TITLE: TRAINING GUIDE 10-5
TRANSPORTATION AND MACHINERY EXTRICATION

PURPOSE

1. To comply with WAC 296-305

2. To provide guidelines for Vehicle and Machinery extrications at Rescue operations.

3. To familiarize the SFD personnel with size-up, scene stabilization and the need for additional resources at heavy rescue and vehicle extrication incidents.

4. To familiarize the Seattle Fire Department Personnel with procedures which will **enhance the safety of both Rescuer and Patient**

5. To familiarize the SFD personnel with the safe and efficient use of tools and equipment at heavy rescue and vehicle extrication incidents.

6. To familiarize SFD personnel with basic concepts and techniques for mitigation of heavy rescue and vehicle extrication incidents.

REFERENCES

1. Washington Administrative Code 296-305, Safety Standards for Firefighters

2. Seattle Fire Department Operating Instructions

3. New Technologies in Vehicle Extrication, US Fire Administration, 1994

4. Emergency Evacuation From Amtrak Trains, National Railroad Passenger Corp. 1989

DEFINITIONS

Air Bags — High pressure reinforced bags used for moving or lifting heavy objects. Airbags are supplied by spare MSA bottles through a regulator and come in various sizes and weight limits. They are best used in conjunction with cribbing.

Air Chisel — A pneumatic hand tool, supplied by a spare MSA bottle through a regulator, generally used for cutting sheet metal or nader pins.

AmkusTools	A hydraulic power unit which operates a variety of tools including spreaders, cutters and rams. The power unit consists of a gasoline or hand powered device.
Amtrak	Amtrak is primarily a passenger train. (Operations phone # 1-800-424-0217)
Anchor Point	A solid base or point from which pulling or pushing operations can begin.
Auger	(Industrial) A screw like shaft that turns to move a product, as found in grain terminals, cement plants, sand distributors etc.
Burlington Northern	Primarily a freight carrier. (Freight Dispatcher phone # 1-800-832-5452)
Bill of Lading	A manifest listing origin, destination, route, product and other pertinent information regarding the cargo of a vessel or vehicle.
Cheater Bar	A pipe or other type of extension to the handle of a tool to add leverage.
Circle Survey	A 360-degree walk around survey of an emergency scene to give the person in charge a more complete picture of the incident and problems that could arise.
Come Along	A manually operated device using a ratchet and pulley arrangement to produce mechanical advantage.
Consist	A document that describes the line order or arrangement of cars in a train.
Cribbing	Varied lengths of wooden blocks and wedges used to stabilize and provide a foundation for unstable objects.
Dash Lift	A technique using hydraulic tools to move the dash assembly forward and away from the passenger compartment in an auto.
Explosive Atmosphere	A fuel air mixture that will explode if given an ignition source.

Halligan Tool A heavy combination bar combining an adz and spike on one end and a pickle fork on the other.

Jacking Plates Reinforced areas under a vehicle which are used as points for lifting.

K.E.D. (Kendrick Extrication Device) A specially designed spinal immobilization device that is useful for patients in restricted areas.

Leverage The term for the mechanical advantage obtained when using a fulcrum and lever system.

Lock Out/Tag Out A system used to secure and isolate equipment from a power source while personnel are working on or near that equipment.

Lock Out/Tag Out Device Padlocks, cover plates or other devices used to protect switches or valves from being turned on. For SFD purposes this will be a dedicated Seattle Fire Department guard.

Lexan Polycarbonate glass used for some windows, however, it is 250 times stronger than glass.

Loaded Bumper Automobile bumpers that have been compressed in an accident and have not been released. They can potentially be very dangerous.

Nader Pin Door latch mechanism on autos designed to assist keeping the door closed in an accident.

Post

A Post The furthest forward post, on an auto, that supports the roof and windshield assembly.

B Post The middle post, on an auto, that supports the roof.

C Post The rear post, on an auto, that supports the roof.

PPE (Personnel Protective Equipment) The equipment provided to shield or isolate personnel from the chemical, physical and thermal hazards that can be encountered at a Technical Rescue incident. This includes protective clothing and respiratory protection.

