

Chapter IV.

EMERGENCY RESPONSE

A. INTRODUCTION

In today's emergency response environment you can no longer assume that all vehicles are built and powered like one another. Some alternative vehicles have a distinctive design while others are incorporated into well known and existing ICE vehicle bodies. New vehicle construction techniques and new fuels and energy sources on the vehicles of today, and tomorrow, require that emergency responders maintain an extra measure of vigilance when approaching the scene of an emergency.

B. ALT-FUEL VEHICLE EMERGENCIES

Emergency response personnel along with incident commanders must recognize the special hazards involved during incidents with Alt-Fuel Vehicles. NFPA 1670 outlines the steps needed for departments to prepare for safe and effective operations at incidents involving vehicles of all types. For emergency responders to make appropriate decisions regarding fire control and extrication operations, standard operating guidelines must include steps to identify the vehicle type and energy source early in the incident.

This would include identifying the alternative fuel vehicle type using the vehicles stickers, placards, emblems, badging along with the vehicle style. Positive vehicle identification will provide incident commanders with the critical information on the potential hazards of the emergency. Hybrid vehicle identification reveals that an internal combustion engine is used in combination with an electric motor and high voltage battery pack. Dual fuel, bi-fuel, or flex fuel vehicles reveal that your crew will need to mitigate a combination of gasoline/natural gas or diesel/propane or any combination of fuels. Electric, suggests that you have the potential for mitigating electric/hydrogen and potentially photovoltaic energy.

Hybrid vehicle identification, for example reveals that an internal combustion engine is used in combination with an electric motor and high voltage battery pack. Dual fuel, bi-fuel, or flex fuel vehicles reveal that your crew will need to mitigate a combination of gasoline/natural gas or diesel/propane or any combination of fuels. Electric, suggests that you have the potential for mitigating electric/hydrogen and potentially photovoltaic energy.



Formal Training in all facets of vehicle response, that also include information regarding alternative fuels, will insure scene, victim, and personnel safety.

Will you need to mitigate liquid fuels such as gasoline, ethanol, diesel or bio diesel? Chances are the only change to current operations regarding liquid fuels is the use of AR-AFFF on ethanol blended fuels. Protocol for controlling, containing and cleaning or recovering these fuels will remain unchanged.

Or, will you be mitigating a gaseous fuel such as Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), Propane (LPG) or Hydrogen or Liquid Hydrogen? In each case inertia switches should have isolated the fuel to the cylinder. If the pressure in the storage cylinder expands, the pressure relief valve will release its contents to the atmosphere. The question for emergency responders is whether or not all potential ignition sources can be removed from the area to avoid the released gases from igniting. If the gases have ignited, then protecting exposures and allowing the fuel to burn off is the best tactic when safe to do so.

When all this information is collected and processed then you have the basis for making decisions regarding the fuel systems in terms of what you know:

- ❖ All Alt-Fuel Vehicles have one or more fuel/energy storage containers onboard.
- ❖ Common locations are within the trunk, bed of a pick-up, inside a van, or below the undercarriage.
- ❖ Pressures vary from 2,500 psi and may be up to 10,000 psi.
- ❖ Container may be plastic, steel, aluminum, carbon wrap, fiberglass wrap or other composite material.
- ❖ Pressurized tanks have pressure-relief valves which from past experience have been known to fail.
- ❖ Fuel shutoff valves are provided on high-pressure systems in the form of a manual screw valve or ¼ turn Hoke Valve. They are usually on or close to the storage container.

With all this information and data the next priority is to mitigate a fuel leak or compromised battery using once again the standard operating guidelines. All of these operations are considered as high-risk operations in which all appropriate PPE shall be used:

- ❖ In the event the shutoff valve cannot be reached a hose line can be used to disperse vapors away from the patient(s).
- ❖ Liquid tanks may be plugged or the fluid may be captured
- ❖ Pressure tanks need to be turned off or have a line pinched to control a leak
- ❖ Recognize Battery Pack Hazards
 - a) 12 volts systems—corrosive acid present

- b) 24 volt systems—corrosive acid/base present
- c) High Voltage—May exceed 300 volts & 10 amps
- d) HAZMAT—exotic battery chemistries and off gassing of toxic fumes

C. ALT-FUEL VEHICLE FIRES

In most cases fires in alternative-fuel vehicles can be dealt with using conventional vehicle firefighting tactics. However, emergency responders must recognize that vehicle fires, regardless of fuel type, produce substantial amounts of toxic products in a very small space. They also present multiple other threats including:

- ❖ Pressurized Tanks—BLEVE (Boiling Liquid Expanding Vapor Explosion)
- ❖ Liquid Fuel Leaks—Fuel may build on ground around responders then ignite
- ❖ Gaseous Fuel Leaks—May add to fire intensity
- ❖ Electric Vehicles—High voltage hazards
- ❖ Air bags and other Supplemental Restraint System components—Air bags, particularly those mounted in steering wheels and dashboards, have been known to explode during vehicle fires and propel debris and flaming material great distances from the vehicle
- ❖ Compression bumpers—Compression struts on bumpers can explode sending the bumper several feet away from the vehicle
- ❖ Hood & Tailgate Struts—Gas struts, commonly used to hold open hoods and tailgates, can explode and launch the strut a great distance
- ❖ Standard transmission vehicles—shorting of wiring may cause vehicle starter to engage. If vehicle is in gear it may roll forward or back as engine turns over.
- ❖ Drivelines—Vehicle driveline may overheat, explode, and launch shrapnel like a pipe bomb
- ❖ Brake pots—Brake pots on commercial vehicles may melt releasing the coil brake spring. The spring may be propelled great distances, typically to the rear of the vehicle.



Like ICE vehicles, emergencies involving alternative fuel vehicles can take place in areas where they are stored, fueled, and maintained.



Consider that many of the fuels are delivered in tanker trucks and trains. It is not uncommon for these tanker vehicles to be involved in an emergency.

—Courtesy of Mike Waldron

Due to intensive training by the Department of Homeland Security, law enforcement is fully participating within the Incident Management System.



Vehicle emergencies involve the collaboration of law enforcement, fire and EMS.

- ❖ Falling loads—Tie down straps on loads may melt and suddenly release the load.
- ❖ Unknown Cargo—Trunks, Trailers and Storage areas may contain hazardous cargo

When approaching fires in alt-fuel vehicles, responders should use their conventional response guidelines. Some of the updated guidelines that pertain to both conventional vehicles as well as alt-fuel vehicles should include the following:

- ❖ Park apparatus approximately 100 feet away from fire
- ❖ Approach from Upwind & Uphill
- ❖ 1 ¾ inch lines should be used as the minimum size attack line
- ❖ Approach all vehicles at a 45 degree angle to the vehicle
- ❖ Do not approach the vehicle until the hose line is fully charged
- ❖ Use a sweeping motion from bumper to bumper to cool fuel tanks and other explosion hazards
- ❖ For unvented heavy interior fires, do not open doors until one or more windows are removed (use pike pole, etc.) and fire is knocked down
- ❖ Complete fire extinguishment with the least amount of firefighters so as not to expose more than necessary

D. EXTRICATION SAFETY AND ORGANIZATION

Beyond the recognized challenges presented by alternative vehicles, the vehicle itself is like most others on the road today. That is not to say that the vehicles on the road today do not already present their own unique hazards and challenges—they certainly do! This section provides a review of such considerations and the management practices that should be employed at all vehicle emergencies for effective scene management and scene safety.

The State Highway Patrol or local law enforcement have jurisdiction with regards to vehicle emergencies on the roadway. Due to intensive training by the Department of Homeland Security, law enforcement is fully participating within the Incident Management System. Fire Department or EMS agencies may be in charge of the emergency if they arrive first to the scene of the emergency, but the scene is turned over to law enforcement upon their arrival. Fire and EMS agencies then fall into the Operations Section of the Incident Management System.

The command structure can include law enforcement, investigation, traffic control, coroner, EMS, triage, treatment, transport, fire, fire

control, rescue, HazMat, plus other duties not taken on by law enforcement. For communication purposes it is important to use appropriate ICS titles for your positions, where law enforcement is Incident Command and fire and EMS is relegated to Operations or Branch ICS levels. It is important before the emergency to get involved in what the local emergency response plans are for your community. Most jurisdictions have written plans, interagency agreements and mass casualty protocols that affect highway incident management in their area. Get familiar with these issues as part of your local orientation and training.

The Extrication Team

Unlike Wildland or Structural fires, fire departments typically send a very limited number of resources on the first alarm to vehicle collision incidents. When a collision involves entrapment or a “pin-in”, resources can become depleted very rapidly.

The strength of successful extrication operations is dependent on having sufficient resources to fill a minimum of ten “Extrication Team” positions as described below. Multiple “pin-ins”, particularly if in multiple vehicles, may require multiple teams. For this reason it is important to conduct an effective scene assessment and order additional resources as necessary to fill these Extrication Team positions:

Team Leader

In early stages of the incident may also perform as Operations Section Chief, Fire/Rescue Branch Director or even the Incident Commander and will perform other team roles until all other positions are staffed.

Safety Officer

In the early stages of the rescue may also be Team Leader, or positions discussed above. This individual should separate from Incident Command/Team Leader as soon as possible. The Team Leader may perform as Safety Officer until the position is staffed.

Nozzle Person

The Nozzle Person position is critical to the incident. Nozzle Persons must remain at the nozzle and NOT be assigned other tasks, including the overall role of Safety Officer. They must fill only this position. On larger incidents multiple hose lines and Nozzle Persons may need to be deployed. To avoid injuring rescuers with hose streams, to avoid forcing burning flammable liquids to spread under or around vehicles and to allow for the best overall scene coverage, it is imperative that all nozzles be positioned well away from where rescuers are working. Rescuers can be best protected if nozzles are positioned at least 25 ft. away.



A charged line and nozzle person stand ready 25 ft. from the rescue operation.



The most experienced tool operator should be used for live rescues.



The operator back-up doesn't watch the tool, but the victim and the tool operator.



The Tool Staging Manager keeps tools and equipment organized and accessible to the rescue operation



Team Assistants are valuable assets for fetching tools and equipment assisting EMS personnel or the rescue team when required.

