	
3. Observe and record the pressure drop	
4. Close main drain slowly	
	SLIDE: 7-7-5
5. Compare these readings to the previous readings	
a) Note any significant differences	
	What could cause significant differences in the readings?
1) Supply valve may be partially closed	

PRESENTATION	APPLICATION
2) May be an obstruction in the supply line D. Procedure for systems using an alarm check valve 1. Take pressure reading from lower gauge 2. Erroneously high static pressure can exist above the valve	**SLIDE: 7-7-6**

Summary:

The wet-pipe sprinkler systems are subjected to at least three types of tests. The inspector should be familiar with the tests in order to understand and verify the records and ensure the operational readiness.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 in order to prepare yourself for the upcoming test. Study for our next session.

Topic: 7-8: Procedures For Conducting Tests On Dry-Pipe Sprinkler Systems

Time Frame: 0:30

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 4-3.4

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the procedures for conducting tests on dry-pipe sprinkler systems

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 1

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
I. MAIN DRAIN TEST	
A. Conducted quarterly per NFPA 25	
B. Detects impairments	
1. Closed valves	
2. Obstructions	
3. Gradual deterioration in the water supply	
	SLIDE: 7-8-1
C. Procedure (same as wet-pipe system)	
1. Observe and record the pressure on the gauge at the system riser	
2. Fully open the main drain slowly	
3. Observe and record the pressure drop	
4. Close main drain slowly	
5. Compare these readings to the previous readings	
a) Note any significant differences	
	What could cause significant differences in the readings?
1) Supply valve may be partially closed	
2) May be an obstruction in the supply line	
D. Procedure for systems using an alarm check valve	
1. Take pressure reading from lower gauge	
2. Erroneously high static pressure can exist above the valve	
II. TRIP TEST	
A. Operational test of a dry-pipe valve	
B. Permits water to flow into the system	
C. This procedure can take 2-4 hours to complete depending on the size of the system and the capacity of the air compressor	
	SLIDE: 7-8-2

PRESENTATION	APPLICATION
D. Procedure 1. Fully open the main drain to flush sediment or scale that may be in the water supply a) Close the main drain slowly 2. Check the water control valve for freedom of movement a) Slightly open the main drain and turn the water control handwheel or crank 1) To prevent pushing the clapper off its seat	**SLIDE: 7-8-3**
3. Leave the water control valve partially open a) Close the main drain 4. Bleed air from the system a) Open the primary water valve or valve body drain b) Observe the reading on the air-pressure gauge during this step	**SLIDE: 7-8-4**
5. Record the tripping point of the dry-pipe valve a) Close the control valve 6. Check water and air-pressure gauges to ensure pressure equalization has occurred after tripping 7. Verify that local alarm and control panel, central station alarm, or fire department alarm has operated	**SLIDE: 7-8-5**
8. Open main drain valve a) Be sure system is completely drained before proceeding 1) Water accumulation in the system riser will rush out when the valve cover is opened if not properly drained	

PRESENTATION	APPLICATION
9. Open the dry-pipe valve a) Ensure clapper is latched in the open position 10. Clean the air and water clapper seats, and remove any debris from the valve housing	**SLIDE: 7-8-6**
11. Release the clapper latch and reseat the valves 12. Close valve cover 13. Add priming water 14. Close all drain valves 15. Pressurize the system with air to the proper level	**SLIDE: 7-8-7**
16. Check for water flow at the intermediate chamber drain a) Drips not unusual b) Steady stream indicates air seat not properly seated 17. Partially open the main drain a) Fully open water control valve 18. Close the main drain slowly 19. Check the air and water gauges a) Air pressure should be lower than the water pressure b) If they are the same, valve has been tripped and Steps 9-18 must be repeated	**SLIDE: 7-8-8**
20. Notify alarm service that test is completed 21. Attach tag to the valve a) Test date b) Air pressure at which valve was tripped c) Name of person performing the test	

Summary:

There are two tests needed for dry-pipe systems. The main drain test ensures that the supply line is not obstructed and the valve is open. The trip test exams the full system for its ability to function under a simulated fire.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 in order to prepare yourself for the upcoming test. Study for our next session.

Topic: 7-9: Characteristics Of Standpipe Systems

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.5

Behavioral Objective:

Condition: Given an activity and formative test

Behavior: The student will confirm a knowledge of the characteristics of standpipe systems

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 99-100

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices
- Individual Activity 7-9-1: Standpipe Required Systems

References:

- California Fire Code, CBSC, 2007 Edition, Section 905
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7
- NFPA 14: Standard on the Installation of Standpipe, Private Hydrant, and Hose Systems, NFPA, 2003 Edition
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 2

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	What is a standpipe system? **SLIDE: 7-9-1**
I. STANDPIPE SYSTEM CLASSIFICATIONS	
A. A wet or dry system of piping, valves, outlets, and related equipment designed to provide water at specified pressures and installed exclusively for the fighting of fire[1]	What are the classifications of standpipe systems? **SLIDE: 7-9-2**
B. Components of a Class I system 1. Primarily used by trained fire department or fire brigade personnel 2. Large hoselines a) 2½-inch outlet size b) May be equipped with a reducer 3. Minimum riser size of 4 inches 4. Flow and pressure requirements for new structures is 500 gpm at 65 psi at topmost outlet a) Current standard requires 500 gpm at 100 psi for fog nozzle 5. Dry piping	**SLIDE: 7-9-3** **SLIDE: 7-9-4**
C. Components of a Class II system 1. Used by building occupants 2. Outlet size is 1½ inches with 1½" hoseline attached 3. Minimum riser size of 2-2½ inches	

PRESENTATION	APPLICATION
4. Flow and pressure requirement of 100 gpm at 65 psi at the topmost outlet a) Connected directly to a water supply	**SLIDE: 7-9-5** **SLIDE: 7-9-6**
D. Components of a Class III system 1. Outlet size is 2½ inches with a 1½-inch reducer attached 2. 1½" hoseline attached 3. Used by building occupants and fire department or fire brigade members 4. Minimum riser size of 4 inches 5. Flow and pressure requirements for new structures is 500 gpm at 100 psi at topmost outlet	**SLIDE: 7-9-7**
E. Combined systems 1. Standpipe plumbing is combined with the fire sprinkler system 2. Other requirements are the same as a Class I system in addition to sprinkler system requirements	What are the methods of operations common to standpipe systems?
II. METHODS OF OPERATION (TYPES)	**SLIDE: 7-9-8**
A. Wet standpipe system 1. Water supply valve open a) Water is in the system at all times b) At proper pressures and flows	

