Spring 2018

Dear No-Rosion Customer,

Spring is here… and if you're like me, you're raring to go, anxious to get your cars out and start driving!

Have you ever noticed that gasoline prices go up every year when the weather turns warm? It would be easy to think that this is just refiners' way of price gouging – i.e. fleecing us before we hit the roads and start driving on summer vacations, etc. That's what we used to think. What we've learned is that there's more to the story…

In June 1989, major revisions were made to the Federal Clean Air Act. The goal was to reduce acid rain, urban air pollution, and toxic air emissions. As a result, the EPA began restricting the "volatility" of retail gasoline sold during warm summer months. **What is *volatility*?**

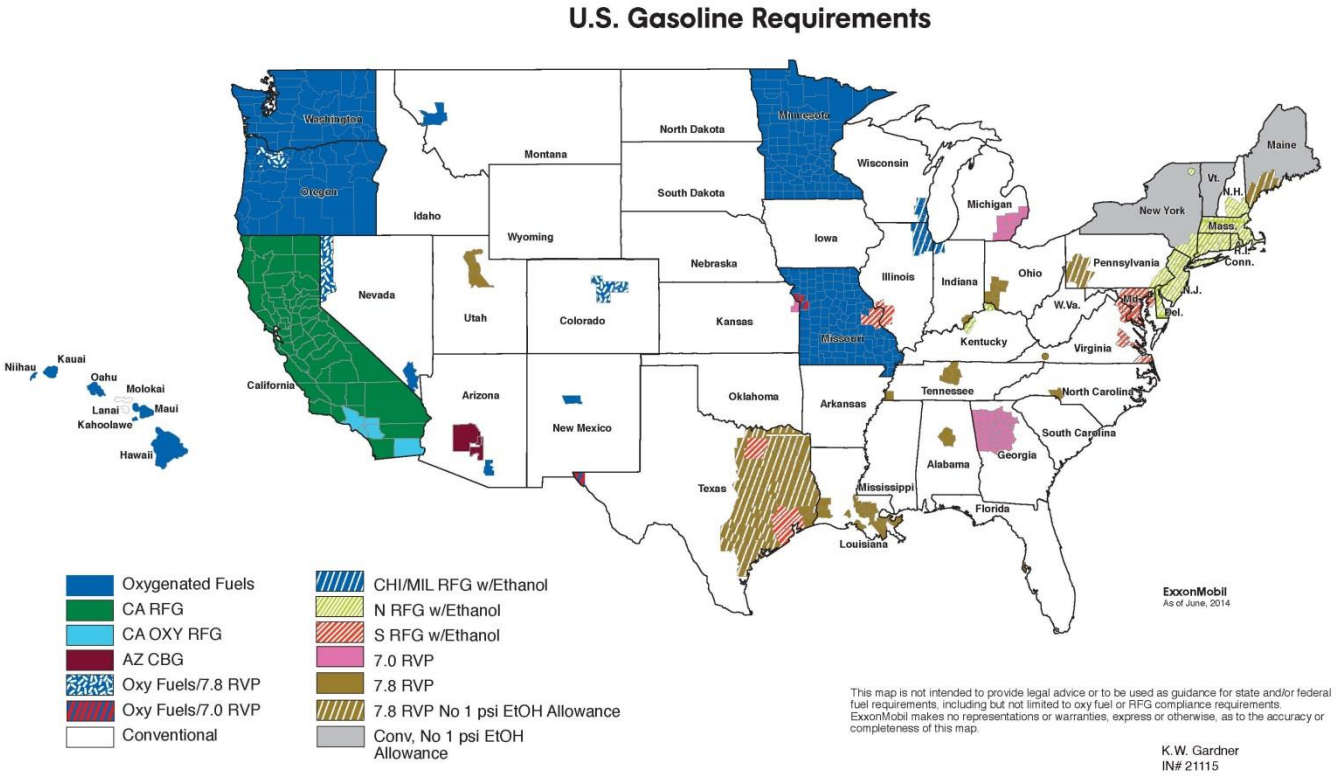
Volatility is the temperature above which gasoline vaporizes, or evaporates, and changes from liquid to gaseous form. Vaporized gasoline that accumulates in the earth's atmosphere is blamed for increases in ground-level ozone, which contributes to smog in urban areas. Worse yet, vaporized gasoline causes dreaded "***vapor lock***," in which gasoline vaporizes before it reaches the fuel pump. You may remember this happening to your hot rods back in the 50's and 60's, for example.

Beginning in the 70's, all new cars came equipped with what is called "Evaporative Emission-Control Systems" (EVAP), in which a charcoal filter in the gas tank traps and filters gasoline vapor that is then routed back into the throttle body. While this system largely resolved issues with vapor lock, the government deemed it insufficient to prevent vapors from reaching the environment. Also, the government caught on to the fact that some of us were removing this ugly EPA-mandated plumbing from our engine compartments.

As a result, the Federal government took more control, requiring that gasoline have a **Reid vapor pressure (RVP)** no higher than 9.0 psi at retail gas stations from June 1 - September 15. By definition, the RVP of gasoline is the vapor pressure exerted (in psi) at a stabilized temperature of 100°F. As a point of reference, a fuel with RVP of 14.7 would "volatize" at sea level pressure, on a 100°F day.