PTO	(Power Take Off) A rotating shaft that transfers power from an engine to auxiliary equipment.
Pre Rescue Briefing	This action should occur before operations begin. This is the time that the Rescue Group Leader solicits ideas from the Rescue Team members. Once the action plan has been determined the Rescue Group Leader will brief the members, make assignments and begin the set up phase of the rescue. The Rescue Group Leader should be very specific about what they want, assignments should be short, to the point and concise. Do not assume members know.
Pry Bar	A bar used to gain leverage to assist in prying or lifting.
Purchase Point	A solid point of contact to gain leverage or mechanical advantage.
Reciprocal Saw	An electric or gas powered saw operating in an in/out motion. Very useful in light to medium weight sheet metal removal.
Recovery	Operation undertaken by responders to recover the remains of victims or property and shall only be implemented when the risk to responders has been reduced to the lowest level possible.
Relief Cut	A cut made in an object to assist in bending or pushing apart.
Rescue	Operations undertaken by responders to remove victims from hazardous situation in which the victim is able to offer little or no assistance due to their physical condition or immediate environment.
Rescue Saw	Gas powered circular saw with either a carbide tipped blade composite steel or masonry blade.

Response Level	**Awareness Level**: the level that represents the minimum capability needed to identify technical rescue emergencies, their hazards and recognize the need for additional resources necessary to safely and successfully conduct operations. Members trained to this level shall be competent in recognizing the need for technical rescue operations, conducting an approach assessment (size up) and resource requirements and management. Members will be able to initiate ICS and begin an initial risk/benefit analysis based on the hazards, availability of trained personnel and equipment. Actions taken by responders at the Awareness Level may place the rescuer at low risk. All Seattle Fire Department members will be trained to this level. **Operational Level** - In addition to the Awareness level capabilities, the Operational Level represents the minimum capability needed to conduct limited technical rescue operations safely and effectively. Members will be able to conduct a more in depth risk/benefit analysis based on the hazards, availability of trained personnel and equipment . Actions taken by responders at the Operational Level may place the rescuer at a low to moderate risk. Seattle Fire Department Ladder Companies are trained and equipped to this level. **Technical Level** - in addition to the Awareness and Operational Level capabilities, the Technical Level represents the ability to conduct safe and effective complex rescue operations. Operations conducted at the Technical Level may place the rescuer at a moderate to high risk . Seattle Fire Department Technical Rescue Units are trained and equipped to this level.
Risk Benefit Analysis	Is the ongoing decision making process that weighs the hazards encountered by the responder verses the potential benefit from that exposure.
Speed Chocks	Pre-made stacked cribbing used to rapidly stabilize an object.
Supplemental Restraint Systems	Airbag and seat belt systems in vehicles which are mechanically or electrically operated.
Union Pacific	Primarily a freight carrier. (Freight Dispatcher phone # 1-800-299-3483)

Waybill The Shipping papers on a train describing the origin, destination, route and product for each car. Carried by the conductor.

Operational Zones

Cold Zone -- A safe area at a rescue incident, outside the warm and hot zones. The area where apparatus personnel and equipment not actively involved in the rescue are placed. Base should be located here. The media, bystanders and non-essential personnel will also be in this zone.

Warm Zone -- The area between the hot zone and the cold zone that contains personnel and equipment essential to the support of the rescue effort. This area may contain the Command Post and Staging Area. Control of this area is essential for management of the rescue.

Hot Zone -- The area of the rescue operation where specified rescue personnel may be placed at risk. Only rescue personnel directly involved in the operations and equipped with the proper safety equipment are allowed in this area.

TITLE: TRAINING GUIDE 10-5
TRANSPORTATION AND MACHINERY EXTRICATION

GENERAL INFORMATION

Mechanical/Heavy Rescue/Vehicle Extrication is the most diverse discipline of the technical rescue grouping. This discipline covers a wide variety of situations that could arise during any emergency call requiring the use of rescue tools. This training guide is to begin to familiarize SFD members with successful solutions to mitigate the problems while minimizing risk. Knowledge and awareness of a wide variety of tools is essential for safe and efficient operations during these incidents.

At all emergency sites several basic SFD practices need to be implemented and followed:

1. **Size Up / Radio Report**
   - Correct address.
   - Brief description of the incident.
   - Circle Survey (360' Walk around survey.)
   - Assume or pass command.

2. **Implement ICS**
   - Establish command and designate command post location.
   - Implement other ICS functions as necessary.