In the event that fire erupts, the first priority of the Nozzle Person is to immediately apply water in a fog pattern over the rescue site to allow rescuers to escape, similar to the way airport firefighters apply water over the aircraft as they make their initial approach. Once rescuers have retreated to safety, the Nozzle Persons may then safely switch to a direct attack mode and move in to quell the fire without fear of pushing the fire onto rescuers or injuring them with hose streams.

Tool Operator

The Team Leader should use the most experienced tool operator for live rescues. Allow less experienced persons to run tools or work on body recoveries. This is a high stress and physically demanding position. Rotation should be allowed between Operator and the Back-up Operator frequently.

Operator-Back-up person

The Operator-Backup person may be the Team Leader or Safety Officer in the early stages of the emergency. They serve as the immediate safety back-up for tool operator and victim(s) watching the victim and remainder of vehicle for reaction, while operator focuses on tool contact. Importantly, the Operator Back-up person does not watch the tool itself!

Personnel/Tool Staging Manager

In early stages of the emergency the Tool Staging Manager can be performed as a dual role for Team Leader or Safety Officer. The Tool Staging Manager keeps the tools and equipment organized, often times using tarps for the tool staging area. This team member oversees tool set-up and ensures tools and people return to the staging area.

Team Assistants—“Go-fers” and Tool Set-Up Person

Whenever possible it is best to strive for at least four persons to assist with tool set-up, cribbing, and traffic control. The Go-fers are an invaluable asset to any team operation in that they can assist EMS or fetch tools and equipment for the Tool Operator.

Successful extrication requires teamwork, and no member of the team is more important than another. Though a rookie firefighter may be assigned the seemingly mundane task of directing traffic at an incident, that role is critical and provides for the safety of the seasoned veteran using the JAWS to extricate a victim. Regardless of their roles, everyone on the team contributes to the team's overall success!

Again, don't underestimate your resource needs! Major incidents may require multiple extrication teams, and will tap resources rapidly. Order tools, equipment and personnel early and order enough.

Personal Protective Equipment & Safety

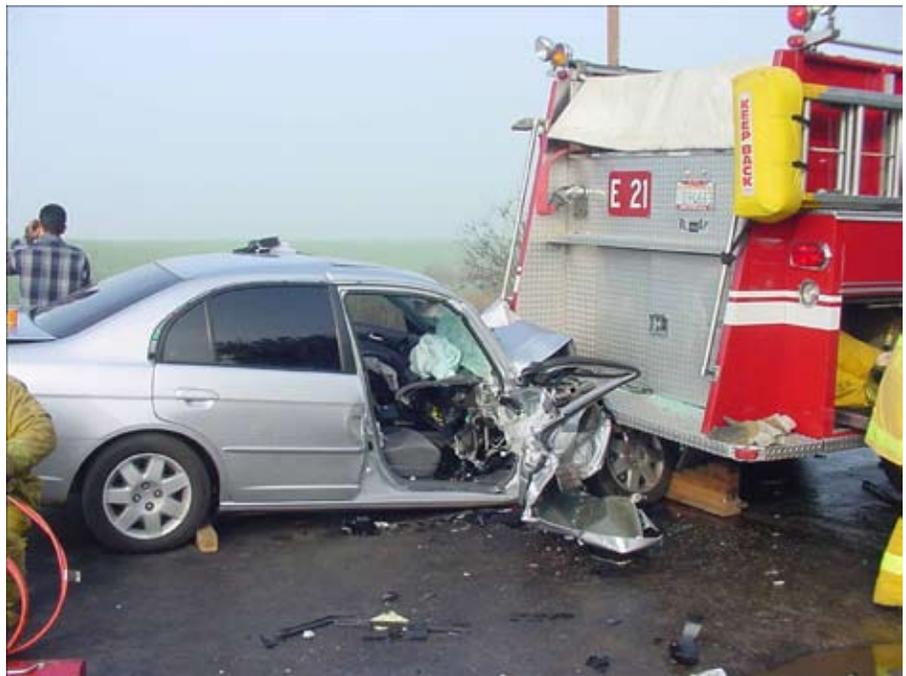
You and your team are your first priority! It is important in the emergency decision making process to keep your priorities straight beginning with the first priority—yourself, followed by your crew, the community, and the victim(s). It is imperative that you do not put priority number four, the victim, before yourself or your crew. This means that your response vehicle should be properly positioned, initial traffic controls measures started, and protective hose lines put in place, as needed, before you begin operations to treat and free victims. Past experience has shown that when you do you risk the entire operation. Your responsibility is to send your crew home to their families at the end of the shift alive and uninjured!

Taking care of your self should go without saying, but it is always important to review your own personal safety requirements. Always wear full protective clothing: Turnout pants, coat, helmet, eye protection, and leather gloves along with SCBA. If you see or smell fuel in flammable or toxic areas (as in many vehicle accidents), then do not hesitate to don your SCBA. If you haven't heard of these requirements enough in the course of your career—you can say that you've heard it once again here! Beyond personal protective equipment the following recommendations are suggested for you and your team safety:

- ❖ Dust masks and face shields are appropriate for vehicle emergencies
- ❖ Use a Personnel Accountability System
- ❖ Establish Personnel and Tool staging areas
- ❖ Rescuers must “check-in” upon arrival
- ❖ Rescuers stay in staging until assigned, return to staging when tasks are completed
- ❖ Stage out of the “Danger Zone” and clear of oncoming traffic

E. OPERATIONAL SAFETY

Remember that your second priority is to protect other emergency responders. On the initial size-up of the emergency, other hazards should be noted and communicated to other individuals and agencies on scene. They may not recognize the hazards, or have



Vehicle placement is critical to the safety of the rescue operation.

appropriate personal protective equipment and may need to back-out and away from the scene of the emergency until the situation is stabilized. In cases such as this you should use firm but polite warnings to get people to safety. These hazards could involve:



Angle your emergency vehicle to oncoming traffic to allow “bank shot away” from the work area.

