A Word from the Executive Board

Emerging stronger with highly qualified personnel

With global warming challenges and consequent new cleaner energy mix perspective, the industry that will emerge from the crisis may look significantly different from the one we have known before. In this new reality, adapting energy specialists’ skills and roles to updated ways of working will remain crucial to building operating-model resilience and to respond to our industry key challenges.

Based on its 45 years of international experience IFP Training stands firmly through the current difficult period and responsively has adapted its competency development services Offer that can be customized to your organization’s requirements.

To ensure tomorrow’s energy competencies

As an integrated part of the IFP Group, IFP Training benefits from synergies with IFPEN multidisciplinary projects connected to industry needs as well as the field experience of sister companies like Axens and Beicip-Franlab.

Our competency-based training solutions cover sectors as varied as: Oil, Gas, Electricity, Refining, Petrochemicals & Chemicals, New Energies and Transport.

Please note that whether in-house or public, most of our face-to-face courses can be followed remotely. This year we also propose training simulators accessible 24/7, worldwide.

We invite you to browse our new 2021 offer. Our teams, especially our lecturers and associate experts, remain at your disposal to convince you that IFP Training's competency development Offer is a reliable solution to help you succeed in your today and tomorrow’s challenges.
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Tuition fees include instruction and documentation as well as meals and beverage breaks.
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## Petroleum Products, Analysis, Transfer & Storage

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<td>In-house course</td>
<td>AMT-EN-P</td>
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## Analytical Methods & Techniques Applied to Hydrocarbons & Derivatives

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<th>Location</th>
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<tbody>
<tr>
<td>Transfer &amp; Storage Operations in Oil Storage Depots &amp; Chemical Terminals</td>
<td>5 days</td>
<td>28 June-2 July</td>
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<tr>
<td>Properties, Formulation, Transfer &amp; Storage of Petroleum Products</td>
<td>8 days</td>
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<tr>
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<td>3 days</td>
<td>In-house course</td>
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<tr>
<td>Properties, Storage &amp; Transfer of LPG</td>
<td>4 days</td>
<td>In-house course</td>
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<tr>
<td>Liquid Transport by Pipeline</td>
<td>4 days</td>
<td>In-house course</td>
<td>TLPIP-EN-A</td>
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## Properties, Formulation, Transfer & Storage of Petroleum Products

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## Fuel Manufacturing - In Line Blending Optimization

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<td>In-house course</td>
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## Properties, Storage & Transfer of LPG

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## Liquid Transport by Pipeline

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## Equipment, Materials, Corrosion & Inspection

### Technology

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<td>Recent Developments &amp; Innovation in Equipment</td>
<td>5 days</td>
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### Materials & Corrosion

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<tr>
<td>Corrosion &amp; Risk Based Inspection</td>
<td>5 days</td>
<td>22-26 March</td>
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<td>Corrosion &amp; Corrosion Prevention Certification</td>
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<td>Failure Analysis &amp; Repairs of Piping &amp; Vessels</td>
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### Maintenance & Inspection

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<td>Non-Destructive Testing for Petrochemical Industries</td>
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### Inspector Certification

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## Energy & Thermal Equipment

### Energy Efficiency & Renewable Energy

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<td>Introduction to Renewable Energies</td>
<td>3 days</td>
<td>14-16 September</td>
<td>Rueil-Malmaison</td>
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<td>Process Energy Efficiency Improvement for Industrial Plants</td>
<td>3 days</td>
<td>29 September-1 October</td>
<td>Rueil-Malmaison</td>
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<td>Day-to-Day Energy Optimization for Industrial Plants</td>
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<td>15-18 June</td>
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### Exchangers, Process Furnaces & Boilers

#### Thermal Equipment

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<td>4 days</td>
<td>21-24 June</td>
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#### Heat Exchangers Certification

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<td>HEDES-EN-A</td>
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#### Furnaces Safe Operation & Optimization

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#### Boilers Safe Operation & Optimization

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#### Cogeneration - Combined Cycles

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<td>3 days</td>
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### Rotating Equipment

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<tr>
<th>Specifications, Technology &amp; Performance</th>
<th>Duration</th>
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<th>Location</th>
<th>Tuition Fees excl. VAT</th>
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<td>18-22 October</td>
<td>Rueil-Malmaison</td>
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<td>Operation, Maintenance &amp; Inspection of Rotating Machinery</td>
<td>10 days</td>
<td>In-house course</td>
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<td>OMIRM-EN-A</td>
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<td>Gas Compression &amp; Expansion, Compressors &amp; Turbines Certification</td>
<td>4 days</td>
<td>13-16 September</td>
<td>Bahrain</td>
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<td>Gas Turbines</td>
<td>5 days</td>
<td>15-19 March</td>
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<td>Centrifugal Pumps &amp; Positive Displacement Pumps</td>
<td>4 days</td>
<td>9-12 August</td>
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<td>Steam Turbines</td>
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<td>Reciprocating Compressors</td>
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<td>In-house course</td>
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<td>Basics in Fluid Flow</td>
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### Troubleshooting, Maintenance & Reliability

| Machinery Failure Analysis & Repair Methods | 5 days | In-house course | | | RUPTE-EN-A | 125 |
| Rotating Machinery Vibration Analysis      | 4 days | In-house course | | | PRMB-EN-P | 126 |
| Rotating Equipment Technicians Certification | 40 days | In-house course | | | TECMT-EN-P | 127 |

### Instrumentation, Control & Electricity

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<th>Instrumentation, Control &amp; Electricity</th>
<th>Duration</th>
<th>Dates</th>
<th>Location</th>
<th>Tuition Fees excl. VAT</th>
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<td>5 days</td>
<td>30 May-3 June</td>
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<td>Introduction to Industrial Electricity</td>
<td>5 days</td>
<td>In-house course</td>
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<td>Electrical Maintenance for Industrial Plants</td>
<td>5 days</td>
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<td>Electrical Motors: Technology, Operation &amp; Maintenance</td>
<td>5 days</td>
<td>In-house course</td>
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<td>Electrical Technicians Certification</td>
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### Maintenance & Works Supervision

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<th>Location</th>
<th>Tuition Fees excl. VAT</th>
<th>Reference</th>
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<td>Maintenance Policy &amp; Equipment Reliability</td>
<td>5 days</td>
<td>28 November-2 December</td>
<td>Bahrain</td>
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<td>Equipment Basic Maintenance</td>
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*Tuition fees include instruction and documentation as well as meals and beverage breaks*
### Operation in the Downstream Industry

#### Vocational Training Courses for Operation Teams

<table>
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<th>Course</th>
<th>Duration</th>
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<th>Location</th>
<th>Tuition Fees excl. VAT</th>
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<tr>
<td>Console Operator Training</td>
<td>20 days</td>
<td>8 March - 2 April</td>
<td>Martigues</td>
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#### Selection & Training of the Production Staff

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### HSE

#### HSE Design & Intervention

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### HSE Management

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### Industrial Safety Engineer

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Tuition fees include instruction and documentation as well as meals and beverage breaks.
## Project Management

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## Engineering Studies

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* Tuition fees include instruction and documentation as well as meals and beverage breaks.
## Course calendar

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## Operator, Panelist & Shift Leader Training Path

### Field Operator

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Engineers Training Path

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### ENGINEERS WITH FEW YEARS OF EXPERIENCE

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### PETROLEUM PRODUCTS - REFINING & PETROCHEMICAL PROCESSES

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<td>Hydrocracking</td>
<td>4 days</td>
<td>HDK-EN-P</td>
</tr>
<tr>
<td>Hydrogen Production Unit</td>
<td>3 days</td>
<td>VAPOREF-EN-A</td>
</tr>
<tr>
<td>Base Chemicals &amp; Polymers Manufacturing</td>
<td>80 days</td>
<td>PPM-EN-A</td>
</tr>
<tr>
<td>Utilities - Environment Management</td>
<td>5 days</td>
<td>UTILENV-EN-P</td>
</tr>
</tbody>
</table>

### SAFETY - OPERATION

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Duration</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety in Plant Operation</td>
<td>5 days</td>
<td>SECOP-EN-B</td>
</tr>
<tr>
<td>Safety in Maintenance &amp; Construction Works</td>
<td>4 days</td>
<td>SECTRA-EN-P</td>
</tr>
<tr>
<td>Commissioning &amp; Start-Up of Process Units</td>
<td>4 days</td>
<td>OPSEM-EN-A</td>
</tr>
</tbody>
</table>
# Engineers Training Path

## Senior Engineers

**Sessions** | **Duration** | **References**
--- | --- | ---
**DESIGN & OPERATION OF EQUIPMENT**  
Ethylene Compression & Hypercompressors for LDPE Units | 4 days | ETHCO-EN-A  
Rotating Equipment | 5 days | ROTMACH-EN-A  
Day-to-Day Energy Optimization for Industrial Plants | 5 days | MENERG-EN-A  
Thermal Equipment | 5 days | THERMEQ-EN-P  
Storage of Petroleum Products: Storage Equipment & Tank Operation | 5 days | DEPOTS-EN-P  
Analytical Methods & Techniques Applied to Hydrocarbons & By-Products | 5 days | AMT-EN-P  
Automation of Refinery Offsite Operations | 3 days | AUTOOFF-EN-A  
Corrosion & Corrosion Prevention Certification | 5 days | CICP-EN-A  
Risk Based Inspection (RBI) | 5 days | PL INS-EN-P

**SAFETY - ENVIRONMENT**  
Improve Your SHE Management System | 3 days | SHEMAN-EN-P  
Implementing Safety Review | 4 days | REVSEC-EN-P  
Introduction to Process Safety Engineering | 5 days | SAFENRC-EN-A  
Design & Operation of a Safety Instrumented System (SIS) | 3 days | SIS-EN-A

**MAINTENANCE**  
Maintenance Engineer Certification | 75 days | INGMTN-EN-P  
Maintenance Management & Equipment Availability Certification | 5 days | GEMA-EN-A  
Turnaround Management | 5 days | OTSUJ-EN-A

**PROJECTS**  
Management of Small Projects | 5 days | GPP-EN-A  
Management of Site Projects Certification | 5 days | MRS PROJ-EN-A

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## Junior engineers

**Engineers with few years of experience**

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## Engineers

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Refining, Petrochemicals & Natural Gas

Refining

- Refining Processes & Petroleum Products .......................................................... p. 16
- Refining Processes & Manufacturing Flowsheet .................................................. p. 17
- Introduction to Refining ..................................................................................... p. 18
- Understanding the Operation of Refining Processes ...................................... p. 19
- Utilities - Environment Management ................................................................. p. 20
- Introduction to Refining Techniques ................................................................. p. 21
- Base Oil Production ......................................................................................... p. 22
- Place & Role of Equipment in Refining & Chemical Processes ..................... p. 23
- Recent Developments in Oil Refining Technologies ....................................... p. 24
- Air Separation Unit ......................................................................................... p. 25

Petrochemicals

- Production of Base Chemicals & Commodity Polymers ................................. p. 26
- Introduction to the Petrochemical Industry ...................................................... p. 27
- Introduction to the Polymer Industry ............................................................... p. 28

Gas

- Introduction to the Gas Chain ......................................................................... p. 29
- Gas Valorization ............................................................................................... p. 30
- Gas-To-Liquid Technologies ............................................................................ p. 31
This course can be adapted to virtual classroom mode

Refining Processes & Petroleum Products

**Level:** KNOWLEDGE

**Purpose**

This course provides a broad technical information on refining processes and petroleum products, enabling a rapid immersion in the refining industry.

**Audience**

Professionals in the Oil & Gas industry (engineers, technicians...) or related sectors (in the technical, commercial, legal, finance, or HR departments) interested in oil refining.

**Learning Objectives**

Upon completion of the course, participants will be able to:

- describe the composition, main characteristics and new trends of petroleum products,
- explain the role of various processing units in a refinery,
- describe the main manufacturing schemes encountered in oil refining,
- assess the economic environment of this industry.

**Ways & Means**

- Detailed course material with a glossary of the main technical terms used in the refining industry.
- Active participation of trainees through interactive games and quizzes to grasp the key points of the course.
- A virtual visit of a refinery using the augmented reality gives an idea of the size of the equipment and units presented.
- A summary per unit is built to highlight key process variables.

**Learning Assessment**

Multiple-choice questionnaire.

**Prerequisites**

To fulfill at least one of the following criteria:

- to have a 3 months of proven professional experience in the refining or petrochemical industry,
- or to have followed a training course orientated to introduction to the refining environment.

**Expertise & Coordination**

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

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### Course Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>PETROLEUM PRODUCTS</td>
<td>1.25 d</td>
</tr>
<tr>
<td>Energy and non-energy products and their main uses, CO₂ emissions and main regulated pollutants in the end use. Principal components of petroleum products; general hydrocarbon classification and main impurities (sulfur, nitrogen, metals and asphaltenes, etc.). Quality requirements imposed on petroleum products in view of their utilization: quality specifications measured by standard tests, characteristics related to the product composition, origin and processing routes. New trends in market structure and product characteristics to European and worldwide scale, post-combustion depollution systems, biofuels (nature, alternative fuel pathways for transport, strengths and weaknesses).</td>
<td></td>
</tr>
<tr>
<td>REFINING PROCESSES</td>
<td>2.75 d</td>
</tr>
<tr>
<td>Crude oil fractionation:</td>
<td></td>
</tr>
<tr>
<td>Conversion units:</td>
<td></td>
</tr>
<tr>
<td>MANUFACTURING FLOWSHEETS</td>
<td>0.25 d</td>
</tr>
<tr>
<td>Main routes to major products. Up to date refining schemes including the production of petrochemical intermediate products. Impacts of the evolution of market demand and the quality of the products on manufacturing patterns. Base lube oil manufacturing.</td>
<td></td>
</tr>
<tr>
<td>MAIN ECONOMIC FEATURES OF REFINERY OPERATION</td>
<td>0.75 d</td>
</tr>
<tr>
<td>Prices of crude oils and products, operating costs, economic margin of a refinery. Examples of flexibility in operation and its economic consequences.</td>
<td></td>
</tr>
</tbody>
</table>

**Reference:** BRP-EN-A - Can be organized as an In-House course. Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
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<tr>
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<td>28 March</td>
<td>1 April</td>
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<tr>
<td>Rueil-Malmaison</td>
<td>19 April</td>
<td>23 April</td>
<td>€3,100</td>
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<tr>
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<td>6 September</td>
<td>10 September</td>
<td>€3,100</td>
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This course is also available in French: BRP-FR-A. Please contact us for more information.
Virtual Classroom
This course is available in face-to-face mode

NEW
Refining Processes & Manufacturing Flowsheet

Level: KNOWLEDGE

Purpose
This course provides a broad technical information on refining processes and units.

Audience
Professionals in the Oil & Gas industry or related sectors (in the technical, commercial, legal, finance, or HR departments) interested in oil refining.

Learning Objectives
Upon completion of the course, participants will be able to:
- explain the role of various processing units in a refinery,
- describe the main manufacturing schemes encountered in oil refining,

Ways & Means
This training offers a new training solution that integrates not only a virtual classroom but also a complete environment to support the trainees in the acquisition of the proposed contents.

- Pre-workshop: this sequence immerses the participants in the training, a few days before the virtual class, through introductive contents on our LMS.
- Live session: virtual classroom (20 hours in 5 days): the virtual classroom allows a face-to-face meeting with the participants. It begins with interactions with the participants in order to assess the understanding of the contents delivered in the "Pre-workshop" sequence, continues with the development of the whole targeted technical program and ends with an assessment of the acquired knowledge.
- Post-workshop: it provides a post event support to the participants, through additional content allowing those who wish to deepen the topics covered. The support will also be complemented by a question-and-answer forum, accessible during the week following the virtual class.
- Detailed course material with a glossary of the main technical terms used in the refining industry.
- Active participation of trainees through interactive games and quizzes to grasp the key points of the course.
- A summary per unit is built to highlight key process variables.

Learning Assessment
Multiple-choice questionnaire.

Prerequisites
To fulfill at least one of the following criteria:
- to have a 3 months of proven professional experience in the refining or petrochemical industry,
- or to have followed a training course oriented to introduction to the refining environment.

IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

REFINING PROCESSES

Crude oil fractionation:
- Origin, overall characteristics and classification of crude oils.
- Yields and properties of straight-run cuts obtained by distillation, potential destinations.
- Industrial units: atmospheric distillation, vacuum distillation, light-ends fractionation.
- Typical process scheme, operating conditions, energy consumption.

Catalytic reforming and isomerization:
- Octane improvement of virgin naphthas.
- Basics of processes, types of catalyst, product yields and hydrogen production.
- Industrial units: process flowsheets, operating conditions, equipment, low pressure processes.

Hydrotreating processes:
- Main features of impurities removal by catalytic hydrogen treatment.
- Main refining applications.
- Example of ULSD hydrotreating unit: operating principles, operating conditions.
- Scrubbing treatments: amine washing, sulfur production, treatment of residual gases from Claus units.

Conversion units:
- Outline of conversion and various cracking processes.
- Characteristics and origin of feeds for cracking.
- Conversion by means of thermal cracking: visbreaker, various cokers.
- Conversion by means of catalytic cracking: FCC and related units, gasoline sweetening and desulfurization, alkylation, production of MTBE, ETBE and propylene, hydrocracker and related units, hydrogen production (SMR, POX).
- Recent developments in hydrotreatment and hydroconversion of heavy residues.
- Hydrogen balance in the refinery, energy consumption per unit, CO₂ emissions at the outlet of the refinery.
- Manufacturing flowsheets.

Conversion by means of catalytic cracking: FCC and related units, gasoline sweetening and desulfurization, alkylation, production of MTBE, ETBE and propylene, hydrocracker and related units, hydrogen production (SMR, POX).

Outline of conversion and various cracking processes.

Conversion by means of thermal cracking: visbreaker, various cokers.

Conversion by means of catalytic cracking: FCC and related units, gasoline sweetening and desulfurization, alkylation, production of MTBE, ETBE and propylene, hydrocracker and related units, hydrogen production (SMR, POX).

Recent developments in hydrotreatment and hydroconversion of heavy residues.

Hydrogen balance in the refinery, energy consumption per unit, CO₂ emissions at the outlet of the refinery.

Manufacturing flowsheets.

Reference: BRP-EN-D

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: BRP-FR-D. Please contact us for more information.
Introduction to Refining

Level: AWARENESS

Purpose
This course provides basic information on refining industry and its integration in the petroleum chain.

Audience
This training is intended for anyone with no technical background who wants to have information about refining industry worldwide.

Learning Objectives
At the end of the training, participants will be able to:
- list the properties and applications of petroleum products,
- explain the different stages of refining and the manufacturing scheme of a typical refinery,
- identify and assess the risks inherent to product handling, equipment use and operations,
- situate the refining industry in its energy and geographic environment.

Ways & Means
- Detailed course material with a glossary of the main technical terms used in the refining industry.
- Active participation of trainees through interactive games.
- A virtual visit of a refinery using the augmented reality to give an idea of the size of the equipment and units presented.

Learning Assessment
Quiz.

Prerequisites
No prerequisites for this course.

More info
This training offers a new training solution that integrates not only a virtual classroom but also a complete environment to support the trainees in the acquisition of the proposed contents. 1 day divided into 2 half days. As soon as we receive your payment, a login to access the course will be sent to you.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

METHOD DESCRIPTION

SEQUENCE “BEFORE”
This sequence immerses the participants in the training, a few days before the virtual class, through the provision of introductory content on our LMS.

SEQUENCE “DURING”
It is composed of the virtual classroom allowing a face-to-face meeting with the participants. It will begin with an exchange in order to measure the understanding of the contents disseminated in the “Before” sequence, will continue with the development of the whole of the targeted technical program and will end with an evaluation of the acquired knowledge.

SEQUENCE “AFTER”
It provides a posteriori support to the participants, through the provision of additional content allowing those who wish to do so, to deepen the themes dealt with. The service will also be complemented by a question-and-answer forum, accessible during the week following the virtual class.

TECHNICAL CONTENT OF THE TRAINING
(6 hours face-to-face in virtual class + 1 hour of independent work)

PETROLEUM PRODUCTS: PROPERTIES & MAIN OUTLETS
2 h

REFINING STEPS
5 h
Sources of oil, modes of supply.
Simple refining scheme: initial fractionation of crude oils, transformation processes according to refining criteria and mixing of the bases obtained. The role of the different refining units, their interdependencies and the operating conditions of the main units. Key product and process risks. Changes in refining patterns and synergies with petrochemicals (objectives, advantages and type of flows and services exchanged).

Reference: DECRAF-EN-D
Can be organized as an In-House course.
Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
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<tr>
<td>Virtual Classroom</td>
<td>13 April</td>
<td>15 April</td>
<td>€700</td>
</tr>
</tbody>
</table>
Understanding the Operation of Refining Processes

Level: SKILLED

Purpose
To bring an in-depth understanding on the running, operation and follow-up of the performances of the different crude oil refining processes.

Audience
Engineers and executives in contact with refinery operators but who are not directly involved in the production unit operation: laboratory personnel, people from the programming or piloting departments, process control, maintenance, research centers, HSE departments...

Learning Objectives
Upon completion of the course, participants will be able to:
- describe the schemes of the main production processes, the operating conditions and the main controls,
- assess the characteristics of the feed and products,
- express qualitatively the effect of the main operating parameters,
- point out the specific problems related to safety, health, and environmental protection in relation to the operation of the units.

Ways & Means
The efficiency of the training is guaranteed by numerous practical applications related to the operation of these processes that highlight the role of the operating parameters, the specific points in the follow-up and some key-sequences of the operation.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have a Master degree or equivalent in process, engineering, industrial chemistry or 1 year’s of proven professional experience in the refining industry,
- or to have followed a “Refining Processes and Petroleum Products” training course.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

For each process, the following points are detailed: material balances, chemical reactions and catalysts, operating conditions, operating parameters and effects, performance criteria, optimization strategies, operating constraints, safety devices and environmental protection. The topics mentioned here below constitute a few points among the most important ones. It is possible to cover only a few processes that are more important than others.

CRUDE OIL ATMOSPHERIC & VACUUM DISTILLATIONS
Adjustment of the quality of the cuts: material balance and cut points; side stream stripping.
Pumparounds: principle, relation with the fractionation capability, crude preheating and energy consumption.
Corrosion, corrosion control and desalting.
Vacuum systems: operation, failure and remedies.

GASOIL DESULFURIZATION & SULFUR CHAIN
Role of hydrotreating in refining, chemical reactions and catalysts.
Means used for a deep desulfurization: role and compared importance.
Hydrogen consumption and parameters of the hydrogen balance management in the refinery.
Operating parameters of Claus process and unit reliability.
Treatment of Claus stack gas and control of the sulfur emissions to the atmosphere.

CATALYTIC REFORMING & ISOMERIZATION
Bifunctional catalyst and sequence of the reforming reactions in the different reactors.
Severity: effect on the material balance and the qualities, hydrogen production and the catalyst.
Discontinuous and continuous regeneration: successive steps, layout of the regeneration tower of the RR.
Separation of the isomerate by distillation or chromatography: impact on the octane number.

FLUID CATALYTIC CRACKING
Conversion: impact of the feed quality and the operating conditions.
Heat balance, temperature optimization and coke production management.
Pressure balance: catalyst circulation, fluidization and combustion safety.
Regenerator operation: complete or incomplete combustion, advantages, incidents.
Potential malfunctions and impact on the environment.

ALKYLATIONS
Technology of reactors and operating conditions corresponding to the acids HF or H2SO4.
Conducting the acid inventory: consumption and regeneration of acid.
Neutralization and purification of the products exiting the unit.

HYDROCRACKING & PRODUCTION OF HYDROGEN
Material balance and characteristics of the cracking products.
Operating parameters, process operation, temperature and safety automation control.
Production of hydrogen: efficiency, purity and energy consumption.

VISBREAKING
Feed structure and stability of the cracked residue.
Follow-up of the evolution of the visbreaking furnace, skin temperature of tubes and decoking.

COKER
Delayed coking, fluid, fluid with avce gasification.
Technology of coke drums and layout of the valve manifolds. Main decoking steps.
Conversion and recycle ratio at the fractionator. Operating parameters and follow-up of coking in the furnace tubes.

Reference: PRORAF-EN-P. Only available as an In-House course.
This course is also available in French: PRORAF-FR-P. Please contact us for more information.

Contact: rc.contact@ifptraining.com
# Utilities - Environment Management

## Purpose
Utility production processes and equipment (water, steam, electrical power, air). Management of environmental issues (air, water, waste, management system).

## Audience
Engineers and supervisors from operations and technology departments of Refining/Petrochemical sites.

## Learning Objectives
Upon completion of the course, the participants will be able to:
- design and operate the main utility production units and networks,
- manage environmental issues and prevent pollutions.

## Ways & Means
- Videos to demonstrate the implementation of the various technologies.
- Practical exercises on the design and/or operation of each utility.
- Actual case studies, learning games and quizzes to test participants’ learning.

## Learning Assessment
Multiple-choice questionnaires.

## Prerequisites
No prerequisites to be able to follow this course.

## Expertise & Coordination
IFP Training trainer (permanent or contracted) having expertise and experience of Utilities and Environment, trained to adult teaching methods, and whose competencies are kept up-to-date.

## Course Content

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td><strong>BFW QUALITY - STEAM PRODUCTION</strong></td>
<td>Boiler feed water quality, drawbacks resulting from impurities. Production of boiler feed water. Condensate recovery. Steam pressure levels, user types, network control, turbines, static expansions. Water-tube boiler: water and steam circuits, air and stack (equipment and control). Other boiler types.</td>
<td>1 d</td>
</tr>
<tr>
<td><strong>ELECTRICAL POWER PRODUCTION &amp; SUPPLY</strong></td>
<td>Quality requirements: power and voltage. Production: generators, gas turbines, cogeneration. Electrical network: key-equipment, transducers, grounding, back-up supply, safety and reliability.</td>
<td>0.5 d</td>
</tr>
<tr>
<td><strong>COMPRESSED AIR GASES</strong></td>
<td>Process requirements and reasons, air supply criticality. Instrument air: compressors, dryers. Network, back-up supply. Nitrogen production: design, uses and risks. Uses and risks of O₂ and CO₂.</td>
<td>0.5 d</td>
</tr>
<tr>
<td><strong>INDUSTRIAL WATER NETWORKS</strong></td>
<td>Cooling water networks (open, closed, semi-open). Use of sea water, design and operations. Cooling tower design: key parameters, sizing rules, prevention of operational concerns. Fire fighting water network: key design elements, main equipment, good practices.</td>
<td>1 d</td>
</tr>
<tr>
<td><strong>WATER POLLUTION &amp; WASTE WATER TREATMENT</strong></td>
<td>Pollution sources in refining. Waste water effluent typical specifications. Quality control. Treatment of oily water (settling, floatation, biological) and process water. Finishing options.</td>
<td>0.5 d</td>
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<tr>
<td><strong>ENVIRONMENTAL MANAGEMENT SYSTEM</strong></td>
<td>Other pollution mechanisms: soil, solid waste, noise, smells. Prevention and remediation. Importance of environmental regulations. Environmental impact assessment. ISO 14001 standard.</td>
<td>0.5 d</td>
</tr>
</tbody>
</table>

Reference: UTILENV-EN-P  
Only available as an In-House course.  
Contact: rc.contact@ifptraining.com  
This course is also available in French: UTILENV-FR-P. Please contact us for more information.
This course can be adapted to virtual classroom mode

Introduction to Refining Techniques

Course Content

- **CRUDE OILS & PETROLEUM PRODUCTS**
  - 0.5 d
  - Crude oils: supply, properties, classification, yields and properties of petroleum cuts.
  - Main characteristics of commercial products, relation to product uses.
  - Trends in market structure and product characteristics. Biofuels.

- **INITIAL CRUDE OIL FRACTIONATION**
  - 0.75 d
  - Operation principle, unit flow diagram, operating conditions, energy consumption:
    - Crude oil atmospheric distillation, desalting.
    - Light-ends fractionation.
    - Atmospheric residue vacuum distillation.

- **CATALYTIC REFORMING - ISOMERIZATION**
  - 0.25 d
  - Process fundamentals, operating conditions, catalysts.
  - Industrial units, process flow diagrams, equipment, yields, energy consumption, hydrogen production.

- **HYDROREFINING PROCESSES - SULFUR PLANT**
  - 0.5 d
  - Main features of impurities removal by catalytic hydrogen treatment: example of gas oil desulfurization unit.
  - Amine washing, sulfur plant (Claus unit), treatment of tail gas from Claus units.

