



# Controlling Ignitable Liquids and Gases

## Course Plan

### Course Details

- Description:** This course provides the knowledge and skills that prepare a firefighter to extinguish an ignitable liquid fire, control a flammable gas fire, and develop an incident action plan for a pipeline emergency.
- Designed For:** Individuals pursuing SFT Firefighter II certification
- Authority:** NFPA 1001: Standard for Fire Fighter Professional Qualifications (2013), paragraphs 6.3.1 and 6.3.3  
California Government Code (CGC) Sections 51010-51019.1
- Prerequisites:** SFT Firefighter I (completion of education requirements)  
SFT or CSTI - First Responder Hazmat Operational (FRO)
- Standard:** Complete all activities and skills
- Hours:** Lecture: 6:30 / Activities: 1:30 / Skills: 8:00
- Hours (Total):** 16:00
- Maximum Class Size:** Determined by instructor/student ratio
- Instructor Level:** Primary instructor and senior instructor
- Instructor/Student Ratio:** Lecture: 1 registered primary instructor  
Skills: 1 registered senior instructor (cannot be included in the 1:5 student ratio), 1 registered primary instructor, and as many assistant instructors as needed to meet a 1:5 student ratio
- Restrictions:** See Facilities, Equipment, and Personnel requirements (page 3)
- SFT Designation:** FSTEP

### Required Resources

#### Instructor Resources

To teach this course, instructors need:

- One of the following three texts:
  - *Fundamentals of Fire Fighter Skills* (including Instructor's Toolkit DVDs) (Jones & Bartlett Learning, 3<sup>rd</sup> edition, ISBN: 978-4496-7085-6)
  - *Essentials of Fire Fighting and Fire Department Operations* (Stowell, Frederick M., Murnane, Lynne, Brady Publishing, a division of Pearson Education, 6<sup>th</sup> edition, ISBN: 978-013-3140804)
  - *Fire Engineering's Handbook for Fire Fighter I and Fire Fighter II* (including Instructor Guide and Sample Skills Drills DVDs) (Corbett, Glenn, PennWell Corporation, 1<sup>st</sup> edition, ISBN: 978-1-59370-135-2)
- *Pipeline Emergencies* (Noll, Gregory G., Hildebrand, Michael S., Red Hat Publishing Company, Inc., 2<sup>nd</sup> edition)
- *Emergency Response Guide* (U.S. Department of Transportation, current edition)
- Full structural personal protective equipment (including SCBA)

#### Online Instructor Resources

The following instructor resources are available online at:

- Skills Exercises <http://osfm.fire.ca.gov/training/SFTCurriculum>:
  - Skills Exercise 1: Foam Operations
  - Skills Exercise 2: Gas Cylinder Fires
  - Skills Exercise 3: Gas Meter Fires
  - Skills Exercise 4: Gas Valves / Flanges and Piping
- Pipeline Emergencies <https://www.pipelineemergencies.com/index.html> (Must create a free account in order to download this textbook)

#### Student Resources

To participate in this course, students need:

- The firefighter textbook selected by the instructor
- [Pipeline Emergencies](#) (Noll, Gregory G., Hildebrand, Michael S., Red Hat Publishing Company, Inc., 2<sup>nd</sup> edition)  
Note: Must create a free account on the [pipelineemergencies.com](https://www.pipelineemergencies.com) in order to download this textbook
- *Emergency Response Guide* (U.S. Department of Transportation, current edition)
- Full structural personal protective equipment (including SCBA)

### Facilities, Equipment, and Personnel

The following facilities, equipment, or personnel are required to deliver this course:

#### Facilities

- Classroom environment for lecture
- Training area to accommodate skills and required equipment
  - Adequate hose lines (500' length / 1½" width)
  - Adequate nozzles
    - Standard
    - Foam capable
  - Eductor (must match nozzle)
  - BC fire extinguisher
  - Minimum of two (2) water sources
  - Adequate water supply
  - Adequate Class B foam or foam substitute
  - FLAG trailer or equivalent fixed props
  - Adequate propane supply
  - Air supply (if necessary)
  - Communication equipment (including batteries)
  - Emergency medical equipment (AED recommended)
  - Lavatory and hand washing facilities
  - Site security (if applicable)
  - Rehabilitation area and supplies

#### Equipment

- Flammable liquids or oil pan (or equivalent)
- Cylinder prop
- Valve/flange and piping prop
- Meter prop

#### Personnel

- Appropriate instructor/student ratios for lecture and skills

### 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, 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. What is a formative test? What is a summative test?

