

**Training Title**

**ATMOSPHERIC RESIDUE DE-SULFURIZATION TECHNOLOGY**

**Training Duration**

**5 days**

**Training Venue and Dates**

PE179	Atmospheric Residue De-Sulfurization Technology	5	19 - 23 January, 2020	\$4,500	Dubai, UAE
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**In any of the 5 star hotels. The exact venue will be informed once finalized.**

**Training Fees**

- US\$4,500 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**

Atmospheric residue desulfurization (ARDS) process is extensively used in upgrading of heavy petroleum oils and residues to more valuable clean environmentally friendly transportation fuels and to partially convert the residues to produce low-sulfur fuel oil and hydrotreated feedstocks. Graded catalyst systems in multiple reactors are used in the process in order to achieve hydrodesulfurization (HDS), hydrodemetallization (HDM), hydrodenitrogenation (HDN), and conversion of residues to distillates at desired levels.

This course is designed to provide in depth practical review of the core elements of (ARDS) process technology including the key variables that affect product yields, properties, catalyst issues, reaction mechanisms, process design, operation, control and optimization. A framework is presented for troubleshooting operating problems and, throughout this discussion, participants are encouraged to describe their specific challenges.

**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, monitoring and troubleshooting of ARDS units. This will include the impact of feed quality, catalyst, operating conditions and unit

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

### **TRAINING OUTCOME**

- Overview of the Catalytic Processes in a Refinery, with a special emphasis on ARDS units.
- ARDS 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 of the ARDS units.
- To tailor your approach to specific design, analysis and troubleshooting problems.

### **WHO SHOULD ATTEND?**

This 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 Hydro-treating

- Refinery Overview
- HDT 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
- Commercial history

### ARDS Process Fundamentals

- Process description
- Chemical 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

### Case Study

#### Q&A Session for Day 1 Topics

## DAY 2

### ARDS Unit Process Design

- Design considerations
- Feed and product quality
- Flow schemes
- Typical processing conditions
- Reactor systems (H Oil/UFR/OCR difference and significance)
- Steam Strippers
- Steam Generators
- Amine absorption system
- PSA System
- Fired Heater
- Fundamentals of Fractionator
- Corrosion Control in Fractionator
- Complex control system (Reactor/Heater/Recycle gas/PSA/Feed system)

### Case Study

#### Q&A Session for Day 2 Topics

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### **DAY 3**

#### **ARDS Unit 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 and activity
- Maximizing the performances of the unit under constraints or limit conditions

#### **Process Capabilities**

- Feedstocks and applications
- Hydrogen utilization
- Product qualities
- Catalyst consumption
- Hydrogen consumption
- Utilities

#### **Case Study**

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

### **DAY 4**

#### **Catalysis**

- Nature of ARDS Catalysts
- Composition and activity
- Catalyst selection and reactor loading diagrams
- Multi-catalyst Systems
- Hydrogenation – Dehydrogenation Equilibrium
- Sulfiding procedures: role, steps and details of the different methods
- Catalyst poisons
- Catalyst deactivation

#### **Catalyst Management**

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

#### **Case Study**

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## Q&A Session for Day 5 Topics

### DAY5

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

- Startup/Shutdown/Emergency handling 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 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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