3. **Identify Existing or Potential Hazards**
   - Fire or potential flammable conditions.
   - Hazardous Materials
   - Supplemental Restraint Systems (***See appendix A***)
   - Electrical/Mechanical Lock-out (***See appendix B***)
   - Shifting Loads (***See appendix C***)
   - Electrical Shock Hazards
   - Engulfing Agents (***See appendix D***)
   - Traffic (***See appendix E***)
   - Terrain
   - Mechanical
   - Overhead
   - Weather (***See appendix F***)
   - Water

4. **Recognize The Need For and Use Personal Protective Equipment**
   - Appropriate clothing. (Bunking gear, nomex pants etc.)
   - SCBA when needed.
   - Eye protection
   - Air monitors

5. **Scene Assessment and Patient Triage**
   - Number of victims
   - Location of victims
   - Entrapment obstacles impacting patient care
   - Scene Triage
     - ♦ What additional resources might be needed
   - Risk/Benefit Analysis
     - ♦ Safety of Rescuers
     - ♦ Safety of Patients
   - Is this a recovery or a viable rescue

6. **Recognize the need for and request additional resources**
   - Haz-Mat
   - Technical Rescue
   - Marine Unit
   - Medic Unit/s
   - Police
   - Extra Manpower
   - Railroad
   - City Light
   - Metro
   - Engineering
   - Mutual Aid

7. **Pre Operational Checks**

   - Identifying and Controlling Hazards
     - ⇒ Complacency
       - * Lack of hands on safety check
       - * Getting in a hurry
       - * Degradation of skills
       - * Not asking questions when directions are not clear
     - ⇒ Personnel limitations

- Be self limiting, if you don't know how or are uncomfortable with your task tell the Rescue Group Leader

⇒ Equipment limitations
- Do you have the needed equipment on hand.

⇒ Training limitations
- Do you have enough trained personnel to start and complete the operation.

⇒ Communications
- The lack of a pre rescue briefing: If the plan and assignments are not clear the operation may be slowed or break down due to lack of understanding of the objectives.
- Misunderstanding of common terms used in the rescue.

8. **Incident Stabilization**

- Use the apparatus to block and protect the scene.
- Protective line laid if needed.
- Secure the scene from the public.
- Establish Hot, Warm and Cold Zones.
- Shut down machinery or vehicle if possible.
- Establish contact with responsible parties.
  - Conductor or Engineer
  - Driver
  - Job Foreman
  - Maintenance personnel or Mechanic
  - Home Owner
  - Coworker
  - Witness
- Establish Lock Out/Tag Out for electrical/mechanical shut-offs.
- (Acceptable SFD Lock Out is a posted SFD personnel guard.)
- Notify affected agencies:
  - Rail Roads
  - Police Agencies
  - Company

- Home Owner
- Coast Guard
- Metro

9. **Mitigate the Incident**

- Prioritize the rescue effort **Think**
- Have Rescue group fully aware of plan of action **Plan**
  - Use input from all sources
  - Designate Safety Officer
  - Determine how the Rescue Plan may impact patient safety and condition
- Deploy resources **Act**
  - Correct tools
  - Trained Rescuers
- Reassess Progress
  - Allow for change of plans

10. **Incident Termination**

- Accountability.
  - Ensure all personnel, fire and civilian are accounted for.
- Equipment retrieval.
  - When possible retrieve and account for all Fire Department equipment involved in the Rescue. Do not place members at risk to recover equipment.
  - Note damaged and missing equipment.
- Ensure all personnel and equipment are properly decontaminated.
- Be aware of the need for Critical Incident Stress Debriefing.
- Conduct post incident company debriefing.

SAFETY

1. At vehicle/machinery rescue incidents, the rescuer should be aware of all immediate and potential hazards that may develop during rescue efforts. The rescuers must constantly reassess the scene for changing conditions which may effect the safety of personnel or victims. Safety equipment must be worn that is specific to the potential

hazards that may be encountered at each incident At a minimum; safety shoes, gloves and helmet will be worn.

2. At all Transportation and Machinery Rescue Incidents appropriate Personal Protective Equipment (PPE) will be used. All members entering the hot zone of a rescue incident will be fully protected. The need to protect personnel from the incident degrading and the appropriate level of PPE increasing has to be factored into every rescue. At all rescue incidents SFD personnel will have proper hand, eye, foot and head protection. When a precautionary hose line is laid the crews laying the line will be fully protected with bunking uniform and SCBA.

