



Machinery Rescue Technician (2021)

Course Plan

Course Details

- Description:** This course provides the knowledge and skills to prepare an emergency responder to extricate victim(s) from machinery in a safe and effective manner in accordance with AHJ policies and procedures. Topics include sizing up an incident; establishing safety zones; mitigating hazards; stabilizing and creating access and egress openings for rescue; disentangling and removing victims; and terminating an incident. This course incorporates awareness, operations, and technician training based on NFPA 1006 (2021).
- Designed For:** Fire fighters with three years' full-time or six years' part-time/volunteer experience and any emergency personnel who perform machinery rescue.
- Prerequisites:** Vehicle Extrication **or** Common Passenger Vehicle Rescue (SFT)
Confined Space Rescue Awareness (CSTI, IAFF, or SFT)
- Standard:** Attend and participate in all course sections
Successful completion of all skills identified on the Training Record
- Hours:** 24 hours
(5.25 lecture / 18.75 application)
- Max Class Size:** 32
- Instructor Level:** SFT Registered Machinery Rescue Technician Instructor
- Instructor/Student Ratio:** 1:32 (lecture)
1:8 (skills/teaching demonstrations)
- Restrictions:** All instructors counted toward student ratios, including application components, must be SFT Registered Machinery Rescue Technician Instructors.
- SFT Designation:** FSTEP

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Required Resources

Instructor Resources

To teach this course, instructors need:

- NFPA 1006: Standard for Technical Rescue Personnel (2021) (physical or digital access to current edition)
- NFPA 2500: Standard for Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services (2022) (physical or digital access to current edition)
- Full personal protective equipment per AHJ requirements (including hand, eye, and P-100 respiratory protection)

Recommended Video Resources from Fire Engineering:

- Man vs. Machinery Rescue: Hand Trapped in Press
 - <https://www.youtube.com/watch?v=8SJRGaB94uM>
- Tech Rescue: Hand in Meat Grinder
 - <https://www.youtube.com/watch?v=Nb2jV7oq7LM&list=PLq1zsBWIAGFi7ETyFHsjTmVgZ4HCdjONc>
- Man vs. Machinery: Finger Caught in Gas Tank
 - <https://www.youtube.com/watch?v=liwu5v8H7pY&list=PLq1zsBWIAGFii2gCHRQ3RO5NVwtfoE3oy&index=2>
- Man vs. Machinery: Impalement
 - <https://www.youtube.com/watch?v=Tym5NMyDVnM&list=PLq1zsBWIAGFii2gCHRQ3RO5NVwtfoE3oy&index=2>
- Patient Impaled on a Fence
 - <https://www.youtube.com/watch?v=5EZxfC8F6oc&list=PLq1zsBWIAGFii2gCHRQ3RO5NVwtfoE3oy&index=10>
- Impalement Victim Stabilization with Webbing
 - <https://www.youtube.com/watch?v=n8XDCCD-Y6Ow>
- Portable Bandsaw Use for Impalement Rescue
 - https://www.youtube.com/watch?v=BneGzS_hD7o
- Man vs. Machinery: Ring Entrapment
 - <https://www.youtube.com/watch?v=6cGCSJKbqkl&list=PLq1zsBWIAGFii2gCHRQ3RO5NVwtfoE3oy&index=5>
- Ring Removal Using Cutting Tools
 - https://www.youtube.com/watch?v=l_OXbKug51U
- Tungsten Ring Removal
 - <https://www.youtube.com/watch?v=WhVGhtrOpWw&list=PLq1zsBWIAGFii2gCHRQ3RO5NVwtfoE3oy&index=22>
- Non-invasive Ring Removal
 - <https://www.youtube.com/watch?v=picq6AfU0wQ&t=36s>

- Rescuing a Victim from Auger Entrapment
 - <https://www.youtube.com/watch?v=qLaVNdo9w2A>
- Tech Rescue: Auger Entrapment, Part 2
 - <https://www.youtube.com/watch?v=4cnmVXo7f9I&t=57s>
- Man vs. Machinery: Victim Stuck in Snow Blower
 - <https://www.youtube.com/watch?v=F8ALKT5VxUU&list=PLq1zsBWIAGFii2gCHRQ3RO5NVwtfoE3oy&index=7>
- Patient Stuck in Swing
 - https://www.youtube.com/watch?v=OaxD_RS6rOM&list=PLq1zsBWIAGFii2gCHRQ3RO5NVwtfoE3oy&index=11
- Ladder Lever for Victim Removal
 - <https://www.youtube.com/watch?v=VzGNQTWGI1M>
- Man vs. Machinery: It's Not Always Technical
 - <https://www.youtube.com/watch?v=NcxFmexCvCg&list=PLq1zsBWIAGFii2gCHRQ3RO5NVwtfoE3oy&index=4>
- Man vs. Machinery: The Quick Hit Bag
 - <https://www.youtube.com/watch?v=70s3KQpRPAQ&list=PLq1zsBWIAGFii2gCHRQ3RO5NVwtfoE3oy&index=6>

Online Instructor Resources

The following instructor resources are available online at

<https://osfm.fire.ca.gov/divisions/state-fire-training/fstep-curriculum/>

- None

Student Resources

To participate in this course, students need:

- Full personal protective equipment per AHJ requirements (including hand, eye, and P-100 respiratory protection)

Facilities, Equipment, and Personnel

Facilities

The following facilities are required to deliver this course:

- Standard learning environment or facility, which may include:
 - Writing 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 Machinery Rescue Technician training site with the NFPA 1006 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 curriculum

Equipment

Student safety is of paramount importance when conducting the type of high-risk training associated with this Machinery Rescue Technician (2021) course.