PRESENTATION	APPLICATION
2. System is instantly available for use when hose valve is opened	
B. Dry standpipe systems	
1. Three types	
	SLIDE: 7-9-9
2. First	
a) Water flows to the system after a valve controlled by an electrical switch or other device located at each hose station is operated	
b) Water is available at hose stations after supply valve is opened from the control device	
	SLIDE: 7-9-10
3. Second	
a) Air under pressure automatically admits water to the system when a hose valve is opened through the use of a dry-pipe valve	
	SLIDE: 7-9-11
4. Third	
a) No water in the system	
1) And, system is not hooked up to any supply	
b) Will only operate after a fire engine attaches to the FDC	
c) Allowed only on Class I systems	
III. REQUIREMENTS FOR STANDPIPE SYSTEMS	
A. Standpipes required by CBC and CFC[2]	
	SLIDE: 7-9-12
B. Location of standpipe outlets and inlets	
1. Required at specific locations in certain occupancies	

PRESENTATION	APPLICATION
2. Required in buildings under construction 3. Basement pipe inlets required over every unsprinklered basement except in areas where archives and similar materials are stored 4. Covered malls 5. Horizontal exits	**SLIDE: 7-9-13**
C. Construction 1. Specific requirements a) Construction and performance standard found NFPA 14	
D. Maintenance and service standards are in CCR Title 19, Chapter 5 and NFPA 25 1. Maintenance performed every six months 2. Full hydrostatic service performed every five years	**ACTIVITY 7-9-1:** Complete the activity in the student supplement.

Summary:

The three classes of standpipe systems in use today form an important part of most buildings' fire protection. Likewise, outside hose systems are important to properties where they are needed.

Evaluation:

The student will complete the activity and formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 and Fire Prevention 1B Student Supplement, SFT, 2009 Edition, Pages 99-100 in order to prepare yourself for the upcoming test. Study for our next session.

INDIVIDUAL ACTIVITY 7-9-1: STANDPIPE REQUIRED SYSTEMS

Time Frame:	0:20
Materials Needed:	• California Fire Code, CBSC, 2007 Edition, Section 905.3 • Pen or pencil
Introduction:	This activity provides the students the opportunity to become familiar with the standpipe requirements.
Directions:	1. Using CFC Table 1004-A, answer the following questions. 2. You have 10 minutes to complete this activity. 3. Be prepared to discuss your answers with the class.

1. What is the required class of standpipe in a fire-sprinklered Group A Occupancy that has an occupant load of 1250?

   Class I

   California Fire Code, CBSC, 2007 Edition, Section 905.3.2

2. What class of standpipe is required in a fire-sprinklered high-rise building? Is there a hose requirement?

   Class I / No hose requirement

   California Fire Code, CBSC, 2007 Edition, Section 905.3.1 Exception 1

3. In fire-sprinklered buildings that require standpipes, can they be combined with the automatic fire sprinkler system?

   Yes

   California Fire Code, CBSC, 2007 Edition, Section 905.3

4. What class of standpipe may be substituted in an open parking garage over 30 feet tall that is located in an area subject to freezing?

   Class I, Manual Dry standpipe

   California Fire Code, CBSC, 2007 Edition, Section 905.3.1 Exception 3

5. Are standpipes required in an open air seating space without enclosed spaces?

   No

   California Fire Code, CBSC, 2007 edition, section 905.3.2 Exception 1

ENDNOTES

The endnotes provide support and facilitate instruction. It is recommended you insert the specific code section in the lesson plan where it is used. Please report immediately to State Fire Training Curriculum Development Division of any errors or changes you find to the endnotes.

[1] California Fire Code, CBSC, 2007 Edition, Section 902.1

[2] California Fire Code, CBSC, 2007 Edition, 905.3

Topic: 7-10: Procedures For Inspecting Standpipe Systems

Time Frame: 1:00

Level Of Instruction: Level II

Authority: 1998 NFPA 1031: Section 3-3.5

Behavioral Objective:

Condition: Given a formative test

Behavior: The student will confirm a knowledge of the procedures for inspecting standpipe systems

Standard: With a minimum 80% accuracy according to the information contained in Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7

Materials Needed:

- Conference board/pads with markers/erasers
- Appropriate audiovisual training aids and devices

References:

- Barclays Official California Code of Regulations Title 19, West Group, Division 1, Chapter 5
- NFPA 25: Inspection, Testing and Maintenance of water based fire protection systems, NFPA, 2006 Edition with California Amendments
- Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7
- NFPA 14: Standard on the Installation of Standpipe, Private Hydrant, and Hose Systems, NFPA, 2003 Edition
- Private Fire Protection and Detection, IFSTA, Second Edition, Chapter 2

Preparation: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)	**B**egin
Curiosity (arouse)	**A**ssociation
Interest (create)	**S**tudents
Desire (stimulate)	**E**xperience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

PRESENTATION	APPLICATION
	What items should be inspected after installation? **SLIDE: 7-10-1**
I. INITIAL INSTALLATION INSPECTION A. Hydrostatically tested at 200 psi for two hours by the installer 1. Ensure tightness and integrity of the fittings B. Flushed and flow tested 1. Remove any construction debris 2. Ensure there are no obstructions C. Systems with fire pumps 1. Flow test at highest outlet a) Ensure fire pump will start when hose valve is opened 2. Test fire pump a) Ensure delivery at rated flow and pressure D. All devices are listed and labeled by a nationally recognized testing laboratory 1. Valves 2. Racks 3. Cabinets and closets	
	SLIDE: 7-10-2
E. Hose stations and connections 1. Located conspicuously within the immediate area 2. Not be obstructed 3. Easy reach of a person standing on the floor a) Within six feet from the floor 4. Hose can be attached to the valve without kinking	

PRESENTATION	APPLICATION
5. Each hose cabinet or closet for Class II or Class III systems is provided with a sign a) "FIRE HOSE" and/or "FIRE HOSE FOR USE BY OCCUPANTS OF BUILDING"	**SLIDE: 7-10-3**
F. FDC 1. Proper threads or connection 2. Designated with a sign a) "STANDPIPE"	
G. Dry standpipes 1. Designed with a sign a) "DRY STANDPIPE FOR FIRE DEPARTMENT USE ONLY"	What items should be checked on an in-service inspection? **SLIDE: 7-10-4**
II. IN-SERVICE (PERIODIC) INSPECTIONS A. Water supply valves are sealed in the open position 1. Isolation control valves supervised 2. Other control valves supervised	
B. Starting and operating fire pumps (if so designed)	How often and how long should fire pumps be test run?
1. Run for a minimum of 30 minutes weekly 2. By owner or designated agent 3. Ask for maintenance log a) Must be maintained for 5 years	
C. Hose valves 1. Free of paint, corrosion, other impediments 2. Threads are not damaged	

