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ExxonMobil Baton Rouge Refinery Coke Bed Combustion Incident

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Agenda

Introduction
Event Summary
Coke Drum Repair Strategy
Investigation Conclusions
Investigation Recommendations
Baton Rouge Coker Complex

• Baton Rouge – three Cokers, 10 drums
• Far East Coker – four drum coker, 1979 start-up
  • Bottom deheading – force actuated closure
  • Top deheading – manual unbolting with hydraulic swing back
  • Coke cut into pit, transferred to railcars, transported to barge loading
Event Summary

Stuck drillstem → Temperature increase → Drum failure

Timeline
• Circulated out of coke drum
• Quench, vent, and dehead drum without issue
• Pilot hole complete, drill stem becomes stuck while raising
• Coke drum temperature increases
• Drum integrity compromised, sparks observed falling from the drum – Emergency Response includes:
  • Top water
  • Rehead bottom and add quench water
  • Steam purge into top head space
• Drum decoke complete

Outcome
• No personnel injured or exposed
• Two through-wall holes formed near outage level
• Damage localized to drum
• Extended downtime to repair
Factors Contributing to Combustion

• Ignition source
  • Average layer AIT of petcoke dust <700F
  • Potential region of hot material in drum after quench

• Stack effect
  • Pilot hole provides ~4’ diameter air ingress point, bottom head open
  • Multiple air egress points: open vent, drillstem guide plate
  • Bed cave in could resist flow, but is not airtight
  • Air density differential: ambient temperature near freezing, vapor space in head >150F

• Event drum operating conditions
  • Circulated furnace at end of cycle, material fed to drum at lower operating temperature
  • Ignition sensitivity increases with VCM
  • End of cycle material likely to deposit near top of drum
Drum Damage

~2’x2’

~5’x2’
Drum Damage
Coke Drum Repair Options

1. Local insert patch (~13’H x 24’W) deformed to match bulge profiles at ends.
2. Minimal height shell can (13’H) – leaving significant bulging.
3. 20’ height shell can – removing fire related bulging/cracking.
Coke Drum Repair – 19’-10” shell can replacement

Schedule Optimization:

- Supported top head/shell from coke drum structure
- Installed curved monorail – minimized bull rigging
- Demo’d 19’-10” of shell vs panel replacement approach
- Installed bare C-1/2 Mo shell rather than clad or overlayed, future replacement previously scheduled
- Limited vertical weld seam thickness to 5/8”, eliminating PWHT requirement and temper bead
- Protected vertical seam CA with Inconel WOL
- Allowed re-insulation prior to hydro coupled with NDE
- Temporary insulation vs permanent panels
Investigation Conclusions

- Extended exposure of coke bed to air allowed combustion event
  - Smoldering coke observed in past at lower severity
  - Risk assessments had not considered drum failure due to combustion

- Circulation event led to less-reacted resid feed and escalated severity
  - Drum did not meet site unreacted/green drum criteria
  - Circulation procedure followed

- Reduced quench water injection effectiveness
  - Normalized quench water volume below 5th percentile of recent operations
  - Minor mid-cycle temperature upsets – potential abnormal bed channeling
  - Increased probability of abnormally quenched coke
Investigation Recommendations

- Reduce frequency of delays while cutting
  - Improvements to cutting equipment and instrumentation

- Develop procedure for management of cycle delays
  - During quench – Do not drain, ensure water covers coke bed, open vent
  - While draining – Stop drain, do not dehead, refill with water, leave vent open
  - If drained and bottom deheaded – When delay exceeds 1 hour
    - Ensure telescoping chute is up
    - Start overhead water injection
    - Introduce water 15 minutes every 2 hours or continuously if drum draining
      - Visually check if drum is draining
      - Stop water if level detected above bed
    - Perform visual checks for smoke
  - Routinely reheading bottom not practical for Baton Rouge Cokers
    - For Cokers with bottom slide valves: option to close bottom and steam purge or refill with water
Questions?