- The equipment listed below is the minimum for the delivery of this course.
- The student is responsible for providing all PPE and ensuring that all PPE meets AHJ and site requirements.
- For all tools and equipment, ensure that you have the power source, operating supplies (blades, fuel, etc.), cleaning supplies, and appropriate PPE.

The following equipment is required to deliver this course:

Quantity Per 8-person Squad	Equipment
Disassembling	
At least 1	Prop (developed by AHJ to be disassembled by students – e.g., roller system, black box)
At least 1	Mechanic’s tool set (equipped per prop requirements)
TBD	Any additional tools/equipment required by AHJ prop
TBD	Stabilization items to support prop requirements
TBD	Appropriate patient packaging and stabilization items
TBD	Lockout/tagout tools and equipment
Cutting	
At least 1	Prop (developed by AHJ to be cut by students – e.g., impalement)
At least 1	<p>Must have at least one of the following cutting tools:</p> <ul style="list-style-type: none"> • Reciprocating saw • Portable band saw • Right angle grinder (electric/pneumatic) • Rotary tool (e.g., Dremel) • Rotary saw <p><i>Multiple cutting tools encouraged</i> <i>Cutting tools must be appropriate to the prop</i></p>
TBD	Thermal protection for victim (thermal barriers, fire blankets, cooling, etc.)
TBD	Any additional tools/equipment required by AHJ prop
TBD	Stabilization items to support prop requirements
TBD	Appropriate patient packaging and stabilization items
TBD	Lockout/tagout tools and equipment
Burning	

At least 1	Prop (item developed by the AHJ for metal burning – e.g., entrapment/impalement)
At least 1	Burning Torch- Must have at least one of the following burning tools: <ul style="list-style-type: none"> • Oxygen/acetylene • Oxy-gasoline • Exothermic • Plasma <i>Multiple torches encouraged</i>
TBD	Thermal protection for victim (thermal barriers, fire blankets, cooling, etc.)
TBD	Fire suppression equipment appropriate for prop
TBD	Any additional tools/equipment required by AHJ prop
TBD	Stabilization items to support prop requirements
TBD	Appropriate patient packaging and stabilization items
TBD	Lockout/tagout tools and equipment
Lifting	
At least 1	Prop (item developed by the AHJ to be lifted and stabilized – e.g., crush)
At least 1	Lifting device(s) – Must have at least one of the following lifting tools <ul style="list-style-type: none"> • Airbags • Jacks • Hoist (come-a-long, chain pull, Grip Hoist) • Hydraulic tools <i>Multiple lifting tools encouraged</i> <i>Lifting tools must be appropriate to the prop</i>
TBD	Hand tools (pry bars, levers, etc.)
TBD	Any additional tools/equipment required by AHJ prop
TBD	Stabilization items to support prop requirements
TBD	Appropriate patient packaging and stabilization items
TBD	Lockout/tagout tools and equipment
Prying/Separating	
At least 1	Prop (item developed by the AHJ to be lifted and stabilized – e.g., crush)
At least 1	Must have at least one of the following prying/separating tools: <ul style="list-style-type: none"> • Airbags • Jacks • Hoist (come-a-long, chain pull, Grip Hoist) • Hydraulic tools <i>Multiple prying/separating tools encouraged</i> <i>Prying/separating tools must be appropriate to the prop</i>
TBD	Hand tools (pry bars, levers, etc.)
TBD	Any additional tools/equipment required by AHJ prop

TBD	Stabilization items to support prop requirements
TBD	Appropriate patient packaging and stabilization items
TBD	Lockout/tagout tools and equipment
Breaking	
At least 1	Prop (item developed by the AHJ for breaking – e.g., concrete, rivets, bolts, etc.)
At least 1	<p>Breaking tools - Must have at least one of the following:</p> <ul style="list-style-type: none"> • Electric • Pneumatic • Hydraulic <p><i>Multiple breaking tools encouraged</i> <i>Breaking tools must be appropriate to the prop</i></p>
TBD	Hand tools
TBD	Any additional tools/equipment required by AHJ prop
TBD	Stabilization items to support prop requirements
TBD	Appropriate patient packaging and stabilization items
TBD	Lockout/tagout tools and equipment
Stabilizing a Machine	<i>(The following equipment will be introduced in the tool lab and used as needed per AHJ's props)</i>
TBD	Cribbing – dimensions based on AHJ/prop load requirements
TBD	Wedges/chocks
TBD	Struts – per AHJ prop requirements (e.g., hydraulic, pneumatic, mechanical)
TBD	Cables, chains, ropes, slings
TBD	Any additional tools/equipment required by AHJ prop
Lockout/Tagout	<i>(The following equipment will be introduced in the tool lab and used as needed per AHJ's props)</i>
TBD	Lockout/tagout kits
TBD	Any additional tools/equipment required by AHJ prop
Stabilizing, Disentangling, Packaging, and Removing a Patient	<i>(The following equipment will be introduced in the tool lab and used as needed per AHJ's props)</i>
TBD	AHJ/LEMSA patient packaging equipment (e.g., SpecPAK, LSP Half Back, KED, etc.)
TBD	AHJ/LEMSA appropriate medical equipment (e.g., tourniquet)
TBD	Any additional tools/equipment required by AHJ prop

Additional Support Equipment	<i>(The following equipment will be introduced in the tool lab and used as needed per AHJ's props)</i>
TBD	Caution tape
TBD	Constricting bands (dental floss, rubber bands, etc.)
TBD	Lubricant (dish soap, cooking oil, etc.)
TBD	Heat/cutting shields (e.g., modified spoon, 10" tape measure sections, Slim Jim)
TBD	Exam gloves
TBD	PPE (appropriate for each station) <ul style="list-style-type: none"> • Gloves • Hearing protection • Eye protection • Flash protection • Fall protection • Helmet

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 Machinery Rescue Technician class.

Personnel

The following personnel are required to deliver this course:

- Any instructor counted toward student ratios must be an SFT Registered Machinery Rescue Technician (2021) Instructor.

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: Introduction to Machinery Rescue			
Topic 2-1: Introduction to Machinery Rescue	0.25	0.0	
Topic 2-2: Selecting and Using PPE	0.25	0.0	
Topic 2-3: Using Tools and Equipment	0.25	2.75	
Unit 2 Totals	0.75	2.75	3.5
Unit 3: Incident Response			
Topic 3-1: Planning for a Machinery Incident	0.25	0.0	
Topic 3-2: Sizing Up a Machinery Rescue Incident	0.25	0.0	
Topic 3-3: Utilizing a Subject Matter Expert	0.25	0.0	
Topic 3-4: Recognizing the Need for Technical Rescue Resources	0.25	0.0	
Topic 3-5: Supporting an Operations- or Technician-level Incident	0.25	0.0	
Topic 3-6: Recognizing and Isolating Incident Hazards	0.25	0.0	
Topic 3-7: Establishing Scene Safety Zones	0.25	0.0	
Topic 3-8: Isolating Energy Sources	0.25	0.0	
Topic 3-9: Establishing Fire Protection	0.25	0.0	
Unit 3 Totals	2.25	0.0	2.25
Unit 4: Machinery Management			
Topic 4-1: Stabilizing a Machine	0.25	4.0	
Topic 4-2: Controlling Fluid, Mechanical, and Energy Release Hazards	0.25	4.0	
Topic 4-3: Determining Access and Egress Points	0.25	0.0	
Topic 4-4: Creating Access and Egress Openings for Rescue	0.25	4.0	
Unit 4 Totals	1.0	12.0	13.0
Unit 5: Victim Rescue			
Topic 5-1: Disentangling a Victim	0.25	2.0	
Topic 5-2: Removing a Packaged Victim	0.25	2.0	
Unit 5 Totals	0.5	4.0	4.5
Unit 6: Termination			
Topic 6-1: Terminating an Incident	0.25	0.0	
Unit 6 Totals	0.25	0.0	0.25
Formative Assessments			
Determined by AHJ or educational institution	0.0	0.0	0.0

Segment	Lecture	Application	Unit Total
Summative Assessment			
Determined by AHJ or educational institution	0.0	0.0	0.0
Course Totals	5.25	18.75	24.0

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. 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: Introduction to Machinery Rescue

Topic 2-1: Introduction to Machinery Rescue

Terminal Learning Objective

At the end of this topic a student, given machinery common to the AHJ, will be able to identify machinery common to the AHJ and factors that determine incident complexity so that rescuers are prepared to respond to machinery rescue incidents.

Enabling Learning Objectives

1. Define a “machinery rescue” incident
 - Incidents involving personnel who have become trapped, entangled, or pinned in various types of machinery
2. Identify factors that determine incident complexity
 - Extent of anatomy involved
 - Complexity of machine
 - Complexity of extrication process
 - Risk to victim and rescuers
 - Tool or equipment required
 - Environmental hazards
3. Identify simple machinery common to the AHJ
 - NFPA 1006 (2021) - Machinery or equipment capable of simple disassembly or constructed of lightweight materials presenting simple hazards which are capable of being controlled by the rescuer
 - Simple machines can be large (a press) or small (meat grinder)
4. Identify complex machinery common to the AHJ
 - NFPA 1006 (2021) - Complex machines (or machinery systems) constructed of heavy materials, not capable of simple disassembly, and presenting multiple concurrent hazards (e.g., control of energy sources, hazardous materials, change in elevation, multiple rescue disciplines, etc.), complex victim entrapment, or partial or complete amputation, and requiring the direct technical assistance of special experts in the design, maintenance, or construction of the device or machine
 - Complex machines can be large (conveyer belt system) or small (paper shredder)
5. Describe machine components and construction
 - Structural components (frame, bearings, axles, etc.)
 - Mechanisms that control movement (gears, belts, chains, etc.)
 - Control components (buttons, switches, sensors, etc.)
 - Energy sources (mechanical, electrical, hydraulic, pneumatic)

Discussion Question

1. What types of simple machines are common in your AHJ?
2. What types of complex machines are common in your AHJ?
3. What factors determine incident complexity for a machinery rescue?

Application

1. Determined by instructor

Instructor Notes

1. For ELOs that references the AHJ, adjust the course content to reflect AHJ-specific policies, practices, equipment, operations, tactics, etc.

CTS Guide Reference: None

Topic 2-2: Selecting and Using PPE

Terminal Learning Objective

At the end of this topic a student, given a machinery rescue incident and AHJ policies and procedures, will be able to select and use personal protective equipment (PPE), so that PPE is appropriate to incident response needs and donned and worn correctly.

Enabling Learning Objectives

1. Identify PPE used during machinery rescue incidents
2. Identify the protections provided by PPE during machinery rescue incidents
3. Identify the limitations of PPE during machinery rescue incidents
4. Identify when and how to don and doff PPE
 - Safety considerations
 - Manufacturer guidelines
 - AHJ policies and procedures
5. Don and doff PPE

Discussion Question

1. What types of PPE does your AHJ have available for machinery rescue?

Application

1. Students will practice this skill at multiple skill stations and must perform it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: None

Topic 2-3: Using Tools and Equipment

Terminal Learning Objective

At the end of this topic a student, given various hand and power tools and equipment, will be able to select, safely transport, operate, and use them in accordance with manufacturer specifications and AHJ policies and procedures.