SPECIAL CONSIDERATIONS

1. **Railroad emergencies**

- At all incidents involving railroad tracks **the Railroad Dispatcher must be notified.** The dispatcher will need to know the mile marker on each side of the incident location (i.e. "We have an accident on the tracks, Mile marker 10 is north and mile marker 9 is south of our location.") Notify the Railroad Dispatcher **immediately** if train traffic must be stopped on the rails involved, or near the incident. It must be confirmed with the Railroad Dispatcher that all rail traffic is able to stop prior to reaching the incident location. It can take a freight train traveling at 55 m.p.h. up to a mile and a half to come to a stop.

- At incidents that involve a locomotive or railroad cars, the rescuer needs to be aware of the electrical system, lexan windows, general rail car construction and the large volume of diesel carried on locomotives.

CAUTION

All Amtrak cars are equipped with 480-volt circuits. The cars are connected by jumper cables. Only trained Amtrak crews can safely de-energize the power to the cars. **Fire department personnel should not attempt to separate or remove the jumper cables.**

CAUTION

The windows on Amtrak passenger cars are made of Lexan plastic. Tools used to attempt to break these windows can rebound and cause serious injury. **These windows will not break**. Remove the rubber molding around the window to safely remove the window.

- Gaining access to railcars should not be attempted by cutting through the steel body with available equipment. It has proven extremely time consuming and all other access possibilities should be explored first.

- Diesel Locomotives carry a large amount of diesel fuel. A rupture of a fuel tank can result in a potentially flammable situation. It takes approximately one minute for a locomotive diesel engine to shut down after the fuel supply is shut off. This must be done as soon as possible; when necessary, by locating the clearly marked "**fuel shut off**" ring and pulling it.

- **Emergency Phone Numbers**

Amtrak	**1 800-424-0217**
Burlington Northern	**1 800-832-5452**
Union Pacific	**1 800-299-3483**

- ***For map with mileage markers listed see Appendix G.***

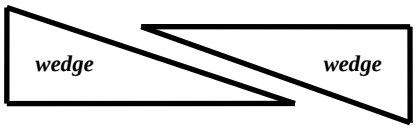
TOOLS, EQUIPMENT AND TECHNIQUES FOR STABILIZATION AND MITIGATION OF TRANSPORTATION AND MACHINERY RESCUES.

A. STABILIZATION

The goal of Stabilization is to minimize the hazards posed by the Machinery, vehicle or object to victims, rescuers and bystanders. The tools listed here will deal primarily with the ***mechanical*** stabilization of the scene. There are other hazards to consider and these must be addressed accordingly.

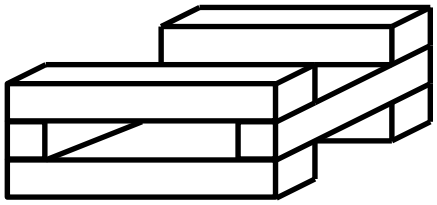
1. Cribbing

Cribbing is the simplest type of shoring and has a wide range of uses. It is most commonly constructed of high-grade softwood 4" x 4" and 2" x 4" s cut into sections 18" long. The full pieces are cut lengthwise from corner to corner to make ***wedges*** and ***shims*.**



Two wedges, cut surfaces of the wedges, fit together to form a shim.

Single pieces of cribbing may be used to prevent movement of the load. If the gap to be filled exceeds the width of two pieces of the cribbing material a ***crib box*** may be built. The crib box is constructed by placing perpendicular layers of the cribbing material on top of one another. As a rule of thumb, ***each point*** where the cribbing material crosses is rated for 6,000 lbs. of load. A crib box constructed with two pieces on each layer will support 24,000 lbs. over the ***whole crib*** (if only two points are supporting the load, then it is only rated for 12,000 lbs.) A box with three pieces on each layer is good for 36,000 lbs. over the ***whole crib***, and so on.



CRIB BOX HEIGHT SHOULD NOT EXCEED TWICE Its WIDTH AND SHALL NOT EXCEED THREE TIMES ITS WIDTH

Some general ***safety rules*** for cribbing an unstable load:

- Never place any part of your body in the fall path of an unstable load to place or move cribbing.
- The crib box height should not exceed twice its width, and shall not exceed three times its width.
- No more than two pieces of cribbing should be stacked parallel.
- All members shall constantly monitor the load for potential undesired movement.
- The force should pass straight through the crib at the points of contact, do not place the load over a bridge in the crib.
- If you are moving the load, crib as you go. **Lift an inch crib an inch.**