- **CONVERSION UNITS**
  - 0.5 d
  - Characteristics of feeds to be cracked.
  - Overview of conversion processes by cracking of heavy feeds.
  - Conversion by means of thermal cracking: resid visbreaker, impact on heavy fuel oil production. Delayed coker.
  - Conversion by means of fluid catalytic cracking: FCC (process flow diagram, operating conditions, products disposal) and ancillary units: gasoline sweetening, alkylation, MTBE-ETBE.
  - Conversion by hydrocracking: process flow diagram, operating conditions, yields, product quality, hydrogen consumption. Adjustments to heavy feedstocks.

- **MANUFACTURING SCHEMES OF MAIN PRODUCTS**
  - 0.25 d
  - Integration of the units into the manufacturing scheme.
  - Simple and complex refineries, trends.
  - Manufacturing of main products.

- **BASE OIL MANUFACTURING**
  - 0.25 d
  - Base oil properties.
  - Purpose of the different refining treatments.

Reference: ITR-EN-A

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: ITR-FR-A. Please contact us for more information.

www.ifptraining.com
This course can be adapted to virtual classroom mode

Base Oil Production
Refining & Environment

**Level:** AWARENESS

**Purpose**
This course provides in-depth knowledge of lube base stocks manufacturing with an overview of the business environment.

**Audience**
Non-technical professionals from oil or lubricant industries, or subcontractors interested in base oil refining technology and environment.

**Learning Objectives**
Upon completion of the course, participants will be able to:
- give an overview of lubricant uses, classifications and markets,
- explain the relation between quality requirements, processes used and composition of lube base stocks and by-products,
- describe the main operating parameters and their impact on performances.

**Ways & Means**
- Detailed course material with a glossary of the main technical terms used in the refining industry.
- Active participation of trainees through interactive games.
- The use of photos, videos and demonstration material makes it possible to understand the size of the devices and units presented.

**Learning Assessment**
Quiz.

**Prerequisites**
To fulfill at least one of the following criteria:
- to have a 3 months of proven professional experience in the refining or petrochemical industry,
- or to have followed a training course orientated to introduction to the refining environment.

**Expertise & Coordination**
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

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**Course Content**

<table>
<thead>
<tr>
<th>3 days</th>
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</thead>
<tbody>
<tr>
<td><strong>CLASSIFICATION &amp; PROPERTIES OF BASE OILS</strong></td>
</tr>
<tr>
<td>0.25 d</td>
</tr>
</tbody>
</table>

| **STRUCTURE OF BASE OIL MARKET** |
| 0.25 d |
| Market demand in relationship with uses of lube oils. International market and future trends in main developing countries. |

| **BASE OIL MANUFACTURING SCHEMES** |
| 0.25 d |

| **BASE OIL CONVENTIONAL REFINING PROCESSES** |
| 1 d |
| Vacuum distillation:
  - Residue fractionation: distillates yields depending on crude oil.
  - Operating conditions. Quality control: viscosity and flash point tuning. |
| Solvent extraction:
  - Vacuum residue deasphalting and aromatics extraction: solvent choice, operating variables, viscosity and VI control.
  - Solvent recovery, energy consumption. |
| Solvent dewaxing:
  - Paraffin crystallization in the presence of a solvent: operating conditions. Specific equipment: chillers, rotating filters. |

| **BASE OIL UNCONVENTIONAL REFINING PROCESSES** |
| 1 d |
| Hydrotreatment processes:
  - Typical process flow diagram - Main equipment: reactor, heaters, heat exchanger. Chemical reactions and catalyst for hydrotreating. Operating conditions: pressure, temperature, hydrogen ratio, WABT. Impact of conditions on quality: pour point, viscosities, VI, CCR… |

| **SAFETY IN BASE OIL REFINING** |
| 0.25 d |
| Overview of the main specific risks in base oil refining. REX of accidents. |

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Reference: RHB-EN-A. Can be organized as an In-House course.

Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
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<th>Tuition Fees excl. VAT</th>
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</thead>
<tbody>
<tr>
<td>Lillebonne</td>
<td>4 May</td>
<td>6 May</td>
<td>€1,950</td>
</tr>
</tbody>
</table>

This course is also available in French: RHB-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

Place & Role of Equipment in Refining & Chemical Processes
Furnaces, Heat Exchangers, Pumps, Compressors, Dryers or Filters

Level: AWARENESS

Purpose
This course provides a deep knowledge of the role and operating conditions of specific equipment used in various processing plants as well as a better understanding of process users: their processes, vocabulary, work environment, etc.

Audience
Engineers and/or technicians. Suppliers or subcontractors of the Oil & Gas processing sector or the refining and chemical industry.

Learning Objectives
Upon completion of the course, participants will be able to:
- define the role of specific equipment in various processes,
- identify the operating conditions and constraints for different phases of operation,
- explain the industry’s terms and conditions.

Ways & Means
- Interactive course.
- The use of 2D/3D photos and videos makes it possible to understand the size of the presented devices and units.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have 3 months of proven working experience in a company supplying equipment to petrochemical sites,
- or to be in the process of moving to a position requiring basic knowledge of equipment available in refining or chemical plants.

More info
Duration according to the selected training scope.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: ITREQ-EN-A  Only available as an In-House course.
Contact: rc.contact@ifptraining.com
This course is also available in French: ITREQ-FR-P. Please contact us for more information.

Course Content

This is a modular course divided into independent parts. On request, the course can be customized to focus on different types of equipment such as pumps, compressors, furnaces, filters, dryers, etc.

EXAMPLE OF COURSE CONTENT RELATED TO COMPRESSORS
For each unit, the following items are discussed:
- Role and principle of the process, simplified process flow diagram, role of the compressor in the process.
- Normal operating conditions and impact of various modifications on the operation of the compressor.
- Particular operating conditions: shutdown, start-up, regeneration of the catalyst, decoking, etc.

COMPRESSORS IN OIL & GAS PROCESSING & TRANSPORTATION  3 d
Production of natural gas and associated gas: natural production and reinjection compressors.
Secondary oil recovery: gas lift, associated gas reinjection compressors.
Gas transportation by pipe: recompression station.
Gas storage: surface, underground.
LNG production and treatment: conventional units, ssLNG.

COMPRESSORS IN REFINING PROCESSES  2 d
Initial fractionation of crude oil: overhead gas compressor.
Catalytic reforming: recycle, make-up, recontacting, regeneration compressors.
Hydrorefining: recycle and make-up compressors.
Fluid catalytic cracking (FCC): wet gas compressor and air blower.
Hydrocracking: recycle and make-up compressors.
Alkylation: cryogenic compressor.
Visbreaking: wet gas compressor.
Coker: wet gas compressor.

COMPRESSORS IN THE PETROCHEMICAL/CHEMICALS INDUSTRY  4 d
Steamcracking: cracked gas and cryogenic compressors.
Commodity polymers: on-purpose propylene production (metathesis, PDH, MTP/MTO...), polyethylene and polypropylene production (gas and liquid phase), ethylene oxide production, styrenics production: transfer, refrigeration or recycle compressors, according to the process scheme.
Ammonia: air compressor, syngas compressor, refrigeration compressor.
Urea: CO2 compressor.
Nitric acid: turbo compressor, single and dual pressure units.
Sulfuric acid: air blower.
Methanol: make-up compressor, syngas compressor, air blower.

This course is also available in French: ITREQ-FR-P. Please contact us for more information.

Contact: rc.contact@ifptraining.com

Reference: ITREQ-EN-A  Only available as an In-House course.
Recent Developments in Oil Refining Technologies

Level: EXPERT

Purpose
This course provides an up-to-date information on present and future trends of oil refining processes.

Audience
Engineers, process or technical staff interested in recent developments in oil refining technologies.

Learning Objectives
Upon completion of the course, participants will be able to:
- get a broad vision of future from technical, safety and environmental constraints for the refining industry,
- quote the recent developments in oil refining processes,
- explain how the latest breakthroughs can help meet the new challenges.

Ways & Means
Each single topic is covered by a world-class expert in the field.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have a Master degree or equivalent in process, engineering, industrial chemistry,
- or to have knowledge in refining processes or to have more than 3 years' proven technical experience in the refining industry.

More info
The participation of many experts from IFP Energies nouvelles, Axens and Technip requires organizing the training session in IFP Training facilities near Paris - France. A part of the program can be delivered outside France if you need it.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

REFINERY PRODUCTS & PROCESS EVOLUTION OUTLOOK FOR 2020 0.5 d
Recent trends and new constraints reshaping the environment of the refining activity on various regions around the world.
Quality requirements and desulfurization.
New and future regulations concerning emissions: SOx, CO2, NOx, COVs.
Evolution of the refining process flow diagram: hydrogen addition or carbon removal, trends to petrochemical tendencies.

ATMOSPHERIC & VACUUM DISTILLATION: NEW CONCEPTS 0.25 d
Progressive distillation, concept and example.
Heat recovery optimization and energy consumption.
Modern internals for crude oil distillation column.
Efficient and low energy consumption vacuum equipment.

CATALYTIC REFORMING & ISOMERIZATION 0.5 d
Fixed bed reforming debottlenecking options.
Continuous catalytic reforming: concept, comparison with “semi reg” units.
Benzene separation, paraxylene production and purification.
Advanced isomerization technology for recycling paraffins.
New breakthroughs in catalytic fields.

FCC: MORE PROPYLENE OR MORE LCO 0.75 d
Feed injection and temperature control of the mixture.
Riser termination devices and catalyst separation. Post riser quench.
Stripping technology.
Regeneration and catalyst coolers.
Propylene yield enhancement.
Reduction of SOx and NOx emissions.

GASOLINE & SULFUR REDUCTION STRATEGIES 0.5 d
Sulfur distribution in FCC gasoline and selective HDS.
Alternate sources of gasoline:
Light olefins oligomerization.
New trends in alkylation.

ULTRA - LOW SULFUR DIESEL PRODUCTION & VGO DEEP HYDROTREATMENT 0.5 d
New generation catalysts and their performance.
Diesel hydrotreater units: investigation of new and existing means of achieving ULSD.
FCC feed pretreatment.

HYDROCRACKING FOR VACUUM DISTILLATES & RESIDUES 0.75 d
High pressure hydrocracking, mild hydrocracking.
Recent technologies: catalysts, energy recovery, fractionation.
Various technologies available: fixed bed, ebullient bed, moving bed.

HYDROGEN BALANCE 0.25 d
Routes for hydrogen production (steam methane reforming, partial oxidation).
Management of hydrogen network and optimization.

THERMAL CONVERSION OF RESIDUES 0.5 d
Renewal of an old process: delayed coker and residue destruction.
Purification of the products and hydrogen consumption.
Integration into the framework of crude upgrading.

CRITICITY OF SULFUR UNITS 0.5 d
Sulfur plants: efficiency of different arrangements, reliability in the refining operation, solid sulfur production.
Tail gas treatments: comparison of different processes and performances.

Reference: RECENT-EN-P  Can be organized as an In-House course. Contact: rc.contact@ifptraining.com

<table>
<thead>
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<th>End Date</th>
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<td>Rueil-Malmaison</td>
<td>5 October</td>
<td>8 October</td>
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</table>
Air Separation Unit

Course Content

PRINCIPLES OF AIR SEPARATION UNIT
Overview on the air separation technology along the relevant process units:
- Introduction to air separation technology.
- Basics of the separation process.

PROCESS UNIT DETAILS, DESCRIPTION, TECHNOLOGY & OPERATING PARAMETERS
Air filtration system.
Air compression.
Pre-cooling system.
Front end purification.
Brazed alumina heat exchanger.
Distillation columns.
Vapor/condenser.
Cryogenic pumps/expander.
Storage and backup vaporization.

THE SPECIFIC RISK OF OXYGEN/NITROGEN
Introduces to oxygen risk, reactivity of material with oxygen, design of O₂ installation.
Review of incidents in air separation units, causes and preventive measures.
Safe operation and maintenance of equipment.
Anoxia, deficient atmosphere.

BASIC CONTROL PRINCIPLE
Main control loops.
Safety loops, elements important for safety.
Transition phase: start-up, load change, shutdown.

3 days

Level: SKILLED

Purpose
This course reminds the basic background and knowledge of Air Separation Unit technology and operation.

Audience
Operators, supervisors and plant managers involved in operation and optimization, technicians support, process engineers, process control engineers and safety personnel.

Learning Objectives
Upon completion of the course, participants will be able to:

- describe the main equipment associated with the Air Separation Unit and their function,
- explain the operating parameters and the product management,
- grasp safety concerns and safe operation of ASU,
- detect abnormal situations by troubleshooting and implement preventive measures.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:

- to have 1 year’s of proven experience in the petrochemical or chemical industry,
- or to be in the process of being moved to a position in an air separation unit.

Expertise & Coordination
Technical expert in the field of Air Separation Unit.

Reference: ASU-EN-P

Only available as an In-House course.

Contact: rc.contact@ifptraining.com
Blended Learning
This course offers a combination of online and face-to-face training sequences

Production of Base Chemicals & Commodity Polymers

Level: KNOWLEDGE

Purpose
This course provides a technical information of the main processes used to produce olefins and aromatics along with a comprehensive information on polymers and polymerization processes, and technologies available mainly in the polyolefins field.

Audience
Professionals, in the oil or petrochemical industry, interested in olefins, aromatics and polymers processes. Specifically for engineers and technical staff who are beginners in this industry, as well as subcontractors, traders, etc.

Learning Objectives
Upon completion of the course, participants will be able to:
- list the sources and outlets of olefinic and aromatic compounds.
- review the manufacturing processes in the petrochemical industry.
- grasp the principles of polymerization techniques and the main characteristics of manufactured polymers.

Ways & Means
- This course can be adapted for distance learning.
- Detailed course material.
- Pictures of main equipment and samples.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have 3 months of proven professional experience in the refining or petrochemical industry.
- or to have followed a training course previously by the participants via the LMS IFP Training.

More info
This training is available in French. This training is carried out in Blended Learning:
- 1st step: e-learning, composed of four modules, realized individually and previously by the participants via the LMS IFP Training.
- 2nd step: session carried out in classroom with all participants.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

E-learning: HYDROCARBONS - DISTILLATION - CATALYSTS - POLYMERS

Module 1 - HYDROCARBONS - TYPES & IMPURITIES
Composition of crude oils. Hydrocarbon groups and composition of petroleum products. Crude oil impurities.

Module 2 - DISTILLATION PROCESS
Flash of a hydrocarbon mixture. Principles of continuous distillation. Industrial features of the distillation process.

Module 3 - INTRODUCTION TO CATALYSTS

Module 4 - POLYMERS
Introduction to polymers. Polyethylene. Polypropylene.

CLASSROOM TRAINING (4 days)

STEAMCRACKING & TREATMENT OF THE CUTS PRODUCED

PRODUCTION OF AROMATICS

CATALYTIC CRACKING FCC

ON PURPOSE PROPYLENE PROCESSES
Technical-economic context. Processes for metathesis, propane dehydrogenation (PDH), methanol to olefins (MTO and MTO-OCP) and methanol to propylene (MTP), light olefin cracking (LOC). Comparison of Technologies - Selection criteria.

POLYMER PRODUCTION - ASSOCIATED PROPERTIES
Type of reaction and basic characteristics of polymer reactions: polyaddition, polycondensation, heat of reaction, activation mode, etc. Different arrangements of monomer building blocks in polyaddition: atactic, syndiotactic or isotactic polymers; random; block; graft polymers and others. Relationship between end uses implementation and main polymer properties. Impact on properties. Main tests used to get polymer characterization: melt index, viscosity index, etc. Test signification, relationship with polymer structure. Consequences regarding polymer implementation techniques (extrusion, injection, etc.).

POLYMERIZATION IMPLEMENTATION - MAIN COMMODITY PLASTIC PROCESSES
Techniques implemented to produce polymers: solution, bulk, emulsion, suspension, gas phase techniques. Advantages and drawbacks of those different techniques consequences on processes implementation. Examples applied to main processes used to manufacture major thermoplastics: polyethylene (PE), propylene (PP), poly styrenes (PS) and polyvinylchloride (PVC). Flow charts and principles of processes. Some common and average operating conditions. Influence of operating parameters (temperatures, pressures, monomers ratio and proportion of any chemicals involved in the reaction) regarding the quality of polymer obtained. Some pretreatments of polymers outside the reactor before the transformation step.

Reference: PETRO-EN-B  Can be organized as an In-House course. Contact: re.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
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<tbody>
<tr>
<td>Bahrain</td>
<td>29 March</td>
<td>1 April</td>
<td>£3,150</td>
</tr>
</tbody>
</table>

This course is also available in French: PETRO-FR-B. Please contact us for more information.
Virtual Classroom
This course is available in face-to-face mode

Introduction to the Petrochemical Industry

Level: SKILLED

Purpose
This course provides basic information on petrochemical industry and its integration in the petroleum chain.

Audience
This course is for non-technical people interested in petrochemical industry worldwide.

Learning Objectives
After completion of the course, participants will be able to:
- know the origin and uses of the main olefinic and aromatic intermediates,
- explain the different steps of the petrochemical industry,
- understand the stakes in term of economy and the main parameters which influence the productivity of the petrochemical industry,
- situate the petrochemical industry in its energy and geographic environment.

Ways & Means
- This training offers a new training solution: distance training, including not only a virtual classroom but also a complete environment to support the trainees in their process of acquisition of the provided contents.
- Various pedagogical activities (quizzes, games ...) allow the acquisition of the different technico-economic basis.

Learning Assessment
Quiz.

Prerequisites
No technical prerequisites for this course.

More info
To take the best advantage of this course, it can be preceded by the course “Introduction to Refining”. These two courses are scheduled consecutively.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

<table>
<thead>
<tr>
<th>ORIGINS &amp; USES OF OLEFINIC &amp; AROMATIC INTERMEDIATES</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Main units: steamcracking unit, catalytic reforming unit, fluid catalytic cracking unit.</td>
<td></td>
</tr>
<tr>
<td>Outlets and main industrial uses of olefins, diolefins and aromatics hydrocarbons.</td>
<td></td>
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<tr>
<td>Opening on the petrochemistry of the main plastics.</td>
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<table>
<thead>
<tr>
<th>THE DIFFERENT STEPS OF THE PETROCHEMICALS INDUSTRY</th>
<th>0.25 d</th>
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</thead>
<tbody>
<tr>
<td>Analysis of the different paths of synthesis.</td>
<td></td>
</tr>
<tr>
<td>Main polymer manufacturing.</td>
<td></td>
</tr>
<tr>
<td>Risks related to products and processes.</td>
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<tr>
<td>Interactions with refining (objectives, advantages, flow and services exchanges ...).</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>PETROCHEMICAL ECONOMICS &amp; MANAGEMENT</th>
<th>0.25 d</th>
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<tbody>
<tr>
<td>General economic environment.</td>
<td></td>
</tr>
<tr>
<td>Main markets for olefins, C4 cuts and aromatics.</td>
<td></td>
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<tr>
<td>Economics of a steamcracking unit using the different feeds.</td>
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</table>

<table>
<thead>
<tr>
<th>SITUATION TODAY &amp; FUTURE TRENDS</th>
<th>0.25 d</th>
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</thead>
<tbody>
<tr>
<td>Main challenges of the petrochemical industry on an international scale with emphasis on the shale Oil &amp; Gas development in the US and the impact on the European market.</td>
<td></td>
</tr>
<tr>
<td>Future projects, strategy of the main actors, financial and political stakes.</td>
<td></td>
</tr>
<tr>
<td>Impact of the environmental regulations and climate change on the economics of the petrochemical industry.</td>
<td></td>
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<tr>
<td>Future trends for biosourced products and the related challenges.</td>
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</tbody>
</table>

Reference: DECPET-EN-D. Only available as an In-House course.

This course is also available in French: DECPET-FR-D. Please contact us for more information.
This course can be adapted to virtual classroom mode

Introduction to the Polymer Industry

**Level: SKILLED**

**Purpose**

This course is a way to help people to discover the world of the polymers produced by the company.

**Audience**

This course is for non-technical people interested in polymer industry.

**Learning Objectives**

Upon completion of the course, the participants will be able to:
- precise what is a polymer,
- list the main applications of the polymers produced on site,
- present the role of the main chemicals used to produce the polymers,
- quote the main characteristics of each process.

**Ways & Means**

- This course can be adapted for distance learning.
- Illustration with samples of polymers.
- Pictures of units: general overview.

**Learning Assessment**

Quiz.

**Prerequisites**

No technical prerequisites for this course.

**Expertise & Coordination**

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

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**Course Content**

<table>
<thead>
<tr>
<th>INTRODUCTION TO THE POLYMER WORLD</th>
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<tbody>
<tr>
<td>Plastics: some data about.</td>
<td></td>
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<tr>
<td>Manufacturing processes: the downstream industry.</td>
<td></td>
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<tr>
<td>A set of definitions: what is a plastic, a polymer, a monomer…</td>
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</table>

<table>
<thead>
<tr>
<th>FOUR DIFFERENT POLYMER PRODUCTIONS</th>
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<tbody>
<tr>
<td>Origin of the feedstock.</td>
<td></td>
</tr>
<tr>
<td>Processes implemented on site.</td>
<td></td>
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<tr>
<td>Expected properties of the polymers.</td>
<td></td>
</tr>
<tr>
<td>Markets targeted in terms of end-use products.</td>
<td></td>
</tr>
</tbody>
</table>

Reference: DECPOL-EN-A

Only available as an In-House course.

Contact: rc.contact@ifptraining.com
**Virtual Classroom**
This course is available in face-to-face mode

**NEW**
Introduction to the Gas Chain

**Level:** AWARENESS

**Purpose**
This course provides basic information on the gas chain and its integration into the oil chain.

**Audience**
This training is intended for anyone with no technical background who wants to have information about gas chain worldwide.

**Learning Objectives**
At the end of the training, participants will be able to:
- detail the properties and the different ways of valorization of natural gas,
- explain the different steps in the gas chain,
- analyze the economic stakes of the gas industry: the markets and their structural changes, the players and their main strategic lines,
- situate the gas industry in its energetic and geographical environment.

**Ways & Means**
This training offers a new training solution that integrates not only a virtual classroom but also a complete environment to support the trainees in the acquisition of the proposed contents.

- **Pre-workshop (1 hour):** this sequence immerses the participants in the training, a few days before the virtual class, through introductory contents on our LMS.
- **Live session (6 hours):** the virtual classroom allows a face-to-face meeting with the participants. It begins with interactions with the participants in order to assess the understanding of the contents delivered in the “Pre-workshop” sequence, continues with the development of the whole targeted technical program and ends with an assessment of the acquired knowledge. The virtual class is organized into 2 half days including 4 sessions of 45 min each, with 3 breaks of 10 min each.
- **Post-workshop (2 hours):** it provides a post event support to the participants, through additional content allowing those who wish to deepen the topics covered. The support will also be complemented by a question-and-answer forum, accessible during the week following the virtual class. Various pedagogical activities (quizzes, games, summaries) allow the acquisition of different technical-economic fundamentals.

**Learning Assessment**
Quiz.

**Prerequisites**
No prerequisites for this course.

**Expertise & Coordination**
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

**GAS: PROPERTIES & MAIN USES**
Main characteristics of the gas, connection with their composition. Specific hazards. Upgrading of natural gas: fuel gas, generation of other forms of energy (electricity production, cogeneration), fuels (CNG, conversion into liquid fuels: GTL), production of chemicals.

Focus on gas consumption: by country, by sector of activity, by valorization method. Possible substitution of oil by gas: technical and administrative constraints.

**SOURCES OF SUPPLY & RESPECTIVE NETWORKS**

**ECONOMICS & MANAGEMENT OF THE GAS CHAIN**

**CURRENT SITUATION & FUTURE OUTLOOK**
Main challenges for the global gas industry with a focus on European particularities. Future projects, strategy of the various players, financial and political stakes. Impact of environmental regulations and global warming on the gas economy.

**Reference:** DECGAZ-EN-D  
Can be organized as an In-House course.

**Contact:** rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
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www.ifptraining.com
### Course Content

<table>
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<th>Topic</th>
<th>Duration</th>
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<tbody>
<tr>
<td><strong>NATURAL GAS</strong></td>
<td>1 d</td>
</tr>
<tr>
<td>Natural gas reserves, conventional or non-conventional. Production, consumption and trade, utilization of natural gas worldwide. Field treatment, production and by-products (ethane, LPG’s, condensates). Different ways for gas transportation: pipelines, LNG shipping… Quality specifications for commercial natural gas. Valorization of natural gas: as fuel (domestic or industrial uses), generation of other energy types (electrical, cogeneration), car-fuel (CNG, GTL), chemical valorization.</td>
<td></td>
</tr>
<tr>
<td><strong>SYNGAS PRODUCTION</strong></td>
<td>1 d</td>
</tr>
<tr>
<td>Composition and feedstocks (natural gas, hydrocarbons, coal). Different modes of syngas production: steam reforming, partial oxidation (POx), autothermal reforming. Gas production from biomass: advantages, yields, constraints. Example of a biorefinery.</td>
<td></td>
</tr>
<tr>
<td><strong>SYNGAS VALORIZATION</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td><strong>ECONOMIC ASPECTS OF GAS VALORIZATION</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Investment (Capex), operating costs (Opex), costs for raw materials. Marketing advantages, environment issues. Example: comparison of GTL with LNG. Strategies of different actors: production countries of natural gas, licensers, oil or gas trusts, engineering companies.</td>
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</table>
This course can be adapted to virtual classroom mode

Gas-To-Liquid Technologies

Course Content

**Level: AWARENESS**

**Purpose**

This course provides a technical and economic information regarding GTL processes.

**Audience**

Managers and engineers interested in the current developments of GTL technologies.

**Learning Objectives**

Upon completion of the course, participants will be able to:

- analyze the essence of natural gas markets,
- grasp the technology and economics of various GTL conversion units,
- have the latest update on current projects.

**Ways & Means**

- This session is adaptable to distance classroom.
- Interactive course.

**Learning Assessment**

Quiz.

**Prerequisites**

To fulfill at least one of the following criteria:

- to have a 3 months of proven professional experience in the refining or petrochemical industry,
- or to be in the process of moving to a position requiring basic knowledge in Gas-To-Liquid technologies.

**Expertise & Coordination**

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

**NATURAL GAS MARKETS**

Production and consumption of natural gas in the world.
Main uses of natural gas.
Existing and potential routes for gas: pipelines, LNG, electrical power.
Natural gas reserves, associated gas: potential markets for GTL.

0.5 d

**GTL TECHNOLOGIES**

Overview of full GTL production chain: synthesis gas, Fisher-Tropsch reaction, finishing.
Products quality from conventional versus GTL technologies.
Different processes for synthesis gas manufacturing and their reactions, catalysts, process schemes, past uses (methanol, etc.):
- Steam reforming,
- Partial oxidation (POX),
- Auto-thermal reforming.
Fischer-Tropsch manufacturing processes: reactions, catalysts and process schemes.
Finishing processes for products upgrading, oligomerization and hydrocracking downstream Fischer-Tropsch units: reactions, catalysts and process schemes.

1.25 d

**GTL PROJECTS & ISSUES**

Investments, operating costs: CAPEX, OPEX, costs for natural gas.
Marketing advantages, environmental incentives.
Economic advantages/drawbacks of GTL versus LNG.
Strategies of the different actors (producing countries of natural gas, process licensors, Oil & Gas companies, engineering companies).

0.25 d

Reference: GTLE-EN-A

Only available as an In-House course.

Contact: rc.contact@ifptraining.com
Applied Chemical Engineering Certification ................................................................. p. 33
Applied Chemical Engineering for the Refining & Petrochemical Industries ................ p. 34
Applied Thermodynamics ............................................................................................ p. 35
Select Thermodynamic Models for Simulation ............................................................ p. 36
Process Engineering - Equipment Sizing ..................................................................... p. 37
Troubleshooting in the Oil & Gas Industry ................................................................. p. 38
Graduate Diploma of Petroleum Studies Refining & Petrochemicals ....................... p. 39
Petroleum Refining & Petrochemicals Certification .................................................... p. 40
Chemical Reaction Engineering .................................................................................. p. 41
Hydrocarbon Types & Impurities ............................................................................... p. 42
Distillation Process ...................................................................................................... p. 43
Introduction to Catalysts .............................................................................................. p. 44
Polymers ....................................................................................................................... p. 45
Practice of PRO-II/Provision or HYSYS Simulation Software ....................................... p. 46
Advanced Certificate
Applied Chemical Engineering Certification
to Oil, Gas & Chemical fields

Course Content

Module 1: LIQUID-VAPOR EQUILIBRIA, DISTILLATION & PRELIMINARY DESIGN
3 d

Thermodynamics in liquid-vapor equilibria:
- Material and energy balances in continuous processes.
- Fluid properties, law of corresponding states, equations of state.
- Thermodynamic models applicable to hydrocarbon mixtures.
- Non ideal mixtures, water-hydrocarbon mixtures.

