



DESERT BREEZE

VOLUME VI ISSUE II

JUNE 2018

Hydrogen Fuel

As many are aware, the availability and usage of alternative fuels has been growing in California over the last several years. These fuels help to reduce the emission of air pollutants from our vehicles, which account for a large portion of pollution being emitted into the air. Some alternative fuels, like natural gas and propane, are still hydrocarbon fuels, and therefore can still emit a variety of harmful pollutants (though in reduced quantities compared to gasoline and diesel fuel). Hydrogen fuel, as the name implies, is composed almost entirely of hydrogen gas and can be combusted similar to a standard fuel or used as part of a fuel cell. Combusting hydrogen gas cannot form many of the harmful pollutants that combusting traditional fuels would: combustion products of hydrogen gas are primarily water and nitrogen oxides (NO_x) when combusting directly with air, and only water when combusting with pure oxygen or when used in a fuel cell.

Hydrogen gas is not naturally available in large quantities, and therefore must be produced through industrial methods. Hydrogen gas is mainly generated through steam-methane reforming; this process consists of heating methane (natural gas) in the presence of steam and a catalyst (a substance that increases the rate of a chemical reaction) made of nickel, and results in the formation of carbon monoxide and hydrogen gas. A less common method of forming hydrogen gas involves using electrolysis, in which electricity is run through water to separate hydrogen and oxygen atoms. This method, however, requires much more energy and is more expensive.

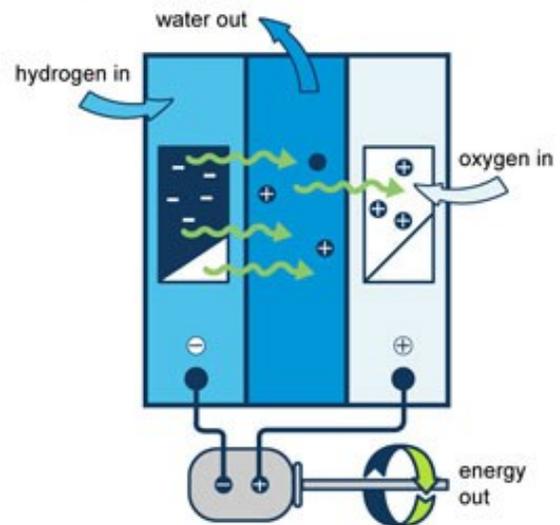
Fuel cells have been the main approach by manufacturers to implement hydrogen fuel usage, as it is more efficient than combusting hydrogen gas and avoids some major disadvantages. Hydrogen gas is much less dense than gasoline, and therefore consumes more fuel to travel the same distance as a conventional vehicle when using combustion. Hydrogen gas also has low ignition energy, meaning that it is more likely to combust prematurely, which can damage the engine. In a fuel cell, the hydrogen is sent through an anode (an electrical conductor that electrical current enters into) and a catalyst, creating a chemical reaction that creates protons (in the form of hydrogen ions with a positive charge) and electrons; the electrons are drawn from the anode to a cathode (electrical conductor that an electrical current exits from) through an external circuit, which provides electricity for the vehicle. At the cathode, the protons and electrons are reacted with air in the presence of another catalyst to form water molecules, which then exit the fuel cell.

Several automotive manufacturers are making hydrogen fueled vehicles available to consumers. One example is the Toyota Mirai, which is estimated to have a driving range and refueling time similar to conventional vehicles, and is currently being offered with the first 3 years or \$15,000 of hydrogen fuel costs covered as part of the lease agreement. While California does have the largest hydrogen refueling infrastructure in the US (36 of 40 listed stations nationwide), no fueling stations equipped with hydrogen fuel are currently located in the District. The California Fuel Cell Partnership, a collection of governmental, regulatory, and private industry groups, are working to expand the accessibility of hydrogen-fueled transportation to California residents. For more information about hydrogen fuel, you can visit the US Department of Energy's Alternative Fuels Data Center website at: <https://www.afdc.energy.gov/fuels/hydrogen.html>

[hydrogen.html](https://www.afdc.energy.gov/fuels/hydrogen.html)

By: Samuel Johnson

Hydrogen fuel cell



Greenhouse Gas—Fluorinated Gases

In the last two Desert Breeze newsletters, we talked about two types of greenhouse gases: Methane and Nitrous Oxides. In June 2015 Desert Breeze, we also talked about another greenhouse gas - Carbon Dioxide (CO₂). Therefore, the fourth and last type of greenhouse gas will be discussed in this newsletter. It is called fluorinated gases. There are four main categories of fluorinated gases: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), and nitrogen trifluoride (NF₃).

Unlike other greenhouse gases, fluorinated gases have no natural sources. They are man-made gases that can stay in the atmosphere for centuries. They are emitted through a variety of industrial processes such as aluminum and semiconductor manufacturing. Additionally, fluorinated gases have very high global warming potentials (GWPs) relative to other greenhouse gases. A small emissions of those fluorinated gases can have large effects on global warming because the larger the numbers of GWPs are, the more that a given gas warms our planet. In general, fluorinated gases are the most potent and longest lasting greenhouse gases emitted by human activities. Below is the table of fluorinated gases' GWPs compared to other greenhouse gases.

