PROPANE AUTOGAS

A Safe, Economical, and Environmentally Friendly Option for Fleet Vehicles

PROPANE education & research COUNCIL

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James Mays Jr., Vice President and Interior Firefighter
Sheridan Fire Department, New York

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PROPANE AUTOGAS: THE SMARTER ALTERNATIVE

Transportation. It's a cornerstone of our economy. Moving people to and from work, getting food from the farm to the table, taking finished products from the factory to the sales floor. Every day, we depend on a system of safe and economical transportation to enable our busy lives as workers, parents, and students.

Many organizations, including government agencies and private and public companies, are rethinking their transportation options and exploring alternative fuels for their vehicle fleets. For many of them, propane autogas is the answer. Propane autogas is plentiful, affordable, and produced right here in the U.S. Moreover, it is a safe, economical, and environmentally friendly alternative to gasoline and diesel fuel. That's why school districts, municipalities, police departments, taxi services, and many other fleets and organizations have made the switch.

Produced in the U.S.

Approximately 90 percent of propane consumed in the U.S. is produced domestically, while an additional 7 percent is from neighboring Canada. This abundant and reliable resource helps reduce our dependence on foreign petroleum and increase our nation's energy security.

Growing in Popularity

For more than 80 years, vehicles fueled by propane autogas have been a popular choice in countries around the globe. In fact, with approximately 17 million propane-autogas-fueled vehicles in operation today, propane autogas is the most widely used alternative transportation fuel in the world.

More and more, people in the U.S. are discovering the benefits of these vehicles. In terms of power, performance, maintenance, and safety, propane-autogas-fueled vehicles are equivalent to their gasoline- and diesel-fueled counterparts. But when you look at the environmental benefits, propane autogas is the superior choice. Propane autogas is a clean-burning fuel, which means far fewer carbon emissions in the atmosphere. In addition, propane autogas is non-toxic and presents no hazards to soil or groundwater.

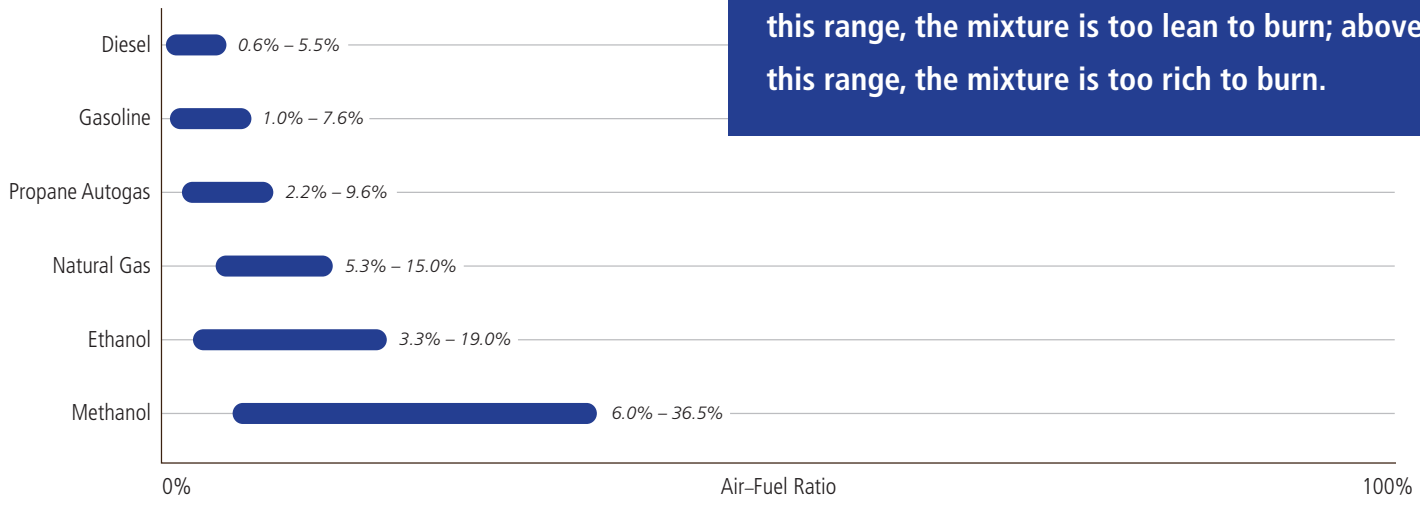
A PROVEN TRACK RECORD OF DURABILITY AND SAFETY

