

Refinery Sector Rule (RSR) Update: NHV Management

RSR Compliance Solutions Vary

At refining site, I was recently asked, “So, what solution trends are you seeing for Refinery Sector Rule (RSR) related NHV monitoring and for management during purge events?”

The answer was another question: “Could we start by discussing trends amongst your group’s refineries?” There wasn’t one clear cut answer to the refining site’s question because even within their refinery group, each distinct site has significant variation in how they are approaching these new challenges.

Recent AFPM and industry-related discussions show that the answers to both questions are mixed nationally. Refinery flares, after all, are all unique in some forms. And each has its own special requirements for both NHV monitoring and management.

Addressing NHV Management

There are, though, some issues related to the RSR that are common to all. This includes the primary requirement to maintain >270 BTU Net Heating Value in the flare combustion zone (NHV_{cz}) during consecutive 15-minute blocks. This aspect of the rule is intended to help improve destruction of hazardous air pollutant emissions. And it means that control solutions must be in place to make sure sufficient BTU levels exist during flaring events. To add to this challenge, refineries must also meet new requirements limiting flare smoking event durations.

Reducing flare smoking is typically accomplished through steam or air assist. This assist can significantly reduce the flare NHV_{cz} . The reduction impact is generally not an issue during “normal malfunctions” where flare gas flow is primarily comprised of high BTU hydrocarbons. Over assisting flares (i.e. too much steam), however, can result in out-of-compliance conditions. This would most likely occur at the end of an event where manually controlled steam feed might not be adjusted down quickly enough to match reduced flare gas flow. Refineries are actively addressing this issue through combinations of procedural guidelines and some additions of automatic controls.

The SSM Challenge

Plants must also operate with the understanding that “the Rule applies at all times.” So while the Startup, Shutdown and Malfunction (SSM) exemption removal presents a challenge for many sites to meet minimum NHV_{cz} levels, the requirement must still be met. This is especially challenging during major nitrogen purge and steam out events where nitrogen feed flows might reach over 4000scfm where the high inert gas flow into the flare could require addition of some sort of supplemental fuel gas to boost NHV_{cz} to compliance levels. Decision-making on a best approach for meeting this requirement can be complicated and requires consideration of a number of factors, including:

- Availability of internal supplemental fuel gas (ISFG) sources within a plant (natural gas, light ends fuel gas or hydrogen) in sufficient volumes and at all times

- Capital costs associated with running available ISFG sources to flare lines
- BTU levels of ISFG sources, which, if low, could increase the volume of fuel gas needed and could cause total flow rates to exceed flare tip limits

Supplemental Fuel Gas Alternatives

For some sites, ISFG remains available in sufficient quantities even during plant malfunctions and unit outages. ISFG is preferred where it's practical and affordable to include additional piping, valves and control work to route plentiful ISFG sources to flares. For others, ISFG availability and/or infrastructure capital outlays—including engineering and management expenses for systems used only every year or two—are prohibitive.

Another option includes turning down purge flow rates to match fuel gas availability. This option is generally ranked low against other alternatives due to direct costs associated with extended turnaround project cycles and opportunity costs associated with major process unit downtime.

Another alternative is addition of external supplemental fuel gas (ESFG) feed to flares on a “projects needed” basis. ESFG supply can be implemented either in lieu of or supplemental to ISFG. For some, this option provides a scaled-to-fit solution which can help maintain full purge flow rates and minimize turnaround cycles, major unit downtime and capital investments which have little production enhancing impact.

Striking the Balance

The best evaluation of solutions clearly requires consideration of numerous factors which vary flare by flare and plant by plant. Various factors complicate the ability to point to any clear trend other than the need for refineries to identify the solution that provides them the best overall balance between operations and cost efficiency to meet compliance with the new Rule.