Application of CFD for Troubleshooting of CHF (Controlled Heat Flux) Heater

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Applying modern CFD technology, NATCO engineers solved problems encountered in CHF (Controlled Heat Flux) Heater through alteration of internal baffle positions and configurations. Field application engineers have discovered that vessel's front shell near the burner section of a CHF heater warped after extended use. We speculated that it was caused by ineffective mixing of gases that resulted in excessively high temperature at the front-end of the heater. Subsequently, field engineers also observed corrosion on the heat exchanger tubes and fins, believed to be caused by a "dead-zone" or the so-called "cold-spot", in the heat exchanger tube sections close to the burners section. Within relatively short period of time, NATCO engineers simulated nine different baffle arrangements and various internal configurations and successfully developed an improved internal baffles design in the fire box section and an advanced internal configuration in the heat exchange tubes section to eliminate the excessive heat problem and the "cold-spot" problem, respectively. Most importantly, these CFD study results were successfully validated in field physical tests.

The CHF (Controlled Heat Flux) Heater is an advanced indirect heating system widely used in the oil and gas industry. It uses a forced draft system where the products of combustion function as the heat transfer medium. The heat generation section (the burner section, or the so-called "fire box" section) and the heat transfer section (the heat exchanger tubes section) are separated. Heat generated by the burner is transferred to an extended surface area coil bundles through forced convection. The flue gas circulates from the burner section to the heat exchanger tubes section, across the coil bundles, and moves to the stack. Meanwhile, part of the flue gas is recirculated to the burner section