Enabling Learning Objectives

1. Describe how to use machinery rescue tools and equipment
 - Stabilization
 - Wedges/chocks
 - Cribbing (6x6 or 4x4 – determined by load)
 - Box (crosstie)
 - Solid (crosstie platform)
 - Modified crosstie
 - Struts
 - Cables, chains, ropes, slings
 - Machine Management
 - Disassembling
 - Cutting
 - Burning
 - Lifting
 - Prying/separating
 - Breaking
 - Victim Rescue
 - Disentanglement
 - Stabilization
 - Packaging
 - Removal
2. Identify safety considerations for storing and transporting tools and equipment
3. Identify guidelines for cleaning, inspecting, and maintaining tools and equipment
 - Manufacturer guidelines
 - AHJ guidelines
 - Documentation and reporting requirements
4. Describe methods for cleaning tools and equipment
 - Equipment/tools to use
 - Solvents or solutions to use
5. Identify when and how to remove hand and power tools from service
 - Manufacturer guidelines
 - AHJ guidelines
 - Documentation and reporting requirements
6. Transport, operate, and maintain tools and equipment

Discussion Question

1. What tools does your agency use for machinery rescue?
2. What are maintenance procedures for these tools?

3. Which tools are carried on different apparatus types in your AHJ?

Application

1. Students will practice this skill in a tool lab or skill station and must demonstrate using tools and equipment to disassemble, cut, burn, lift, pry, and break at least once for evaluation.

Instructor Notes

1. ELO 1 – Use the course equipment list as the minimum requirements and then include any other tools and equipment common to your AHJ.

CTS Guide Reference: None

Unit 3: Incident Response

Topic 3-1: Planning for a Machinery Incident

Terminal Learning Objective

At the end of this topic a student, given agency guidelines, planning forms, and operations-level machinery incident or simulations, will be able to pre-plan for a machinery incident, so that a standard approach is used during training and operational scenarios; initiation and ongoing size-ups are being completed; emergency situation hazards are identified; isolation methods and scene security measures are identified; machinery stabilization needs are evaluated; and resource needs are identified and documented for future use.

Enabling Learning Objectives

1. Describe operational protocols
2. Identify specific planning forms
3. Identify components to include in pre-planning activities
 - Machine components and construction
 - Tools and equipment
 - Subject matter experts
 - Technical rescue and support resources
 - Hazards
 - Energy sources
 - Stabilization
 - Access and egress
 - Disentanglement
 - Patient packaging
4. Apply operational protocols
5. Select specific planning forms based on the types of machinery

Discussion Question

1. Does your AHJ have pre-plans for machinery rescue incidents? If so, what type of incidents?
2. What should be included in an incident pre-plan?

Application

1. Determined by instructor

Instructor Notes

1. None

CTS Guide Reference: CTS 2-1, CTS 2-9, CTS 3-1

Topic 3-2: Sizing Up a Machinery Rescue Incident

Terminal Learning Objective

At the end of this topic a student, given background information and applicable reference materials, will be able to size up a machinery rescue incident so that the scope of the rescue is determined, the number of victims is identified, the last reported location of all the victims is established, witnesses and reporting parties are identified and interviewed, resource needs are assessed, primary search parameters are identified, and information required to develop an initial incident action plan is obtained.

Enabling Learning Objectives

1. Identify components to include in size-up activities
 - Machinery components and construction
 - Tools and equipment
 - Subject matter experts
 - Technical rescue and support resources
 - Hazards
 - Energy sources
 - Environmental conditions
 - Victim(s) location
 - Entrapment complexity
 - Digital entrapment
 - Entanglement
 - Crush
 - Impalement
 - Amputation
 - Risk/benefit analysis
 - Rescue vs. recovery
2. Describe types of reference materials and their uses
 - Occupancy pre-plan
 - AHJ standard operating procedures and guidelines
 - Subject matter expert
 - On-site manuals, guides, etc.
3. Describe availability and capability of the resources
4. Describe elements of an incident action plan and related information
 - Formal (ICS roles) vs. informal
 - Determined by incident complexity
5. Describe relationship of the size-up to the incident management system
6. Describe information gathering techniques and how that information is used in the size-up process
 - Pre-incident
 - En route
 - On scene
 - Evolving

7. Describe basic search criteria for machinery rescue incidents
8. Read technical reference materials
9. Gather information
10. Use interview techniques
11. Relay information
12. Use information-gathering sources

Discussion Question

1. What should be included in an initial size up?
2. What technical and support resources are available to your AHJ?

Application

1. Students will practice this skill at multiple skill stations and must describe it once for evaluation.

Instructor Notes

1. For ELOs that references the incident, adjust the course content to reflect the props and scenarios used in the AHJ/course.

CTS Guide Reference: CTS 1-1

Topic 3-3: Utilizing a Subject Matter Expert

Terminal Learning Objective

At the end of this topic a student, given a machinery rescue event and an SME capable of supplying event- or system-specific technical guidance, will be able to utilize specific information from a subject matter expert (SME) so that the technical guidance supports decision making and operational considerations applied during the event.

Enabling Learning Objectives

1. Describe benefits of working with a SME
 - Provide direct knowledge of machinery, hazards, disassembly, etc.
 - Provide specialized tools and equipment
 - Place machine in “zero mechanical state”
 - Direct on-site operations
2. Describe operational protocols
3. Describe how to collect and interpret data
4. Conduct interviews
5. Take notes
6. Interpret diagrams/technical drawings

Discussion Question

1. What are some examples of subject matter experts?
2. How can subject matter experts contribute to rescue operations?
3. What questions might you ask a subject matter expert?

