



Saba Metallurgical & Plant Engineering Services, LLC

401 Saint Louis St. · Madisonville, LA 70820 · Phone: 225-405-4015

Shell Overheating Distortion Fitness-for-Service (Finite Element Analysis, 3D Laser Scanning, ASME FFS-1)

Project Description: The hemispherical mid-section of a vessel experienced refractory failure, localized overheating and local rupture. High temperature hydrogen at the ID produced localized high temperature hydrogen attack (HTHA), with several cracks linking up to produce the main rupture. Third party 3-D laser scanning data produced replicated the localized distortion, where in combination with thickness data, a solid 3D model was created with the heat/pressure damaged region replaced with this imported 3D surface. The area of the cracking was cut out and replaced with a flush patch, again replicated in the FEA model. ASME FFS-1 Code calculations were performed using the FEA model, including limit load analysis, elastic-plastic analysis (local strain analysis and local buckling), and strain-based low cycle fatigue. Assistance was then provided with evaluating a new internal refractory lining and system of supports, as well as external cooling and monitoring of this cooling. Fitness-for-service inspection are continually performed on an on-going routine basis.

FEA Results: Pertinent images of this fitness-for-service study are shown below:

