

TR: Vehicle Rescue

Lesson One

Rescue Operations

DOMAIN: COGNITIVE / PSYCHOMOTOR

LEVEL OF LEARNING: COMPREHENSION / APPLICATION

MATERIALS

IFSTA Principles of Vehicle Extrication, 2nd Edition; IFSTA Essentials 5th Edition or Jones and Bartlett Fundamentals of Fire Fighter Skills 2nd Edition or Delmar Firefighter's Handbook 3rd Edition; NFPA 1006, Standard for Technical Rescuer Professional Qualifications, 2008 Edition; NFPA 1670, Standard on Operations and Training for Technical Rescue Incidents; Vehicle Rescue and Extrication, 2nd Edition, by Ron E. Moore; NC Highway Incident Safety Guidelines DVD, 2009; laptop computer; multimedia projector; whiteboard or flipchart; marking pens.

NFPA 1006, 2008 Edition JPRs

- 10.1.1 Plan for a vehicle incident
- 10.1.2 Establish scene safety zones
- 10.1.3 Establish fire protection
- 10.1.4 Stabilize a vehicle
- 10.1.5 Isolate potentially harmful energy sources
- 10.1.6 Determine the vehicle access and egress points
- 10.1.10 Terminate a vehicle incident
- 10.2.1 Plan for a heavy vehicle incident
- 10.2.2 Stabilize heavy vehicles

Junior Member Statement:

Junior Member training activities should be supervised by qualified instructors to assure that the cognitive and psychomotor skills are completed in a safe and non-evasive manner. While it is critical that instructors be constantly aware of the capabilities of all students both mentally and physically to complete certain tasks safely and successfully,

the instructor should take every opportunity to discuss with departmental leaders and students the maturity and job awareness each participant has for the hazards associated with fire and rescue training.

TERMINAL OBJECTIVE

The Technical Rescuer candidate shall correctly identify in writing the necessary elements of pre-incident planning, a Scene Size-up, Incident Action Plan, Hazard Assessment Procedures and Command responsibilities associated with vehicle extrication incidents.

ENABLING OBJECTIVES

1. The Technical Rescuer candidate shall correctly describe in writing an understanding of pre-planning and factors rescuers must know to effectively perform a scene size-up, for vehicle rescue incidents.
2. The Technical Rescuer candidate shall correctly describe in writing necessary elements for implementing an on-scene operational plan or incident action plan (IAP) associated with incidents involving vehicle rescue operations.
3. The Technical Rescuer candidate shall correctly describe in writing the types of hazards and their consequences for rescuers that need to be included in a hazards assessment associated with incidents involving vehicle rescue operations.
4. The Technical Rescuer candidate shall correctly describe in writing the responsibilities of command, and the primary functions of command associated with incidents involving vehicle rescue operations.
5. The Technical Rescuer candidate shall correctly identify in writing the various types of PPE that are considered appropriate for use at vehicle accident incidents.
6. The Technical Rescuer candidate, when given a specific rescue tool, shall correctly identify the operational characteristics of the tool.

7. The Technical Rescuer candidate shall correctly identify the procedures for controlling the threat of fire associated with vehicles to include identification of appropriate types of portable fire extinguishers.

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MOTIVATION

Statistically, motor vehicle accidents are the leading cause of death for Americans between the age of 5 and 32. According to the North Carolina Highway Patrol, since 2004 there have been over 9,700 total traffic fatalities and 412,407 injuries in North Carolina. Of these incidents, over 2,600 fatalities occurred because the passenger was unrestrained. These numbers are even greater if you factor in accidents involving off road accidents, and accidents involving agricultural and industrial machines. Since a large portion of fire rescue responses involve vehicle accidents it is imperative that the personnel are trained to deal with all of the elements that come into play at an accident scene. This lesson plan prepares the responder to recognize the importance of scene control and delegating tasks to insure that all hazards are identified and safely mitigated.

PRESENTATION

ENABLING OBJECTIVE #1

The Technical Rescuer candidate shall correctly describe in writing an understanding of pre-planning and factors rescuers must know to effectively perform a scene size-up, for vehicle rescue incidents.

1. Define and discuss a needs assessment.
2. Discuss your department's needs.
 - a) Evaluate the capability of the department to handle potential rescue situations.
3. Define site-survey and discuss its importance for rescue situations involving vehicle extrication?
4. Discuss the importance of good pre-planning efforts such as site-surveys.