Application

1. Students will practice this skill at multiple skill stations and must describe it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 13-3

Topic 3-4: Recognizing the Need for Technical Rescue Resources

Terminal Learning Objective

At the end of this topic a student, given AHJ guidelines, will be able to recognize the need for technical rescue resources at an operations- or technician-level incident so that the need for additional resources is identified, the response system is initiated, the scene is secured and rendered safe until additional resources arrive, and awareness-level personnel are incorporated into the operational plan.

Enabling Learning Objectives

1. Identify factors that determine technical resource needs
 - Incident complexity
 - Machine complexity
 - Victim status/needs
 - Capabilities of on-site resources
2. Describe operational protocols
 - Determined by incident and AHJ
3. Identify specific planning forms
4. Describe incident support operations and resources
 - Determined by incident and AHJ
5. Apply operational protocols
6. Select specific planning forms based on the types of incidents
7. Request support and resources
8. Implement required safety measures

Discussion Question

1. What medical support is available to your AHJ?
2. Who within your jurisdiction is qualified to amputate in the field?
3. What technical rescue resources are available within your AHJ?

Application

1. Students will practice this skill at multiple skill stations, but it will not be evaluated.

Instructor Notes

1. None

CTS Guide Reference: CTS 1-3

Topic 3-5: Supporting an Operations- or Technician-level Incident

Terminal Learning Objective

At the end of this topic a student, given an incident, an assignment, an incident action plan, and resources from the tool cache, will be able to support an operations- or technician-level incident so that the assignment is carried out, progress is reported to command, environmental concerns are managed, personnel rehabilitation is facilitated, and the incident action plan is supported.

Enabling Learning Objectives

1. Identify support roles and responsibilities
 - Fire suppression
 - Establishing safety zones
 - Notifications
 - Resource requests
 - Logistical support
 - Emergency medical services
2. Describe AHJ operational protocols
3. Describe incident management
Describe resource selection and use
4. Identify scene support requirements
5. Apply operational protocols
6. Function within an incident management system
7. Follow and implement an incident action plan
8. Report the task progress status to a supervisor or incident command

Discussion Question

1. What are some of the roles and responsibilities of an awareness-level responder during an incident?

Application

1. Students will practice this skill at multiple skill stations and must perform it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 1-4

Topic 3-6: Recognizing and Isolating Incident Hazards

Terminal Learning Objective

At the end of this topic a student, given scene control barriers, personal protective equipment (PPE), requisite equipment, and available specialized resources, will be able to recognize incident hazards and initiate isolation procedures so that all hazards are identified; resource application fits the operational requirements; hazard isolation is considered; risks to rescuers, bystanders, and victims are minimized; and rescue time constraints are taken into account.

Enabling Learning Objectives

1. Describe types and nature of incident hazards
 - Physical/mechanical
 - Chemical
 - Biological
 - Safety
 - Environmental
 - Organizational
2. Describe common types of rescuer and victim risks
 - Moving machinery parts
 - Machine stability
 - Product exposure
 - Hazardous materials
 - Falls
 - Electrocution
 - Stored energy release
 - Fire
 - Biohazards
 - Psychological impact
 - Injury
 - Death
3. Describe methods for controlling access to the scene
 - Flagging
 - Caution tape
 - Personnel (crew, law enforcement, etc.)
4. Describe equipment types and their use
 - Tools
 - Equipment
 - Visual identifiers
5. Describe isolation methods and implementation
 - Place in “zero mechanical” state
 - Lockout/tagout
 - Elevators in common hoist ways
 - Clear passengers from adjacent elevators

- Secure all elevators and prevent from movement
- 6. Describe operational requirement concerns
 - Responder safety
 - Patient safety
 - Public safety
- 7. Describe resource capabilities and limitation
- 8. Describe types of technical references
 - NFPA 1006 (current edition)
 - NFPA 2500 (current edition)
 - Safety Data Sheets (SDS)
- 9. Identify incident hazards
- 10. Assess potential hazards to rescuers and bystanders
- 11. Place scene control barrier
- 12. Operate control and mitigation equipment

Discussion Question

1. What machinery features create hazards for rescuers?
2. What risks might rescuers encounter when isolating or mitigating hazards?
3. Who is best qualified to isolate or mitigate hazards?

Application

1. Students will practice this skill at multiple skill stations and must describe it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 1-2

Topic 3-7: Establishing Scene Safety Zones

Terminal Learning Objective

At the end of this topic a student, given scene security barriers, incident location, incident information, and PPE, will be able to establish “scene” safety zones so that hot, warm, and cold safety zones are designated, zone perimeters are consistent with incident requirements; perimeter markings can be recognized and understood by others; zone boundaries are communicated to incident command; and only authorized personnel are allowed access to the rescue scene.

Enabling Learning Objectives

1. Describe area control flow and concepts
 - Hot (exclusion/working area)
 - Warm (equipment cache, logistics, stand-by personnel)
 - Cold (support, IC, medical, etc.)
2. Identify types of control devices and tools
 - Caution tape
 - Personnel (crew, law enforcement, etc.)
 - Fencing, cones, etc.
3. Identify types of existing and potential hazards
 - Physical/mechanical
 - Chemical
 - Biological
 - Safety
 - Environmental
 - Organizational
4. Describe methods of hazard mitigation
 - Avoid
 - Eliminate
 - Isolate
 - Mitigate
5. Describe organizational standard operating procedures
 - Determined by incident and AHJ
6. Describe types of zones and staffing requirements
 - Determined by incident and AHJ
7. Apply hazard control concepts
8. Identify and mitigate existing or potential hazards
9. Apply zone identification and personal safety techniques

Discussion Question

1. What agencies in your AHJ can help with scene control?
2. What determines whether an area is a hot, warm, or cold hazard zone?
3. What are some examples of (chemical, mechanical, environmental, etc.) hazards associated with machinery rescue?