##### Activities

1. To be determined by the instructor

### 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 operate as a member of a team to extinguish an ignitable liquid fire by identifying escape routes and safety zones prior to advancing, selecting the correct type of foam concentrate for the given fuel and conditions, applying a properly proportioned foam stream to the surface of the fuel to create and maintain a foam blanket, extinguishing the fire, preventing re-ignition, maintaining team protection, and facing hazards until the team successfully retreats to a safety zone.

##### Enabling Learning Objectives

1. Discuss methods by which foam prevents or controls a hazard
2. List principles by which foam is generated
3. Identify causes of poor foam generation and corrective measures
  - 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
5. Identify the characteristics, uses, and limitations of firefighting foams
6. Discuss the advantages and disadvantages of using fog nozzles versus foam nozzles for foam application
7. Describe foam stream application techniques
  - Roll on or bounce
  - Bank down or deflect
  - Rain down
8. List hazards associated with foam use
9. Prepare foam concentrate supply for use
10. Assemble foam stream components
11. Demonstrate foam application techniques
12. Approach and retreat from spills as part of a coordinated team

### Discussion Questions

1. What are some limitations of foam use?
2. What are some hazards of foam use?
3. What are the advantages and disadvantages of smooth bore, fog, and foam nozzles for foam application?
4. What are some alternative extinguishing agents and methods that can be used in conjunction with foam?

### Activities

1. To be determined by the instructor

### Skills

1. 2-1 Foam Operations

## 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 cylinder outside of a structure, an attack line, personal protective equipment, and tools, will be able to operate as a member of a team to control a flammable gas cylinder fire by maintaining crew integrity, identifying contents, identifying escape routes and safety zones prior to advancing, closing any open valves, and extinguishing flames only when leaking gas is eliminated, the cylinder is cooled, cylinder integrity is evaluated, hazardous conditions are recognized and acted upon, and the cylinder is faced during approach and retreat.

#### Enabling Learning Objectives

1. Identify characteristics of pressurized flammable gases
2. List elements of a gas cylinder
3. Describe effects of heat and pressure on closed cylinders
4. Describe boiling liquid expanding vapor explosion (BLEVE) signs and effects
5. Identify methods for identifying contents
6. Describe how to identify escape routes and safety zones before approaching flammable gas cylinder fires
7. Describe water stream usage and demands for pressurized cylinder fires
8. Describe what to do if the fire is prematurely extinguished
9. Identify valve types and their operation
10. Discuss alternative actions related to various hazards and when to retreat
11. 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)
12. Execute effective advances and retreats
13. Apply various water application techniques

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

### Discussion Questions

1. What signs indicate a potential BLEVE?
2. What changes in conditions might occur during fire impingement on a gas cylinder?
3. What factors or conditions should a firefighter consider when determining appropriate fire stream?
4. How do control tactics differ with a vapor leak versus a liquid leak?

### Activities

1. To be determined by the instructor

### Skills

1. 3-1 Gas Cylinder Fire
2. 3-2 Gas Meter Fire
3. 3-3 Valves/Flanges and Piping

### Instructor Notes

1. Emphasize that techniques for controlling a cylinder fire can be used for any type of flammable gas fire.

## Unit 4: Pipeline Emergencies

### Topic 4-1: Identifying Pipeline Regulations

#### Terminal Learning Objective

At the end of this topic, a student, given regulatory documents, will be able to identify pipeline regulations in accordance with state and federal requirements.

