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## **Question 48: What are important considerations for evaluating the methods used for fouling detection and mitigation in preheat exchangers and furnaces in crude and coker units?**

**DENNIS HAYES** (Nalco Champion)

Methods for fouling detection and quantification need to be capable of normalization to minimize 'noise' from system variables. Complex heat transfer rating programs can be used for this purpose. These programs must be capable of looking at heat exchanger networks as systems, as well as individual exchangers. After detection and quantification of fouling, mitigation strategies then need to be developed based on a review of the causes of the fouling (such as incompatible feed blends, elevated inorganics content, reduced utilization rates, etc.).

**SRINI SRIVATSAN** (Amec Foster Wheeler)

Fouling detection of crude preheat exchangers is typically noted by either lower temperatures to the heater or higher pressure drops across the exchanger bank. Prevention is difficult, so parallel trains are sometimes provided for periodic cleaning. There are two ways to detect fouling in coker furnaces: if there is 1) an excessive or sudden pressure drop that is more than design and 2) an increase in skin temperature rise. In properly designed heaters, the increase in skin temperature occurs before design fouled pressure drops are realized. Typically, online spalling of the furnace is initiated when tube skin temperatures reach 1200 to 1250°F.

**RALPH WAGNER** (Dorf Ketal Chemicals LLC)

For the crude preheat exchangers and furnace, the typical fouling detection methods include monitoring pressure drop across the preheat exchanger, delta temperature across the preheat exchanger, and normalized furnace inlet temperature. Use of Dorf Ketal's simulation software will help determine the fouling factor, heat transfer coefficient, and heat duty of key exchangers. Asphaltenes often play a major role in fouling crude unit preheat exchanger and furnace. Inorganic precursors, especially Ca (calcium) and Fe (iron) aggravate the deposition on metal surfaces. Use of Dorf Ketal's asphaltene dispersant, coupled with a metal passivator, has successfully mitigated fouling issues in refineries across the globe and across a range of difficult-to-treat crudes.

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