Protection from Traffic

Each year many emergency workers are killed or injured when struck by on-coming traffic at the scene of a roadway emergency. While working on the roadway is always dangerous, such factors as hills, curves, darkness, heavy rain, and fog all add to the hazard. Poor visibility and other conditions can increase the danger dramatically. You must take steps to protect yourself, your crew, and other rescuers. This can be accomplished by getting traffic control assistance, using traffic control devices like road flares, cones, signs, and flag persons.

You can use your emergency vehicle as a barrier by parking emergency vehicles at a slight angle to the traffic lane. An emergency vehicle may travel less when struck at angle and offending vehicles tend to “bank shot” away from the work area. Parking at angle also makes the emergency vehicle’s stripes and lighting more visible. If using an engine as a barrier always park with pump panel facing away from oncoming traffic. Other recommendations include:

- ❖ Establish a 50 foot Danger Zone (100 feet for alternative fuel vehicles)
- ❖ The “Danger Zone” is not a parking lot! Keep it clear of Emergency Vehicles!
- ❖ Create adequate workspace – move debris/tripping hazards
- ❖ Reduce threat from fire by removing ignition sources
- ❖ Be ready for fire:
 - Pull, charge and staff one 1-3/4 inch or equivalent hose line
 - Large incidents may require multiple lines
 - Consider pulling hose lines when no “pin-in”
 - Position nozzles at least 25 ft. away
 - If fire erupts, protect people with water first
 - Apply fog streams overhead, don’t use straight streams
 - Consider having specialized fire extinguishers ready

Eliminating Ignition Sources

This text recommends in several sections to eliminate ignition sources. This is an extremely important aspect of scene management when working with all vehicles and highly recommended when working with alternative fuel vehicles as well.

Consider disconnecting battery first by weighing the fire hazard risk against the necessity you might need battery power further in the emergency. Do not cut battery cables. If you need to reconnect the battery for any reason—you cannot reconnect cut battery cables.

- ❖ Use caution when placing power units and portable generators
- ❖ Use caution when placing road flares
- ❖ Crack flare over knee before lighting to prevent rolling
- ❖ Do not spot apparatus in fuel spill areas
- ❖ Stop traffic if necessary

Stabilize Involved Vehicles

The amount of stabilization needed, if any, will be dictated by the amount of damage to the vehicle(s), ground conditions, and other factors.

- ❖ Chock at least two wheels
- ❖ Turn off ignition switch
- ❖ Put vehicle in park
- ❖ Crib body, frame, or bumper - to ground
- ❖ Simply deflating the tires, DOES NOT make the vehicle stable!
- ❖ If using “Step Cribs” insert under the vehicle at a 45 degree angle
- ❖ Use ropes, other devices as needed
- ❖ Cribbing may loosen as victims or vehicle parts are removed.

Downed Power Lines

When conducting a scene assessment look-up and around for electrical power lines. If power lines are down do not approach until power is confirmed to be shut-off.

Caution and common sense are the watch words when working or parking around damaged lines or poles. Realize that damage at one location may drop lines in another location out of immediate view. Downed power lines across fences may become energized and pose an even greater shock hazard. Always provide barriers to prevent contact. Rely on electrical professionals for moving downed lines safely. If not already



Stabilizing the vehicle is essential to safe rescue operations.



Realize that a damaged power line or pole may drop power lines at another location out of immediate view.

incorporated into your Standard Operating Guidelines add these policies:

1. Immediately notify Dispatcher! Do not just say "Lines Down," give specific location: "East side of the building, laying across driveway," or "On north shoulder of roadway, 100 ft. west of Engine 21," and "In tree, at southeast corner of the garage." Provide the name of utility company when possible. Dispatch will sound alert tones, broadcast warning and all units at, or responding to, the scene must acknowledge.

2. Provide a safety person and a visible barrier such as Black and Yellow flagging a minimum of 25 ft. from wires/hazard area. Do not allow anyone to lift flagging or enter area and maintain the exclusion zone until power is confirmed off by utility company. Note: It is recommended that - in lieu of common "Fireline -Do Not Cross" flagging—every Fire Department adopt and use some form of special "Life Hazard Warning" flagging for situations such as downed power lines.

Additional Hazards

Like power lines, working in, on or around railroad tracks is another potential hazard at the scene of an emergency. If you are operating on, or close to, rail road tracks your list of

priorities has just been expanded. If you are not able to IMMEDIATELY move victims off of the tracks you should:

- 1. Immediately get a flare or fusee onto the tracks at least one mile in each direction. Leave a person near the tracks at the flare/fusee to serve as a lookout and be seen by the train engineer.*
- 2. Notify dispatch to call the railroad to inform them of the emergency.*

Remember a train may already be too close for railroad dispatch to warn in time and it takes a while to slow or stop a train, so getting someone with a flare or fusee down the tracks a mile is a priority.