Application

1. Students will practice this skill at multiple skill stations and must perform it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 2-2

Topic 3-8: Isolating Energy Sources

Terminal Learning Objective

At the end of this topic a student, given machinery tool cache and PPE, will be able to isolate potentially harmful energy sources so that all hazards are identified; systems are managed; beneficial system use is evaluated; and hazards to rescue personnel and victims are minimized.

Enabling Learning Objectives

1. Identify types of energy sources
 - Kinetic vs. potential
 - Electrical
 - Fuel
 - Chemical
 - Pneumatic systems
 - Hydraulic
 - Gravity
 - Mechanical
2. Describe specialized system features
3. Describe system isolation methods
 - Operate beneficial systems in support of tactical operations before isolating
 - Ventilation
 - Machinery movement and positioning controls
 - Other devices that enable more efficient operations
4. Describe tools for disabling hazards
 - Determined by AHJ
 - Determined by incident
5. Describe policies and procedures of the AHJ
6. Identify hazards
7. Operate beneficial systems in support of tactical objectives
8. Operate tools and devices for securing and disabling hazards

Discussion Question

1. What are some common energy sources associated with machinery?
2. What systems should you address before isolating power?
3. What tools or equipment does your agency use to manage energy sources?
4. Who can assist with lockout/tagout procedures at an incident?

Application

1. Students will practice this skill at multiple skill stations and must perform it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 2-5

Topic 3-9: Establishing Fire Protection

Terminal Learning Objective

At the end of this topic a student, given an extrication incident and fire control support, will be able to establish fire protection so that fire and explosion potential is managed and fire hazards and rescue objectives are communicated to the fire suppression crew.

Enabling Learning Objectives

1. Identify types of fire and explosion hazards
 - Determined by incident
2. Describe IMS
3. Identify types of extinguishing devices
 - Water or foam
 - Extinguishers
4. Describe agency policies and procedures
 - Determined by incident and AHJ
5. Identify types of flammable and combustible substances
6. Identify types of ignition sources
7. Describe extinguishment or control options
8. Operate within the IMS
9. Use extinguishing devices
10. Apply fire control strategies
11. Manage initiation potential

Discussion Question

1. What potential fire or explosion hazards might be present at a machinery rescue incident?

Application

1. Students will practice this skill at multiple skill stations and must perform it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 2-3

Unit 4: Machinery Management

Topic 4-1: Stabilizing a Machine

Terminal Learning Objective

At the end of this topic a student, given a machinery tool cache and PPE, will be able to stabilize a machine so that the machinery is prevented from moving during the rescue operations; entry, exit, and tools placement points are not compromised; anticipated rescue activities will not compromise machinery stability; selected stabilization points are structurally sound; stabilization equipment can be monitored; and the risk to rescuers is minimized.

Enabling Learning Objectives

1. Describe mechanism of machinery movement
 - Horizontal
 - Vertical
 - Roll
 - Pitch
 - Yaw
 - Additional considerations for multiple objects with potential to move in multiple directions
2. Describe types of machinery construction components as they apply to stabilization
3. Describe types and rated capacities of stabilization devices
 - Wedges/chocks
 - Machinery systems (power source, brakes, etc.)
 - Cribbing (6x6 or 4x4 – determined by load)
 - Box (crosstie)
 - Solid (crosstie platform)
 - Modified crosstie
 - Struts
 - Cables, chains, ropes, slings
4. Identify types of stabilization points
 - Single point vs. multi-point (based on access needs)
 - Machinery orientation (may already provide stabilization)
 - May need to stabilize multiple objects (may not all be machines)
5. Identify types of stabilization surfaces
 - Use what is available based on machinery position
 - Solid structural machinery surfaces
 - Improvised attachment points
 - Building surfaces (structural components)
6. Describe how to stabilize a machine
 - Determined by incident
7. Describe AHJ policies and procedures
8. Select, operate, and monitor stabilization devices

Discussion Question

1. How does stabilizing a small or simple machine differ from stabilizing a large or complex machine?
2. How does machinery location or position impact stabilization needs?
3. What tools and equipment does your agency use to stabilize machinery?
4. How could you create an anchor or stabilization point when a machine doesn't have one?

Application

1. Students will practice this skill at multiple skill stations and must perform it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 2-4, CTS 3-2

Topic 4-2: Controlling Fluid, Mechanical, and Energy Release Hazards

Terminal Learning Objective

At the end of this topic a student, given an entrapment within machinery, will be able to control hazards presented by the release of fluids, mechanical release devices, and energy equipment so that mechanical processes are secured, energy equipment is stabilized, the position of machinery is determined to optimize the removal of victim(s), and chosen points do not compromise the removal of victim or rescuer.

