



## **Alkylation and Isomerisation Units Course: Acid Strength Control, C5/C6 Isom and Octane Blending**



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### **Introduction:**

Alkylation and isomerisation units, covering acid strength control, C5/C6 isom and octane blending, are the subject of this 5-day course for staff who run and optimise light-ends gasoline upgrading units, ending with a Light-Ends Upgrading Unit Improvement Plan for a case refinery. Octane barrels are lost when acid strength drifts towards runaway, isobutane ratios slip, isom catalyst is poisoned and blends ignore vapour pressure limits. Nominees already operate or engineer these units and learn through case studies built on unit logs and blend data. CoreConcept Training Center delivers this alkylation and isomerisation units course.

### **Course Objectives:**

- Explain sulphuric acid and HF alkylation reaction paths and how isobutane to olefin ratio, temperature and mixing set alkylate octane and acid consumption
- Control spent acid strength, acid soluble oil and water content to keep alkylation reactors away from acid runaway
- Apply HF hazard mitigation layers, acid relief neutralisation and API RP 751 operating practices to daily unit work
- Select chlorided alumina, zeolitic or sulphated zirconia isomerisation catalyst and protect it from water, sulphur and nitrogen poisons
- Evaluate once-through, deisopentaniser and deisohexaniser recycle isom schemes by octane gain, utility use and stream yield
- Produce a Light-Ends Upgrading Unit Improvement Plan that ranks octane, vapour pressure and acid cost moves for a case refinery

### **Target Audience:**

- Staff responsible for operating sulphuric acid or HF alkylation reactors, settlers and fractionation on shift
  - Staff responsible for running light naphtha isomerisation reactors, dryers and stabilisers
  - Process engineering staff responsible for alkylation and isom unit settings, test runs and catalyst performance
  - Technical services staff responsible for acid quality tracking, isom catalyst health and unit monitoring reports
  - Blending and planning staff responsible for placing alkylate, isomerate and butane in the gasoline pool
  - Unit safety and operations support staff responsible for HF and spent acid handling routines
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## Course Outline:

### Day 1: Light-Ends Upgrading Context, Feeds and Unit Baseline

- Gasoline Pool Octane Gap and Light-Ends Upgrading Role
- Alkylation Feed Map of Propylene, Butylenes and Isobutane
- Light Straight-Run Naphtha C5/C6 Composition and Octane Values
- Alkylate and Isomerate Properties Versus Reformate and Cracked Naphtha
- Unit Baseline Review of Octane Barrels and Acid Use

### Day 2: Alkylation Chemistry, Reactor Designs and Isom Technology

- Carbocation Alkylation Mechanism and Polymerisation Side Reactions
- Sulphuric Acid Contactor and Effluent Refrigeration Reactor Design
- HF Settler, Acid Rerun Column and Riser Reactor Design
- Chlorided Alumina, Zeolitic and Sulphated Zirconia Isom Catalysts
- Once-Through, Deisopentaniser and Deisohexaniser Recycle Isom Schemes

### Day 3: Alkylation and Isomerisation Unit Operating Control

- Isobutane to Olefin Ratio Control at Reactor Inlet
- Spent Acid Titration, Acid Soluble Oil and Water Monitoring
- Reaction Temperature, Emulsion Mixing and Acid to Hydrocarbon Ratio
- Isom Feed Dryer and Hydrotreater Guard Against Water and Sulphur
- Organic Chloride Injection, Caustic Scrubber and Isom Reactor Temperature

### Day 4: Acid Runaway, HF Hazard Mitigation and Octane Blending Economics

- Acid Runaway Warning Signs and Recovery Sequence
- HF Release Mitigation with Water Curtains, Isolation and Rapid Transfer
- API RP 751 Practices for HF Unit Access Control
- Spent Sulphuric Acid Regeneration Versus Fresh Acid Purchase Cost
- Octane and Reid Vapour Pressure Value of Alkylate

### Day 5: Case Study and Light-Ends Upgrading Unit Improvement Plan

- Case Alkylation Unit Log Review of Ratio and Acid Strength
  - Case Isom Unit Catalyst Activity Decline Root Cause Analysis
  - Case Gasoline Pool Blend Recalculation with Seasonal Vapour Pressure Limits
  - Improvement Move Ranking by Octane Barrel and Acid Cost
  - Light-Ends Upgrading Unit Improvement Plan Completion and Peer Challenge
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## Skills You Will Gain:

- Isobutane Ratio Management
- Spent Acid Strength Tracking
- Acid Runaway Recognition
- HF Release Mitigation
- Isomerisation Catalyst Protection
- Recycle Isom Scheme Assessment
- Octane and Vapour Pressure Blending
- Upgrading Margin Estimation

## Why Attend This Course:

- Deliver a Light-Ends Upgrading Unit Improvement Plan to the operations manager and technical services lead for the case alkylation and isom units
- Judge whether falling alkylate octane calls for an isobutane ratio, acid strength or mixing correction before the next shift
- Avoid acid runaway events, lost isom catalyst activity and gasoline pool giveaway caused by late reading of unit trends
- Coach shift operators on spent acid titration, HF response steps and isom dryer checks using the course worksheets

## Conclusion:

Back on site, the participant gives the operations manager and technical services lead a Light-Ends Upgrading Unit Improvement Plan for the alkylation and isom units. Shift supervisors use it to set isobutane ratio, spent acid strength and isom dryer targets, while blending staff use its octane and vapour pressure values to place alkylate and isomerate in the gasoline pool. After the first operating month under the plan, the unit should compare acid use, alkylate octane, isom conversion and blend giveaway with the baseline and tighten any limit that failed to catch drift.

## Frequently Asked Questions FAQ:

### What should participants know before the alkylation and isomerisation units course?

Participants should already operate, supervise or engineer an alkylation, isomerisation or related light-ends unit and read unit logs and laboratory results. Bringing anonymised acid strength records, isom reactor trends or a gasoline blend sheet helps them apply the case work to their own site.

## **How does the alkylation and isomerisation units course differ from a general refinery processes course?**

This course stays on the light-ends upgrading units at operating depth: acid strength, isobutane ratio, HF mitigation, isom catalysts and recycle schemes. General refinery courses survey every unit briefly, and cracking or reforming courses treat those units in depth while touching alkylation only in passing.

## **What causes acid runaway in alkylation and isomerisation units work?**

Acid runaway in an alkylation unit begins when acid strength falls too low, often from high water, feed contaminants or a low isobutane ratio. Polymerisation then overtakes alkylation, acid activity collapses and octane falls, so operators cut olefin feed and restore acid strength quickly.

## **What do participants take back from the alkylation and isomerisation units course?**

Participants take back a Light-Ends Upgrading Unit Improvement Plan for a case refinery, with ratio and acid strength targets, an isom catalyst protection checklist, HF response steps and an octane and vapour pressure blend value table ready to adapt to their own units.

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