Hazardous materials pose another potential hazard. Scene size-up should also include identifying placards, insignia, badging, and other identifying markings. With the growing number of alternative vehicles on the road consider the vehicle type. Look around the vehicle for liquid, powder, solids or gas releases. Listen for the sound of gas releasing into the atmosphere. If you smell rotten eggs, the suspect vapor cloud could either be natural gas or propane. Do you observe people running away from the emergency? It is important to isolate the scene, identify the suspect substances and deny entry!

F. SPECIAL THREATS IN NEWER VEHICLES

Late model vehicles, regardless of fuel type, contain special hazards that all emergency responders should be aware of. Many of the new innovations designed to protect vehicle occupants in a collision, make it more difficult, and more hazardous for emergency responders to conduct rescue work following a collision. Some of the more common hazards are outlined below, but it is critical that emergency responders recognize that these hazards are changing and growing all the time, and they must take steps to stay informed about “what’s new”.

There are numerous emergency services related websites, magazines and other sources that provide regular updates on changes to vehicle technology. Regular visits to automotive dealer showrooms or vehicle manufacturing facilities also provide great opportunities for emergency responders to see the latest technologies, ask questions and become better prepared to respond to emergencies involving newer vehicles.

Here is some general information about several hazards that are common to many newer vehicles:

❖ Compression Bumpers

Late model vehicles frequently have bumpers that are made of lightweight materials that melt or burn away when subjected to substantial fire. These bumpers are mounted to large gas or liquid filled struts that compress in a very low speed collision and minimize vehicle damage. When subjected to fire, and particularly after the bumper has melted or burned away, these struts can explode and rocket large pieces of the strut, and any remaining portion of the bumper for a great distance away from the front or rear of the vehicle. These have caused serious injuries to emergency responders. To reduce risk of injury when heavy fire involves the front or rear of the vehicle always apply large volumes of water, wear full PPE and approach the vehicle from the side.

❖ 12 Volt Battery

You can never assume you’ll find the battery under the hood of the



Even small hood struts like the one shown can violently and unexpectedly explode during a fire sending an arrow like projectile through the air.

vehicle! The 12 volt battery maybe relocated to another location like the wheel well, under the rear seat, in the trunk, or under the rear cargo area floor. Several late model vehicles also have two or more 12 volt batteries, mounted in different locations. If available, the vehicle “Owners Manual” can assist in identifying battery locations.

- ❖ **Suspension Systems**

The air cushion common on buses and truck trailers is also a potential hazard and can fail. You can find hydraulic/air suspension systems on upscale passenger vehicles or modified show vehicles. Personnel should never get underneath a vehicle unless the vehicle has been cribbed and stabilized as it may drop suddenly and without warning. These components also react explosively during a fire.

- ❖ **Passive Roll Bar System**

Optional on newer convertibles, passive roll bar systems deploy when a vehicle rolls-over and/or when airbags deploy. There are several types of mechanisms; Hydraulic System, Mechanical System and Pyrotechnic System. Some of these can be raised while driving through a switch on the dashboard. The roll-bar is mounted immediately behind front and/or rear seats. The potential risk is that some models can deploy suddenly during a rescue. Rescue personnel should always avoid the deployment zones of the roll bar system.

- ❖ **Supplemental Restraint Systems**

When developing passenger safety systems for vehicle occupants, the Supplemental Restraint Systems (SRS) technologies have proven a challenge and a hazard for emergency personnel who are not prepared to mitigate them. SRS include seat belt pretensioners and airbags:

- ❖ **Seat Belt Pretensioners**

Seat belt pretensioners activate in a collision to tighten seat belts of front and/or rear seat occupants to keep proper airbag distance, and/or keep the occupants head in vehicle. These generally activate with the front airbags. The pretension devices can be found on seat belt buckle or incorporated into retractor at the pillar or inside seat. Depending on vehicle make and model, the sensor that activates the device may be in A, B or C pillar, door or elsewhere in the vehicle. The caution here is that some use a pyrotechnic device and some are mechanical. Importantly, like airbags they could be deployed after the accident.

- ❖ **Airbags**

Airbags can explode during fire sending pieces rocketing through windows or the roof. It is advisable to cool the interior of the vehicle before approaching. Typical airbag activation components include the deceleration and impact sensors along with the SRS control module.



Personnel must be aware if all hydraulic and pneumatic systems on all types of vehicles including the hydraulics used in mass transit vehicles that “kneel” to allow access for handicapped customers.

Most airbags are constructed of heavy nylon and inflate by an explosion of Sodium Azide that fills bag with nitrogen gas. Many newer systems use compressed gas cylinders and various inert gases. The bags are packed in talcum powder to act as a lubricant. When a bag deploys it may appear to look like a HAZ-MAT emergency in progress. These airbags are often hidden in the steering wheel, dashboard, upholstery, and can deploy from the roof or pillars of the vehicle.

