

Case Studies – On-Line dry chemical cleaning of Furnaces

(1) Reformer Heater – radiant section (TX, USA)

Gas-fired reformer heater, where the scale was formed by dust and fuel impurities. The refractory was ceramic fiber which is very sensitive to mechanical impacts.

The cleaning results were excellent as you can read below. There was no damage to metallurgy (tubes and construction) or refractory.



Before cleaning: Extensive scale, hot spots, pieces of refractory



After cleaning: Tubes are clean; refractory (ceramic fiber) is undamaged

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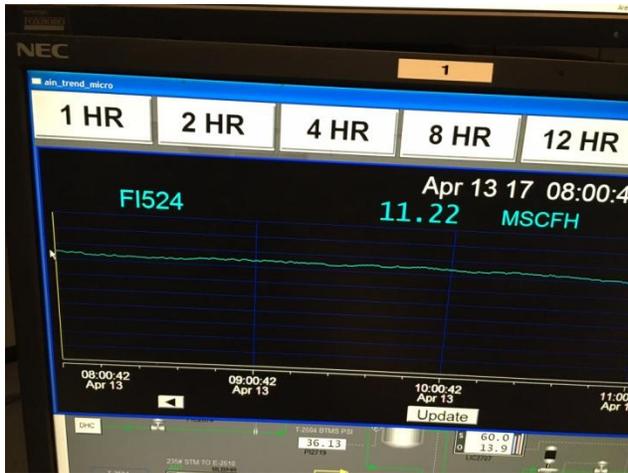
Here is what I see on the fuel gas system..

1. About 1 psig reduction in fuel gas pressure.
2. Fuel gas control valve opening dropped about a 3%
3. All the skin temperatures increased which may suggest the heat transfer improved.
4. Fuel gas consumption dropped about 2000 scfh

When inspection does an IR scan of the tubes in July it will be interesting if they see a signal on tube temperatures with the IR scan.

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(2) Crude Heater 501 – radiant section (LA, USA)



Before cleaning: fuel consumption 11.2 MSCFH (million square cubic feet per hour)



After cleaning: fuel consumption 10.6 MSCFH (million square cubic feet per hour)

Result: fuel consumption is decreased by 5.4%

(3) Crude Heater 502 – radiant section (LA, USA)



Before cleaning: fuel consumption 20.54 MSCFH (million square cubic feet per hour)



After cleaning: fuel consumption 19.33 MSCFH (million square cubic feet per hour)

Result: fuel consumption is decreased by 5.9%

(4) Heater 503 – convection section (LA, USA)



Before cleaning: North stack temperature 767 F



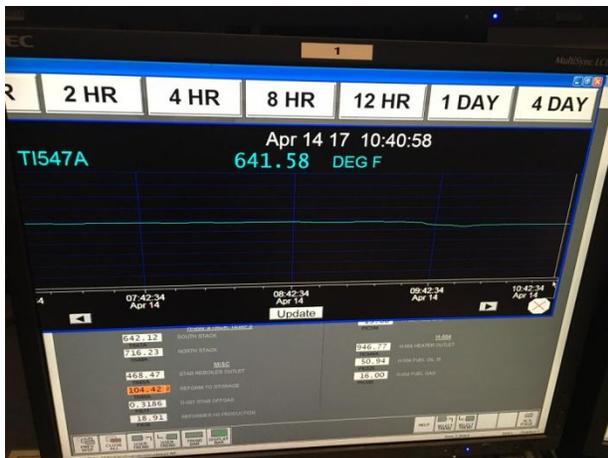
After cleaning: North stack temperature 716 F

Result: North stack temp. is decreased by 51 degrees

(5) Heater 504 – convection section (LA, USA)



Before cleaning: South stack temperature 691 F



After cleaning: South stack temperature 641 F

Result: South stack temp. is decreased by 55 degrees

(6) Convection section cleaning (CA, USA)



Dirty tubes

Clean tubes

(7) Radiant section cleaning (KS, USA)



Dirty radiant shock-tubes before cleaning, with scale and hot spots

Result: all scale and hot spots have been removed.

Thermal efficiency of the heater has been significantly increased

(8) Ethylene Heater

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In approximately April of 2019, I was assigned to find a solution for furnace convection cleaning. We were experiencing high convection section temperatures due to convection section fouling. Traditionally the equipment must be shut down and locked out in order to conduct cleaning. Through some independent research we found an online cleaning service, Sentro-Tech. After reaching out to Sentro-Tech we got a very quick response. After a few discussions, we were able to set up a meeting with Sentro-Tech personnel, environmental, safety, and furnace team. We discussed safety concerns and the environmental impact. After due process and approval, we were given authorization to do a test run on our worst furnace convection section. During that process Sentro-Tech was extremely professional with outstanding customer service, and readily provided all information that was necessary to expedite the job. The job was then scheduled (approximately the end of July), with minimal execution required, we were able to complete the convection section cleaning online within 12 hours with no safety incidents at temperatures above 1000F. The results were immediate and measurable online. Without divulging proprietary information, we saw a stack reduction of 50 degrees; which is excellent for the age of that convection section. The annuitized financial impact exceeded expectations. The process and the performance by Sentro-Tech allows the versatility for excellent cleaning of convection sections online, without taking the equipment out of service. This is a truly innovative technology that I highly recommend to anyone looking for similar results. Flint Hills Resources plans to continue using Sentro-Techs services in the future for convection cleaning.

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(9)Coker Heater

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Just wanted to say THANKS ! I know it was slow getting started with the unplanned S/D's and Weather issues but as you can see from the trends

Below it looks like we dropped 70 degrees after the cleaning. That's huge! This will allow us to run unconstrained till BBTA 19'

Would it be possible to get a report out from Sentro , nothing elaborate. I foresee us using them routinely at the Coker and other Units here at Deer Park

and outside Deer Park have been waiting to see what type of results we had. I would be sharing their report out with other Units and Sites.

Starting Stack Temp 952.7

Ending Stack Temp 882.7

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(10)

(CHS McPherson KS) Reduced fuel consumption by 9.1%

(CHS Montana) Reduced stack temperature by 110F

(PAR Hawaii) Reduced fuel consumption by 5.9%

(PAR Hawaii) Reduced stack temperature by 109F