

Section 4

GARAGE GUIDELINES FOR ALTERNATIVE FUELS

(The following is a NYSERDA brochure developed for distribution to fleet operators interested in acquiring AFVs. It was compiled based on experience gained in the AFV-FDP.)

INTRODUCTION

As a fleet manager, you are already busy keeping your existing vehicles on the road doing their assigned jobs. Your budgets are probably tight, your staff is perhaps a little short-handed, and you are being asked to get longer life from your equipment.

Nonetheless, as good as your fleet is at accomplishing its mission, it now has an additional job to do—to operate and maintain some new equipment built to use cleaner, domestic “alternative fuels.”

Why are you being asked to do this? There are three main reasons:

1. **Energy Policy**—The United States is once again heavily dependent on imported petroleum to power its vehicles. New York State, for example, gets approximately 75% of its fuel from foreign countries. Domestic alternative fuels can reduce this dependency. The Federal law requiring States to begin to operate alternative fuel vehicles (AFVs) is designed to reduce our imports of petroleum by 10% by the year 2000.
2. **Environmental Policy**—Alternative fuels can be cleaner-burning fuels, reducing particulate matter and smog-causing nitrogen oxides (NOx) and hydrocarbons. The U.S. Environmental Protection Agency (EPA) has determined that the New York metropolitan area is second only to the Los Angeles basin in poor air quality. Most fleets in and around New York City will be required to take extra steps including switching to alternative fuels to improve the local air quality.
3. **Economic Policy**—Alternative fuels and their equipment are predominantly American-made. The U.S. Department of Energy says, “If Americans begin displacing imported oil by using domestically produced fuels, we can help to reduce the trade deficit, create jobs, and promote economic activity.”

Your present facility was designed and built with conventional fuels (diesel and gasoline) in mind and modifications may be necessary in converting the facility to the needs of the new vehicles.

This brochure contains information about adapting your garage and repair procedures to these new alternative fuel vehicles (AFVs), especially as it concerns the safety of your people and equipment. It includes information on the legislative initiatives requiring the use of alternative fuels and on the attributes of these fuels. Your attention to the information in this brochure will help make the transition to AFVs in your garage safe and smooth.

LEGISLATIVE INITIATIVES

THE ENERGY POLICY ACT OF 1992 (EPACT)



This Act, signed in October 1992, is intended to reduce American dependence on imported petroleum. Its overall goals are to reduce petroleum consumption in the transportation sector by 10% in the year 2000, and 30% in the year 2010. To accomplish this, Federal fleets began purchasing light duty (under 8,500 lb gross vehicle weight [GVW]) AFVs in 1993. At the end of 1994 there were more than 17,000 AFVs in Federal service. State and fuel provider fleets are required to begin purchasing AFVs in the 1997 model year. By 2003, private and municipal fleets could be required to purchase AFVs under EPACT. Figure 4.1 shows the schedule for fleet participation as currently written in EPACT. Between 1997 and 2001, annual AFV purchases will grow from 10% to 75% of fleet acquisitions for state fleets. For alternative fuel providers, the AFV growth will range from 30% in 1997 to 90% in 2000 of fleet acquisitions.

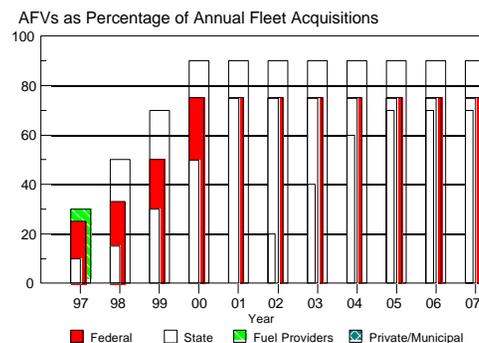


Figure 4.1 EPACT Fleet AFV Requirements

Figure 4.2 shows the counties/population areas in New York included in EPACT. ***If your fleet is not in any of the shaded counties shown, you may not be required to comply with EPACT. Check the EPACT regulations to be sure.***