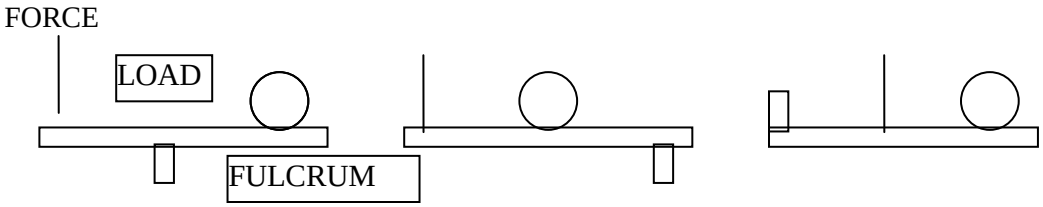
Some basic ***stabilization strategies*.**

- Stabilize your access path and area in the immediate vicinity of the victim(s) first. This will give you a safe environment to work in and limit the hazard to the victim(s). Do not become part of the problem.

- The next priority is to stabilize the load to minimize unwanted movement during the extrication process. Once the extrication strategy is developed, determine how this will affect the load. Crib to minimize unwanted movement during the extrication. Think ahead.

- In some cases, as in auto extrication, it may be possible to lower the load onto the crib. Place the cribbing in place and then lower the load by flattening the tires.

- Constantly re-evaluate the load and the need for additional cribbing.



CLASS ONE LEVER ***CLASS TWO LEVER*** ***CLASS THREE LEVER***

B. LIFTING AND SPREADING

Lifting and spreading are common techniques used to gain access to and remove victims of Transportation and Machinery incidents. There are many tools available to the operations companies to perform these functions. It is important to remember to always control the movement of the load. Anticipate the direction and degree of movement and crib the load as required to keep the load as stable as possible.

BARS

The simplest and most accessible lifting and spreading tool are the bars carried on Fire Department apparatus. By using the bar as a lever Rescuers can effectively move heavy objects or bend and pry metal. They are versatile and have a valuable application in almost any Rescue scenario. You are limited only by your imagination.

Advantages-

- No moving parts
- Readily available
- Ease of use and maintenance
-

Disadvantages-

- Limited capability requires a lot of personnel power, time and cribbing for a lift of any significant size.

2. HYDRAULIC POWERED TOOLS (Amkus)

Hydraulic powered tools are currently found on the Ladder Companies throughout the City. They are a highly effective resource for lifting and spreading operations. The system consists of a gas powered hydraulic powerplant, or hand operated pump that powers several interchangeable tools through hoses with quick disconnect fittings. The powerplant can run two tools at once. The brand we use is Amkus and the tool may be referred to by that name.

Hydraulic Powered Spreaders

The spreaders will open to about 32 inches exerting a maximum force of 16,950 lbs. They have a wide variety of applications and can be used to push or, when used with the chain set attached to the tips, to pull. Some common uses are prying open vehicle doors, lifting heavy objects or the dash assembly / steering wheel of a vehicle.

Hydraulic Powered Ram

The Rams come in various lengths from 20" to 60", the most common size measures 40" fully extended. Screw on extensions are available that add 10" to the piston length. They have a capacity of 30,650 lbs. pushing and apply 14,400 lbs. when pulling. The same chain set used for the spreaders can be fitted on the ends of the ram, making it an effective pulling tool. Potential uses include, lifting heavy objects, pushing the dash of an auto, setting shoring and pulling objects.

Advantages-

- Significant power with little personnel required.
- Provides quick, effective force where it needs to be applied.

Disadvantages-

- Requires trained, proficient personnel to operate it safely and effectively.
- Limited by length of supply hose to powerplant.
- Operation of gas powered powerplant is noisy and can provide an ignition source.

3. AIR BAGS

Another effective tool for lifting and spreading operations are air bags. High-pressure pillow type air bags are currently available on Ladder Companies. These have a maximum lift height of 13" and a capacity of 32 tons. Many sizes and shapes of bags are available, the largest bags lift up to 72 tons. Using these air bags present some unique hazards. As the bag is inflated it changes it shape from a flat bladder to a pillow shape. The more it is inflated the more pronounced the pillow shape and the smaller the area in contact with the load. This reduces the stability and lifting capacity of the bag. The hazard of an unstable load, a slipping bag or a potential bag failure can be minimized by proper load management and cribbing techniques. Be proactive, **lift an inch, crib an inch**. Anticipate potential problems and operate within the limits of your training and equipment.