The chemical propellant used in most airbags is Sodium Azide. This chemical is more toxic than Cyanide and if a few grams are ingested it can be fatal. Obviously this poses an inhalation hazard, and the chemical can also be easily absorbed through skin. When it is wet or heated it can ignite violently! When water is applied the combination can create a very explosive acid. Damaging airbag components should be avoided at all costs. An Internet search for "Sodium Azide" will provide numerous links to some interesting and important information about this chemical.

When an airbag deploys only trace amounts of Sodium Azide should remain. It is advisable to ventilate the vehicle upon arrival. The gas can cause respiratory distress in some people and the talcum powder residue found in the vehicle can be irritating to the skin and respiratory system. Dust masks and eye protection should be part of your own personal protective equipment.

Be aware that crushing or damaging the SRS Control Modules may result in activation of all SRS devices in the vehicle simultaneously. It is advisable to check for and avoid control modules which can be located under seats, in the console, or kick panels.

Other airbag systems include:

- ❖ Head Protection System (HPS) also known as Inflatable Tubular Structure (ITS)
- ❖ Inflatable Curtain Systems
- ❖ Knee/Leg bolster systems
- ❖ Some are located across bottom of dash or under steering column
- ❖ Some built into front edge of seat
- ❖ And under carpet systems to lift feet off floor and protect knees from dashboard
- ❖ The near future might include Exterior "Pedestrian Protection Bags"
- ❖ Newer steering wheel/dashboard airbags may be designed to deploy twice.

All of these airbags may be left un-deployed even after severe collisions. The newer systems select which airbags to deploy based on many factors like:



Air bags are hidden in the steering wheel, dashboard, upholstery, and can deploy from the roof or pillars of the vehicle.

- ❖ Weight on seat
- ❖ Seatbelt buckled
- ❖ Distance from Airbag
- ❖ Child Safety Switch
- ❖ Force of Collision
- ❖ Angle of Collision

Rescuers cannot completely disable airbags or pretensioners. There is no standardization of SRS wiring, although SRS wiring and connectors in newer vehicles are typically yellow in color. It is important to recognize that it may not be possible to access and disconnect a vehicles 12 volt battery system. As such extreme caution must be used when rescue efforts commence. It is also worth remembering that even if the 12 volt battery is disconnected, there may be another someplace in the vehicle, and there may also be devices in the vehicle that have small lithium type batteries for storing device settings and so forth. There is always a potential that when cutting wiring or performing other recue work that wires can become crossed and power from other sources may find its way to a SRS component. Cutting, pushing, pulling, friction and static may all result in SRS deployment. It is essential that rescuers make



Tools common to the auto-extrication experts include (l-r) air chisel, a variety of hand tools, jaws kit, cribbing materials, high pressure and low pressure air bags, and sawzall.

every effort to avoid performing these tasks until all rescuers are clear of potential SRS deployment zones. If at all possible, rescuers, including ambulance personnel, should get out of the vehicle and away from SRS components while work is being done on the vehicle.

The use of airbag restraint devices is not recommended by NFPA and others. The best protection is to avoid accidental activation by being cautious of cutting or displacing areas that may contain Airbag components:

- ❖ Steering wheels and columns
- ❖ Dashboards
- ❖ Cushions on seat backs
- ❖ Interior door panels
- ❖ Under seats and in consoles
- ❖ Lower middle and back corner of doors
- ❖ Above base of “A” & “B” pillars: Common location for SRS modules, pretensioners, etc.

This list appears to be all the areas that you would hope that you could use to cut, pull or pry. Which is, again, why you should not cut, push or pull until all rescuers and EMS personnel are clear of the airbag deployment areas. Rescue personnel should not be in the vehicle during active cutting, pushing, and pulling.

Accident victims can be protected by tilting the steering wheel up, moving the seat backwards, reclining the seat, all while rescuers are aware of hidden airbag locations and expecting a sudden airbag deployment. Applying the 10 and 18 rule, by staying 10 inches away from any undeployed steering wheel, door or seat mounted airbag and 18 inches away from any undeployed dashboard or roof rail mounted airbag will provide a measure of safety for rescue personnel.

Rescue personnel have developed the “peel and peek” protocol to expose what is underneath the pillars. By peeling back the decorative finish on the vehicles interior of the pillars and roof edges, you can expose the hidden dangers inherent in airbags, seatbelt pretentioners, and other seat belt components and avoid cutting through them. But before you cut a pillar it is advisable to consider whether the intact pillar will be needed as an anchor point for pushing or pulling at some other phase of your operation.

Applying the 10 and 18 rule, by staying 10 inches away from any undeployed steering wheel, door or seat mounted airbag and 18 inches away from any undeployed dashboard or roof rail mounted airbag will provide a measure of safety for rescue personnel.

CONCLUSION

What will we be using as transportation 20 to 30 years from now and what fuel/energy source will emerge as the dominant choice is unpredictable. There should be no doubt that the next decade will bring about significant changes to the vehicles we see on the road today. The expressed purpose of this text is to prepare you for this uncertain future by providing you with the wide range of available information regarding these new vehicle technologies.