Distillation:
- Design principles of distillation columns.
- Operating parameters of industrial distillation columns: material balance, pressure, operation of the liquid-vapor contact material, heat balance, implementation of reboilers and condensers, liquid-vapor traffic, temperature and composition profiles.
- Distillation column control: basic control, sensitive tray, control of calculated variables, advanced control.

Module 2: FLUID FLOW & ROTATING EQUIPMENT
3 d

Thermodynamics applied to rotating equipment.

Fluid flow:
- Characteristics of the single-phase liquid and gaseous flows.
- Flow rate measurement with measuring devices.
- Determining pressure drops in sites, influence of the valves.
- Characteristic curve of a circuit, examples of typical circuits.
- Liquid-gas two-phase flow map.

Pumping and compression:
- Functions and elements of the main rotating equipment.
- Operation of the centrifugal pumps and characteristic curves.
- Connections pump-circuit. Adjustment to the operating conditions: changes in the flow rate, the product, temperature, cavitation.
- Gas behavior during compression.
- Operation of reciprocating and centrifugal compressors.
- Adjustment to the operating conditions: change in the efficiency, operating limits.

Module 3: HEAT & ENERGY TRANSFER, PRELIMINARY DESIGN
4 d

Heat transmission:
- Reminders on thermodynamics in heat transfer.
- Conduction and convection: parameters that affect the exchange, means of calculation.
- Radiation: emission, absorption, application to furnaces and boilers, tube skin temperature.

Exchangers - Furnaces and boilers:
- Function, classification and terminology of heat exchangers.
- Performances of the exchangers depending on the fluid circulation mode, evolutions depending on changes in the operating conditions.
- Design principle of the exchangers and introduction to energy efficiency.

Combustion, energy balance (radiation and convection zone) and efficiency determination of energy recovery in furnaces and boilers. Heat exchanges in the radiation section. Circulation of air and stack fumes.

Preliminary project:
- An application related to the study of an industrial site allows the implementation of the knowledge acquired corresponding to the different disciplines of chemical engineering presented over the three training weeks, the great principles of design and an economic evaluation of the process.

<table>
<thead>
<tr>
<th>Module</th>
<th>Duration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 d</td>
<td>LIQUID-VAPOR EQUILIBRIA, DISTILLATION &amp; PRELIMINARY DESIGN</td>
</tr>
<tr>
<td>2</td>
<td>3 d</td>
<td>FLUID FLOW &amp; ROTATING EQUIPMENT</td>
</tr>
<tr>
<td>3</td>
<td>4 d</td>
<td>HEAT &amp; ENERGY TRANSFER, PRELIMINARY DESIGN</td>
</tr>
</tbody>
</table>

Prerequisites

To fulfill at least one of the following criteria:
- To have a Master degree or equivalent in process engineering, industrial chemistry, or to have knowledge in refining processes,
- To have more than 3 years' proven technical experience in the refining industry,
- To be in the process of moving to a new position requiring competences in chemical engineering.

Ways & Means

- Specific and original documentation covering different topics from an applied angle.
- Numerous applications and case studies related to industrial situations.
- Data, diagrams, graphs, various correlations presented in one single ring binder for easy reference after the course.

Learning Assessment

Quiz at the end of each module.

Why an IFP Training Certification?

- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Applied Chemical Engineering Certification.
- Ready-to-use skills.

More info

Training session split into three independent modules. To be eligible for certification, participants must attend all three modules.

Reference: GENCHIM-EN-P

Can be organized as an In-House course.

Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rueil-Malmaison</td>
<td>23 August</td>
<td>3 September</td>
<td>€5,710</td>
</tr>
</tbody>
</table>

This course is also available in French: GENCHIM-FR-P. Please contact us for more information.
This course can be adapted to virtual classroom mode - Advanced Certificate
Applied Chemical Engineering for the Refining & Petrochemical Industries

Course Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEMICAL ENGINEERING FUNDAMENTALS</td>
<td>12 d</td>
</tr>
<tr>
<td>Thermodynamics applied to liquid-vapor equilibria.</td>
<td></td>
</tr>
<tr>
<td>Hydrocarbon physico-chemistry.</td>
<td></td>
</tr>
<tr>
<td>Fluid dynamics.</td>
<td></td>
</tr>
<tr>
<td>Heat transfer.</td>
<td></td>
</tr>
<tr>
<td>Industrial reactor design.</td>
<td></td>
</tr>
<tr>
<td>PETROLEUM PRODUCTS &amp; REFINING PROCESSES</td>
<td>20 d</td>
</tr>
<tr>
<td>Crude oil and petroleum products.</td>
<td></td>
</tr>
<tr>
<td>Distillation (theory and dynamic simulation).</td>
<td></td>
</tr>
<tr>
<td>Introduction to Provision simulation software (PROII) usage and application in a distillation project.</td>
<td></td>
</tr>
<tr>
<td>Refining processes, process flow sheets and visit of a refinery.</td>
<td></td>
</tr>
<tr>
<td>INDUSTRIAL EQUIPMENT &amp; INSTRUMENTS</td>
<td>17 d</td>
</tr>
<tr>
<td>Materials and corrosion.</td>
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<tr>
<td>Static equipment.</td>
<td></td>
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<tr>
<td>Rotating machinery.</td>
<td></td>
</tr>
<tr>
<td>Heat exchangers, furnaces and boilers.</td>
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</tr>
<tr>
<td>Instrumentation. Process control.</td>
<td></td>
</tr>
<tr>
<td>Introduction to HTRI software usage and application in a heat-exchanger project.</td>
<td></td>
</tr>
<tr>
<td>MONOMERS &amp; POLYMERS MANUFACTURING</td>
<td>17 d</td>
</tr>
<tr>
<td>Olefins and aromatics in petrochemistry.</td>
<td></td>
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<tr>
<td>Polymer chemistry, structure and characterization.</td>
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<tr>
<td>Industrial reactor design of polymer reactors.</td>
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<tr>
<td>Visits of a steamcracker unit, polymer units and plastic converters companies.</td>
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</tr>
<tr>
<td>ECONOMICS</td>
<td>1 d</td>
</tr>
<tr>
<td>Economics of supply and refining operations.</td>
<td></td>
</tr>
<tr>
<td>CASE STUDIES</td>
<td>13 d</td>
</tr>
<tr>
<td>Two projects based on conception, design and cost estimation of an industrial distillation column (with PROII) and different heat exchangers (with HTRI).</td>
<td></td>
</tr>
<tr>
<td>Two workshops are organized to design a CSTR styrene polymerization reactor and a LLDPE gas phase reactor.</td>
<td></td>
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<tr>
<td>These studies are carried out by trainees with instructor guidance.</td>
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</tr>
</tbody>
</table>

Reference: ACE-EN-A Can be organized as an In-House course.
Contact: rec.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rueil-Malmaison</td>
<td>31 August</td>
<td>17 December</td>
<td>£20,810</td>
</tr>
</tbody>
</table>
Applied Thermodynamics

**Level:** EXPERT

**Purpose**
This course provides the fundamentals of thermodynamics applied to hydrocarbon processing.

**Audience**
Engineers, technical staff and supervisors involved in the design, operation and troubleshooting of refining and petrochemical plants.

**Learning Objectives**
Upon completion of the course, participants will be able to:
- recall the physical and chemical properties of the petroleum cuts,
- explain the practical aspects of the hydrocarbon behavior in the vapor-liquid equilibria,
- calculate flashes and thermodynamic properties of fluids in LVE,
- explain the technology of distillation columns,
- describe the operating principle, control scheme and critical variables of a given distillation column.

**Ways & Means**
- Participative lecturing.
- Illustrated documentation.
- Numerous applications.

**Learning Assessment**
Quiz + Exam.

**Prerequisites**
To fulfill at least one of the following criteria:
- to have a Master degree or equivalent in process, engineering, industrial chemistry
- or to have more than 3 years’ proven technical experience in the refining industry including process optimization or operation.

**Expertise & Coordination**
All IFP Training lecturers are experts in the course technical domain, and trained to pedagogical methods for adults.

**Course Content**

**PHYSICAL & CHEMICAL PROPERTIES OF HYDROCARBONS**
- Hydrocarbons classification, structure and properties.
- Main physical and chemical properties of hydrocarbon mixtures (IBP-FBP, sulfur content, specific gravity…).
- Others contaminants in relation with hydrocarbons origin (gas fields, crude oils).

**FLUID PROPERTIES**
- Properties of pure substances, vapor pressure, thermodynamic diagrams (P-t, h-t, h-S, h-P), application to refrigeration systems, boilers.
- Fluid properties: ideal gas law, real gas: compressibility factor, corresponding state law, analytical equations of state, mixtures of gases, partial pressures.
- Equations of state: conception, uses, examples, selection.

**LIQUID-VAPOR EQUILIBRIA OF HYDROCARBON MIXTURES**
- Liquid-vapor equilibrium of pure substances: vapor pressure curves, critical point, volatility of pure substances…
- Liquid-vapor equilibrium of mixture: bubble and dew curves, critical point, phase envelopes.
- Liquid-vapor equilibrium coefficient - Raoult’s law.
- Behavior of ideal and non-ideal solutions.

**SEPARATION PROCESSES USED IN THE PETROLEUM INDUSTRY**
- Processes based on liquid vapor equilibria selectivity, liquid-liquid equilibria selectivity, adsorption selectivity, liquid-solid equilibria selectivity, permeability…

**DISTILLATION PROCESS**
- Principle of distillation process.
- Technology - Internals - Selection criteria.
- Operation of distillation columns.
- Distillation column control.
- Troubleshooting of distillation columns.
- Design of distillation columns.

**Reference:** ATERMO-EN-P

Can be organized as an In-House course.

Contact: rc.contact@ifptraining.com

**Location | Start Date | End Date | Tuition Fees excl. VAT**
--- | --- | --- | ---
Bahrain | 7 March | 11 March | €3,150

www.ifptraining.com
Select Thermodynamic Models for Simulation

Course Content

PHYSICO-CHEMICAL PROPERTIES & CHARACTERIZATION OF PURE COMPONENTS 0.25 d
Ideal gas behavior and equations of states; the corresponding states principle (ex: the Lee&Kesler method).
Useful correlations for vapor pressure (ex: Antoine), liquid molar volume (ex: Rackett), heat capacity (ex: Aly & Lee), enthalpy of vaporization (ex: use of the Clapeyron equation).
Group contribution methods (ex: Joback).
Application: compute the normal boiling temperature, heat of vaporization and liquid molar volume of a complex compound.

VAPOR-LIQUID EQUILIBRIUM OF IDEAL MIXTURES 0.5 d
Phase diagrams (PT, isobaric, isothermal) and main laws (Raoult, Henry).
Computation principles (ex: Rachford-Rice).
Applications:
  - Calculate LPG entrainment using a liquid solvent.
  - Calculate the process conditions in a distillation column, using bubble or dew temperatures.

PHASE EQUILIBRIUM OF NON-IDEAL MIXTURES 0.5 d
Use of activity coefficient and significance of infinite dilution properties (relationship with Henry’s law).
Azeotropy and its molecular significance.
Parameter fitting using a simple model (ex: Margules).
Application: hexane + acetone mixture.
Liquid-liquid phase split with the example of water-hydrocarbon.
Application: recognize and read binary phase diagrams.

CURRENT & ADVANCED THERMODYNAMIC MODELS 0.75 d
Definition of fugacity; homogeneous and heterogeneous models.
Main activity coefficient models, their theoretical foundations and their parameters: Margules; Flory; Regular solutions; Flory-Hugns; NRTL; UNIQUAC; UNIFAC.
Cubic equations of state, their parameters and limitations (PengRobinson, SoaveRedlichKwong): alfa functions and mixing rules.
Some advanced models and their molecular significance.

CASE STUDIES FOR MODELS SELECTION 0.5 d
Case studies for chemistry and oil refining:
  - C, distillation: comparison of the efficiency without and with a solvent (extractive distillation, butadiene or acetonitrile).
  - Biofuels: esterification process and separations of alcohol/ester systems.

RETURN OF EXPERIENCE OF AN OPERATIONAL ENGINEER 0.5 d
How to select and use a model for different applications?
Emphasis on the compulsory need for a relevant model.

Reference: THERMO-EN-P  Only available as an In-House course.
Process Engineering - Equipment Sizing

Level: SKILLED

Purpose

This course provides an overview of Oil & Gas projects engineering studies, from conceptual design to detail drawing.

Audience

Process engineers.

Learning Objectives

Upon completion of the course, the participants will be able to:
- know the various aspects of project engineering and to apply their directly to concrete cases,
- be able to work with PID schemes.

Ways & Means

- Lectures with exercises.
- Project by team (2 or 3 students): conception of a PID scheme from a PFD.
- Specific and detailed documentation, industrial examples.

Learning Assessment

Quiz.

Prerequisites

To fulfill at least one of the following criteria:
- have a Master degree or equivalent,
- or at least 1 year of proven experience in a technical position in a refinery or petrochemical site,
- or in the process of moving towards a position linked to the improvement of processes.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

<table>
<thead>
<tr>
<th>Project Definition</th>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of the different type of projects. Planning, description of the different project steps. Organization: task force or conventional. Departments description and role: purchasing, cost control, planning, engineering, construction… Relation between client and contractor: progress report, change order…</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Engineering Diagrams (PID's)</th>
<th>2 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process flow schemes: purpose, available information. General rules for the PID’s conception: PID’s importance during the contract. Milestones: PID’s review… Potential development, “clever PID’s”. Study of the PID’s by splitting them in elementary parts (each part is made of one or several equipment): fractionation column, furnace, reactors, compressors…; piping; regulation, instrumentation will be studied in each part. Safety elements: safety valves, valve action per air failure. Utilities, start-up and shutdown piping: steam/condensate networks, hot oil, drain systems. Other auxiliary piping: off-spec., start-up and shutdown piping.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Engineering Rules &amp; Standards</th>
<th>2 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units and conversion factors. Hydrocarbon properties. Equipment design rules: rotating machines (compressors, pumps…); thermal equipment (furnaces, heat exchangers); storage tanks; pressure vessels. Piping design as per the fluid inside: gas, subcooled liquid, boiling liquid… Instrumentation: control valves, on-off valves, flow meters, indicators…</td>
<td></td>
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</table>

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<thead>
<tr>
<th>Relief System Design Basis</th>
<th>0.5 d</th>
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</table>

<table>
<thead>
<tr>
<th>Project (treated all along the course)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conception of a PID from a process flow scheme. Application of rules for sizing piping and pieces of equipment.</td>
</tr>
</tbody>
</table>

Reference: PIDE-EN-P Only available as an In-House course. Contact: rc.contact@ifptraining.com
Troubleshooting in the Oil & Gas Industry

Level: SKILLED

Purpose
This course provides a better understanding of what troubleshooting is and gives keys to solve basic troubleshooting cases on refining and petrochemical equipment and plants.

Audience
Engineers, senior operation personnel or technical supervisory staff interested in solving troubleshooting cases on refining and petrochemical plants.

Learning Objectives
Upon completion of the course, participants will be able to:
- describe the method used to perform a troubleshooting case study,
- write a troubleshooting chart for each industrial equipment of Oil & Gas industry,
- troubleshoot main equipment problems: air cooler, distillation column, reactor, furnaces…
- systematically use an easy-to-implement methodology of troubleshooting.

Ways & Means
- “Gamification”, quizzes and exercises.
- Videos.
- Interactive and realistic sessions of troubleshooting cases studies.

Learning Assessment
Quiz and case studies per group.

Prerequisites
To fulfill at least one of the following criteria:
- have a Master degree or equivalent,
- or at least 1 year of proven experience in a technical position in a refinery or petrochemical site,
- or in the process of moving towards a position linked to the operation or optimization of units.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

TROUBLESHOOTING IN PRACTICE
0.75 d
What is troubleshooting? Typical cases seen in refineries and petrochemical plants.
How to start with a troubleshooting case: main rules, laws, orders of magnitude often used during a troubleshooting exercise on site (mass and energy balances, pressure and pressure drop behavior, thermodynamical laws…).
Main onsite practical devices used in troubleshooting for temperature, pressure, flows measurements, chemical analysis, gamma scanning… - Advantages and drawbacks, precautions of uses.

METHODOLOGY
0.25 d
Overview of different methods used in troubleshooting: 5 Why, RCA, PDCA…
Presentation of an easy-to-implement method based on PDCA. This methodology will be use during all the training to solve the different troubleshooting exercises.
Exercises to implement the methodology on real cases studies.

TROUBLESHOOTING OF EQUIPMENT - CASES STUDIES
2 d
Troubleshooting case study on industrial equipment.
The objective of these exercises is to list, per equipment, the main operating conditions, the main causes of malfunction or failure and the different solution to implement in order to solve the situation (PDCA Method).
Review of the main causes of malfunction of equipment (troubleshooting checklists):
- Heat exchangers (performances, velocity influence, potential problems, fouling and cleaning, water exchanger, tubes inserts types and influence…).
- Air cooler (optimization, potential problems, fouling and cleaning, fogging system).
- Furnace (combustion and yield, controls, fouling and cleaning, tubes coking…).
- Distillation column (tower tray: efficiency and flooding, commissioning…).
- Reactor (internals, catalysts: potential problems…).
- Vacuum system (functioning, potential problems…).
- Pumps and compressors.
Troubleshooting case study on industrial units.
The objective of these exercises is to summarize and practice all the elements discussed during the course.

Reference: TBS-EN-P
Can be organized as an In-House course.

Location | Start Date | End Date | Tuition Fees excl. VAT
---|---|---|---
Rueil-Malmaison | 16 November | 18 November | €2,450

Contact: rc.contact@ifptraining.com
This course can be adapted to virtual classroom mode - Graduate Certificate

Graduate Diploma of Petroleum Studies Refining & Petrochemicals

Level: EXPERT

Purpose

The set of public courses hereunder leads to a graduate diploma of petroleum studies in Refining & Petrochemicals within 4 years after the first attendance to one of the courses listed. All of them are independent. About fees and dates of each course, see details in our course directory. An additional fee will be charged due to GD administration. For more information about additional fee, contact our representative in our office in Bahrain at mohamed.skhiri@ifptraining.com.

Audience

Any person in accordance with IFP School criterias.

Prerequisites

Engineering degree or equivalent professional experience within the Refining & Petrochemical industry.

Why an IFP Training Certification?

- An international recognition of your competencies.
- A Graduate Certificate delivered.
- An expertise confirmed in Graduate Diploma of Petroleum Studies Refining & Petrochemicals.
- Ready-to-use skills.

More info

For more information, contact our representative in our office in Bahrain at mohamed.skhiri@ifptraining.com.

Course Content

APPLIED THERMODYNAMICS

INSTRUMENTATION & PROCESS CONTROL CERTIFICATION

THERMAL EQUIPMENT

CENTRIFUGAL PUMPS & POSITIVE DISPLACEMENT PUMPS

KEY POINTS FOR COMPRESSORS & TURBINES OPERATION & INSPECTION

LIGHT CUTS PROCESSING

HEAVY CUTS PROCESSING

UTILITIES - ENVIRONMENT MANAGEMENT

PIPING & INSTRUMENTATION DIAGRAM - PID (Project)

SAFETY IN PLANT OPERATION

COMMISSIONING & START-UP OF PROCESS UNITS

PRODUCTION OF BASE CHEMICALS & COMMODITY POLYMERS

Reference: GDPETRC-EN-A - Only available as an In-House course. Contact: rc.contact@ifptraining.com
This course can be adapted to virtual classroom mode - Graduate Certificate

**Petroleum Refining & Petrochemicals Certification**

Processes, Equipment & Safety

**Level:** KNOWLEDGE

**Purpose**
This certification aims to develop competencies in processes, equipment, operation, safety, and the economical aspects of petroleum refining and petrochemicals.

**Audience**
This training is geared towards engineers entering the refining and petrochemical industries or professionals with limited industry experience wishing to broaden their knowledge.

**Learning Objectives**
Upon certification, participants will be able to:
- understand the basics of refining techniques,
- analyze the performances of the processes concerned, and optimize them,
- select and design the main equipment of processing plants,
- comprehend the technology and operation of equipment,
- understand the main refining processes, their fundamental aspects and operation,
- recognize safety and environmental issues in operation of such units,
- explain economic industry issues.

**Ways & Means**
- Case studies and applications related to industrial situations,
- Dynamic simulators (CORYS IndissPlus simulators): equipment simulators and generic process units simulators,
- Project: design of a distillation column using PROII/PROVISION.

**Learning Assessment**
- Continuous assessment: individual quizzes for each module.
- Mini-projects and final project.

**Prerequisites**
Engineering degree or equivalent professional experience within the Refining & Petrochemical industry.

**Why an IFP Training Certification?**
- An international recognition of your competencies.
- A Graduate Certificate delivered.
- An expertise confirmed in Petroleum Refining & Petrochemical Certification.
- Ready-to-use skills.

**Expertise & Coordination**
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

<table>
<thead>
<tr>
<th>Module</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICO-CHEMICAL PROPERTIES OF HYDROCARBONS &amp; PETROLEUM CUTS</td>
<td>5 d</td>
</tr>
<tr>
<td>Organic compounds, crude oil and petroleum products.</td>
<td></td>
</tr>
<tr>
<td>Quality control - Standard tests - Blending rules.</td>
<td></td>
</tr>
<tr>
<td>APPLIED THERMODYNAMICS</td>
<td>5 d</td>
</tr>
<tr>
<td>Properties of pure substances.</td>
<td></td>
</tr>
<tr>
<td>Fluid properties: liquid-vapor equilibria of hydrocarbons mixtures, of non-ideal mixtures, of non-identified components.</td>
<td></td>
</tr>
<tr>
<td>K values from modern numerical methods.</td>
<td></td>
</tr>
<tr>
<td>DISTILLATION COURSE &amp; PROJECT WITH PROII</td>
<td>10 d</td>
</tr>
<tr>
<td>Classical industrial column design, short cut methods.</td>
<td></td>
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<tr>
<td>Operating parameters, optimization, process control parameters.</td>
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<tr>
<td>Internal equipment.</td>
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</tr>
<tr>
<td>Practice of PROII/PROVISION, process simulation, simplified design of equipment, economic evaluation and optimization.</td>
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<tr>
<td>HEAT TRANSFER EQUIPMENT</td>
<td>5 d</td>
</tr>
<tr>
<td>Heat transmission.</td>
<td></td>
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<tr>
<td>Heat exchangers: sizing and performances, operation.</td>
<td></td>
</tr>
<tr>
<td>Furnaces and boilers: performances, operating conditions, combustion, operation, safety.</td>
<td></td>
</tr>
<tr>
<td>FLUID FLOW - ROTATING MACHINERY</td>
<td>10 d</td>
</tr>
<tr>
<td>Characteristics of liquid and gas simple phase flow; gas compression laws, expansion.</td>
<td></td>
</tr>
<tr>
<td>Technology and operation of pumps, compressors, steam turbines, gas turbines, electrical motors.</td>
<td></td>
</tr>
<tr>
<td>INSTRUMENTATION &amp; PROCESS CONTROL</td>
<td>5 d</td>
</tr>
<tr>
<td>Instrumentation, controllers, valves, control loops implementation.</td>
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<tr>
<td>PID tuning, monovariable control limits, multivariable control.</td>
<td></td>
</tr>
<tr>
<td>REFINING PROCESSES - PRINCIPLES &amp; OPERATION</td>
<td>20 d</td>
</tr>
<tr>
<td>Characteristics of feeds and products, principles of the processes used, operating and control parameters of the unit, analytical follow-up, typical incidents, concerning the following refining units:</td>
<td></td>
</tr>
<tr>
<td>Atmospheric and vacuum distillation of crude oil, Catalytic reforming, isomerization, hydrotreatment, sweetening of light cuts and sulfur recovery.</td>
<td></td>
</tr>
<tr>
<td>Conversion of heavy cuts and related units: visbreaking, coking, FCC, RFCC, distillate hydrocracking, residue hydrocracking, Base oil refining.</td>
<td></td>
</tr>
<tr>
<td>PETROCHEMICAL PROCESSES - PRINCIPLES &amp; OPERATION PRODUCTION OF OLEFINS &amp; AROMATICS</td>
<td>12 d</td>
</tr>
<tr>
<td>Production of olefins and aromatics:</td>
<td></td>
</tr>
<tr>
<td>Sources, outlets and main industrial uses of olefinic and aromatic intermediaries.</td>
<td></td>
</tr>
<tr>
<td>Steam cracking and treatment of the cuts produced.</td>
<td></td>
</tr>
<tr>
<td>Fluid catalytic cracking (FCC) and production of aromatics.</td>
<td></td>
</tr>
<tr>
<td>Economics of petrochemicals.</td>
<td></td>
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<tr>
<td>Implementation principles and techniques.</td>
<td></td>
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<tr>
<td>Production of syngas:</td>
<td></td>
</tr>
<tr>
<td>Main processes: steam reforming, partial oxidation (POX).</td>
<td></td>
</tr>
<tr>
<td>Valuation of synthesis gas: combined cycles.</td>
<td></td>
</tr>
<tr>
<td>SAFETY - UTILITIES - ENVIRONMENT IN OPERATION</td>
<td>8 d</td>
</tr>
<tr>
<td>Process safety:</td>
<td></td>
</tr>
<tr>
<td>Product and equipment related risks, safety in process operation.</td>
<td></td>
</tr>
<tr>
<td>Hazard analysis in design and operation.</td>
<td></td>
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<tr>
<td>Utilities:</td>
<td></td>
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<tr>
<td>Steam networks.</td>
<td></td>
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<tr>
<td>Electricity generation and networks.</td>
<td></td>
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<tr>
<td>Production and distribution networks for air, fire and cooling water; flare.</td>
<td></td>
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<tr>
<td>Environmental control:</td>
<td></td>
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<tr>
<td>Air pollution sources, detection and technologies for reduction.</td>
<td></td>
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<tr>
<td>Sources of aqueous pollution: wastewater treatment, regulation and controls.</td>
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</tr>
<tr>
<td>PETROLEUM ECONOMICS</td>
<td>5 d</td>
</tr>
<tr>
<td>Evolution of the demand for derived products, international oil markets.</td>
<td></td>
</tr>
<tr>
<td>Short-term refinery management.</td>
<td></td>
</tr>
</tbody>
</table>

Reference: PETREF-EN-A

Contact: rc.contact@ifptraining.com

Only available as an In-House course.
This course can be adapted to virtual classroom mode

Chemical Reaction Engineering

Level: SKILLED

Purpose

This course aims to impart the method for selecting the adequate reactor and determine the necessary data for design or performance optimization.

Audience

Engineers and technical staff from the refining, petrochemical and the chemical industries, involved in R&D, technical support, project functions. Process engineers or any person involved in the design or improvement of processes.

Learning Objectives

Upon completion of the course, the participants will be able to:
- understand the characteristics of chemical reactions, operating parameters and their impact on the conversion and yield,
- estimate the characteristics of the various technologies of the reactor (catalytic or otherwise),
- select the technology and optimal operating conditions.

Ways & Means

- Numerous examples from the refining and chemical industry, based on real cases.
- Emphasis on exchanges between participants.
- Extensive use of case studies, based on experience feedback, to illustrate the topics covered in the course.
- The duration and content of the training course can be customized to the needs of the client site and the profile of the participants.
- Parts of or whole session adaptable to virtual classroom.

Learning Assessment

Quiz.

Prerequisites

To fulfill at least one of the following criteria:
- have a Master degree or equivalent,
- or at least 1 year of proven experience in a technical position related to the development or improvement of processes in the refining or petrochemical industry,
- or in the process of moving towards a position involved in the development or improvement of processes.

