DCU FURNACE TROUBLESHOOTING: "HIGH TUBE METAL TEMPERATURE"

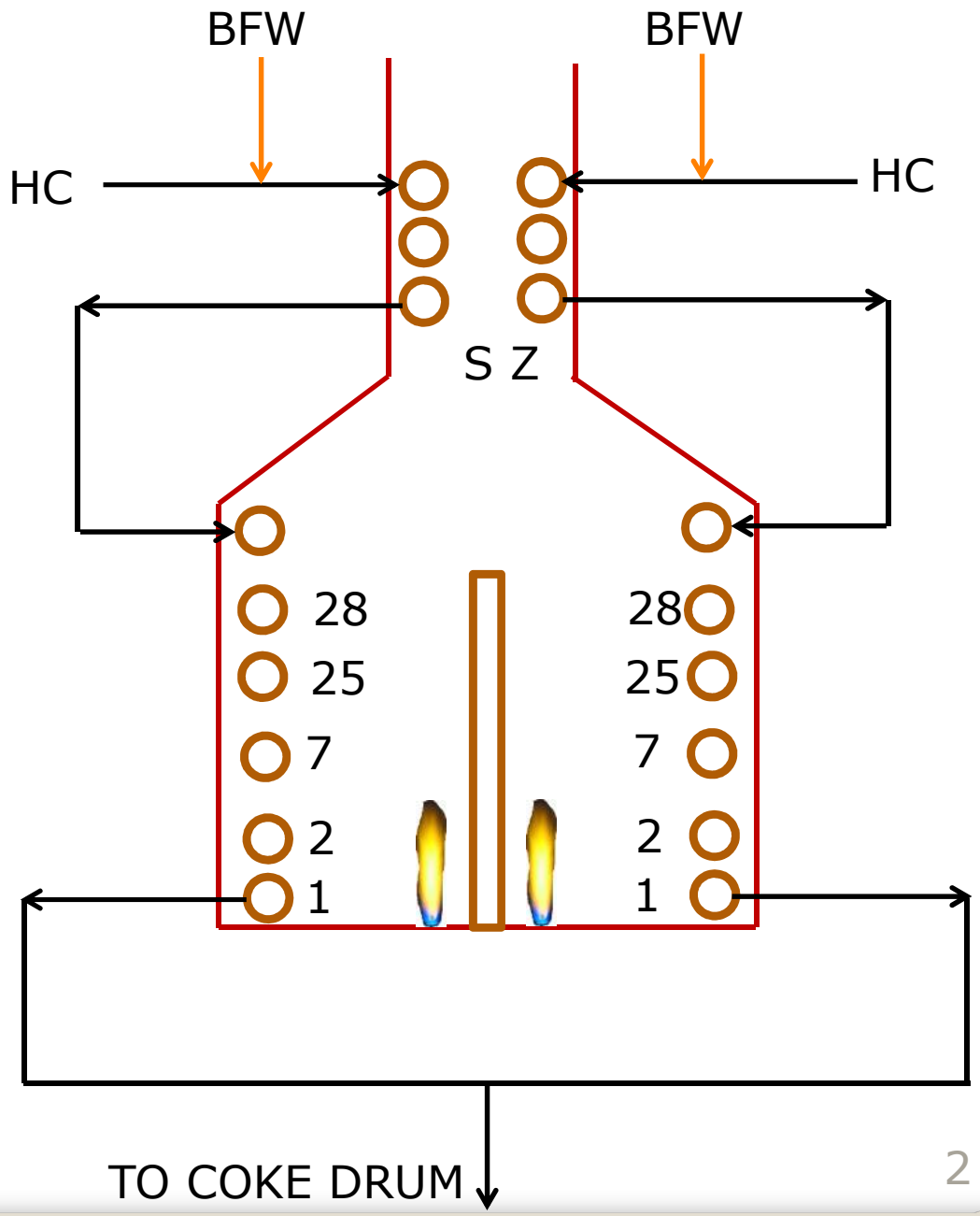
C K SINHA
Senior Manager Technical Services,
sinhack@indianoil.in

REFCOMM MUMBAI 17-20 Oct 2016

IndianOil

FURNACE OVERVIEW

- 2 - Pass Bottom Fired Natural draft Furnace
- Design Fired duty- 8.16 Gcal/hr
- Low Nox flat flame burner
- Total 36 no of tubes in radiation section
- Tube metal T t'couple on tube no 1,2,7,25,28 & shock zone (SZ) tube