PRESENTATION	APPLICATION
D. Hose valve wheels 1. Present and not damaged E. Hose cabinets and closets 1. Accessible 2. Used for storing fire fighting equipment only 3. Swing-out rack checked for ease of operation 4. Not locked unless with an approved device F. Hose 1. In good condition 2. Dry 3. Properly positioned on rack or reel 4. Couplings are not damaged 5. Gaskets are in good condition	**SLIDE: 7-10-5**
G. Nozzles 1. Not obstructed 2. Threads not damaged 3. Shut-off valve, if any, is working properly 4. Nozzle application compatible with installation H. Dry standpipe system 1. Discharge outlets are closed 2. Drained of moisture I. FDC 1. Access is not blocked 2. Free of obstruction 3. Swivels rotate freely 4. Caps in place J. Water supply tanks (if so designed) 1. Proper water levels are maintained	

PRESENTATION	APPLICATION
2. Pressurized tank a) Minimum 75 psi 3. Precautions against freezing when necessary K. Individual discharge valves operate properly 1. Gaskets are in good condition 2. There is no corrosion or evidence of leaks	**SLIDE: 7-10-6**
L. Discharge outlet threads are compatible with fire department threads and are not damaged M. Drains are free of dirt and/or sediment **III. MAINTENANCE REQUIREMENTS**	**SLIDE: 7-10-7**
A. Class I standpipes 1. FDC a) Inlet caps missing 1) Inspect interior 2) Replace b) Couplings damaged and not rotating smoothly 1) Repair or replace 2) Lubricate for smooth rotation c) Gaskets missing or deteriorated 1) Replace gaskets d) Clapper valves do not close completely 1) Repair e) Visible or exterior obstructions 1) Remove f) Not identified 1) Replace, repair, or install sign	

PRESENTATION	APPLICATION
	SLIDE: 7-10-8
2. Hose outlets a) Cap missing 1) Replace b) Fire hose connection threads damaged 1) Repair c) Valve handles missing 1) Replace d) Cap gaskets missing or deteriorated 1) Replace e) Valve does not operate smoothly 1) Lubricate f) Visible or exterior obstructions 1) Remove	
	SLIDE: 7-10-9
3. Piping a) Accessible piping damaged 1) Repair b) Visible or exterior obstructions 1) Remove	
	SLIDE: 7-10-10
B. Class II standpipes 1. Hose a) Mildew, cuts, abrasions, and deterioration 1) Replace with approved lined hose b) Coupling damaged 1) Replace or repair c) Gaskets missing or deteriorated 1) Replace	

PRESENTATION	APPLICATION
2. Nozzle a) Missing 1) Replace with approved nozzle b) Gasket missing or deteriorated 1) Replace c) Obstructions 1) Remove	**SLIDE: 7-10-11**
3. Hose outlet a) Damaged fire hose connection threads 1) Repair or replace b) Valve handles missing 1) Replace handle c) Corroded or leaking 1) Repair or replace	
4. Hose rack or reel a) Difficult to rotate 1) Repair or replace b) Damaged 1) Repair or replace c) Obstructions 1) Remove d) Hose improperly racked or rolled 1) Rerack or reroll	**SLIDE: 7-10-12**
5. Cabinet a) Difficult to open 1) Repair b) Not readily distinguishable as containing fire equipment 1) Provide labeling	

PRESENTATION	APPLICATION
c) Visible or exterior obstructions 1) Remove	**SLIDE: 7-10-13**
C. Class III standpipes 1. Fire department connection a) Same as Class I 2. Hose outlets a) Same as Class I 3. Piping a) Same as Class I 4. Hose a) Same as Class II 5. Nozzle a) Same as Class II 6. Hose outlet a) Same as Class II 7. Hose rack or reel a) Same as Class II 8. Cabinet a) Same as Class II	

Summary:

By conducting inspections on a regular basis, and following the checkpoints as given in this lesson, you can save time and energy, and possible lives. Remember, all the components need to be checked: fire department connections (FDC), hose outlets, piping, hose, nozzles, rack or reel, and cabinets.

Evaluation:

The student will complete the formative test at a time determined by the instructor.

Assignment:

Review your notes and read Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Chapter 7 in order to prepare yourself for the upcoming test. Study for our next session.

Appendix A: Formative Test #1 Answer Key

Each answer space is worth five points. Some questions may have more than one correct answer. You may use the California Fire Code while taking this test. You have 30 minutes to complete the entire test.

INSTRUCTIONS: This is a short answer test. For each of the following questions or statements, enter the correct answer(s) in the space(s) provided.

EXAMPLE: What organization developed the Incident Command System?

The fire service

	Flash Point	Boiling Point	Autoignition Temperature	Specific Gravity	Vapor Density	Lower Explosive Limit	Upper Explosive Limit
Butyl alcohol	99°F	244°F	649°F	.81	2.6	1.4	11.2
Xylene	79°F	282-286°F	932°F	.87	3.7	1.9	12.3
Acetone	-4°F	133°F	869°F	.79	2.0	2.5	12.8
Diborane	N/A	-135.1°F	100-125°F	.341	1.2475	0.8	98
Hydrogen	N/A	-423°F	932°F	N/A	0.082	4	75

Use the information above when answering questions 1-7.

1. Name one material in the chart that may be classified as a Class I-C flammable liquid.

   Butyl alcohol or xylene

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 322-324
   California Fire Code, CBSC, 2007 Edition, Section 3402.1

2. Name one material in the chart that may be classified as a Class I-B flammable liquid.

   Acetone

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 322-324
   California Fire Code, CBSC, 2007 Edition, Section 3402.1

3. Name one material in the chart that may be classified as a Class I-A flammable liquid.

   None

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 322-324
   California Fire Code, CBSC, 2007 Edition, Section 3402.1

4. Which material in the chart presents the greatest potential for explosion?

   Diborane ***Note: Refers to flammable range***

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 322-324

5. Name one material in the chart that will float on water.

   Butyl alcohol, xylene, acetone, or diborane ***Note: Refers to specific gravity***

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 322-324

6. Name one material in the chart that will produce vapors capable of being ignited at ambient temperatures below 80°F.

   Acetone, ~~butyl alcohol~~, or xylene ***Note: Refers to flash point***

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 322-324

7. Which one material in the chart that has a vapor density that is lighter than air?

   Hydrogen ***Note: Refers to vapor density***

   Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 322-324

8. How many gallons of acetone can be stored in 55-gallon drums outside of a Group F-1 Occupancy (per pile)?

   Up to 2,200 ***Note: Refers to Class I-B liquid***

   California Fire Code, CBSC, 2007 Edition, Table 3404.2 Table 3404.4.2

9. In a Group F-1 Occupancy with an approved automatic fire sprinkler system, how many gallons of xylene and butyl alcohol can be stored indoors?