5. Identify the on-scene safety and survival priorities.
 - a) Self.
 - b) Rescue team.
 - c) Bystanders.
 - d) Victim.

Reference: IFSTA Principles of Extrication, 2nd Edition.
Reference: Jones and Bartlett Vehicle Extrication, page 21.

6. Discuss the guidelines for risk analysis.
 - a) Risk should be based on our knowledge, skill and ability to assess the safety of the environment.
 - b) Evaluate whether the risk taken will result in a positive or negative outcome. Remember fools often rush in where angels fear to tread.
7. Discuss the three rules of taking risk.
 - a) Risk a lot to save a lot.
 - b) Risk a little to save little.
 - c) Risk nothing to save nothing.
8. Discuss briefly the criteria for each scene extrication component.
 - a) Establish the scene.
 - b) Establish the safety zone.
 - c) Establish fire protection.
 - d) Isolate all existing and potential scene hazards including potential energy sources within and outside the vehicle.
 - e) Stabilize the vehicle.
 - f) Determine access and egress points. Create access and egress points.
 - g) Disentangle the victim.
 - h) Remove the packaged victim.
 - i) Terminate the incident.

Reference: IFSTA Principles of Extrication, 2nd Edition,
pages 13 – 14.
Reference: Jones and Bartlett Vehicle Extrication, page 22.

9. Discuss what is determined by scene size-up.
 - a) Recognition and mitigation of immediate danger to life and health hazards.
 - b) Exposure to traffic.
 - c) Incident scope and magnitude.

- d) Risk benefit analysis.
- e) Number, size, and type(s) of vehicles/machines involved.
- f) Number of victims.
- g) Identification of witnesses/bystanders.
- h) Stability of vehicles/machines.
- i) Scene access.
- j) Needed resources.

Reference: Jones and Bartlett Vehicle Extrication, page 157.

10. Discuss the concept of triage.
- a) Triage is used for multiple victim incidents.
 - b) Victims are categorized according to severity of injuries.
 - c) Immediate – Red – is a life threatening condition, a multi-system trauma requiring immediate treatment and transportation.
 - d) Delayed – Yellow – is a serious non-life threatening injury requiring care, but transportation can be delayed.
 - e) Minor or Minimal – Green – is a minor injury that can be treated as resources become available.
 - f) Expectant – Black – is deceased or dying.

Reference: Jones and Bartlett Vehicle Extrication, page 235.

11. Discuss the terms and guidelines for the placement of warning devices and emergency vehicles at a highway vehicle rescue incident.
- a) Discuss the term *upstream* of an incident so that candidates understand that this is the *end* of an incident where traffic is approaching you.
 - b) Discuss the term *downstream* of an incident so that candidates understand that this is the *end* of an incident where traffic is moving away from you.
 - c) Discuss the term *transition area* so that candidates understand that this is the area where traffic is moved out of its normal path and redirected around the scene.
 - d) In an emergency situation, you typically redirect traffic with a *taper*, which is basically a line of orange cones placed to show traffic which way to move around the scene. You can also use a properly positioned response vehicle, such as a

fire or rescue vehicle with flashing lights, or both. NCDOT recommends you follow this example when setting up your taper with traffic cones.

- (1) Start by taking 5 traffic cones and walking upstream along the side of the road for five pavement skips.
 - (2) These skips are 10' long and spaced 30' apart, so you'll use the cones to install a 200' taper. If you have more cones, then continue adding one skip line for each additional cone.
 - (3) While keeping an eye on traffic at all times, place the first cone on the solid edge line in line with the fifth pavement skip.
 - (4) As you walk back towards the edge of the vehicle blocking the incident scene, place the cones in a straight, diagonal line spaced at each skip line.
 - (5) The last cone should be at or near the edge of the blocking vehicle on the center of the skip line. That way, motorists will understand what to do, as they approach the scene.
- e) Discuss the term *block left* which means the vehicle should be angled left towards the median.
- f) Discuss the term *block right* which means the vehicle should be angled to the right towards the outside shoulder of the road.
- g) Discuss the term *buffer space* which is the protected area where first responders can properly perform their duties.
- h) Fire and rescue departments should use their vehicles to block on the upstream side of an incident, creating a 50' to 100' buffer space.
- i) Fire and rescue goals:
- (1) Scene and personal safety.
 - (2) Patient extrication and treatment.
 - (3) Fire and spill control.
 - (4) Environmental impact containment.
- j) EMS transport agencies should park on the downstream side of an incident which allows for easy patient access without interfering in fire and rescue operations.
- k) EMS goals:
- (1) Scene and personal safety.
 - (2) Rapid triage and treatment.