Propane autogas is considered to be a safe motor fuel by the federal government. While vehicles fueled by propane autogas have a long history of performing safely under all operating conditions, some people have the perception that these vehicles are more dangerous than traditional gasoline- and diesel-fueled vehicles. However, these perceptions are inaccurate. In fact, propane autogas offers the following safety advantages:

- Propane autogas requires a much higher temperature to ignite. For example, gasoline and diesel fuel will catch fire at temperatures as low as 495 degrees Fahrenheit, whereas propane autogas requires a temperature of at least 920 degrees Fahrenheit to ignite.
- Among alternative fuels, propane autogas has the narrowest flammability range. The flammability range of propane autogas is comparable to that of gasoline and diesel fuel (see chart).
- Unlike gasoline and diesel fuel, if propane autogas leaks it does not puddle, but instead vaporizes and dissipates into the air.
- Since propane autogas is released from the tank as a vapor, it cannot be ingested like gasoline, diesel, or alcohol fuels.
- Propane autogas tanks are 20 times more puncture-resistant than gasoline tanks, so they are more durable in an accident. They can also withstand up to four times the pressure when compared with a gasoline tank.
- Propane autogas engine fuel systems are fitted with safety devices and shut-off valves that function automatically if the fuel line ruptures.

Propane autogas will burn only with a fuel-to-air ratio between 2.2 percent and 9.6 percent. Below this range, the mixture is too lean to burn; above this range, the mixture is too rich to burn.

Flammability Range



With more than 300,000 firefighters and emergency first responders trained, the Propane Emergencies program continues to be the benchmark by which many other safety training programs are measured.

SAFETY IS THE HIGHEST PRIORITY

Propane autogas is a safe fuel when properly stored, transported, handled, and used. This is due to several factors: propane autogas' natural properties; stringent codes and regulations; and the industry's extensive education, training, and safety-awareness programs.

A Strict Set of Codes and Regulations

Many organizations develop and implement codes, standards, and regulations needed for the safe use of propane-autogas-fueled vehicles. These regulations are constantly reviewed, updated, and improved to ensure that all new vehicles and vehicle technologies are as safe as possible.

At the federal level, the Department of Transportation and the National Highway Traffic Safety Administration test crashworthiness of vehicles to make sure they meet safety standards. The Environmental Protection Agency regulates vehicle emissions to ensure that better and cleaner vehicles are on the roads.

Several organizations develop and implement codes specific to the safety of propane-autogas-fueled vehicles. The American Society of Mechanical Engineers (ASME) is responsible for rules governing vehicle tanks and piping. As an example, the tanks in all vehicles fueled by propane autogas are constructed from carbon steel in accordance with a code developed by ASME. The National Fire Protection Association also develops and implements codes and standards for propane autogas storage systems, dispensing stations, and vehicle systems.

Extensive Education and Training Programs

The propane industry works extensively with local fire departments and emergency responders to ensure they have the necessary training to properly respond to any potential emergencies.

The industry's Propane Emergencies program is a comprehensive training program for firefighters and emergency responders that is used by 35 state firefighter training academies. With more than 300,000 firefighters and emergency first responders trained, the Propane Emergencies program continues to be the benchmark by which many other safety training programs are measured.

This collaborative effort between the propane industry and the firefighter community means that more emergency responders are kept safe, knowledgeable, and better equipped to manage and respond to propane-related emergencies.

Propane-autogas-fueled vehicles emit 17 percent fewer greenhouse gases into the atmosphere than gasoline- and diesel-fueled vehicles.

BETTER FOR THE ENVIRONMENT

Propane autogas is a clean-burning fuel and — because of its lower carbon content — is more environmentally friendly than gasoline or diesel fuel. A switch from conventionally fueled vehicles to propane-autogas-fueled vehicles can result in substantial reductions of hydrocarbons, nitrogen oxide, carbon monoxide, and overall greenhouse gas emissions.

Unlike gasoline-fueled vehicles, propane-autogas-fueled vehicles emit no evaporative vapors while running or parked. This is because propane autogas fuel systems are tightly sealed. During refueling, very small amounts of propane autogas may escape into the atmosphere. However, propane autogas vapors are 50 percent less reactive than gasoline vapors, so they do not generate near the amount of smog-forming ozone as gasoline does.