   Up to 240 ***Note: Refers to Class I-C liquids; apply Footnote "d" in Table 2703.1.1(1)***

   California Fire Code, CBSC, 2007 Edition, Table 2703.1.1(1)

10. In a Group F-1 Occupancy with an approved automatic fire sprinkler system, how many gallons of xylene and butyl alcohol is allowed for indoor open use?

    60 ***Note: Refers to Class I-C liquids; apply Footnote "d" in Table 2703.1.1(1)***

    California Fire Code, CBSC, 2007 Edition, Table 2703.1.1(1)

11. What color is used by NFPA 704 to designate a Class I-B flammable liquid?

Red

Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 319

12. What is the maximum allowable size of an approved safety can when used for the storage of flammable liquids?

5 gallons

Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 333

13. What is the maximum allowable size of a flammable/ combustible liquid container when used for the storage of flammable liquids?

60 gallons

Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 333

14. What is the maximum allowable size of a portable tank when used for the storage of flammable liquids?

660 gallons

Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 333

15. What is the maximum allowable size of a metal drum when used for the storage of flammable liquids?

60 gallons

Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 333

16. What is the maximum allowable size of a glass container when used for the storage of flammable liquids?

1 gallon

Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 333

17. According to IFSTA, fire prevention measures for flammable and combustible liquids are based on five basic techniques or principles. List four of the five.

(1) ***Eliminating or excluding sources of ignition***

(2) ***Excluding air (or oxygen)***

(3) ***Storing liquids in closed containers or systems***

(4) ***Ventilating to prevent the accumulation of vapors within the flammable range***

Additional answer(s): Maintaining an atmosphere of inert gas instead of air

Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Page 324

QUIZ SCORING Each answer space is worth five points	
Total Possible	100
80% Minimum	80
Score	
Pass or Fail?	

Appendix A: Formative Test #2 Answer Key

Each answer space is worth five points. Some questions may have more than one correct answer. You may use the California Fire Code while taking this test. You have 30 minutes to complete the entire test.

INSTRUCTIONS: Section I is a short answer test. For each of the following questions or statements, enter the correct answer(s) in the space(s) provided.

EXAMPLE: What organization developed the Incident Command System?

The fire service

SECTION I

Use the attached MSDS pages to answer questions 1-5.

1. List the classification of acetone.

   Flammable liquid

2. What is the flash point?

   -4°F

3. What is the boiling point?

   133°F

4. List four conditions to avoid when storing acetone.

   (1) ***Heat***

   (2) ***Flames***

   (3) ***Ignition sources***

   (4) ***Incompatibles***

5. List three materials acetone will react with.

   (1) ***Concentrated nitric acid***

   (2) ***Sulfuric acid***

   (3) ***Oxidizing materials***

   Additional Answer(s): ***Chloroform, Alkalis, Chlorine compounds, Acids, or Potassium T-Butoxide***

6. According to the CFC, which four of the following require secondary containment when stored outside?

   - Class 4 oxidizer (solid)
   - Corrosive (liquid)
   - Class II organic peroxide (liquid)
   - Class 2 water reactive (solid)
   - Class 3 unstable (liquid)
   - Pyrophoric (liquid)

   (1) ***Corrosive***

   (2) ***Class 2 water reactive***

   (3) ***Class 3 unstable***

   (4) ***Pyrophoric***

   California Fire Code, CBSC, 2007 Edition, Table 2704.2.2

7. According to the CFC, when evaluating the degree of hazard present depends upon many variables that should be considered individually and in combination. What are three of these variables?

   (1) ***Chemical properties of the material***

   (2) ***Physical properties of the material***

   (3) ***The amount and concentration of the material***

   Additional Answer(s): ***Actual use, activity, or process involving the material or surrounding conditions***

   California Fire Code, CBSC, 2007 Edition, Appendix E, Section E103.1

8. The CFC identifies questions that can be asked to help an inspector evaluate a hazardous material. Write three of these questions.

   (1) ***What is the material?***

   (2) ***What are the concentration and strength?***

   (3) ***What is the physical form of the material?***

   Additional Answer(s): ***How much material is present?***

   What other materials are close enough to interact with the material?

   What are the likely reactions?

   What is the activity involving material?

   How does the activity affect the hazardous characteristics of the material?

   What must the material be protected from?

   What effects of the material must people and the environment be protected from?

   How can protection be accomplished?

   California Fire Code, CBSC, 2007 Edition, Appendix E, Section E103.2

INSTRUCTIONS: Section II is a completion test. For each of the following questions or statements, enter the correct answer(s) in the space(s) provided.

EXAMPLE: The _____ developed the Incident Command System.

fire service

SECTION II

9. In retail and wholesale occupancies regarding storage and display of hazardous materials, storage of individual containers less than _____ gallons or less than _____ pounds shall be stored or displayed on pallets, racks, or shelves less than _____ feet above the finished floor.

5

25

6

California Fire Code, CBSC, 2007 Edition, Sections 2703.11.3.2 and 2703.11.3.2

10. Incompatible materials in storage and storage of materials incompatible with materials in use shall be separated when the stored materials are in containers having a capacity of more than _____ pound(s) or _____ gallon(s).

5

1/2

California Fire Code, CBSC, 2007 Edition, Section 2703.9.8

11. Separation of incompatible materials may be accomplished by segregating incompatible materials storage by a distance of not less than _____ feet.

20

California Fire Code, CBSC, 2007 Edition, Section 2703.9.8

12. Separation of incompatible materials may be accomplished by isolating them with a noncombustible partition extending not less than _____ above and to the sides of the stored materials.

18 inches

California Fire Code, CBSC, 2007 Edition, Section 2703.9.8

13. Separation of incompatible materials may be accomplished by storing liquid and solid materials in _____.

    hazardous materials storage cabinets

    California Fire Code, CBSC, 2007 Edition, Section 2703.9.8

14. Separation of incompatible materials may be accomplished by storing compressed gases in _____.

    gas cabinets or exhausted enclosures

    California Fire Code, CBSC, 2007 Edition, Section 2703.9.8

15. Compressed Gas Materials that are _____ shall not be stored within the same cabinet or enclosure.

    incompatible

    California Fire Code, CBSC, 2007 Edition, Section 2703.9.8

QUIZ SCORING Each answer space is worth five points	
Total Possible	150
80% Minimum	120
Score	
Pass or Fail?	