- (3) Evaluation of transportation priority and method.
- (4) Safe transportation.
- l) Law enforcement agencies should park at a distance on the upstream side of the incident. This allows oncoming motorists an advanced notification of the incident scene.
- m) Law enforcement goals:
 - (1) Scene and personnel safety.
 - (2) Securing evidence and enforcing motor vehicle laws.
 - (3) Securing evidence and enforcing motor vehicle laws.
 - (4) Information gathering and managing tow response.
 - (5) Clearing the scene and resuming traffic flow.

Reference: NC Highway Incident Safety Guidelines DVD, 2009.

- 13. Discuss the guidelines for setting up a hot zone.
 - a) This is the restricted area immediately surrounding the incident.
 - b) Restricted to entry teams and rescue teams only.
 - c) Also called the action zone.
- 14. Discuss the guidelines for setting up a warm zone.
 - a) This area surrounds the hot zone.
 - b) This area is designated as an equipment support zone.
 - c) Personnel and equipment decontamination take place in this area.
 - d) Debris removed from the vehicle is placed in this area.
- 15. Discuss the guidelines for setting up a cold zone.
 - a) This area surrounds the warm zone.
 - b) This area is designated for incident command and related functions.
 - c) Media representatives, responding equipment and personnel are initially staged here.
 - d) The outer edge of the cold zone is designated as the crowd control line; all bystanders are contained in the cold zone.

Reference. Jones and Bartlett Vehicle Extrication, pages 162 and 163.

APPLICATION

Divide the class into small, equal groups. Supply each group with an accident scenario to include a passenger vehicle, bus, farm tractor, and tractor-trailer. Supply each group with hypothetical information regarding the number of vehicles. Have the groups establish scene control with hot, warm, and cold zones. Have the groups describe what should and should not be in each zone.

PRESENTATION

ENABLING OBJECTIVE #2

The Technical Rescuer candidate shall correctly describe in writing necessary elements for implementing a scene size-up so that an operational plan can be formulated.

1. Discuss the need for first arriving personnel to initiate a thorough scene assessment.
 - a) Quick scene assessment helps to avoid confusion.
 - b) It clarifies required tasks.
 - c) It can prevent further injury.
 - d) It reduces the risk to on-scene personnel.

2. Identify what the firefighter should be looking for while approaching the scene.
 - a) Recognition and mitigation of IDLH issues.
 - b) Exposure to traffic.
 - c) Incident scope and magnitude.
 - d) Risk-Benefit analysis.
 - e) Number, size, and types of vehicles/machines involved.
 - f) Number of known or potential victims.
 - g) Identification of witnesses/bystanders.
 - h) Stability of vehicles/machines involved.
 - i) Access to the scene.
 - j) Necessary resources and their availability.

3. Discuss with the students the safety considerations concerning the trunk.
 - a) Check for miscellaneous products.

- b) Gasoline In non-approved containers.
- c) Fertilizers – anhydrous ammonia or nitrogen (oxidizer).
- d) Small propane canisters such as Coleman lanterns and stoves can *BLEVE* during a vehicle fire.
- e) Explosive devices – blasting caps.

4. **Conduct an inner and outer survey.**

Reference: Jones and Bartlett Vehicle Extrication, pages 157 – 160.

APPLICATION

Divide the class into small, equal groups. Supply each group with an accident scenario to include a passenger vehicle, bus, farm tractor, and tractor-trailer. Supply each group with hypothetical information regarding the number of vehicles, position of vehicles and number of victims, existing and potential hazards on-scene, initial resource availability and projected resource capability. Have each group list the individual elements of the initial incident scene survey and the key components of incident size-up. Then have several candidates write their lists on the board and discuss their findings with the class.

PRESENTATION

ENABLING OBJECTIVE #3

The Technical Rescuer candidate shall correctly describe in writing the types of hazards and their consequences for rescuers that need to be included in a hazards assessment associated with incidents involving vehicle rescue operations.

1. Identify general scene hazards associated with extrication incidents.
 - a) Spilled fuels.
 - b) Alternate fuels.
 - c) Down or ruptured utilities – electrical, gas.
 - d) Threat of fire or explosion
 - e) **Ignition sources.**
 - f) Type of cargo. (Haz-Mat?)

- g) Structural instability such as a vehicle in a structure.
- h) Environmental hazards

Reference: Jones and Bartlett Vehicle Extrication, pages 163-166.