Greenhouse Gases		Chemical Formula	Lifetime in Atmosphere (Years)	GWP (100 Years)
Carbon Dioxide		CO ₂	Variable	1
Methane		CH ₄	12	25
Nitrous Oxide		N ₂ O	114	298
Hydrofluorocarbons	Fluorinated Gas	HFCs	Up to 270	Up to 14,800
Perfluorocarbons		PFCs	2,600-50,000	7,390-12,200
Sulfur Hexafluoride		SF ₆	3,200	22,800
Nitrogen Trifluoride		NF ₃	740	17,200

Fluorinated gases were developed as a replacement for chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). Unlike CFCs and HCFCs, fluorinated gases do not deplete the stratospheric ozone layer. According to EPA, regulations issued under Sections 601-607 of the Clean Air Act phase out the production and import of ozone-depleting substances such as CFCs and HCFCs. In fact, CFCs had been completely phased out since 1996 and HCFCs will be completely phased out by 2030.

Different fluorinated gases are being used in different applications. Hydrofluorocarbons are used inside of products like refrigerators, air-conditioners, foams, and aerosol cans. Emissions from these products are caused by leakage during manufacturing process as well as throughout the product's life. Perfluorocarbons are a byproduct of industrial processes associated with manufacturing of aluminum and semiconductors. Sulfur hexafluoride is used in magnesium processing and semiconductor manufacturing. Sulfur hexafluoride is also used by the electric power industry as an insulator and arc interrupter.

Emissions of fluorinated gases used as refrigerants can be reduced by better handling of these gases and use of other fluorinated gases with lower global warming potentials. According to EPA regulations (40 CFR Part 82, Subpart F) under Section 608 of the Clean Air Act, emissions of fluorinated gases are being reduced by testing refrigerant recovery and recycling equipment to ensure it meets EPA requirements. In conclusion, it is our responsibilities to try and reduce fluorinated gas emissions for better air quality and environment.

By: Wanna Aung

WOODSMOKE REDUCTION PROGRAM

The Woodsmoke Reduction Program (Program) is a grant program administered by the California Air Resources Board (CARB) with funding through California Climate Investments (CCI) and the Greenhouse Gas Reduction Fund (GGRF). The Program is designed to replace high-polluting, uncertified wood stoves, wood inserts, and fireplaces with cleaner burning, more efficient home heating devices. The 2016/17 GGRF appropriation committed \$5,000,000 for the Program. The Program will be implemented by the California Air Pollution Control Officers Association (CAPCOA) in coordination with local air pollution control districts or air quality management districts (Air Districts). Implementation of the Program will reduce greenhouse gas emissions; provide co-benefits, in reducing black carbon emissions; and improving air quality.

The Eastern Kern Air Pollution Control District (District) is slated to receive \$100,000 from the Program. Residences using uncertified wood stoves, wood inserts, and fireplaces as primary home heating sources are eligible for the Program. The incentive amount will vary. Households in disadvantaged or low-income communities and low-income households will qualify for higher incentives. The Program will include outreach and educational material to ensure households make informed decisions about how to burn and what to burn to maximize the efficiency of the device and minimize pollution. A list of wood stoves certified by the United States Environmental Protection Agency (EPA) can be found at the following website: <https://www.epa.gov/compliance/list-epa-certified-wood-stoves> More information regarding the Program is coming soon. Stay tuned.

