Enhancing
Infrastructure

Coker Vessel Life Extension Repair Implementation

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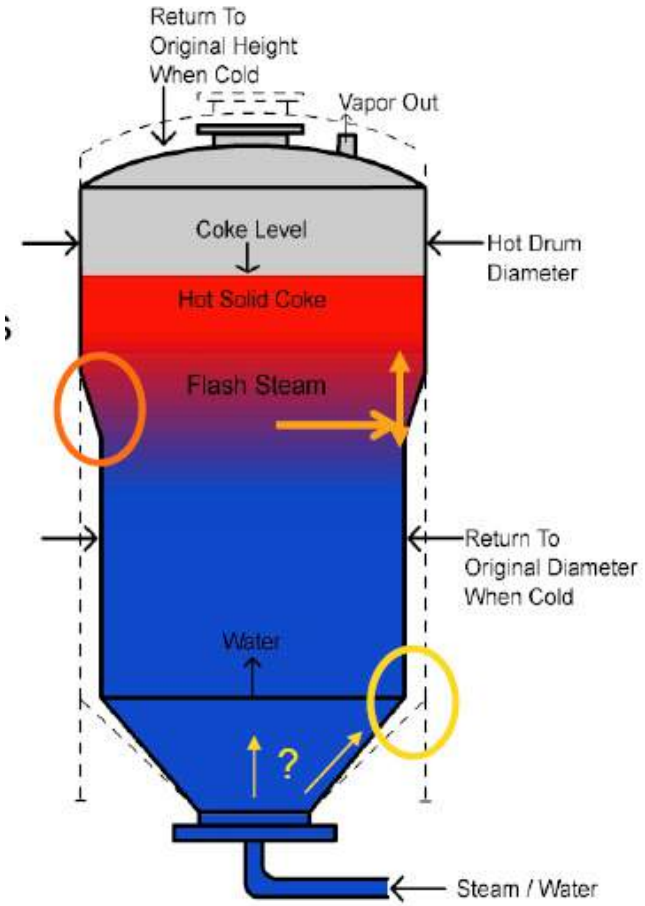
General Coke Drum Statistics

- API - 80% of all coke drums in operation are experiencing cracking
- Cracking occurs within 5 to 7 years
- Most are Cracking and Bulging

Typical Failures

- Bulging
  - Circumferential Seams
  - Shell Course
- Cracking (Partial and Through Wall)
  - Circumferential seam
  - Skirt to Shell welds
  - Shell plate cracks
- ID Erosion/Corrosion
  - Delamination/wear of cladding



Delayed Coker Unit Karlsruhe Germany

March 2012

- The MiRO refinery, in Karlsruhe, has a capacity of 300,000 BBL/d
- Drum Diameter - 7315 mm
- Base Material 1,25Cr, ½Mo / 13CrMo44
- Wall Thickness - 40.5mm + 2mm SS410

Delayed Coking Unit

Case study MiRo

- Planned T/A in 2012
- Bulges in delayed coking unit increased rapidly,
  so emergent repair had to be executed
- Analytical support and “Engineered Repair” developed
- Machine welding used to implement structural
  improvement repair
- Temperbead process eliminated requirement for PWHT

Shell Bulging Damage

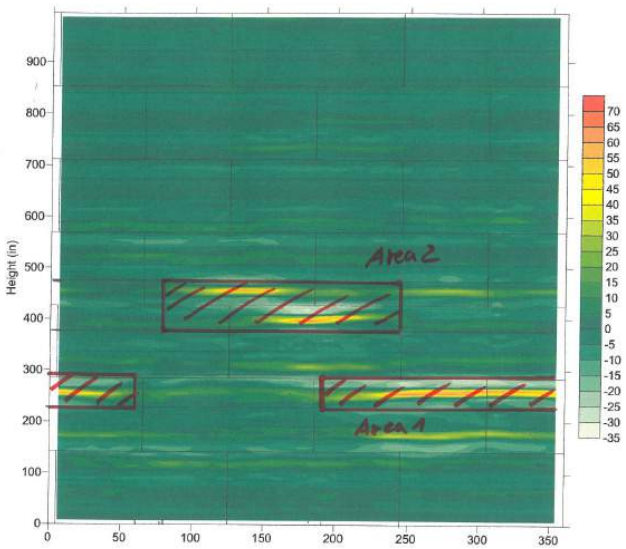
Repair Options Evaluated

Option	Implementation Schedule	Repair Complexity	Repair Integrity
Window Replacement	Long	High	Low
Section Replacement	Long	High	Medium-Low
Structural Overlay	Short	Low	High

