

Ethylene Plant Doubles Production and Increases Profitability with New Gas Cooling Injectors



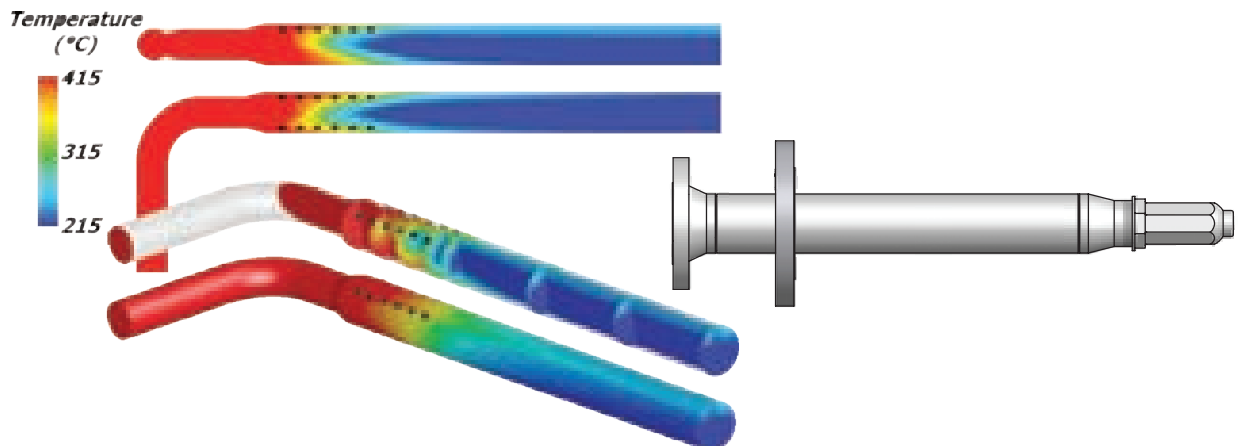
Problem:

An ethylene producer in China needed to spray quenching oil into a gas stream to cool the temperature from 400°C to 170°C (750°F to 340°F). They were using eight, large (8") full cone nozzles for cooling in the original process line. To increase total ethylene production from 600,000 tons/year to 1.2 million tons/year, the producer was adding two more steam cracking furnaces. Because the gas flow in the new cracking furnaces was significantly lower, a new gas cooling system was needed for each. An engineering firm made specific nozzle recommendations, but the ethylene producer wanted to validate that recommendation before proceeding with the project.

Solution:

Using proprietary gas cooling calculations and Computational Fluid Dynamics (CFD) modeling, Spraying Systems Co. determined that optimal gas cooling would be achieved using more, smaller nozzles. Although the engineering firm had recommended six 6" full cone nozzles, ten 3" FullJet® full cone nozzles were ultimately specified by the processor to ensure proper drop size and total flow rate for effective gas cooling.

Specific nozzle selection, co-current spray direction and insertion points were all determined using CFD modeling. This advanced modeling technique analyzed several criteria including gas velocity, spray concentration, drop residence time and temperature and tested various nozzle configurations for the gas cooling system. Several CFD studies were done to refine the design to yield optimal results.





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Results:

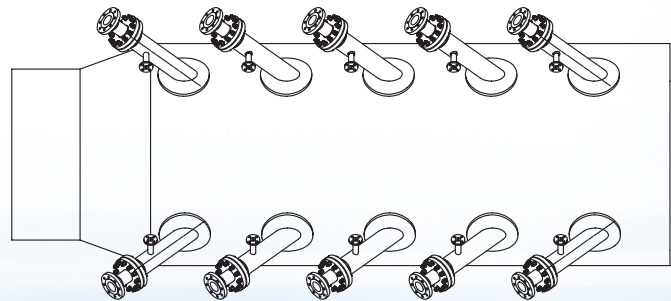
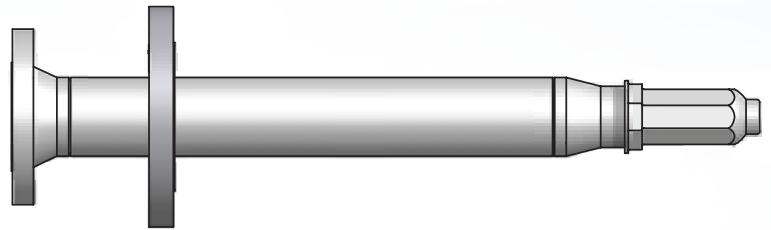
The nozzles were successfully installed and the plant has achieved its goal of doubling ethylene output. In addition, the newly designed quenching system has helped increase the plant's output of Level "A" ethylene, which sells at a 20% price premium above lower grades. Increasing the percentage of this top-grade product helped generate a payback period of about one month for the total investment in CFD modeling and nozzle lances.

A CLOSER LOOK AT THE SYSTEM



FullJet® Nozzles

Stainless steel FullJet nozzles produce a full cone spray pattern with medium size droplets.



Spray Lances

Each FullJet nozzle is attached to an 850 mm (33") lance. The lances are each inserted at a 45° angle in the duct, which has a diameter of 1950 mm (77").



Spraying Systems Co.®
Experts in Spray Technology

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