

**Training Title**

**DE-SULFURIZATION TECHNOLOGY**

**Training Duration**

**5 days**

**Training Venue and Dates**

RT102	De-Sulfurization Technology	5	08 - 12 January, 2024	\$5,500	Dubai, UAE
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**In any of the 5-star hotels. The exact venue will be informed once finalized.**

**Training Fees**

- \$5,500 per participant for Public Training includes Materials/Handouts, tea/coffee breaks, refreshments & Buffet Lunch.

**Training Certificate**

**Define Management Consultancy & Training Certificate of course completion will be issued to all attendees.**

**TRAINING DESCRIPTION**

The petroleum industry uses desulfurization technology as a primary process for quality improvement to meet final fuel specifications as well as feed preparation for many intermediate processing units. This course covers the core elements of desulfurization technology. Key variables that affect product yields and properties are described and their impact on the optimization of the unit operation is discussed. A framework is presented for troubleshooting operating problems and, throughout this discussion, participants are encouraged to describe their specific challenges. The scope of the course includes the core of most Hydrotreating problems and attempts to cover solutions useful to design and operating engineers. Concerns associated with processing for clean fuels are covered. This course will provide an overview of the diverse nature of the desulfurization processes, depending on the feedstocks used, products made and the environmental issues. It will address process integration issues, which are vital for economic viability.

**The course includes practical worked examples and case studies to reinforce the key learning.**

**TRAINING OBJECTIVES**

Upon completion of this course, participants will have gained a solid understanding of the key elements associated with the design, operation and troubleshooting of desulfurization units. This will include the impact of feed quality, catalyst, operating conditions and unit design on

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product qualities. In addition, they will have gained some valuable insight into how to optimize, debottleneck and troubleshoot their desulfurization units.

### **TRAINING OUTCOME**

- Overview of the Catalytic Processes in a Refinery, with a special emphasis on Hydro-treatment Systems.
- Catalyst Evaluation Techniques.
- An understanding of Reactor and Catalyst interaction.
- The operation, control and troubleshooting of a reactor and associated heaters, heat exchangers and distillation equipment.
- An overview of reactors, practical solutions as well as theory.
- An understanding of essential reaction concepts.
- Valuable practical insights for trouble free design and field proven techniques for commissioning, start up and shutdown of reactor, heater, heat exchanger and distillation operations.
- To tailor your approach to specific design, analysis and troubleshooting problems.

### **WHO SHOULD ATTEND?**

The desulfurization technology is a comprehensive core skills course for professionals dealing with all aspects of the Hydrotreating units. The course will be highly valuable to all engineers involved in the operation and design of Hydrotreating facilities. Additionally, the course will be useful to any technical personnel wishing to gain a perspective of how desulfurization fits into the operation of a complete refining plant. Those who are experienced in other fields and seek a review of the fundamentals of desulfurization technology will also find this course most beneficial.

### **TRAINING METHODOLOGY:**

A highly interactive combination of lectures and discussion sessions will be managed to maximize the amount and quality of information and knowledge transfer. The sessions will start by raising the most relevant questions and motivate everybody find the right answers. You will also be encouraged to raise your own questions and to share in the development of the right answers using your own analysis and experiences. Tests of multiple-choice type will be made available on daily basis to examine the effectiveness of delivering the course.

Very useful Course Materials will be given.

- 30% Lectures
- 30% Workshops and work presentation
- 20% Group Work& Practical Exercises
- 20% Videos& General Discussions

### **DAILY OUTLINE**

#### **DAY 1**

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## Course Introduction and Pre-Test

### Introduction to Desulfurization Technology

- Refinery Overview
- HDS role in a refinery: aim of the various treatments with hydrogen and integration in the refining scheme
- Impurities in petroleum cuts and products, their impact on health, environment and on other refining processes
- Recent regulations and future trends: quality specifications of petroleum products and fuels

### Desulfurization reactions

- Characteristics of the chemical reactions
- Thermodynamic and kinetic aspects
- Consequences on the operation of units
- Side reactions and optimum operating conditions to deplete their evolution
- Specific features of reversion reactions

### Desulfurization unit design basics and safety

- Unit design features
- Compositions of the main streams; mass balance and yields, sulfur balance, hydrogen balance and consumption

### Case Study

### Q&A Session for Day 1 Topics

## DAY 2

### Operation, Monitoring and Troubleshooting

- Operating conditions and compositions of the main streams; mass balance and yields, sulfur balance, hydrogen balance and consumption
- Significance of the operating variables and their influence on the process: mean temperatures and profile, pressures, partial pressure of hydrogen, recycle rate, quench ratio, feed flow rate and space velocity
- Advanced process control and optimization of the process
- Catalyst follow up and cycle length optimization, ageing and deactivation
- Reaction Selectivity
- Regeneration steps and monitoring
- Maximizing the performances of the unit under constraints or limit conditions
- Revision of the Basics: FCC Naphtha Treating for Clean Fuels

### Case Study

### Q&A Session for Day 2 Topics

## DAY 3

### Catalysis

- Nature of HDS Catalysts
- Composition and activity

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- Catalyst selection and reactor loading diagrams
- Multi-catalyst Systems
- Pre-sulfuring procedures: role, steps and details of the different methods
- Catalyst deactivation
- Catalyst Regeneration

#### **Catalyst Management**

- Reactor loading and unloading, catalyst handling
- Reactor Distribution and Internals
- Effects of poor distribution
- Developments in internals design
- Pressure drop management

#### **Case Study**

#### **Q&A Session for Day 3 Topics**

### **DAY 4**

#### **Performance of the various Desulfurization units**

- For each of the following processes, the operating parameters and the specific operating features are addressed:
  - Naphtha desulfurization for catalytic reformer and isomerization feed.
  - Cracked gasoline treatments, special hydrotreatments for the FCC gasoline.
  - Stabilization of the pyrolysis gasoline.
  - Hydro isomerization of the C4 cuts out of the FCC to feed alkylation unit.
  - Hydrotreatment of middle distillates: kerosene and gasoil, LCO processing.
  - Desulfurization of vacuum gasoil to FCC units.
  - Residues demetalization processes.
  - Ultra-low Sulfur Gasoline & Diesel Fuels

#### **Start-up, Shutdown and Troubleshooting**

- Startup/Shutdown procedures
- Causes of quality decrease and corresponding actions.
- Main automatic safety systems.
- Feed pump failure, heater failure.
- Compressor failure: fresh gas or recycle, adapted reaction and safe shutdown.

#### **Case Study**

#### **Q&A Session for Day 4 Topics**

### **DAY 5**

#### **Refinery Hydrogen Balance**

- Using Hydrogen wisely
- HPU options

#### **Equipment Design and Process Debottlenecking**

- Reactors, exchangers, separators, strippers, compressors
- Design options

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- Typical bottlenecks
- Ultra-low Sulfur Gasoline & Diesel Fuels**
- Specific developments to specifications
- Case Study**
- Q&A Session for Day 5 Topics**
- Course Closing and Final Test**

NOTE:

**Pre & Post Tests will be conducted**

**Case Studies, Group Exercises, Group Discussions, Last Day Review & Assessments will be carried out.**



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