New York EPACT Areas

- Albany MSA
- Binghamton MSA
- Buffalo-Niagara CMSA
- New York City CMSA
- Poughkeepsie MSA
- Rochester MSA
- Syracuse MSA
- Utica-Rome MSA

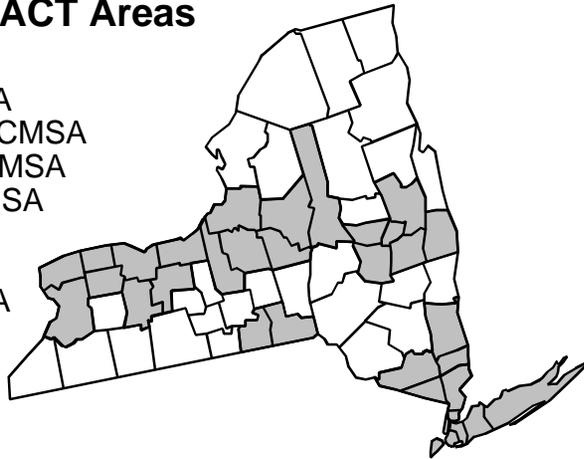


Figure 4.2 Areas of New York State Where EPACT Requires AFVs
 Note: MSA = Metropolitan Statistical Area
 CMSA= Consolidated Metropolitan Statistical Area

THE CLEAN AIR ACT AMENDMENTS OF 1990 (CAAA)

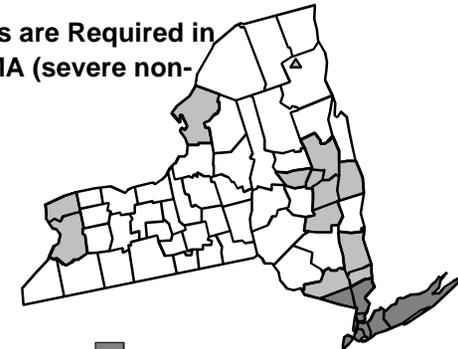


This Act, which amends and extends the Clean Air Act of 1970, is intended to improve air quality throughout the nation. New York City and other areas of the State have been found to be out of compliance with National Ambient Air Quality Standards (NAAQS). Figure 4.3 is a map of noncompliance areas in New York State. All types of stationary and mobile emissions sources are considered under the Clean Air Act. The New York City metropolitan area is considered a severely polluted area and the CAAA requires purchases of “clean fuel vehicles.” Clean fuel vehicles

(CFVs) must use alternative or reformulated fuels and meet stringent emissions standards beginning in 1998. *Other regions of New York are not required to comply with the clean fuel vehicle purchase requirements of the CAAA as long as their air quality does not degrade.* Fleets in and around New York City will be required to comply with both EPACT and CAAA. Figure 4.4 shows the schedule for CAAA clean fuel vehicle purchase requirements on light and heavy-duty (up to 26,000 lb GVW) vehicles.

New York Clean Air Act Ozone Non-Attainment Areas

Clean Fuel Vehicles are Required in New York City CSMA (severe non-attainment area)



■ Non-Attainment Area ■ Severe Non-Attainment Area

Figure 4.3 New York State Clean Air Act Non-Attainment Areas. Clean Fuel Vehicles required in Severe Non-Attainment Areas only.

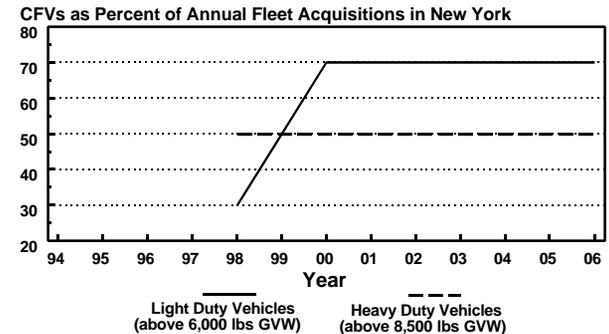


Figure 4.4 CAAA Requirements for Clean Fuel Vehicles

NOTE: Both EPACT and CAAA exempt certain types of fleet vehicles from compliance. For public sector fleets, these exemptions include: law enforcement, emergency, and military vehicles.