In addition, all vehicles fueled with propane autogas meet stringent EPA emission standards. And several commercially available propane-autogas-fueled vehicles already meet the strict engine emissions requirements of the California Air Resources Board.

In the future, propane-autogas-fueled vehicles will play an important role in reducing carbon and other greenhouse gas emissions from the earth's atmosphere — emissions that have been cited as contributors to global climate change. This will help clean the air we breathe and benefit future generations.

Emission Comparisons

Compared to gasoline-fueled vehicles, propane-autogas-fueled vehicles emit approximately:

Gasoline-fueled vehicle emissions

Propane-autogas-fueled vehicle emissions

12% fewer carbon dioxide emissions

20% fewer nitrogen oxide emissions

60% fewer carbon monoxide emissions

SUCCESSFUL FLEET INITIATIVES

Propane autogas is fueling major fleet vehicle initiatives across the country. Take a look at a few examples:

Oregon School District Gives High Grade to Propane-Autogas-Fueled School Buses

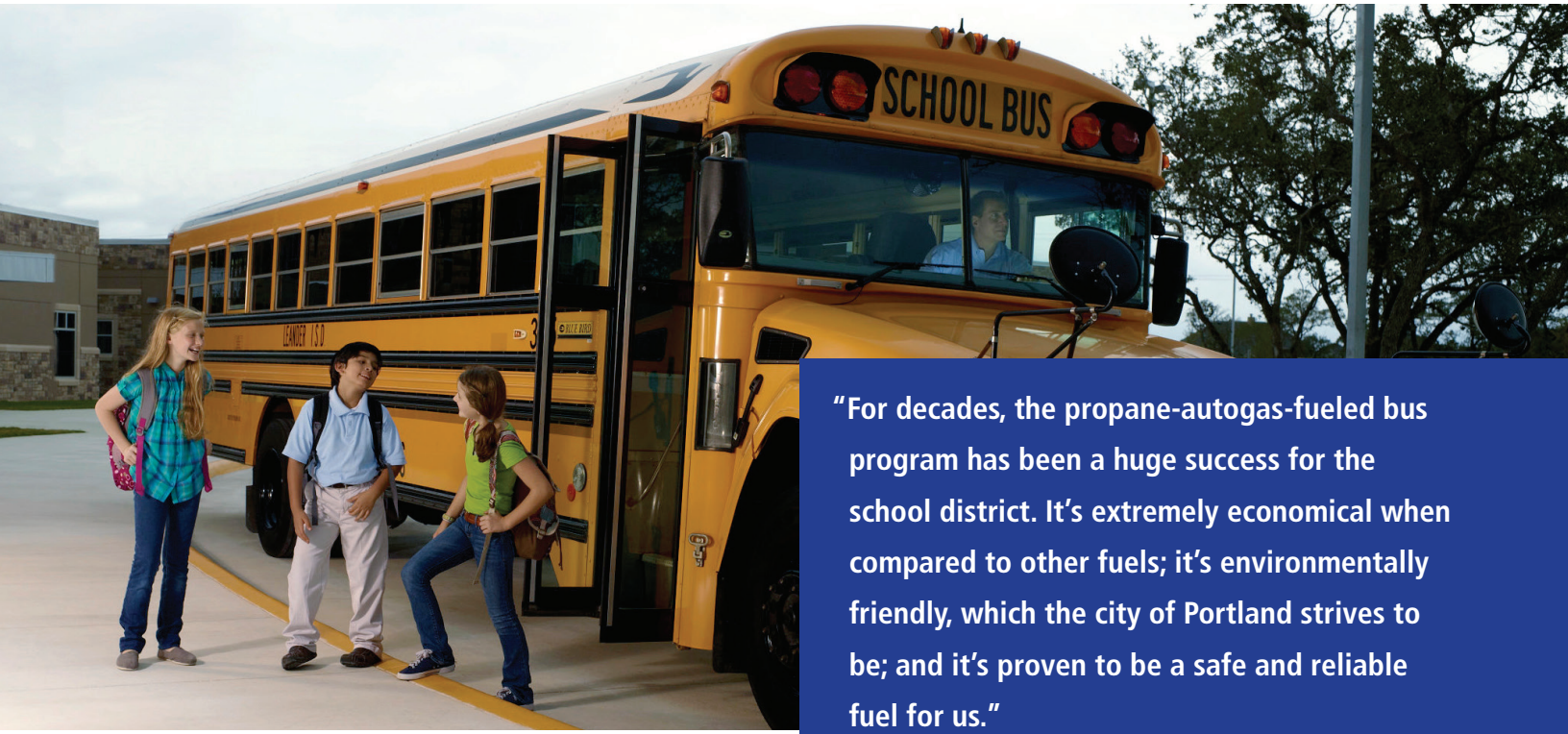
When parents send their kids to school on a bus, their top priority is safety. Talk to any parent, and he or she will tell you that they won't put their child in a vehicle that isn't safe. In Portland, Ore., the public school district feels the same way. That's why for almost 30 years, the school district has transported students to and from school in propane-autogas-fueled school buses.

