Ignitable Liquids and Gases Awareness/Operations (2022)

Course Plan

Course Details

Description: This course provides the skills and knowledge needed to extinguish an ignitable liquid fire and control a flammable gas fire.

Designed For: All emergency personnel with responsibility for managing ignitable liquids and gases.

Prerequisites: The following topics from the State Fire Training Fire Fighter 1 curriculum must be completed: Fire Fighter Safety (Unit 2), Communications (Unit 3), Structural Fire Suppression (Unit 5), Suppression of Fires Outside of a Structure (Unit 7), and Hazardous Materials/WMD (Unit 9)

One of the following courses may be used in place of Hazardous Materials/WMD (Unit 9): First Responder Hazmat Operational (FRO) (SFT), First Responder Operations (CTSI), Hazardous Materials Responder at the Core Operations Level: With Product Control, or PPE Mission Specific Competencies (IAFF)

Standard: Attend and participate in all course sections

Successful completion of all skills identified on the Training Record.

Hours (Total): 12 hours

(4 hours lecture / 8 hours application)

Maximum Class Size: 50

Instructor Level: SFT Registered Fire Control 4A: Ignitable Liquids and Gases Awareness/Operations Instructor

Instructor/Student Ratio: 1:50 (lecture)

1:5 (application/skills – a minimum of two Registered Fire Control 4A: Ignitable Liquids and Gases Awareness/Operations Instructors per active live fire prop and as many Fire Fighter Instructors as needed to meet the 1:5 student ratio)

Restrictions: See Equipment, Facilities, and Personnel requirements

SFT Designation: FSTEP

Table of Contents

Required Resources

Instructor Resources

To teach this course, instructors need:

- One of the following texts:
  - *Fundamentals of Fire Fighter Skills* (including Instructor's Toolkit DVDs) (Jones & Bartlett Learning, 4th edition, ISBN: 978-1-284-15133-6)
  - *Essentials of Fire Fighting and Fire Department Operations* (Stowell, Frederick M., Murnane, Lynne, Brady Publishing, a division of Pearson Education, 7th edition, ISBN: 978-087939657-2)
- *Emergency Response Guidebook* (NAERG)
  - Physical or digital access to current edition
- AHJ policies and procedures
- Personal protective equipment
  - Minimum requirements: full structural PPE with SCBA and spare SCBA bottle
- An Incident Action Plan (IAP) for course delivery

Online Instructor Resources

The following instructor resources are available online at https://osfm.fire.ca.gov/divisions/state-fire-training/fstep-curriculum/

- Skills Exercise 1: Foam Operations
- Skills Exercise 2: Gas Cylinder Fires
- Skills Exercise 3: Gas Meter Fires
- Skills Exercise 4: Gas Fires Involving Valves, Flanges, and Piping

Student Resources

To participate in this course, students need:

- The textbook selected by the instructor
- *Emergency Response Guidebook* (NAERG)
  - Physical or digital access to current edition
- AHJ policies and procedures
- Personal protective equipment
  - Minimum requirements: full structural PPE with SCBA and spare SCBA bottle

Facilities, Equipment, and Personnel

Facilities

The following facilities are required to deliver this course:

- Standard learning environment or facility, which may include:
  - Dry erase board or paper easel chart
  - Markers, erasers
  - Amplification devices

    - Projector and screen
    - Laptop or tablet with presentation or other viewing software
    - Internet access with appropriate broadband capabilities
- A Fire Control 4A: Ignitable Liquids and Gases Awareness/Operations training site with the required facilities, structures, work areas, materials, props, tools, and equipment of adequate size, type, and quantity to fully and safely support the cognitive and psychomotor training required to deliver the Fire Control 4A: Ignitable Liquids and Gases Awareness/Operations curriculum

Equipment

Student safety is of paramount importance when conducting the type of high-risk training associated with the Fire Control 4A: Ignitable Liquids and Gases Awareness/Operations course. The equipment listed below is the minimum for the delivery of this course. The student is responsible for providing all personal protective equipment and SCBA and ensuring that it meets AHJ and site requirements.