GARAGE GUIDELINES FOR ALTERNATIVE FUELS

THE ALTERNATIVE FUELS - CNG, LPG, METHANOL, ETHANOL, AND ELECTRICITY

These five fuels appear to be the most likely alternative fuels to be used in the late 1990s.

1. COMPRESSED NATURAL GAS (CNG)

Natural gas is extracted from underground reserves throughout North America (including western New York) and supplied by utilities to most regions of New York State. There are about 30,000 CNG vehicles currently in use in the United States including about 3,000 in New York State.

Fuel Description—Natural gas is composed primarily of methane (CH₄), a lighter-than-air gas. For vehicle use, it is compressed to approximately 3,000 psi for storage in vehicle fuel cylinders.

Fueling—Compressor stations raise the pressure of the pipeline gas to fill cylinders on the vehicles. “Fast-fill” stations have dispensers that refuel a vehicle in approximately 5 minutes. Slow-fill (or time-fill) stations refuel a vehicle over several hours, usually overnight.

Vehicle Availability—Passenger cars, vans, and light trucks are available from Ford. Specialty buses and service vehicles are also available. Existing conventional vehicles can be converted to CNG operation in bifuel or dedicated configurations.

Performance—The range of most light-duty CNG vehicles is approximately one-half that of comparable gasoline fuel vehicles. This is because, even when compressed, CNG has less energy density than gasoline. Power, acceleration, and payload are nearly equal to conventional fuel vehicles.

Safety—Pressurized CNG tanks and systems are designed to withstand severe impact and high temperatures. Training is required to safely operate and repair CNG vehicles.

2. LIQUEFIED PETROLEUM GAS (LPG)

LPG is the alternative fuel used in largest quantity in the United States. Its common name is propane since it is composed predominately of propane. LPG or propane is a gas at ambient (normal) temperatures and pressures. Under storage pressures of 100 to 300 psi, it is a liquid. Hence, its name, Liquefied Petroleum Gas.

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Fuel Description—LPG is composed predominately of propane (C₃H₈) with lesser amounts of butane and other hydrocarbons. It is a by-product of natural gas processing and petroleum refining.

Fueling—Similar to gasoline refueling but somewhat more rigorous; a leak-tight pressurized connection must be made between the refueling nozzle and the vehicle.

Vehicle Availability—Over 350,000 LPG vehicles operate in the United States. LPG vehicles can be made by converting gasoline engine fuel systems. Ford offers medium-duty LPG trucks.

Performance—Since the energy content of LPG is about 30% less than that of gasoline, the range of LPG vehicles is less than comparable gasoline vehicles for the same fuel volume, although larger fuel tanks are often installed to compensate. Power, acceleration, payload, and cruising speed are comparable to equivalent gasoline vehicles.

Safety—LPG is a liquid when it is stored under pressure. If released into the atmosphere, it evaporates into a heavier-than-air-gas. Training is required to operate and repair LPG vehicles safely.

3. METHANOL

Methanol is an alcohol that can be manufactured from natural gas, coal, or plant materials. Your facility may have some on hand to use as a solvent and it is often included in windshield washer fluid. It is a liquid fuel and storage is similar to gasoline in fuel tanks that are compatible with methanol.

Fuel Description—An odorless, clear liquid, methanol is usually mixed with gasoline to give it cold-weather starting capability and to improve flame visibility if spilled fuel is ignited. The standard mixture is called M85 - 85% methanol and 15% gasoline. While M85 is usually used for light-duty vehicles, M100 is used in most heavy-duty vehicles.

Fueling—Similar to gasoline.

Vehicle Availability—Ford offers M85 flexible fuel sedans (Chrysler and General Motors have offered M85 sedans in the past). “Flexible fuel” indicates that a vehicle is designed to adjust automatically to different mixtures of alcohol and gasoline fuel. Flexible fuel vehicles can use M85 or gasoline in a single fuel tank.

