



# THE CHEMICAL ENGINEERING MAJOR

Oil Refinery &  
Petrochemical Industry  
Wastewater Treatment

# *Oil Refinery & Petrochemical Industry Wastewater Treatment*

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## **Introduction**

Petroleum refining and petrochemical industries unavoidably generate large volumes of wastewater. As environmental regulations for wastewater disposal are getting stricter, and fresh water resources are becoming increasingly limited, the industry requires more efficient management and reuse of this wastewater. Therefore, wastewater treatment must be explored and resolved by every oil refinery and petrochemical company.

This 5-Day BTS Oil & Gas Technology training course on Oil Refinery & Petrochemical Industry Wastewater Treatment will identify how to get to the core of this issue using thorough analysis of the development status of wastewater treatment methods including flotation, coagulation, biological treatment, membrane separation technology, combined technology and advanced oxidation process that ultimately results in maximization of petroleum refining and petrochemical industries profitability and meeting with the strict environmental regulations.

Participants will learn several configurations and techniques for Wastewater Treatment Plants (WWTP) in oil refining and petrochemical industries. Understanding of these techniques will be reinforced by exercises and case studies.

**This BTS Oil & Gas Technology training course provides both theoretical and practical knowledge and skills on:**

- Typical sources and contaminants of wastewater produced from oil refining and petrochemical industries
- Refinery and petrochemical Wastewater Treatment Plants (WWTP) impacts and benefits
- Conventional refinery and petrochemical wastewater treatment plants
- Current development status of wastewater treatment technologies
- Latest on wastewater recycle / reuse for oil refining and petrochemical industries (ZLD)

# Training Objectives

## What are the Goals?

**By the end of this BTS training course participants will be able to:**

- Learn the purpose, principles of operation and limitations of the different wastewater treatment technologies in oil refining and petrochemical industries
- Understand how to establish high recovery of wastewater for reuse onsite, reducing fresh water intake and meeting strict regulatory requirements
- Understand the advanced cost-effective technologies for reduction of waste volume and obtain Zero Liquid Discharge (ZLD)
- Learn how to reduce the energy consumption and operational costs of the wastewater treatment facilities and optimize treatment conditions
- Learn industry standard targets for wastewater prior to discharge or reuse
- Identify the impact of pollution on the environment
- Modify treatment facilities operating conditions according to the properties of incoming polluted wastewater
- Improve the operability and reliability of equipment

## Target Audience

### Who is this Training Course for?

This intensive BTS Oil & Gas Technology training course is intended for anyone who takes part in the wastewater treatment facilities in oil refining and petrochemical industries or who helps decide wastewater treatment investments. No prior knowledge of wastewater treatment facilities is required.

**This BTS training course is suitable to a wide range of professionals but will greatly benefit to:**

- Refinery and Petrochemical Plant Managers
- Process Engineers and Technologists involved in wastewater treatment facilities
- Maintenance Engineers
- Plant Engineers
- Operations Personnel including Shift Supervisors
- All Professionals involved in wastewater treatment facilities
- Other Engineers who would like to have a further understanding of the wastewater treatment technology
- Anyone who wishes to update himself on the methods used in this important field

## **Training Methods**

### **How will this Training Course be Presented?**

A highly interactive combination of lectures and discussion sessions as well as case studies will be managed to maximize the amount and quality of information, knowledge and experience transfer.

This BTS Oil & Gas Technology training course on Oil Refinery & Petrochemical Industry Wastewater Treatment will be intensive but practical and highly interactive. The sessions will start by raising the most relevant questions, and motivate everybody finding the right answers. The attendants will also be encouraged to raise more of their own questions and to share developing the right answers using their own analysis and experience. There will also be some indoor experiential activities to enhance learning. Course material through power point equipped with necessary animation, learning videos and general discussions will be provided.