2. Identify and discuss hazards associated with passenger vehicles.
 - a) Air bags and their locations within the vehicle, deployed, non-deployed, their activation devices and their locations.
 - b) Passive restraint systems.
 - c) Energy absorbing bumpers.
 - d) Roll bars and Rollover Protective Structure ROPS
 - e) Alternative Power.

Reference: Jones and Bartlett Vehicle Extrication, pages 86-96 and pages 54-79

3. Identify and discuss hazards associated with buses and trucks.
 - a) When attempting to shut off a bus or tractor engine by discharging an extinguisher into the air intake, use only CO₂. Any other agent may cause the engine to break apart causing flying debris.
 - b) Buses with electric lifts will have a separate battery located at various locations on the chassis and will need to be disconnected to insure all electrical power has been shut down.
 - c) Be alert when breaching the floor of a bus due to the danger of a flash fire.
 - d) When using stacked pneumatic bags to lift heavy loads, there is always the risk of one or more bags becoming dislodged, causing serious injuries.

Reference: IFSTA Principles of Extrication, 2nd Edition, pages 117 - 118.

4. Identify the Commercial Truck Classifications
 - a) GVWR system.
 - b) Work duty of the engine.
5. Identify the major parts of Commercial Truck Anatomy
 - a) Cab.

- b) Chassis.
- c) Cargo area.
- d) Axles.
- e) Doors.
- f) Braking systems.
- g) Fuel tanks and types.

Reference: Jones and Bartlett Vehicle Extrication, pages 301 – 311.

4. Identify hazards associated with rail cars.
 - a) Railcars weighing in excess of 265,000 pounds, or passenger cars weighing in excess of 100,000 pounds should not be stabilized using pneumatic lifting bags and cribbing. Catastrophic failure could result. Heavy shoring is preferred.
 - b) Do not climb or walk on a locomotive or car in a catenary system.
 - c) Do not attempt to disconnect the jumper cables between the cars or make contact with any of the electrical equipment. All Amtrak cars are equipped with 480 volt electrical circuits charged by power from the locomotive, commonly called head-end power.
 - d) Rescuers should not attempt to remove these cables. Only trained Amtrak crews can safely de-energize this system.
 - e) Due to the high voltage carried by a catenary rail system, no one should approach or permit any metallic object within 8' of the 138,000 volt transmission line, or 3' from the 12,000 volt catenary system or 6,900 volt signal power lines.

Reference: IFSTA Principles of Extrication, 2nd Edition, pages 148 - 155.

PRESENTATION

ENABLING OBJECTIVE #4

The Technical Rescuer candidate shall correctly describe in writing the responsibilities of command, and the primary functions of command associated with incidents involving vehicle rescue operations.

1. Discuss the concept of an Incident Management System (IMS) for vehicle rescue incidents.
 - a) IMS should be established at all small and large rescue incidents.
 - b) Most jurisdictional protocols require the first-in officer/unit to assume initial command.
2. Discuss the importance of proper incident organization.
 - a) Maintain scene control.
 - b) Develop primary strategy.
 - c) Develop secondary strategy.
3. List the important points that an IC must observe at a vehicle or machinery rescue incident.
 - a) Monitor overall operation.
 - b) Reassess operations periodically.
 - c) Check to see if anything was missed during initial size-up.
 - d) Has the situation changed?
 - e) Are additional resources needed?
 - f) Reassess rescue personnel's mental and physical status periodically.
4. Discuss some of the command responsibilities necessary when directing a vehicle or machinery rescue/recovery incident.
 - a) Assign tactical tasks to competent personnel.
 - b) Establish and maintain communications.
 - c) Ensure safety for all personnel involved.
5. List and discuss the three 'keeps' of command.
 - a) Keep all personnel on the scene safe.
 - b) Keep trying to implement your entire plan.
 - c) Keep thinking and assimilating any new information. Are there better ways?
6. Describe and discuss the functions of command.
 - a) Establish command.
 - b) Determine the magnitude and projected duration of the incident. Recovery may continue for hours. Combination of rescue and recovery may deplete resources.
7. Describe and discuss the assessment of priorities at a vehicle or machinery rescue/recovery incident.

- a) Patient access and stabilization. This may include stabilization of vehicle or machinery.
 - b) Patient extrication.
8. Describe and discuss how to ensure positive scene control.
- a) Control spectators.
 - b) Security for evidence gathering and personnel.
 - c) Identify witnesses.
 - d) Establish a secured area for family members.
 - e) Isolation from spectators and control for rescue operations.
 - f) Establish an information/media area if necessary, and appoint a PIO.