Performance—Because of the low energy content of M85, the range of M85 vehicles is only about half that of a gasoline vehicle for a given size fuel tank. Power, acceleration, cruising speed and payload are comparable to gasoline/diesel versions of the same vehicles. Because of

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its high octane content and the fact that it burns without smoke, methanol is used as a racing fuel in Indianapolis 500-type cars and in some classes of dragsters.

Safety—Methanol is poisonous and can be absorbed through the skin. Training is required to safely operate and repair methanol vehicles.

4. ETHANOL

Ethanol is an alcohol that can be manufactured from corn or other grains, and from chemical feedstocks. It is a liquid fuel and storage is similar to gasoline.

Fuel Description—A clear liquid, ethanol is usually mixed with gasoline to improve cold-weather starting capability and flame visibility. The standard mixture is called E85—85% ethanol and 15% gasoline.

Fueling—Ethanol or E85 fuel uses the same procedures as gasoline or M85.

Vehicle Availability—Ford offers a flexible fuel E85 sedan; General Motors built E85 sedans in the past. Mid-western transit buses have been operating on ethanol fuels.

Performance—About 25% less range than gasoline equivalent vehicles. Power, acceleration, payload, and cruising speed are comparable to gasoline versions of the same vehicle.

Safety—Both pure ethanol (E100) and E85 are denatured (made poisonous) when used as a fuel. Training is required to safely operate and repair ethanol vehicles.

5. ELECTRICITY

Both the Energy Policy Act (EPACT) and the Clean Air Act Amendments (CAAA) encourage the use of Zero Emission Vehicles (ZEVs), i.e., vehicles without tailpipe emissions. Electric vehicles (EVs) have batteries instead of fuel tanks, and electric motors instead of engines. They are known for their short range, especially in cold weather. Much work is underway to develop EVs with more practical and acceptable operating characteristics.

Fuel Description—Onboard rechargeable batteries power an electric motor.

Fueling—120-, 240- or 440-v AC power line connected to an onboard charger. Takes 4-8 hours for a full charge. Quick-charge battery systems are being developed.

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Vehicle Availability—GM offers its EV1 two-seater passenger car. Chrysler plans to offer an electric version of its minivan. Ford offers a conversion of their Ranger pickup truck. Smaller U.S. firms (U.S. Electricar, Solectria, etc.) are also developing and selling electric vehicles.

Performance—Usually best suited for a range of 50 miles or less between charges. Payload usually limited due to heavy weight of batteries. Acceleration and cruising speed generally less than for equivalent vehicles.

Safety—EVs are heavier than their conventional counterparts, primarily due to the weight of their batteries. Training is required to operate and repair these electric vehicles.

ALTERNATIVE FUEL GARAGE SAFETY INFORMATION

This section presents the safety information relevant to each alternative fuel for maintaining and storing AFVs indoors. Each alternative fuel section that follows is self-contained.

COMPRESSED NATURAL GAS (CNG)

If you have natural gas supplied to your facility, it is likely to be considered as a potential fuel for your fleet. Some relevant properties of natural gas include:

- Natural gas is invisible but odorized so its presence can be detected.
- CNG fuel systems store fuel at approximately 3,000 psi, and as high as 3,600 psi.
- Unlike gasoline vapors, natural gas is lighter than air so it will rise.
- A leak anywhere in a CNG system will allow all the fuel to escape. Leaks downstream of the storage tanks can usually be stopped by closing the appropriate system valves. The gas has a characteristic odor and you may be able to hear a natural gas leak when it is occurring.
- Natural gas fuel systems deliver fuel to the engine by the stored pressure in the tanks. There are no pumps or compressors. As CNG moves from tanks to engine, its pressure is reduced in steps to a pressure level slightly above atmospheric.
- Natural gas has a relatively narrow flammability range (air-to-fuel ratio that will support combustion) and is more difficult to ignite than gasoline.

