



## Saba Metallurgical & Plant Engineering Services, LLC

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

### Gasifier Injection Nozzles – Mechanical and Flow New Design Evaluation (Finite Element Analysis, Computational Fluid Dynamics, ASME Section VIII Div. 2 Non-Linear Methods, Cyclic-Creep Analysis)

**Project Description:** A nozzle in a coal gasifier melted within 30-min of being placed into service. This water-jacket cooled nozzle was analyzed by SMPES, LLC and found that a pocket of low flow at the upper tip of the nozzle existed, which then caused a vapor pocket. Ultimately, this caused a cascading effecting, resulting in overheating and subsequent melting. Using CFD, the flow path was revised to create an efficient flow path, which led to successful use of this nozzle in its harsh service. The success of this redesign led to evaluation and iterative improvement of numerous other designs, not only via CFD, but also FEA model creation and Code analysis for static, cyclic, and cyclic-creep conditions.

**FEA and Code Results:** Shown in the top left image is the identification of the low flow space in the nozzle water jacket. Remaining images show multi-flow and/or multiphase mixing CFD model results. The bottom left image is a still from a transient analysis where the vortex shedding frequency was visually observed and graphically determined.