The fact that the public is provided with a range of alternative fuel/energy vehicles will certainly impact each individual vehicle emergency. But the strength of our Standard Operating Guidelines is that they are written in a way that takes into account changes to the emergency response environment. When you analyze the variety of fuels, ethanol, biodiesel, natural gas, propane and hydrogen along with the voltages in electric, hybrid electric and fuel cell vehicles you discover that there is really nothing new here for emergency responders, just new applications of the hazards that we've grown accustomed to mitigating throughout our careers. Knowing the potential hazards in these and all vehicles will keep you and your crew safe from harm.



A team meeting at the start of an auto-extrication class ensures a safe training environment and an understanding of assigned roles.

EMERGENCY RESPONSE GUIDEBOOK 2008 QUICK REFERENCE
 (This a quick guide for Alt- Fuel Vehicle emergencies refer to the ERG 2008 guide for more detailed information)

ID Number	Guide Number	Material	Potential Hazards	Public Safety	Emergency Response
1203	Guide 128	Gasoline	<p>FIRE OR EXPLOSION</p> <p>HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.</p> <p>Vapors may form explosive mixtures with air.</p> <p>Vapors may travel to source of ignition and flash back.</p> <p>Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).</p> <p>Vapor explosion hazard indoors, outdoors or in sewers.</p> <p>Runoff to sewer may create fire or explosion hazard.</p> <p>Containers may explode when heated.</p> <p>Many liquids are lighter than water.</p>	<p>As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.</p> <p>Keep unauthorized personnel away.</p> <p>Stay upwind.</p> <p>Keep out of low areas.</p> <p>Ventilate closed spaces before entering.</p>	<p>FIRE</p> <p>CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.</p> <p>CAUTION: For mixtures containing alcohol alcohol-resistant foam may be more effective.</p> <p>Small Fire</p> <p>Dry chemical, CO₂, water spray or regular foam.</p> <p>SPILL OR LEAK</p> <p>ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).</p> <p>All equipment used when handling the product must be grounded.</p> <p>Do not touch or walk through spilled material.</p> <p>Stop leak if you can do it without risk.</p> <p>Prevent entry into waterways, sewers, basements or confined areas.</p> <p>A vapor suppressing foam may be used to reduce vapors.</p> <p>Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.</p> <p>Use clean non-sparking tools to collect absorbed material.</p>

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3475	127	<p>Ethanol Ethanol & Gasoline mixture with more than 10% Ethanol</p>	<p>FIRE OR EXPLOSION HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks). Vapor explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard. Containers may explode when heated. Many liquids are lighter than water.</p>	<p>As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering.</p>	<p>FIRE CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient. Small Fire Dry chemical, CO₂, water spray or alcohol-resistant foam. SPILL OR LEAK ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.</p>

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1202 1993	128	Diesel	<p>FIRE OR EXPLOSION</p> <p>HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.</p> <p>Vapors may form explosive mixtures with air.</p> <p>Vapors may travel to source of ignition and flash back.</p> <p>Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).</p> <p>Vapor explosion hazard indoors, outdoors or in sewers.</p> <p>Runoff to sewer may create fire or explosion hazard.</p> <p>Containers may explode when heated.</p> <p>Many liquids are lighter than water.</p>	<p>As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.</p> <p>Keep unauthorized personnel away.</p> <p>Stay upwind.</p> <p>Keep out of low areas.</p> <p>Ventilate closed spaces before entering.</p>	<p>FIRE</p> <p>CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.</p> <p>CAUTION: For mixtures containing alcohol or polar solvent, alcohol-resistant foam may be more effective.</p> <p>Small Fire</p> <p>Dry chemical, CO2, water spray or regular foam.</p> <p>SPILL OR LEAK</p> <p>ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).</p> <p>All equipment used when handling the product must be grounded.</p> <p>Do not touch or walk through spilled material.</p> <p>Stop leak if you can do it without risk.</p> <p>Prevent entry into waterways, sewers, basements or confined areas.</p> <p>A vapor suppressing foam may be used to reduce vapors.</p> <p>Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.</p> <p>Use clean non-sparking tools to collect absorbed material.</p>

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1971	115	NATURAL GAS	EXTREMELY FLAMMABLE.	As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.	FIRE
1972	115	PROPANE	Will be easily ignited by heat, sparks or flames.	Keep unauthorized personnel away.	DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.
1075	115	HYDROGEN	Will form explosive mixtures with air.	Stay upwind.	CAUTION: Hydrogen (UN1049), and Hydrogen, refrigerated liquid (UN1966) burn with an invisible flame. Hydrogen and Methane mixture, compressed (UN2034) may burn with an invisible flame.
1049	115	Compressed and Liquefied	Vapors from liquefied gas are initially heavier than air and spread along ground. CAUTION: Hydrogen (UN1049), Hydrogen, refrigerated liquid (UN1966) and Methane (UN1971) are lighter than air and will rise. Hydrogen fires are difficult to detect since they burn with an invisible flame. Use a thermal image camera.	Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Keep out of low areas.	Small Fire Dry chemical or CO2. Fire involving Tanks Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