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The main safety concern regarding CNG vehicles in a repair facility is the possibility of fuel releases and their consequences. Natural gas leaks can be either fast or slow. A fast leak usually involves the release of a safety valve or complete severing of a fuel line. In the case of the safety valve, all the gas in the fuel tank will be vented to the atmosphere. Other major fuel releases can be controlled by closing appropriate valves. Slow releases are those caused by fuel escaping through a loose fitting or an abraded line or hose.

Both types of leaks can cause flammable mixtures to form in the work area. These flammable mixtures will disperse and over time will dissipate to safe levels. Workplace safety can be maintained by:

- Reducing fuel release volumes.
- Keeping ignition sources away from areas where flammable mixtures may travel.
- Using proper ventilation to control how long these flammable mixtures exist and where they will be present.

If a slow fuel release occurs, natural mixing of the released fuel with the surrounding air will cause **most** such mixtures to become too lean to support combustion. (Though a slow leak over time in a confined space may cause the entire space to become flammable.) Methane's relatively narrow flammability range means that the diluting of the mixture occurs quickly and the only flammable mixture will be near the release site while fuel is being released.

Fast releases have the potential to generate large clouds of fuel that can form flammable mixtures some distance from the release site. Since methane is lighter than air, released fuel will tend to rise from the release site. This contrasts with conventional fuels which puddle and form vapors that travel along the floor. In facilities where CNG vehicles are being serviced, **ignition sources above the vehicles are of primary concern**. These ignition sources can include electric equipment that generate sparks or high surface temperatures (essentially all equipment not rated for use in hazardous environments) and open flame heaters. **Ventilation systems should be designed to remove fuel from above vehicles or to promote mixing of the air in the space above the vehicles**. Ignition sources neither near the ceiling nor directly above where CNG vehicles are being repaired **may not** be a problem.

It should be noted that high-pressure leaks directed downward could also create flammable mixtures at ground level near the vehicle. In these cases, attention must be paid to identify the ground level ignition sources in the area near the leak.

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Two case-studies are provided as examples. Both facilities use overhead lighting and infra-red heaters. The first is a facility with a flat roof (see Figure 4.5).

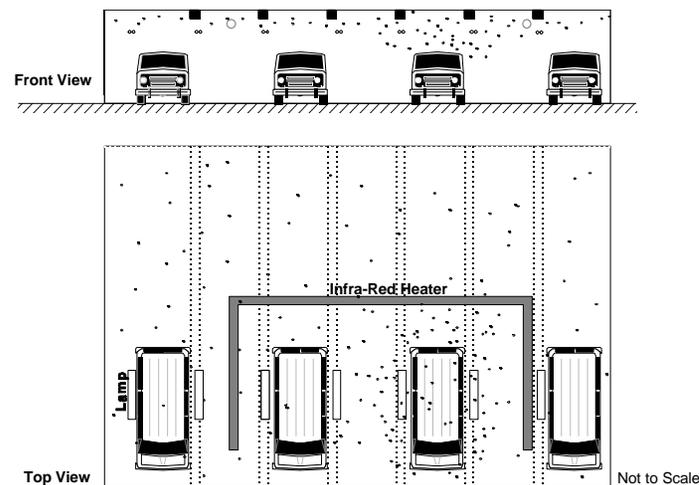


Figure 4.5 Example of CNG Vehicle Fuel Release—Flat Roof Case

Note: Dispersion of dots represents released CNG

A fast fuel release from one of the vehicles will cause a flammable cloud to travel across the ceiling. While rising it will pass over the lighting and the heating system. With the large flat ceiling, a flammable layer can form below the ceiling. Without proper ventilation removing fuel from near the ceiling, this layer can be ignited by a spark from the lighting or heating system.

The second example, Figure 4.6, shows a facility with a peaked roof. Again, overhead lighting and infrared heaters are used. A fast fuel release will again rise and travel past the lighting and infrared heaters. With the peaked roof, however, the flammable layer will form above these ignition sources. If an opening along the roof peak is available, the released fuel can be safely vented from the building. The local ignition sources—those directly over the work area—**may** still cause problems.