## **Organisational Impact**

- Provide technical staff with skills required to realize wastewater treatment design, operation, analysis, and selection
- Ensure that the right wastewater treatment technology is selected
- Improve awareness when communicating with WWTP vendors and consultants
- Enhance competence in new and revamped wastewater process projects

## **Personal Impact**

- Understand principals, processes and management of wastewater treatment in refineries and petrochemical plants, elements of pollutants that must be removed, their measurement and the overall treatment methodology
- Promote creativity in the selection and specifying of new wastewater treatment plant
- Enhance the ability to troubleshoot and improve existing wastewater plants
- Be familiarized with the latest developments in wastewater treatment technologies

# Daily Agenda

## Day One: Refinery and Petrochemical Plant Overview

### Section 1

#### Refinery and Petrochemical Plant Overview

Raw materials  
Product and Processes  
Refinery configuration

### Section 2

#### Water and Wastewater management

- Refinery water overview
- Overall refinery water balance
- Sources of water
- Water leaving the refinery
- Raw water treatment
- Process water

Best Practices for Managing Refinery and Petrochemical Plant WWTP

## Day Two: Primary & Secondary Oil/Water Separation

### Section 3

#### The Composition of Wastewater

Aquatic Biology  
Six Important Elements

### Section 4

#### Analytical Methods Used in the Laboratory and Through On-line Analyzers

- Biochemical Oxygen Demand
- Chemical Oxygen Demand (COD)
- COD and BOD5 Equivalence for Hydrocarbons
- Hydrocarbons (HC) in Water

## Section 5

### **Effluent treatment**

Unit Processes in Wastewater Treatment

Process wastewater pretreatment

- Desalter effluent treatment
- Desalter oil/water separation
- Desalter effluent VOC control

## Section 6

### **Primary treatment**

- Particle Settling
- Ideal Sedimentation
- First stage: separation (oil/water separators, API separators, CPI)
- Oil Skimming Device

## **Day Three: Biological Treatment**

## Section 6

Coagulation/ Flocculation

Dissolved air flotation (DAF)

Induced air flotation (IAF)

Equalization system

## Section 7

### **Biological Treatment**

Secondary treatment/Biological Treatment

Activated sludge

- Sludge Volume Index

- Activated Sludge troubles and remedial actions
- Aerators

Biological Treatment Options

Activated sludge treatment with powdered activated carbon

## Day Four: Tertiary Treatment

### Section 7

#### **Biological Treatment Options**

- Oxidation Ditch
- Aerated lagoons
- Powdered Activated Carbon Treatment
- Sequencing batch reactor (SBR)
- Membrane bioreactor technology
- Attached Growth Processes
- Biological Clarification Gravity Clarifiers

### Section 8

#### **Tertiary Treatment**

- Sand filtration
- Activated carbon

#### **Chemical oxidation**

### Section 9

#### **Sludge Treatment**

Sewage sludge quantity and characteristics

- Sludge pumping systems
- Thickening/ dewatering of Sludge
- Dimensioning of a static thickener
- Dewatering

Treatment of sludge's

- API separator—bottom sludge

- Bioremediation
- DGF/IGF float and sludge

Waste biological sludge

Sludge stabilization

- Simultaneous aerobic stabilization
- Mesophilic anaerobic digestion
- Aerobic digestion

Sludge Disposal and Agricultural Utilization

## **Day Five: Recycle and Reuse Issues**

### Section 10

Recycle and reuse issues

- Re-use of non-contaminated stormwater
- Fire water
- Cooling tower makeup water
- Utility water
- Boiler feedwater makeup

Technologies for upgrade of refinery wastewater

- Basic media/sand filtration
- Microfiltration or ultrafiltration
- Microfiltration or ultrafiltration, with reverse osmosis
- Microfiltration or ultrafiltration, with nanofiltration
- Ion exchange

Technology summary—refinery wastewater reuse

Reuse of municipal wastewater

- Media filtration
- Microfiltration or ultrafiltration
- Microfiltration or ultrafiltration, plus reverse osmosis

Zero liquid discharge