Why Vapor Concentrations Vary in Gasoline/Diesel Loading Terminals

In the typical truck loading terminal at least two fuels are normally loaded. Those loading highly volatile gasoline this trip may load only low RVP diesel on the next trip. Some days a truck may drop off at service stations where vapor balancing is mandated, increasing the hydrocarbon concentration they return with, and other days the same truck may deliver to service stations where vapor balancing is not required and the truck returns with mostly air in its empty compartments. On the busiest days they may make several trips to a terminal, and on slower days they may make only one. On the weekends the trucks may be parked and vented as the drivers take their days off. All of these factors and more affect the vapor phase hydrocarbon concentration in the empty compartments when the trucks return to the terminal for its next load.

Truck loading is totally dynamic, ever-changing, and not at all predictable. For these reasons short term vapor sampling is not likely to reflect the reality of day-to-day loading in any terminal. Long term sampling is needed to get a feel for reality.

CHART 1
INLET VAPOR

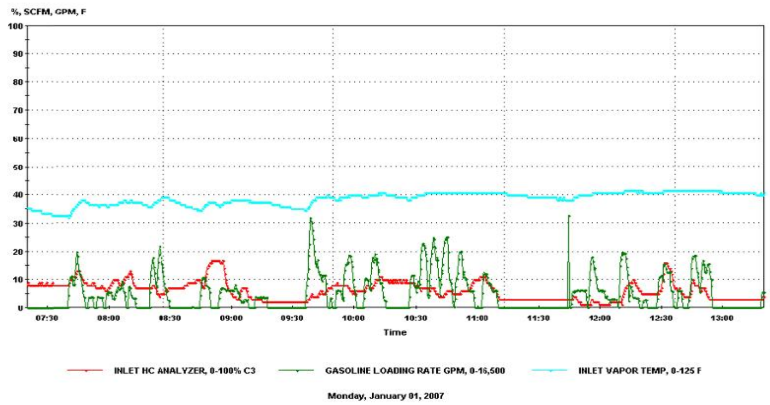

Chart 1 (right) is a graphical documentary of some of these loading dynamics over a short six-hour period. The red line is VRU inlet hydrocarbon concentration coming from the loading rack. It varies from a low of about 2% to a high of about 17%, and averages about 6.6% through this time frame. The green line depicts the actual loading rate throughout this same time frame. Loading rates vary from zero to about 32% (5,120 GPM) of the 16,000 GPM maximum at this six bay terminal, and average about 1800 GPM whenever a truck is in the rack. Since vapors are compressible and vary in real volume with temperature, the blue line depicts the actual temperature of the vapors coming from the rack during this time frame, adding one more dynamic variable to the mix.

Vapor recovery systems are sized and purchased based on the assumption of a constant inlet hydrocarbon value/concentration. The hydrocarbon concentration used most often for this purpose is 30%. Since vapor recovery units convert gasoline vapor into ever more valuable liquid gasoline, recovery calculations are often based on that same 30% concentration assumption.

From the above, it may now be more evident that since the actual hydrocarbon concentration varies dramatically in the real world, the actual volume of gasoline recovered varies in direct proportion to the varying concentration and with the loading rate that generates it. When a 30% hydrocarbon concentration value is used to calculate recovered gasoline it results in a figure of 1.64gallons/1000 gallons loaded. In the short six hour example shown above the actual recovered gasoline is a ratio of 6.6% to 30%. From this we see that the actual recovery rate is only 22% (6.6/30=22) of the 1.64 gallons, or about 0.36 gallons per 1000 gallons loaded, 78% less than might have been predicted. The nationwide recovery average is documented at 0.6-0.8 gallons/1000 gallons loaded.

This single example may help affirm why any presumptions regarding fixed gasoline recovery rates come more from optimism or overly zealous salesmanship than from the real world.

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