ACETONE - MSDS NUMBER: A0446 --- EFFECTIVE DATE: 04/10/01

1. PRODUCT IDENTIFICATION

Synonyms: Dimethylketone; 2-propanone; dimethylketal
CAS No.: 67-64-1
Molecular Weight: 58.08
Chemical Formula: (CH3)2CO

Product Codes:
J.T. Baker: 5356, 5580, 5805, 9001, 9002, 9003, 9004, 9005, 9006, 9007, 9008, 9009, 9010, 9015, 9036, 9125, 9254, 9271, A134, V655
Mallinckrodt: 0018, 2432, 2435, 2437, 2438, 2440, 2443, 2445, 2850, H451, H580, H981

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS Registry Number	Molar (volume) concentration	Hazardous
Acetone	67-64-1	99% - 100%	Yes

3. HAZARDS IDENTIFICATION

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 – Slight
Flammability Rating: 4 - Extreme (Flammable)
Reactivity Rating: 2 – Moderate
Contact Rating: 1 – Slight
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation: Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. Higher concentrations can produce central nervous system depression, narcosis, and unconsciousness.

Ingestion: Swallowing small amounts is not likely to produce harmful effects. Ingestion of larger amounts may produce abdominal pain, nausea and vomiting. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms are expected to parallel inhalation.

Skin Contact: Irritating due to defatting action on skin. Causes redness, pain, drying and cracking of the skin.

Eye Contact: Vapors are irritating to the eyes. Splashes may cause severe irritation, with stinging, tearing, redness and pain.

Chronic Exposure: Prolonged or repeated skin contact may produce severe irritation or dermatitis.

Aggravation of Pre-existing Conditions: Use of alcoholic beverages enhances toxic effects. Exposure may increase the toxic potential of chlorinated hydrocarbons, such as chloroform, trichloroethane.

4. FIRST AID MEASURES

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion: Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.

Skin Contact: Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact: Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

5. FIRE FIGHTING MEASURES

Fire: Flash point: -20C (-4F) CC

Autoignition temperature: 465C (869F)

Flammable limits in air % by volume: lel: 2.5; uel: 12.8

Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.

Explosion: Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Contact with strong oxidizers may cause fire. Sealed containers may rupture when heated. This material may produce a floating fire hazard. Sensitive to static discharge.

Fire Extinguishing Media: Dry chemical, alcohol foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

Special Information: In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. ACCIDENTAL RELEASE MEASURES

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB(R) solvent adsorbent is recommended for spills of this product.

7. HANDLING AND STORAGE

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Airborne Exposure Limits:	Acetone
OSHA Permissible Exposure Limit (PEL):	1000 ppm (TWA)
ACGIH Threshold Limit Value (TLV):	500 ppm (TWA), 750 ppm (STEL) A4 - not classifiable as a human carcinogen

Ventilation System

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved)

If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Clear, colorless, volatile liquid.
Odor:	Fragrant, mint-like
Solubility:	Miscible in all proportions in water.
Specific Gravity:	0.79 @ 20C/4C
pH:	No information found.
% Volatiles by volume @ 21C (70F):	100
Boiling Point:	56.5C (133F) @ 760 mm Hg
Melting Point:	-95C (-139F)
Vapor Density (Air=1):	2.0
Vapor Pressure (mm Hg):	400 @ 39.5C (104F)
Evaporation Rate (BuAc=1):	ca. 7.7

10. STABILITY AND REACTIVITY

Stability:	Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:	Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:	Will not occur.
Incompatibilities:	Concentrated nitric and sulfuric acid mixtures, oxidizing materials, chloroform, alkalis, chlorine compounds, acids, potassium t-butoxide.
Conditions to Avoid:	Heat, flames, ignition sources and incompatibles.

11. TOXICOLOGICAL INFORMATION

Oral rat LD50: 5800 mg/kg; Inhalation rat LC50: 50,100mg/m3; Irritation eye rabbit, Standard Draize, 20 mg severe; investigated as a tumorigen, mutagen, reproductive effector.

Cancer Lists

	NTP Carcinogen		
Ingredient	**Known**	**Anticipated**	**IARC Category**
Acetone (67-64-1)	No	No	None

12. ECOLOGICAL INFORMATION

Environmental Fate

When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.

Environmental Toxicity

This material is not expected to be toxic to aquatic life. The LC50/96-hour values for fish are over 100 mg/l.

13. DISPOSAL CONSIDERATIONS

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. TRANSPORT INFORMATION

Domestic (Land, D.O.T.)

Proper Shipping Name:	ACETONE
Hazard Class:	3
UN/NA:	UN1090
Packing Group:	II
Information reported for product/size:	350LB

***International** (Water, I.M.O.)*

Proper Shipping Name:	ACETONE
Hazard Class:	3
UN/NA:	UN1090
Packing Group:	II
Information reported for product/size:	350LB

15. REGULATORY INFORMATION

Chemical Inventory Status - Part 1

Ingredient	TSCA	EC	Japan	Australia
Acetone (67-64-1)	Yes	Yes	Yes	Yes

Chemical Inventory Status - Part 2

		Canada		
Ingredient	Korea	DSL	NDSL	Phil.
Acetone (67-64-1)	Yes	Yes	No	Yes

Federal, State, and International Regulations, Part 1

	SARA 302		SARA 313	
Ingredient	RQ	TPQ	List	Chemical Catg.
Acetone (67-64-1)	No	No	Yes	No

Federal, State, and International Regulations, Part 2

		RCRA	TSCA
Ingredient	CERCLA	261.33	8(d)
Acetone (67-64-1)	5000	U002	No

Chemical Weapons Convention:	No
TSCA 12(b):	Yes
CDTA:	Yes
SARA 311/312:	
Acute:	Yes
Chronic:	No
Fire:	Yes
Pressure:	No
Reactivity:	No (Pure / Liquid)
Australian Hazchem Code:	2[Y]E
Poison Schedule:	No information found.
WHMIS:	This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. OTHER INFORMATION

NFPA Ratings:	Health: 1 Flammability: 3 Reactivity: 0
Label Hazard Warning:	DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.
Label Precautions:	Keep away from heat, sparks, and flame. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Avoid breathing vapor. Avoid contact with eyes, skin, and clothing.
Label First Aid:	Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:	Laboratory Reagent.
Revision Information:	No changes.

