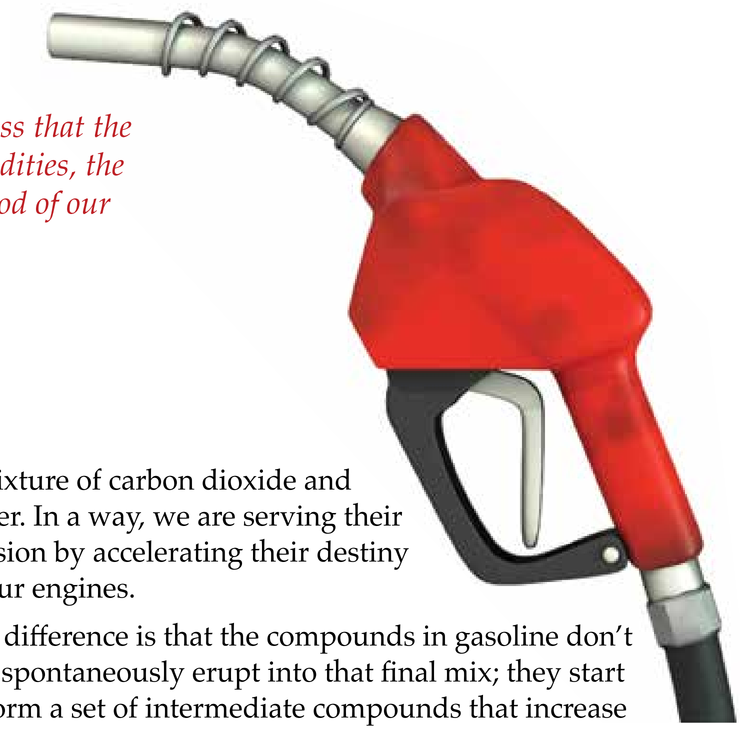
Meandering Through the Oil Industry: Part 7



This technical article is in a series characterizing the process that the oil industry follows to bring us one of our favorite commodities, the gasoline that powers our Classics. Gasoline is the lifeblood of our vehicles; does it ever break bad?

BAD BLOOD

By Brian Rohrback

Particularly as you get older, nothing is more offensive than bad gas. If you are now expecting a treatise on biological functioning or possibly a set of scathing restaurant reviews, I will now disappoint. Impractical and dangerous to refine at home, we use gasoline here and make it there; stuff can happen en route. So, when and why does good fuel go bad?

There are several categories in the "bad" collection, some are not terribly relevant to the operation of our Classics, but will be belabored here because the story is interesting. The categories are mislabeling, aging, tax avoidance, and adulteration. Detecting, and to some extent preventing, these types of unacceptable quality makes up a part of my workday (OK, maybe that is why I identify the topic as "interesting").

Mislabeling
(a category but not a problem)

We purchase fuel on faith, as we are unable to verify the composition of what we pump. The wrong fuel can be put into a distribution tank, but this is a rare occurrence. A fuel can be mis-color-coded (this happened to me with a batch of aviation fuel, labeled with a motor fuel dye). In some cases, the refinery will sell higher-octane gasoline simply because they had "too much of the good blend components and the tank was going to overflow" (I can give you dates when this has happened at one Washington refinery). We do have the technology to verify at the pump, but the problem is not a big one in the US and likely not worth the effort and expense.

Aging
(something to address)

This is a more significant problem for our Classics. The adage: *there is nothing worse than bald tires and old gas.* The problem is that gasoline is thermodynamically unstable. Here it is a mixture of hundreds of different hydrocarbons, but every one of them would rather be a mixture of carbon dioxide and water. In a way, we are serving their mission by accelerating their destiny in our engines.

The difference is that the compounds in gasoline don't just spontaneously erupt into that final mix; they start to form a set of intermediate compounds that increase the viscosity, slow the flow, gum up the jets. If your car sits over the winter, it is a good idea to add a fuel stabilizer, which prevents the formation of this varnish-like chemistry. If you store the car for much longer, drain the fuel (it is a safety issue anyway).

Tax Avoidance
(bet you hadn't thought about this)

Tax fraud is alive and well and is the most significant in countries that have high taxes added to the fuel or live adjacent to countries that subsidize their fuel for political benefit. Several examples that I have been asked to assess:

1. In Saudi Arabia, gasoline and diesel fuel are cheap. Entrepreneurs risk getting a body part chopped off by adding used motor oil to good fuel, trucking it across the border as a waste product, then distilling to restore the fuel, sans tax.
2. All over the world, governments charge less (no road tax) for fuel used on farms or for industrial processes. Taking farm fuel and rebranding it as road fuel (it is the same stuff after all) avoids tax. In the UK, that is a 50% savings.