Reference: IFSTA Principles of Extrication, 2nd Edition.

9. Discuss the determination of the method of rescue.
- a) How much time will it take to set up a rescue/recovery system? The patient's condition is the determining factor.
 - b) Remember - Keep It Simple Sweetheart (KISS).
10. Consider the risk to your rescue personnel. The prime concern is rescuer safety.
- a) Consider the probability of success. Will chosen strategy and tactics solve the problem?
 - b) On-scene resources. Are sufficient resources and personnel currently available to make strategies and tactics work as planned?
 - c) Off-scene resources. Time required for additional resources, if needed.

Reference: IFSTA Principles of Extrication, 2nd Edition, pages 17 - 18.

11. Discuss information that should be transferred to a new incident commander if there is a transfer of command, as well as the objectives for terminating an incident.
- a) What is the name of the incident?
 - b) What is the incident status?
 - c) What are the safety considerations?
 - d) What is the action plan for the incident?
 - e) What is the progress toward completion of the tactical objectives?
 - f) Restore the scene to near normal.

- g) Maintain safety to rescue personnel while the incident is being terminated.
- h) Make it safe for vehicles and people to pass through.
- i) Contact any agencies to remove vehicles and debris.
- j) Communicate remaining hazards to proper authorities.
- k) Secure the scene for law enforcement investigation.
- l) Provide for an incident critique.
- m) Provide for a critical incident stress debriefing (CISD).

Reference: IFSTA Principles of Extrication, 2nd Edition, page 17-19.

PRESENTATION

ENABLING OBJECTIVE #5

The Technical Rescuer candidate shall correctly identify in writing the various types of PPE that are considered appropriate for use at vehicle accident incidents.

1. Initiate a discussion on the importance of wearing the appropriate PPE for a specific task.
 - a) Proper PPE provides full torso and extremity protection.
 - b) Proper PPE provides protection from the flying debris and noise.
 - c) Proper PPE provides protection from cuts and abrasions and some protection from contamination, depending on contaminant.
 - d) Specialized PPE provides for protection from specific hazards such as fire, heat, noise, hazardous materials, and hazardous atmospheres.
 - e) Respiratory protection may be needed.
2. Discuss the role of the on-scene incident Safety Officer or the IC on small incidents, regarding the proper use of PPE.
 - a) The Safety Officer enforces the applicable SOPs and dictates any changes in the type and level of PPE as necessary.

- b) The Safety Officer verifies that the appropriate PPE is being worn properly and all openings are closed and all fasteners are fastened.
- c) The Safety Officer prohibits anyone not dressed appropriately from entering the established danger zone.

Reference: Jones and Bartlett Vehicle Extrication, page 17

3. Discuss the importance of wearing the appropriate PPE for Universal Precautions.
 - a) The PPE isolates the wearer from contact with blood and other body fluids.
 - b) The rescuer may wear exam gloves under work gloves. Refer to your glove manufacturer for the protection it provides.
 - c) A surgical mask and a splash shield may be worn. Refer to AHJ infectious control policy for guidance.
 - d) A Tyvec gown may be available for the rescuer. Refer to AHJ infectious control policy for guidance.
4. Discuss the need for proper head and eye protection.
 - a) Helmets protect the skull from flying debris and falling objects.
 - b) Firefighting helmet construction should comply with NFPA 1971 Standard on Protective Ensemble for Structural Firefighting.
 - c) Rescue helmet construction should comply with the NFPA 1951 Standard on Protective Ensembles for Technical Rescue Incidents.
 - d) The most common type of eye protection is the helmet face shield with 4" - 6" lengths. Some newer helmets may have flip down visors. When performing extrication the face shield should be used in conjunction with safety glasses or goggles as required by NFPA 1500 where applicable.
 - e) NFPA 1500 requires eye protection to meet ANSI Z87.1.
 - f) Fire retardant hoods are recommended with helmets when engaged in extrication activities.
5. Discuss the need for hearing protection.

