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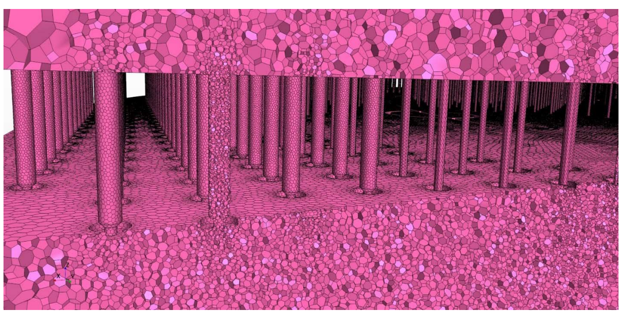
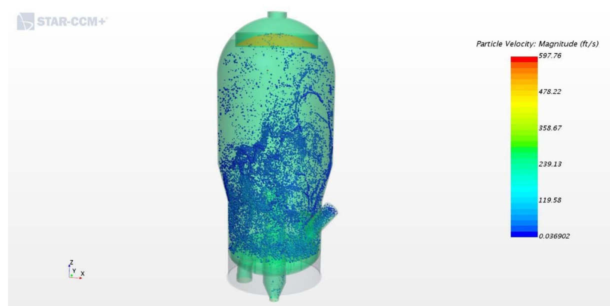
Air Grid – Mechanical New Design Evaluation (Finite Element Analysis, Computational Fluid Dynamics, ASME Section VIII Div. 2 Non-Linear Methods, ASME Weld Fatigue-Equivalent Structural Stress Method)

Project Description: A redesign of an air grid for a fluidized bed was evaluated by first creating a computational fluid dynamics (CFD) transient Eulerian-Lagrangian particle flow simulation. Temperatures of the fluid, metals, refractory, and particles were achieved through conduction, convection and radiation in the CFD model. Radiation is supplied from the particles in the fluidized bed in participating media to the top-side grid refractory. Transient temperatures are mapped to the FEA model, where both static and fatigue analyses were conducted per ASME Section VIII Div. 2 and ASME Section III.5 (Nuclear Code) rules. The former Code rules were used for both static and non-creep regime fatigue, while the latter rules were used for cyclic-creep analysis. Weld fatigue was performed according to the Equivalent Structural Stress (ESS) method using the program Verity. A final study was performed for the grid refractory anchor welds.

3D CAD and FEA Models: The CFD meshed model of the grid is shown below to the left:





FEA and Code Results: Fluidized particle flow is shown above in the image to the right. Due to confidentiality, design results are not shown. The image below shows a generic result for the Weld Fatigue ESS Method.