If the incentive is high, there will be action. And, for every action governments perform, we bring in smarter and smarter criminals. So, let's follow the history:

Have you heard of Red Diesel? We placed red dye in farm diesel so it would be easy to distinguish untaxed from taxed.

- Great, no training needed to detect fraud.
- Bleach, acid treatment, running through silica gel – they all remove the dye.

Add a high molecular weight marker in low concentration to not disrupt engine performance

- Test for the marker is pretty simple, but involves an instrument.
- Criminals can distill off and sell the diesel portion, leaving the marker behind.
- Note now we are encouraging organized crime due to cheating's added capital expense.

Add a small amount of a marker (Dow's Accutrace is popular) that is smack in the middle of the diesel range of hydrocarbons to make it impossible to remove by any of the means above.

- Employing this approach, the UK retrieved £1 billion in taxes by setting up roadside test stations.
- To make it work, governments must mark (and someone pays the cost) the fuel.
- Have you ever tried to get a collection of governments that have the petro-economy intertwined to agree? In fact, they decided to all go it alone in 2016; I wonder where they are now.

Adulteration
(on the rise, but only for diesel)

Adulteration implies that there is a purposeful misleading of the public. For this to happen, there must be some form of economic gain. The messing around with gasoline is really a very insignificant problem for several reasons. One, gasoline is dangerous to play around with, more so than other fuel types. Second is that much of the fraud involves adding two ingredients, one lighter and one heavier than the base fuel (to make the bulk quality tests stay constant). This bracketing will be in play when we talk about diesel fuel, but gasoline starts with butane (four carbon chain) and anything you add on the lighter end will evaporate like crazy. Also, if you add just a touch of heavier hydrocarbons, like kerosene or diesel, a car's gasoline engine will let you know immediately (runs rough, doesn't want to turn off – dieseling!).

As with tax avoidance, where this becomes more of a problem is with diesel fuel. Mostly things like base oils (motor oil) and bio-oils are the adulterants of choice, but lots of mangy hydrocarbons and fats show up in fuel. At least from what I have seen, the murkiest problem is in Europe, where the adultered diesel tends to originate in Eastern longitudes and heads West where diesel demand is strongest and prices are high. Testing is spotty and inconsistent (or non-existent).

In the US, the UK and Asia, the problem is more the unfettered addition of biodiesel, above the labeled standard. Most engines have a limited tolerance of bio-origin diesel. And, waste oil is pretty cheap, easy to convert, and untaxed when processed outside the system. This is complicated when a certain percentage of biodiesel is allowed, even required. Then how do we tell the extra from the recipe?

From the annals of technology...

A review by Bill Deibel

An article entitled "Vapor Lock"

Problems with Ethanol Blended Fuels and Possible Mitigations by Jim Chase appeared in the July 2017 issue of The Packard Club journal The Cormorant News Bulletin. It is a very comprehensively researched piece with data from technical papers published in 1928,1931,1935, 2005 and 2007. From his research Mr. Chase not only found data regarding the impact of ethanol to the gasoline blend, but a great deal about what actually causes vapor lock and where the problem is created. Through the text Mr. Chase suggests many things that can be done to help minimize the propensity for a car engine to vapor lock.

An SAE paper documents the test of an unidentified 1935 car driven up a 7% grade at 40 MPH for 20 minutes on an 80 F day. At that point the car was stopped and left to idle at 360 RPM for another 25 minutes. Temperatures were measured at the Carburetor flange (hottest point), Coolant (location not noted), Air under hood, Main Fuel Jet, Carburetor Inlet, Carburetor Bowl and Fuel-Pump Inlet (coolest point). After 10 minutes all these temperature had stabilized. Fifteen minutes after stopping at idle all except the Carburetor Flange and the Fuel-Pump Inlet had stabilized. The Carburetor Flange rose from 123 F at start of idling to 241 F after 23 minutes and then steadily declined to 218 F at end of test. The Fuel-Pump inlet rose from 102 F at start of idling and rose to 153 F at end of test however its rate of rise diminished after 20 minutes. Throughout the test the temperature at all of the above points remained in order

Continued on Page 24