Today, the school district owns and operates approximately 75 of these types of buses, mainly transporting special-needs students to and from schools throughout the district. In addition, an independent contractor, First Student, also owns and operates a large fleet of propane-autogas-fueled buses that are used for the school district's general transportation requirements. Recently, First Student added 89 Collins small school buses (Type A) and 86 Blue Bird conventional school buses (Type C) fueled by propane autogas to its fleet, making it one of the largest propane autogas fleet owners in the country.

According to Fleet Service Coordinator Eric Stewart of Portland Public Schools, "For decades, the propane-autogas-fueled bus program has been a huge success for the school district. It's extremely economical when compared to other fuels; it's environmentally friendly, which the city of Portland strives to be; and it's proven to be a safe and reliable fuel for us."

He continues, "As you can imagine, when you operate as many fleet buses as we do in a large city like Portland, occasionally accidents are going to happen. I've been here for six years, and I don't know of any propane autogas safety issues that we've ever encountered as the result of an accident. These buses and their fuel tanks are extremely durable."

"Just as it is with gasoline or diesel, safety comes from understanding how to properly handle the fuel. All of our drivers receive extensive, hands-on training on how to refuel their buses. We have 100 or so bus drivers, and they all refuel their buses at the school district's central fueling station," concludes Stewart.



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Portland Public Schools, Oregon

Raleigh Police Department Relies on the Safety and Durability of Propane-Autogas-Fueled Patrol Cars

Between 2011 and 2012, the Raleigh Police Department in North Carolina purchased 20 bi-fuel vehicles for its fleet. The department views propane autogas as a safe, cost-effective fuel that helps it serve and protect the citizens in its community in an environmentally friendly manner.

"These patrol cars have performed extremely well for us," says Raleigh Police Captain Doug Brugger. "As you know, police officers have to drive under all sorts of conditions and respond in a variety of situations. We spend a lot of time in our vehicles, and occasionally we're going to be in collisions. Over the past year or so, we've had a number of accidents involving propane-autogas-fueled patrol cars, and the damage from those wrecks didn't appear to be any different from what we'd expect of our gasoline-fueled vehicles."

Brugger continues, "When we started looking into replacing our patrol cars, we had certain criteria that needed to be met. First and foremost, they needed to be safe. So far, these patrol cars definitely seem to address that requirement."

Positive Propane Autogas Experience Leads Police Department to Consider Switching Entire Fleet