PROBLEM

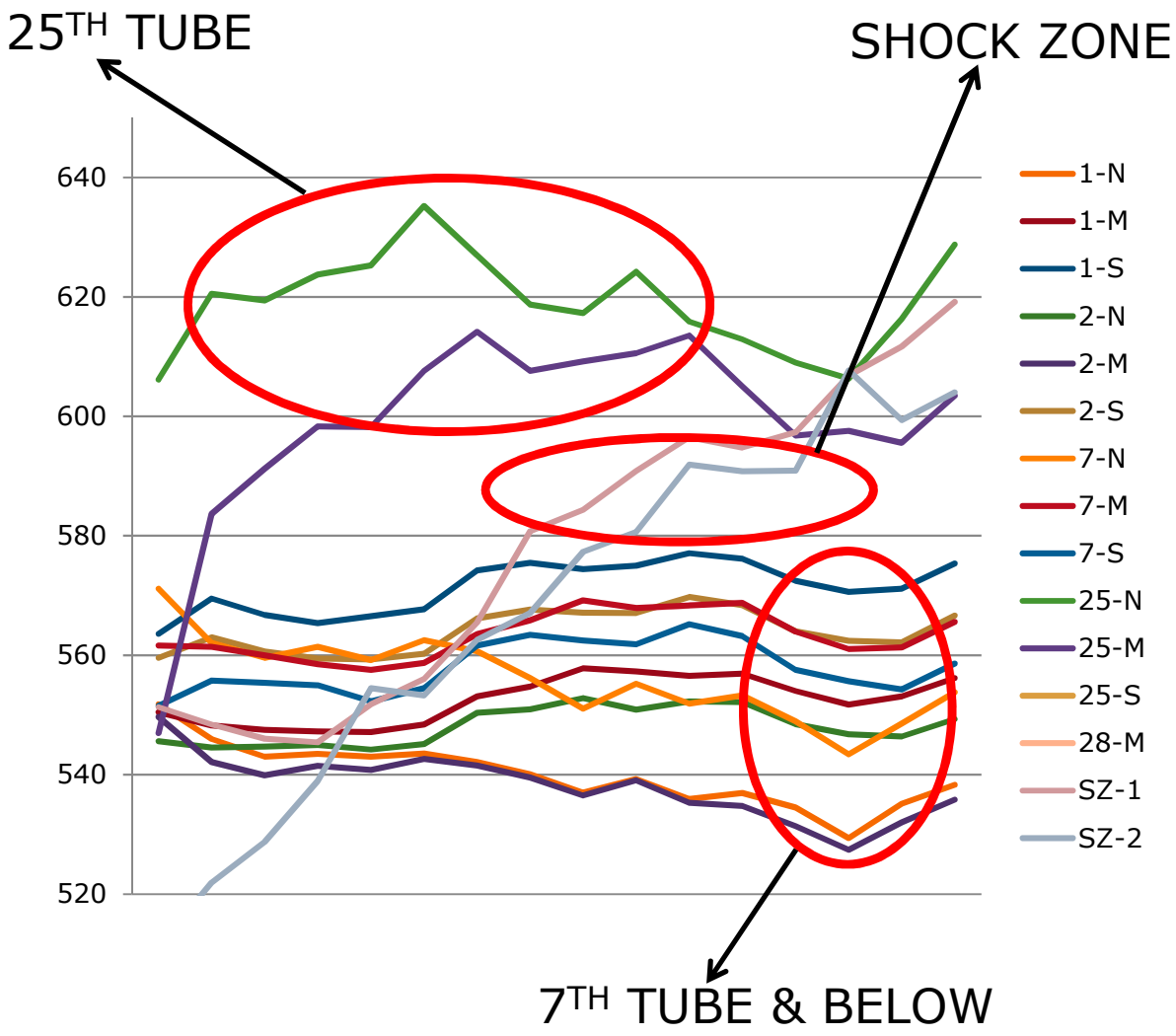
- Rise in tube metal temperature (TMT) in short time
- No on-line spalling facility
- Frequent SAD
- Frequent DCU outage
- Reduction in Refinery Profit

