Failure Analysis of a Major Piping Header in the Delayed Coking Unit

The 36 NPS blow-down header in the Delayed Coking Unit [DCU] experienced a number of failures soon after startup. Design conditions for the system are a temperature of 820 °F [438 °C] at a pressure of 50 psig [345 kPa]. These failures included thru-wall cracking, partial wall cracking, damaged pipe support guides and damaged structural bolting. Root cause analysis suggested multiple causes from loads not identified during detailed engineering. These loads included both dynamic and fatigue loading events occasioned by operating conditions not normally experienced in hydrocarbon processing units.

Both finite element analysis and piping analysis techniques were utilized to determine the magnitude of these loads and which also provided insight into several mitigation approaches to address each of these several unique loading conditions.

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