The EPA has also established geographic exceptions for acceptable RVP's across the US, as a result of the fact that certain densely-populated urban areas are more prone to smog buildup. As a result, cities in fourteen different states have been designated "high-ozone attainment areas." In these cities, the EPA mandates even lower RVPs of either 7.0 or 7.8 psi. For example, California has a statewide limit of 7.0 psi, which drops to 6.9 psi for gasoline blends that don't contain ethanol or other alcohols. And because California doesn't get very cold during the winter, summer-grade low-RVP gasoline must be sold starting as early as April 1 and as late as October 31. Multiple other "warm weather" cities must sell summer-grade fuels well into the late fall.

In order to meet widely-varying and often overlapping Federal, state, and city requirements, refiners find it necessary to blend and distribute upward of **twenty different types of summer-grade gasoline!** As you will note on the US map at the top of the next page (Source: ExxonMobil) most gas stations sell conventional 9.0-psi summer-grade gasoline. But city and state-specific variances create a complicated geo-specific maze of summer gasoline blend requirements for refiners. A few examples: (1) They must produce blends that are oxygenated (i.e. blended with alcohols), to reduce carbon monoxide. (2) They must sell reformulated blends in 17 states, to further reduce ozone and smog. (3) They must abide by California-specific restrictions. And so on…..



This map also explains why gasoline prices can often vary widely between short distances within the same state. In some locations, simply crossing the street may provide access to a different blend, yielding a price difference of 10-15 cents per gallon. To look up the EPA's RVP requirements for where you live, visit their web site at:

www.epa.gov/gasoline-standards/gasoline-reid-vapor-pressure

Further complicating matters is the fact that over 98% of all gasoline blends sold in the US now contain ethanol. Why does this complicate matters? Gasoline blended with 10% ethanol (known as "E10") has a RVP of 10 psi – which is 1 psi higher than the EPA's nationwide 9.0 psi requirement. Recognizing this fact, the EPA has granted an exemption on the standard 9.0 psi mandate for E10 blends. But here's the rub: Many states, including all of New England, don't recognize the EPA's 10 psi exemption for E10 gasoline. So refiners have to get "creative" in how they reduce RVP below 10 psi for E10 blends. Said "creativity" doesn't come cheap. **It drives up cost.**

Back to my original point: **Why do prices go up during the summer?** Gasoline is a complex mixture of hydrocarbons, including a number of different additives that refiners use for adjusting octane, vapor pressure, etc. Each of these different additives has a different cost structure. Butane is one of the cheaper additives, but it has a very high RVP of 52 psi. For this reason, refiners typically blend with less than 2% butane during the summer – which requires them to replace it with higher-cost additives, such as alkylates and reformates. This, plus the aforementioned complicated network for distributing summer blends, combines to drive up prices at the pump during warm summer months.

When it comes to the specialized needs of antique/collector cars, there are certain things you should know about summer and winter blends. With a lower RVP, summer blends evaporate less from carburetors, and thus fare better during storage…. as opposed to high RVP winter blends, which evaporate more readily from carburetors, leaving behind sticky **gums** that clog jets, destroy accelerator pumps, and gunk up capillary check valves. Summer blends also contain 1.7% more energy than winter blends, meaning they will yield better fuel economy. But low RVP summer blends also don't ignite well during cold weather. Trying to run a low RVP summer blend in cold weather may result in hard starts (or no starts) and misfires, depending on your engine and how it's tuned.

At left is an image of a carburetor float bowl from a 1967 Jaguar XKE. The tank of this car was filled with gasoline that was later determined to be a high RVP winter blend. It was parked in a climate-controlled garage for 20 months. The gasoline evaporated from the carburetor, leaving behind heavy, sticky **gum**s. The gums were bad enough to prevent the carburetors from functioning, and the car would not start or run.

This photo was sent to us by a customer who had previously used No-Rosion in the cooling systems of his cars. But he had never used our fuel system products. After paying his mechanic over $3,000 to dismantle, clean, and rebuild the entire fuel system, he began using No-Rosion Fuel System Combustion Optimizer, and has suffered no repeat issues.

So what are the takeaways from all this? (1) Don't blame refiners for seasonal fluctuations in gasoline prices. You can blame that on our government. (2) When you top off your tank at the end of the driving season, before winter storage, do it before September 15 if you live in an area designated in white on the map to the left. This should provide some level of assurance that you will have low RVP gasoline in your tank over the winter, and be less prone to complete evaporation from carburetors. (3) Regardless of what type of gasoline you have in the tank, for complete protection and peace of mind, add **No-Rosion Fuel System Combustion Optimize**r.

No-Rosion Fuel System Combustion Optimizer contains a proprietary, concentrated PEA (*Polyether Amine*) detergent that **prevents/removes gums** and deposits formed by today's unstable fuel blends. It also stabilizes fuel to prevent oxidation, and contains a commercial-grade demulsifier that prevents ethanol from absorbing water from humidity in the air. Throw in the fact that it also contains a multi-metal corrosion inhibitor, as well as lubricity agents for fuel pumps, and you end up with a product that can be used with any type or blend of gasoline as an inexpensive insurance policy against damage caused by the issues mentioned above.