Problem Analysis

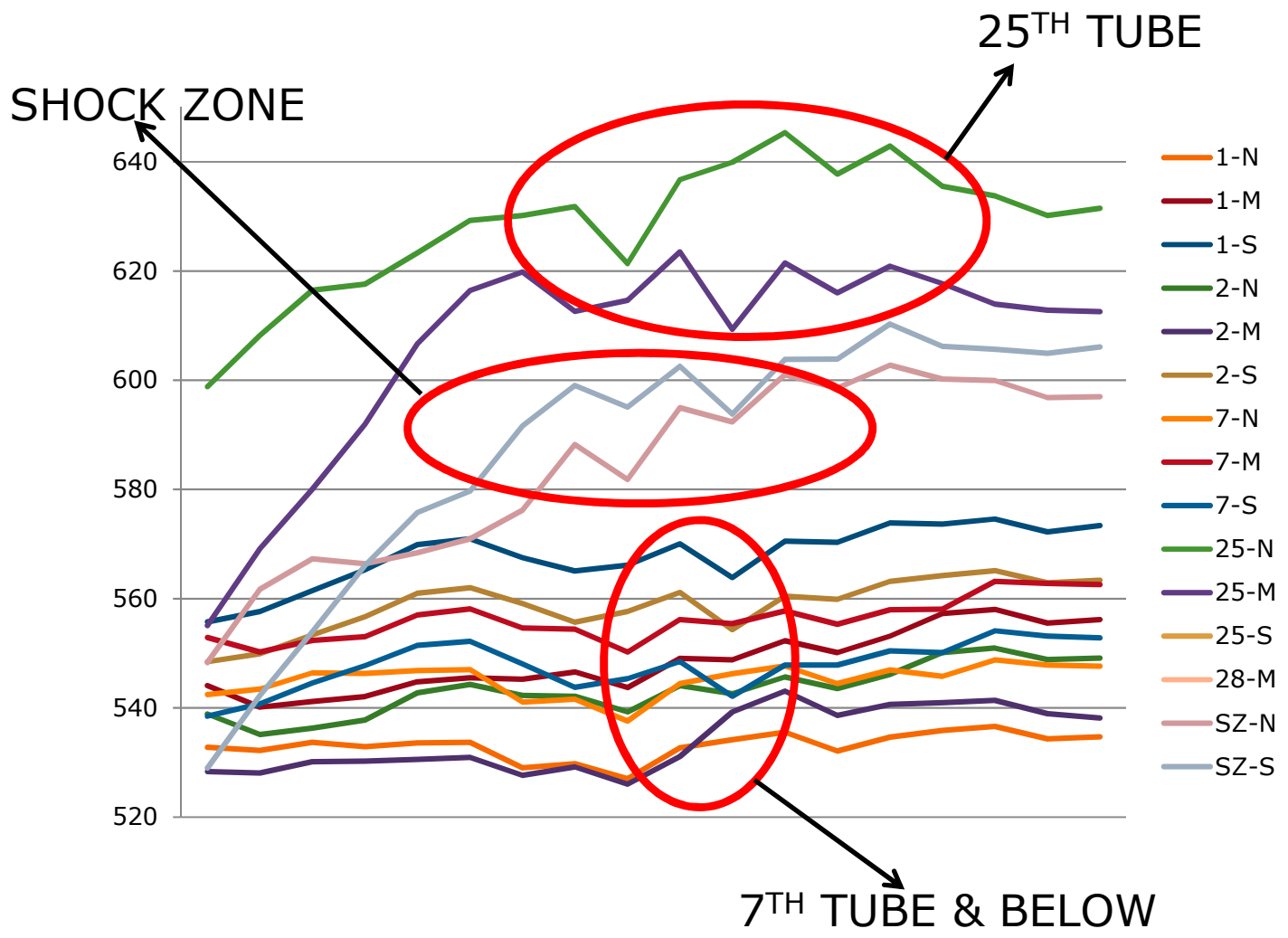
FIELD CHECKS

- CROSS CHECKING OF TMT BY THERMOGRAPHY
- FEED PROPERTY , FG PROPERTY
- CONTAMINATION OF FEED WITH RESIDUE
- FURNACE FEED PUMP SUCTION STRAINER
- START-UP CIRCULATION PUMP SUCTION STRAINER
- TRAMP AIR
- FIRED DUTY

