

**Training Title**

**PROCESS REACTORS: OPERATION, TROUBLESHOOTING, START-UP & SHUTDOWN**

**Training Duration**

**5 days**

**Training Venue and Dates**

PE320	PROCESS REACTORS: OPERATION, TROUBLESHOOTING, START-UP & SHUTDOWN	5	26 – 30 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**

This course will guide the participants to develop key concepts and techniques to operate, startup, shutdown, troubleshoot, and optimize refinery process reactors. These key concepts can be utilized to make design and operating decisions. Knowledge and understanding on the different usages of process reactors for different refinery catalytic processes will be covered. The course covers most of the key catalytic processes in modern refineries and indicates how each integrates with the high value products.

The following items are presented for each catalytic refining unit: process and chemical reaction characteristics, catalyst implementation, process performances and catalyst monitoring, catalysts protection from contaminants/poisons and reactor configurations, operation, startup, shutdown and troubleshooting.

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

**TRAINING OBJECTIVES**

**Upon successful completion of this course, participants will be able to:**

- Understand how process reactors are configured in catalytic process units in modern refineries.

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- Understand how efficiently startup, shutdown, and troubleshoot refinery process reactors in catalytic processes.
- Be familiar with catalyst contaminants, poisons, fouling, deactivation and thermal degradation in process reactors.
- Analyze the influence of operating parameters (temperature, pressure, LHSV, ....) on catalyst selectivity and stability
- Master the methods for performance monitoring.
- Be familiar with catalyst evaluation techniques.
- Understand reactors and catalysts selection for different applications.

### **WHO SHOULD ATTEND?**

- Refinery shift team leaders
- Engineers and managers in the operations, process development or technical departments of refineries.
- Project engineers, process engineers or technical assistance and commissioning personnel in engineering or licensing and catalyst suppliers.
- Other professionals who desire a better understanding of the subject matter.

### **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

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### **DAILY OUTLINE**

#### **DAY-1**

##### **Introduction to Oil Refinery Processes**

- **Refinery Configurations**
  - Hydro-skimming refinery
  - Cracking refinery
  - Deep conversion refinery
  - Oil refinery processes

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## **Characteristics & Properties of Reactors and Industrial Catalysts**

- Main features of catalysis
- Process Reactor Types and Internals
- What is a catalyst, difference between heterogeneous and homogeneous catalyst
- Catalyst types versus industrial processes / applications
- Catalytic reaction; chemical reactions at surfaces, reactivity of metal complexes, or macromolecular structure to catalytic function and processes
- Catalyst performance improvement
- Kinetics in heterogeneous catalysis
- Quality requirements for an industrial catalyst, characterization of its properties
- Processes for catalyst synthesis and industrial production of catalysts

- **Case Study**
- **Q&A Session for Day 1 Topics**

## **DAY-2**

### **Classification of Process Reactors, Catalysts; types and usage for different types of industrial applications / processes**

- **Catalytic Reforming/Platforming Processes, Reactors, and Catalysts**
  - Feedstock, reaction, catalyst
  - Reactor Configurations and Internals
  - Difference between fixed bed and moving bed reactors; advantages/disadvantages
  - Catalyst operating temperature & pressure
  - Effect of chloride on catalyst surface
  - Catalyst loading, regeneration, reduction
  - Catalyst special procedures (On-the fly-replacement; decoking, loading/unloading, circulation, drying)
  - Catalyst contaminants
  - Precautions for start-up, monitoring and maintaining catalyst activity, incidents
  - Common Problems
  - Catalyst evaluation techniques

- **Case Study**
- **Q&A Session for Day 2 Topics**

## **DAY-3**

### **Classification of Process Reactors, Catalysts; types and usage for different types of industrial applications / processes (contd.)**

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▪ **Penex / Isomerization Processes, Reactors, and Catalysts**

- Process Chemistry
- Feedstock, Reaction, Catalyst
- Reactor Configurations and Internals
- Process Variables
- Different types of catalysts and process arrangement
- Impact on the resulting octane number
- Influence of poisons on the catalytic activity and operational constraints linked to the type of catalyst
- Precautions for start-up, shutdown, monitoring and maintaining catalyst activity, incidents
- Reactor Troubleshooting
- Catalyst evaluation techniques

▪ **Case Study**

▪ **Q&A Session for Day 3 Topics**

**DAY-4**

**Classification of Process Reactors, Catalysts; types and usage for different types of industrial applications / processes (contd.)**

▪ **Hydro-treatment and Hydro-cracking Processes, Reactors, and Catalysts**

- Process chemistry
- Feedstock, reaction, catalyst
- Process variables
- Reactor Configurations and Internals
- Active phase structure, sulfiding at start-up
- Specific issues in treating unsaturated cuts from coker, visbreaker and FCC
- Evolution of catalytic formulas and processes for heavy cuts and residue hydro-treatment
- Selective hydrogenation and hydro-treatment of FCC gasoline minimizing octane loss
- PNA control
- Precautions for start-up, shutdown, monitoring and maintaining catalyst activity, incidents
- Reactor Troubleshooting

▪ **Catalytic Cracking Processes, Reactors, and Catalysts**

- Process Chemistry
- Feedstock, Reaction, Catalyst
- Process Variables

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- Reactor Configurations and Internals
- Zeolite structure and design for yield optimization
- Analysis of catalyst ageing
- Improvements in catalyst regeneration
- Metal passivation and solutions for Vanadium effects
- Precautions for start-up, shutdown, monitoring and maintaining catalyst activity, incidents
- Reactor Troubleshooting

- **Case Study**
- **Q&A Session for Day 4 Topics**

### DAY-5

#### **Reactors and Catalysts for Claus Converter and Tail Gas Treatment**

- Process Chemistry
- Feedstock, Reaction, Catalyst
- Process Variables
- Reactor Configurations and Internals
- Claus catalysts
- Impact of sulfur deposition and temperature on conversion
- COS and CS<sub>2</sub> hydrolysis
- Deactivation and regeneration
- Adaptation to tail gas treatment processes
- Precautions for start-up, shutdown, monitoring and maintaining catalyst activity, incidents
- Reactor Troubleshooting

- **Case Study**
- **Q&A Session for Day 5 Topics**
- **Course Closing & Final Assessment**

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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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