Question 3: How have you developed integrity operating windows (IOWs) to follow American Petroleum Institute (API) Recommended Practice (RP) 584? How are the IOWs maintained and communicated to the operating staff?

BURTON (Motiva Enterprises LLC)

Shell and Motiva have been on a journey, for well over 15 years, to educate our operators and provide them with the information necessary to operate their units within the safe operating window. The starting point is to define the unit operating window in terms of temperature, pressure, flows, etc. We then provide that information, with appropriate alarms, to the operators with an explanation for each of those parameters. Expected response to each alarm is defined and also provided for both the inside and outside operators and suggests actions to do to help mitigate those conditions once the set points are exceeded.

Defining the operating window for the operators is one piece of the puzzle. The next piece is to define the expectations of the support staff as they also have a key role in ensuring that plants are operating within their safe operating window. Support staff take a longer-term view of plant operation and management of chronic conditions such as corrosion, catalyst health, etc. The overall message is that for any program you try to implement, you will have to change the culture of the environment to one that supports the operators and provide for them the knowledge of the safe operating window and how to maintain operation within that window. The culture should then support and empower the operator to take correct action including, as necessary, to slow down or shut down the plant when operation deviates outside of the safe operating window.

PATEL (Valero Energy Corporation)

For the development of IOWs, a review team is formed for each process unit. The team includes the processing unit inspector, metallurgists, operations, chemical treatment vendor, and outside facilitator. Process and material SMEs (subject matter experts) are consulted, as needed, for the review. The team identifies the damage mechanisms that could occur in process equipment in the corrosion loops based on the review of the mechanical design, expected operating conditions, metallurgy, material construction, and the inspection history. All of the process variables are identified that can affect each damaged mechanism, and then the operating targets and high and/or low limits are set for those targets. The action items are generated, and responsibilities are assigned to implement the project. For the implementation of IOWs, limits are incorporated into unit health monitoring and key operating parameters documents.

ADRIAN SKIPPER (Phillips 66)

We recently recognized that we may have a gap in our vernacular, in terms of what we use as safe operating limits for flare drums, a high-high level in a flare drum. I want to poll the panelists as to whether any of you have utilized this scenario as one of these IOWs. If you have, then how was it established and the resultant outcomes or concerns? Our concern is focused on two areas. One is that when you get an extremely high level, you can create back pressure in the PSVs (pressure relief valves) upstream of that high level, which decreases air capacity slightly depending on where and at what pressure they lift. Secondly, the concern was the surge of liquid pushed by high flow of vapors down the flare header could cause hammering and maybe destruction of piping.

BURTON (Motiva Enterprises LLC)

On any alarm or level on a vessel, we will look at why that alarm was placed and where it is, including all the parameters that you have mentioned on the flare knockout drum. On any flare knockout drum and/or any vessel, we would have reviewed why the alarm limits are there and the process implications of exceeding these limits. Alarm limits are then documented, and that information is provided to the operators. So, the short answer to your question on flare drums specifically is, yes, we do evaluate those levels and alarms in the context of the parameters that you have mentioned.

PATEL (Valero Energy Corporation)

Also, the review of the upstream system is also important for any flare drum-related issues regarding the type of contaminants coming to the flare drum.

TARIQ MALIK (CITGO Petroleum Corporation)

The question asks about getting to a high-high level in a flare knockout drum, the causes behind it, and why you got there in the first place. Everyone has flare knockout pumps to pump out the liquids, and the auto-start feature of the pump, as well as the alarm system, should be investigated. Normally, there are two pumps there. So then why was the pumping capacity not compatible with getting a high level? In my opinion, yes, there can be an instantaneous buildup of high liquid level; nevertheless, the pumps should be capable of pumping that liquid out and preventing those conditions, especially the buildup of back pressure in the flare header.

BARTON FREDERICK [(Marathon Petroleum Company (MPC)]

Regarding the flare drum question, we have looked at that extensively across our plants and our designs. I know that in our design, we look at making sure our flare knockout drums have adequate

holdup time for our worst-case scenarios, so our design takes that into account. As far as there being some reference to pumping out the drums, you also must be very cautious about how your pump-out system is set up and where it goes to. For example, if you are pumping out to tankage, you need to be sure that what is in the flare drum is compatible with the tankage and that you do not move your risk from the flare drum into your tanks. We make sure that the drums have an adequate capacity, and we have done a lot of work in our plants to make sure we have that capacity.

JAMES PROROK (Husky Energy Inc.)

At the Ohio Refinery where I work, we had an incident where, after putting in a water seal with the flare gas recovery unit to maintain the back pressure for the compressors suction, the fill rate with water was great enough that it kept up with the water being blown out during a relief event. We then filled the stack with water, so we were then downstream of a knockout drum trying to maintain the water seal. So, be careful about sizing your level control valves there or they could be the cause of high level.

We had the second issue once when we had failure of the level instruments on the flare knockout drum. Our flare knockout drum on the one unit is directly below the flare stack, and we had a high level there. Yes, we could see the high pressure building in the flare headers, and then we did succeed in filling the flare stack with oil and blowing oil all over the place. It was not pretty. I am not sure if you want to give any comments about the unexpected. So what I am saying is: expect the unexpected.

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