CAUTION
Loads become less stable as the bag inflates.

Operation of the bag systems is not difficult but should be carefully coordinated to reduce hazards. The regulator is hooked to the air source and set for 136 psi. A hose is hooked from the regulator to a deadman controller. The dead man allows the operator to inflate or deflate up to two bags simultaneously. The inflate or deflate button must be depressed to operate the bag, once the button is released the system is static. A hose and relief valve connect the deadman to the bag. The maximum bag pressure is 118 psi. To help ensure a safe controlled evolution some key positions need to be filled.

TEAM LEADER-	Coordinates entire lifting operation, responsible for implementation of extrication strategy. Usually filled by the Company Officer.
CONTROLLER-	Operates deadman to inflate and deflate air bags under the direction of the team leader.
TEAM SAFETY-	Monitors operation for potential unsafe conditions
CRIBBER(S)-	Personnel who actually manage the load by manipulating cribbing and air bags.

While it requires the direction of the team leader to move the load, any member of the team can call *"Stop"* to halt movement of the load if a problem is discovered. The Team Leader will respond with *"Why Stop"* to reinforce the stop, identify the problem and initiate corrective action.

Some ***operational points*** to consider.

- Although the manufacturer allows two of these bags to be stacked, it shall be the practice in our operation never to do this. If you need to get the bag closer to the load, crib up to it.

- When cribbing under an air bag ensure there is a complete layer of cribbing supporting the entire bottom of the bag.

- Use plywood panels to protect bags for punctures.

- Ensure that at least 80% of the bag is under the load to minimize the chances of the bag slipping out.

- Maximum rated capacity is obtained by a 1" lift at the center of the bag

Advantages-
- Effective at lifting large heavy loads.
- Requires small insertion space.
- Quick setup time.

Disadvantages-
- Can be unstable.
- Requires air source for operation
- Requires a trained, proficient crew for safe effective operation.
- Requires relatively large foot print for safe lift.

3. CUTTING TOOLS

Cutting operations are often required in vehicle and machinery extrications. In many cases it is easier to remove the vehicle or machinery from around the patient than to remove the patient from the vehicle or machinery. Cutting tools play and integral role in this type of extrication strategy. These types of tools also present their own set of hazards when used in these types of situations. Care must be taken to anticipate how the loads involved may shift when pieces are cut away, in addition these machines can severely injure personnel who are not adequately protected. Operators must think ahead and anticipate how their actions will affect the rescue environment and the people in that environment.

A good example of using cutting operations as part of an extrication strategy is the removal of the roof of an auto involved in a wreck. This often provides quick unlimited access to the trapped victims as well as a path for removal that requires little manipulation of the patient. The tactics used to accomplish this goal can involve one or more cutting tools to separate the roof from the rest of the vehicle.

ROTARY RESCUE SAW

Advantages
- This is a good way to cut a lot of metal quickly.
- Can also be fitted with blades that are capable of cutting stone and masonry.
- It is powered by a two-stroke gas motor and spins at about 5500 rpm..
- Works well on large open areas.

Disadvantages
- This saw is very loud and produces a lot of sparks when cutting metal.
- It should not be used in close quarters, in close proximity to a patient or in flammable atmospheres.

CAUTION

Always use appropriate blade for the type of material cut.

Some general ***safety rules*** when using this tool

- When cutting, the saw will develop a lot of sparks and dust. Be sure those in the vicinity are properly protected, including the patient
- Do not use damaged, or oil soaked blades. Pay particular attention to chips or cracks in blade.
- The saw operation is a potential ignition source, protect against possible ignition of nearby combustibles and flammable. A precautionary line may be necessary
- This saw can quickly cut you and cause great personal injury, be aware of the blade location at all times
- Always ensure that the rated speed of the saw does not exceed the rated speed of the blades.

ELECTRIC RECIPROCATING SAW

Advantages-
- Rapidly cuts a variety of lightweight materials, is easy to use and quick to set up.

Disadvantages-
- Dependent on its power source and length of cord available.
- It is easy to break or bend blades if not used correctly and is slow when cutting heavier gauge materials.

Some ***safety considerations*** when operating this equipment

- Appropriate eye, ear and hand protection should always be worn.
- Edge protection should be used to protect rescuers and patients from sharp or jagged edges after cuts are made.
- Be aware of possible kickback if blade jams.