Disclaimer

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

Appendix A: Formative Test #3 Answer Key

Each answer space is worth five points. Some questions may have more than one correct answer. You may use the California Fire Code while taking this test. You have 30 minutes to complete the entire test.

INSTRUCTIONS: This is a short answer test. For each of the following questions or statements, enter the correct answer(s) in the space(s) provided.

EXAMPLE: What organization developed the Incident Command System?

The fire service

1. When is a hood and duct extinguishing system required in a commercial cooking operation?

   When commercial cooking equipment produces grease laden vapors, and is provided with a type I hood

   California Fire Code, CBSC, 2007 Edition, Section 904.11 (See also 904.2.1 and 609)

2. Where a hood and duct extinguishing system is provided for the protection of commercial cooking equipment, what is the minimum requirement by type and placement for portable fire extinguishers?

   Type: ***Listed and labeled for Class K (Section 904.11.5)***

   Placement: ***Installed within 30 feet and unobstructed path (Section 906.1)***

   California Fire Code, CBSC, 2007 Edition

3. List three types of fire protection acceptable for use in a hood and duct extinguishing system.

   (1) ***Wet-chemical extinguishing system complying with U.L. 300***

   (2) ***Carbon Dioxide extinguishing systems***

   (3) ***Automatic fire sprinklers***

   California Fire Code, CBSC, 2007 Edition, Section 904.11

4. During an inspection of an office building, you find the required fire extinguishers stored in ordinary, unmarked file cabinets. What two CFC sections prohibit this practice?

   (1) ***Section 906.5***

   (2) ***Section 906.6***

   California Fire Code, CBSC, 2007 Edition

5. How often must extinguishing systems used for the protection of commercial cooking equipment be serviced?

   Every 6 months or after system activation

   California Fire Code, CBSC, 2007 Edition, Section 904.11.6.4 (Partially mentioned in 904.5.1)

6. How often must hoods, grease-removal devices, fans, ducts, and other appurtenances be cleaned in order to prevent the accumulation of grease?

   As often as necessary

   California Fire Code, CBSC, 2007 Edition, Section 904.11.6.3

7. All cleaning of hoods, grease-removal devices, fans, ducts, and other appurtenances must be recorded. Where should these records be kept and what cleaning information should the inspector look for when reviewing them?

   (1) ***On the premises***

   (2) ***Time, date, and the extent of cleaning***

   California Fire Code, CBSC, 2007 Edition, Section 904.11.6.3

8. Where should manual fire alarm boxes be located?

   Within 5 feet of the entry of an exit, and not more than 200 feet travel distance.

   California Fire Code, CBSC, 2007 Edition, Section 907.4.1

9. Until the system is restored, what can replace a fire alarm system that is out of service?

   Fire watch personnel

   California Fire Code, CBSC, 2007 Edition, Section 901.7

10. What type of fire alarm system must be provided in a room where highly toxic compressed gases are stored?

    Automatic smoke detection

    California Fire Code, CBSC, 2007 Edition, Section 907.2.5

11. Which section of the CFC addresses the alarm requirements for a large nightclub having an occupant load of 375?

    907.2.1

    California Fire Code, CBSC, 2007 Edition

12. Which section of the CFC addresses the alarm requirements for a one-story bank building?

    907.2.2

    California Fire Code, CBSC, 2007 Edition

13. A voice/alarm communication system initiated by the fire alarm system is required in assembly-use occupancies when the occupant load exceeds what?

    1,000+ occupant load

    California Fire Code, CBSC, 2007 Edition, Section 907.2.1.1

14. Inspection, testing and maintenance of fire protection systems shall be in accordance with the standards listed in what section of the CFC?

    901.6.1 and Table 901.6.1

    California Fire Code, CBSC, 2007 Edition, Section 1001.5.4

15. A manual fire alarm box is required to be what color? What CFC section requires this?

    Red, Section 907.4.3

    California Fire Code, CBSC, 2007 Edition

16. Where should an inspector find reports of all inspections and tests performed on fire protection systems and equipment?

    On the premises

    California Fire Code, CBSC, 2007 Edition, Section 901.6.2

17. List three things that must be checked when performing a periodic inspection or test on a fire alarm initiating device.

(1) ***Access***

(2) ***Damage***

(3) ***Ease of operation***

Additional Answer(s): ***Alterations or Location***

Fire Inspection and Code Enforcement, IFSTA, Sixth Edition, Pages 281-285

18. What are two methods for reducing nuisance alarms from residential smoke detectors?

(1) ***Move it***

(2) ***Vacuum it***

Additional Answer(s): ***Replace it***

Fire Prevention 1B Student Supplement, SFT, 2008 Edition, Pages 80-81

19. List two areas of a home that should be protected with a smoke detector.

(1) ***Bedroom***

(2) ***Top of the stairs***

Additional Answer(s): ***On every level, basement, or area outside the bedroom***

Fire Prevention 1B Student Supplement, SFT, 2008 Edition, Page 78

20. How often should residential smoke detectors be tested?

Monthly

Fire Prevention 1B Student Supplement, SFT, 2008 Edition, Page 80

QUIZ SCORING Each answer space is worth five points	
Total Possible	160
80% Minimum	130
Score	
Pass or Fail?	

Appendix B: Formative Test #1

Name: _____ Date: _____

Each answer space is worth five points. Some questions may have more than one correct answer. You may use the California Fire Code while taking this test. You have 30 minutes to complete the entire test.

INSTRUCTIONS: This is a short answer test. For each of the following questions or statements, enter the correct answer(s) in the space(s) provided.

EXAMPLE: What organization developed the Incident Command System?

The fire service

	Flash Point	Boiling Point	Autoignition Temperature	Specific Gravity	Vapor Density	Lower Explosive Limit	Upper Explosive Limit
Butyl alcohol	99°F	244°F	649°F	.81	2.6	1.4	11.2
Xylene	79°F	282-286°F	932°F	.87	3.7	1.9	12.3
Acetone	-4°F	133°F	869°F	.79	2.0	2.5	12.8
Diborane	N/A	-135.1°F	100-125°F	.341	1.2475	0.8	98
Hydrogen	N/A	-423°F	932°F	N/A	0.082	4	75

Use the information above when answering questions 1-7.