By: Glen Stephens

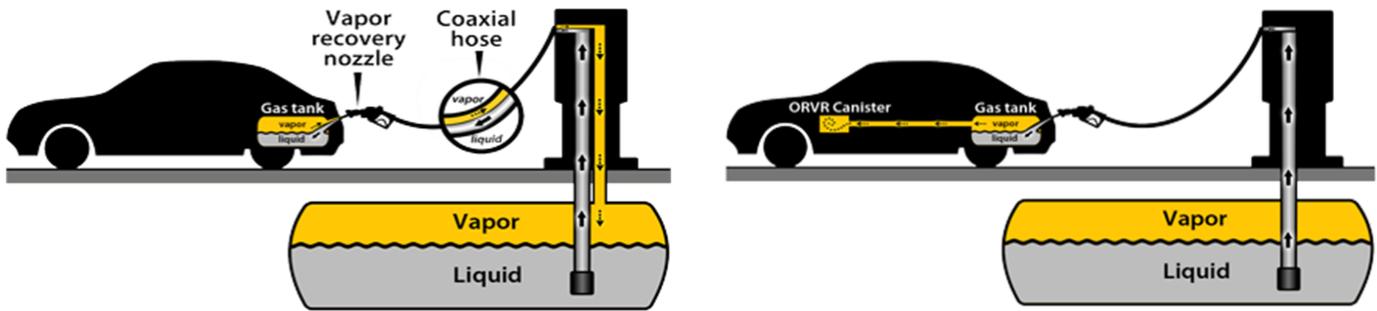


CARCINOGENIC EMISSIONS AND HOW THEY ARE BEING REDUCED

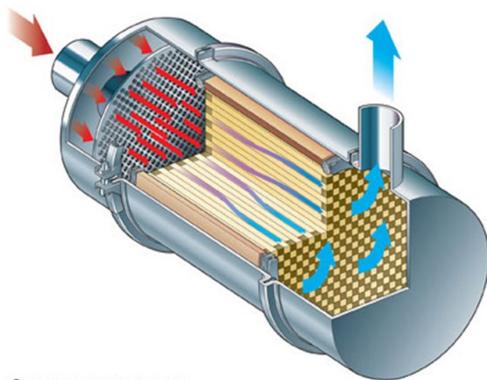
Our lives are full of risk. It is all around us, every day. For example, driving a car, or even riding in a car can be high risk activity. There is an element of choice to these particular activities. However, we all must breathe, and there is no choice concerning breathing. Some of us are less willing to accept risk that involves no choice. When it comes to air pollution, risk is less acceptable. Sources of air pollution that emit cancer causing agents (carcinogens) are often required to reduce carcinogenic emissions into the atmosphere.

Consider sources that are all around, we may not even think about, like Gas Stations, Diesel engines, Auto Body Shops, and Drycleaners using Perchloroethylene (Perc). We probably breathe emissions from each or any of these sources on a daily basis. Consideration of these risks is likely not a source of concern for all people; however, for Air Districts it is a concern, and control measures are utilized to minimize these sources of emissions.

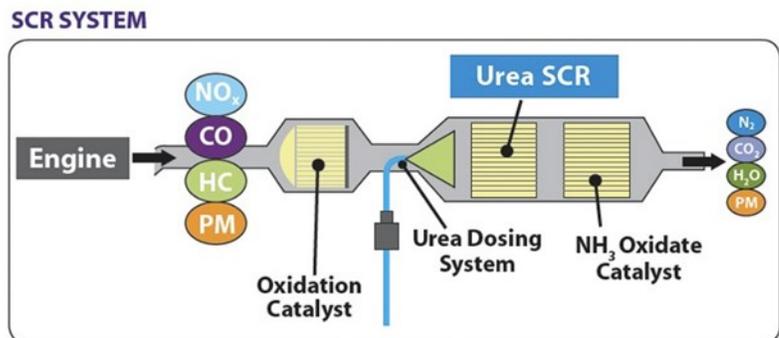
Gasoline Dispensing Facilities (GDFs) emit benzene (a known carcinogen), as part of the gasoline vapors. To minimize the vapors emitted from GDF vapor control systems are installed on most gasoline stations in California. The boot goes around the car fill cap and returns the vapors into the gasoline storage tank. Some of the newer vehicles have on-board vapor control that adsorbs gasoline vapors while pumping gasoline.



We see Diesel Engines every day; they are in eighteen-wheelers and super-duty pick-up trucks. In the 2000 calendar year, the California Air Resources Board determined diesel particulate emissions to be a carcinogen. Currently, diesel particulate matter filters (DPF) are used to capture diesel particulate matter emissions. Currently, new diesel engines are using urea and ammonia in combination with a catalyst (called selective catalytic reduction {SCR}) to reduce nitrogen oxide emissions.



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In our neighborhoods, we can easily find Dry Cleaning Operations. Years ago, most dry cleaners used the cleaning solvent called Perchloroethylene or “Perc”. However, most Perc dry cleaning operations are being phased out. Currently, most dry cleaning operations use non-toxic petroleum and synthetic hydrocarbons with names like: Green Earth®, ExxonMobil DF-20001, Chevron Philips EcoSolv®1, and others (et.al.).

Close to our neighborhoods, we can easily find Automotive Body Shops. Similar to Dry Cleaning Operations, the controls for Automotive Body Shops is the reformulation of old products and manufacture of new products without carcinogenic compounds. For instance: many paint formulations contained a compound called strontium chromate. Strontium chromate was removed from paint formulations; thereby, eliminating the carcinogenic risk.

The Eastern Kern Air Pollution Control District issues permit to hundreds of sources that emit toxic air contaminant emissions. Our Air Quality Specialist’s complete inspections to assure the control equipment is operating correctly. Our part to clean the air for everyone.

By: Brenton Smith

Board of Directors

Ed Grimes, Chair (Mayor, Tehachapi)
Don Parris, Vice Chair (Councilman, California City)
Eddie Thomas (Vice Mayor, Ridgecrest)
Mick Gleason (KC 1st District Supervisor)
Zack Scrivner (KC 2nd District Supervisor)

Board of Directors usually meet once every two months starting in January at the Tehachapi Police Department Community Room.

Air Pollution Control Officer

Glen E. Stephens, P.E.

Hearing Board Members

William Deaver
Doris Lora
Dr. Wallace Kleck
Chris Ellis
Charles Arbaut



For news updates and other information, please visit the Eastern Kern APCD website at www.kernair.org

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