HYDRAULIC POWERED CUTTER (Amkus)

Advantages-
- Significant power with minimal personnel required.
- Provides quick, effective force where it needs to be applied.

Disadvantages-
- Requires trained, proficient personnel to operate it safely and effectively.
- Dependent on hydraulic power plant and length of supply line.
- Can be cumbersome and awkward to work with.

Some ***safety considerations*** when operating this equipment

- Use proper protective gear
- Be aware of the force exerted by the tool and the repercussions of that force.

PNEUMATIC (Air) CHISEL

Advantages-
- Easy to operate, maneuverable,
- Light weight and portable.
- It rapidly cuts sheet metal and has a variety of cutting bits.

Disadvantages-
- It rapidly goes through a 30 min. SCBA bottle and is limited to air supply on hand.
- Very loud
- Leaves a sharp edge after cuts
- Generally limited to light gauge materials.

Some ***safety considerations*** when operating this equipment

- Use proper protective gear and edge protection where necessary.
- Be aware of the proper operating pressure for the tool and be sure the regulator is adjusted accordingly.

ACKNOWLEDGMENTS

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APPENDIX A

Supplemental Restraint Systems ("SRS" or "Air Bags")

- **Vehicles involved in accidents that have undeployed SRS present a serious hazard to responders and occupants.**

Construction And Operation

A SRS is composed of four major components. Impact Sensors, Inflator Module, Bag Assembly and Diagnostics Module. The location of these components can vary with vehicle design.

There are two methods of actuating a SRS. The first and the most prevalent uses an electrical signal generated by the Impact Sensor to actuate the Inflator Module and inflate the bag. All front and rear impact SRS use this type of actuation. In this configuration the Bag Assembly is located in the dashboard or hub of the steering wheel. The Impact Sensors are sensitive to rapid deceleration along the long (front to back) axis of the vehicle. The angle and magnitude of impact that will deploy these systems varies between vehicle makes. All these systems require electrical energy to deploy the bag, This power is usually supplied by the vehicle's electrical system. Some systems have their own back-up system that will keep the system armed from several seconds up to several minutes after the main electrical source is disconnected. The second actuation method is mechanical and is found exclusively on side impact systems. Side impact SRS sense lateral (sideways) force to inflate a bag stored in the door panel or the outside edge of the seat. However, not all side impact SRS are mechanically activated, some use a system similar to the front / rear impact configuration. Mechanically activated systems need no electrical support and are always armed until deployed. It is possible to have mechanically activated side impact SRS on a vehicle with electrically operated front / rear impact airbags. The rescuer must be aware that both types of systems can be present on the same vehicle.

Hazards

Undeployed SRS possess a potential to injure rescuers and victims in an extrication scenario. Anything in the path of the deploying air bag can be propelled at speeds up to 200 mph. This includes tools, medical equipment and parts of the human anatomy.

The fine light colored powder associated with a deployed airbag is a talc used to keep the bag from sticking together when deploying. It is a mild irritant and can

cause complications, during an extrication, that will range from burns to the patient to respiratory problems for asthmatics.

The inflation module itself is completely self contained, The volatile Sodium Azide propellant is not normally accessible, until the bag is deployed and then the possibility of the propellant causing burns to the patient exists.

Risk Reduction

There is no way to completely assure that an undeployed airbag will not inflate unexpectedly. the best defense is to expect the unexpected. Keep tools, equipment and personnel out of the inflation path of the airbag. Disabling the vehicle's electrical system as early as possible can significantly reduce the risk of undesired deployment of an electrically operated SRS. This means gaining access to the battery and disconnecting it. The rescuer must be aware that some of these systems contain residual power and will remain armed after the battery is disconnected. Some systems will be completely de-energized in a few seconds, some systems take several minutes, **there is no reliable way of determining if the system is totally de-energized.** Therefore it is most important that the battery be disconnected as soon as possible to minimize risk of accidental deployment. Rescuers need to be aware that static electricity has caused undeployed airbags to deploy, so utmost caution should be used when confronted with an undeployed airbag during any situation that could cause further injury to the patient or to the rescuer. A mechanically activated SRS can not be disarmed in the field.

The airbags will also deploy if involved in a fire and the actuator temperature reaches 300-350 degrees. Care should be taken during car fire operations to cool the actuator (usually in the vicinity of the bag). Automobiles that use struts to hold the hood or trunk are also in danger of having those struts explode during times of high temperature exposure, and have caused severe injury to rescuers.