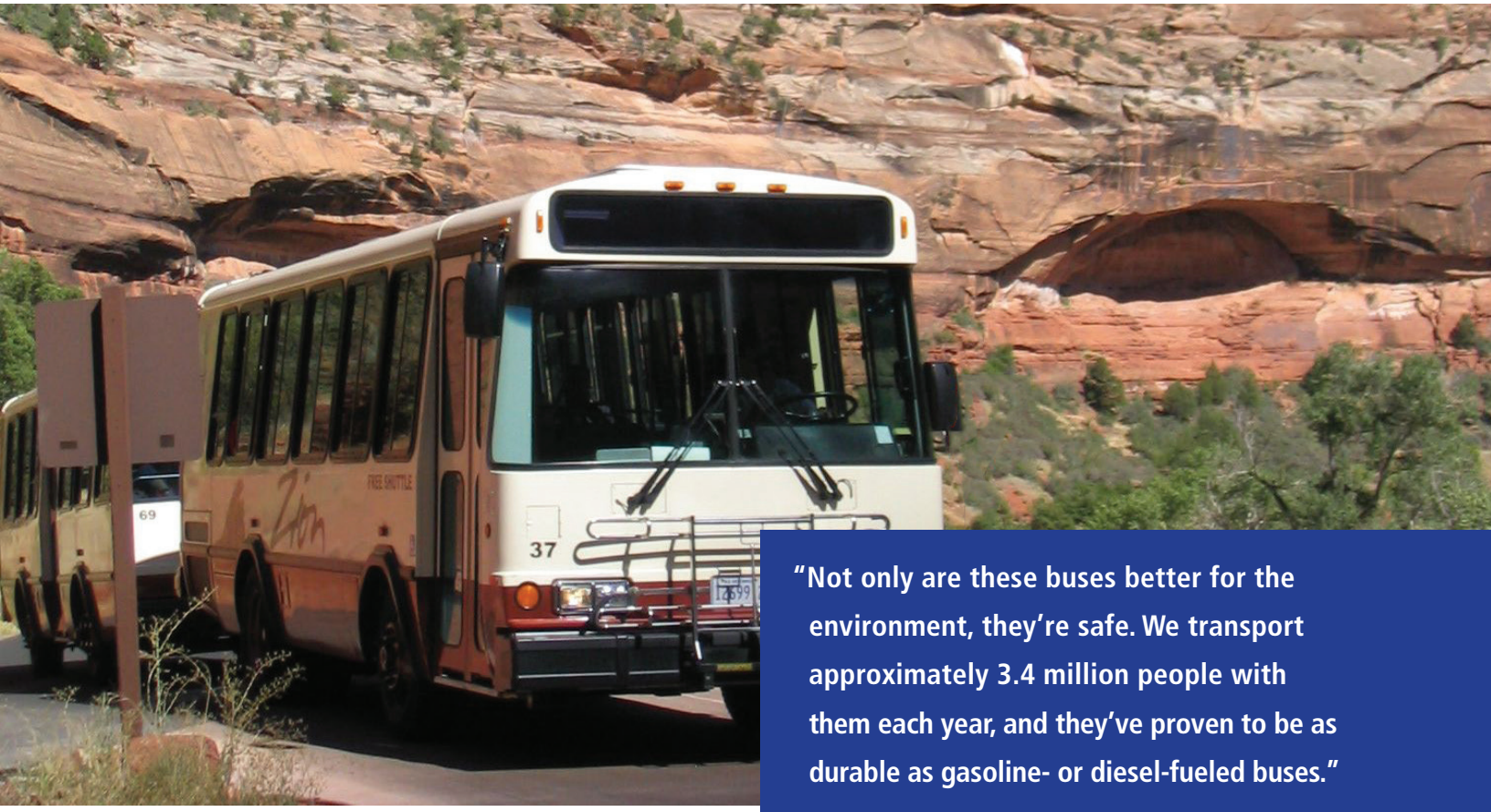
The Police Department in Exeter, Calif., has added two propane-autogas-fueled pickup trucks to its fleet. One truck is used as a crime scene investigation unit, while the other is used for performance-driven tasks including hauling a large trailer used at sobriety checkpoints. The police department received funding from a Clean Air Grant from the San Joaquin Valley Air Pollution Control Board for the purchase of the vehicles.

"We're extremely satisfied with these two vehicles," says Exeter Police Chief Cliff Bush. "Safety is a non-issue. Our experience shows that these trucks are as safe as traditionally fueled pickup trucks. I drive one of them, and I feel very safe in it. I'm currently investigating options to replace all of our vehicles to operate on propane autogas."

"When we started looking into replacing our patrol cars, we had certain criteria that needed to be met. First and foremost, they needed to be safe."

Doug Brugger, Police Captain
Raleigh Police Department, North Carolina

Image Courtesy of City of Raleigh



"Not only are these buses better for the environment, they're safe. We transport approximately 3.4 million people with them each year, and they've proven to be as durable as gasoline- or diesel-fueled buses."

Jack Burns, Concessions Management Chief
Zion National Park, Utah

Reducing Pollution in National Parks

The National Park Service, responsible for overseeing, maintaining, and keeping safe the millions of acres of land and water in the nearly 400 parks within the U.S., is strongly committed to using alternative-fueled vehicles, such as those fueled by propane autogas. These vehicles are helping reduce air, land, and noise pollution within the parks.

In 2000, Zion National Park, located in the Zion Canyon in Utah, instituted a free propane-autogas-fueled shuttle bus service to transport visitors through the busiest portions of the park. Today, this fleet, consisting of 32 buses and 23 accompanying passenger trailers that shuttle visitors throughout the peak tourist season, eliminates the emissions associated with the displacement of approximately 5,000 motor vehicles daily.