The following equipment is required to deliver this course:

Per 10 Person Module	Equipment
As needed	Adequate hose lines (1½" width or larger)
As needed	Adequate foam capable nozzles
1	Eductor (must match nozzle)
1	B:C fire extinguisher
2	Water sources
As needed	Adequate water supply
As needed	Adequate Class B foam or foam substitute
1	Flammable liquid pan or equivalent
1	Gas cylinder prop or equivalent
1	Meter prop or equivalent
1	Valve, flange, and piping prop or equivalent
As needed	Adequate propane supply or flammable liquids
As needed	Valve shut-off tool (one per prop with valves)
10	Full PPE and SCBA (with adequate replacement air)
As needed	Communication equipment

Training Props

The following training props are required to deliver this course:

- Pan prop
- Cylinder prop
- Meter prop

- Valve, flange, and piping prop

The provider or agency assumes all responsibility, liability, and maintenance for the engineering design, strength, stability, and adequacy of all props. The provider or agency further assumes all responsibility, liability, and maintenance for all tools, equipment, and supplies used at the site for the delivery of a Fire Control 4A: Ignitable Liquids and Gases Awareness/Operations class. This includes, but is not limited to, ladders, ropes, rescue hardware, and software.

Personnel

The following personnel are required to deliver this course:

- Each active live fire prop requires a minimum of two Registered Fire Control 4A: Ignitable Liquids and Gases Awareness/Operations Instructors
- Fire Fighter Instructors may be used to meet the 1:5 student ratio if the active live fire prop Registered Fire Control 4A Instructor requirement is already met
    - See *SFT Procedures Manual* for Fire Fighter Instructor qualifications

Time Table

Segment	Lecture	Application	Unit Total
Unit 1: Introduction			
Topic 1-1: Orientation and Administration	0.5	0.0	
Unit 1 Totals	**0.5**	**0.0**	**0.5**
Unit 2: Ignitable Liquid Fires			
Topic 2-1: Extinguishing an Ignitable Liquid Fire with Foam	1.75	4.0	
Unit 2 Totals	**1.75**	**4.0**	**5.75**
Unit 3: Flammable Gas Fires			
Topic 3-1: Controlling a Flammable Gas Fire	1.75	4.0	
Unit 3 Totals	**1.75**	**4.0**	**5.75**
Formative Assessments			
Determined by AHJ or educational institution	**0.0**	**0.0**	**0.0**
Summative Assessment			
Determined by AHJ or educational institution	**0.0**	**0.0**	**0.0**
Course Totals	**4.0**	**8.0**	**12.0**

Time Table Key

1. The Time Table documents the amount of time required to deliver the content included in the course plan.

2. Time is documented using the quarter system: 15 min. = .25 / 30 min. = .50 / 45 min. = .75 / 60 min. = 1.0.

3. The Course Totals do not reflect time for lunch (1 hour) or breaks (10 minutes per each 50 minutes of instruction or assessment). It is the instructor's responsibility to add this time based on the course delivery schedule.

4. Application (activities, skills exercises, and formative testing) time will vary depending on the number of students enrolled. The Application time documented is based on the maximum class size identified in the Course Details section.

5. The following is a breakdown of what a program might look like if there were fewer students. These estimates may need to be adjusted based on student abilities.
   - 40 – 50 Students = 260 hours
   - 30 – 40 Students = 180 hours
   - 20 – 30 Students = 120 hours
   - 1 – 20 Students = 60 hours

6. Summative Assessments are determined and scheduled by the authority having jurisdiction. These are not the written or psychomotor State Fire Training certification exams. These are in-class assessments to evaluate student progress and calculate course grades.

Unit 1: Introduction

Topic 1-1: Orientation and Administration

Terminal Learning Objective

At the end of this topic a student will be able to identify facility and classroom requirements and identify course objectives, events, requirements, assignments, activities, skills exercises, resources, evaluation methods, and participation requirements in the course syllabus.