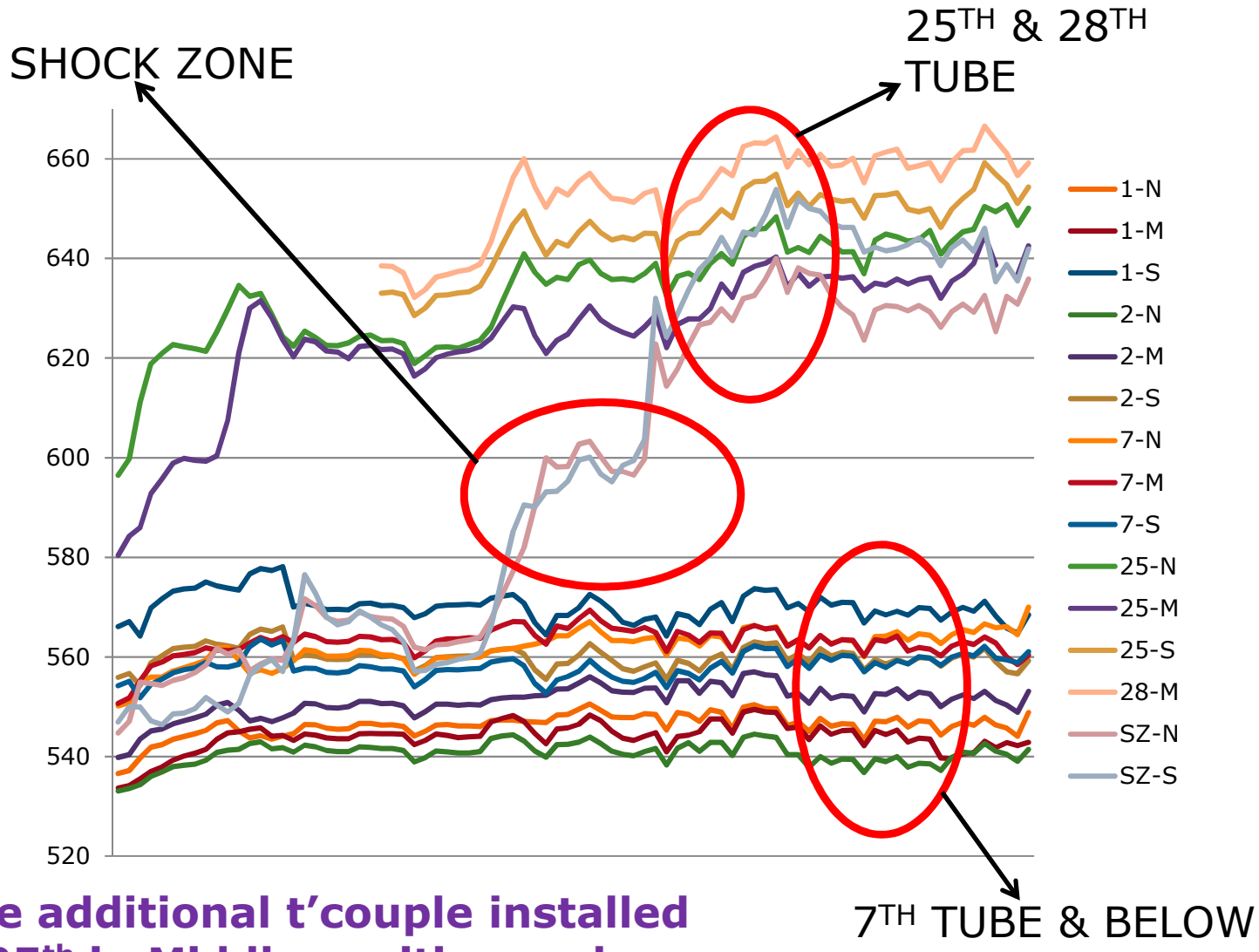
TMT TREND OF PAST RUN-1



TMT TREND OF PAST RUN-2

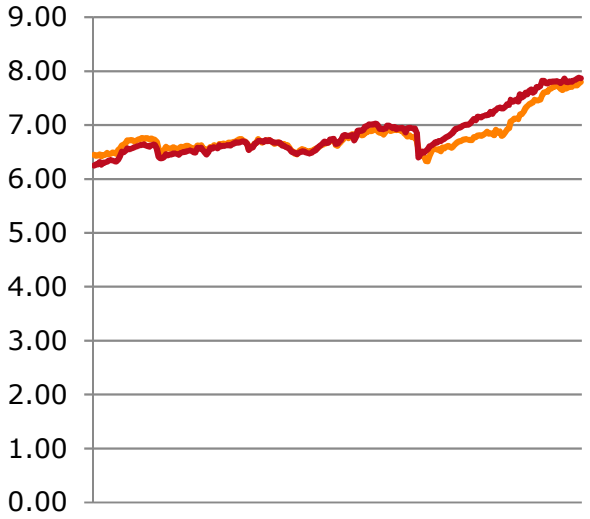


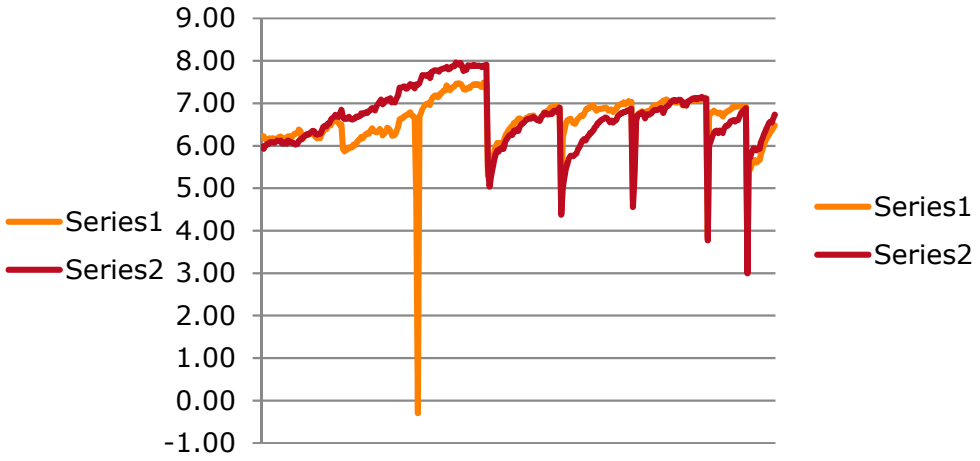
TMT TREND OF PAST RUN-3

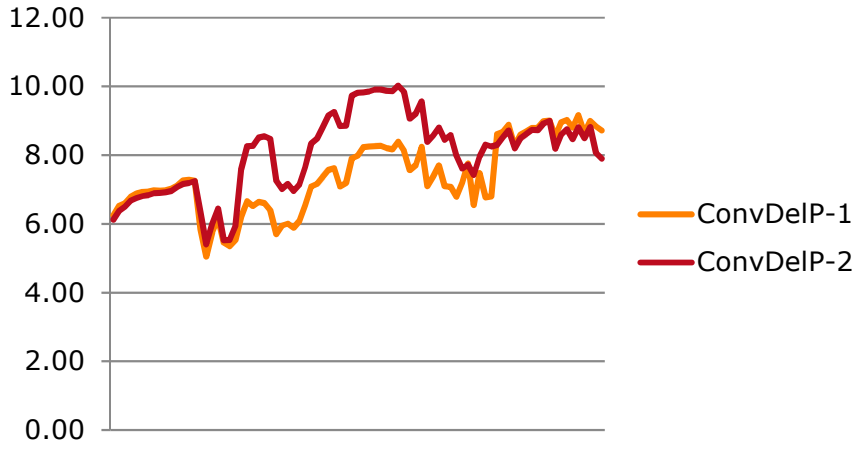


***One additional t'couple installed on 25th in Middle position and on 28th in Middle position**

CONVECTION COIL PRESSURE DROP



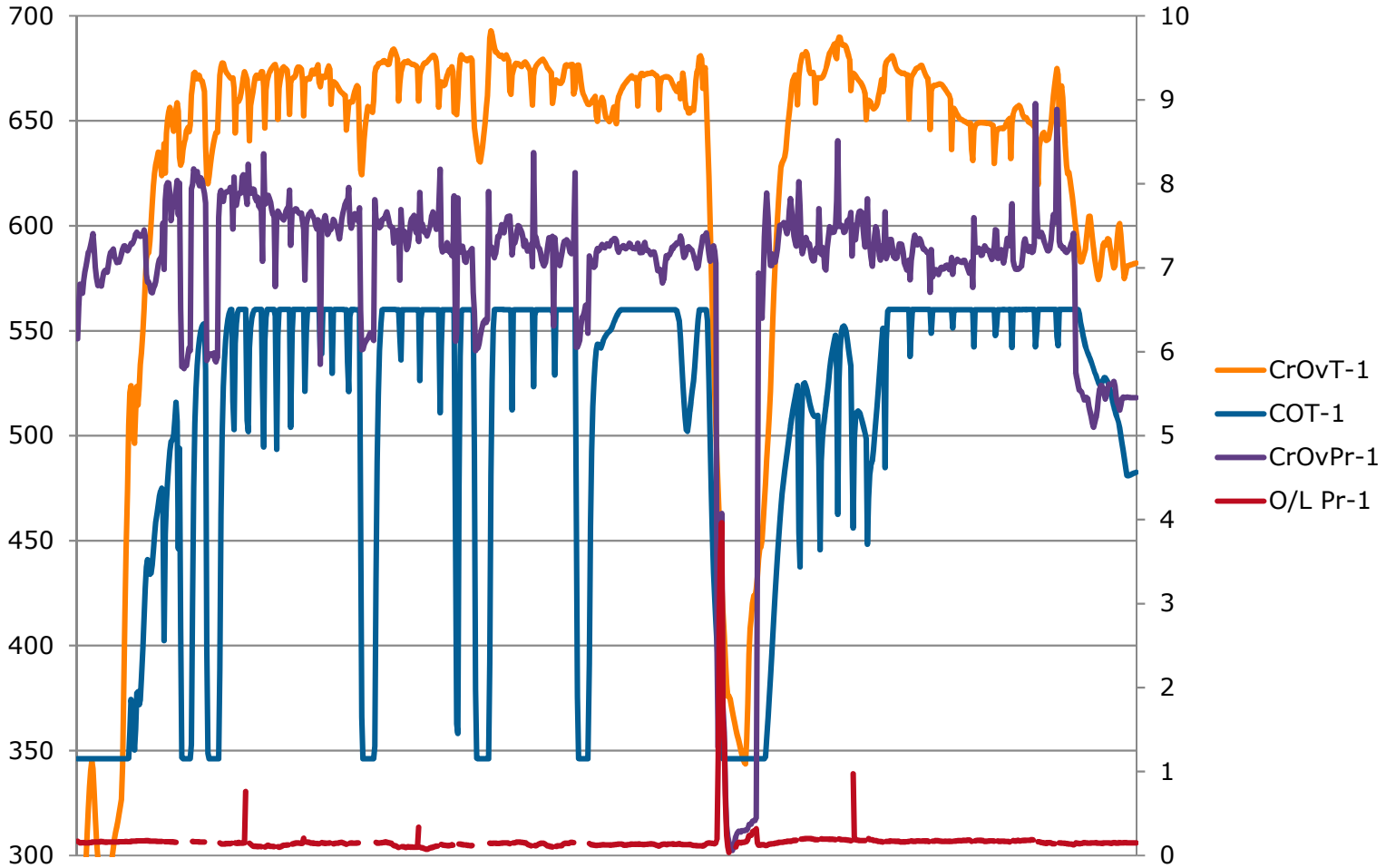




OPERATING CONDITIONS

- HC flow 29 m3/hr
- BFW to convection coil flow rate 0.32 m3/hr
- CIT- 325^{0}C , COT- 492.5^{0}C
- Furnace draft- 7 mmWC
- O2 analyzer reading- 8 vol%
- Convection O/L T- 433^{0}C
- Stack T- 230^{0}C
- Flue gas T at arch- 740^{0}C
- Flue gas T at floor-620^{0}C
- Fuel Gas flow- 560 kg/hr

PROCESS TEMPERATURE DURING SAD WITH SAME DRAFT AND O2 IN FLUE GAS



OBSERVATIONS

- HIGH DRAFT, HIGH EXCESS AIR, HIGH TMT IN SHOCK ZONE & RADIANT TOP ZONE
- HIGH HEAT TRANSFER IN CONVECTION TUBES
- HIGH RADIATION INLET TEMP
- CONVECTION COIL FOULING
- HIGH AMOUNT OF HEAT AVAILABLE IN RADIATION TOP ZONE
- COKE FORMATION IN RADIATION TOP ZONE AT FAST RATE
- COKE LAYER IN 25^{TH} & 28^{TH} TUBE
- TUBE 1 & 2 VERY CLEAN

- Reduce the draft in the furnace box to shift the heat transfer to radiation bottom