"Not only are these buses better for the environment, they're safe," says Concessions Management Chief Jack Burns of Zion National Park. "We transport approximately 3.4 million people with them each year, and they've proven to be as durable as gasoline- or diesel-fueled buses."

Burns continues, "In the event of an emergency such as an accident, our drivers will turn the engine key switch to the off position. By doing so, the propane autogas fuel system automatically closes a valve between the fuel tanks and the engine compartment to prevent fuel from escaping. If for some reason a fire occurs at or near the propane autogas fuel tanks, a high-pressure-relief valve will release propane autogas vapor into the atmosphere from a line on the roof of the bus. This is just like the pressure-relief system found on large propane storage tank systems."

The National Park Service also safely operates vehicles fueled with propane autogas in other famous areas including Glacier National Park, Montana, and Mammoth Cave National Park, Kentucky.

"It's difficult to change a perception without first understanding the facts. And the facts are, when you understand its properties and know how to properly handle it, propane autogas is safe."

Mark Holloway, Volunteer Fire Chief
West I-10 Fire Department, Texas

FIREFIGHTERS TALK PROPANE-AUTOGAS-FUELED VEHICLE SAFETY

In upstate New York, Vice President and Interior Firefighter James Mays Jr., of the Sheridan Fire Department, is a supporter of propane-autogas-fueled vehicles for fleet use. He is working to educate first responders, school district personnel, and others about the fuel.

"Propane-autogas-fueled vehicles, if handled and maintained properly, are very safe and offer a lot of benefits to fleet users," says Mays, who is also a licensed emergency first responder. "However, since the fuel has different characteristics than gasoline or diesel, it's important to understand those differences."

According to Mays, one of the misperceptions about vehicles fueled by propane autogas is that the fuel tanks aren't safe. "Propane autogas tanks are more durable than gasoline or diesel tanks," continues Mays. "If in the rare instance a tank were to get punctured, it doesn't mean that the vehicle would explode like you might see in a Hollywood movie."

He adds, "I've seen videos where members of the police department actually shoot them with their guns, and nothing happened but for a few dents in the tank. They're very safe."

Mays concludes, "I'm seeing more and more commercial fleets being fueled by propane autogas. When I instruct at training seminars, I tell police officers and firefighters to become familiar with these types of vehicles because they're going to see a lot more of them in the future."

In Harris County, Texas, West I-10 Volunteer Fire Chief Mark Holloway, a firefighter with 25 years of service, believes that propane autogas is a safe fuel and that public perception has been skewed based on how it has been portrayed by the media and the film industry.

"For some reason, a lot of people have the perception that it's a volatile fuel when, in fact, it has a very narrow window for flammability," says Holloway.

Holloway feels strongly that firefighters and emergency first responders should complete a propane safety training program so they can more easily identify and respond to a propane emergency. "It's extremely important for them to understand the basic principles of propane," he adds. "The physical properties of the fuel are different from what they're probably accustomed to, so they need to be aware of them in order to know how to react."

He concludes, "It's difficult to change a perception without first understanding the facts. And the facts are, when you understand its properties and know how to properly handle it, propane autogas is safe."

VALUABLE RESOURCES TO HELP UNDERSTAND PROPANE-AUTOGAS-FUELED VEHICLES

As propane autogas continues to gain momentum in the marketplace, it's increasingly important for emergency first responders, as well as fire and police departments, to understand the basic principles of propane autogas.

Several online resources are available that provide users with information such as the characteristics of propane autogas and case studies on how companies are converting their fleets to run efficiently on propane autogas.

A PowerPoint presentation geared towards the emergency response community is available from the Propane Education & Research Council (PERC). The presentation discusses the general properties of propane, propane autogas vehicle components, vehicle identification, and approaching and assessing an incident. Go to www.propanesafety.com to download the presentation.

Online Autogas Resources

http://www.autogasusa.org

This PERC-sponsored website provides information on the several different types of propane-autogas-fueled vehicles (and other types of propane equipment), fueling with propane autogas, adoption incentives, and propane autogas webinars.

http://www.propanesafety.com

This PERC website provides information and training dates for the Propane Emergencies program.

www.propanecouncil.org
www.propanesafety.com