Enabling Learning Objectives

1. Identify facility requirements
    - Restroom locations
    - Food locations
    - Smoking locations
    - Emergency procedures
2. Identify classroom requirements
    - Start and end times
    - Breaks
    - Electronic device policies
    - Special needs and accommodations
    - Other requirements as applicable
3. Review course syllabus
    - Course objectives
    - Calendar of events
    - Course requirements
    - Student evaluation process
    - Assignments
    - Activities
    - Required student resources
    - Class participation requirements

Discussion Questions

1. Determined by instructor

Application

1. Have students complete all required registration forms.

Unit 2: Ignitable Liquid Fires

Topic 2-1: Extinguishing an Ignitable Liquid Fire with Foam

Terminal Learning Objective

At the end of this topic a student, given an assignment, an attack line, personal protective equipment, a foam proportioning device, a nozzle, foam concentrate, and a water supply, will be able to extinguish an ignitable liquid fire, operating as a member of a team, to identify escape routes and safety zones prior to advancing, select the correct type of foam concentrate for the given fuel and conditions, apply a properly proportioned foam stream to the surface of the fuel to create and maintain a foam blanket, extinguish the fire, prevent reignition, maintain team protection with a foam stream, and face hazards until the team successfully retreats to a safety zone.

Enabling Learning Objectives

1. Describe how foam prevents or controls a hazard
   - Separating
   - Cooling
   - Smothering
2. List principles by which foam is generated
   - Foam proportioner
   - Aeration
3. Identify causes of poor foam generation and their corrective measures
   - Incorrect ratios of water, concentrate, and air
   - Mismatched educator and nozzle
   - Air leaks in pick-up tube or hose connection
   - Improper flushing after maintenance or previous use
   - Kinked discharge hose line
   - Too much nozzle elevation
   - Too much hose between eductor and nozzle
   - Incorrect inlet pressure to eductor
   - Partially closed nozzle shut-off
   - Collapsed or obstructed pick-up tube
   - Pick-up tube too long
   - Improper internal flow meter calibration
4. Describe the difference between hydrocarbon and polar solvent fuels and the concentrates that work on each
   - Hydrocarbon fuels
     - Petroleum based
     - Combustible or flammable
     - Float on water
   - Polar solvent fuels
     - Flammable liquids
     - Mix readily with water

- Class B foam is utilized for both

5. Identify the characteristics, uses, and limitations of firefighting foams
   - Class A
   - Class B
6. Discuss the advantages and disadvantages of using fog nozzles versus foam nozzles for foam application
   - Fog nozzle
     - Advantage: Produces low expansion short lasting foam, widely available on most apparatus
     - Disadvantage: May not create the same quality of foam as foam nozzles
   - Foam nozzle
     - Advantage: Most effective for generating low, medium, or high expansion foam
     - Disadvantage: Not as versatile as a fog nozzle and generally does not have the same reach
7. Describe foam stream application techniques
   - Rain down
   - Roll in/on
   - Bank back
8. List hazards associated with foam use
   - Can degrade PPE
   - Most are mildly corrosive
   - Environmental impacts
   - Health impacts
9. Describe methods to reduce or avoid hazards
   - Maintain foam blanket to reduce risk of reignition
   - Avoid standing in pools of fuel or run-off water
10. Prepare foam concentrate (or suitable substitute) supply for use
11. Assemble foam stream components
12. Demonstrate foam application techniques
13. Approach and retreat from spills as part of a coordinated team

Discussion Questions

1. What types of foam are used during firefighting operations?
2. What are some limitations of foam use?
3. What are some hazards of foam use?
4. What are some alternative extinguishing agents and methods that can be used in conjunction with foam?

Application

1. Skills Exercise 1: Foam Operations

Instructor Resources

1. If unable to demonstrate foam application due to cost or environmental restrictions:
   - Use digital sources to review foam application.
   - Demonstrate using dish soap, bucket, and eductor.

Unit 3: Flammable Gas Fires

Topic 3-1: Controlling a Flammable Gas Fire

Terminal Learning Objective

At the end of this topic a student, given an assignment, a simulated gas fire outside of a structure, an attack line, personal protective equipment, and tools, will be able to control a flammable gas fire, operating as a member of a team, to maintain crew integrity; identify contents; identify escape routes and safety zones prior to advancing; close any open valves; extinguish flames only when leaking gas is eliminated, the cylinder is cooled, cylinder integrity is evaluated, and hazardous conditions are recognized and acted upon; and face the cylinder during approach and retreat.

