



THE EMERGENCY RESPONSE GUIDE TO ALTERNATIVE FUEL VEHICLES



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Disclaimer

This student manual is intended for use by personnel who have extensive emergency response training. Members of the public should not attempt to respond to an emergency involving vehicle fires or collisions but should instead contact emergency response personnel.

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This student manual provides general background information and should not be used as a substitute for any detailed information that may be available from the manufacturer with respect to each vehicle's design and safety features.

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Chapter I.

INTRODUCTION

I. INTRODUCTION

The text you hold in your hand has been 15 years in the making. This book combines the training programs that have been produced to address a variety of alternative fuel vehicle programs as they have “come of age” over the years. These projects span from electric vehicles, the vehicle of choice in the mid 1990’s to Fuel Cell Vehicles, the vehicle of choice for tomorrow. In between we have also seen propane, natural gas, hybrid electric, and bio-fuels as other alternative fuel choices.

This training manual is designed to prepare emergency medical, law enforcement, and fire service personnel for an emergency response involving a wide range of alternative fuel vehicles. Funding for this program was provided by the California Air Quality Control Board. This text explores and provides an overview of the basic operation of alternative fuel vehicles, their component parts, infrastructure, and importantly, how this technology affects the standard operating procedures for emergency response personnel.

This requires a great deal of guess-work in that, in the context of the millions of vehicles on the road today, only a small percentage alternative fuel vehicles compete with gasoline or diesel vehicles, and even fewer alternative fuel vehicles have been involved in accidents.

But, any discussion of alternative fuel vehicles must begin with an understanding of how and why this technology has suddenly come to our attention. Four areas of influence include: environmental concerns, government regulation, energy diversity and homeland security, and the innovation of the auto industry have all converged to make these vehicles today’s reality.

Environmental Concerns

Alternative fuels and energy vehicles are viewed as a mechanism to reduce the environmental impact of automotive vehicles in terms of air quality, water pollution, and global warming.

Air quality concerns and the formation of Photochemical smog has been associated, and the brunt of many jokes, with California and specifically with Los Angeles for several decades. The inland valleys of California have the perfect conditions for the development of



Vehicular traffic contributes significantly to air quality concerns and it's relationship to global warming.

photochemical smog. The necessary ingredients are: 1) the type of pollutants put out by automobiles, and 2) sunlight. The primary pollutants involved are a mixture of oxides of nitrogen and hydrocarbons, both emitted by the millions of automobiles on our freeways and roads.

In the presence of sunlight, reactions take place that form a new set of chemicals, including ozone, which is a corrosive substance, harmful to the health of humans. Since California has lots of cars and lots of sunshine, we also have lots of smog. Things get worse when you add in thermal inversions, typical of many parts of California's inland valleys, which trap the air with its pollutants, and lead to a concentration of pollutants in the atmosphere. This phenomenon is recognized by leading scientist as a contributing factor in global warming.

Reduced emission vehicles, or vehicles that burn a cleaner fuel such as ethanol, biodiesel, natural gas or propane along with zero-emission vehicles like electric and fuel cell vehicles, have proven effective in reducing vehicle emissions and clearing the atmosphere.

Water pollution is also an area where clean energy technologies can be used effectively. Internal combustion vehicles have been targeted by government agencies as a "non-point" pollution source. These sources are varied and sometimes hard to identify. But examples include storm runoff from city streets, which include huge amounts of motor oil, spilled fuel and anything else that has been dumped on the street, accounting for a majority of water pollution. In this case, electric vehicles, which require no motor oil, can help minimize non-point sources of water pollution.

Government Regulations

To reduce these environmental issues, California, in 1990, established a zero emission mandate for vehicle manufacturers. The focus of this mandate was to meet federal clean air requirements. Then, as now, electric vehicles are the only vehicle propulsion system that can meet this mandate. All of the major original equipment manufacturers scrambled to develop a vehicle that would achieve the states mandate that is acceptable to the consumer. The Federal Government soon followed suit with a version of fuel reduction policies that focus on energy diversity.

In 1992, Congress approved, and the President signed, the National Energy Policy Act. The National Energy Policy Act establishes a national goal to reduce petroleum consumption by 10 percent by 2000 and 30 percent by 2010.

The Act had many requirements for developing alternatives to petroleum use in the transportation sector. These requirements applied



primarily to government and private fleets and to encourage the purchase and use of all types of alternatives to petroleum, including a tax credit for refueling facilities. Specific to alternative fuel vehicles, the Act provides tax credits for their purchase. The goal of this Act is to decrease America's reliance on foreign oil by developing alternative domestic energy sources.

Energy Diversity & Homeland Security

It has been recognized since the first oil embargo in the 1970's that America needs to reduce its reliance on imported fuel stocks from countries who aim to use the profit from our purchase to undermine the security of our nation. Global warming and our use of fossil fuels are also cited as a motivating factor in finding sustainable alternatives to gasoline and diesel fuels. In a key note speech, Matt Bettenhausen, the Director of California Emergency Management Agency (CAL EMA), noted that "alternative energy is a homeland security issue."

The most obvious target for fuel diversification and air quality is the millions of vehicles on American roads. Mobile sources are the largest source of air pollution. Cars and trucks are the main source of smog forming pollutants and carbon monoxide. Cars and trucks are not the whole story, heavy-duty diesel trucks and off-road sources such as locomotives, ships, and utility engines also contribute to the air pollution problem.

