



Residue Upgrading and Delayed Coking

Course: Coker, Visbreaker and Solvent Deasphalting Operations



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Introduction:

Residue upgrading and delayed coking is a 2-week course for the operations, supervision and technical support staff of coker, visbreaker and solvent deasphalting units, ending with a Residue Unit Reliability and Margin Improvement Plan for a case refinery. Bottom-of-the-barrel units lose value when drum cycles stretch, heater passes foul early, decoking incidents halt production and the wrong residue blend downgrades coke or destabilises visbroken tar. Nominees already run or support these units and learn through case studies on drum cycle logs, heater trends and coke and tar test results. CoreConcept Training Center delivers this residue upgrading and delayed coking course.

Course Objectives:

- Interpret vacuum residue assays and SARA results to predict coke make, liquid yield and the stability limit of thermally cracked residue
- Operate coke drum fill, switch, steaming, quench and decoking steps against a written sequence with interlocks verified at each stage
- Extend coker heater run length by trending tube metal temperatures, setting velocity steam and planning spalling or pigging
- Prevent foam-over, hot spots and steam eruptions through antifoam control, drum level monitoring and unheading exclusion practice
- Adjust visbreaker severity and deasphalter solvent ratio to balance conversion, tar stability, DAO yield and pitch quality
- Build a Residue Unit Reliability and Margin Improvement Plan that ranks cycle, fouling, safety and feed selection moves by value

Target Audience:

- Coker board operators and outside operators who run drum switches, quench and hydraulic decoking on shift
 - Shift supervisors accountable for safe drum cycles, unheading exclusion zones and handover between crews
 - Process engineers responsible for coker, visbreaker and deasphalter yields, severity and run length
 - Technical services staff who trend heater tube temperatures, drum cycle data and coke and tar test results
 - Unit coordinators who route DAO, pitch, visbroken tar and green coke to downstream units and buyers
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Course Outline:

Day 1: Vacuum Residue Characterisation and Bottom-of-the-Barrel Economics

- Vacuum Residue Assay Reading for Conradson Carbon and Asphaltenes
- SARA Fractionation and Colloidal Stability of Heavy Residue
- Conversion Route Map Comparing Carbon Rejection and Hydrogen Addition
- Bottom-of-the-Barrel Value Gap Between Fuel Oil and Distillates
- Residue Unit Placement Downstream of the Vacuum Column

Day 2: Delayed Coker Process Fundamentals and the Coke Drum Cycle

- Thermal Cracking Kinetics Applied to Coker Heater Coil Residence
- Coke Drum Fill Cycle Timing and Twin-Drum Sequencing
- Coker Fractionator Recycle Ratio and Heavy Coker Gas Oil Endpoint
- Drum Pressure and Outlet Temperature Effect on Liquid Yield
- Coker Yield Correlation Using Feed Carbon Residue Content

Day 3: Coker Heater Operation, Fouling and Furnace Run Length

- Tube Skin Thermocouple Trending for Coke Laydown Detection
- Velocity Steam and Condensate Injection Rate Setting
- Online Spalling and Pigging Decisions for Fouled Heater Passes
- Burner Firing Balance, Flame Impingement and Pass Flow Control
- Run Length Forecast From Tube Metal Temperature Rise Rate

Day 4: Drum Switching, Decoking Sequence and Coke Handling

- Drum Switch Valve Lineup Checklist and Interlock Verification
- Steaming, Quench Water Rate and Drum Cooling Curve Monitoring
- Bottom and Top Unheading Device Operation and Exclusion Zones
- Hydraulic Decoking Jet Pump, Drill Stem and Cutting Tool
- Coke Pit, Crusher and Overhead Crane Handling Practice

Day 5: Guided Case Study on a Delayed Coker Cycle Log

- Case Data Pack With Drum Cycle and Heater Logs
 - Foam-Over Event Reconstruction From Nuclear Drum Level Gauge Readings
 - Hot Drum Steam Eruption Near-Miss Root Cause Review
 - Coker Yield Shift Analysis After a Heavier Residue Blend
 - Case Findings Record and Capstone Unit Selection
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Day 6: Visbreaker and Solvent Deasphalting Unit Operation

- Coil Versus Soaker Visbreaker Severity Setting by Outlet Temperature
- Visbroken Tar Stability Testing With P Value and Sediment
- Cutter Stock Reduction From Visbroken Residue Viscosity Change
- Propane, Butane and Pentane Solvent Selection for Deasphalting
- Solvent-to-Oil Ratio, Extractor Temperature and DAO Yield Control