Enabling Learning Objectives

1. Identify types of energy equipment within a machine
 - Electrical
 - Batteries
 - Capacitors
 - Static
 - Hydraulic
 - Pneumatic
 - Mechanical
 - Thermal
2. Describe energy system isolation and release methods
 - Electrical
 - De-energize (“zero mechanical state”)
 - Disconnect
 - Remove
 - Discharge
 - Ground
 - Hydraulic
 - Contain
 - Confine
 - Divert
 - Pneumatic
 - Contain
 - Confine
 - Divert
 - Mechanical
 - Stop
 - Move (controlled environment)
 - Remove
 - Thermal
 - Cool (active and passive)
 - Remove
3. Describe the purpose of fluid release within a machine
4. Describe the purpose of mechanical release devices within a machine
5. Identify types of stabilization devices
6. Describe mechanism of machinery movement and travel

7. Identify types of stabilization points
8. Describe specialized system features
9. Describe tool selection and application
10. Describe special features of unique machinery systems
11. Identify common energy control devices and construction
12. Perform hazard control based on techniques selected
13. Apply tactics and strategy based on assignment
14. Select and operate tools and equipment specific to machinery rescue
15. Demonstrate safety procedures

Discussion Question

1. How does controlling or isolating hazards inside a machine differ from isolating hazards outside or around a machine?
2. What hazards might you encounter when working within a machine?
3. Can you think of a scenario when you would not want to de-energize an energy source?
4. What unique machinery energy sources are present in your AHJ?

Application

1. Students will practice this skill at multiple skill stations and must perform it once for evaluation.

Instructor Notes

1. Many ELOs in this topic mirror the ELOs in Topic 4-1: Stabilizing a Machine. Topic 4-1 focuses on stabilizing the whole machine. Topic 4-2 should focus on stabilizing or isolating components, fluids, and energy within the machine.

CTS Guide Reference: CTS 2-11, CTS 2-12

Topic 4-3: Determining Access and Egress Points

Terminal Learning Objective

At the end of this topic a student, given the structural and damage characteristics and potential victim location(s), will be able to determine machinery access and egress points so that victim location(s) is identified; access and egress points for victims, rescuers, and equipment are designated; flows of personnel, victim(s), and equipment are identified; existing entry points are used; time constraints are factored; selected entry and egress points do not compromise stability; all machinery involved is stabilized and isolated; chosen points can be protected; equipment and victim stabilization are initiated; and AHJ safety and emergency procedures are enforced.

Enabling Learning Objectives

1. Describe machinery construction/features
 - Simple
 - Complex
2. Describe access and egress points
 - Existing
 - Created
3. Describe mechanism of machinery movement and travel
 - Anticipate potential movement
 - Compensate for compromising structural integrity
4. Describe routes and hazards
 - Routes
 - Primary vs. alternates (if possible)
 - Access vs. egress
 - Rescuer route vs. victim route
 - Hazards
 - Physical (sharp objects)
 - Leaking contaminates
 - Biohazards
 - Psychological stress
 - Falling
 - Thermal
5. Describe operating systems related to determining access and egress
6. Describe AHJ standard operating procedures
7. Describe emergency evacuation and safety signals
8. Identify access and egress points and probable victim locations
9. Assess and evaluate impact of machine stability on the victim

Discussion Question

1. How can you identify access and egress points?
2. What emergency and evacuation signals do you use in your agency?
3. When might you need to remove a victim through a different point than they entered?

Application

1. Students will practice this skill at multiple skill stations and must perform it once for

evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 2-6, CTS 2-10, CTS 3-3

Topic 4-4: Creating Access and Egress Openings for Rescue

Terminal Learning Objective

At the end of this topic a student, given a machinery tool cache, specialized tools and equipment, PPE, and an assignment, will be able to create access and egress openings for rescue from a machine so that they movement of rescuers and equipment compliments victim care and removal; the technique chosen is expedient; victim and rescuer protection is afforded; and stability is maintained.

Enabling Learning Objectives

1. Identify access and egress equipment for:
 - Disassembling
 - Cutting
 - Burning
 - Lifting
 - Prying/separating
 - Breaking
2. Describe techniques and hazards for:
 - Disassembling
 - Cutting
 - Burning
 - Lifting
 - Prying/separating
 - Breaking
3. Describe agency policies and procedures
4. Describe emergency evacuation and safety signals
5. Select and operate tools and equipment
6. Apply tactics and strategy based on assignment
7. Perform hazard control based on techniques selected
8. Demonstrate safety procedures and emergency evacuation signals

Discussion Question

1. How would you prioritize selecting access and egress points?
2. What hazards might occur because of creating access and egress points?
3. What factors would determine which technique to use for creating access and egress points?

Application

1. Students will practice this skill at multiple skill stations and must perform each of the following techniques — disassembling, cutting, burning, lifting, prying/separating, and breaking — once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 2-7, CTS 3-4

Unit 5: Victim Rescue

Topic 5-1: Disentangling a Victim

Terminal Learning Objective

At the end of this topic a student, given an extrication incident, a machinery tool cache, PPE, and specialized equipment, will be able to disentangle victims(s) so that undue victim injury is prevented; victim protection is provided; and stabilization is maintained.

Enabling Learning Objectives

1. Describe how recovery operations differ from rescue operations
2. Describe tool selection and application for:
 - Disassembling
 - Cutting
 - Burning
 - Lifting
 - Prying/separating
 - Breaking
3. Describe victim stabilization systems
 - Control victim movement during disentanglement
 - Administer medical stabilization per county (LEMSA) EMS policies and procedures
4. Describe protection methods
 - Eye protection
 - Respiratory protection
 - Hearing protection
 - Exposure protection
 - Debris protection
5. Describe dynamics of disentanglement
 - Basic laws of physics
 - Change in victim condition
 - Change in machinery condition
6. Describe how to disentangle victims from common rescue scenarios
 - Digital entrapment
 - Entanglement
 - Simple
 - Complex
 - Crush
 - Impalement
 - Amputation
 - As a tool for rescue vs. caused by incident
 - Recovery
 - Body
 - Body parts
7. Operate disentanglement tools

8. Initiate protective measures
9. Identify and eliminate points of entrapment
10. Maintain incident stability and scene safety

Discussion Question

1. How would you stabilize a victim during disentanglement?
2. What type of victim protection equipment does your agency use?
3. What are common entanglement points that may trap victims?