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ID Number	Guide Number	Material	Potential Hazards	Public Safety	Emergency Response
					<p>SPILL OR LEAK</p> <p>ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).</p> <p>All equipment used when handling the product must be grounded.</p> <p>Do not touch or walk through spilled material.</p> <p>Stop leak if you can do it without risk.</p> <p>If possible, turn leaking containers so that gas escapes rather than liquid.</p> <p>Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.</p> <p>Do not direct water at spill or source of leak.</p> <p>Prevent spreading of vapors through sewers, ventilation systems and confined areas.</p> <p>Isolate area until gas has dispersed.</p> <p>CAUTION: When in contact with refrigerated/ cryogenic liquids, many materials become brittle and are likely to break without warning.</p>

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ID Number	Guide Number	Material	Potential Hazards	Public Safety	Emergency Response
1830	137	Sulfuric Acid (Electrolyte used in Lead Acid Batteries)	<p>HEALTH</p> <p>CORROSIVE and/or TOXIC; inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns or death.</p> <p>Fire will produce irritating, corrosive and/or toxic gases.</p> <p>Reaction with water may generate much heat that will increase the concentration of fumes in the air.</p> <p>Contact with molten substance may cause severe burns to skin and eyes.</p> <p>Run off from fire control or dilution water may cause pollution.</p> <p>FIRE or EXPLOSION</p> <p>EXCEPT FOR ACETIC ANHYDRIDE (UN1715), THAT IS FLAMMABLE, some of these materials may burn, but none ignite readily.</p> <p>May ignite combustibles (wood, paper, oil, clothing, etc.).</p>	<p>As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.</p> <p>Keep unauthorized personnel away.</p> <p>Stay upwind.</p> <p>Keep out of low areas.</p> <p>Ventilate enclosed areas.</p>	<p>FIRE</p> <p>When material is not involved in fire, do not use water on material itself.</p> <p>Small Fire</p> <p>Dry chemical or CO₂.</p> <p>Move containers from fire area if you can do it without risk.</p> <p>SPILLS OR LEAKS</p> <p>Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.</p> <p>Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.</p> <p>Stop leak if you can do it without risk.</p> <p>Use water spray to reduce vapors; do not put water directly on leak, spill area or inside container.</p> <p>Keep combustibles (wood, paper, oil, etc.) away from spilled material.</p> <p>Small Spill</p> <p>Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.</p>

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			<p>Substance will react with water (some violently), releasing corrosive and/or toxic gases and runoff.</p> <p>Flammable/toxic gases may accumulate in confined areas (basement, tanks, hopper/tank cars, etc.).</p> <p>Contact with metals may evolve flammable hydrogen gas.</p> <p>Containers may explode when heated or if contaminated with water.</p> <p>Substance may be transported in a molten form.</p>		<p>Use clean non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.</p> <p>Prevent entry into waterways, sewers, basements or confined areas.</p>

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1824	154	Sodium Hydroxide Solution (Electrolyte used in Nickel Metal Hydride Batteries)	<p>HEALTH</p> <p>TOXIC; inhalation, ingestion or skin contact with material may cause severe injury or death.</p> <p>Contact with molten substance may cause severe burns to skin and eyes.</p> <p>Avoid any skin contact.</p> <p>Effects of contact or inhalation may be delayed.</p> <p>Fire may produce irritating, corrosive and/or toxic gases.</p> <p>Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.</p> <p>FIRE</p> <p>Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.</p> <p>Some are oxidizers and may ignite combustibles (wood, paper, oil, clothing, etc.).</p> <p>Contact with metals may evolve flammable hydrogen gas.</p> <p>Containers may explode when heated.</p>	<p>As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.</p> <p>Keep unauthorized personnel away.</p> <p>Stay upwind.</p> <p>Keep out of low areas.</p> <p>Ventilate enclosed areas.</p>	<p>FIRE</p> <p>Small Fire</p> <p>Dry chemical, CO2 or water spray.</p> <p>Large Fire</p> <p>Dry chemical, CO2, alcohol-resistant foam or water spray.</p> <p>Move containers from fire area if you can do it without risk.</p> <p>Dike fire-control water for later disposal; do not scatter the material.</p> <p>SPILLS</p> <p>ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).</p> <p>Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.</p> <p>Stop leak if you can do it without risk.</p> <p>Prevent entry into waterways, sewers, basements or confined areas.</p> <p>Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.</p> <p>DO NOT GET WATER INSIDE CONTAINERS.</p>

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3480 3481	147	Lithium Ion	<p>HEALTH Contact with battery electrolyte may be irritating to skin, eyes and mucous membranes. Fire will produce irritating, corrosive and/or toxic gases. Burning batteries may produce toxic hydrogen fluoride gas (see GUIDE 125). Fumes may cause dizziness or suffocation.</p> <p>FIRE Lithium ion batteries contain flammable liquid electrolyte that may vent, ignite and produce sparks when subjected to high temperatures (> 150 °C (302 °F)), when damaged or abused (e.g., mechanical damage or electrical overcharging). May burn rapidly with flare-burning effect. May ignite other batteries in close proximity.</p>	<p>As an immediate precautionary measure, isolate spill or leak area for at least 25 meters (75 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering.</p>	<p>FIRE Small Fire Dry chemical, CO2, water spray or regular foam. Large Fire Water spray, fog or regular foam. Move containers from fire area if you can do it without risk. SPILL OR LEAK ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Do not touch or walk through spilled material. Absorb with earth, sand or other non-combustible material. Leaking batteries and contaminated absorbent material should be placed in metal containers.</p>

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