1. Name one material in the chart that may be classified as a Class I-C flammable liquid.

_____

2. Name one material in the chart that may be classified as a Class I-B flammable liquid.

_____

3. Name one material in the chart that may be classified as a Class I-A flammable liquid.

_____

4. Which material in the chart presents the greatest potential for explosion?

_____

5. Name one material in the chart that will float on water.

_____

6. Name one material in the chart that will produce vapors capable of being ignited at ambient temperatures below 80°F.

_____

7. Which one material in the chart that has a vapor density that is lighter than air?

_____

8. How many gallons of acetone can be stored in 55-gallon drums outside of a Group F-1 Occupancy (per pile)?

_____

9. In a Group F-1 Occupancy with an approved automatic fire sprinkler system, how many gallons of xylene and butyl alcohol can be stored indoors?

_____

10. In a Group F-1 Occupancy with an approved automatic fire sprinkler system, how many gallons of xylene and butyl alcohol is allowed for indoor open use?

_____

11. What color is used by NFPA 704 to designate a Class I-B flammable liquid?

12. What is the maximum allowable size of an approved safety can when used for the storage of flammable liquids?

13. What is the maximum allowable size of a flammable/ combustible liquid container when used for the storage of flammable liquids?

14. What is the maximum allowable size of a portable tank when used for the storage of flammable liquids?

15. What is the maximum allowable size of a metal drum when used for the storage of flammable liquids?

16. What is the maximum allowable size of a glass container when used for the storage of flammable liquids?

17. According to IFSTA, fire prevention measures for flammable and combustible liquids are based on five basic techniques or principles. List four of the five.

(1) _____

(2) _____

(3) _____

(4) _____

QUIZ SCORING Each answer space is worth five points	
Total Possible	100
80% Minimum	80
Score	
Pass or Fail?	

Appendix B: Formative Test #2

Name: _____ Date: _____

Each answer space is worth five points. Some questions may have more than one correct answer. You may use the California Fire Code while taking this test. You have 30 minutes to complete the entire test.

INSTRUCTIONS: Section I is a short answer test. For each of the following questions or statements, enter the correct answer(s) in the space(s) provided.

EXAMPLE: What organization developed the Incident Command System?

The fire service

SECTION I

Use the attached MSDS pages to answer questions 1-5.

1. List the classification of acetone.

2. What is the flash point?

3. What is the boiling point?

4. List four conditions to avoid when storing acetone.

(1)

(2)

(3)

(4)

5. List three materials acetone will react with.

(1) _____

(2) _____

(3) _____

6. According to the CFC, which four of the following require secondary containment when stored outside?

- Class 4 oxidizer (solid)
- Corrosive (liquid)
- Class II organic peroxide (liquid)
- Class 2 water reactive (solid)
- Class 3 unstable (liquid)
- Pyrophoric (liquid)

(1) _____

(2) _____

(3) _____

(4) _____

7. According to the CFC, when evaluating the degree of hazard present depends upon many variables that should be considered individually and in combination. What are three of these variables?

(1) _____

(2) _____

(3) _____

8. The CFC identifies questions that can be asked to help an inspector evaluate a hazardous material. Write three of these questions.

(1) _____

(2) _____

(3) _____

INSTRUCTIONS: Section II is a completion test. For each of the following questions or statements, enter the correct answer(s) in the space(s) provided.

EXAMPLE: The _____ developed the Incident Command System.

fire service

SECTION II

9. In retail and wholesale occupancies regarding storage and display of hazardous materials, storage of individual containers less than _____ gallons or less than _____ pounds shall be stored or displayed on pallets, racks, or shelves less than _____ feet above the finished floor.

10. Incompatible materials in storage and storage of materials incompatible with materials in use shall be separated when the stored materials are in containers having a capacity of more than _____ pound(s) or _____ gallon(s).

11. Separation of incompatible materials may be accomplished by segregating incompatible materials storage by a distance of not less than _____ feet.

12. Separation of incompatible materials may be accomplished by isolating them with a noncombustible partition extending not less than _____ above and to the sides of the stored materials.

13. Separation of incompatible materials may be accomplished by storing liquid and solid materials in _____.

_____

14. Separation of incompatible materials may be accomplished by storing compressed gases in _____.

_____

15. Compressed Gas Materials that are _____ shall not be stored within the same cabinet or enclosure.

_____

QUIZ SCORING Each answer space is worth five points	
Total Possible	150
80% Minimum	120
Score	
Pass or Fail?	

ACETONE - MSDS NUMBER: A0446 --- EFFECTIVE DATE: 04/10/01

1. PRODUCT IDENTIFICATION

Synonyms: Dimethylketone; 2-propanone; dimethylketal
CAS No.: 67-64-1
Molecular Weight: 58.08
Chemical Formula: (CH3)2CO

Product Codes:
J.T. Baker: 5356, 5580, 5805, 9001, 9002, 9003, 9004, 9005, 9006, 9007, 9008, 9009, 9010, 9015, 9036, 9125, 9254, 9271, A134, V655
Mallinckrodt: 0018, 2432, 2435, 2437, 2438, 2440, 2443, 2445, 2850, H451, H580, H981

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS Registry Number	Molar (volume) concentration	Hazardous
Acetone	67-64-1	99% - 100%	Yes

3. HAZARDS IDENTIFICATION

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 – Slight
Flammability Rating: 4 - Extreme (Flammable)
Reactivity Rating: 2 – Moderate
Contact Rating: 1 – Slight
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation: Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. Higher concentrations can produce central nervous system depression, narcosis, and unconsciousness.

Ingestion: Swallowing small amounts is not likely to produce harmful effects. Ingestion of larger amounts may produce abdominal pain, nausea and vomiting. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms are expected to parallel inhalation.

Skin Contact: Irritating due to defatting action on skin. Causes redness, pain, drying and cracking of the skin.

Eye Contact: Vapors are irritating to the eyes. Splashes may cause severe irritation, with stinging, tearing, redness and pain.

Chronic Exposure: Prolonged or repeated skin contact may produce severe irritation or dermatitis.

Aggravation of Pre-existing Conditions: Use of alcoholic beverages enhances toxic effects. Exposure may increase the toxic potential of chlorinated hydrocarbons, such as chloroform, trichloroethane.

4. FIRST AID MEASURES

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion: Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.

Skin Contact: Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact: Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

5. FIRE FIGHTING MEASURES

Fire: Flash point: -20C (-4F) CC

Autoignition temperature: 465C (869F)

Flammable limits in air % by volume: lel: 2.5; uel: 12.8

Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.

Explosion: Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Contact with strong oxidizers may cause fire. Sealed containers may rupture when heated. This material may produce a floating fire hazard. Sensitive to static discharge.

Fire Extinguishing Media: Dry chemical, alcohol foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

Special Information: In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. ACCIDENTAL RELEASE MEASURES

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB(R) solvent adsorbent is recommended for spills of this product.