Day 7: Coke Quality, Residue Feed Selection and Unit Hazard Control

- Sponge, Shot, Needle and Anode Coke Morphology Drivers
- Green Coke Volatile Matter, Sulphur and Metals Tracking
- Antifoam Injection Strategy and Shot Coke Hot Spot Prevention
- Residue Feed Blending Matrix for Target Coke Grade
- Layer of Protection Analysis for Unheading and Cutting Hazards

Day 8: Shift Coordination, Product Routing and Offtake Communication

- Shift Handover Log Template for Drum Cycle Status
- Board and Cutting Crew Communication Protocol During Drum Switch
- DAO Routing Agreement With Cracking and Lube Base Units
- Pitch and Asphalt Disposition to Fuel, Gasification or Bitumen
- Green Coke Offtake Coordination With Calciner and Fuel Buyers

Day 9: Residue Unit KPIs, Benchmarking and Margin Impact

- Residue Unit KPI Dashboard for Cycle Time and Liquid Yield
- Coke Make per Barrel and Coker Liquid Value Calculation
- Visbreaker Conversion Versus Fuel Oil Stability Reserve Trade-Off
- Deasphalter Lift Economics Comparing DAO Value and Pitch Penalty
- Drum Cycle Shortening Opportunity Screening by Throughput Gain

Day 10: Case Study Capstone on a Residue Unit Reliability and Margin Improvement Plan

- Capstone Baseline of Residue Feed, Cycle Time and Run Length
 - Capstone Ranking of Decoking Safety and Heater Fouling Findings
 - Capstone Feed Selection and Coke Grade Strategy Statement
 - Capstone Margin Case for Visbreaker and Deasphalter Moves
 - Residue Unit Reliability and Margin Improvement Plan Presentation
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Skills You Will Gain:

- Vacuum Residue Assay Interpretation
- Coke Drum Cycle Management
- Heater Tube Fouling Diagnosis
- Decoking Hazard Control
- Foam-Over Prevention
- Visbroken Tar Stability Assessment
- Deasphalter Solvent Ratio Tuning
- Residue Margin Analysis

Why Attend This Course:

- Deliver a Residue Unit Reliability and Margin Improvement Plan to the unit manager and the refinery planning team for approval
- Decide when to spall or pig a fouled coker pass, shorten a drum cycle or change visbreaker severity using trended evidence
- Avoid foam-over carryover, unheading incidents and downgraded coke cargoes that cost throughput, reliability and sales value
- Coach operators and supervisors on drum switch checklists, quench curves, exclusion zones and stability test readings

Conclusion:

Back at work, the participant presents the Residue Unit Reliability and Margin Improvement Plan to the unit manager, the shift supervisors and the planning team. The unit manager uses it to approve heater cleaning and drum cycle changes, the supervisors adopt its switch and unheading checklists, and planners use its feed selection matrix to choose residue blends against coke grade and tar stability targets. After the first full heater run or first planned cycle change under the plan, the unit should review run length achieved, coke quality and incident records, then reset the ranked moves.

Frequently Asked Questions FAQ:

What should participants know before residue upgrading and delayed coking training?

Participants should already operate, supervise or support a coker, visbreaker or deasphalter, or analyse its data. Familiarity with refinery flow diagrams and laboratory test reports helps. Bringing anonymised drum cycle logs, heater trends or coke and tar results lets them apply the case work to their own unit.

How does residue upgrading and delayed coking training differ from a general refinery processes course?

It spends two weeks on the residue units alone: drum cycles, heater fouling, decoking safety, coke quality, visbreaker stability and deasphalter solvent control. A general refinery course surveys every unit from crude distillation to blending and gives thermal conversion only part of one day.

Why does residue feed selection matter so much in residue upgrading and delayed coking?

Feed carbon residue, asphaltenes, sulphur and metals set coke make, coke grade, foaming tendency and visbroken tar stability. A heavier or more asphaltenic blend can turn sponge coke into shot coke, shorten heater run length and push fuel oil stability below its limit.

What do participants take back from residue upgrading and delayed coking training?

Participants take back a Residue Unit Reliability and Margin Improvement Plan with a feed and cycle baseline, ranked fouling and decoking safety findings, a feed selection and coke grade strategy, a margin case for visbreaker and deasphalter moves, and a KPI dashboard.