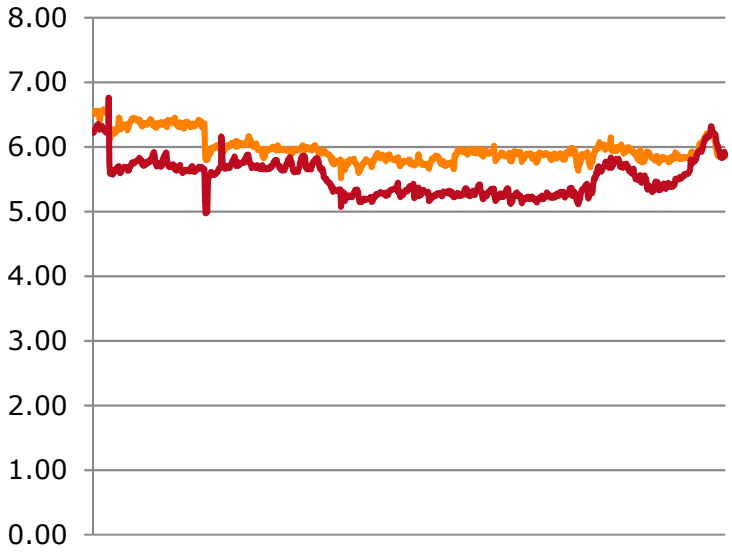
- Increase the HC velocity at the radiation inlet to slow down coke layer formation in radiation top tubes

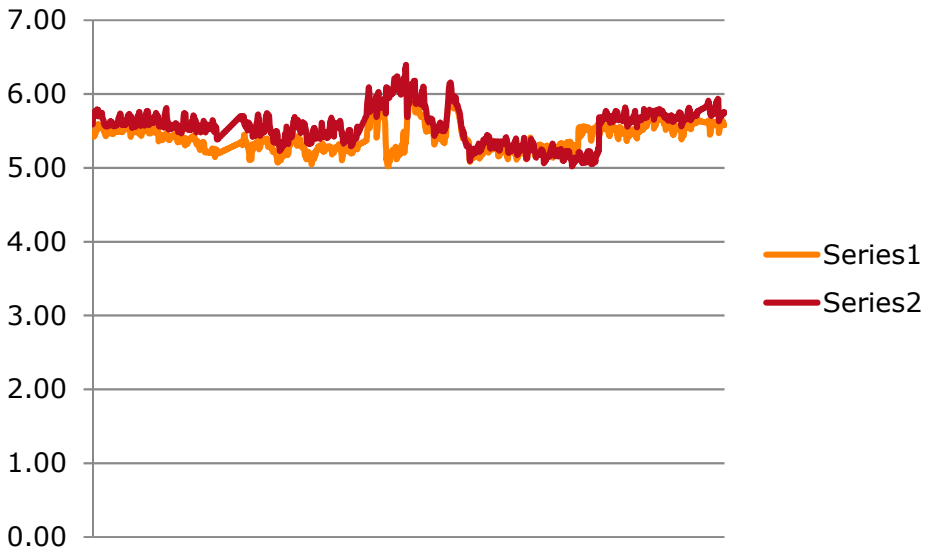
NEW OPERATING CONDITION

- HC flow 29 m3/hr/pass
- BFW to convection coil flow rate 0.32 m3/hr/pass
- **BFW to radiation I/L coil flow rate 0.2 m3/hr/pass**
- CIT- 325ºC , COT- 495ºC
- Convection O/L T- 420ºC
- **Furnace draft- 2.3 mmWC**
- O2 analyzer reading- 3.2 vol%
- Stack T- 210ºC
- Flue gas T at arch- 730ºC
- Flue gas T at floor-620ºC
- Fuel Gas flow- 530 kg/hr