Expertise & Coordination

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEMICAL REACTIONS</td>
<td>0.75 d</td>
</tr>
<tr>
<td>Thermodynamics and kinetics of the chemical reactions.</td>
<td></td>
</tr>
<tr>
<td>Consecutive, competitive reactions.</td>
<td></td>
</tr>
<tr>
<td>Selectivity, yield and conversion.</td>
<td></td>
</tr>
<tr>
<td>Catalysts: main characteristics, shape, structural, textual and mechanical properties. Activity and selectivity.</td>
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</tr>
<tr>
<td>Kinetics of the catalytic reactions: adsorption, on-surface reaction and desorption. Deactivation. Simplified mechanisms and kinetic laws.</td>
<td></td>
</tr>
<tr>
<td>Multiphase reactions: mass transfer at the interface. Intra-granular diffusion for catalytic reactions with a solid catalyst. Importance of specific interfacing area for liquid-liquid reactions.</td>
<td></td>
</tr>
<tr>
<td>Notion of chemical regime, external mass transfer or intragranular limitation.</td>
<td></td>
</tr>
<tr>
<td>Heat of reaction: production, temperature gradients, diffusion and elimination.</td>
<td></td>
</tr>
<tr>
<td>Performance optimization. The different parameters are studied using examples from the chemical industry, with one selected case study (“training case study”) followed through the training session.</td>
<td></td>
</tr>
<tr>
<td>MAIN CHARACTERISTICS OF CHEMICAL REACTORS</td>
<td>0.5 d</td>
</tr>
<tr>
<td>Batch, semi-batch or continuous reactors: management of productivity, control of the yield.</td>
<td></td>
</tr>
<tr>
<td>Control of the temperature profiles in reactors: adiabatic behavior, with thermal exchange. Influence on the results.</td>
<td></td>
</tr>
<tr>
<td>Stability of the exothermic reactions. The criteria of choice: this part is covered through analysis of situations, including the training case study.</td>
<td></td>
</tr>
<tr>
<td>TECHNOLOGICAL FEATURES OF THE REACTORS</td>
<td>1 d</td>
</tr>
<tr>
<td>Performances of mass and heat transfer. Monitoring the type of flow. Constraints in the catalyst formulations.</td>
<td></td>
</tr>
<tr>
<td>Consequences on technological choice:</td>
<td></td>
</tr>
<tr>
<td>Fixed beds, fluidized or circulating beds for gas-solid reactors.</td>
<td></td>
</tr>
<tr>
<td>Bubble columns, reactive absorption columns, etc., for gas-liquid systems.</td>
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</tr>
<tr>
<td>Stirred reactors, single or multiphase; criteria for choosing of the impeller.</td>
<td></td>
</tr>
<tr>
<td>Up-flow or trickle bed for 3 phase fixed beds.</td>
<td></td>
</tr>
<tr>
<td>Criteria for technological choice, basic design rules.</td>
<td></td>
</tr>
<tr>
<td>This section is mainly covered through the use of case studies, including the training case study.</td>
<td></td>
</tr>
<tr>
<td>FROM THE SELECTION OF THE REACTOR TO THE OPTIMIZATION OF THE OPERATING CONDITIONS</td>
<td>0.75 d</td>
</tr>
<tr>
<td>This chapter is divided into different parts within the train case study. This implies an active involvement of each part and allows an application of the different steps of the method.</td>
<td></td>
</tr>
<tr>
<td>Approach of the design of a reactor: Analysis of the thermodynamic, kinetic and thermal characteristics of the desired transformation. Advantages and the drawbacks of the possible technologies of reactors.</td>
<td></td>
</tr>
<tr>
<td>Selection criteria. Use of several reactors. Choice of the operating conditions. Expected performances.</td>
<td></td>
</tr>
</tbody>
</table>

Reference: GRC-EN-A

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: GRC-FR-A. Please contact us for more information.

www.ifptraining.com
Purpose
This e-learning module provides technical information on the main types of hydrocarbons and their associated properties. These modules are integrated into some of our Blended Learning courses but can also be followed independently. For any information please contact us at the following address: contact@ifptraining.com.

Audience
Professionals, in the oil or petrochemical industry, interested in refining, olefins, aromatics, polymers production. Specifically for engineers and technical staff who are beginners in this industry, as well as subcontractors, traders, etc.

Learning Objectives
Upon completion of the course, participants will be able to:
- describe the typical composition of crude oils,
- explain the difference between hydrocarbon molecules and their effects on final products,
- list crude oil impurities and their effects on final products.

Learning Assessment
Quiz.

Prerequisites
No prerequisites for this course.

More info
This module is available in French.

Course Content

COMPOSITION OF CRUDE OILS
Typical composition, density, API gravity classification.

HYDROCARBON GROUPS & COMPOSITION OF PETROLEUM PRODUCTS

IMPURITIES
Main impacts of sulfur, oxygen, nitrogen and metal contaminants in crude oil processing and petroleum products.
e-Learning

Distillation Process
Production of Base Chemicals & Commodity Polymers

Level: SKILLED

Purpose
This e-learning module provides a brief introduction to distillation process. These modules are integrated into some of our Blended Learning courses but can also be followed independently. For any information please contact us at the following address: contact@ifptraining.com.

Audience
Professionals, in the oil or petrochemical industry, interested in refining, olefins, aromatics, polymers production. Specifically for engineers and technical staff who are beginners in this industry, as well as subcontractors, traders, etc.

Learning Objectives
Upon completion of the course, participants will be able to:
- explain the basics of liquid-vapor equilibria,
- describe the role of distillation column internals,
- describe the distillation process,
- identify the main equipment in a real unit.

Learning Assessment
Quiz.

Prerequisites
No prerequisites for this course.

More info
This module is available in French.

Course Content

FLASH OF A HYDROCARBON MIXTURE
Pure substance vapor pressure curve. Flash separation.

PRINCIPLES OF CONTINUOUS DISTILLATION
Separation enhancement via a distillation column. External reflux and reboiler duty impacts on separation quality and energy consumption.

INDUSTRIAL FEATURES OF THE DISTILLATION PROCESS
Liquid-vapor contact material: packings and trays. Distillation column main operating conditions.

Reference: GCA2-EN-E

Contact: rc.contact@ifptraining.com

This course is also available in French: GCA2-FR-E. Please contact us for more information.

www.ifptraining.com
e-Learning

Introduction to Catalysts
Production of Base Chemicals & Commodity Polymers

Level: SKILLED

Purpose
This e-learning module provides a brief introduction to refining & petrochemicals catalysts. These modules are integrated into some of our Blended Learning courses but can also be followed independently. For any information please contact us at the following address: contact@ifptraining.com.

Audience
Professionals, in the oil or petrochemical industry, interested in refining, olefins, aromatics, polymers production. Specifically for engineers and technical staff who are beginners in this industry, as well as subcontractors, traders, etc.

Learning Objectives
Upon completion of the course, participants will be able to:
- describe the effect of a catalyst in a chemical reaction,
- list the catalysis steps,
- classify the main types of catalysts,
- explain the effects of catalyst contaminants,
- explicate how solid catalyst are loaded into reactors.

Learning Assessment
Quiz.

Prerequisites
No prerequisites for this course.

More info
This module is available in French.

Course Content

CATALYTIC ACTION
Chemical reactions: reactants, products, activation energy, overall energy balance, effects of the use of a catalyst. Five elementary steps a catalytic reaction.

INDUSTRIAL APPLICATIONS
Types of catalysis (homogeneous, heterogeneous) and supported catalysts. Catalyst main properties (activity, selectivity, deactivation or stability, regenerability, reproductibility). Catalyst contaminants.

CATALYTIC REACTORS EXAMPLES
Radial reactor with a fixed catalytic bed. Axial fixed bed reactor. Dense and sock loading.

Reference: GCA3-EN-E Only available as an In-House course.
Contact: rc.contact@ifptraining.com
This course is also available in French: GCA3-FR-E. Please contact us for more information.
Course Content

INTRODUCTION TO POLYMERS
Monomers: the building blocks. Monomers to Polymer transition.
Synthetic polymers types and main features.

POLYETHYLENE
Polyethylene development timeline. LDPE, LLDPE and HDPE main features and applications.
Brief introduction to Polyethylene processes.

POLYPROPYLENE
Polypropylene atatic, isotatic and syndiotactic forms. Polypropylene main features and applications.
Brief introduction to Polypropylene processes.
Practice of PRO-II/Provision or HYSYS Simulation Software

Level: KNOWLEDGE

Purpose
This course aims to present an overview of the use of the PRO-II/PROVISION or HYSYS software programs.

Audience
Engineers looking for a practical introduction to simulation of industrial units.

Learning Objectives
Upon completion of the course, the participants will be able to:

- simulate industrial flow schemes with different unit operations, using the thermodynamic tools at hand,
- explain and analyze the output of a simulation,
- grasp the concepts necessary for an efficient use of a simulation tool as a controller, optimizer, calculator, etc.

Ways & Means
Computer-based case studies with analysis of simulation inputs and outputs.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:

- have a Master degree or equivalent,
- or at least 3 months of proven experience in a technical position in the refining or petrochemical industry,
- or in the process of moving to a position requiring the use of process simulation software.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

SIMULATION PRINCIPLES & DATA PREPARATION 0.25 d
Simulation principles: concepts of streams and units.
Getting started with PRO II/PROVISION: start a new simulation or open an existing simulation file, import a keyword input file, export a simulation database.
Presentation of the different menus, ribbon bar buttons, PFD Main Window and PFD palette. Presentation of the input and output files.
Thermodynamic methods: available models, selection criteria.
Supplying required data for components and feed streams: pure components, petroleum pseudo components, analysis data.

OPERATIONS WITH PURE LIQUID-VAPOR EQUILIBRIA 0.25 d
Analysis of different operations with pure components: flash, compression, depressurization, preheating, vaporization, cooling down, condensation.
Practice analysis of two different cryogenic cycles with propane, operating conditions and impact on the efficiency of the process, representation on the enthalpic diagram and validation of the results. Influence of the purity of the propane and impact of a pollution with little quantity of air.

SEPARATION OF HYDROCARBON MIXTURES 0.75 d
Liquid-vapor equilibria of hydrocarbon mixtures:
- Required data for a liquid-vapor equilibrium (flash) simulation.
- Different types of flash specifications: fixed pressure and temperature, bubble point, dew point, etc.
  Practice: hydrocarbon flashes, water-hydrocarbon condensation.
Distillation:
- Required data for the simulation of a distillation column: number of trays, feeds and products, pressure profile, type of condenser and reboiler, etc.
- Different types of specifications - Available parameters.
  Print options: temperature, rate or composition profiles.
  Practice: design of a depropanizer and a draw-off column.

PRACTICE, CASE STUDIES & COMPLEMENTARY TOOLS 0.75 d
By means of numerous exercises, complementary tools are presented: controller, optimizer, case study, calculator, and their role, efficiency and necessary data are studied.
HYSYS practice:
- Natural gas degasolination by different means.
- Cryogenic cycle (flash, compressor, heat exchanger, etc.): determination of the cooling fluid to be implemented in different cases (use of a “controller”).
- Gas expander cycle (compressor, expander, reactor, heat exchanger, etc.): determination of the efficiency in different cases (use of a “calculator”).
PRO-II practice:
- Distillation column: optimization of the feed inlet tray location (use of an “optimizer” or “a case study”). Heat integration.

Reference: PRO2HYS-EN-P
Only available as an In-House course.
Contact: rc.contact@ifptraining.com

This course is also available in French: PRO2HYS-FR-P. Please contact us for more information.
Processes

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  - Distillation Certification - Optimization & Troubleshooting .......... p. 49
  - Operation of a Binary Distillation Column - Level 1 ................... p. 50
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  - Column Internals ............................................................................. p. 53

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  - Polymers Fundamentals & Rheology ............................................ p. 76
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  - Operation of a Chemical Production Unit .................................... p. 82
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Distillation Column Design

Course Content

**REMINDER ABOUT SEPARATION PROCESSES USED IN THE PETROLEUM INDUSTRY**


**STEPS INVOLVED IN THE DESIGN OF A CLASSICAL DISTILLATION COLUMN**


**SHORT CUT METHODS FOR HYDROCARBON SEPARATION**


**OPERATING PARAMETERS OF AN INDUSTRIAL DISTILLATION COLUMN**


**SEPARATING POWER OF AN INDUSTRIAL DISTILLATION COLUMN**

Parameters related to the separating power: L/V ratio, reflux ratio, reboiling ratio, number of theoretical stages, efficiency of the real trays, location of the feed inlet. Change of separating power at a constant material balance. How to optimize the operation. Prominence of the process control quality.

**EQUIPMENT TECHNOLOGY**

Trays: way they act, technology, performances, flexibility. Packings: way they act, structured or random packings, limitations, pressure drop, distribution and channeling phenomenon. Distribution systems.

**PROCESS CONTROL**

Adaptability of process control to actual disturbances. Troubleshooting of disturbances: origin (feed, condenser, reboiler) and consequences (liquid vapor flow rates disturbances, material balance modification, off-spec. products). Material balance control: use of a sensitive tray. Temperature control systems: implementation of a temperature-reflux rate cascade or temperature-reboiler duty cascade, examples with a debutanizer and a benzene-aromatics column. Impact of feed changes: temperature (optimization of the heat balance), flow rate (feed forward control), composition (tuning of the material balance and the separating power). Change of operating conditions: implementation of control systems based on product quality measurement.

Reference: DESIGNE-EN-P

Can be organized as an In-House course. Contact: rc.contact@ifptraining.com

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<thead>
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<th>Location</th>
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<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rueil-Malmaison</td>
<td>1 June</td>
<td>4 June</td>
<td>€3,000</td>
</tr>
</tbody>
</table>
This course can be adapted to virtual classroom mode - Advanced Certificate
Distillation Certification - Optimization & Troubleshooting
Practical Simulator Training (CORYS IndissPlus simulator)

Level: EXPERT

Purpose

This course provides a comprehensive understanding of efficient distillation columns operation as well as optimization strategies implementation.

Audience

Engineers, process engineers, process control personnel and technical staff in the refining and petrochemicals industries.

Learning Objectives

Upon completion of the course, the participants will be able to:
- know about all parameters and profiles for the analysis of a distillation column operation,
- master the concepts necessary to optimize the operation of a column,
- identify the performances and limits of different control systems,
- detect deficiencies, find their origin and solutions.

Ways & Means

- Highly efficient learning process: operation of a virtual column using a dynamic simulator that models the main physical phenomena of distillation.
- Troubleshooting case studies to illustrate process control schemes.
- The content of the exercises can be customized to the needs and specific features of the client site.
- Parts of or whole session adaptable to virtual classroom.

Learning Assessment

- Individual quiz.
- Handling a situation of operation: finding the settings for tuning a column.

Prerequisites

To fulfill at least one of the following criteria:
- to have a Master degree or equivalent in process, engineering, industrial chemistry,
- to have knowledge of liquid-vapor equilibria and the main principles of operation of distillation columns,
- to have more than 3 years' proven technical experience in the refining industry,
- to have a new position requiring competences in distillation.

Why an IFP Training Certification?

- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Distillation Certification - Optimization & Troubleshooting.
- Ready-to-use skills.

More info

Realizado en Español si requerido.

Expertise & Coordination

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

5 days

OPERATING PARAMETERS: DEFINITION & SIGNIFICANCE 0.5 d
Material balance of the virtual column: cut point, separation quality and concept of fractionation capability.
Column pressure: pressure control and pressure profile along the column.
Internal flow rates profiles, concentration and temperature profiles. Concentration peaks.

FRACTIONATION CAPABILITY OF AN INDUSTRIAL DISTILLATION COLUMN 0.5 d
Impact of the parameters related to the fractionation capability:
- Liquid-vapor internal flow rates, associated with reflux and reboiling ratios.
- Number of theoretical stages and internal equipment efficiency.
- Position of feedstock inlet related to feed characteristics.
- Fractionation capability and related energy consumption.
Each item is illustrated by practical exercises conducted by trainees on a dynamic simulator.

PROCESS CONTROL PARAMETERS 3 d

The simulator handling scenario covers the different aspects of operation and control of columns. It starts with a simple control system and implements increasingly sophisticated control systems on increasingly complex columns: from binary to a multiple draw-off column (crude oil distillation).
Survey of operating disturbances; origins and causes.
Process control strategy and optimization targets.
External or internal reflux control, reboiling control with flow rates or duty monitoring.
Material balance control: sensitive tray, temperature control systems.
Optimization of the heat balance: additional energy through the feed or the reboiler, low pressure operation and energy savings.
Implementation of more complex control systems.
Analysis of disturbances caused by the feed and systems for feed forward control.
Implementation of process control in multi-column trains.
Specific case of multiple draw-off columns:
- Quality tuning through material balance (temperature, flow rate or level control).
- Heat balance monitoring (role of pumparounds and vaporizing refluxes, optimization of the fractionation capability).
- The participants can provide diagrams of their distillation columns, the methodology will be applied to confirm that a change of operating parameter does not have the same consequence according to the control scheme implemented.

EQUIPMENT TECHNOLOGY & TROUBLESHOOTING 1 d

Trays: technology; high efficiency trays, performance and flexibility.
Packings and distribution systems: flooding, fouling, mechanical damage and remedies.
Reboilers and condensers: implementation and working principles, various control strategies, problems and related origins, possible solutions.
The items in this chapter are exemplified by case studies corresponding to actual industrial problems and related solutions.

Reference: DSS-EN-A Contact: rc.contact@ifptraining.com
Can be organized as an In-House course.

<table>
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<tr>
<td>Rueil-Malmaison</td>
<td>21 June</td>
<td>25 June</td>
<td>€3,450</td>
</tr>
</tbody>
</table>

www.ifptraining.com
This course can be adapted to virtual classroom mode

**Operation of a Binary Distillation Column - Level 1**

**Practical Simulator Training (CORYS IndissPlus simulator)**

**Level: SKILLED**

**Purpose**

This course provides a comprehensive and working knowledge of distillation columns operating conditions and parameters through a hands-on experience.

**Audience**

Experienced field operators preparing for console operations.

**Learning Objectives**

Upon completion of the course, the participants will be able to:
- Grasp the meaning of the operating conditions of a continuous distillation column with two compounds in the feed,
- Learn how to operate a binary column with a simple control scheme,
- Achieve proper settings to keep products on spec.

**Ways & Means**

- Use of a virtual column modeled on RSI IndissPlus dynamic simulator.
- Each handling includes the definition of setting objectives, implementation with observation of the response of the system, shared analysis of the results and practical conclusions regarding the operation.
- Parts of or whole session adaptable to virtual classroom.

**Learning Assessment**

Quiz.

**Prerequisites**

To fulfill at least one of the following criteria:
- To have 3 months of proven professional experience in a refinery, chemical or petrochemical site with distillation columns,
- Or in the process of being moved to a position in operation.

**Expertise & Coordination**

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

**BASICS OF DISTILLATION**

- Volatility of pure compounds: boiling point, vapor pressure.
- Properties of simple hydrocarbon mixtures.
- Sensible and latent heat: definitions, differences in magnitude and their association with changes of physical state, i.e., vaporization and condensation.
- Behavior of mixtures in distillation: dew and bubble points, incomplete condensation and vaporization, liquid-vapor separation and distribution of lights and heavy compounds.
- Relation between temperature, pressure and the composition of the products.

**ANALYSIS OF OPERATING PARAMETERS USING THE VIRTUAL COLUMN**

- Familiarization with simulator controllers, face plates, trends and control loops.
- Study of the circuits, instrumentation and control loops around the column.
- Principles of a distillation column: liquid and vapor traffic, role of the condenser and reboilers, trays and packing.
- Analysis of the operating conditions: significance of measured values and calculated variables.
- Mass balance, representation of the separation, pressure profiles, composition profiles, temperature profiles, illustrating the link between these profiles and the operating parameters.

**STUDY THE OPERATING PARAMETERS OF THE DISTILLATION COLUMN**

- Operating parameters of the column and analysis of their influences:
  - reflux flow rate modifications: action, consequences on mass balance, purities, and internal profiles.
  - Flow rate of hot oil at the reboiler: modifications of the duty and consequences on the operating parameters.
  - Changes in feed characteristics: temperature, flow rate and composition.
  - Overhead pressure control, different control schemes, pressure modification and consequences.
- Each case is studied using the following pedagogical approach:
  - Make a change to the column via controllers set point.
  - Analyze how column performance is affected in response to the change.
  - Compare the new steady state to the base case influence on cut point and fractionation capability.
  - Identify the consequences of the changes on associated equipment.

**SIMULATOR TRAINING**

Exercises are conducted in small groups of 2 to 3 participants, each group operating its own virtual column.
Each exercise includes: definition of the target exercise objective; adequate time to run the virtual columns; open analysis of the results, shared with all participants; and practical conclusions related to the operation of the columns.

Attendees are invited to bring descriptions of their specific column diagrams. Conclusions drawn from the exercises on the simulator can be transposed to other actual schemes.

Reference: ICD-EN-A  Only available as an In-House course. Contact: rc.contact@ifptraining.com

This course is also available in French: ICD-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

Operation of a Binary Distillation Column - Level 2
Practical Simulator Training (CORYS IndissPlus simulator)

Level: SKILLED

Purpose

This course provides a deeper understanding of operating distillation columns under all conditions, with a practical understanding of operations and control systems through a hands-on experience.

Audience

Console operators and production supervisors, shift supervisors involved in the operation of distillation column.

Learning Objectives

Upon completion of the course, the participants will be able to:
- achieve normal column operation with common control strategies.
- be familiar with all parameters and profiles for the analysis of distillation columns.
- understand the concepts necessary for optimizing the column on the basis of typical economics and constraints.
- anticipate, recognize and react to disturbances in order to maintain safe operation and avoid negative economic consequences.
- be thoroughly familiar with the main steps of start-up and shutdown procedures.

Ways & Means

- Highly efficient learning process: use of a virtual column modeled on CORYS IndissPlus dynamic simulators.
- Exercises are conducted in small groups of 2 to 3 participants, each group operating its own virtual column. Each exercise includes: a pre-discussion of the problem; definition of the target exercise objective; adequate time to run the virtual columns; open analysis of the results, shared with all participants; and practical conclusions related to the operation of the columns.
- Attendees are invited to bring descriptions of their specific column control strategies for group discussion and analysis. Conclusions drawn from the exercises on the simulator can be transposed to other actual control schemes.
- The content of the exercises can be customized to the needs and specific features of the client site.
- Parts of or whole session adaptable to virtual classroom.

Learning Assessment

Quiz.

Prerequisites

To fulfill at least one of the following criteria:
- to have at least 1 year’s proven experience in operation in a refinery, chemical or petrochemical unit.
- or in the process of being moved to a position in operation to site with distillation columns.

Expertise & Coordination

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

5 days

OPERATING PARAMETERS 1 d
Behavior of flash mixtures: vaporized fraction, liquid-vapor separation and distribution of components according to their volatility.
Material balance of the column: concepts of cut point, separation quality and fractionation capability.
Heat balance: reflux and reboiling ratios and selectivity assessment.
Column pressure effects: pressure control and pressure profile along the column - Flow rates, concentration and temperature profiles.

FRACTIONATION CAPABILITY 0.5 d
The trainees will experience these causes and effects on a debutanizer simulator.
Effects of liquid-vapor flow rates, reflux and reboiling ratios on separation - Influence of liquid-vapor traffic on concentration and temperature profiles.
Position of inlet tray.
Fractionation capability and its relationship to energy consumption.

MASS BALANCE & IMPLEMENTATION OF A TEMPERATURE CONTROL 0.5 d
Impact of reflux and reboiler duty on material balance, and consequences on product specifications.
Impact of disturbances on column mass balance and product purities.
Definition of and how to identify the sensitive tray, and its influence on concentration profiles and products qualities.
Implementation of sensitive temperature control systems, advantages and limitations.

OTHER PROCESS CONTROL PARAMETERS 1.5 d
Survey of operating disturbances, their common origins and causes - Pressure control and its impact on column stability.
Analysis of disturbances caused by the feed, composition, temperature or flow rate.
Reboiler fouling, loss of condensing, and tray flooding - External and internal reflux control, and reboiling control by means of flowrates or duty.
Optimizing heat balance, influence of additional energy through feed or reboiler, and benefits of low pressure operation.
Implementation of control systems based on quality measurement.

UPSETS 1 d
Operation of the column at its limits: thermal equipment fouling, cooling water troubles and flooding - Failures of instruments and pumps.

START-UP - SHUTDOWN 0.5 d
Analysis of the behavior in the column at each step of start-up and shutdown.

Reference: CCDSS-EN-A. This course is also available in French: CCDSS-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

Operation of a Multiple-Draw Distillation Column

Practical Simulator Training (CORYS IndissPlus simulator)

Level: SKILLED

Purpose

This course provides a deeper understanding of the working principle and operational tuning of multiple-draw-off distillation columns through a hands-on experience.

Audience

Console operators, production supervisors, shift supervisors in charge of multiple-draw-off columns: crude oil atmospheric and vacuum distillation unit, fractionation towers of cracking units.

Learning Objectives

Upon completion of the course, the participants will be able to:

- understand the main operating parameters of a multiple-draw-off distillation column,
- master the working principle and objectives of typical multi-draw column control loops,
- react properly and efficiently when faced with upset conditions and thus minimize product degradation.

Ways & Means

- Use of a virtual column modeled on CORYS IndissPlus dynamic simulator.
- Exercises are conducted in small groups of 2 to 3 participants, each group operating its own virtual column. Each exercise includes: a pre-discussion of the problem; definition of the target exercise objective; adequate time to run the virtual columns; open analysis of the results, shared with all participants; and practical conclusions related to the operation of the columns.
- Attendees are invited to bring descriptions of their specific column control strategies for group discussion and analysis. Conclusions drawn from the exercises on the simulator can be transposed to other actual control schemes.
- The content of the exercises can be customized to the needs and specific features of the client site.
- Parts of or whole session adaptable to virtual classroom.

Learning Assessment

Quiz.

Prerequisites

To fulfill at least one of the following criteria:

- to have at least 1 year’s proven experience in operation in a plant with distillation columns,
- or in the process of moving to a position in operation in a refinery.

Expertise & Coordination

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: DSMSS-EN-A

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: DSMSS-FR-A. Please contact us for more information.

Course Content

OPERATING PARAMETERS OF THE SIMULATED CRUDE DISTILLATION COLUMN

1 d

Analysis of the column: instrumentation, control loops, and analyzers. Analysis of various operating conditions and the significance of each operating parameter:

- Material balance, concepts of cut points, quality and fractionation capability.
- Total and partial pressures, pressure profiles along the column.
- Feed temperature, over flash and energy consumption.
- Role and operating parameters of the strippers, and stripping ratios.
- Energy balance, heat extraction by pumparound, and partial condensation, overflash.
- Overhead condensation: and various control systems.
- Liquid and vapor traffic, fractionation zone and heat transfer zones.
- Temperature profiles.

MODIFYING CUT POINTS

2 d

Control of the mass balance, and characteristics of the products.

- Change in the side streams flow rates - Change in the overhead cut flow rate.
- Practice changing the cut point between two side streams to meet quality specifications.
- Tuning the operating parameters of the strippers; vapor, reboiling, stripping ratio, and flash point.

ADJUSTING ENERGY BALANCE

1 d

Modifying heat rates extracted by pumparound: effects of changes to flow rates, internal traffics and properties of side streams.

- Change in the transfer line temperature, and energy consumption. Influence of pressure and the consequence on feed heater and top degassing.
- Consequence of changes to the energy balance, liquid and vapor traffics, and their effect on fractionation capability.

TUNING THE COLUMN

1 d

Adjusting the quality of the products.

- Optimization criteria for the energy balance: adjustment of the pumparound to get the desired fractionation capability.
- Influence of the main disturbances: feed flow rate, stripping steam - Influence of a change in the crude oil quality.
- Specific features of other multiple-draw columns like vacuum columns and other fractionators.
- Management of the different requirements (cut points, specification of cuts…) depending on the control scheme implemented for any column studied.
This course can be adapted to virtual classroom mode

Column Internals

**Level:** EXPERT

**Purpose**

This course provides a thorough and practical understanding of the working principles and use of trays and packing installed in many columns for distillation, absorption, stripping, washing, etc. It covers as well the main design issues.

**Audience**

Engineers and supervisory staff in the refining, petrochemical and chemical industry, involved in the design, selection or operation of the internals in distillation columns or their equivalent.

**Learning Objectives**

Upon completion of the course, the participants will be able to:

- know the different types of internals, their advantages and drawbacks,
- investigate the main criteria for choice according to their respective operating field,
- identify the basic features for design,
- master the operating range and troubleshooting of equipment.

**Ways & Means**

- Active participation of trainees with exercises using an equipment sizing software.
- Parts of or the whole session customizable to a virtual remote classroom.

**Learning Assessment**

Quiz.

