Energy

Is Hydrogen Dangerous?

Much skepticism still exists about the safety of carrying around pure hydrogen in a moving vehicle. Many cite the vivid images of the *Hindenburg* ablaze, or the 1986 *Challenger* catastrophe, or the Hydrogen bomb as testaments to the danger of hydrogen. Fortunately, these explosions have little bearing on the safety of hydrogen fuel for your car or home.

Hydrogen vs. Liquid Hydrocarbons

In many ways, hydrogen is a good deal safer than gasoline or diesel. Like any fuel, hydrogen stores significant amounts of energy, and handling it requires certain safety precautions. But hydrogen can be safer than gasoline if it is used properly.

Because it is so light, hydrogen disperses and floats skyward when leaked—it won't pool or soak into clothing like gasoline, just waiting to ignite. (Spilled hydrogen won't soak into the earth and pollute ground water either, or cause an environmental disaster like the Exxon Valdez.)

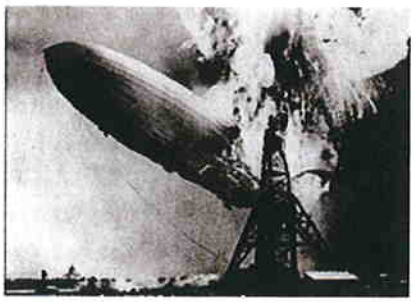
But what if the hydrogen does somehow ignite in a car? Tests conducted at the College of Engineering at Miami University aimed to find this out. 3000 cubic feet per minute of hydrogen was leaked from a vehicle tank and set alight. Over the course of the burn, temperature sensors inside the vehicle did not measure an increase of more than 1 or 2 degrees centigrade anywhere inside the vehicle. The temperature of the surface of the outside of the vehicle did not climb above that of a vehicle sitting in the sunshine!

This might sound unintuitive. But when a carbon-based fuel like gasoline burns, glowing hot soot particles transfer the heat to its surroundings—potentially including you. But because hydrogen contains no carbon, it burns cleanly without a residue of hot soot, producing little radiant energy. This means that a victim would have to be practically in the flame in order to get burned.

Pressurized hydrogen tanks are made to withstand enormous impacts, and fail gracefully, if at all. Some fear that a hydrogen tank has the potential to explode, and that is possible. But these critics often overlook the greater explosive potential of the gas tanks in their very own cars.

Many real-life tests have demonstrated the safety of pressurized hydrogen storage. Simulated 55 mph crash tests left the car totaled, but the hydrogen tank intact. To prove the safety of its hydrogen vehicles, BMW tested its hydrogen tanks in a series of accident simulations that included collision, fire and tank ruptures. In all cases, the hydrogen cars fared as well as conventional gasoline vehicles. And hydrogen-fueled cars are designed to preclude the possibility of leaked hydrogen collecting within the vehicle.

The *Hindenburg* Myth



Most hydrogen concerns stem from the *Hindenburg* disaster of 1937. The hydrogen gas that once filled the *Hindenburg* zeppelin did burn, but it did so quickly, upwardly, and away from the people below. When the airship was docking, an unexpected electrical discharge ignited the airship's canvas (which was unknowingly treated with two major components of rocket fuel!) The clean hydrogen flames swirled above the occupants of the passenger compartment, and all those who rode the airship down to the ground survived. 35 of the 37 casualties perished from jumping to the ground, and most other injuries resulted from diesel burns.

The *Challenger* Space Shuttle and the H-bomb

Many people incorrectly associate hydrogen fears with the vividly haunting images of the 1986 *Challenger* Space Shuttle explosion or the detonation of a hydrogen bomb. Experts agree that the *Challenger* catastrophe was not caused by hydrogen. And an H-bomb employs tritium, a fundamentally different form of hydrogen, to replicate the same process by which the sun generates energy. This occurs at astronomical temperatures and pressures where nuclear rather than chemical reactions take place.

Handling Hydrogen

From the perspective of safety, storing and transporting hydrogen safely is very similar to handling natural gas or propane, which are currently piped all over the world to industries and homes. A safe hydrogen infrastructure will include a system of detectors to pinpoint leaks, alarms in order notify of leakage, and a system of cut-off points, all of which will be regularly tested.

Five percent of natural gas is already reformed to produce hydrogen for industrial use in petrochemical production, food processing, microchip manufacture and for spacecraft fuel. These industries have already resolved the safety issues around the storage and transportation of hydrogen.

- Fuel Cells