

CORROSION IN REFINERY INDUSTRY FAILURE ATLAS

CASE HISTORY n° 3 **Date** 17 September 2007

Hydrodesulfurizer Unit Gas oil heater

DATE OF INCIDENT AND/OR INFORMATION:

Information given at EFC WP5 meeting 13/09/2007

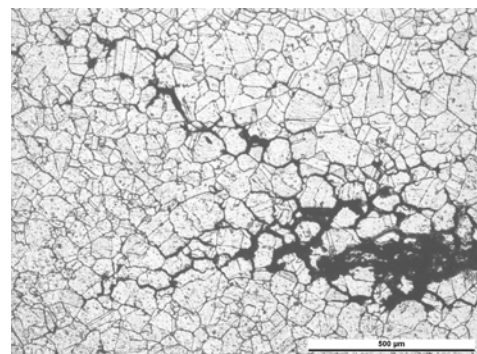
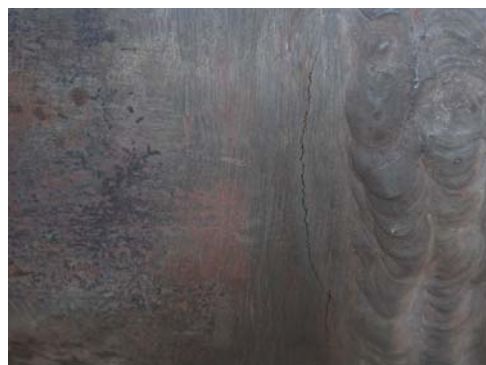
NATURE OF THE INCIDENT :

a. several longitudinal cracks on the fire side of heater tube not penetrating the tube **b.** cracks parallel to welding, near HAZ. Those ones were penetrating the tube, and were all near new weldings from last TA.

CONSEQUENCES : Retubing of both convection and radiant coil.

MATERIAL COMPOSITION and REFERENCES: AISI 304 Stainless Steel

PICTURES AND SCHEMES :



ASPECT : SS304 tubing is fully sensitized. Replica taken on several positions did show intergranular cracks. Some of them were not very deep. Green deposits containing high amount of sulfur and iron with some nickel and chromium have been observed.

MEDIA AND OPERATING CONDITIONS: The sulfur content in the fuel gas was 50 – 200 ppm. Coil has been in service for 46 years.

TIME TO DETERIORATION : near HAZ: since last Turn around. Others: over years



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ANSWER

TYPE OF CORROSION : a. creep b. cracks related to welding new and 46 years old tubing together.

API 571 CLASSIFICATION: a. 4.2.8 b. ? (4.2.12)

CAUSES :

- a. Ageing of tubes, which was not expected to be in the creep range according to API 530 and API 581. Inspection for creep has never been done.
- b. Problems welding 46 years old stainless steel together with new stainless steel. Cracks were not Found in the control of the welds (dye penetrant and radiographic film).

REMEDY :

- a. Retubing to similar material (SS 304). SS 347 or 321 recommended, but not available at the time of delivery.
- b. Future recommendations: Additional control of welds after welding old tubing together with new material. This with Ultrasonic measurements with 45° angled probe to detect eventually cracks on the inner side of the welds.

PUBLICATION - TECHNICAL REPORT: -

BIBLIOGRAPHIC REFERENCES :

API 581
API 530
API 571