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High-Efficiency Separator Internals Reduce Liquid Carryover 99.89% and Increase Capacity 50%

After Audit to Optimize service, Southeast Asia gas plant retrofitted with CONSEPT ACI device and CONSEPT DC cyclone achieves design-basis throughput

CHALLENGE

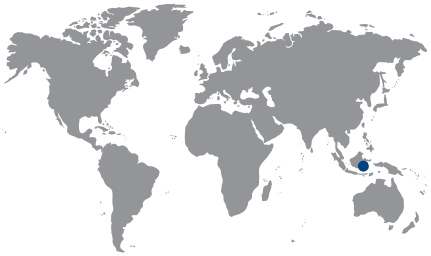
Optimize separation performance at gas processing facility, minimize liquid carryover, and increase throughput to 450 MMcf/d.

SOLUTION

- Perform Audit to Optimize* process unit audit and optimization service.
- Retrofit scrubber vessels using CONSEPT ACI* axial cyclonic inlet devices and CONSEPT DC* demisting cyclones.

RESULTS

- Maximized NGL revenue.
- Achieved customer's performance-separation criteria.
- Increased separation efficiency to over 99.94%.
- Reduced NGL carryover to under 10 bbl/d.
- Enabled operation during turndown and gas spikes.



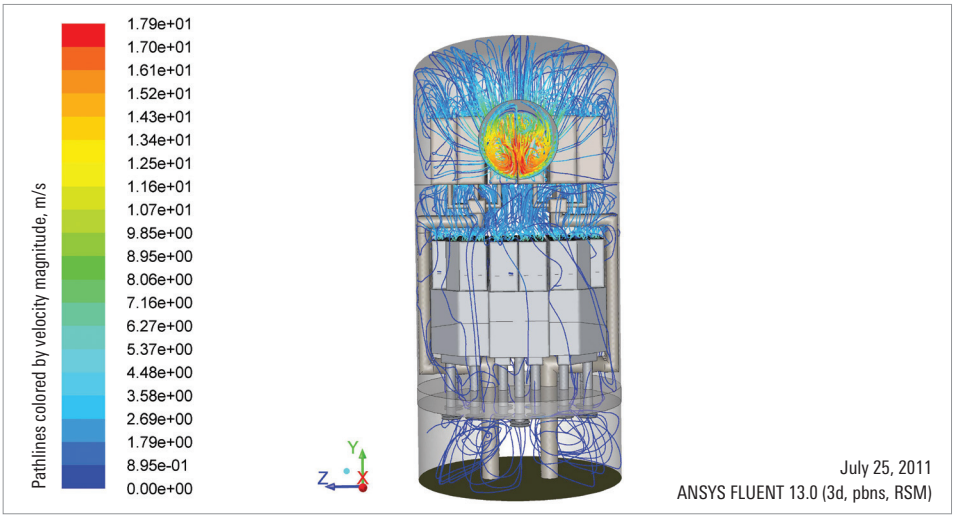
Reduce lost revenue caused by poor performance of plant scrubbers

An onshore 450-MMcf/d gas processing facility in Southeast Asia that receives rich, wet gas was losing revenue to severe NGL carryover (1,550 bbl/d) and operating at only 300 MMcf/d. The customer approached Schlumberger for a solution that would enable higher gas throughput while boosting and maintaining hydrocarbon revenue through higher NGL recovery.

Schlumberger computational fluid dynamic (CFD) analysis of the existing scrubber design revealed an unevenly distributed flow in the scrubber vessel and loss of separation efficiency. The existing inlet vane design had a very high gas loading factor (K value) and directed a relatively large fraction of the gas downward at high velocities against the liquid pad, causing reentrainment of the separated liquid. Also, large secondary vortexes formed in the scrubber vessel, leading to relatively chaotic gas flow with high-velocity zones, droplet breakup, and poor liquid separation. The estimated separation performance at design-basis throughput was 51%.

Provide high-efficiency bulk separation tolerant of high liquid loads

To increase separation efficiency at high K values and reduce the liquid carryover, Schlumberger first conducted an Audit to Optimize service, which resulted in recommending a retrofit scrubber design that incorporated a high-efficiency CONSEPT ACI axial cyclonic inlet (ACI) device combined with CONSEPT DC demisting cyclones. In the new design, the ACI device directed gas flow upward to prevent high velocities above the liquid pad and curtailed reentrainment of liquid. The overall retrofit scrubber design featured 116 CONSEPT DC 80-mm demisting cyclones in the inlet compartment (for bulk removal of gas), 270 CONSEPT DC 56-mm-diameter axial flow demisting cyclones in the demisting section, and a 150-mm mesh pad. The retrofit scrubber was also designed to maintain separation efficiency under turndown and gas spike conditions. As an added advantage, the proposed retrofit design did not require hotwork operations when installing internals. Instead, it uses bolting techniques, which drastically improves operational safety.



The design of the retrofit scrubber resolved unwanted liquid carryover and increased separation efficiency to maximize design basis throughput.

Increased separation efficiency to over 99.94% and reduced carryover to under 10 bbl/d

The combination of the inlet device and the axial flow cyclones provided a robust system design that increased separation performance. CFD verification of the retrofit design at a flow rate of 485 MMcf/d (and a gas density of 54.39 kg/m^3) showed a uniform distribution of the gas out of the gas outlet and mesh pad. Modeling predicted the retrofitted scrubber vessels would have the capability to remove droplets in the gas stream down to an average size of 6 microns and separator efficiency would increase from 51% to over 99.9%. In addition, the design would also maintain efficiency during turndown and intermittent gas spikes.

Independent third-party field test results verified that the new scrubber design consistently achieved higher separation efficiency (more than 99.94% separation with less than 10-bbl/d liquid carryover) even under turndown or lower inlet gas flow conditions. The capture of the previously entrained NGLs increased the customer's NGL revenues. The facility has been successfully operating since 2011 per the design performance separation criteria.

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