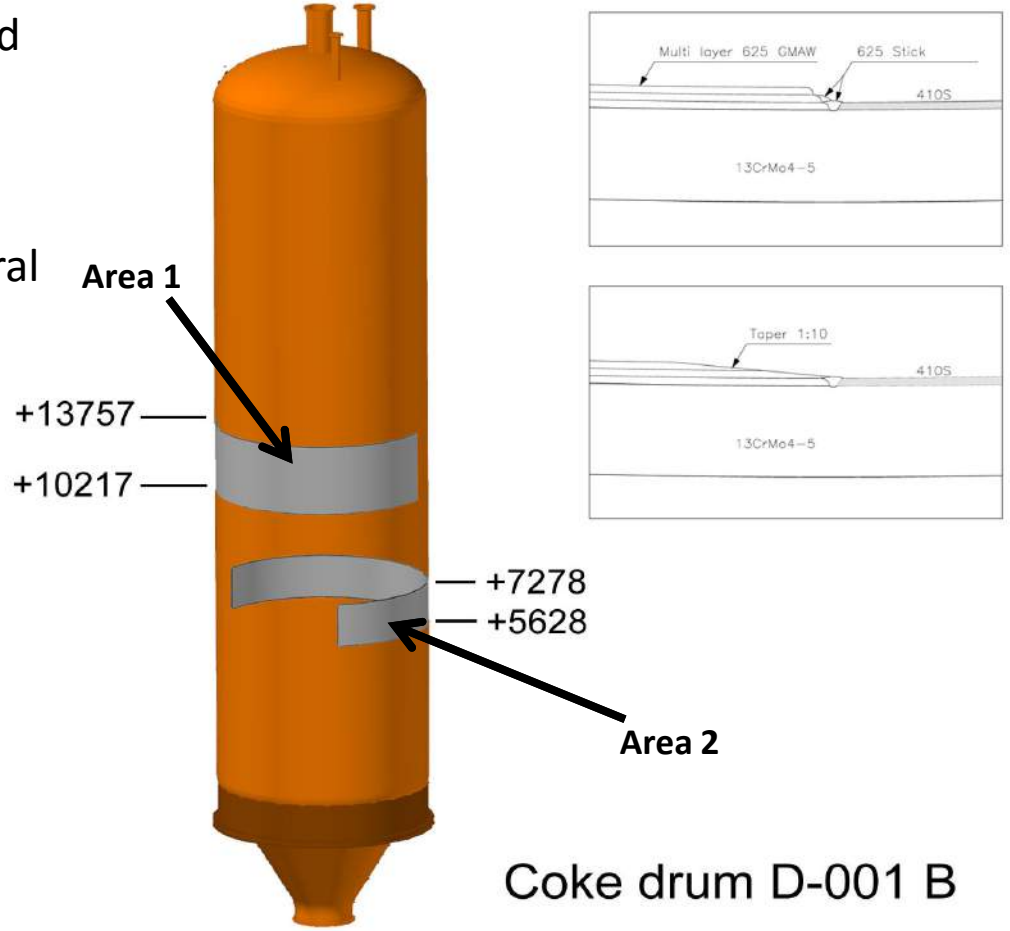
Case study MiRo

Engineered repair solution

- Plastic Strain Index Study performed
- 2 bulge repair areas defined
  - #1 23m2
  - #2 27m2
- Design required additional structural thickness:
  - 0.56” (14.3mm)



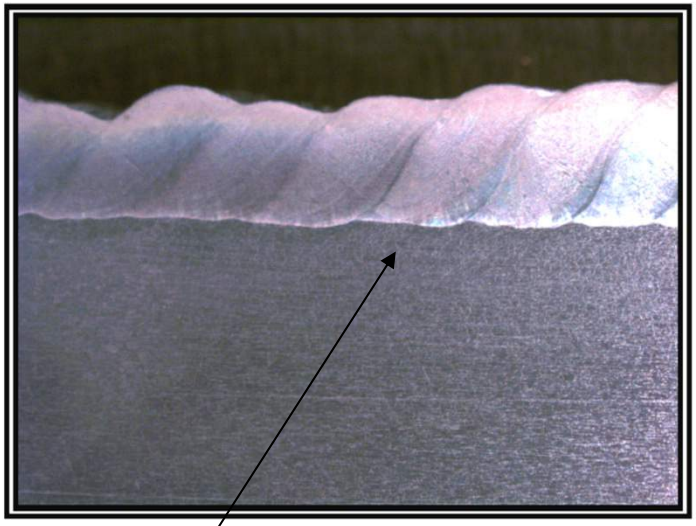
Contour plot of the Plastic Strain Index (PSI) looking from the outside of the drum