- a) Earplugs or earmuffs are recommended when working with tools that create moderate to high levels of noise.
6. Discuss the guidelines for body garments appropriate for extrication activities.
 - a) Traditionally turnout gear has been the garment of choice for activities requiring protection from fire, cuts and abrasions, contaminants and considered to give optimum personal protection while conducting extrication activities.
 - b) PPE worn for any rescue activity should comply with NFPA standards for personal safety.
 - c) Personal protective clothing should be easily visible. NFPA 1971 has established guidelines for the recommended striping of PPE. NFPA 1951 does not specify a visibility enhancement requirement. The AHJ should conduct a risk assessment and determine the level of visibility required based on the anticipated use of the garment.
 7. Discuss the guidelines for selecting appropriate footwear.
 - a) Proper footwear protects from the heat, punctures, and impacts.
 - b) Boot construction should meet ANSI Z42-1991, NFPA 1951 and NFPA 1971.
 - c) Boot construction should conform well to the wearer's feet for comfort, support, and the reduction of the chance of blisters.
 8. Discuss the guidelines for selecting appropriate hand protection for extrication activities.
 - a) Proper hand PPE should protect the hands from cuts, abrasions, and punctures.
 - b) Proper hand PPE should be close fitting, but allow freedom of movement.
 - c) Latex gloves should be worn if blood borne pathogens may be present.

Reference: IFSTA Principles of Vehicle Extrication, 2nd Edition, pages 21 - 24.

Reference: Jones and Bartlett Vehicle Extrication, pages 102-106.

PRESENTATION

ENABLING OBJECTIVE #6

The Technical Rescuer candidate, when given a specific rescue tool, shall correctly identify the operational characteristics of the tool.

1. Discuss and demonstrate the applications of chains and webbing for vehicle extrication incidents.
 - a) Chains and webbing of appropriate size and strength may be used interchangeably.
 - b) Use only rescue rated steel alloy chain, not proof coil chain, or common hardware chain.
 - c) The recommended minimum chain size for rescue operations is 3/8".
 - d) Chain failure is usually due to improper use or poor maintenance.
 - e) Hooks, pins, links and attachments should be made of the same material, and equal or greater strength.
 - f) Do not shock load chains.
 - g) Webbing used for lifting and pulling operations should start at 2" and is available in tubular or flat construction.
 - h) Spiral weave tends to be stronger than chain weave and has a greater resistance to abrasion.
 - i) The strength requirement should be the same as for chain for the same application.
 - j) Protect webbing from abrasion and chemical exposure.

Reference: IFSTA Fire Service Rescue Manual, 6th Edition, page 66.

2. Demonstrate how the various types of hand tools used by the AHJ can be very effective for creating purchase points and creating entry and egress points into various types of vehicles.
 - a) Demonstrate prying tools such as a pry-axe, Halligan bar, and pry bar.
 - b) Demonstrate handsaws such as a hacksaw. Use demolition blades designed for rescue applications.
 - c) Demonstrate pulling tools such as winches.

- d) Demonstrate jacks such as bar screw jacks and a High Lift jack. The High Lift jack has a 5000 pound pulling capacity, 7000 pound test load lifting capacity, but the manufacturer's recommended safe working lifting load is 4660 pounds.
- e) Demonstrate mechanic's tools such as wrenches, socket sets, and pliers.
- f) Demonstrate cable and chain come-a-longs. Point out that those used for rescue should have a minimum pulling capacity of 2 tons. A one ton rated cable come-a-long used in a single strand configuration generates one ton of pulling power, when cable is doubled using the provided pulley and hook, the pulling capacity doubles.
- g) Demonstrate cutting tools.

Reference: IFSTA Principles of Vehicle Extrication, 2nd edition, pages 36 - 39.

- 3. Discuss and demonstrate the operation of corded and cordless reciprocating saws.
 - a) Point out that the new generation batteries of the cordless saw do not generate a memory. The batteries drain rapidly under load thus preventing a memory build-up.
 - b) Demolition blades for metal should have 10 - 14 tpi (teeth per inch) capability, 5 - 8 tpi for wood.
 - c) A variable tooth blade is now available for rescue application. Throughout the length of the blade, the tpi varies from a 5 - 8 tpi pattern to a 10 - 14 tpi pattern. This type of blade is the most efficient for rescue application.
 - d) The recommended lengths of blades are 6" and 9".

Reference: IFSTA Principles of Extrication, 2nd Edition, page 42.

- 4. Discuss and demonstrate the operation of air chisels.
 - a) Most air chisels operate at an air pressure of 100 - 150psi. Some are rated for 300psi.
 - b) They are good for cutting medium and heavy gauge sheet metal, rooftops, doorposts, rivets, and bolts.