**Prerequisites**

To fulfill at least one of the following criteria:

- have an Master degree or equivalent in process, engineering, industrial chemistry,
- or have knowledge in distillation processes,
- or have a proven technical experience of more than one year in a technical position related to the design of equipment, such as technical support, engineering,
- or be in the process of moving towards a position requiring the sizing of distillation columns.

**Expertise & Coordination**

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

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**Course Content**

2 days

**TECHNOLOGY & FUNCTIONING OF TRAYS**

Basics of mass transfer between liquid and vapor: importance of the interface area, viscosity and relative volatility. Definition of some working parameters: efficiency, capacity, flexibility, pressure drop, etc.

Different types of trays: with or without downcomers. Different types of contacting systems for the active area: bubble caps, fixed or mobile valves. Hydraulic working and pressure drops. Troubles such as flooding, weeping, fouling, etc.

Main parameters to take into account in the design of internals. Specific features for multi-pass trays. Equipment for transition zones as flash zone, changing of pass number, etc. Aim of high performance trays and working principles. Advantages and fields of use. New technology trays and implementation in the near future.

**Example:**

- Simulation of tray design; representation of trays in operation (video).
- Implementation of HP trays and feedback information.

**TECHNOLOGY & FUNCTIONING OF PACKED BEDS**


**Example:**

- Representation of packing in operation (video); implementation of packing and evaluation of performances. Presentation of tests in the manufacturer’s workshop.

**COMPARISON & TROUBLESHOOTING OF BEDS & PACKINGS**


Gammametry: method and examples of diagrams.

**Example:**

- Revamping an existing column.
- Case study of disturbed equipment, diagnosis and remedy.

Reference: INCOL-EN-A

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: INCOL-FR-A. Please contact us for more information.

www.ifptraining.com
Catalysts in Refining Processes

Course Content

CHARACTERISTICS & PROPERTIES OF INDUSTRIAL CATALYSTS 1.25 d
Main types of catalytic processes and related catalyst markets in the refining and heavy petrochemical industries. Main features of catalysis: Thermodynamics in a chemical reaction. Kinetics in heterogeneous catalysis. Quality requirements for an industrial catalyst, characterization of its properties. Processes for catalyst synthesis and industrial manufacture of catalysts.

OPERATION & PERFORMANCE CONTROL OF INDUSTRIAL CATALYSTS 3.25 d

IMPLEMENTATION & LIFE CYCLE OF CATALYSTS 0.25 d
Precautions in the transport and the manipulation of catalysts. Follow-up of performances, from the start-up to the regeneration; metals recovery.

VISIT OF TEST & PILOT FACILITIES OF IFP Energies nouvelles 0.25 d
Different stages of testing at micro-pilot, pilot and semi-industrial scale.

Prerequisites
To fulfill at least one of the following criteria:
► to have a Master degree or equivalent in process, engineering, industrial chemistry,
► or to have knowledge in refining processes,
► or to have more than 3 years' proven technical experience in the refining industry,
► or to have followed a "Refining Processes and Petroleum Products" training course.

Expertise & Coordination
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Learning Objectives
Upon completion of the course, the participants will be able to:
► grasp the role of a catalyst and the basic mechanism of catalytic reactions,
► assess the link between preparation and catalytic properties,
► understand the issues related to industrial use (start-up, shutdown, regeneration, etc.),
► analyze the influence of operating parameters on catalytic selectivity and stability,
► master the methods for performance monitoring.

Ways & Means
► Active participation of trainees through interactive exercises to grasp the key points of the course.
► A summary per unit is built to highlight key issues.
► Intervention by experts from IFP Energies nouvelles.

Learning Assessment
Quiz.

Reference: CATAL-EN-P
Can be organized as an In-House course. Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyon</td>
<td>15 November</td>
<td>19 November</td>
<td>£3,100</td>
</tr>
</tbody>
</table>

Level: EXPERT
Purpose
This course provides a deeper understanding of catalysts: their preparation, performance control, troubleshooting during operation, unit start-up, shutdown and regeneration.

Audience
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.

Ways & Means
Active participation of trainees through interactive exercises to grasp the key points of the course.

A summary per unit is built to highlight key issues.

Intervention by experts from IFP Energies nouvelles.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
► to have a Master degree or equivalent in process, engineering, industrial chemistry,
► or to have knowledge in refining processes,
► or to have more than 3 years’ proven technical experience in the refining industry,
► or to have followed a "Refining Processes and Petroleum Products" training course.

Expertise & Coordination
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.
# Light Cuts Processing

## Level: KNOWLEDGE

### Purpose

This course provides a thorough knowledge of operation and refining processes involved in gasoline and diesel production.

### Audience

Engineers and supervisors involved in light and middle distillates processing units.

### Learning Objectives

Upon completion of the course, the participants will be able to:

- link processing units operation to various constraints set by product specifications,
- analyze operating parameters and their impacts,
- acquire the basics for operating processing units,
- know about the latest developments in these processes.

### Ways & Means

Numerous exercises and case studies based on real industrial situations.

### Learning Assessment

Quiz.

### Prerequisites

To fulfill at least one of the following criteria:

- to have a 3 months proven professional experience in the refining or petrochemical industry,
- or to have followed a training course orientated to introduction to the refining environment.

### Expertise & Coordination

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

## Course Content

<table>
<thead>
<tr>
<th>Category</th>
<th>Duration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PETROLEUM PRODUCTS</strong></td>
<td>0.25 d</td>
<td>Origin and characteristics of naphtha cuts. Octane properties and hydrocarbon (HC) families. Quality requirements. Gasoil and Diesel oil: cetane, cold flow and other properties.</td>
</tr>
<tr>
<td><strong>ISOMERIZATION OF LIGHT GASOLINES</strong></td>
<td>0.5 d</td>
<td>Integration in the gasoline production scheme. Isomerization reaction characteristics. Different types of catalysts: properties, activation, poisons, operating conditions. Industrial process: principle and specific constraints. Downstream separation main types and impact of recycling.</td>
</tr>
<tr>
<td><strong>HYDROREFINING PROCESSES</strong></td>
<td>2 d</td>
<td>Removal of impurities, hydrogenation of unsaturated compounds: chemical reactions characteristics. Role and types of catalysts in relation with feeds, hydrogen consumption and required results. Operating conditions and main variables (temperature, WHSV, (\text{H}_2/\text{HC}) ratio, (\text{PPH}_2), etc.). Catalyst loading map; cycle length optimization. Main refining applications and specific operating features, example of gasolines and middle distillates desulfurization.</td>
</tr>
<tr>
<td><strong>SWEETENING OF LIGHT CUTS</strong></td>
<td>0.25 d</td>
<td>Role of sweetening process, basic chemical reactions, nature and efficiency of the catalyst. Main applications for LPG’s, naphtha’s and kerosene cuts. Operating conditions: temperature, caustic concentration, mixing efficiency, air injection, etc.</td>
</tr>
<tr>
<td><strong>SULFUR RECOVERY</strong></td>
<td>0.75 d</td>
<td>Refinery sulfur balance. Importance of sulfur recovery chain processes. Amine scrubbing chemical reactions and operating parameters. Industrial process and operating parameters as air/H_2S ratio, steam production. Claus chemical reactions. Process control and impact on environment: causes for sulfur emission increase. Tail gas treatments: process principles, operating conditions.</td>
</tr>
</tbody>
</table>

### Reference:

Reference: REF1-EN-P

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

www.ifptraining.com

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Heavy Cuts Processing

**Level:** KNOWLEDGE

**Purpose**
This course provides a comprehensive knowledge of refining processes available to upgrade heavy cuts into lighter ones.

**Audience**
Engineers and supervisors interested or involved in the processing of heavy cuts.

**Learning Objectives**
Upon completion of the course, the participants will be able to:
- understand differences between refining conversion processes with regard to planning, operations and investment issues,
- analyze the operating parameters of these conversion processes,
- acquire the basics for operating cracking units,
- know about on the latest developments in heavy cuts processing.

**Ways & Means**
Case studies based on real industrial situations.

**Learning Assessment**
Quiz.

**Prerequisites**
To fulfill at least one of the following criteria:
- to have a 3 months proven professional experience in the refining or petrochemical industry,
- or to have followed a training course orientated to introduction to the refining environment.

**Expertise & Coordination**
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

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**Course Content**

<table>
<thead>
<tr>
<th>Module</th>
<th>Duration</th>
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<tbody>
<tr>
<td>OVERVIEW OF CONVERSION PROCESSES</td>
<td>0.25 d</td>
</tr>
<tr>
<td>THERMAL CONVERSION PROCESSES</td>
<td>1.5 d</td>
</tr>
<tr>
<td>CATALYTIC CRACKING</td>
<td>1.25 d</td>
</tr>
<tr>
<td>DISTILLATE HYDROCRACKING</td>
<td>1.25 d</td>
</tr>
<tr>
<td>RESIDUE PROCESSING</td>
<td>0.5 d</td>
</tr>
<tr>
<td>LUBE BASE STOCKS MANUFACTURE</td>
<td>0.25 d</td>
</tr>
</tbody>
</table>

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Reference: REF2-EN-P

Only available as an In-House course.

Contact: rc.contact@ifptraining.com
This course can be adapted to virtual classroom mode

**Hydrotreatment Processes**

**Optimization & Troubleshooting**

**Level:** SKILLED

**Purpose**

This course provides a deeper understanding for operating, monitoring and optimizing hydrotreatment units.

**Audience**

Engineers, senior operation personnel or technical supervisory staff interested or involved in the operation of hydrotreatment units. Engineers from research centers and engineering companies involved in the different aspects of the operation and process control of these units.

**Learning Objectives**

Upon completion of the course, the participants will be able to:

- grasp the essence of hydrotreatment processes,
- analyze the operation and optimization of hydrotreatment units,
- manage the hydrogen balance in relation with the hydrogen network,
- detect potential deficiencies by troubleshooting.

**Ways & Means**

- Applications, teamwork, case studies and interactive workshops based on typical real situations.
- Potential use of a generic dynamic simulator.
- The duration and content of the training course can be customized to the needs of the client site and the profile of the participants.
- Possible contribution of experienced staff reporting his industrial experience of the operation on a daily basis.
- Parts of or whole session adaptable to virtual classroom.

**Learning Assessment**

Quiz.

**Prerequisites**

The trainee is required to fulfill at least one of the following criteria:

- to have at least 1 year of proven experience in a technical position in a refinery,
- or to be in the process of being moved to a position in operation,
- or to have followed a training course orientated to introduction to the refining.

**Course Content**

**OBJECTIVES OF HYDROTREATMENT PROCESSES**

0.25 d

Impurities in petroleum cuts and products; their impact on health, environment and on other refining processes. Highly refractory compounds.

Recent regulations and future trends: quality specifications of petroleum products and fuels in relationship with concerns mentioned above.

Aim of the various treatments with hydrogen and integration in the refining scheme: hydropurifications of straight run cuts, stabilization or saturation of cracked cuts.

**CHEMICAL REACTIONS & HYDROTREATMENT CATALYSTS**

0.75 d

Characteristics of the chemical reactions involved: 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.

Characteristics of the catalysts for hydropurification and for hydrogenation: effect of molybdenum, cobalt and nickel, importance of the substrate, selection criteria for a hydrotreatment specific issue. Top gradings.

Catalyst dense loading. Reactor internals.

Presulfiding procedures: role, steps and details for the different methods.

**OPERATION OF A DISTILLATE HYDROTREATMENT UNIT**

1 d

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, PPH2, recycle ratio, quench ratio, feed flow rate and space velocity.

Advanced process control and optimization of the process.

Management of the hydrogen network in the refinery. Effect of feed composition and origin.

Catalyst follow up and cycle length optimization, ageing and deactivation.

Regeneration steps and monitoring.

Maximizing the performances of the unit under constraints or limit conditions.

**DISTURBANCES, INCIDENTS & TROUBLESHOOTING**

0.5 d

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.

**PERFORMANCE OF THE VARIOUS HYDROTREATMENT UNITS**

0.5 d

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.

Hydrotreatment of middle distillates: kerosene and gas-oil, LCO processing.

Desulfurization of vacuum gasoil to FCC units.

Residues demetallation and hydroconversion processes.

**Reference:** HDT-EN-A

Contact: rc.contact@ifptraining.com

*This course is also available in French: HDT-FR-A. Please contact us for more information.*

Realizado en Español si requerido.

**Expertise & Coordination**

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: HDT-EN-A

Only available as an In-House course.

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This course can be adapted to virtual classroom mode

Hydrotreatment Processes
Simulator assisted training

Level: SKILLED

Purpose
This course provides a better understanding of the operation of hydrotreatment units and helps participants to be better prepared to deal with disturbed situations.

Audience
Shift leaders, panel operators and experienced operators in charge of the operation of hydrotreatment units.

Learning Objectives
Upon completion of the course, the participants will be able to:
- monitor the operation and optimization of the steady state operation of the HDT unit,
- understand the phenomenons involved in deviations or troubles,
- react in the correct direction to restabilize the unit.

Ways & Means
Each case study is covered by handling using a high fidelity simulator, following several steps:
- objective of the case study, action by the trainees: operation/settings, stabilization,
- analysis of the evolution of operating parameters up to the final state ; mass balance, ratios, performance,
- consequences for operation strategies. The duration and content of the training course can be customized to the needs of the client site and the profile of the participants.
- Parts of or whole session adaptable to virtual classroom.

Learning Assessment
Quiz.

Prerequisites
The trainee is required to fulfill at least one of the following criteria:
- to have at least 1 year of proven experience in a technical position in a refinery,
- or to be in the process of being moved to a position in operation,
- or to have followed a training course orientated to introduction to the refining.

Expertise & Coordination
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>STUDY OF INITIAL SIMULATED STEADY CASE</td>
<td>1 d</td>
</tr>
<tr>
<td>Main process scheme, operating circuits, main pieces of equipment, control systems. Characteristics of the streams, operating conditions. Significance of the process parameters of the units: mass balances, temperatures, pressures, recycle flow rates, amine washing efficiency, recontacting system. Profile of important parameters along the unit (pressure, temperatures). Analytical survey.</td>
<td></td>
</tr>
<tr>
<td>OPERATION OF THE UNIT: MAIN OPERATING PARAMETERS &amp; OPTIMIZATION</td>
<td>2.5 d</td>
</tr>
<tr>
<td>Each operating parameter impact on operation is illustrated thanks to simulator handlings. Reactor temperatures, pressure drop and H₂, partial pressure, recycle rate, quench ratio, recontacting ratio… Feed composition according to origins of constituents. Severity of different processes according to feed and products specifications. Protection of the catalyst along a run. Give away and how to avoid it. Optimization of stripping and drying operation.</td>
<td></td>
</tr>
<tr>
<td>TROUBLESHOOTING</td>
<td>1.5 d</td>
</tr>
<tr>
<td>Risks and hazards related to the process. Safety and ESD system. Operating deviations: Feed or hydrogen composition change. Amine washing failure, heater failure. Make-up gas or recycle gas compressor failure, feed pump failure. Start-up procedures: main steps and explanation of the role of each step.</td>
<td></td>
</tr>
</tbody>
</table>

Reference: HDTS-EN-A Only available as an In-House course. Contact: rc.contact@ifptraining.com
This course can be adapted to virtual classroom mode

## Crude Oil & Vacuum Distillation

**Optimization & Troubleshooting**

**Level:** SKILLED

### Purpose
This course provides a deeper understanding of the operating and monitoring of atmospheric and vacuum distillation units.

### Audience
Engineers, senior operation personnel and technical supervisors interested or involved in the operation, optimization and monitoring of crude oil atmospheric distillation and residue vacuum distillation units.

### Learning Objectives
Upon completion of the course, the participants will be able to:
- Grasp fundamental process control and the impact of each controller on the process and on the characteristics of the cuts produced.
- Analyze desalter operation and corrosion monitoring.
- Detect potential deficiencies by troubleshooting.

### Ways & Means
- Applications, teamwork, case studies and interactive workshops based on typical real situations.
- Possible use of a generic dynamic simulator for crude oil distillation unit operation issues.
- The duration and content of the training course can be customized to the needs of the client site and the profile of the participants.
- Possible contribution of experienced staff reporting his industrial experience of the operation on a daily basis.
- Parts of or whole session adaptable to virtual classroom.

### Learning Assessment
Quiz.

### Prerequisites
The trainee is required to fulfill at least one of the following criteria:
- To have at least 1 year of proven experience in a technical position in a refinery.
- To be in the process of being moved to a position in operation.
- Or to have followed a training course oriented to introduction to the refining.

### More info
Realizado en Español si requerido.

### Expertise & Coordination
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

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### Course Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IMPACT OF CRUDE OIL QUALITY ON PRODUCTS</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Tuning of the volatility of petroleum fractions in view of their end-use: constraints and flexibility of cut points; principal problems related to quality. Crude oils: properties (TBP analysis), product yields, related margins. Main schemes for crude oil fractionation.</td>
<td></td>
</tr>
<tr>
<td><strong>OPERATING CONDITIONS OF AN ATMOSPHERIC &amp; VACUUM DISTILLATION UNITS</strong></td>
<td>2 d</td>
</tr>
<tr>
<td><strong>DESALTING &amp; CORROSION CONTROL</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Corrosion by sulfur, naphthenic acids and mineral salts. Crude oil desalting: purpose, functioning of the desalter, operating variables and troubleshooting. Downstream neutralizing treatment: purpose, advantages and drawbacks. Controlling corrosion at the head of topping column and anticorrosion techniques.</td>
<td></td>
</tr>
<tr>
<td><strong>SAFETY &amp; ENVIRONMENTAL CONCERNS</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td><strong>PROCESS CONTROL, OPERATION &amp; TROUBLESHOOTING OF MULTI-DRAW-OFF COLUMNS</strong></td>
<td>1 d</td>
</tr>
<tr>
<td>Different control systems in atmospheric and vacuum distillation columns, using flowrate, level or temperature control. Cut point control: modification of flowrate of a cut and consequences on the column. Impact of the preflash on the operation of the furnace and atmospheric columns. Separation control: tuning of the separation selectivity, consequences on the column and on the heat recovery system. Influence of pressure and pressure control. Case studies on overall control setup of these two distillation columns and disturbances. Maximizing the performances of the unit under constraints or limit conditions. Start-up - Shutdown - Troubleshooting.</td>
<td></td>
</tr>
<tr>
<td><strong>DISTURBANCES &amp; TROUBLESHOOTING</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Case studies (in groups) related to disturbances and incidents; detection, consequences and corrective actions: Stripping shutdown. Failure of one pumparound pump, of the furnace. Loss of part of the feed, etc.</td>
<td></td>
</tr>
</tbody>
</table>

Reference: DADSV-EN-A ✷ Only available as an In-House course. Contact: rc.contact@ifptraining.com

This course is also available in French: DADSV-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

Catalytic Reforming for Refining & Petrochemicals
Optimization & Troubleshooting

Course Content

THE CATALYTIC REFORMER WITHIN THE REFINERY SCHEME


CATALYTIC REFORMING REACTIONS & CATALYSTS

Review of the characteristics of all the chemical reactions: thermodynamics and kinetics. Influence of the operating parameters on the production of aromatics, hydrogen, octane number, and other yields. Consequences for SR and CCR units. Catalyst properties: role of the acidic and metallic functions, of the support, of the different promoters and their impact on chemical reactions and yields. Water/chlorine balance and management. Poisons and ageing factors. Activity follow up and cycle length prediction for semi-regenerative units. Catalyst regeneration. Management of each step for an optimal activity recovery for SR units. Operating parameters for CCR regeneration loops.

OPERATING PARAMETERS OF A CATALYTIC REFORMER

Process flow diagrams and operating parameters of semi-regenerative (SR) and Continuous Catalyst Regeneration (CCR) units. Main control loops. Typical range of yields. Material balance. Energy consumption. Operating variables: WABT, WAIT, H₂/HC ratio, flow rates, treat gas characteristics. Main equipment and metallurgy. Specific features for low pressure equipment. Moving bed technology, recontacting section, catalyst circulation: lifts, ΔP control, seal legs, nitrogen loops for regeneration, etc. Analysers and process control.

OPERATION & OPTIMIZATION FOR CATALYTIC REFORMING

Monitoring the operating variables and optimization, for semi-regenerative and regenerative units. Operation case studies. Adjusting to changes in feedstocks origins, N+2A. High severity of the CCR towards optimized yield in Aromatics. Performance follow-up. Maximizing the performances of the unit under constraints or limit conditions. Main steps for start-up and shutdown.

TROUBLESHOOTING FOR CATALYTIC REFORMING

Case studies: main symptoms encountered in operation, diagnosis and remedies. Specific troubles of CCR units linked to catalyst circulation and regeneration loops. Catalyst regeneration problems. ESD, main safety sequences.

THE REFORMER IN THE AROMATIC COMPLEX

Outlets and main uses of BX (Benzene, Xylenes), ethylbenzene. Basic scheme to upgrade benzene and paraxylenes. Aromatic loop. Transformation processes involved: hydrodealkylation, disproportionation, transalkylation and isomerization. Associated separation processes. Operating conditions for a typical arrangement.

Reference: REFCAT-EN-A

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: REFCAT-FR-A. Please contact us for more information.

Level: SKILLED

Purpose

This course provides a thorough technical understanding of semi-regenerative and continuous regenerative catalytic reforming processes, for refining and petrochemistry.

Audience

Engineers, senior operations personnel or technical supervisory staff involved in the operation, optimization or monitoring of hydrogen and aromatics production units. Engineers from research centers and engineering companies involved in the different aspects of the operation and process control of these processes.

Learning Objectives

Upon completion of the course, the participants will be able to:
- assess the influence of operating parameters on a unit performance,
- optimize the process to achieve the targeted yield in BTX, from the design to the operation,
- distinguish between the specificities of semi-regenerative and continuously regenerative units, depending on the refining or petrochemistry environment,
- grasp the essence of catalyst regeneration,
- detect potential deficiencies by troubleshooting,
- acquire the best practices for unit start-up, normal operation and shutdown,
- analyze the optimization process options of an aromatic complex.

Ways & Means

- Applications, teamwork, case studies and interactive workshops based on typical real situations.
- The duration and content of the training course can be customized to the needs of the client site and the profile of the participants.
- Possible contribution of experienced staff reporting his industrial experience of the operation on a daily basis.
- Parts of or whole session adaptable to virtual classroom.

Learning Assessment

Quiz.

Prerequisites

The trainee is required to fulfill at least one of the following criteria:
- to have at least 1 year of proven experience in a technical position in a refinery,
- or to be in the process of being moved to a position in operation,
- or to have followed a training course oriented to introduction to the refining.

More info

Realizado en Español si requerido.

Expertise & Coordination

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.
This course can be adapted to virtual classroom mode

Light Gasoline Isomerization
Optimization & Troubleshooting

Level: SKILLED

Purpose

This course provides a thorough understanding of various isomerization processes and how to optimize the operation of this unit, particularly the reaction and recycle sections.

Audience

Engineers, senior operation personnel or technical supervisory staff interested or involved in the operation, optimization and monitoring of octane boosting processes. Engineers from research centers and engineering companies involved in the different aspects of the operation and process control of these units.

Learning Objectives

Upon completion of the course, the participants will be able to:

- assess the influence of operating parameters on a unit performance through an analysis of the catalyst's activity,
- detect potential deficiencies by troubleshooting,
- acquire the best practices for unit start-up, normal operation and shutdown.

Ways & Means

Applications, teamwork, case studies and interactive workshops based on typical real situations.

- The duration and content of the training course can be customized to the needs of the client site and the profile of the participants.
- Possible contribution of experienced staff reporting his industrial experience of the operation on a daily basis.
- Parts of or whole session adaptable to virtual classroom.

Learning Assessment

Quiz.

Prerequisites

The trainee is required to fulfill at least one of the following criteria:

- to have at least 1 year of proven experience in a technical position in a refinery,
- or to be in the process of being moved to a position in operation,
- or to have followed a training course orientated to introduction to the refining.

More info

Realizado en Español si requerido.

Expertise & Coordination

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: ISOM-EN-A  Only available as an In-House course. Contact: rc.contact@ifptraining.com

This course is also available in French: ISOM-FR-A. Please contact us for more information.
Fluid Catalytic Cracking Operation
Optimization & Troubleshooting

Course Content

OVERVIEW OF THE FCC PROCESS
0.25 d
Aim of the fluid catalytic cracking unit and its place in the refining scheme.
Characteristics of the feeds, impact on the process; incentive for conversion of heavy cuts.
Mass balance, characteristics of the products and related treatments.

PLANT TYPICAL BALANCES
0.75 d
Interpretation of the operating parameters:
- Heat balance and catalyst flow rate.
- Cracking conditions: thermal and catalytic severity, impact on operation and products.
- Pressure balance, fluidization and catalyst circulation; ∆P of slide valve and safety.
- Energy balance: heat recovery in the flue gas line and in the bottom pump-around.

FCC OPERATING PARAMETERS IN REACTION SECTION
2 d
The following parameters:
- Different modes of changing the catalyst circulation.
- Control of the cracking temperature.
- Effect of the feed temperature, flowrate and chemical composition.
- Impact of acceleration or stripping steam.
- Pressure monitoring.
are investigated, as well as their effect on balances, Δcoke, regenerator temperature and yields.

CATALYST MONITORING
0.5 d
Catalytic cracking reactions and resulting products.
Catalyst structure and catalyst mode of action.
Catalyst additives: CO promoter, metals scavengers, sulfur trap.

OPERATION & OPTIMIZATION
0.5 d
Different operating situations are analyzed to illustrate: optimization of LCO production; maximization of heavy feed processing under constraint of air flow rate limitation.
Modification of the process for maximization of C3 & C4 olefins production, or maximization of gasoline.

INCIDENTS & TROUBLESHOOTING
1 d
Incidents of heat balance: coke build up, afterburning, lack of coke, etc.
Incidents of pressure balance: low pressure drop, reverse flow, failure of the wet gas compressor.
Incidents on the energy recovery circuits: loss of boiler level, loss of circulation in the bottom pump-around, etc.
Main interlock configurations.

Reference: FCC-EN-P
Only available as an In-House course.
Contact: rc.contact@ifptraining.com
This course is also available in French: FCC-FR-P. Please contact us for more information.
Alkylation (HF or H₂SO₄)

Level: SKILLED

Purpose
This course provides a deeper understanding of alkylation processes: operation, monitoring and optimization.

Audience
Engineers, shift leaders and technical staff interested or involved in the operation of alkylation units.

The technical content of this training course also makes it suitable for the staff of refineries, research centers, oil companies and engineering firms involved in the different aspects of the operation of the alkylation unit.

Learning Objectives
Upon completion of the course, the participants will be able to:
- grasp the exact role of an alkylation unit within the refining scheme,
- analyze the importance and impact of operating parameters on process optimization,
- know about main potential incidents, their origin, consequences and apply preventive measures,
- monitor corrosion problems.

Ways & Means
- The content of this course can be adapted to the customer’s needs. The pedagogy is focused on the units concerned, under cover of a secrecy agreement if necessary.
- Case studies handled in groups, based on typical situations of the sections studied.
- Possible contribution of experienced staff reporting his industrial experience of the operation on a daily basis.