Enabling Learning Objectives

1. Identify characteristics of pressurized flammable gases
2. List elements of a gas cylinder
3. Identify valve types and their operation
    - Target hazard specific
    - AHJ specific
4. Describe effects of heat and pressure on closed cylinders
5. Describe boiling liquid expanding vapor explosion (BLEVE) signs and effects
6. Describe methods for identifying contents
7. Describe how to identify escape routes and safety zones before approaching flammable gas cylinder fires
8. Describe how techniques used to control flammable gas fires in cylinders can apply to fire control in gas delivery and distribution systems
    - Meters
    - Pipes (above and below ground)
9. Describe water stream usage and demands for pressurized cylinder fires
    - Hand lines
    - Master streams
10. Describe what to do if the fire is prematurely extinguished
11. Describe alternative actions related to various hazards and when to retreat
12. Execute effective advances and retreats
    - Communication
    - Hose management
        - Avoid kinking
        - Ensure proper angle of attack
13. Apply various water application techniques
    - Single attack line
    - Coordinated dual lines
        - Avoid opposing hose streams
    - Master streams
    - Protection systems

14. Assess cylinder integrity and changing cylinder conditions
15. Operate control valves
16. Choose effective procedures when conditions change

Discussion Questions

1. What changes in conditions might occur during fire impingement on a gas cylinder?
2. What signs indicate a potential BLEVE?
3. What safety precautions should be taken in anticipation of a BLEVE?
4. What factors or conditions should a fire fighter consider when determining appropriate fire streams?
5. Why is it a problem if a venting tank fire is extinguished prematurely?
6. How do control tactics differ with a vapor leak versus a liquid leak?

Application

1. Skills Exercise 2: Gas Cylinder Fires
2. Skills Exercise 3: Gas Meter Fires
3. Skills Exercise 4: Gas Fires Involving Valves, Flanges, and Piping

Instructor Notes

1. None

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How to Read a Course Plan

A course plan identifies the details, logistics, resources, and training and education content for an individual course. Whenever possible, course content is directly tied to a national or state standard. SFT uses the course plan as the training and education standard for an individual course. Individuals at fire agencies, academies, and community colleges use course plans to obtain their institution's consent to offer course and provide credit for their completion. Instructors use course plans to develop syllabi and lesson plans for course delivery.

Course Details
The Course Details segment identifies the logistical information required for planning, scheduling, and delivering a course.

Required Resources
The Required Resources segment identifies the resources, equipment, facilities, and personnel required to deliver the course.

Unit
Each Unit represents a collection of aligned topics. Unit 1 is the same for all SFT courses. An instructor is not required to repeat Unit 1 when teaching multiple courses within a single instructional period or academy.

Topics
Each Topic documents a single Terminal Learning Objective and the instructional activities that support it.

Terminal Learning Objective
A Terminal Learning Objective (TLO) states the instructor's expectations of student performance at the end of a specific lesson or unit. Each TLO includes a task (what the student must be able to do), a condition (the setting and supplies needed), and a standard (how well or to whose specifications the task must be performed). TLOs target the performance required when students are evaluated, not what they will do as part of the course.

Enabling Learning Objectives
The Enabling Learning Objectives (ELO) specify a detailed sequence of student activities that make up the instructional content of a lesson plan. ELOs cover the cognitive, affective, and psychomotor skills students must master to complete the TLO.

Discussion Questions
The Discussion Questions are designed to guide students into a topic or to enhance their understanding of a topic. Instructors may add to or adjust the questions to suit their students.

Application
The Application segment documents experiences that enable students to apply lecture content through cognitive and psychomotor activities, skills exercises, and formative testing. Application experiences included in the course plan are required. Instructors may add additional application experiences to suit their student population if time permits.

Instructor Notes
The Instructor Notes segment documents suggestions and resources to enhance an instructor's ability to teach a specific topic.

CTS Guide Reference
The CTS Guide Reference segment documents the standard(s) from the corresponding Certification Training Standard Guide upon which each topic within the course is based. This segment is eliminated if the course is not based on a standard.

Skill Sheet
The Skill Sheet segment documents the skill sheet that tests the content contained within the topic. This segment is eliminated if the course does not have skill sheets.