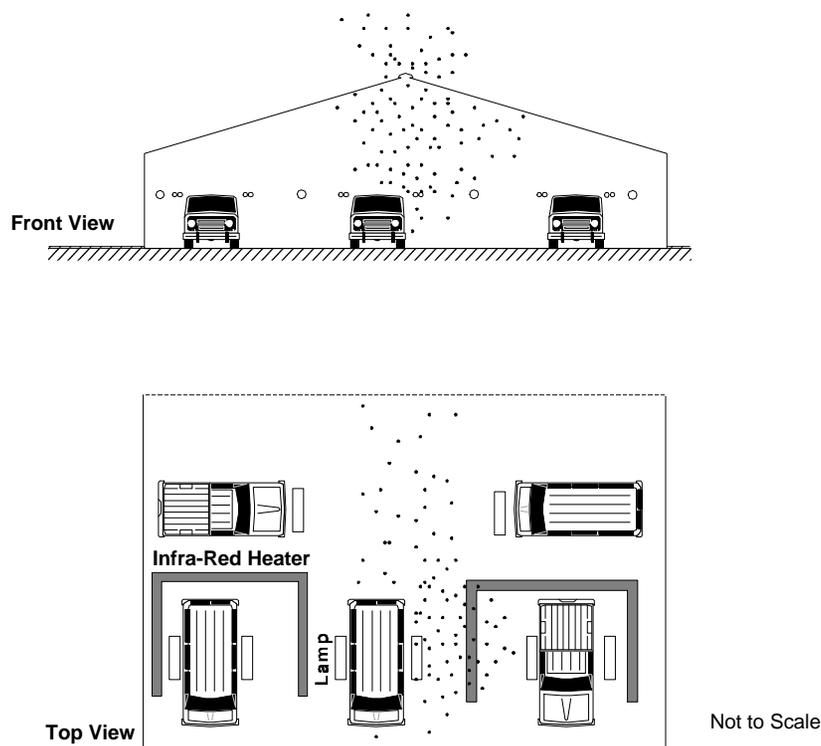


Figure 4.6 Example of CNG Vehicle Fuel Release—Peaked Roof Case
Note: Dispersion of dots represents released CNG

The key safety phrase for a Natural Gas release is

"Look Up!!"

The key safety features your facility should have are:

- **Good ceiling ventilation.**
 - **Elimination of ignition sources above the vehicles.**
 - **Safety training of your natural gas vehicle maintenance staff.**
-

Some heating systems do not use open flames in the repair area (hot water or steam systems with separate boilers). These systems may not require modification for CNG vehicles.

There are methane-sensing systems available to sense release of CNG and these should be considered, especially if vehicles are stored indoors when the facility is not being staffed. These sensors can be connected to building ventilation systems to ensure that the released gas is removed safely. (Modifications to ventilation systems may be required.)

LIQUEFIED PETROLEUM GAS (LPG, or PROPANE)

If you have used an outdoor barbecue grill or own a home away from a natural gas line, you already may have used LPG. LPG is delivered by pressurized tanker truck and stored above ground as a liquid. LPG must be kept in sealed containers because, if exposed to ambient air, it will quickly evaporate (flash) into an invisible, flammable, but odorized gas. LPG is available throughout New York except in New York City, where its use as a vehicle fuel is prohibited.

- LPG is invisible but is odorized so you can sense when it is present.
- LPG is heavier than air so, like gasoline and diesel, its vapors will fall and build up in low, unventilated areas. Adequate ventilation in these areas should dissipate LPG quickly.
- LPG is stored as a liquid on AFVs in pressurized cylinders.
- Because it is pressurized, you may be able to hear an LPG leak when it is occurring.

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- LPG fuel systems are driven by the stored pressure in the tanks. There are no gas pumps or compressors on board. As LPG moves from the tank to the engine, its pressure is reduced in steps from about 100 psi to a pressure level slightly above atmospheric.

Several properties of LPG are quite similar to those of gasoline. Both are heavier than air and have relatively wide flammability ranges. With these similarities many precautions currently used with gasoline vehicles are applicable to LPG vehicles. Garages generally do not have ignition sources or open flames located near the ground and include extra ventilation in below ground level areas, such as service pits.

