Question 1: What is your experience with emergency isolation equipment (such as a check valve or actuated valve) on the outlet of reactor charge heaters to prevent loss of containment of the reactor loop in a tube rupture scenario? What are the advantages and disadvantages of having this type of equipment?

Michael Chuba (Sunoco)

Sunoco typically looks at the use of isolation equipment on the reactor charge heaters on a case by case basis. The need for these devices is driven by the design configuration of the unit, the process stream being charged to the heater, the emergency depressuring capabilities installed on the unit, and LOPA/HAZOP analysis.

Sunoco's general heater safety practice is to install a check valve in the combined process outlet of heaters to prevent backflow in the event of tube rupture if there are no downstream vapor depressurizing facilities or liquid blowdown facilities and if the heater operates at 150 psi or higher, and/or if there is a downstream liquid holdup of 350 cu ft or greater. Thus, as previously stated the requirement for a check valve is dependent on the application.

Typically on units where feed to the heater is H2 Treat gas only, these heaters generally have discharge check valves just upstream of where the H2 mixes with the oil as standard practice. On oil only heaters this same practices applies. It is primarily in mixed phase heaters where there is a tendency to find some units with no isolation device and others with discharge check valves. The need for an outlet devise is typically evaluated on a case by case basis. For instance a LOPA analysis on high pressure units with large downstream volume might show the need for additional layers of protection. In this case, a check valve might be added to the design and identified as "safety critical devices". Being identified as a safety critical device would generally require the valve to be placed on a periodic inspection and test program. Valves of this nature are allowed an IPL credit of "1" during the LOPA analysis. Actuated ESD valves are generally not recommended due to the potential of inadvertent closure and the resulting dead head situation. In most units this would result in the need for additional relief valves for preheat exchanger protection. In addition, if designed with a SIL rating of "1" the ESD receives the same LOPA credit as a discharge check valve.

Vern Mallett (UOP)

UOP's practice is to install a check valve at the outlet of a recycle gas only heater. UOP does not install a check valve at the outlet of a combined feed heater. The philosophy is that we want to try to keep liquid out of the heater if the recycle compressor stops. Some customers/contractors seem to feel that a check valve at the outlet of the heater will help 3 in some way to prevent a release in the event of a tube rupture at the heater. This ignores the rather large volume of equipment and piping upstream of the heater. In any event the whole unit will eventually depressure through the ruptured heater tube, so the presence of a check valve will not mitigate that. We believe that at least for a combined feed heater, it is

better to put the money that would have been spent on a check valve into a more conservative heater design that won't be as likely to sustain a tube rupture.

If an actuated shutoff valve were placed in this service, it would create a blocked outlet scenario for equipment upstream of the shutoff valve. That scenario might require that upstream equipment be designed for a much higher mechanical design pressure than would be required in the absence of an actuated shutoff valve. UOP does not specify an actuated shutoff valve downstream of a charge heater.

Brian Slemp (CITGO)

The three CITGO refineries have different design heritages therefore different configurations on the furnace outlet backflow prevention. Most of our hydrotreaters do not have backflow prevention on the reactor charge furnace outlets. **One of our high pressure hydrotreaters with a recycle gas only furnace has a check valve without an actuated isolation valve. We have never had a tube failure in this system or any other indication that the check valve was ever utilized.** The newest hydrotreaters in our system were evaluated for the installation of furnace outlet backflow prevention and the study indicated that check valves were not appropriate. The new unit design incorporated a rapid depressurizing system to minimize the duration and volume of any loss of containment. One of CITGO's hydrocracking units did have a furnace tube failure and the back flow prevention on the outlet did help mitigate the release inside the firebox.

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