How good is our proprietary PEA detergent? Over the last few years, it has gained the attention of a few domestic fuel refiners. Under private label, it is now being blended into several boutique gasolines.

Let's go back to the case of the aforementioned Jaguar XKE… One of the contributing factors to the severe gum formation in its carbs was the fact that high RVP gasoline was unwittingly/errantly used to fill the tank just before storage. Which begs the question: *Because Avgas has a low RVP, and because it contains tetraethyl lead, it should be a great choice for our old cars, right*? **Wrong**.

Avgas is of course short for "*Aviation Gasoline*." It is intriguing to many of us with old cars because it contains tetraethyl lead. Thus, it has a high octane rating, and protects non-hardened valve seats. It also costs less than commercial leaded race fuels. But the more you learn about Avgas, the more you'll realize it's not a good choice for anything other than airplanes… not to mention the fact that it is not legal to run in on-road vehicles.

The most common version of Avgas is "LL100," which stands for "Low Lead 100 Octane." It contains 0.5 grams per liter of tetraethyl lead. While good for octane, it's bad for lead deposit formation. Tetraethyl lead naturally degrades to form ***lead oxide*** when it is burned. In reality, it is this oxide that provides the octane boost. The problem is that lead oxide exists as a solid up to a temperature of about 1650^{o}F. With the exception of some racing engines, cylinder walls rarely exceed this temp. To prevent lead oxide deposits, ethylene dibromide (a lead scavenger) is blended in Avgas 100LL. It reacts with lead oxide to form lead bromide, which is more volatile – becoming a gas at around 475^{o}F. This ensures that lead is converted to gaseous form, and exits the airplane engine via the exhaust. But will it also convert to the gaseous form when used in an automobile engine?

No. Most of us don't achieve cylinder temps this high while driving on public roads, which means **lead oxide deposits will form**. These deposits are corrosive, and damage valves, valve guides/seats, and cylinder heads. Because corrosion inhibitors in Avgas are aluminum-specific, they won't protect the cast iron cylinder heads found on the engines of most of our older cars. And of course, in newer cars, lead oxide will ruin catalysts.

Keep in mind that Avgas is formulated to run at altitude – where oxygen levels are low, air temps are low, and atmospheric pressures are low. It is formulated accordingly. It has a low RVP, in the range of 5.8 to 7.2 psi. This allows Avgas to remain in liquid state at high altitude, thus preventing vapor lock – which of course could be catastrophic in the case of airplane engines. **It is NOT formulated to run at ground-level conditions.**

AvGas is formulated for large-bore, long-stroke airplane engines that operate at consistently low RPM. This allows refiners to formulate with high aromatic content. While fine for airplane engines, high aromatic content in gasoline creates problems for automotive engines. Its slower burn rate negatively impacts throttle response, and creates issues with part-throttle drivability and cold starts. Its lower specific gravity requires rejetting of carbs to change air-fuel ratios. And aromatic can damage rubber components in automotive fuel systems, causing fuel lines, fuel pump seals, and injector washers to harden, crack, and eventually leak/fail.

So while at first glance Avgas seems to offer some advantages for engines in older cars, its disadvantages easily outweigh its advantages in all but very specialized applications. And of course, it can't be used in cars that have catalysts.

This is precisely the reason we offer our **No-Rosion Fuel System Octane Booster**. Like Avgas, it contains a highly effective metallic octane ingredient called methylcyclopentadienyl manganese tricarbonyl (MMT). This material contains manganese instead of lead. It boosts octane almost as effectively as lead, even at low concentrations. Like lead, its metallic properties allow it to protect non-hardened valve seats. But importantly, UNLIKE lead, it does not cause buildup of corrosive deposits. It is not a neurotoxin, as is lead, so it is approved by the EPA for on-road use at low concentrations. And it does NOT contain aromatic.

Adding **No-Rosion Octane Booster** to low RVP summer gasoline blends provides the best of all worlds – the octane your engine needs, without the harmful effects of lead. It can even be used at low doses in newer cars without the risk of damaging catalysts. As such, MMT delivers the same "old school" benefits of tetraethyl lead, but in a more modern, high tech format that doesn't come with any of lead's undesirable side effects.

It's worth noting that there are synergistic benefits to be achieved from using **No-Rosion Combustion Optimizer** and **No-Rosion Octane Booster** in combination. Because **Combustion Optimizer** effectively cleans combustion chambers, it reduces an engine's Octane Requirement (OR), and prevents Octane Requirement Increase (ORI). This is because cleaner combustion chambers are less prone to detonation, and therefore require less octane. So by reducing your engine's OR with our **Combustion Optimizer**, and at the same time increasing fuel's octane level with our **Octane Booster**, your engine will be running as efficiently as possible!

Thank you for being a customer. We appreciate your support, and look forward to continuing to be of service.

Sincerely,

Applied Chemical Specialties, Inc.