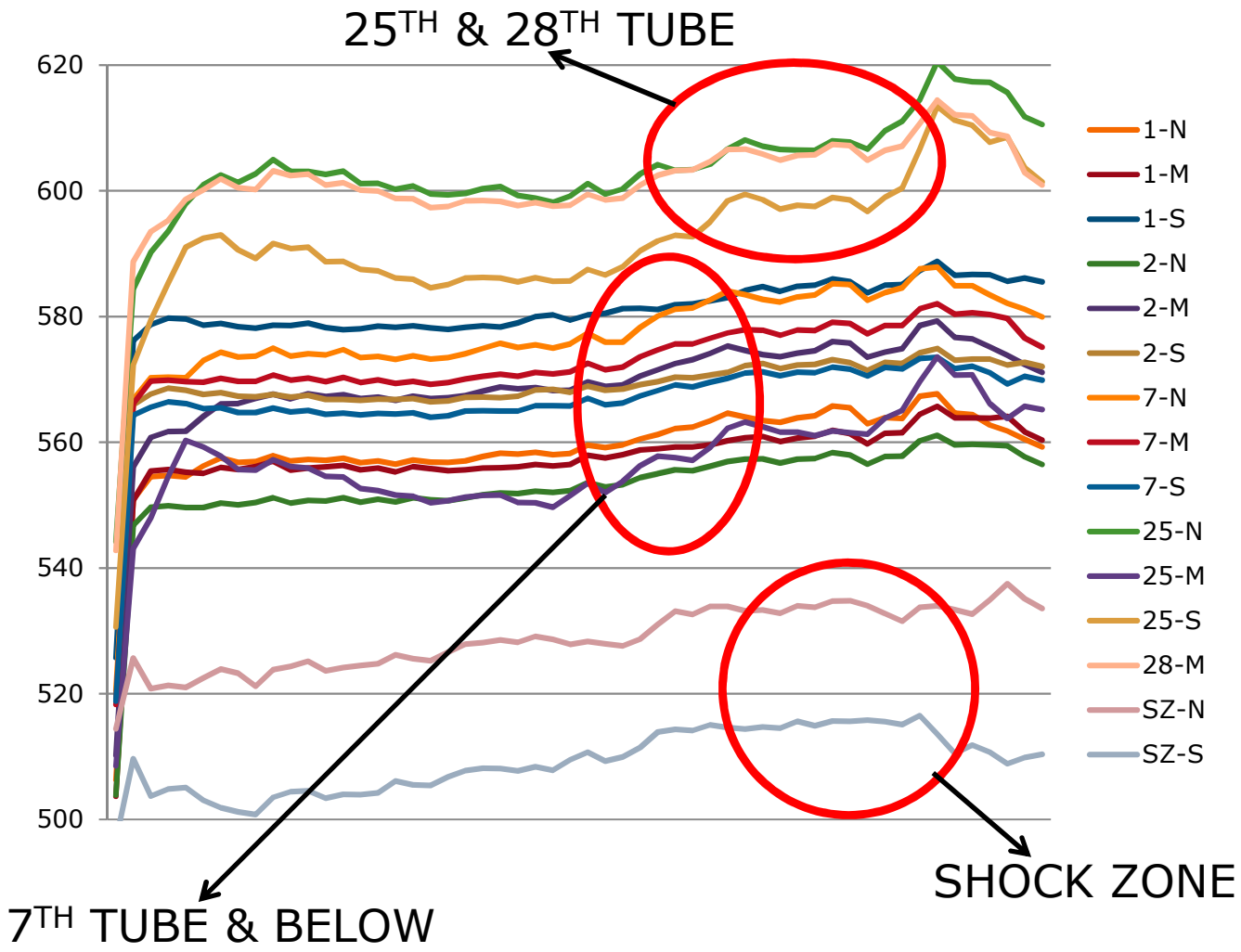
RESULTS

CONVECTION COIL PRESSURE DROP

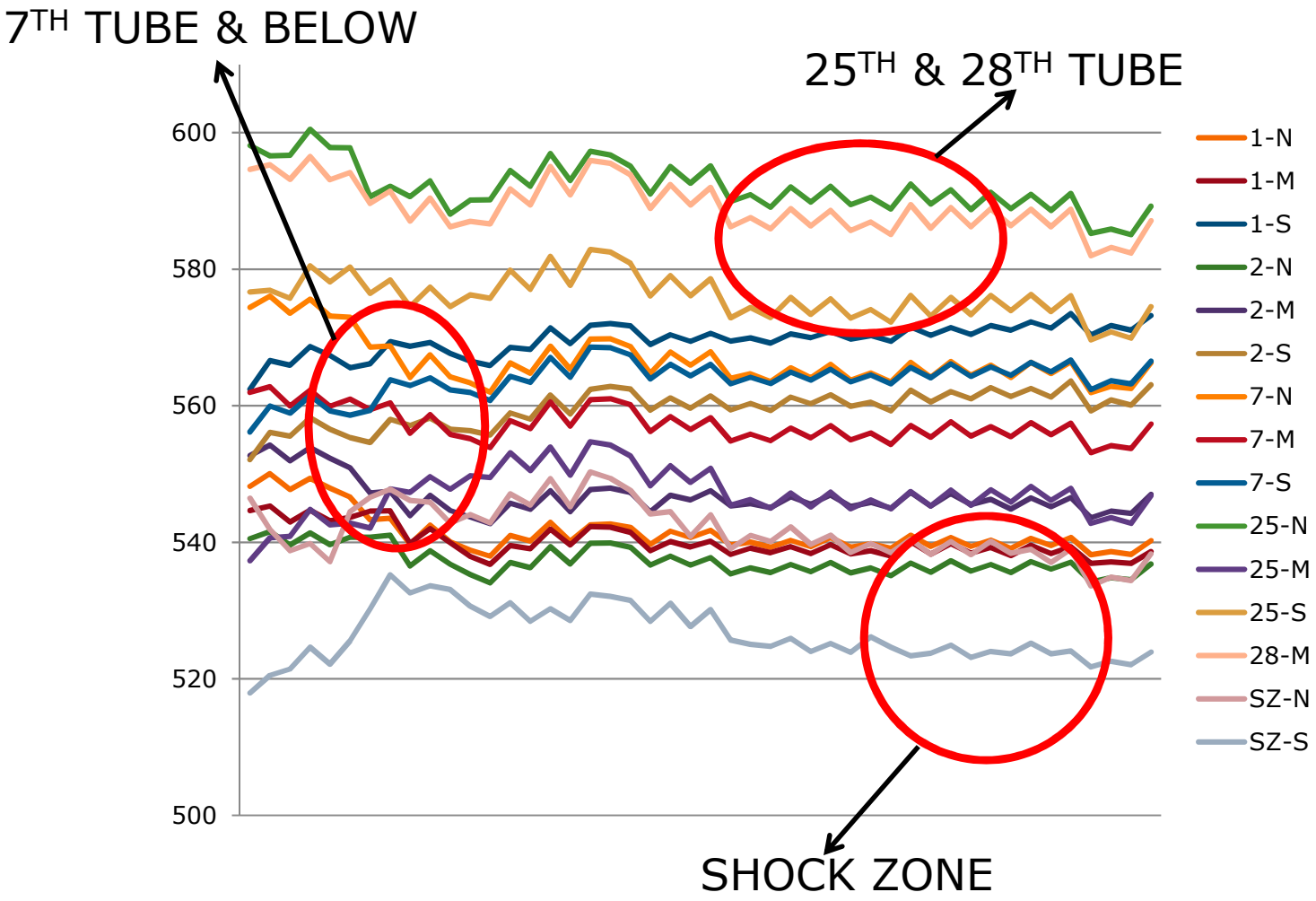