Application

1. Students will practice this skill at multiple skill stations and must perform it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 2-8, CTS 3-5

Topic 5-2: Removing a Packaged Victim

Terminal Learning Objective

At the end of this topic a student, given a victim transfer device, a designated egress route, and PPE, will be able to remove a packaged victim to a designated safe area as a member of a team so that the team effort is coordinated, the designated egress route is used, the victim is removed without compromising victim packaging, undue injury is prevented, and stabilization is maintained.

Enabling Learning Objectives

1. Describe patient handling techniques
 - Determined by county (LEMSA) EMS policies and procedures
 - Consider:
 - Mechanism of injury
 - Triage
 - Patient safety during extrication
 - Spinal precautions
 - Advanced EMS needs
 - Documentation
 - Goal is patient outcome (minimize harm to victim), not machine outcome
2. Describe types of immobilization, packaging, and transfer devices
 - Qualified medical personnel to address before victim removal
 - Determined by county (LEMSA) EMS policies and procedures
3. Describe types of immobilization techniques
 - Qualified medical personnel to address before victim removal
 - Determined by county (LEMSA) EMS policies and procedures
4. Describe uses of immobilization devices
5. Use immobilization, packaging, and transfer devices for specific situations
6. Use immobilization techniques
7. Apply medical protocols and safety features to immobilize, package, and transfer
8. Use all techniques for lifting the patient

Discussion Question

1. What tools and equipment does your agency use to immobilize patients?
2. What rescuer actions might contribute to victim injuries?
3. Who is responsible for determining how a patient is handled, packaged, and transported?

Application

1. Students will practice this skill at multiple skill stations and must perform it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 2-14

Unit 6: Termination

Topic 6-1: Terminating an Incident

Terminal Learning Objective

At the end of this topic a student, given PPE specific to the incident, isolation barriers, and tool cache, will be able to terminate an incident so that rescuers and bystanders are protected and accounted for during termination operations, the party responsible is notified of any modification or damage created during the operational period, documentation of loss or material use is accounted for, scene documentation is performed, scene control is transferred to a responsible party, potential or existing hazards are communicated to that responsible party, debriefing and post-incident analysis and critique are considered, and command is terminated.

Enabling Learning Objectives

1. Describe PPE characteristics
 - PPE requirements change in IDLH vs non-IDLH
 - Decontamination requirements
2. Identify hazard and risk identification
 - Reevaluate mitigated and ongoing hazards
 - Resources in transition
 - Complacency
 - Normalized deviance
 - Fatigue
3. Describe tool removal procedures
 - When to leave in place
 - Systematic breakdown and removal
4. Describe isolation techniques
5. Identify statutory requirements
 - Determined by AHJ
6. Identify responsible parties
7. Describe accountability system use
 - PAR – personnel accountability report
8. Describe documentation and reporting methods
 - Determined by AHJ
9. Describe post-incident analysis techniques
 - Determined by AHJ
 - Critical incident stress debriefing
10. Select and use hazard-specific PPE
11. Decontaminate PPE
12. Use barrier protection techniques
13. Implement data collection and record-keeping/reporting protocols
14. Conduct post-incident analysis activities

Discussion Question

1. What hazards and risks can arise during incident termination?
2. Who are some examples of responsible parties that may assume responsibility for the scene when the incident terminates?
3. What critical incident stress management resources are available to you?

Application

1. Students will practice this skill at multiple skill stations and must describe it once for evaluation.

Instructor Notes

1. None

CTS Guide Reference: CTS 2-15

Skill Stations

The following components must be covered in the skill stations but can be combined and completed in the order that best suits the props available and AHJ policies and procedures.

Skill stations must address the following operations:

- Stabilize a whole machine
- Stabilize interior parts or pieces of a machine
- Disassembling
 - To create access/egress
 - To disentangle/extricate a victim
- Cutting
 - To create access/egress
 - To disentangle/extricate a victim
- Burning
 - To create access/egress
 - To disentangle/extricate a victim
- Lifting
 - To create access/egress
 - To disentangle/extricate a victim
- Prying/separating
 - To create access/egress
 - To disentangle/extricate a victim
- Breaking
 - To create access/egress
 - To disentangle/extricate a victim
- Stabilizing a victim
- Disentangling a victim
- Packaging a victim
- Removing a victim

Skill stations must incorporate the following learning objectives:

- Sizing up
- Utilizing a subject matter expert
- Recognizing the need for technical rescue resources
- Supporting an operations- or technician-level Incident
- Recognizing and isolating incident hazards
- Establishing scene safety zones
- Isolating energy sources (lockout/tagout)
- Establishing fire protection

Skills stations must incorporate use of the following tools and equipment:

- PPE unique to machinery rescue

- Stabilization
 - Wedges/chocks
 - Cribbing (6x6 and 4x4 – determined by load)
 - Box (crosstie)
 - Solid (crosstie platform)
 - Modified crosstie
 - Struts
 - Cables, chains, ropes, slings
- Machine Management
 - Disassembling
 - Cutting
 - Burning
 - Lifting
 - Prying/separating
 - Breaking
- Victim Rescue
 - Disentanglement
 - Stabilization
 - Packaging
 - Removal

Skills stations must incorporate the following rescue scenarios:

- Digital entrapment
- Entanglement – simple (more than a digit)
- Entanglement – complex
- Crush
- Impalement

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.