

UOP design rated (SUPERIOR005075). The UOP document provided (SUPERIOR013120) Stacked FCC Unit with Bubbling Bed Regenerator, Main Column and Gas Concentration Unit noted on page V-291 (SUPERIOR013410) under Spent Catalyst Slide Valve Failure-" Ex 4

It was not indicated from the PHA review that the facility covered recognized hazards such as air entering the reactor from the regenerator due to loss of catalyst barrier, loss of seal on the spent slide valve, or erosion of slide valve rendering it ineffective in preventing air leakage. None of the PHAs seemed to address the mechanical integrity of the slide valve even though it is considered a critical piece of equipment; additionally management personnel noted the slide valve, like any other valve, is prone to leakage and does not prevent or block any and all air flow. Management particularly maintenance and inspection staff were aware based on previous turnarounds in 2008 and 2013 that the spent slide valve had documented severe erosion when it was taken out for turnaround services.

The PHA revalidations do include a node for maintenance activities and include one item in the Global Issues node about getting foreign materials in the system but do not consider the potential for air entering the system on a startup or shutdown. Regarding air getting into the reactor, the FCCU PHA revalidation includes two items:

The first is associated with the spent slide valve failing open, resulting in "reverse flow", "potential equipment damage", and "personnel harm". However, no safeguards are listed other than differential pressure indications and operator response; it indicated that there are no recommendations by the PHA team at this time. (SUPERIOR007066-SUPERIOR007213 - FCCU 2016 - Appendix E - Sessions and PHA Worksheets, pg 7099-7100)

It does not cover a shutdown situation in which air is introduced into the system.

The second is associated with maintenance if air is drawn into the Main Column due to, Ex 4

Industry Incidents- Slide Valve failure has been acknowledged in the refinery industry as in 2015 a slide valve failure was indicated in an explosion that occurred at the ExxonMobil refinery in Torrance, CA. PHAs are intended to include incidents that have been identified within the refinery and within the industry.

b) Equipment:

The employer provided the initial PHA from 1995 and PHAs for Gas Con and the FCCU to include the following:

- Gas Con PHAs provided included: 1995, 2009 Revalidation HazOp Analysis, revalidation 2014/2015 HazOp and LOPA

- FCCU PHAs provided included: 1995, 2011 Revalidation, Revalidation 2016 HazOp and LOPA

- SOP OPP1537 (HUSKY000781)

- UOP document provided (SUPERIOR013120) Stacked FCC Unit with Bubbling Bed Regenerator, Main Column and Gas Concentration Unit

- UOP design rated (SUPERIOR005075)

c) Location: FCCU & Gas Concentration (Gas Con)

d) Injury/Illness (and Justifications for Severity and Probability):

Severity-The facility did not address thoroughly the hazards of shutdown and reversal which are critical dangerous situations.

Probability-The incident that occurred on 4/26/18 in which the explosion occurred was potentially due to reversal in the system during shutdown.