Under the Hood, April 2021

The VW, and to a lesser extent Mercedes and BMW, diesel emission cheating scandal has cost the manufacturers terrible publicity and several billion dollars in fines, buybacks etc. They are not the first manufacturers to "cheat" on the emissions standards. Engineers are challenged to be creative, and perhaps sometimes to their detriment. Think back to the early 1970s. Emission standards had been gradually introduced in the prior decade. In 1971, all the USA manufacturers began lowering the compression ratios in their engines to use the lower octane unleaded fuel. We already knew that in 1972, the old SAE gross horsepower rating was going to be replaced with the new SAE net rating which required testing with all engine accessories and full exhaust systems. The combination of factors caused a huge drop in advertised horsepower ratings. The rated horsepower decrease due to reduction in compression ratio was real and could be felt. However, the buyer would never realize that there was a difference between gross and net horsepower ratings, as by the time the vehicle was delivered to the buyer the engine was already running in the "net" configuration. The changes were dramatic. In 1970 the base 350 Corvette engine was rated at 300 hp. With the compression reduction in 1971, the base 350 was downrated to 270 hp. Knowing that the change in SAE rating system was coming in 1972, Chevy rated the 1971 engines with two different numbers, 1971 and expected 1972 for the same engine. The 1971 base 350 was rated 270 hp SAE gross and 210 hp SAE net (1972 expected). Things didn't really go as well as Chevy expected, and the 1972 Corvette base 350 engine was actually rated 200 hp. Two years and a decrease of 100 hp in ratings for the base engine. Everyone could see the handwriting on the wall; we were facing the end of the muscle car era. Enter the Pontiac engineers. Pontiac had been given much of the credit for creating the muscle car with the introduction of the 1964 GTO. The Pontiac engineers weren't ready to throw in the towel on muscle cars. Pontiac had an engine family with the "SD" suffix (Super Duty) for some years. These were ultimate performance engines and powered much of Pontiac's early 1960s success in NASCAR. The engineers created a 455 SD engine for 1973 GTOs, Grand AMs and Firebirds. A change at the general manager's office dropped the GTO and Grand Am, but Pontiac continued with the 455 SD for the Firebird Formula and Trans Am. Of course, Pontiac was selling many "lazy" 455 engines for their sedans and wagons, but the 455 SD was a totally different engine. The SD had a different crankshaft and rods, much better breathing heads and exhaust, and a definitely lumpy camshaft. One could expect that those changes would not be emissions legal, but the Pontiac engineers had developed a work around. They knew that the EPA engine testing (at the time) only ran for less than a minute. The engineers put together a system that would shut off the EGR (exhaust gas re-circulation) valve after about a minute. Pontiac then tried to pass off this 455 SD as a normal (emission compliant) 455 station wagon engine. Pontiac further masked the deception by rating the 455 SD at an under rated 310 hp. Road tests at the time clearly showed that it was probably closer to 350 hp. Remember by 1973, we had all the horsepower reductions due to compression ratio decreases and the change in SAE ratings. In comparison the top 1973 Corvette 454 ci engine was only rated 275 hp, and the base 350 ci engine was down to 190 hp. However, Pontiac wasn't the only organization with good engineers. The EPA engineers smelled a rat and it soon went downhill for Pontiac. By March of 1973, Pontiac had revised the EGR valve deception, changed the heads and put in a much less aggressive camshaft design (changing lift from 0.480" to 0.401"), to correctly emission certify the 455 SD engine. Advertised horsepower declined to 290 hp, still very respectable for the era, but a clear indication that the initial 310 hp rating was grossly under rated. There was a big difference between the then and now in reaction to the cheating. Pontiac was cheered by the public and EPA was booed. I suspect at the time that many felt that the EPA was a bit overbearing.

The world continues towards electrification for our mobility. The European Union has announced a new push towards electric vehicles and even hydrogen fuel cells to create that electricity. By the time you read this column, Hyundai will have shipped about 50 heavy duty hydrogen fuel cell trucks to Switzerland. Hyundai is partnering with a Swiss company to create the hydrogen infrastructure necessary. Hyundai has introduced these trucks with an interesting business model. The operators are paying a per mile/use charge. In this way, the operators are not being required to invest the significant purchase cost, nor are they exposed to unusual operating/maintenance costs, should the experiment prove unsatisfactory. Hyundai hopes that this model will help overcome the natural reluctance to adopt newer technologies. One of the stated goals is that renewable electric power will be used to separate the hydrogen atoms from water, which would imply that these trucks will really be zero-emissions. Of course, this is a great goal but until renewable electricity is available for all uses, we are basically just trading one use for another. The sun shines and the wind blows in Saudi Arabia. That country has heavily invested in solar and wind power to produce hydrogen. Closer to home, California has issued new regulations that will require 30% of heavy-duty trucks to be zero-emissions by 2030. That is only 9 years away, so this will be an interesting trend to watch.

There are many racing greats, but certainly in the top tier was British driver Graham Hill. Today it seems every great race driver started racing carts by the time they were 6. Graham entered his first race at age 25 in 1954. He soon joined the Lotus team as a mechanic and talked his way into the cockpit. By 1962 he was F1 world champion. He repeated as F1 champ in 1968 and had 3 additional second place finishes in the championship. In the 1969 US Grand Prix at Watkins Glen, Graham had a terrible accident that left both legs badly broken. He was flown home in a special stretcher and told that he would never drive again. However, he worked hard at recovery and 2 days before the start of the 1970 F1 season he decided to compete in the first race in South Africa. In this era, F1 cars still had clutch pedals and manual transmissions. The pain in one of his legs got so bad, that he was operating the three pedals with one leg. Even with that handicap, Graham placed sixth. Graham was also involved with sports car racing. He was the driver of the Rover-BRM gas turbine racer (See Under the Hood, January 2021) at Le Mans. Unfortunately, his racing career was never as successful after the accident. By 1975 he had fully retired from racing and was managing the racing team that he had established a couple years earlier. Later that year Graham was at the controls of his twin-engine Piper Aztec with 5 others of the racing team when he crashed in the fog coming home from a French race, and all perished. To date, Hill is the only driver that has won the Indy 500, 24 hours at Le Mans and a F1 Championship. At the time, this was considered the Triple Crown of motor racing.