Course Content

<table>
<thead>
<tr>
<th>Course Content</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ALKYLATION PRINCIPLES</td>
<td>0.5 d</td>
</tr>
<tr>
<td>FEED &amp; PRODUCTS</td>
<td>0.5 d</td>
</tr>
<tr>
<td>Origins of the feed: C₃ and C₄ olefinic cuts from FCC. Imposed proportion of olefins and isobutane: alternate sources of isobutane. Impact of the inert components and of the pollutants in the feeds; feed pretreatments. Characteristics of the alkylation: RON, MON, RVP, final point, etc.</td>
<td></td>
</tr>
<tr>
<td>CHEMICAL REACTIONS &amp; CATALYSTS</td>
<td>0.5 d</td>
</tr>
<tr>
<td>Characteristics of the main reactions, side and undesired reactions; influence of the operating parameters. I/O ratio: definition, role, implementation, influence on performance and on energy consumption. Catalysts: hydrofluoric acid (HF) or sulfuric acid (H₂SO₄); respective properties and safety. Impact, performances and consumption of the liquid acid used.</td>
<td></td>
</tr>
<tr>
<td>OPERATING PARAMETERS OF THE REACTION SECTION</td>
<td>1 d</td>
</tr>
<tr>
<td>Alkylation reactor (depending on the catalyst): technology, mixing method and containment. Reactors arrangement and circulation of the fluids inside and outside of the reactors. Importance of mixing the two contacting phases, decantation step and separation. Cooling of the reactors: heat exchange and heat integration. Cryogenic section and pressure control, heat integration. Control of the operating parameters: temperature, I/O ratio, acid composition, acid/HC ratio. Impact of these parameters on operation and optimization bottleneck removal.</td>
<td></td>
</tr>
<tr>
<td>OPERATING PARAMETERS OF SEPARATION SECTION</td>
<td>0.5 d</td>
</tr>
<tr>
<td>Separation of the isobutane recycle, influence of the nC₄ and C₄ content. Separation of the entering nC₄. Role and benefit of a depropanizer for the mass balance.</td>
<td></td>
</tr>
<tr>
<td>OPERATION OF THE NEUTRALIZING SECTION</td>
<td>0.5 d</td>
</tr>
<tr>
<td>Neutralization with caustic solid or liquid (HF). Neutralization with acid: hydrofluoric acid (HF) or sulfuric acid (H₂SO₄).</td>
<td></td>
</tr>
<tr>
<td>OPERATION &amp; TROUBLESHOOTING</td>
<td>0.5 d</td>
</tr>
<tr>
<td>Feed composition, lack of olefins or of isobutane. Optimization: maximizing RON, maximizing production, minimizing acid consumption, etc. Acid consumption: acid composition, acid regeneration (HF) or acid run away (H₂SO₄). Upsets: compressor failure, mechanical failure.</td>
<td></td>
</tr>
</tbody>
</table>

Referenced: ALKY-EN-P
Only available as an In-House course.
Contact: rc.contact@ifptraining.com

This course is also available in French: ALKY-FR-P. Please contact us for more information.

Reference: ALKY-EN-P

Contact: rc.contact@ifptraining.com

www.ifptraining.com
Hydrocracking

Level: SKILLED

Purpose
This course provides a comprehensive understanding of the operating, monitoring and optimizing of hydrocracking units.

Audience
Engineers, shift leaders, senior operation personnel and technical staff interested or involved in the operation of hydrocracking units. The technical content of this training course also makes it suitable for the staff of refineries research centers, oil companies and engineering firms involved in the different operation aspects of this process.

Learning Objectives
Upon completion of the course, the participants will be able to:
► grasp the exact role of a hydrocracking unit regarding to feeds and product’s characteristics,
► analyze the importance and impact of operating parameters on process output,
► identify common potential incidents in the reaction section: origin, consequences, solutions and preventive measures.

Ways & Means
The content of this course can be adapted to the customer’s needs. The pedagogy is focused on the units concerned, under cover of a secrecy agreement if necessary.
► Case studies handled in groups, based on typical situations of the sections studied.
► Possible contribution of experienced staff reporting his industrial experience of the operation on a daily basis.

Learning Assessment
Quiz.

Prerequisites
The trainee is required to fulfill at least one of the following criteria:
► to have at least 1 year of proven experience in a technical position in a refinery,
► or to be in the process of being moved to a position in operation,
► or to have followed a training course orientated to introduction to the refining.

Expertise & Coordination
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

ROLE OF HYDROCRACKING IN THE OVERALL REFINING PROCESS SCHEME
0.5 d
Description of the different units of the hydrocracking complex and interactions with other units. Qualitative and quantitative change in the market of petroleum products, impact of hydrocracking on distillate production and on product blending.

CHEMICAL TRANSFORMATIONS & CATALYSTS
0.5 d
Chemical reactions and catalyst for hydrorefining and hydrocracking: characteristics of reactions for removal of impurities, hydrogenation and decyclization. Composition of the catalyst, mechanism and impact of the operating parameters on hydrogen consumption and activity of the catalyst, exothermicity, poisons, ageing and coking. Monitoring of the exothermicity. Side reactions and additional catalysts.

ANALYSIS OF INDUSTRIAL HYDROCRACKING OPERATING CONDITIONS
1.25 d
Typical process flow diagram of the reaction section and of the fractionation section. Standard operating conditions. Characteristics of the feeds:
- Origin and physical properties.
- Chemical composition and impurities.
- Quality criteria for the operation of the process.
- Characteristics of the hydrogen supply: production, purification, composition. Products of the unit:
- Yields and mass balance, definition of conversion, hydrogen consumption.
- Characteristics of the products: gas, naphtha, kerosene, gas oil.
Specific features of the residue, recycle or treatment. Analysis of the operating conditions in the reaction section: flowrates, pressure, temperature, etc. Study of the operating variables: WABT, quench, hydrogen recycle ratio, hydrogen partial pressure, feed flowrate and space velocity. Characteristics of the equipment:
- Heat exchangers, heaters, reactors, rotating machines, etc.
- Metallurgy, corrosion, analyzers.
Fractionation section: operating conditions, compositions, quality control, tuning parameters.

OPERATION & TROUBLESHOOTING
0.75 d
Process control, analyzers, safety systems. Impact of the operating parameters on yield and product quality, tuning and optimization. Adjusting the operating conditions to compensate for variable feed quality and the ageing of the catalyst, monitoring the activity of the catalyst. Start-up and shutdown. Study of the industrial risks of this operation. Disturbances: nitrogen peak in the cracking zone, drop of feed flowrate, etc. Incidents: temperature run-off, compressor failure, safe shutdown.

Reference: HCK-EN-P
• Only available as an In-House course.
Contact: rc.contact@ifptraining.com

This course is also available in French: HCK-FR-P. Please contact us for more information.
This course can be adapted to virtual classroom mode

Hydrogen Production Unit
Steam Reforming

Level: SKILLED

Purpose
This course provides a deeper understanding of the operating and monitoring of steam reformers.

Audience
Engineers, supervisors and staff interested or involved in the operation of a SMR unit.

Learning Objectives
Upon completion of the course, the participants will be able to:

- analyze the impact of operating parameters on the HPU efficiency through an analysis of the catalyst’s performance,
- know about the effect of various control parameters,
- operate a steam reformer with proper safety measures.

Ways & Means
- The content of this course can be adapted to the customer's needs.
- The pedagogy is focused on the units concerned, under cover of a secrecy agreement if necessary.
- Case studies handled in groups, based on typical situations of the sections studied.
- Possible contribution of experienced staff reporting his industrial experience of the operation on a daily basis.

Learning Assessment
Quiz.

Prerequisites
The trainee is required to fulfill at least one of the following criteria:

- to have at least 1 year of proven experience in a technical position in a refinery,
- or to be in the process of being moved to a position in operation,
- or to have followed a training course oriented to introduction to the refining.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

ANALYSIS OF SMR OPERATING CONDITIONS 1 d
Main hydrogen manufacturing processes.
Objective of the successive steps: desulfurization, steam reforming, CO shift, hydrogen purification.
Process flow scheme.
Material balance, conversion, yields at various steps.
Feedstock and product quality: natural gas, demineralized water, hydrogen quality.
Operating conditions and control loops.
Characteristics of the chemical reactions involved: thermodynamic and kinetic aspects, their consequences on the operation, side reactions and optimum operating conditions to limit their evolution.
Role and mechanism of a catalyst: chemical and physical characteristics, effect of poisoning and ageing.
Influence of operating conditions on hydrogen production and on downstream steps.
Hydrogen purification:
  - Adsorption (PSA) and methanation: comparison of performances.
  - Influence of operating parameters on hydrogen purity, CO2 absorption and amine regeneration.
PSA unit characteristics and operation.

STEAM REFORMER FURNACE OPERATION 0.5 d
Different types of furnaces: technology, furnace efficiency, operating parameters, control and safety loops.
Catalyst loading procedure.
Behavior of the tube bundle. Mechanical and thermal stress.
Routine operation and main operating constraints.

STEAM PRODUCTION 0.25 d
Water preparation: drawbacks arising from impurities in water, water quality measurement, characteristics of feed water, thermal degassing, chemical conditioning of water.

OPERATION & START-UP - DISTURBANCES & TROUBLESHOOTING 0.25 d
Key operating parameters and overall process optimization, interactions between process steps, catalyst cycles management.
Principles of start-up procedure: preparation, ignition, temperature build-up, feed in.
Disturbances: modification of the steam/HC ratio, decrease of feed flowrate, change in feed composition.
Incidents: pretreatment reactor runaway, tube rupture in the furnace, absorption section bypassing.

Reference: VAPOREF-EN-A
Contact: rc.contact@ifptraining.com

This course is also available in French: VAPOREF-FR-A. Please contact us for more information.
H₂S Removal & Sulfur Recovery Processes
Application using CORYS IndissPlus dynamic simulator

Level: SKILLED

Purpose
This course provides a deeper understanding of the operation and the monitoring, including HSE considerations, of common processes for elimination of H₂S and for sulfur recovery.

Audience
Engineers and supervisors involved in operating, troubleshooting, optimizing or revamping sour gas treatment and sulfur recovery facilities.

Learning Objectives
Upon completion of the course, the participants will be able to:
- know about the chemistry, technologies and safety and environmental issues of hydrogen sulfide removal from refinery gas streams,
- analyze the operating parameters of an H₂S conversion train and their impact on NOₓ and SOₓ emissions,
- avoid the most common deficiencies by applying preventive measures.

Ways & Means
- Use of a dynamic simulator for amine and Claus units to simulate operating conditions.
- Parts of or the whole session customizable to a virtual remote classroom.

Learning Assessment
Quiz.

Prerequisites
The trainee is required to fulfill at least one of the following criteria:
- to have at least 1 year of proven experience in a technical position in a refinery,
- or to be in the process of being moved to a position in operation,
- or to have followed a training course orientated to introduction to the refining.

Expertise & Coordination
Skilled chemical engineer.

Course Content

OVERVIEW OF SULFUR REMOVAL & RECOVERY
Amine washing and sulfur recovery units role in refineries.
Nature, origins and compositions of the streams to be treated, ammonia content.
Determination of the sulfur balance for a typical refinery.
Environmental aspects, treatment justification.
0.25 d

AMINE UNITS
Chemical reaction between amines and H₂S.
Process flow sheet and equipment review: absorption, regeneration, pumps and filtration.
Process control: pressures, temperatures, amine solution optimization, steam flowrate to regenerator optimization.
Regeneration quality: objectives, follow-up methods, and performance impacts.
Troubleshooting: amine solution degradation, foaming, corrosion, washing quality follow-up.
Safety issues.
Application: what you can learn from your amine analysis (routine and detailed).
0.75 d

SULFUR RECOVERY UNITS
Chemical reactions: required and undesired ones, thermodynamics and kinetics.
Process flow sheet: thermal stage, catalytic stage, sulfur recovery, tail gas incineration. Operating parameters and impact on sulfur yield.
Process control: H₂S/SO₂ ratio control, air flowrate optimization, tail gas analyzer, warming up techniques and temperature control at the converters.
Troubleshooting: hydrocarbons presence, sulfur behavior as per temperature, H₂S degassing from sulfur product, safety.
Shutdown situations and consequences, safety issues, ISS.
Use of a dynamic simulator to illustrate the impact of parameter changes.
1 d

TAIL GAS CLEAN-UP PROCESSES
Process flow schemes: sub-dewpoint Claus or amine route.
Operating parameters and impact on process and sulfur yields.
Influence of the H₂S/SO₂ ratio.
Sources of usual operation troubles for each process: improper regeneration, catalyst ageing…
Impact on the CLAUS unit optimization.
0.75 d

SOUR WATER STRIPPER OFF-GAS TREATMENT
Sour water characteristics. Ammonia content. Ammonia conversion and NOₓ monitoring.
Principle, main equipment, operating parameters, water quality follow-up.
0.25 d

Reference: PFCS-EN-P
This course is also available in French: PFCS-FR-A. Please contact us for more information.

Contact: rc.contact@ifptraining.com

Only available as an In-House course.
Visbreaking

**Level:** SKILLED

**Purpose**
This course provides a comprehensive understanding of the operation of visbreaking units.

**Audience**
Operators, control panel operators, supervisors and personnel from refineries, research centers and engineering companies interested or involved in visbreaking.

**Learning Objectives**
Upon completion of the course, the participants will be able to:
- understand the stability and compatibility properties of residues,
- know about the processing parameters, especially those of the furnace and the fractionation,
- seize the relationship between operating conditions and residue’s stability.

**Ways & Means**
Applications, case studies based on typical industrial situations.

**Learning Assessment**
Quiz.

**Prerequisites**
The trainee is required to fulfill at least one of the following criteria:
- to have at least 1 year of proven experience in a technical position in a refinery,
- to be in the process of being moved to a position in operation,
- to have followed a training course orientated to introduction to the refining.

**Expertise & Coordination**
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

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<tr>
<td><strong>VISBREAKING PROCESS &amp; FEEDSTOCKS</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td><strong>THERMAL CRACKING REACTIONS</strong></td>
<td>0.25 d</td>
</tr>
<tr>
<td>Characteristics of primary cracking reactions and secondary reactions. Reactivity of the different families of hydrocarbons. Influence of the nature of the feedstock. Parameters influencing the severity: temperature, residence time. Role and influence of the soaker. Changes in the various families of hydrocarbons present in the feedstock: saturated compounds, aromatics, resins, asphaltenes.</td>
<td></td>
</tr>
<tr>
<td><strong>PRODUCTS OF THE VISBREAKING UNIT</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td><strong>ANALYSIS OF THE WORKING CONDITIONS OF A VISBREAKING UNIT</strong></td>
<td>0.75 d</td>
</tr>
<tr>
<td><strong>OPERATION OF THE UNIT</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td><strong>INCIDENTS &amp; TROUBLESHOOTING</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Special operating precautions. Safety. Incidents: furnace failure, vacuum system failure, failure of quench pump or of cracked vacuum residue pump. Troubleshooting: excess of coking in furnace or at the bottom of the fractionator. Emergency shut down and flushing, ISS.</td>
<td></td>
</tr>
</tbody>
</table>

Reference: VISCO-EN-P  Only available as an In-House course. Contact: rc.contact@ifptraining.com

This course is also available in French: VISCO-FR-P. Please contact us for more information.
# Cokefaction

**Level:** SKILLED

**Purpose**
This course provides a thorough understanding of the operating and monitoring of a coker.

**Audience**
Engineers, panel operators, shift leaders and staff interested or involved in cokefaction.
The technical content of this training course also makes it suitable for the staff of refineries, research centers, oil companies and engineering firms concerned by the different operation aspects of this process.

**Learning Objectives**
Upon completion of the course, the participants will be able to:
- grasp the relationship between the cracking process and the operation of a coker,
- analyze the importance and impact of operating parameters,
- avoid the most common incidents by applying corrective measures.

**Ways & Means**
Applications, case studies based on typical industrial situations.

**Learning Assessment**
Individual quiz.

**Prerequisites**
The trainee is required to fulfill at least one of the following criteria:
- to have at least 1 year of proven experience in a technical position in a refinery,
- or to be in the process of being moved to a position in operation,
- or to have followed a training course orientated to introduction to the refining.

**Expertise & Coordination**
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

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## Course Content

<table>
<thead>
<tr>
<th>Role of the Coker Complex in the Refinery</th>
<th>0.5 d</th>
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</thead>
<tbody>
<tr>
<td><strong>ROLE OF THE COKER COMPLEX IN THE REFINERY</strong></td>
<td></td>
</tr>
<tr>
<td>Heavy cuts in the refinery: origins, nature, characteristics and composition.</td>
<td></td>
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<tr>
<td>Basic features of coker units compared to other conversion processes.</td>
<td></td>
</tr>
<tr>
<td>Delayed coker and differences with other coking processes: flexicoker and fluidcoker.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical Aspects of Cracking</th>
<th>0.25 d</th>
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</thead>
<tbody>
<tr>
<td><strong>CHEMICAL ASPECTS OF CRACKING</strong></td>
<td></td>
</tr>
<tr>
<td>Characteristics of primary and secondary cracking, reactions of different hydrocarbons.</td>
<td></td>
</tr>
<tr>
<td>Parameters influencing the severity of cracking: temperature, residence time, pressure, feed quality, etc.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Analysis of Industrial Operating Conditions</th>
<th>0.5 d</th>
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</thead>
<tbody>
<tr>
<td><strong>ANALYSIS OF INDUSTRIAL OPERATING CONDITIONS</strong></td>
<td></td>
</tr>
<tr>
<td>Process flow diagram and example of a delayed coker unit with operating conditions and control setup.</td>
<td></td>
</tr>
<tr>
<td>Impact of operating parameters on products and on coke production.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation of the Delayed Coker Drums</th>
<th>0.75 d</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATION OF THE DELAYED COKER DRUMS</strong></td>
<td></td>
</tr>
<tr>
<td>Successive steps of a cycle: filling of live drum, switch out and steam out, quench, draining, unheading, cutting and decoking, reheading and testing, preheating, switch in.</td>
<td></td>
</tr>
<tr>
<td>Parameters having an impact on the duration of each step and time saving details.</td>
<td></td>
</tr>
<tr>
<td>Monitoring of the block valves.</td>
<td></td>
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<tr>
<td>Cutting equipment: technology and operation.</td>
<td></td>
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<tr>
<td>Safety related issues.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Products &amp; Related Treatments</th>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRODUCTS &amp; RELATED TREATMENTS</strong></td>
<td></td>
</tr>
<tr>
<td>Fractionation operation and switch management.</td>
<td></td>
</tr>
<tr>
<td>Gas plant and light ends separation.</td>
<td></td>
</tr>
<tr>
<td>Naphtha and gasoil fractionation. Hydrotreatment, hydrogen management.</td>
<td></td>
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<tr>
<td>Different types of coke, characteristics, handling and storage.</td>
<td></td>
</tr>
<tr>
<td>Water handling, treatment and recycle.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Incidents, Troubleshooting &amp; Solutions</th>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INCIDENTS, TROUBLESHOOTING &amp; SOLUTIONS</strong></td>
<td></td>
</tr>
<tr>
<td>Main incidents: foamover causes and consequences, longer cycles, coking phenomena outside the drums, misoperation of one block valve.</td>
<td></td>
</tr>
<tr>
<td>Consequences and classic solutions for these incidents.</td>
<td></td>
</tr>
</tbody>
</table>

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Reference: COKER-EN-P

Only available as an In-House course.

Contact: rc.contact@ifptraining.com
# Extra Heavy Crude Oil Upgrading

## Course Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CRUDE OIL PROPERTIES</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Main physical and chemical properties and standard tests of crude oils. Extra heavy crude properties in contrast to classical crude oils.</td>
<td></td>
</tr>
<tr>
<td><strong>UPGRADER PRINCIPLES &amp; OBJECTIVES</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Production, fluidification and transportation of extra heavy crude oils. Different ways to upgrade heavy crude oils. Overview of an upgrader, role and purposes of the different processes.</td>
<td></td>
</tr>
<tr>
<td><strong>ATMOSPHERIC &amp; VACUUM DISTILLATION</strong></td>
<td>0.75 d</td>
</tr>
<tr>
<td>Upgrader distillation units: principles of distillation, capacity, process flowsheets. Atmospheric and vacuum distillation unit: operating conditions, material balance, energy consumption and heat recovery, tower and equipment characteristics.</td>
<td></td>
</tr>
<tr>
<td><strong>THERMAL CONVERSION UNITS: VISBREAKING &amp; DELAYED COKING</strong></td>
<td>1 d</td>
</tr>
<tr>
<td>Heavy cuts thermal conversion processes. Visbreaking: feed and products, process flow diagram, operating conditions; specific equipment: furnace, soaker, separation section, stability of heavy cracked fuel oils.</td>
<td></td>
</tr>
<tr>
<td><strong>UPGRADER HYDROTREATMENTS TO PROCESS NAPHTHA &amp; DISTILLATE</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Origin of feeds and related characteristics. Hydrotreatment chemical reactions and hydrogen consumption.</td>
<td></td>
</tr>
<tr>
<td><strong>UPGRADER HYDROCRACKER (HCK) OR MILD HYDROCRACKER (MHC)</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Main methods of cracking heavy cuts: thermal, catalytic and hydrocracking processes. Specific hydrocracking chemical reactions: exothermicity, hydrogen consumption.</td>
<td></td>
</tr>
<tr>
<td><strong>HYDROGEN MANUFACTURING PLANTS</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Different processes for hydrogen production (SMR and POX). Steam methane reforming (SMR): material balance, feed and products, preliminary desulfurization and sulfur trap, chemical reactions, catalysts, process scheme, operating conditions.</td>
<td></td>
</tr>
<tr>
<td><strong>H2S REMOVAL &amp; SULFUR RECOVERY PROCESS</strong></td>
<td>0.25 d</td>
</tr>
<tr>
<td>Overview of sulfur removal and recovery. Amine processes: process flow scheme and operating conditions, safety issues.</td>
<td></td>
</tr>
<tr>
<td><strong>OTHER CONVERSION PROCESSES</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Deasphalting units: vacuum residues structure and properties; deasphalting principles: different deasphalting solvents, overall flow sheet, operating conditions; integration of deasphalting units in conversion schemes.</td>
<td></td>
</tr>
</tbody>
</table>

## Learning Objectives

Upon completion of the course, the participants will be able to:
- Know about various extra heavy crude oils and heavy cuts for processing.
- Understand the role of different units in a heavy crude upgrading plant.
- Acquire a good understanding of the operation of these units and the specific features related to extra heavy crude oil processing.

## Prerequisites

To fulfill at least one of the following criteria:
- To have 1 year’s of proven professional experience in the refining industry.
- To be in the process of being moved to a position in a unit processing heavy oils.

## Expertise & Coordination

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.
This course can be adapted to virtual classroom mode - Advanced Certificate

Base Chemicals & Polymers Manufacturing*

Level: EXPERT

Purpose
This course provides a comprehensive understanding of practical expertise in monomer manufacturing, polymerization processes, market and products, storage and transport of products, with attention to environmental, safety, quality and economic issues.

Audience
Engineers interested in a foundation training on polymers.

Learning Objectives
Upon completion of the course, the participants will be able to:
- participate in studies involving the design, sizing and economics of processes used in the refining, petrochemicals, polymers and plastics sectors,
- acquire the know-how for a position in production,
- acquire a thorough knowledge of industrial incidents and related safety and environmental issues,
- grasp the essence of the collaboration between R&D and Production departments,
- analyze the quality of manufactured products,
- understand the relationship between suppliers and manufacturers in the plastic’s chain.

Ways & Means
- Case studies based on industrial situations.
- Visits to industrial sites.

Learning Assessment
Quiz.

Prerequisites
A degree corresponding to 4 or 5 years of higher education, such as a French ‘Diplôme d’ingénieur’ (in 5 years), an American BSc (in 4 years), or another equivalent degree.

Why an IFP Training Certification?
- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Base Chemicals & Polymers Manufacturing*.
- Ready-to-use skills.

More info
Locations:
- Rueil-Malmaison (Paris)
- Ferrara (Italy)
- Alençon (France)
* This program is the second part of a 16-month Master degree program at IFP school. It is highly recommended that participants be familiar with topics covered in the course “Applied Chemical Engineering for the Refining and Petrochemical Industries” (refer to GCA/ACE).

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content 80 days

BASE CHEMICALS & MONOMERS MANUFACTURING 6 d
First and second generation monomers.
Interaction between refining and petrochemical.
Technical visit of an industrial plant (if possible).

POLYMER CHEMISTRY & POLYMERIZATION REACTION ENGINEERING 4 d
Fundamentals of radical, ionic, catalytic…, polymerization.
Polymer reaction engineering.

ENGINEERING IN PETROCHEMICAL PROCESSES 13 d
Description of the main steps of a polymer project and methodology for organizing the sustainably safe and clean operation of petrochemical plants (HAZOP studies).
Corrosion and materials.
A PFD/PID project is organized with the support of an engineering company.

COMMODITY PLASTICS 15 d
Chain value and manufacturing processes: polymerization reactions, unit description, main operating parameters, technical evolution of processes, troubleshooting, main producers, market trends, economics.
A period of one week in Italy is organized with lectures, case studies and plant visits: development of a product (PP) and associated process, main characteristics of PP, industrial manufacturing process, main relations between the operating parameters and final characteristics of the product.

MAIN ENGINEERING & HIGH PERFORMANCE PLASTICS 5 d
Specificities, advantages and drawbacks of standard polymers compared to engineering and high performance plastics.
Discuss the inter-polymer competition.

RISK MANAGEMENT 6 d
Methodology for organizing a sustainably safe and clean operation of a petrochemical plant.
Reaction run-away and run-away prevention, powder explosions. How to handle toxic chemicals.

SUSTAINABLE DEVELOPMENT IN PETROCHEMICALS 7 d
Energy efficiency of the processes.
Bio polymers and polymers environment.
Regulatory affairs and chemical health effects.

OVERVIEW OF POLYMER PROCESSING(1) 9 d
Structure of polymer processing industry.
Various processing technologies.
Optimum technico-economical selection of material during final product development.
Resin specifications, process control and quality control.
(1) 5 days are spent at the “Institut Supérieur de la Plasturgie”, in Alençon - France (ISPA).

ELECTIVE COURSES: PETROCHEMICAL ECONOMICS OR PRODUCTION SUPPLY CHAIN 15 d
Petrochemical economics:
- General economics, competitor analysis, benchmarking.
- A project deals with the conceptual study of a new petrochemical plant project.
Production supply chain:
- Logistics and transportation.
- A project deals with the design of a finishing section of a polyolefin plant.

Reference: PPM-EN-A - Can be organized as an In-House course.
Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
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</thead>
<tbody>
<tr>
<td>Rueil-Malmaison</td>
<td>1 March</td>
<td>25 June</td>
<td>£21,630</td>
</tr>
</tbody>
</table>
Production of Paraxylene - Aromatic Plant

Course Content

SOURCES, OUTLETS & MAIN INDUSTRIAL USES OF AROMATIC INTERMEDIATES  
0.25 d
Main sources: catalytic reforming, steamcracker, coke oven gases. Outlet and main uses of: benzene, toluene, ethylbenzene and xylenes.

AROMATICS COMPLEX SCHEMES  
0.25 d
Available layouts related to downstream markets. Naphtha to paraxylene typical scheme. Alternate schemes.

AROMATICS ORIENTED CATALYTIC REFORMING  
1 d

AROMATICS - NON AROMATICS SEPARATION PROCESSES  
0.75 d
Liquid-liquid extraction. Extractive distillation: basic principle and applications in the petrochemical industry - Benzene Recovery Unit. Advantages and drawbacks of both techniques. Available technologies.

SEPARATION OF AROMATICS BY CARBON NUMBER  
0.25 d
Standard distillation: benzene and toluene fractionation columns, xylenes rerun column, orthoxylene splitter, heavy aromatics column.

AROMATICS TRANSFORMATION  
0.75 d
Overview of the aromatics transformation processes: hydrodealkylation, disproportionation, transalkylation, isomerization and toluene methylation. Available technologies: focus on XyMax and TransPlus technologies. Case study on several aromatics production typical schemes.

C8 AROMATICS SEPARATION  
0.25 d
Crystallization. Adsorption on solid (application to xylenes separation).

PARAXYLENE RECOVERY UNIT  
1.25 d
Principles and details of the ELUXYL process: role of equipment; adsorption technique (solid specificity, solid behavior); main operating parameters. Downstream separation: extract, raffinate, paraxylene purification, solvent rerun columns. Available technologies: PAREX.

TREATMENT OF THE PYROLYSIS GASOLINE FROM THE STEAMCRACKER  
0.25 d

Reference: AROE-EN-P  Can be organized as an In-House course. Contact: rc.contact@ifptraining.com

Location Start Date End Date Tuition Fees excl. VAT
Rueil-Malmaison 6 September 10 September €3,240
Cracking & Chemical Treatments of Purification

Level: SKILLED

Purpose
This course brings technical information on the steamcracker sections focused on chemical transformations: feed cracking, cracked gas purification, hydrogenations or purification stages on a solid (drying).

Audience
Operating personnel in steamcracking plants: experienced filed operators, panel operators, shift leaders and all technicians involved in the operation of these sections.

Learning Objectives
Upon completion of the course, participants will be able to:
- analyze chemical or physico-chemical phenomena involved in the different sections of the steamcracker, in order to solve problems in case of incidents,
- explain the meaning of the main operating parameters of these processes and the influence of operating variables.