The fact that LPG storage is pressurized and that LPG vaporizes rapidly upon release increases the vapor-generating potential of the fuel. In facilities where LPG vehicles are being introduced, it may be necessary to pay closer attention to ignition sources and ventilation than is normally done with gasoline vehicles.

The key safety phrase for an LPG release is

"Look Down!!"

The key safety features your facility should have are:

- **Good floor-level ventilation.**
 - **Elimination of ignition sources near the ground.**
 - **Safety training of your LPG vehicle maintenance staff.**
-

ALCOHOL FUELS: METHANOL and ETHANOL

Because their properties, operational procedures, and safety procedures are so similar, the critical safety information for these fuels are combined as "Alcohol Fuels." The biggest difference in the two fuels is their sources: primarily natural gas or coal for methanol, agricultural crops for ethanol. Ethanol has the higher heat content of the two fuels although its heat content is still less than that of gasoline.

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Of the alternative fuels, transport, storage, and dispensing of alcohol fuels are most like conventional fuels. Each is delivered by tanker truck as a liquid, can be stored in underground tanks, and is pumped into vehicles using conventional dispensers (with internal material changes). Alcohols are solvents and will react with some elastomers (flexible materials) and metal, so care must be taken in specifying equipment for these fuels.

- An alcohol fuel system is essentially similar to a conventional fuel injection system. It requires a fuel pump to pressurize the fuel to be used in the engine.
- Alcohols have relatively wide flammability ranges, but they disperse more quickly than gasoline. When compared to gasoline, the rich mixture over a puddle of alcohol is more likely to be flammable and the mixture not adjacent to the spill site is less likely to be flammable.
- Pure methanol burns with no visible flame making it difficult for firefighters to locate a fire. M85 and E85 both have enough gasoline content that flames are visible, though not as intense as an all-gasoline fire.
- Vapors from both ethanol and methanol are heavier than air.
- Alcohol fuel spills, as with any fuel spills, should be quickly cleaned up.
- Contamination of ground water by alcohol fuel spills should be avoided because both methanol and ethanol are readily soluble in water.

Many properties of the alcohol alternatives are similar to gasoline. In addition, absorption through the skin and/or ingestion of the fuel is more harmful than gasoline entering by similar means.

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The key safety phrase for an Alcohol fuel release is

"Treat Like Gasoline."

The key safety features your facility should have are:

- **Good floor-level ventilation.**
- **Elimination of ignition sources near the ground.**
- **Safety training of your vehicle maintenance staff.**
- **Eye wash stations and personal protective gear (goggles, alcohol-resistant gloves, etc.).**

ELECTRICITY

Electric Vehicles (EVs) have been around just about as long as gasoline vehicles. You may be familiar with electric forklift trucks. Your facility has electricity, no doubt, but EVs require a lot of electricity and can take many hours to recharge their batteries.

- When some EVs are being recharged, they can generate hydrogen gas that is vented the atmosphere. Hydrogen is the lightest gas in nature and it will quickly rise and dissipate. If there is adequate ventilation and an absence of ignition sources in its path, it should cause no problems. The National Electrical Code has guidelines for ventilation of buildings where EVs are recharged.
- Workplace health and safety issues for EVs are considered in the context of chemical health hazards. As with other common chemicals and fuels available in a garage, Occupational Safety and Health Act (OSHA) standards are used as a benchmark for evaluating EV safety issues. OSHA workplace exposure standards for the chemicals contained in the EV battery system should not be exceeded.
- Battery electrolyte spills must be contained and cleaned up properly.
- Precautions must be taken to avoid the hazards of electric shock from EVs. Inadvertent discharge of the batteries will release relatively large amount of electric current and should be avoided.

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The key safety phrase for EV charging areas is

"Check your reference material before you proceed."