#### Enabling Learning Objectives

1. Describe basic types and categories of pipeline systems
  - Crude oil
  - Liquid
  - Natural gas
2. Describe the primary federal agencies that regulate pipeline operations
  - Department of Transportation, Pipeline and Hazardous Materials Safety Administration
3. Describe the primary state agencies that regulate pipeline operations
  - Office of the State Fire Marshal, Pipeline Safety Division
4. Identify the rules and regulations that govern the design, construction, operation, safety, and maintenance of interstate pipelines
  - 49 Code of Federal Regulations (CFR) Parts 190-199 (federal)
  - California Government Code (CGC) Sections 51010-51019.1 (state)
5. Identify the primary causes of pipeline incidents
6. Identify the key players who may become involved in a major pipeline emergency and describe their role in resolving the emergency

### Discussion Questions

1. Who regulates pipeline operations at the federal level?
2. Who regulates pipeline operations in California?
3. What are the major causes of pipeline incidents?

### Activities

1. To be determined by the instructor

## Topic 4-2: Identifying Pipeline Operations

### Terminal Learning Objective

At the end of this topic, a student, given sample pipeline markers, a transportation chain overview, and basic design and construction features, will be able to identify pipeline operations within a jurisdiction by identifying markers, transportation chains, and basic pipeline design and construction features.

### Enabling Learning Objectives

1. Describe the pipeline transportation chain
2. Identify where pipelines are located within California
3. Identify different types of pipeline markers found along a pipeline corridor
4. Identify the following information on a pipeline marker:
  - Product
  - Owner
  - Emergency telephone number
5. Describe the purpose of pipeline rights-of-way
6. Identify clues that, in the absence of markers, may indicate the presence of an underground pipeline
7. Identify basic design and construction features of a pipeline system
  - Piping
  - Pumps and compressors
  - Meters
  - Valves
    - Manual
    - Automatic
    - Emergency shutdown
    - Pressure relief

### Discussion Questions

1. Where are pipelines located within California?
2. What information should a pipeline marker include?
3. What are some indicators of a pipeline right-of-way?

### Activities

1. To be determined by the instructor

## Topic 4-3: Identifying Hazards Associated with Liquid Pipeline Products

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### Terminal Learning Objective

At the end of this topic, a student, given a list of pipeline products and Safety Data Sheets (SDS), will be able to identify hazards associated with liquids transported through a pipeline in accordance with the SDS for each product.

### Enabling Learning Objectives

1. Describe how different liquid pipeline products behave during an uncontrolled release
  - Crude oil / Bakken oil
  - Flammable and combustible liquids
  - Anhydrous ammonia
  - Carbon dioxide
  - Liquid petroleum gas (LPG)
  - Hydrogen
2. Identify indicators of a leaking liquid pipeline
  - Visual
  - Olfactory
  - Auditory
3. Define “highly volatile liquid” (HVL) and identify common HVLs transported by pipelines
4. Describe danger areas of a liquefied petroleum gas (LPG) release

### Discussion Questions

1. What is Bakken oil? What hazards are associated with it? How is it transported in California?
2. What hazards are associated with non-flammable liquids transported through pipelines?
3. Which products used primarily in their gaseous state transport through pipelines as liquids?

### Activities

1. To be determined by the instructor

## Topic 4-4: Identifying Hazards Associated with Gas Pipeline Products

### Terminal Learning Objective

At the end of this topic, a student, given a list of pipeline products and Safety Data Sheets (SDS), will be able to identify hazards associated with gases transported through a pipeline in accordance with the SDS for each product.

### Enabling Learning Objectives

1. Identify operations of a gas pipeline
  - Gathering systems
  - Processing and treatment facilities
  - Compressor stations
  - Transmission pipelines
  - Service lines
  - Meters
2. Describe how different gas pipeline products behave during an uncontrolled release
  - Natural gas

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- Ethane and ethylene
  - Methane gas
  - Chlorine
3. Identify indicators of a leaking natural gas pipeline
    - Visual
    - Olfactory
    - Auditory

### Discussion Questions

1. Why is a flammable gas incident potentially more dangerous than a flammable liquid incident?

### Activities

1. To be determined by the instructor

## Topic 4-5: Developing an Incident Action Plan

### Terminal Learning Objective

At the end of this topic, a student, given a response scenario involving a pipeline, will be able to develop an initial incident action plan by evaluating and implementing critical safety and tactical considerations.