Ways & Means
- The content of this course can be adapted to the customer’s needs. The pedagogy is focused on the units concerned, under cover of a secrecy agreement if necessary.
- Case studies done in groups based on typical running situations presented in the course.
- Possible contribution of experienced staff in the daily operation of the plant.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have 1 year of proven professional experience in a steamcracker complex,
- or to be in the process of moving to a position linked to operation in a steamcracker complex.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content 5 days

<table>
<thead>
<tr>
<th>Block</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>Block Diagram of the Steamcracker Unit</td>
<td>0.25 d</td>
</tr>
<tr>
<td>Main Petrochemical Intermediates</td>
<td>0.25 d</td>
</tr>
<tr>
<td>Chemical Reactions &amp; Catalysis</td>
<td>1 d</td>
</tr>
<tr>
<td>Steamcracking</td>
<td>1 d</td>
</tr>
<tr>
<td>Cracked Gases Purification</td>
<td>0.25 d</td>
</tr>
<tr>
<td>Drying of Cracked Gases</td>
<td>0.25 d</td>
</tr>
<tr>
<td>Treatments with Hydrogen</td>
<td>1.5 d</td>
</tr>
<tr>
<td>Disturbances - Incidents</td>
<td>0.5 d</td>
</tr>
</tbody>
</table>

Nota: these basic elements have been provided throughout the course as they enhance the understanding of the different topics.

Nota: this part is delivered through case studies and analysis of feedback of on-site incidents.

Reference: RCIVAPO-EN-P

This course is also available in French: RCIVAPO-FR-P. Please contact us for more information.

Contact: rc.contact@ifptraining.com

Only available as an In-House course.

This course is also available in French: RCIVAPO-FR-P. Please contact us for more information.
Selective Hydrogenation of the Steamcracker

Level: SKILLED

Purpose
To improve the knowledge of the selective hydrogenation processes of C2, C3, C4 cuts and pyrolysis gasolines (Pygas) for better controlling the operation.

Audience
Operating personnel of the steam cracker manufacturing units: experienced operators, panel operators, shift leaders and all technicians involved in the operation of these sections.

Learning Objectives
Upon completion of the course, the participants will be able to:
- justify the importance of these sections,
- explain the meaning of the main operating parameters of these processes and the influence of the operating variables.

Ways & Means
- The content of this course can be adapted to the customer’s needs.
- The pedagogy is focused on the units concerned, under cover of a secrecy agreement if necessary.
- Case studies handled in groups, based on typical situations of conduct of the sections studied.
- Possible contribution of experienced staff reporting his industrial experience of the operation on a daily basis.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have 1 year of proven professional experience in a steamcracker complex,
- or to be in the process of moving to a position linked to operation in an steamcracker complex.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

SELECTIVE HYDROGENATION OF THE C2 CUT
1.25 d
Origin, characteristics and valuation of the C2 cut: origin and physical state of the cut, average composition, specifications of ethylene produced.
Identification of the impurity to be removed. Selection of the implementation of the treatment in relation to the nature of the impurity.
Location and operating principle of the selective hydrogenation section within the steamcracker: arrangement of the reactors, characteristics of the reactions involved in the process.
Nature, properties and mechanism of action of the catalyst: typical composition, activity, selectivity, main steps of the catalytic act, main well-known poisons (carbon monoxide, hydrogen sulfide, green oils...).
Analysis of the operating conditions: simplified process flow diagram (main process control loops, standard operating conditions, available analyzers) - Operating parameters (composition of the feedstock and hydrogen-rich gas, associated flow rates, CO content, molar ratio H2/acetylene, pressure, start-up temperature and Δt of the reactor...) - Performance monitoring (conversion rate, ethylene gain) - Analysis of some schematics of the DCS.
Case studies of adjustment: materialization of the evolution of the process using defined steps according to the variation of operating variables - Possible optimization points.
Possible major incidents, process safety and associated procedures.

SELECTIVE HYDROGENATION OF THE C3 CUT
0.5 d
Origin, characteristics and valuation of the cut C3: origin and physical state of the cut, average composition, specifications of the propylene produced.
Identification of the impurities to be removed. Selection of the implementation of the treatment in relation to the nature of the impurities.
Description of the main differences between the selective hydrogenation of the C2 section and that of the C3 section: location of the section, reactions involved, catalyst.
Simplified process flow diagram, operating conditions, driving parameters, performance monitoring, digital driving overviews and associated modules.
Case studies on the tuning of the unit: evolution of the process further to the modification of operating variables according to reference adjustments - Possible optimization points.
Possible major incidents, process safety and associated procedures.

SELECTIVE HYDROGENATION OF THE C4 CUT
0.5 d
Origin, characteristics and valuation of the cut C4: origin and physical state of the cut, average composition, specifications of the butadiene 1-3 produced.
Identification of the impurities to be removed, associated constraints - Simplified process flow diagram.
The main differences between the selective hydrogenation of the C4 cut and those of the C2 and C3 cuts.
Operating conditions and performances.
Process safety and associated procedures.

TREATMENT OF PYROLYSIS GASOLINES BY HYDROGENATION
0.75 d
Origin, characteristics and valuation of the Pygas cut (Pygas): origin and physical state of the cut, average composition.
Identification of the impurities to be eliminated, associated constraints - Simplified process flow diagram.
Selective hydrogenation 1st stage.
Types of catalysts according to the content and nature of the sulfur compounds of the feedstock.
Operating conditions and performance measurement.
Process safety and associated procedures.
Hydrogenation 2nd stage.
Role of section.
Types of catalysts.
Operating conditions and performance.

Reference: HYDVAPO-EN-P
Only available as an In-House course.
Contact: rc.contact@ifptraining.com

www.ifptraining.com
Extractive Distillation

Course Content

SOLVENT EFFECT ON VAPOR-LIQUID EQUILIBRIA 0.75 d
Typical composition of cuts to be processes: C₄ and C₆ cuts of a steamcracker or other units. Natural volatility of compounds and focus on impurities to be removed, highlighting constraints and available processes. Action of the solvent and effects on relative volatilities of the compounds to be separated. Effects of pressure, solvent ratio and feed composition.

BEHAVIOR OF AN EXTRACTIVE DISTILLATION COLUMN 0.75 d

DOWNSTREAM PROCESSES 0.5 d
Solvent recovery system and purification. Make-up of solvent and adjustment of its composition in the solvent loop. Superfractionation if needed.

OPERATING VARIABLES OF AN EXTRACTIVE DISTILLATION COLUMN 0.5 d
Instrumentation and process control scheme. Meaning of controlled parameters. Impact of the modification of: solvent ratio, reboiler ratio, solvent composition and temperature and other parameters depending on the process configuration. Consequences on the yields, the composition of products and the energy consumption.

TROUBLESHOOTING & PROCESS INCIDENTS 0.5 d
Solvent: decrease in flowrate, temperature modification, regeneration failure. Feed: unexpected change in flowrate or composition.
Commodity Polymers Manufacturing

Course Content

POLYMER TYPES & NATURE
Polymer constitution: monomers, macromolecules, building blocks.
Various kinds of polymer: fibers, elastomers, plastics.
Plastic types: thermoplastics and thermosets.
Main commodity polymers: polyethylenes, polypropylenes, polystyrenes and polyvinylchloride.
Economical aspects relating to these commodity polymers.

POLYMER PRODUCTION - ASSOCIATED PROPERTIES
Main polymerization reactions: polyaddition, polycondensation.
Basic characteristics of polymer reactions: heat of reaction, activation mode, etc.
Different arrangements of monomer building blocks in polyaddition: atactic, syndiotactic or isotactic polymers;
random block; graft; alternate polymers.
Relationship between end uses implementation and main polymer properties. Impact on properties.
Main tests used to get polymer characterization: melt index, viscosity index, etc. Test signification, relationship
with polymer structure.
Consequences regarding polymer implementation techniques (extrusion, injection, etc.).

POLYMERIZATION IMPLEMENTATION - MAIN COMMODITY PLASTIC PROCESSES
Techniques implemented to produce polymers: solution, bulk, emulsion, suspension, gas phase techniques.
Advantages and drawbacks of those different techniques consequences on processes implementation.
Examples applied to the main processes used to manufacture the major thermoplastics: polyethylenes (PE),
polypropylenes (PP), polystyrenes (PS) and polyvinylchloride (PVC).
Flow charts and principles of processes. Some typical operating conditions.
Influence of operating parameters (temperatures, pressures, monomers ratio and proportion of any chemicals
involved in the reaction) regarding the quality of polymer obtained.
Some pretreatments of polymers outside the reactor before the transformation step.

Ways & Means
This course can be adapted for distance learning.
Presentation of polymer samples from the manufacturing plants.
Presentation of end uses application samples.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have 3 months of proven professional experience in the refining or
petrochemical industry,
- or to have followed a training course orientated to introduction to the
petrochemical environment.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained
to adult teaching methods, and whose competencies are kept up-to-date.
Polymers Fundamentals & Rheology

Level: KNOWLEDGE

Purpose
This course provides a global knowledge of polymers science and a technical understanding of polymers behavior.

Audience
Professionals interested in properties and rheology of polymers.

Learning Objectives
Upon completion of the course, the participants will be able to:
- list the different reactions of polymerization,
- grasp the principles of polymerization techniques and the main characteristics of manufactured polymers,
- know more about the polymer properties,
- check the specified properties with the adapted characterization techniques,
- discuss the operating parameters of polymer processing.

Ways & Means
- Detailed course material.
- Case study on polymer properties.
- Videos to illustrate the different methods of characterization.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have 3 months of proven professional experience in the refining or petrochemical industry,
- or to have followed a training course oriented to introduction to the petrochemical environment.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

POLYMER REACTIONS
Step reaction - Chain reaction - Addition - Condensation.
Main characteristics of polymerization reactions: reaction enthalpy, polymerization initiation and termination.

POLYMER CHARACTERISTICS - MACROMOLECULAR CHAIN LENGTH & MOLECULAR WEIGHT
Number average - Weight average.
Measurement systems: Gel Permeation Chromatography (GPC), solution and melt (intrinsic) viscosity - Molecular weight distribution - Polydispersity index.

POLYMER CHARACTERISTICS - POLYMER MORPHOLOGY
Intermolecular forces - Stereochemistry.
Amorphous phase - Crystalline phase.
Chemical cross linking - Physical cross linking.
Homopolymers and copolymers: random copolymer, alternating copolymer and graft copolymers.

POLYMER PROPERTIES
Density.
Thermal properties - Glass transition temperature (Tg), melting point (Tm), crystallization, degradation.
Mechanical properties - Stress, strain, modulus, toughness.
Chemical resistance - Hydrophobic, hydrophilic properties.
Electrical properties.

CHARACTERIZATION TECHNIQUES
Surface and identification analyses - Atomic Force Microscopy (AFM), Infrared (FTIR).
Melt flowability - Melt Flow Index.
Thermal properties - Differential Scanning Calorimetry (DSC), Thermal Gravimetric Analysis (TGA), Dynamic Mechanical Analysis (DMA), Heat Distortion Temperature (HDT), Vicat.
Mechanical properties - Tensile strength, Charpy and Izod impact resistance.
Chemical resistance.
Electrical-insulation, volume and surface resistivity, dielectric strength.

RHEOLOGY OF POLYMERS PROCESSING
Basic rheological aspects of polymers melt.
Influence of operating conditions (P, T…) on the rheology of polymer processing.

Reference: POLYK-EN-P
Only available as an In-House course.
Contact: rc.contact@ifptraining.com
Polymer Reaction Engineering

Course Content

POLYMER CHEMISTRY & CHARACTERIZATION  1 d

Chain growth versus step growth polymerization. Polymer characteristics and morphology. Characterization methods relevant to industrial polymerization: molecular weight distribution, melt index, intrinsic viscosity, nuclear magnetic resonance, gel permeation chromatography, light scattering.

FROM MONOMER TO POLYMER  2 d
Definition of polymer reaction engineering. Place of the reactor in the whole process. Operation constraints. Type of industrial polymerization reactors. Comparison of bulk, solution, suspension, emulsion polymerization processes, with examples of industrial licenses. Case study: PE gas phase production in fluidized bed reactors.

Ways & Means
Detailed course material with pictures, videos and animation. Non-confidential information about licenses available in the market.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
► have a Master degree or equivalent,
► or at least 3 months of proven experience in a technical position related to the development or improvement of processes in the petrochemical industry,
► or in the process of moving towards a position involved in the development or improvement of polymerization processes.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: POLYENG-EN-P  Only available as an In-House course.  Contact: rc.contact@ifptraining.com

www.ifptraining.com
Main Polymers PE/PP/PS

Level: SKILLED

Purpose
To provide comprehensive information on polymers and polymerization processes used to produce polyethylenes, polypropylenes and polystyrene.

Audience
Engineers and technical staff interested in the manufacturing of commodity polymers.

Learning Objectives
Upon completion of the course, the participants will be able to:
- understand the global technical and economical structure of commodity polymers, by far the biggest outlet of petrochemistry,
- master the link between product slate and process selection in function of company marketing strategy,
- know the main industrial commodity polymers processes available for licensing, and their main characteristics,
- be aware of the main industrial safety and operational problems.

Ways & Means
Applications and case studies treated in small groups, based on typical situations encountered in the normal or unsettled operation of these units.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have a Master degree or equivalent,
- or to have a proven professional experience of 1 year related to a polymerization unit,
- or to be in the process of moving towards a technical position related to the manufacturing of commodity polymers.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

MAJOR POLYMERS
Various polymer families: commodities, engineering, high performance polymers.

0.5 d

History of polyethylene development.

History of polypropylene development, the youngest of all commodity polymers. Various types of grades (homo, block, random, isotactic, syndiotactic, atactic...); their main applications.


Fixed and variable cost for site production and outside logistics.

Polymer pricing mechanisms. Notion of economical spread. Explanations of the causes of polymers wide price fluctuations.

CATALYTIC SYSTEMS USED FOR POLYOLEFINS PRODUCTION
Review of the various types of catalytic systems for polyolefins.

0.5 d

Mass and heat transfer in the heterophasic polymerization of polyolefins.

Multigrain model of the growing particles and variations around this model.

IMPLEMENTATION OF POLYMERIZATION - MAIN POLYETHYLENE & POLYPROPYLENE PROCESSES
Techniques implemented in polymers production: solution, bulk, emulsion, suspension or slurry, gas phase.

1 d

Advantages and drawbacks of these techniques, consequences for process implementation.

Main processes involved in production of polyethylene and polypropylene. Basic schemes and average operating conditions. Influence of operating parameters (temperature, pressure, reactants proportion) on product quality.

POLYETHYLENES - POLYPROPYLENES & OTHER COMMODITY POLYMERS
General presentation of high pressure and low pressure polyethylene processes, with the various types of polymers grades they can produce. Low, medium, high, ultra-low density...; narrow, broad molecular weight distribution; low, high melt indexes...

2.5 d

Main applications per family of grades.

High pressure processes. Heat transfer in reactors and conversion rate. Comparison of autoclave, tubular mono-injection, tubular multiple injection reactors; consequences on product quality. Specific equipment technology used in HPPE (hypercompressors, letdown valve...).

Safety risks associated with ethylene decomposition.

Main low pressure catalytic processes. Main characteristics of catalyst and reactor types. Which market do they serve? Announced developments.

Various polymerization processes available for polypropylene production (gas phase, loop, liquid pool...). Staged polymerization for broad molecular weight distribution and impact copolymers. New development with single reactor double reaction zone.


Main safety issues. Catalyst killing system in case of emergency.

POLYSTYRENE PROCESSES
Main design and operation characteristics.

0.5 d

How to treat run-away in case of thermal initiation.

Reference: MAIPOLY-EN-P

Only available as an In-House course.

Contact: rc.contact@ifptraining.com
This course can be adapted to virtual classroom mode

Ethylene Compression & Hypercompression

Level: SKILLED

Purpose
This course provides a comprehensive understanding of ethylene compression related to compressors technology, operation and efficiency.

Audience
Engineers and technical staff (operation, maintenance and/or engineering) interested or involved in ethylene compression.

Learning Objectives
Upon completion of the course, the participants will be able to:
- master the technology and operation of ethylene compressors,
- understand the basic design in relation to ethylene compression operating conditions,
- monitor and optimize the performance of compressors,
- identify most common failure modes and corrective measures.

Ways & Means
- Study of actual cases based on industrial situations.
- Various illustrations of actual systems.
- Display of components of compressors.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have a proven professional experience of 1 year related to the operation of an ethylene polymerization unit,
- or to be in the process of moving towards a technical position related to the operation of a PE unit.

Expertise & Coordination
All IFP Training lecturers are experts in the course technical domain, and trained to pedagogical methods for adults.

Course Content

<table>
<thead>
<tr>
<th>Course Content</th>
<th>Duration</th>
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<tbody>
<tr>
<td>ETHYLENE BEHAVIOR DURING COMPRESSION</td>
<td>1 d</td>
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</table>

| PRIMARY COMPRESSORS BEHAVIOR & OPERATION | 1 d |

| HYPERCOMPRESSORS BEHAVIOR & OPERATION | 1 d |

| TECHNOLOGY OF PRIMARY COMPRESSORS | 0.5 d |

| TECHNOLOGY OF HYPERCOMPRESSORS | 0.5 d |

Reference: ETHCO-EN-A  Only available as an In-House course. Contact: rc.contact@ifptraining.com
This course is also available in French: ETHCO-FR-P. Please contact us for more information.

www.ifptraining.com
From Chlorine to PVC: Production Processes

Level: SKILLED

Purpose
This course provides comprehensive technical information on chlorine and PVC processes and characteristics, enabling a rapid immersion in the chlorochemistry industry.

Audience
Professionals: researchers; production, process and product development engineers interested in these production lines.

Learning Objectives
Upon completion of the course, the participants will be able to:
- describe the origin, the applications of chlorinated compounds,
- understand the structure and the role of the industry of chlorine and main derivatives,
- analyze the principle of the various processes of production for chlorine and PVC.

Ways & Means
- Detailed course material.
- Pictures/videos of main equipment and samples.
- The content of this course can be adapted to client needs.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
- to have 1 year of proven professional experience in the chlorine industry,
- or be in the process of moving to a position linked to PVC production.

Expertise & Coordination
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

ORIGIN & USES OF CHLORINE & ITS DERIVATIVES
Overview of chlorine and derivatives uses worldwide.
Strict safety rules, transport constraints.
Recycling of chlorinated products.

PRODUCTION PROCESSES FOR CHLORINE & DERIVATIVES
Main markets for caustic soda and chlorine.
Preparation of brine: extraction of salt, purification and filtration of brine. Quality criteria.
Electrolysis:
- Principle of salt solution electrolysis, with coproduction of hydrogen and caustic soda. Ratios for production.
- Membrane electrolysis: from mercury cells to more environment friendly membrane technology. Diaphragm technology. Comparative operating conditions and specific energy consumption.
- Safety and environment aspects.
Chlorine and hydrogen treatment:
- Chlorine desiccation, compression and liquefaction. Storage and transport of liquid chlorine.
- Hydrogen cooling, desiccation and uses.

VINYL CHLORIDE MANUFACTURING
General features of the various DCE production processes: direct chlorination, balanced process, oxychlorination.
Analysis of a typical VCM process, combining direct use of chlorine and indirect use of recycled HCl.
Industrial technologies: fixed or fluidized catalytic reactors.
VCM production by pyrolysis: DCE cracking, by-product separation and VCM purification.
Flexibility of the processes and integration depending on various schemes to minimize the production of chlorhydric acid and energy consumption.
Toxicity aspects for DCE, VCM.
Examples of chloromethanes production and of VCM production, by both ethylene route and acetylene route from coal.

PVC PRODUCTION & USE
PVC, a very versatile polymer. Various types of PVC products (general purpose and specialties). Main markets.
The growth and future of PVC markets, regarding costs, environmental concerns.
General purpose PVC: product main characteristics.
- Various processes and industrial constraints: polymerization in emulsion, in suspension, in mass. Main steps, control of exothermicity, polymer purification, compounding stage.
- Analysis of the batch suspension process: technology developments towards minimizing cycle time, hence minimizing fixed production costs.
Specialty PVC:
- Major uses.
- Production of copolymers. Emulsion, micro-suspension, chlorinated PVC.

Reference: PVCE-EN-P Only available as an In-House course.
Contact: rc.contact@ifptraining.com
Polymers Extrusion & Pelletizing

**Level:** SKILLED

**Purpose**
This course provides a better knowledge of the equipment and physical phenomena used in the extrusion and granulation of polymers, and a better understanding of the operating rules.

**Audience**
Operating staff in charge of the operation of extruders; pelletizers and ancillary equipment.
Technical staff involved in the operation or maintenance of this kind of facilities.

**Learning Objectives**
Upon completion of the course, the participants will be able to:
- know about the phenomena behind an extruder,
- analyze settings, security and automation,
- interpret drifts and incidents in order to react efficiently.

**Ways & Means**
The content may be customized for a particular type of machine or for products if information is provided in advance.
- The content may be customized for a particular type of machine or for products if information is provided in advance.
- Otherwise, standard products are covered: PolyEthylene, PolyPropylene. It can be implemented on specialties polymers and compounds.
- Case studies based on industrial cases.

**Learning Assessment**
Quiz.

**Prerequisites**
To fulfill at least one of the following criteria:
- to have 1 year of proven professional experience in a polymerization unit,
- or to be in the process of moving to a position in operation in a polymerization unit.

**Expertise & Coordination**
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

**EXTRUSION OF THERMOPLASTIC - PROCESS DESCRIPTION**
0.25 d
Aim of the extrusion, general layout description and the various steps of the polymer treatment.
Operating principle of raw material feeding system.
Operating principle and different cross section areas: feeding system, filling, melting, degassing, compression, transport, pelletization.
Different types of screws, advantages and drawbacks.
Different types of extruders: single screw, counter-rotating or co-rotative twin screw, BUSS type mixers, advantages and drawbacks.
Operating principle of pellets conveying.

**TECHNOLOGY & OPERATION OF EXTRUDERS**
1.5 d
Drive: motors and starters, variable speed drives, gearboxes, loads, overload safety devices, structure of the thrust bearings, auxiliaries.
Extruder: feeding systems, blockage prevention; different section of screw and barrel, adjusting the temperature; starting diverter valve and start-up operation; fouling filters monitoring and filter changing device, the die plate: technology, different heating systems, pressure monitoring, calculating the percentage of blocked holes, risk of damage. The pelletizer, different cutting systems, calculation and adjustment of knives speed, water flow, water temperature, monitoring of pellets size/shape.
Principle of heat exchange in the die plate and temperature control.

**AUTOMATION & SAFETY**
0.25 d
Review of the machine safety principles (flow charts, logic diagrams).

**PRODUCT QUALITY**
0.25 d
Different grades manufactured; specifications in relation to the applications.
Laboratory tests: equipment procedures, visualization of various types of defects.

**INFLUENCE OF OPERATING PARAMETERS**
0.75 d
Fluidity, viscosity: dynamic viscosity, definition, effect of shear rate, kinematic viscosity, melt index (MI), testing conditions, temperature effect.
Consequences: control of the temperature as a function of the polymer grade and feedrate. Required power: the influence of the feedrate, the MI and temperature: guidelines. Equipment reliability.
Application: troubleshooting, solutions, items to be checked.

Reference: EXTRU-EN-P
Only available as an In-House course.

**Contact:** rc.contact@ifptraining.com

This course is also available in French: EXTRU-FR-P. Please contact us for more information.

www.ifptraining.com
Operation of a Chemical Production Unit

Course Content

MAIN SECTIONS OF THE UNIT
Process flow scheme of the unit: raw material storage zone, reaction section, finishing zone. Main operating conditions: temperature, pressure, flow rates, composition, etc. Process control.

CHEMICAL BACKGROUND
Composition of the feed, characteristics of the effluents - Nature and role of the reactants; role of the recycle if any. Chemical and physical characteristics of the chemical reaction: thermal effect, complete or incomplete, kinetics, catalyst role if pertinent. Catalyst nature and effect, loading, poisons, ageing, regeneration, etc.

EQUIPMENT
Reactor type (mixed or piston type), internal devices, mixers, cooling system and temperature control. Recycling system: pumps, compressors, flashes, filters, etc. Safety mechanical devices, SIS, short stop if pertinent.

ANALYSIS OF OPERATING CONDITIONS

OPERATION & DISTURBANCES
Nature and origins of disturbances: consequences, diagnostic, solutions. Specific safety measures around the reactor.

Ways & Means
Content may be customized for a particular process if information is provided in advance.

Learning Assessment
Quiz.

Prerequisites
To fulfill at least one of the following criteria:
► to have 3 months of proven professional experience on a chemical plant,
► or to be in the process of moving to a position in operation.

Reference: CRC-EN-P Only available as an In-House course. Contact: rc.contact@ifptraining.com

This course is also available in French: CRC-FR-P. Please contact us for more information.
Chemical Fertilizer Manufacturing

Course Content

**CHEMICAL FERTILIZERS & THEIR USES**

Main and secondary fertilizers.
Various types of fertilizers: simple, mixed, complex.
Various states of fertilizers: solids, solutions, suspension.
Composition and formula of the various complex fertilizers.
Evolution of the fertilizer markets.
Main production routes.

**PROCESSING UNITS**

Ammonia synthesis:
- Synthesis gas production from hydrocarbon steam reforming.
- Ammonia synthesis loop.
Urea production:
- Example of industrial implementation.
Nitric acid and ammonitrate production:
- Main process steps. Schemes and operating conditions. Catalysts.
- Constraints: corrosion, environment.
- Properties and risks related to the products.
Sulfuric acid production:
- Main steps of the process. Scheme and operating conditions.
- Simple and double absorption processes.
- Specific constraints of the processes: metallurgy, pollution, risks.
Phosphoric acid and superphosphates production:
- Manufacture of the simple or of the phosphoric acid by sulfuric attack of the phosphates.
- Manufacture of the triple by phosphoric attack of the phosphates.
- Main steps and processes schemes.
- Operating conditions - Specific equipment - Risks.
Complex of the fertilizer production:
- Risks: decomposition, pollution.
- Various types of processing units. Comparison of principles and performances.

**STUDY OF PROCESS UNITS ON SITE**

Visualization of the main equipment.
Operation and main operating conditions.

Learning Assessment

Quiz.

Prerequisites

No technical prerequisites for this course.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: FERTILE-EN-P  
Only available as an In-House course.  
Contact: rc.contact@ifptraining.com
Petroleum Products, Analysis, Transfer & Storage

- **Petroleum Products & Analysis**
  - Petroleum Products - Properties & Manufacturing Schemes .................................................. p. 85
  - Current & Future Fuels: Development & Evolution of Biofuels .................................................. p. 86
  - Analytical Methods & Techniques Applied to Hydrocarbons & Derivatives .............................. p. 87

- **Transfer & Storage**
  - Operations in Oil Storage Depots & Chemical Terminals ........................................................ p. 88
  - Properties, Formulation, Transfer & Storage of Petroleum Products ......................................... p. 89
  - Fuel Manufacturing - In Line Blending Optimization ................................................................. p. 90
  - Properties, Storage & Transfer of LPG ..................................................................................... p. 91
  - Liquid Transport by Pipeline ....................................................................................................... p. 92
This course can be adapted to virtual classroom mode

**Petroleum Products - Properties & Manufacturing Schemes**

**Level:** SKILLED

**Purpose**

This course provides a deeper knowledge of petroleum products' properties and specifications. For each product, the manufacturing scheme is explained in details.

**Audience**

Technicians, engineers, managers and commercial or technical staff whose activities are related to the production, storage, purchasing, marketing or use of petroleum products.

Also suitable for technicians, engineers and managers in the refining industry interested in improving their knowledge of petroleum products.

**Learning Objectives**

Upon completion of the course, the participants will be able to:
- list the components of each petroleum product,
- grasp the main characteristics of petroleum products and their relevance for end-users,
- identify recent changes and future trends for the petroleum products specifications,
- describe and explain the manufacturing scheme for each product.

**Ways & Means**

Use of interactive educational games to facilitate the understanding of the manufacturing schemes.

**Learning Assessment**

Multiple-choice questionnaire.

**Prerequisites**

In order to be able to follow this training, trainees are asked to fulfill at least one of the criteria below:
- either a proven experience in the use or constitution of petroleum products of at least 1 year,
- or to be in evolution towards a position related to petroleum products,
- or have previously followed a training type "Refining Processes & Petroleum Products".