Even though technological advances mean that new internal combustion vehicles produce about 80 percent less pollution than vehicles from the 1970s, increases in population, number of vehicles, and miles driven continue to offset the benefits of these cleaner cars. This gave rise to the concept of Zero emission vehicles, or "ZEVs." These vehicles were required to have no tailpipe emissions under any and all modes of operation for the life of the vehicle.

Today, the only vehicles that can meet this standard are electric and fuel cell powered vehicles. Although, fuels like natural gas, propane and hydrogen also offer very low emissions and provide a transition to meet the intention of government mandates.

The key to America's homeland security is in the development of sustainable alternative fuel sources.





1912 Detroit Electric Car at BC Hydro's Stave Falls visitor center in Mission British Columbia.

—Courtesy of Detroit Electric

Industry Innovation

While the concept of alternative fuel vehicles may conjure images of the technological future, you must realize that many of the technologies we are going to explore have actually competed for a market share along with steam and internal combustion engines over 100 years ago.

Solutions to modern problems like air pollution and energy diversity are riding on the successful reintroduction of alternatives to fossil fuel vehicles. Along with this re-emerging technology comes the uncertainty of how new vehicle technology fits within the context of our day-to-day lives. It is a context that often includes: daily commutes, rush hour traffic, traffic jams, servicing, automotive repairs, occasional tows, and yes, vehicle incidents, accidents and collisions.

To this cause, billions of dollars are spent in research and development by the automotive industry to provide better air quality, and greater diversity of transportation energy sources. Long before Federal and State Governments began mandating energy diversity and air quality standards, original equipment manufacturers (OEMs), electric utilities, independent companies, and the academic community began re-searching, testing, and developing vehicles powered by a range of fuel/energy options. Clearly, the automotive industry perceived a unique niche in the market and its members have been racing one another ever since to fill the void.

The fact is our dependence on fossil fuels and the environmental impact of using them have driven many vehicle manufacturers to find solutions to moving people from point A to point B and to do it economically and in an environmentally safe manner. Today the alternative vehicle



Alternative fuel vehicles: Top L-R Mercedes c300 Flex Fuel, Toyota Prius Hybrid, Bottom L-R Honda Civic CNG, Ford Roush F150 Propane

choices offered by original equipment manufacturers (OEMs) include; neighborhood electric vehicles, hybrid electric vehicles and ethanol powered vehicles. Hydrogen and fuel cell vehicles are coming-up in the not too distant future.

Fleet vehicles and mass transit systems run the range of all electric, hybrid electric, natural gas and propane, to fuel cell technologies. Even though as a consumer you are limited in choices that include primarily ethanol and hybrid electric vehicles—this training program will prepare you for the wider range of fleet and future alternative fuel options that are just around the corner.

Program Focus

The solution to our environmental concerns and our dependence on fossil fuels appears to be not just one alternative fuel/energy source but a plethora of choices in a variety of vehicle make and models that we normally associate with internal combustion technology (ICE).

Realize that vehicles, no matter how the vehicles are fueled, may eventually end-up in a collision or become involved in fire which will, in-turn, impact you as the emergency responder. The fuel/energy available today requires emergency responders to have an understanding and appreciation of the situations they may already be facing or will be facing in the very near future.

It is important to note, that this text deals exclusively with vehicles built by original equipment manufacturers (OEM's). After market vehicle conversions are not within the scope of this program. The focus of this training program is also limited to road worthy vehicles such as passenger cars, light trucks, vans, sport utility vehicles, heavy duty vehicles, as well as transit vehicles like school, tour, and municipal busses. Off road vehicles, motorcycles, golf carts, and forklifts are not the focus of this program. However, the alternative fuel/energy technologies discussed in this program may also be extrapolated and applied to vehicle conversions and off-road vehicles as well.

Please note that emergency response guidelines (ERG's) for specific make and models of vehicles are not included in this text. New vehicles and their specific configurations change from model-to-model and year-from-year. This text presents a generic configuration of the fuel/



—Courtesy of Ventura County Fire Department

Realize that vehicles, no matter how the vehicles are fueled, may eventually end-up in a collision...

energy technologies. It is important to consult the emergency response guidelines published by original equipment manufacturer for vehicle specific emergency response information.

Program Goal

This training program will provide fire, emergency medical, and law enforcement personnel information for each of the alternative fuel technologies available so that they can make informed decisions at the scene of a vehicle emergency.

Objectives

The objectives to meet this goal include:

- ❖ Insure safety for emergency response personnel by providing reference and training material for all the alternative fuel/energy technologies available.
- ❖ Spotlight hazards associated with each fuel/energy source
- ❖ Review the infrastructure that supplies the fuel/energy to alternative vehicles
- ❖ Demonstrate that Standard Operating Guidelines (SOG's) are applicable to the new fuel/energy technologies.

This training program is divided into three sections: Internal Combustion Vehicle Technologies, Electric Vehicle Technologies and Response to Vehicle Emergencies. The training materials have been modularized so that they can be taught as each technology becomes prevalent in your jurisdiction and/or taught in conjunction with auto extrication training. The modular format is appropriate for tailboard training or can be taught in its totality as an instructor lead training program.

Like all training programs we start with the known and work towards the unknown. In this case with internal combustion vehicles, and the alternative fuels that support them, and then move on to electric vehicle technologies and the infrastructure that support those. All of this technical information will be tied together in the "Response to Vehicle Emergencies" section.