LESSONS LEARNED: Case histories from the sulfuric acid industry

Don't forget the sulfur pump

Recently, several sulfur burning plants experienced the same problem when their plant shut down. The sulfur pump was not shut off and in a couple of cases, the interlocks failed. One case had a foot of sulfur pooled at the bottom of the sulfur burner. If you are unaware, this can sublime the sulfur and cause sulfur vapor to condense as a solid on mist eliminators and in the packing. This can, in extreme cases, require candle replacement and vacuuming and removing of packing.

Lesson Learned: Periodically check the interlocks and have the field operators make sure the sulfur pump is turned off when the plant is shut down.

Acid pipeline precautions

A newly installed sulfuric acid pipeline is a few miles long. A hazard review revealed the potential for an acid spill on the ground if the pipe leaks. To minimize the spill, the engineer installed block valves in the line for isolation. The engineer changed the valves to a smaller size to reduce costs, not realizing the size and lack of vents in the line prohibited the pipe from filling with acid. The pipeline leaked after having been in service only a short time.

Lesson Learned: Smaller valves work as reducers, so air entrapment between them causes excessive erosion corrosion.

Over-insulating a sulfur furnace is not cool

A 25-year-old sulfur furnace was scheduled for re-insulation. Thinking more is better, the 1-inch of "Temp-Mat" was replaced with three inches of calcium silicate insulation and aluminum jacketing. However, the failing insulation had allowed moisture to reach the furnace shell, causing thinning. Over insulation caused a dramatic rise in temperature and the shell ripped open.

Lesson Learned: Thorough understanding of the total condition with a proper engineering study of a project is imperative before beginning a job. Proper front-end loading could have prevented this incident.

Acid strength control

During an oil fire following a turnaround, the fresh acid transferred to the plant was set up to come into the final absorption tower system and exported from the final tank to the drying system. The acid in the interpass system became weak due to moisture from the combustion process. In the months following, the IPA piping experienced more leaks than usual.

Lesson Learned: Develop standard operating procedures for acid strength control during plant start-up. Include transfer of acid between plants. Conduct training sessions on strength control for all shifts.

Analyze your instruments

During a turnaround start-up, a plant had a visible stack. A common problem, it cleared up and later returned with no obvious indication of operating parameters outside the established limits. The dilution water flow meter indicated a flow and both the IPA and FAT concentration analyzers indicated acid strengths returning to normal. An investigation found the acid to be strong–it had increased to 100 percent and continued to increase.

Lesson Learned: Concentration analyzers indicate decreasing strength as the actual strength increases above 100 percent since conductivity reverses direction at 100 percent. Also, instruments may not be functioning properly after a major shutdown.

Heat exchanger tube failure

A heat exchanger in 99 percent sulfuric acid service had a major tube (waterside) failure. Removing the exchanger and performing NDT analysis determined that an erosion corrosion mechanism had eroded the outside of certain tubes near the water inlet. The wear pattern was most severe at the trailing edges of the cooling water supply deflector plate.

Lesson Learned: To prevent further problems with this and similar exchangers, drill several ½-inch holes in the plates to diffuse the flow and lower the velocity around the edges.

Boiler cracking

The weld between the tubesheet and the shell failed along an arc at the top of the tubesheet. This allowed water to enter the gas side of the plant. It was determined the weld cracking was due to the presence of a vapor space in the top of the boiler. The boiler riser nozzles extended into the boiler and this created the vapor space. The failure was accompanied with loss in thickness of the tubesheet in this zone.

Lesson Learned: Ensure that riser nozzles are coped and fitted flush with the I.D. of the boiler shell. ❑