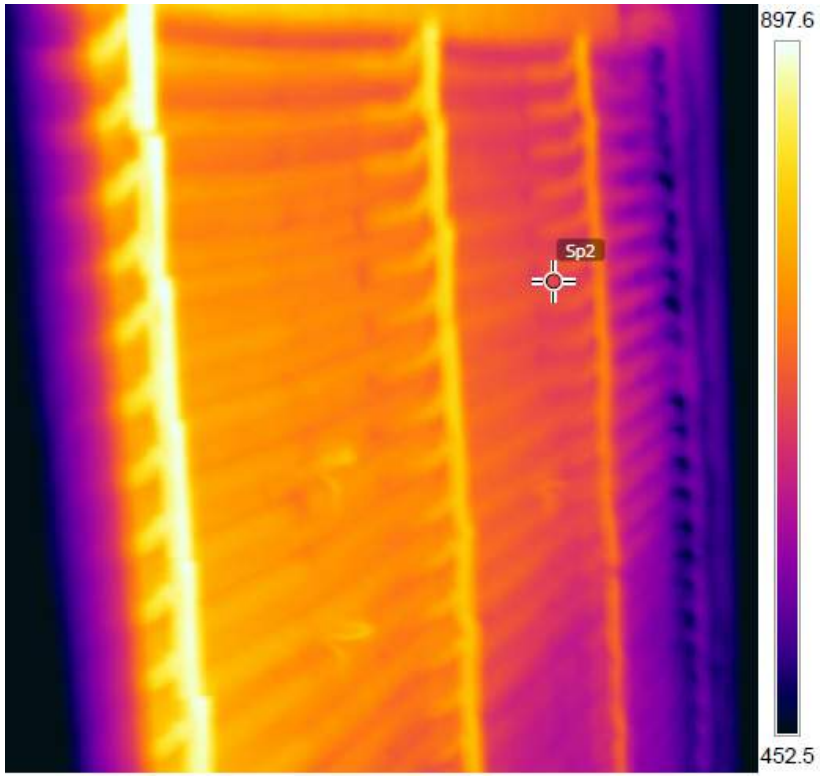
NEW TMT TREND RUN-1

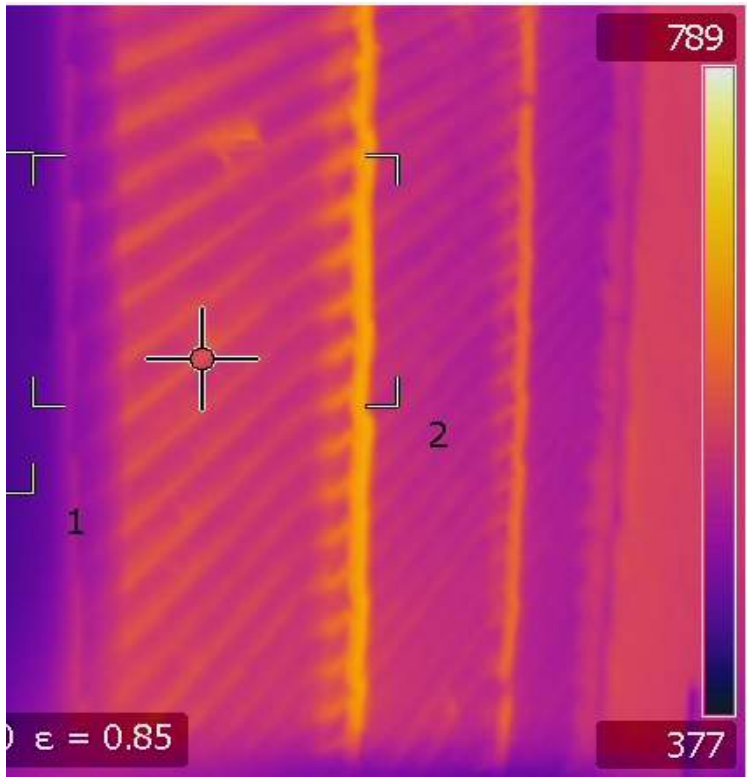


NEW TMT TREND RUN-2



BEFORE





AFTER


Thank you!