- c) Use extreme caution when operating in a hazardous atmosphere.
5. Discuss and demonstrate the operation of lifting bags.
- a) Pneumatic lifting bags are designed to lift or displace objects that can't be lifted with standard extrication equipment.
 - b) A theoretical 100% lifting capacity is based on the width of the bag x the length x the pressure.
Example: $30 \times 30 \times 118 = 106,200$ pounds divided by 2,000 = 53 tons.
 - c) The theoretical 100% capacity is maintained until the center of the high-pressure bag reaches 2" (1" on the early models).
 - d) A 53 ton rated capacity bag inflated to its height of 18" is only capable of lifting 27- 28 tons (an average of 50% or less).
 - e) Depending on the manufacturer, the operating pressure varies from 90 -150 psi.
 - f) Medium pressure bags operate at an average pressure of 15 psi.
 - g) Low pressure bags operate at an average pressure of 7 psi.
 - h) A minimum of a 25' safe zone should be established in the event of a kick-out.
 - i) When stacking bags, the maximum lifting capacity is based on the smallest bag.
 - j) Lift the object only as high as needed, the higher the bags are inflated the more unstable they become.
 - k) Any lifting operation should be constantly maintained with cribbing.
 - l) Low and medium pressure bags are designed to provide vertical lift over a large area.
 - m) Their average lifting capacity is 3 - 18 tons.
 - n) Specialized vehicle lifting bags have a lifting capacity up to 30 tons.
 - o) Maximum lifting height ranges from 24" to 60".
 - p) When placing any type of lifting bag, consider stacking two bags, even if one bag will do the job. The second bag is a backup in the event of a problem.
6. Reference: Jones and Bartlett Vehicle Extrication, pages 119 - 121

7. Discuss and demonstrate the operation of various types of manually operated, hydraulic jacks.
 - a) Hydraulic jacks have lifting capacities ranging from 2 tons to 500 tons.
 - b) Extension is accomplished by the use of hand pumps and retraction occurs when the valve is opened on the hand pump and the pressure is bled off.
 - c) It was the first remote controlled hydraulic jack.
 - d) The two most common units were the 4 ton and the 10 ton capacity unit, offering various sizes of extensions and tips.
 - e) The operational characteristics are much like its big brother, the powered hydraulic ram.

8. Discuss and demonstrate the operation of various types of hydraulic spreaders.
 - a) The Hurst Model 32 was the first hydraulic powered spreader used for rescue in the US.
 - b) Hydraulic spreaders weigh between 35 - 50 pounds and operate at pressures between 3000 and 10,500 psi.
 - c) The spreader is weakest as it begins to open and reaches a maximum capacity at its widest spread.
 - d) The spread varies from 24" to 40".
 - e) Fluid composition can range from phosphate ester, glycol, automatic transmission fluid, or most commonly mineral based hydraulic oil.
 - f) Spreader force is greater in the spreading mode.
 - g) In the pulling mode a loss of power can be as much as 50% of the rated spreading power.
 - h) Typical range of force is between 14,000 and 28,000 psi with some models up to 59,000 psi or greater

9. Stress to the candidates the importance of wearing appropriate PPE. When operating hydraulic tools, especially eye protection. These tools operate at high pressure and contamination from a high-pressure leak can occur by inhalation, absorption (through gloves) or penetration (high pressure pinhole leak) being injected into the skin.

10. Discuss and demonstrate the operation of various types of hydraulic cutters and combination tools.

- a) Cutters are designed as either a single acting unit where the return action is dependent on a mechanical spring that can foul or jam, or a double acting unit where the return action is dependent on hydraulic force, and is more efficient.
- b) Blade configuration is varied, straight, curved, or serrated. Some have cable notches, some have both blades moving, and some have only one blade moving.
- c) Stress the warning: The blades are designed to shear and can energize an object, causing it to fly once it is cut.
- d) Most cutters are designed to cut standard grade sheet metal. Some manufacturers have special accessories for cutting other materials.
- e) Cutting material not approved by the specific manufacturer can have catastrophic results for victim and rescuer.
- f) Cutting forces can range from 40,000 to 80,000 psi with some newer models producing 250,000 psi.

11. Discuss and demonstrate the operation of various types of hydraulic rams, and combination tools.
- a) The porta-power was introduced in the early 1950s and was used extensively for extrication until the introduction of the Hurst tool in the early 1970s.
 - b) The tool is an updated version of the hand operated hydraulic porta-power unit.
 - c) Some manufacturers offer a twin plunger unit with two independent plungers incorporated into one tool and operated by a single control handle.
 - d) Like cutters, rams operate as a single action or double action unit.
 - e) Some rams are direct control or remote control.
 - f) Some manufacturers offer telescoping extension rams. Extensions can be from 12" when retracted to 65" when fully extended.
 - g) They can be used as a push and pull device.
 - h) Point out that more power is generated in the pushing mode.