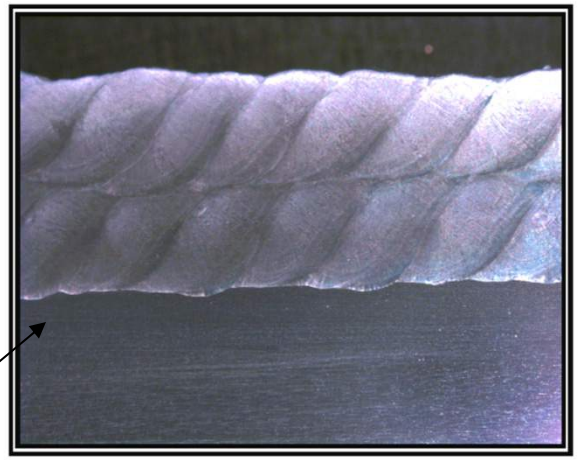
Final repair information

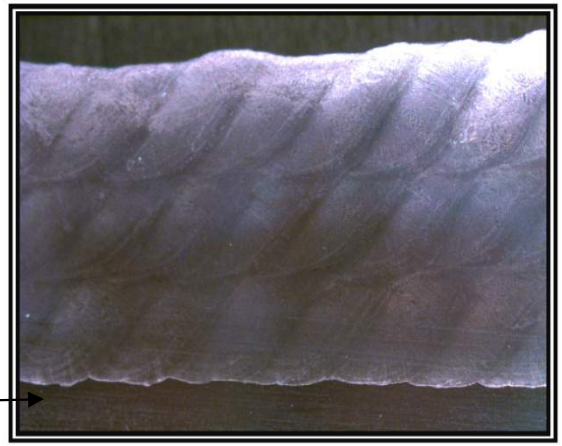
Coke Drum D-001B	Coke Drum D-001B
Bulge repair Area 1 (includes taper zone)	27.7m² per layer
Bulge repair Area 2 (includes taper zone)	30.6m² per layer
Filler material	Alloy 625
Overlay thickness per layer	3/16˝ (5mm)
Total Overlay one layer	**58.3m²**
Overlay three layers	**174.9m²**

Temperbead Welding



HAZ created by 1st weld layer





HAZ is tempered by deposition of successive layers

Site preparation

Equipment Deck

A lot of activity around the unit

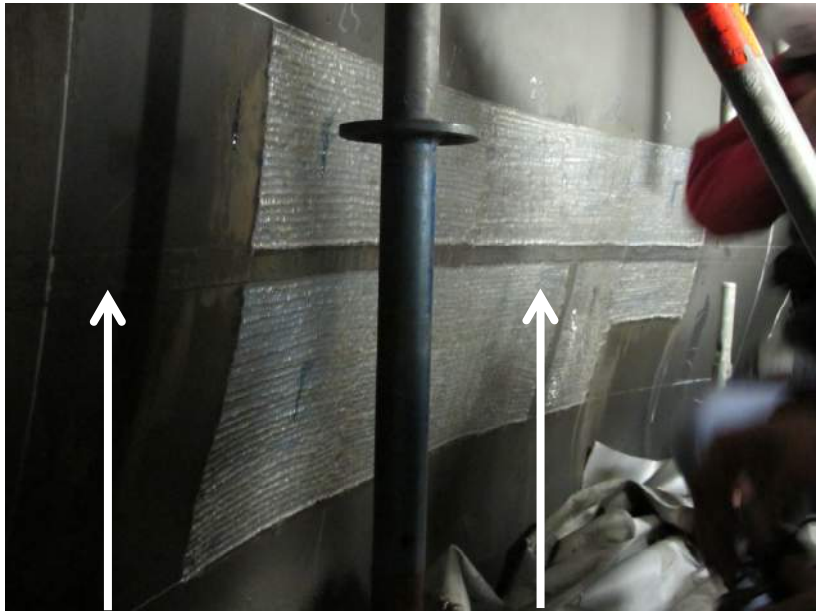
Mock-up: process evaluation & training

Removal of bonded cladding

Mock-up

"Skim" gouging with Carbon Electrodes
2-3mm thickness removed

Surface preparation and gouging in the field



Surface "prepped" 410 cladding

Cladding removed

Gouging in process 2 – 3 mm material removed

Application of Strucrual Overlay on ID of The Vessel

Fully Automated Weld Metal Overlay Welding Systems
Application of NiCr625 Alloy on the ID of the vessel

Summary

Results

- Two bulged areas mitigated
- Alloy 625 installed
- Engineered Repair with 3 layers of overlay
- Additional Cladding areas repaired: surface defects
- Over 40 projects of this type have been performed and demonstrated years of successful operation

Contact

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