### Enabling Learning Objectives

1. Describe general hazard and risk issues to evaluate when responding to a pipeline emergency
2. Describe key considerations to evaluate when developing an initial incident action plan
  - Type of pipeline
  - Product(s) involved
  - Notification
  - Nature of the incident
    - Liquid with fire
    - Liquid without fire
    - Gas with fire
    - Gas without fire
  - Intentional act / terrorism
  - Exposures
  - Evacuation routes and safety zones
  - Initial isolation distance
  - Pipeline isolation or repair
  - Safety considerations
  - Environmental conditions
  - Possible incident escalation
  - Special resource requirements
  - Decontamination

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### Discussion Questions

1. Why is it important to develop an incident action plan?
2. How would the suspicion of an intentional act or terrorism impact incident response?

### Activities

1. Given one of five response scenarios, have students work in small groups to develop an initial incident action plan for an assigned scenario.
  - Use five different scenarios including one intentional act/terrorism scenario
  - Anticipate 30 minutes to develop the plan and 60 minutes for group presentations

### Time Table

Segment	Lecture Time	Activity Time	Total Unit Time
<b>Unit 1: Introduction</b>			
Topic 1-1: Orientation and Administration			
Lecture	0:30		
Activity 1-1: Determined by instructor		0:00	
<b>Unit 1 Totals</b>	<b>0:30</b>	<b>0:00</b>	<b>0:30</b>
<b>Unit 2: Ignitable Liquid Fires</b>			
Topic 2-1: Extinguishing an Ignitable Liquid Fire with Foam			
Lecture	1:00		
Activity 2-1: Determined by instructor		0:00	
<b>Unit 2 Totals</b>	<b>1:00</b>	<b>0:00</b>	<b>1:00</b>
<b>Unit 3: Flammable Gas Fires</b>			
Topic 3-1: Controlling a Flammable Gas Fire			
Lecture	1:00		
Activity 3-1: Determined by instructor		0:00	
<b>Unit 3 Totals</b>	<b>1:00</b>	<b>0:00</b>	<b>1:00</b>
<b>Unit 4: Pipeline Emergencies</b>			
Topic 4-1: Identifying Pipeline Regulations			
Lecture	0:45		
Activity 4-1: Determined by instructor		0:00	
Topic 4-2: Identifying Pipeline Operations			
Lecture	0:45		
Activity 4-2: Determined by instructor		0:00	
Topic 4-3: Identifying Hazards Associated with Liquid Pipeline Products			
Lecture	1:00		
Activity 4-3: Determined by instructor		0:00	
Topic 4-4: Identifying Hazards Associated with Gas Pipeline Products			

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Segment	Lecture Time	Activity Time	Total Unit Time
Lecture	0:45		
Activity 4-4: Determined by instructor		0:00	
Topic 4-5: Developing an Incident Action Plan			
Lecture	0:45		
Activity 4-5: Recommended by SFT		1:30	
<b>Unit 4 Totals</b>	<b>4:00</b>	<b>1:30</b>	<b>4:30</b>
<b>Lecture, Activity, and Unit Totals:</b>	<b>6:30</b>	<b>1:30</b>	<b>8:00</b>

### Course Totals

Total Lecture Time (LT)	6:30
Total Activity Time (AT)	1:30
Total Skills Time (ST)	8:00
Total Testing Time (TT)	0:00
<b>Total Course Time</b>	<b>16:00</b>

**Note:** Skills and activity time will vary depending on the number of students in the program. It is important to remember that the suggested skill hours are for a 1:5 student ratio.

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### Cadre Leadership

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