Reference: Jones and Bartlett Vehicle Extrication, pages 130 – 131.

APPLICATION

Using the various hand tools and power tools available from the AHJ, demonstrate assembling the components of the tools and the start-up procedures. Discuss safety issues for each tool. Given the vehicle resources, have the students practice stabilization procedures, and practice cutting posts, sheet metal and displacing different components of the vehicle. Stress the importance of wearing the appropriate PPE. Suggest a 10 to 1 instructor to student ratio when in the field environment. Instructors should make sure the vehicle is safe to use for practice. Neutralize all electrical energy, make sure gas tanks are empty or removed. Neutralize or remove alternative fuels and any other potential hazard you think is necessary for conducting a safe training operation.

PRESENTATION

ENABLING OBJECTIVE #7

The Technical Rescuer candidate shall correctly identify the procedures for controlling the threat of fire associated with vehicles to include identification of appropriate types of portable fire extinguishers.

1. Point out that NFPA 1670 requires the Incident Commander of a vehicle or machinery incident to recognize the need and supply the resources for, fire control in the event of, or potential for, a fire.
2. Emphasize that the simplest way to address this issue is to have fire personnel on scene, dressed in appropriate PPE, standing by with an engine company, and manning a charged hose line.
3. Discuss the fact that since most AHJs require that fire extinguishers be part of the equipment cache for a rescue response vehicle, the rescuer should be trained in the basic fundamentals and operation of fire extinguishers.

NOTE: This lesson plan does not cover all of the requirements of NFPA 10 on fire extinguisher use. It is designed to address the basic steps of using a fire extinguisher.

4. Define and discuss the term "fire."
5. Define and discuss the fire extinguishment theory.
6. Identify and discuss the four classifications of fire that are related to vehicle incidents, and the fuels associated with each classification.
 - a) Class A.
 - b) Class B.
 - c) Class C.
 - d) Class D.

Reference: IFSTA Essentials of Firefighting, 5th Edition, pages 104, 110, 111, 236 and 237.

7. Identify the various types of fire extinguishers available to the AHJ for rescue, and discuss and demonstrate correct procedures for activating and using a portable fire extinguisher.
8. Discuss the operational characteristics of the different types of portable extinguishers.
9. Explain the NFPA requirements on protection of fire extinguishers from freezing.
10. Discuss the difference between dry chemical and dry powder agents, and the classes of fire for which each agent is used.
11. Identify the extinguisher rating system.
 - a) Class A rating.
 - b) Class B rating.
 - c) Class C rating.
 - d) Class D rating.
12. Discuss the proper steps in selecting the correct extinguishers to use on the different classes of fire.

Reference: IFSTA Essentials of Firefighting, 5th Edition, pages 248 through 250.

13. Discuss and demonstrate the proper operation of each extinguisher used by the AHJ. Have each candidate practice using each fire extinguisher.

14. Discuss how each agency should have policies and procedures on the use of extinguishers.

Reference IFSTA Essentials of Firefighting, 5th Edition, pages 250 through 252.

APPLICATION

Divide the class into small, equal groups. Supply each group with a multi-vehicle, multi-victim accident scenario to include a passenger vehicle, bus, farm tractor, and tractor-trailer. Supply each group with hypothetical information regarding the number of vehicles, the position of the vehicles, and the number of victims. Give on-scene existing and potential hazards, initial resource availability, and projected resource capability. Make organizational assignments. Assign each group a Command title from IC on down. Set up an organizational chart. Have each group identify specific goals and tactical considerations for their specific role.

SUMMARY

It is obvious emergency response departments have no control over victims and bystanders prior to an incident, but they do have control over emergency responders. All department officials have a responsibility to train their personnel to high levels of competency, including appropriate management skills. Implementing a functional command system is critical to insuring the safe outcome of an operation. An effective Incident Management System actually begins with preplanning, identifying potential emergency response situations, and taking appropriate actions to develop plans to handle each situation. Appropriate action includes a thorough site survey and pre-response incident action plans. Command officers must quickly stabilize a scene. Many issues need to be addressed, such as initial scene surveys, hazard assessments, developing strategies, and delegating authority to carry out actions to mitigate all hazards while maintaining a safe operational environment. Such actions are imperative to insure the overall goal of scene safety.