U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF MOBILE SOURCES

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Methanol Fuels and Fire Safety

Vehicle Fire Risk

In 1986, there were 500,000 vehicle fires and 1,400 vehicle fire fatalities in the United States. Gasoline was the first material to ignite in 180,000 of these fires and many of the other fires ultimately involved gasoline.

Gasoline-ignited fires in 1986 involving cars, buses, or trucks resulted in 760 deaths, 4,100 serious injuries, and $215 million in property damage.

Projections indicate that casualties would drop dramatically if methanol were substituted for gasoline as the country's primary automotive fuel. Looking just at vehicle fires in which gasoline is the first material to ignite, a switch to methanol could save an estimated 720 lives, prevent nearly 3,900 serious injuries, and eliminate property losses of millions of dollars a year.

Methanol's fire safety advantage over gasoline stems from several physical and chemical properties (see figures on page 3):

- **LOWER VOLATILITY (Figure 1)**
  Methanol does not evaporate or form vapor as readily as gasoline does. Under the same conditions, exposed gasoline will emit two to four times more vapor than will exposed methanol.
- **HIGHER FLAMMABILITY REQUIREMENT (Figure 2)**
  Methanol vapor must be four times more concentrated in air than gasoline vapor for ignition to occur.
- **LOWER VAPOR DENSITY**
  Gasoline vapor is two to five times denser than air, so it tends to travel along the ground to ignition sources. Methanol vapor is only slightly denser than air and disperses more rapidly to non-combustible concentrations.
- **LOWER HEAT RELEASE RATE**
  Methanol burns 25 percent as fast as gasoline and methanol fires release heat at only one-eighth the rate of gasoline fires.

These properties together make methanol inherently more difficult to ignite than gasoline and less likely to cause deadly or damaging fires if it does ignite. Methanol is the fuel of choice for Indianapolis-type race cars, in part because of its superior fire safety characteristics.

Other Fire Issues

Pure methanol burns with a light blue flame that is not easily seen in bright sunlight. It is possible, though highly unlikely, that spectators or firefighters might fail to notice the heat and unknowingly walk into a methanol fire. In the great majority of vehicle fires, however, burning materials other than fuel (such as engine oil, upholstery, paint, etc.) would produce both smoke and visible flames. In addition, a chemical could be mixed with methanol fuel to provide flame luminosity. Research is under way to identify potential additives.

Unlike gasoline, methanol can ignite at ambient temperatures in enclosed spaces such as fuel tanks (gasoline produces too much vapor to ignite in enclosed spaces). But this property of methanol is unlikely to cause vehicle fires or "explosions" in either collision or non-collision

situations. Explosions occur in collisions when the fuel tank ruptures and spilled gasoline bursts into flame. Again, this is much less of a risk with methanol than with gasoline. In non-collision situations, fuel tanks tend to be isolated from ignition sources. Finally, simple vehicle design modifications to methanol vehicles will even further reduce the chance of fuel tank ignition. These changes include use of materials that prevent flames from spreading through the fuel tank and modifications to further isolate the tank from sparks and other ignition sources.

Fuel Distribution Issues

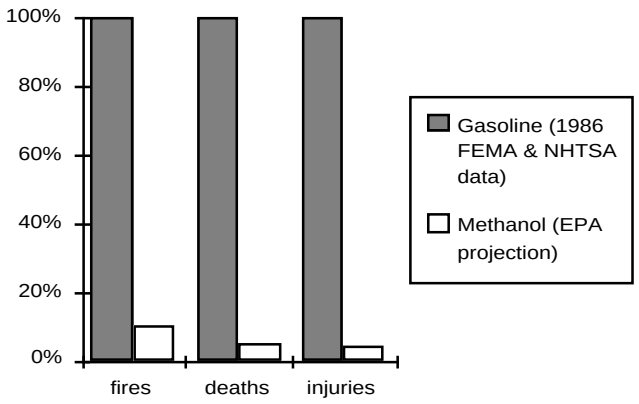
Methanol's energy content on a per-gallon basis is roughly half that of gasoline. Motorists would need about twice as much methanol as gasoline to travel an equivalent number of miles, and nearly twice as much methanol would have to move through the fuel distribution system to accommodate them. (If vehicles were optimized for methanol, it would be possible to reduce the amount of methanol required to travel a distance equivalent to that traveled on one gallon of gasoline.)

If methanol were as flammable as gasoline, the doubling of fuel transport would result in more fires. However, methanol holds such inherent fire safety advantages over gasoline that the opposite should occur. Deaths, injuries, and damage due to fires in the fuel distribution system should in fact decline, despite the increase in fuel transportation.

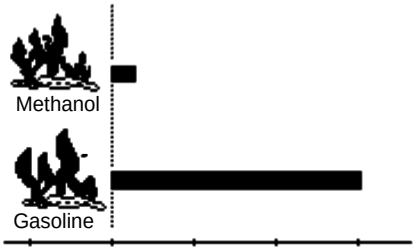
For More Information:

The Office of Mobile Sources is the national center for research and policy on air pollution from highway and off-highway motor vehicles and equipment. You can write to us at the EPA National Vehicle and Fuel Emissions Laboratory, 2565 Plymouth Road, Ann Arbor, MI 48105. Our phone number is (313) 668-4333.

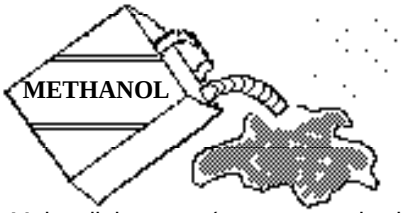
Fuel-related vehicle fires, deaths, and injuries



Fuel fire fatality zones*



*The zone in which 1% or more of bystanders would be killed by fire, assuming a fuel pool ten meters in diameter.

 Makes little vapor (evaporates slowly)	 Needs lots of vapor to burn	 Fire zone is confined; fires much less likely
 Makes lots of vapor (evaporates fast)	 Needs little vapor to burn	 Fire zone is broad; fires much more likely