The key safety features your facility should have are:

- **Good ceiling-level ventilation.**
- **Elimination of ignition sources above the charging area.**
- **Safety training of your vehicle maintenance staff.**
- **Avoid shock hazards.**
- **Eye wash stations, personal protective gear (goggles, gloves, etc.), and chemicals to neutralize electrolyte spills.**

COMBINATIONS

It is likely that some facilities will be required to maintain more than one type of AFV. Facilities that have been upgraded for CNG will tend to be compatible with EV recharging and servicing if they occur in the same area. Likewise, facilities that have been reviewed for LPG will generally be compatible with alcohol fuels as well as diesel and gasoline. Mixing of the lighter-than-air fuels (CNG and EV) with heavier-than-air fuels (alcohols and LPG) will require that safety concerns for both types of fuels be considered in that area. Care must be taken that AFVs are maintained only in the portions of the facility that have been prepared for them. Further, along with the proper facility adjustments, personnel with the proper training must be available.

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SUMMARY

ALTERNATIVE FUELS WILL WORK IN YOUR FACILITY

Because you are already concerned about safety for your staff and equipment when working with conventional fuels, you may find many of the requirements for alternative fuels either already included in normal good shop safety practices (such as using protective eyewear when handling fuels or working in an engine compartment, etc.) or logical extensions of existing shop safety practices. Just as good ventilation and an absence of ignition sources are needed near the floor for gasoline vapors, alcohol and LPG vapors, similar ventilation is needed overhead for natural gas or hydrogen releases.

If your facility needs to be upgraded significantly for alternative fuels, it might be wise to combine fuel safety needs with energy reduction, general upgrading, or other safety upgrades. For instance, Class 1 Division 2 lighting (proper for use with CNG) might fit in with an energy reduction or lighting improvement project that is needed as well. Installing heating systems that comply with Class 1 Division 2 in the areas where alternative fuels may travel also offers the potential of choosing a system with reduced energy costs. A new eyewash will protect against eye damage from all liquid fuels—not just alternative liquid fuels.

Be aware that National Electrical Code (NEC), Building Officials and Code Administrators (BOCA), and National Fire Protection Association (NFPA) codes and standards are being prepared specifically for alternative fuels. These new rulings will contain the most recent consensus on their proper handling. It would be wise to consult these sources before going ahead with your facility upgrade. Further, there are available Material Safety Data Sheets on all the chemical fuels we have discussed. These are available from the fuel suppliers.

Make sure your local fire-fighting staff is aware of the alternative fuels you will be using so they can obtain proper training and suitable equipment, such as alcohol-compatible extinguishers (NFPA Class 1B fire).

Certified technician training courses have been developed for CNG in New York State by the Automotive Technician Training Program (ATTP) and there is now an Automotive Service Excellence (ASE) Certification program available. Such training should pay off in faster service times and fewer fuel releases during the first few months of AFV operation.

When the proper precautions are taken (proper equipment and proper training), alternative fuels can be handled just as safely as conventional fuels.

COST CONSIDERATIONS

Upgrading a garage facility for AFV operations is dependent on a number of factors. Among them are:

- The type(s) of alternative fuels to be used.
- The number of service bays to be prepared for alternative fuels.
- The level of compliance with current codes.
- The type of building construction; the type and location of heat system components; and location of current ventilation intake and exhaust registers.

Many changes for alternative fuel safety are relatively small and could be considered as part of a normal garage facility maintenance program. Examples would be:

- Purchasing eyewash stations, goggles, and gloves.
- Providing neutralizing agents to absorb electrolyte spills.
- Repairing ventilation systems.
- Appropriate training for your staff.

More expensive would be upgrading AFV areas to National Electrical Code Class 1 Division 2 standards for electrical and heating systems or installation of methane sensors. These expenses can be moderated by coordinating AFV facility upgrades with other planned or necessary upgrades, and by selection of the proper facility and/or areas within a facility where AFVs will be serviced.

Disclaimer

This brochure is intended to provide guideline information only. For facility-specific information, fleet facility managers should consider contacting an engineering firm with experience in garage modifications for alternative fuel vehicles.

This brochure was prepared for the New York State Energy Research and Development Authority by EA Engineering, Science and Technology, Inc., March 1995, updated November 1996.