Spent Caustic Treatment and Caustic Treating Units: Wet Air Oxidation, Neutralisation and Reuse

19 – 23 July 2027
Amsterdam - Zuidas business district hotel



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Introduction:

Spent caustic treatment is where refinery treaters and ethylene caustic towers meet the effluent plant: a sulfidic or cresylic batch sent to the drain releases hydrogen sulphide, spreads odour and shocks biotreatment, while poorly run treaters burn fresh caustic and multiply the volume to be handled. This Core Concept course gives engineers the methods to run caustic treating units, characterise each spent caustic stream and choose between neutralisation, wet air oxidation, other oxidation routes, reuse and disposal. Participants produce a Spent Caustic Management and Treatment Selection Study for a case complex.

Course Objectives:

- Map every caustic consumer in a refinery or olefins complex, from cracked gas wash towers to LPG, gasoline and jet sweetening, and quantify spent caustic generation
- Characterise sulfidic, naphthenic and cresylic spent caustic batches using free hydroxide, sulphide, mercaptide, carbonate, phenol and COD analysis
- Operate and troubleshoot caustic prewash, mercaptan extraction and fixed-bed sweetening treaters to extend caustic life and limit carryover
- Control hydrogen sulphide release, odour and corrosion risks in spent caustic transfer, storage and loading
- Evaluate neutralisation with acid springing, wet air oxidation, peroxide oxidation, dilution with biotreatment, reuse and third-party sale against spent caustic composition
- Build lifecycle cost comparisons and compile a Spent Caustic Management and Treatment Selection Study for a case complex

Target Audience:

- Process engineers who run caustic treaters, prewash vessels and sweetening units and set caustic change-out
- Operations engineers accountable for cracked gas caustic wash towers, red oil control and spent caustic transfer
- Environmental engineers who route spent caustic to effluent plants and manage odour and discharge limits
- Technical services engineers who evaluate spent caustic oxidation, neutralisation and reuse projects
- Laboratory leads who analyse caustic strength, sulphide and phenol content and trend treater performance

Course Outline:

Day 1: Caustic Consumers, Spent Caustic Families and Stream Inventory

- Caustic Consumer Map: Cracked Gas Wash Towers, LPG Extraction, Gasoline and Jet Sweetening
- Sulfidic, Naphthenic and Cresylic Spent Caustic: Origin and Chemical Signature
- Caustic Chemistry of Hydrogen Sulphide, Carbon Dioxide, Mercaptans and Organic Acid Uptake
- Spent Caustic Generation Rate Estimate and Site Stream Inventory Sheet
- Current Disposal Route Baseline: Effluent Plant Load, Odour Complaints and Contractor Haulage

Day 2: Caustic Treater Design, Chemistry and Spent Caustic Characterisation

- Three-Stage Caustic Wash Tower Design: Strength Staging, Circulation and Water Wash Section
- Mercaptan Extraction and Regeneration Loop: Catalyst, Oxidiser and Disulphide Separator
- Fixed-Bed Jet and Kerosene Sweetening with Intermittent Caustic Wetting
- Spent Caustic Laboratory Panel: Free Hydroxide, Sulphide, Mercaptide, Carbonate, Phenol and COD
- Caustic Utilisation Index and Degree-of-Spending Calculation per Batch

Day 3: Treater Operation, Handling, Storage and Hydrogen Sulphide Control

- Caustic Strength Monitoring, Make-Up Scheduling and Change-Out Criteria
- Red Oil and Polymer Fouling in Wash Towers: Carbonyl Condensation and Wash Oil Injection
- Emulsion, Carryover and Sodium Contamination Diagnosis Downstream of Treaters
- Spent Caustic Tankage: Nitrogen Blanketing, Vent Scrubbing and Degassing Drums
- Hydrogen Sulphide Exposure, Acidification Hazard and Odour Containment during Transfer

Day 4: Spent Caustic Treatment Routes and Their Limits

- Neutralisation and Acid Springing: Acid Oil Recovery and Sour Gas Handling
- Wet Air Oxidation Regimes for Sulfidic Versus Naphthenic and Cresylic Streams
- Peroxide, Ozone and Catalytic Oxidation Alternatives for Sulphide and Phenol Destruction
- Biological Treatment Compatibility: Dilution Ratio, Sulphide Toxicity and Phenol Acclimation
- Reuse and Sale Outlets: Pulp Mills, Sodium Hydrosulphide Recovery and Cresylic Acid Markets

Day 5: Case Study: Spent Caustic Treatment Selection for a Case Complex

- Case Complex Data Review: Olefins Unit and Refinery Treater Spent Caustic Profiles
- Waste Minimisation Options: Caustic Staging, Regeneration and Segregation of Streams
- Treatment Route Screening Matrix Against Composition, Volume and Downstream Effluent Limits
- Lifecycle Cost Comparison: Capital, Utilities, Chemicals, Haulage and Disposal Fees
- Spent Caustic Management and Treatment Selection Study Presentation and Peer Challenge

Skills You Will Gain:

- Spent Caustic Characterisation
- Caustic Treater Troubleshooting
- Wash Tower Red Oil Control
- Sulphide Odour Containment
- Wet Air Oxidation Screening
- Acid Springing Operation
- Caustic Waste Minimisation
- Disposal Lifecycle Costing

Why Attend This Course:

- Leave with a Spent Caustic Management and Treatment Selection Study you can adapt to your own refinery or olefins site
- Cut fresh caustic consumption and spent caustic volume by spending each batch more fully before change-out
- Stop sulphide shocks and odour events at the effluent plant by knowing which spent caustic streams it can accept
- Compare caustic treating and disposal practice with peers from refining, olefins, aromatics and gas processing

Conclusion:

Spent caustic becomes manageable once each caustic consumer is measured, each batch is characterised and every treater is run to spend its caustic fully. The week moves from caustic consumers and spent caustic families, through treater design and laboratory characterisation, to day-to-day treater operation, storage and hydrogen sulphide control, then to neutralisation, oxidation, biotreatment and reuse routes. The final day applies these methods to a case complex and produces a treatment selection study with lifecycle costs ready for technical review.