

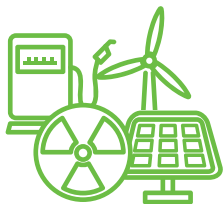
1 <b>H</b> Hydrogen 1.008	
3 <b>Li</b> Lithium 6.94	4 <b>Be</b> Beryllium 9.0121831
11 <b>Na</b> Sodium 22.98976928	12 <b>Mg</b> Magnesium 24.305

**HYDROGEN FUELED VEHICLES AND THE FUELING STATIONS NEEDED TO SUPPORT THEM ARE SAFE TO USE:**

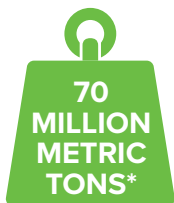
Hydrogen is not new, it's been in widespread industrial use for more than 50 years and codes, standards, and design practices have been developed to enable safe use.

All fuels contain energy and can be hazardous if handled improperly. Like other fuels, hydrogen must be used with care in systems designed around its unique properties. Hydrogen fueling stations and Fuel Cell Electric Vehicles (FCEVs) are designed in accordance with established safety standards to ensure their safety.

FCEVs are cleaner and more efficient than traditional combustion-based engines. Hydrogen FCEVs combine hydrogen stored in a cylinder with oxygen from the air to produce electricity, with water vapor as the by-product.



Hydrogen is derived from petroleum, wind, solar and other sources. Hydrogen is gaining momentum as an energy carrier.



Chemical Refining Electronics Pharmaceuticals

70 million metric tons of hydrogen are produced globally every year for industrial applications.



**U.S. \$199.1 billion**  
in revenue by 2023



**580,000 vehicles**  
by 2023

**HYDROGEN FOR TRANSPORTATION:**



Interest in zero-emission fuel cell trucks and ships is rapidly growing as a way of reducing pollution, carbon emissions, and noise.



**60 fuel cell trains**



**11,000**  
hydrogen-powered cars on the road in 2018



**20,000**  
fork-lifts used in warehouses in 2018

## HYDROGEN INFRASTRUCTURE AND VEHICLE SAFETY

All fuels contain energy and can cause a hazard if not properly handled. Just like gasoline, diesel, and natural gas, it is important to know the properties of hydrogen and to follow established rules for safe handling.

- Most people are aware of the basics of safety when refueling with gasoline, such as not smoking, not using cell phones and not fueling the car with the engine running. Hydrogen dispensers are very similar to traditional gasoline or diesel motor fuel dispensers but have some additional safety features included because hydrogen is delivered as a pressurized gas. The station and vehicle tanks have provisions to vent the hydrogen to a safe location in an emergency.
- When gasoline leaks, it can form a pool on the ground which can be ignited, and it can also flow and carry the fire into gutters or drains. Hydrogen is lighter than air and readily disperses. The hydrogen-air mixture can be ignited and may resemble a torch that is forced in one direction by the pressure.
- Regulations, codes and standards have been developed for the safe deployment of hydrogen-based technology and to ensure public safety.

## HYDROGEN SAFETY SYSTEM

Today, fueling stations and vehicles have built-in safety systems. These systems have characteristics that vary depending upon the type of fuel. With every fuel, the most important safety consideration is avoiding leaks, thus avoiding the opportunity for fuel to ignite. Fuel cell cars and hydrogen fueling stations are designed to prevent hydrogen from leaking and have systems that shut down the flow of hydrogen automatically if a leak is detected. Example safety systems include:

- Both the dispenser and the fuel cell car have leak detecting sensors and will shut-off the flow of hydrogen if a leak is detected.
- The hydrogen fueling nozzle connects to the fuel cell car with a tight seal and stays locked as long as there's hydrogen fuel pressure in the hose.
- Fuel cell cars have a protective device that prevents the vehicle from being driven while the fill hose is attached, thus preventing “drive-offs” and damage to the hydrogen dispenser.
- In case of a collision, while the airbags are busy protecting passengers, the fuel cell car isolates the hydrogen in the storage cylinders so that only a very small amount of hydrogen can escape from broken fuel lines.
- Fuel cell cars are crash tested to the same standards as all other vehicles. This includes front, rear, and side impacts to demonstrate the robustness of the vehicles and fuel systems.
- Firefighters and first responders are trained how to respond to incidents involving fuel cell cars and hydrogen fueling stations.



**The Center for Hydrogen Safety promotes the safe use and deployment of hydrogen-based technologies globally via hydrogen first-responder trainings, safety reviews and evaluations, forums, networking opportunities, establishing guidelines, disseminating information, and much more.**

**For more information, please visit [aiche.org/CHS](https://aiche.org/CHS)**