Fuel Cell Electric Vehicle Safety Systems

FCEVs are as safe as any vehicle on the road. CaFCP vehicle manufacturer members subject fuel cell vehicle models to extensive safety testing prior to releasing them on public roads. Current testing employs both destructive and non-destructive evaluations and occurs at the component, system, and vehicle level.

Safety systems take hydrogen’s unique properties into account:

- Wide flammability range: 4%-74% in air
- Buoyancy: Hydrogen is 14 times lighter than air and 8 times lighter than natural gas
- Very low radiant heat: hydrogen fires don’t easily spread
- Dispersion: hydrogen is a tiny molecule that rapidly disperses in the atmosphere
- Odorless, tasteless, non-toxic and invisible

Passenger vehicles have four safety systems and fuel cell buses have one additional system.

1. Hydrogen sensors detect hydrogen leaks in the passenger cabin and through the vehicle. It’s very unlikely that the fuel system will leak, however if the sensors detect a leak a solenoid will close and seal hydrogen in the tank. In addition, electrical relays open to shut down the vehicle and isolate the high voltage.
2. Impact sensors detect collision, just as air bag sensors do. This also seals fuel in the tank and isolates high voltage. (Buses do not have this sensor)
3. An emergency shutdown device in buses is a manual back-up and allows the operator to quickly disable the bus in an emergency.
4. All fuel systems employ tank-integrated temperature activated pressure relief devices (TPRD) in each tank. Should the tank(s) be subjected to high temperature- such as a gasoline fire under the vehicle- a fusible metal plug melts open and hydrogen rapidly releases, which is an extremely audible event. Because hydrogen is buoyant and dissipates rapidly, the tank(s) vent their contents in about three minutes, for a light duty passenger vehicle.
5. Buses have an additional fire suppression system that is required on CNG buses as well. It fires a single shot of dry chemical fire retardant into the powertrain compartment.

The on-board hydrogen storage tanks are extremely strong, carbon-fiber wrapped tanks. Similar to CNG tanks, hydrogen tanks are put through a battery of extreme tests, including bonfire, pressure cycling, impact, burst and penetration tests. The tanks must meet strict manufacturer guidelines and applicable DOT criteria for acceptable use on public roads.

Unlike other fuels that you can smell or see, hydrogen is colorless, odorless and non-toxic. Natural gas is odorized with mercaptan so you can smell a release. That’s not possible with hydrogen because it is such a small and buoyant molecule that no other substance can move and diffuse as quickly. In other words, by the time you smelled the odorant, the hydrogen might have already moved to another location. You can, however, hear a hydrogen leak as the high-pressure fuel moves through TPRD orifice.
CaFCP does extensive training with fire fighters and other first responders in the communities where FCEVs and FCEBs are and will be deployed. The combination of vehicle design, safety systems and knowledgeable responders make FCEVs as safe as other vehicles on the road.