7. HANDLING AND STORAGE

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Airborne Exposure Limits:	Acetone
OSHA Permissible Exposure Limit (PEL):	1000 ppm (TWA)
ACGIH Threshold Limit Value (TLV):	500 ppm (TWA), 750 ppm (STEL) A4 - not classifiable as a human carcinogen

Ventilation System

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved)

If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Clear, colorless, volatile liquid.
Odor:	Fragrant, mint-like
Solubility:	Miscible in all proportions in water.
Specific Gravity:	0.79 @ 20C/4C
pH:	No information found.
% Volatiles by volume @ 21C (70F):	100
Boiling Point:	56.5C (133F) @ 760 mm Hg
Melting Point:	-95C (-139F)
Vapor Density (Air=1):	2.0
Vapor Pressure (mm Hg):	400 @ 39.5C (104F)
Evaporation Rate (BuAc=1):	ca. 7.7

10. STABILITY AND REACTIVITY

Stability:	Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:	Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:	Will not occur.
Incompatibilities:	Concentrated nitric and sulfuric acid mixtures, oxidizing materials, chloroform, alkalis, chlorine compounds, acids, potassium t-butoxide.
Conditions to Avoid:	Heat, flames, ignition sources and incompatibles.

11. TOXICOLOGICAL INFORMATION

Oral rat LD50: 5800 mg/kg; Inhalation rat LC50: 50,100mg/m3; Irritation eye rabbit, Standard Draize, 20 mg severe; investigated as a tumorigen, mutagen, reproductive effector.

Cancer Lists

	NTP Carcinogen		
Ingredient	**Known**	**Anticipated**	**IARC Category**
Acetone (67-64-1)	No	No	None

12. ECOLOGICAL INFORMATION

Environmental Fate

When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.

Environmental Toxicity

This material is not expected to be toxic to aquatic life. The LC50/96-hour values for fish are over 100 mg/l.

13. DISPOSAL CONSIDERATIONS

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. TRANSPORT INFORMATION

Domestic (Land, D.O.T.)

Proper Shipping Name:	ACETONE
Hazard Class:	3
UN/NA:	UN1090
Packing Group:	II
Information reported for product/size:	350LB

International *(Water, I.M.O.)*

Proper Shipping Name:	ACETONE
Hazard Class:	3
UN/NA:	UN1090
Packing Group:	II
Information reported for product/size:	350LB

15. REGULATORY INFORMATION

Chemical Inventory Status - Part 1

Ingredient	TSCA	EC	Japan	Australia
Acetone (67-64-1)	Yes	Yes	Yes	Yes

Chemical Inventory Status - Part 2

		Canada		
Ingredient	Korea	DSL	NDSL	Phil.
Acetone (67-64-1)	Yes	Yes	No	Yes

Federal, State, and International Regulations, Part 1

	SARA 302		SARA 313	
Ingredient	RQ	TPQ	List	Chemical Catg.
Acetone (67-64-1)	No	No	Yes	No

Federal, State, and International Regulations, Part 2

		RCRA	TSCA
Ingredient	CERCLA	261.33	8(d)
Acetone (67-64-1)	5000	U002	No

Chemical Weapons Convention:	No
TSCA 12(b):	Yes
CDTA:	Yes
SARA 311/312:	
Acute:	Yes
Chronic:	No
Fire:	Yes
Pressure:	No
Reactivity:	No (Pure / Liquid)
Australian Hazchem Code:	2[Y]E
Poison Schedule:	No information found.
WHMIS:	This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. OTHER INFORMATION

NFPA Ratings:	Health: 1 Flammability: 3 Reactivity: 0
Label Hazard Warning:	DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.
Label Precautions:	Keep away from heat, sparks, and flame. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Avoid breathing vapor. Avoid contact with eyes, skin, and clothing.
Label First Aid:	Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:	Laboratory Reagent.
Revision Information:	No changes.

Disclaimer

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

Appendix B: Formative Test #3

Name: _____ Date: _____

Each answer space is worth five points. Some questions may have more than one correct answer. You may use the California Fire Code while taking this test. You have 30 minutes to complete the entire test.

INSTRUCTIONS: This is a short answer test. For each of the following questions or statements, enter the correct answer(s) in the space(s) provided.

EXAMPLE: What organization developed the Incident Command System?

The fire service

1. When is a hood and duct extinguishing system required in a commercial cooking operation?

2. Where a hood and duct extinguishing system is provided for the protection of commercial cooking equipment, what is the minimum requirement by type and placement for portable fire extinguishers?

   Type: _____

   Placement: _____

3. List three types of fire protection acceptable for use in a hood and duct extinguishing system.

   (1) _____

   (2) _____

   (3) _____

4. During an inspection of an office building, you find the required fire extinguishers stored in ordinary, unmarked file cabinets. What two CFC sections prohibit this practice?

   (1) _____

   (2) _____

5. How often must extinguishing systems used for the protection of commercial cooking equipment be serviced?

   _____

6. How often must hoods, grease-removal devices, fans, ducts, and other appurtenances be cleaned in order to prevent the accumulation of grease?

   _____

7. All cleaning of hoods, grease-removal devices, fans, ducts, and other appurtenances must be recorded. Where should these records be kept and what cleaning information should the inspector look for when reviewing them?

   (1) _____

   (2) _____

8. Where should manual pull stations be located?

   _____

9. Until the system is restored, what can replace a fire alarm system that is out of service?

10. What type of fire alarm system must be provided in a room where highly toxic compressed gases are stored?

11. Which section of the CFC addresses the alarm requirements for a large nightclub having an occupant load of 375?

12. Which section of the CFC addresses the alarm requirements for a one-story bank building?

13. A voice/alarm communication system initiated by the fire alarm system is required in assembly-use occupancies when the occupant load exceeds what?

14. Inspection, testing and maintenance of fire protection systems shall be in accordance with the standards listed in what section of the CFC?

15. A manual fire alarm box is required to be what color? What CFC section requires this?

16. Where should an inspector find reports of all inspections and tests performed on fire protection systems and equipment?

17. List three things that must be checked when performing a periodic inspection or test on a fire alarm initiating device.

(1) _____

(2) _____

(3) _____

18. What are two methods for reducing nuisance alarms from residential smoke detectors?

(1) _____

(2) _____

19. List two areas of a home that should be protected with a smoke detector.

(1) _____

(2) _____

20. How often should residential smoke detectors be tested?

_____

QUIZ SCORING Each answer space is worth five points	
Total Possible	160
80% Minimum	130
Score	
Pass or Fail?	