APPENDIX B
Mechanical and Electrical Lock Out

At any rescue site involving electrical or mechanical equipment that is powered by an external energy source, the de-energization of the system should be of prime consideration.

By conferring with a knowledgeable person at the site the rescuer can get reliable information regarding the energy source of a particular piece of equipment. While the rescue/ extrication is taking place a SFD posted guard, with a radio, at the energy source is an acceptable level of lock out. This guard is relieved of duty only upon a face to face relief by a SFD representative and a radio or face to face confirmation with the Rescue Group leader. While the SFD is involved at a rescue incident, the SFD will maintain control of the power sources affecting the incident.

APPENDIX C
Shifting loads

When the need for lifting or moving an object that is restraining or trapping a person, consideration should be given to what will happen to the load as the weight and balance points are shifted. **Cribbing is our best tool to stabilize the shifting load problem**. A protective bed of cribbing should be set around the patient, this will prevent the accidental shifting of the load to further complicate the problem. Before and during load movement, the rescuer needs to be aware of how the balance point of the object will shift and place cribbing and wedges to prevent the unwanted movement. Tools that are used to move and lift: Airbags, Bars, Jacks, Hydraulic tools, etc. should not be considered as stabilizing objects and will be backed up by cribbing and wedges.

APPENDIX D
Engulfment Hazards

When the physical properties of a material that is trapping or endangering a victim is movable and free flowing in its consistency the rescuer must anticipate the potential for the problem to escalate. Movement of material could bury a victim further, or trap a would be rescuer. Provisions must be made to prevent this unexpected occurrence. **All rescuers entering an area containing such material will wear a tag line.**

APPENDIX E
Traffic Hazards

At incidents involving vehicle traffic that could interfere with the rescue, every effort should be made to protect the rescuers, the victims and the incident scene from complications due to reckless or inattentive drivers.

When responding to the incident, the driver and officer must pre-plan their parking in advance of arrival to maximize the protection the apparatus will give to a rescue incident. By parking the apparatus at an angle, taking up the lanes needed to block or slow approaching traffic, the driver can provide the most effective tool for scene safety. Consideration should be given for the laying of lines, water access, spill control, aerial placement, arriving fire units and additional needed resources. After the vehicle is parked the drivers use of traffic cones will assist in funneling traffic away from the scene.

APPENDIX F
Weather Hazards

At all rescue incidents, particularly extended duration incidents, the rescue group leader needs to consider how weather and temperature ranges will affect rescuers and victims. Rapid changes in temperature can have profound impacts on a rescue incident. Unprotected or exposed victims can rapidly deteriorate. Rescuers who are wet or exposed to wind chill factors can cease to be effective. Protection of victims and rotation of personnel can help reduce the problem.

Increased wind and rain can make vehicle accidents more dangerous, as drivers have their vision impaired, this possibility should be considered at all rescue incidents.

In adverse situations with temperature extremes to consider, calling an additional resource such as: Metro- for heated buses can be of benefit to all personnel involved at the rescue incident.

APPENDIX G
Railroad Milepost References for Seattle Area & Emergency Phone #'s for Railroad Incidents

	MILEPOST
S. Boeing Access Rd.	6.91
Military Rd. S	5.24
S. Alboro St.	3.79
S. Corson St.	3.69
S. Corson St. Off Ramp	3.37
S. Lucile St.	3.33
Airport Way. S.	3.10
4 Ave. S.	2.58
S. Spokane St.	1.86
S. Lander St.	1.28
S. Royal Brougham Way.	0.42
King Street Station	0
South Portal to Tunnel	0.15
North Portal to Tunnel	1.11
Lenora St.	1.23
Battery St.	1.46
Wall St.	1.51
Vine St.	1.57
Clay St.	1.68
W. Galer St.	3.26
W. Garfield St.	3.42
W. Dravus St.	4.52
Interbay	4.90
W. Emerson St.	5.14
W. James St./26 Ave. W.	4.45
33 Ave. W. Footbridge	5.96
Drawbridge	6.20
Ballard	6.40
N.W. 57 St.	6.58
Seaview Ave. N.W.	7.91
N.W. 195 St.	13.86
Richmond Beach	14.00

R.R. Dispatcher	Emergency
Amtrack	1-800-424-0217
Burlington	1-800-832-5452
Union Pacific	1-800-299-3483