**Expertise & Coordination**

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Duration</th>
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<tbody>
<tr>
<td>ORIGIN &amp; COMPOSITION OF PETROLEUM PRODUCTS</td>
<td>0.5 d</td>
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<tr>
<td>PROPERTIES &amp; FORMULATION OF ENERGY PRODUCTS</td>
<td>3.5 d</td>
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<tr>
<td>MAIN NON-ENERGY PRODUCTS</td>
<td>0.5 d</td>
</tr>
<tr>
<td>WORLDWIDE MARKET - PRICE &amp; COST MANAGEMENT</td>
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</table>

**ORIGIN & COMPOSITION OF PETROLEUM PRODUCTS**

Composition and main characteristics of crude oils.

Principle of oil refining processes: Fractionation of crude oils in cuts, modification of the chemical composition of the cuts to produce the bases suitable for the fuel manufacturing. In-line blending to produce the commercial products.

Specifications based on normalized tests, tests significance, accuracy of the methods (repeatability and reproducibility).

**PROPERTIES & FORMULATION OF ENERGY PRODUCTS**

For each major product (LPG, automotive gasoline, jet fuel, automotive diesel oil, heating oil and heavy fuel oils), the following aspects are developed:


Manufacturing: in line blending, on line analyzers. Tank Quality Integration (TQI). Analyzer certification advantages.

In addition, in view of current trends, emphasis is placed on the following issues:

- Automotive gasoline: aromatic content limitation, addition of biofuels (ethanol and ethers) and specific case of BOB (Blendstock for Oxygenate Blending): impact on the refining scheme. Impact of the formulation on the engine emissions. Performance additives added at the terminal.


- Automotive Diesel oil: problems raised by the high A.D.0 demand in Europe; consequences of the more stringent limitation of the engine emissions for the car makers (new post-treatment systems); potential quality problems related to the presence of agro-fuels (FAME – Fatty Acid Methyl Ester, HVO - Hydrotreated Vegetable Oil); performance additives added at the terminal.

- Heating oil: problems related to the high cracked stocks content; differences of composition between ADO and HO.


**MAIN NON-ENERGY PRODUCTS**

Bitumen:

- The different types of bitumen: pure, polymer-modified, emulsions.

- The major standard tests: penetration, softening point, ageing. Introduction to rheological measurements used by the road builders.

Lube base oils:

- Base oils manufacturing from vacuum distillates. Composition/properties relationships for base oils.

- Conventional and non-conventional lube chains.

- Properties and characteristics of base oils: viscosity index, cold properties, oxidation stability...

- Base oils groups.

**WORLDWIDE MARKET - PRICE & COST MANAGEMENT**

Oil price variation, refining margin, product prices.

Trading, pricing mechanism, marketing strategies.

Reference: PPE-EN-A  
Can be organized as an In-House course.  
Contact: rc.contact@ifptraining.com

<table>
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<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
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<tbody>
<tr>
<td>Rueil-Malmaison</td>
<td>29 November</td>
<td>3 December</td>
<td>€2,980</td>
</tr>
</tbody>
</table>

This course is also available in French: PPE-FR-A. Please contact us for more information.
Current & Future Fuels: Development & Evolution of Biofuels

**Course Content**

**GASOLINE**
1 d
Market trends and shares of different gasoline grades.
Principle of the spark-ignition engine.
Required properties for automotive gasoline:
- Combustion: nature and incidence of knocking, chemical composition/combustion quality relationship, definition and measure of the gasoline octane numbers.
- Toxicity: aromatics and olefins content.
- Corrosiveness and stability.
- Incorporation of biofuels (ethanol and ethers), specific case of BOB (Blendstocks for Oxygenate Blending).
- Exhaust gas pollution: gas composition and impact on the environment.
- Relations between gasoline specifications and vehicle regulations (EURO 6 standard).

**DIESEL FUEL**
1 d
Market trends.
Principle of the compression-ignition engine.
Required properties for Diesel fuel:
- Cold flow properties: cloud point and Cold Filtering Plugging Point (CFPP).
- Pollution by exhaust gases: particles, NOx:
  - Compositional constraints: reduction of polyaromatic components (PAH - PolyAromatic Hydrocarbons) - High impact on the diesel fuel manufacturing.
- Relations between diesel-fuel specifications and vehicle regulations (EURO 6 standard).
- Impact of the biofuels (FAME - Fatty Acid Methyl Ester, HVO - Hydrotreated Vegetable Oils) on the diesel fuel quality.
- Diesel fuel formulation and manufacturing (hydrodesulfurization unit - in line blending).

**ALTERNATIVE FUELS FOR GASOLINE & DIESEL ENGINES**
1 d
Alternative fuels: background and challenges, production routes, well to wheel cycle.
Alternative fuels for gasoline engines: ethanol and ETBE.
New manufacturing paths to meet the new and more severe constraints on ecological balance. Flex-fuel engine.
Role of the new alternative fuels in the reduction of the CO2 emissions of the vehicles.
Characteristics and impacts of the fatty acid esters on the engine performance.
Potential issues linked to the presence of fatty acid esters: storage stability, oxidation stability, low temperature operability.
Second generation alternative fuel for diesel engine BTL. Synthesis alternative fuels GTL and CTL.

**ALTERNATIVE FUELS FOR TURBINES - BIOMASS RESOURCE BALANCE - GASEOUS FUELS**
1 d
Alternative fuels for turbines (aeronautics):
- Main production routes certified (or soon certified) of Biojetfuels: hydrotreated vegetable oils, synthetic biojets, biological pathways. Impact on: logistics, the aircraft, and the performance of the turbine.
- Possible sources of biomass resource:
  - 1st generation, new sources: used oils, jatropha…
  - 2nd generation: lignocellulosic pathway;
  - 3rd generation seaweed based.
Gaseous fuels:
- LPG, LNG and DME.
- Hydrogen: principle, performance and constraints related to the use of the fuel cell.
Analytical Methods & Techniques Applied to Hydrocarbons & Derivatives

**Level:** KNOWLEDGE

**Purpose**

This course provides technical knowledge related to the choice of analyses, their implementation and the use of results.

**Audience**

Engineers, technical managers and technicians from laboratories in plant and research centers.

Engineers from the process and operation units in refining, petrochemical and engineering companies.

Engineers involved in ensuring the quality of petroleum products.

**Learning Objectives**

Upon completion of the course, the participants will be able to:

- Identify the different techniques used in oil and petrochemical analysis.
- Point out their application fields and evolutions.
- Understand the analysis management principles.

**Ways & Means**

- Laboratory study of analytical equipment.
- This course takes place in the laboratory of the requesting client.

**Learning Assessment**

Quiz.

**Prerequisites**

In order to be able to follow this training, trainees are asked to fulfill at least one of the criteria below:

- Either a Bac or equivalent level,
- Or to have a proven experience in an analytical laboratory of at least 6 months.

**Expertise & Coordination**

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

**ELEMENTARY ANALYSIS**

Analysis of the elements: C, H, O, N, S, Ni, V, etc.

Potentiometric analysis, sulfur, nitrogen.

**SPECTROMETRY**

Presentation of the different techniques.

Implementation of X-ray fluorescence (XRF).

Implementation of Plasma (ICP).

Implementation of atomic absorption (AA).

Implementation of RMN, IR, UV techniques.

Implementation of mass spectrometry (MS).

**SEPARATION TECHNIQUE**

Analytical and separating distillation.

Gas chromatography (GC).

Liquid chromatography (LC).

Supercritical fluid chromatography (SFC).

Gel permeation chromatography (GPC).

**COMBINATIONS - ADVANTAGES - IMPLEMENTATION**

Combination PC-MS.

Combination LC-MS.

Combination GC-DEA (DiElectric thermal analysis).

**CHROMATOGRAPHY SPECIFIC DETECTORS**

Analysis sulfur and nitrogen.

**ONLINE ANALYSIS**

Gas analysis:

- Sampling: quick loop.
- Injection problem.
- Validation of results.
- Applications to a catalytic reforming and hydrotreating gas.

Liquid effluents:

- Online injection system.
- Sulfur industrial analysis.
- NIR analysis.

**Reference:** AMT-EN-P

Only available as an In-House course.

**Contact:** rc.contact@ifptraining.com

www.ifptraining.com
Operations in Oil Storage Depots & Chemical Terminals

Course Content

PROPERTY OF PETROLEUM PRODUCTS MANAGED IN OIL DEPOTS 0.3 days
Detailed breakdown of petroleum products.
Properties related to their safe storage and handling.
Product specifications and blending activities.

STORAGE OF LIQUID PETROLEUM PRODUCTS & CHEMICALS 0.75 days
Various types of atmospheric storage tanks (fixed roof, floating roof, floating screen) and operating facilities.
Heating and mixing systems.
Safety equipment (level switches...), firefighting facilities (sprinklers, foam, extinguishing gas...).
Fail safe equipment. Safe operation.
Measurement equipment: gauging well, level, temperature, sampling.

MEASUREMENT OF QUANTITIES: RECEIVED, STORED, DELIVERED 0.75 days
Static measurement: level, temperature, density, volume.
Dynamic measurement: working conditions, sensors (flowmeter, density meter, viscosity meter, pressure meter, calculator) and their protection.
Metrology aspect: calibration methods.
Operating product losses: evaporation, overflow, leaks...
Origin and consequences of errors of measurement.
Mass balance.

LOADING & UNLOADING OPERATIONS 1.75 days
Equipment in connection with loading and unloading facilities. Corresponding safe operating conditions.

PRODUCT HAZARDS & OPERATING PREVENTIVE MEASURES 1 day
Flammability:
Flammable products handling - Presence of ignition sources, oxygen and other oxidizers. Operating guidelines.
Product hazards for the human being:
Risks identification.
Main forms of intoxication. Mechanisms of body poisoning and effects on the metabolism.
Prevention. Personal and collective protection.
Product hazards for the environment:
Potential polluting sources from the storage depots, preventive actions.
Liquid products hazards:
Thermal expansion, storage under vacuum, water hammer. Operating guidelines.

Reference: DEPOTS-EN-P. Can be organized as an In-House course.

Contact: re.contact@ifptraining.com

<table>
<thead>
<tr>
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<tr>
<td>Martigues</td>
<td>28 June</td>
<td>2 July</td>
<td>€3,000</td>
</tr>
</tbody>
</table>

This course is also available in French: DEPOTS-FR-P. Please contact us for more information.
Properties, Formulation, Transfer & Storage of Petroleum Products

Level: SKILLED

Purpose
From the properties of the finished products, this training provides a deeper knowledge on petroleum products formulation, storage and transfer between different sites.

Audience
Operation staff (field operators, panel operators, supervisors…) in reception, blending, storage and shipping facilities in refineries and petrochemical plants. Anyone involved in petroleum products transfer and storage management.

Learning Objectives
Upon completion of the course, participants will be able to:
- list the main characteristics of crude oil, petroleum fractions, blending stocks and finished products,
- apply the blending and manufacturing rules of finished products,
- calculate operating parameters of gravity and pump transfers,
- recognize equipment from atmospheric storage tanks,
- identify risks for safety, equipment and accounting in storage operations and develop measures appropriate to control such risks.

Ways & Means
- Usage of many pictures and video for equipment understanding. Field visit if possible to be organized.
- Case studies based on industrial situations: products transfers, products formulations.

Learning Assessment
Final quiz.

Prerequisites
In order to be able to follow this training, trainees are asked to fulfill at least one of the criteria below:
- either proven experience in petroleum products or storage for at least 1 year,
- or to be in evolution towards a position related to petroleum products and storage.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content 8 days

PROPERTIES OF CRUDE OIL & PETROLEUM PRODUCTS 2.75 d
Crude oils: main constituents, properties, initial fractionation in petroleum cuts.
Petroleum products:
- LPG, gasoline, jet fuel, Automotive Diesel Oil, heating oil, heavy fuel oils, bitumen.
- Main specifications, manufacturing constraints, storage and safety specificities.
- Evolution of product specifications.
Bases and alternative fuels: ethanol, ETBE and FAME.

MANUFACTURING OF PETROLEUM PRODUCTS 1.25 d
Bases manufacturing from petroleum cuts: petroleum products manufacturing scheme, simplified process diagrams of refineries and petrochemical units.
Finished products manufacturing:
- Economic aspects (give-away, added profit).

TRANSFER & TRANSPORT OF PETROLEUM PRODUCTS 1.75 d
Transfer by gravity: characteristics of gravity flow.
Transfer by pumping:
- Performance of centrifugal pumps, simplified technology and adaptation to pumping circuits.
- Operation of centrifugal pumps, start-up, shutdown, installation in series and parallel implementation.
- Operation and simplified technology of volumetric pumps.
- Operation of a transfer installation: practical and economic aspects, risks of vaporization, pressure surges, etc.
- Transfer of crude oil and petroleum products by ship.
Application: study of transfer from one tank to another.

STORAGE OF PETROLEUM PRODUCTS 2.25 d
Storage equipment:
- Pressurized and refrigerated tanks, spheres, cylindrical tanks, cryogenic tanks, cavities; ancillary equipment: safety valves, hydraulic safety valves.
- Fixed roof tanks: different types, vents, justification and limits of vent valves.
- Floating screen tanks: special features, justification.
- Floating roof tanks: different types of roof and seals, supporting legs, rainwater drainage.
Protection against fire risks.
Tank operation:
- Operational safety: risks of inflammation, static electricity, pyrophoric substances, emulsions, overflow, toxic products.
- Heating, Mixing.
Measuring the quantities delivered, stored and shipped: manual and remote gauging, measuring the temperature locally and remotely, volumetric and dynamic meters, manual and automatic sampling.
Usual operation of storage tanks including emptying, degassing and decommissioning.

Reference: PCTS-EN-P
Only available as an In-House course.
Contact: rc.contact@ifptraining.com
This course is also available in French: PCTS-FR-P. Please contact us for more information.

www.ifptraining.com
This course can be adapted to virtual classroom mode

Fuel Manufacturing - In Line Blending Optimization

Level: SKILLED

Purpose

This course provides a thorough understanding of the product manufacturing principles: in line blending monitored by a global optimizer.

Audience

Engineers, managers, technical and operating staff interested or involved in product manufacturing.

Learning Objectives

Upon completion of the course, the participants will be able to:

- list the key specifications for each product and predict the impact of each component on each property,
- describe the blending laws used for each product, and explain how they should be used,
- monitor a blend thanks to the optimizer, and take the necessary actions required by the optimizer messages.

Ways & Means

Training content is fully adapted to the refinery blending optimization tool, which is done under confidentiality agreement.

Learning Assessment

Blend simulations - Practical exercises.

Prerequisites

In order to be able to follow this training, trainees are asked to fulfill at least one of the criteria below:

- or proven experience in knowledge of petroleum products from a refinery of at least 1 year,
- or to be in evolution towards a position related to the formulation or constitution of petroleum products.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

<table>
<thead>
<tr>
<th>Course Content</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>GASOLINES, DIESEL FUELS, HEAVY FUELS SPECIFICATIONS</td>
<td>0.5 d</td>
</tr>
<tr>
<td>Normalized tests used to check specifications. Specifications: main constraints for the optimizer. Optimization of the blend: notion of give-away and identification of the key constraints.</td>
<td></td>
</tr>
<tr>
<td>BASES &amp; ADDITIVES</td>
<td>0.25 d</td>
</tr>
<tr>
<td>BLENDING LAWS USED BY THE OPTIMIZER</td>
<td>0.75 d</td>
</tr>
<tr>
<td>Density, octane numbers, cetane numbers, vapor pressure, distillation, cloud point, flash point, viscosities, sulfur. Analyzers: principle; sampling loop; Tank Quality Integration (TQI). Particular case of properties optimized by additives (case of CFPP for Diesel fuel).</td>
<td></td>
</tr>
<tr>
<td>BLEND OPTIMIZATION: SP95 &amp; ADO MANUFACTURING</td>
<td>0.75 d</td>
</tr>
<tr>
<td>Check of base properties - The optimizer requires all the base properties. Ratio constraints due to inventory constraints. Quality constraints (specifications). Economic optimum. Follow up of the blending with the main process view of the application.</td>
<td></td>
</tr>
<tr>
<td>BLEND MONITORING</td>
<td>0.5 d</td>
</tr>
<tr>
<td>UPSETS - STUDY CASES</td>
<td>0.25 d</td>
</tr>
<tr>
<td>Often result from wrong inputs. Identification of the origin of the problem and corrective measures. Switch of the optimizer in “model mode” in case of analyzer failures during the blend.</td>
<td></td>
</tr>
</tbody>
</table>

Reference: AUTOFF-EN-A - Only available as an In-House course. Contact: rc.contact@ifptraining.com

This course is also available in French: AUTOFF-FR-A. Please contact us for more information.
NEW Properties, Storage & Transfer of LPG

Level: KNOWLEDGE

Purpose

From the properties of Liquefied Petroleum Gas (LPG), the storage, loading/unloading equipment and associated hazards, this training course aims to meet the needs for safe operation in LPG depots, chemical and petrochemical terminals.

Audience

Staff (field operators, panel operators, shift leaders, young engineers and terminal managers) involved in LPG storage and transfer activities. By extension, any person involved in depot LPG activities (technicians & engineers in Maintenance, Projects, Engineering, Logistics, SHE).

Learning Objectives

Upon completion of the course, the participants will be able to:

- describe LPG composition, specifications and sampling procedures,
- present equipment main characteristics for storage, transfer and (un)loading,
- explain pumping operating conditions and main troubleshooting,
- appreciate operating instructions for safe operation.

Ways & Means

The pedagogy is active and refers essentially to participants’ experience. The documentation delivered to the participants as training medium is also a reference document useful after the training session.

Case studies based on industrial situations.

Learning Assessment

Final quiz.

Prerequisites

In order to be able to follow this training, trainees are asked to fulfill at least one of the criteria below:

- either a proven experience in LPG of at least 1 year,
- or to be in evolution towards a position in connection with LPG.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competences are kept up-to-date.

Course Content 4 days

LPG PROPERTIES

- Origins and main components of different liquefied gas: propane, butane, autogas, ethylene, propylene, butadiene, butenes, ammonia.
- Main properties related to storage, transfer and different uses: liquid & gas densities, vapor pressure, water content, corrosivity, odor, toxicity.
- LPG’s finished products specifications and standard tests.

STORAGE TANKS

- Different types: spheres, bullets, semi buried storage, refrigerated storage, underground storage.
- Storage operation: equipment, circuits, instrumentation, water purge, sampling...

ROTATING EQUIPMENT FOR TRANSFER

- Simplified technology of centrifugal pumps, different types of centrifugal pumps used for LPG transfer. Total head, yield, horsepower and motor intensity. Operation of centrifugal pumps, start-up, shutdown, decommissioning, field checks, troubleshooting and operational solutions. Safe operation.
- Simplified technology of reciprocating compressors, field checks, troubleshooting and operational solutions. Safe operation.

LOADING & UNLOADING OPERATIONS

- Equipment in connection with loading and unloading facilities. Corresponding safe operating conditions.
- Marine bulk loading/unloading:
  - Basic tankers description. Different loading stations layouts, isolation flange or grounding.
  - Loading arms and safety accessories: manual and hydraulic control, quick coupling, movement detection, breakaway coupling, drainage systems.
  - Fixed firefighting equipment on board, on shore, safety checklist.
- Tank truck and railcar bulk loading/unloading:
  - Truck and railcar loading stations: hoses or loading arms, gas phase/liquid phase connections, quantity measurement and control systems.
  - Safety and operating equipment on tank trucks and railcars: vessel’s hydraulic or pneumatic valves, high level switch, Gestra type valves, breakaway coupling, drainage systems, fire & gas detection, fixed firefighting equipment. Procedures.

PRODUCT HAZARDS & OPERATING PREVENTIVE MEASURES

- Flammability:
  - Flammability conditions, flammability limits, different types of gas detectors.
  - Product hazards for the human being:
    - Toxics, exposure limits, Safety Datasheet.
    - Low temperature burn.
  - Fluid behavior hazards:
    - Heat addition/removal consequences on closed circuit: pressurization, thermal expansion, vessel under vacuum, temperature drop due to vaporization, icing ...
    - LPG storage pressure control: vapor condensation, cooling systems.
    - BLEVE: description of the phenomenon, different consequences, prevention and mitigation.
  - Examples of different hazardous situations and correct behavior: normal operating conditions (operator field check, purges, sampling), incidents (leak, fire), startup/shutdown operations, maintenance activities...
Liquid Transport by Pipeline

Course Content

4 days

PIPELINE OPERATION
0.5 d
Flow characteristics: flowrate, velocity, mass flow and volume flow, link between pressure and height, product viscosity, friction losses.
Piezometric line, practical use.
Circuit resistance.

CENTRIFUGAL PUMPS
0.5 d
Technology. Various parts, seals, lubrication.
Survey - Potential damages and incidents.
Pump types used with pipeline transfer. Variable speed drive.
Pump operation. Performance curves: head-flowrate, power, NPSH, efficiency.
Performances vs rotation speed and impeller diameter change.
Operation limits: minimum and maximum flows.

PIPELINE OPERATION
1.5 d
Operating point, flow control.
Pump arrangements selection and optimization according to the pipeline characteristics.
Start-up, shutdown, incidents.
Liquid hammer effects.

OPERATION OF EQUIPMENT OTHER THAN PUMPS
0.5 d
Pipeline fittings: valves types, check valves, pigs, pig stations.
Instrumentation and metering: hydrometers, flowmeters, colorimeters, turbines, metering stations.
Drag reducers: different types, use, properties, implementation.

PIPELINE MAINTENANCE
0.5 d
Key points.

CONTAMINATION - CONTAMINANTS TREATMENT
0.5 d

Prerequisites
In order to be able to follow this training, trainees are asked to fulfill at least one of the criteria below:
► a proven experience in liquid transfers by pipeline of at least 1 year,
► either evolving towards a position related to the movement of liquids by pipeline.

Reference: TLPIP-EN-A
Only available as an In-House course.
Contact: rc.contact@ifptraining.com

This course is also available in French: TLPIP-FR-A. Please contact us for more information.

More info
Also available in French.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.
Equipment, Materials, Corrosion & Inspection

▶ Technology
Recent Developments & Innovation in Equipment ................................................................. p. 94
Introduction to Equipment Technology ................................................................................ p. 95
Static Equipment .................................................................................................................. p. 96

▶ Materials & Corrosion
Corrosion & Risk Based Inspection ....................................................................................... p. 97
Corrosion & Corrosion Prevention Certification ...................................................................... p. 98
Failure Analysis & Repairs of Piping & Vessels .................................................................. p. 99
Risk Based Inspection (RBI) ................................................................................................ p. 100

▶ Maintenance & Inspection
Fresh Inspector Practical Training ........................................................................................ p. 101
Non-Destructive Testing for Petrochemical Industries ......................................................... p. 102
Inspector Certification ........................................................................................................ p. 103
Recent Developments & Innovation in Equipment

Course Content

**IMPROVING PLANT EFFICIENCY & ENERGY CONSUMPTION** 0.5 d
Motivations and constraints: energy dependence and regulation.
Plant mapping of energy losses. How to improve energy efficiency and implement significant solutions: day-to-day operational improvement, operating conditions optimization, Best Available Techniques (BAT), heat integration (Pinch analysis). Energy management system and standard ISO 50001.

**LATEST DEVELOPMENTS IN THERMAL EQUIPMENT** 0.5 d
Advanced technology for shell and tube heat exchangers: tube bundle, inserts…
Specific materials: high emissivity paint, plastic heat exchangers…
Low NOx and ultra low NOx burners.
Inspection and cleaning techniques for heaters and heat exchangers.

**LATEST INDUSTRIAL IMPLEMENTATIONS WITH ROTATING EQUIPMENT** 3 d
Machine implementations:
- Materials improvements: new alloys, single crystal castings, DLC/TBC coatings… applications to all rotating equipment.
- Moving parts design improvements: FFP™ piston technology with reciprocating compressors, e-compressors, axial thrust balancing devices.
- Auxiliaries improvements: bearing designs, latest magnetic bearings, use of synthetic lube oils, varnish removal units, new oiler designs, NOx/CO2 treatment techniques and heat recovery devices with gas turbines.
- New machines developments: microturbines.
- Design practices: modular designs, consequences on layouts and footprints.

Control and safety systems:
- Centrifugal compressors: recent developments on surge, load sharing, operation control systems.
- Steam turbines: electronic governors; use of HP control oil circuits.
- Reciprocating compressors: e-Hydrocom™ flow control systems.

Maintenance methods:
- Parts scanning for reengineering/spare parts manufacturing/dynamic simulations/inspections.
- 3D printing vs. parts manufacturing/modeling.
- Use of laser devices for foundations/machine alignments/casings geometry checks.

On-line monitoring and predictive maintenance:
- Wireless measurements and monitoring, thermal, sound, electrical current, shaft displacements and vibrations monitoring analysis.
- Reciprocating and hypercompressor monitoring.

**DCS & IT RECENT TECHNOLOGIES** 1 d
Plant monitoring and control using newest IT technologies. Remote control and wireless systems.
Smart manufacturing approach, MES, SPC.
Use of digital twins.
Design and simulation.
Cyber security, protection of plant control system.

Reference: RDEI-EN-P  
Can be organized as an In-House course.
Contact: rc.contact@ifptraining.com

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<tr>
<td>Martigues</td>
<td>11 October</td>
<td>15 October</td>
<td>€2,980</td>
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This course can be adapted to virtual classroom mode

Introduction to Equipment Technology

Level: KNOWLEDGE

Purpose

This course provides a good knowledge of equipment technology, including thermal, static and rotating equipment.

Audience

Engineers and supervisors involved in various disciplines such as process, maintenance, operation, mechanical, inspection, HSE, engineering, etc.

Learning Objectives

Upon completion of the course, the participants will be able to:

► provide basic understanding of static and rotating equipment installed in process plants,
► describe the technology of thermal equipment,
► explain operating practices and key performances of each family of equipment.

Ways & Means

► Sharing of participants’ best practices.
► Study of actual cases based on industrial Oil & Gas and petrochemical processes.

Learning Assessment

Final quiz.

Prerequisites

Provide evidence of a professional experience of at least 1 month, related to the concerned field.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

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<tbody>
<tr>
<td>PIPING, VESSELS &amp; MATERIALS</td>
<td>1.5 d</td>
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<tr>
<td>Symbols and equipment representation on P&amp;ID drawings. Pressure and temperature ratings. Different types of piping equipment and fittings: pipes, flanges, gaskets, valves, steam traps, safety valves, insulation, pipe supports, etc. Vessels: technology of separator drums; technology and internals of distillation columns and reactors. Storage tanks: different types (atmospheric, pressurized, cryogenic...). Design and technology. Overview of ASTM and EN material and main standards.</td>
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</tr>
<tr>
<td>INTRODUCTION TO THERMAL EQUIPMENT</td>
<td>1.5 d</td>
</tr>
<tr>
<td>BASICS IN ROTATING EQUIPMENT</td>
<td>2 d</td>
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Reference: TMPP-E-EN-A

Only available as an In-House course.

This course is also available in French: TMPPC-FR-A. Please contact us for more information.

Contact: rc.contact@ifptraining.com

www.ifptraining.com
This course can be adapted to virtual classroom mode

Static Equipment

Level: SKILLED

Purpose
This course provides in-depth knowledge related to static equipment technology.

Audience
Engineers, supervisors, technical staff from many departments: process, maintenance, operation, mechanical, inspection, HSE, instrumentation, electrical...

Learning Objectives
Upon completion of the course, the participants will be able to:
► provide a clear understanding of Static Equipment installed in process plants,
► describe the operating principle of these types of equipment,
► give main applications of each type and highlight the main selection criteria,
► list the common maintenance practices, and reliability criteria.

Ways & Means
► Sharing of participants' best practices.
► Applications and case studies.
► Visit of running plant or workshop if available.
► Demo on a process dynamic simulator (PID loop).

Learning Assessment
Final quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month, related to the concerned field.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

METALLURGY OF FERROUS & NON FERROUS MATERIAL USED IN PROCESS INDUSTRIES

PIPING - FLANGES
Different types of piping equipment per ASME B31.3: pipes, flanges & gaskets, valves, steam traps, bellows, safety valves, rupture discs...
Main risks in case of failure, common problems. Corrective and preventive maintenance.

VESSELS & STORAGE TANKS
ASME VIII vessels: design of drums, columns, reactors. Specific internals technology of distillation columns and reactors.
API 650 Storage tanks: different types (atmospheric, pressurized, cryogenic...).
API 520 pressure relieving devices: design, technology; main safety and operating equipment; reliability criteria. Pressure vessels stress analysis under pressure, vacuum, temperature. Various types of corrosion mechanisms. Prevention: material selection, coatings.

THERMAL EQUIPMENT
Other types of heat exchanger: tubular or plate type, air coolers and condensers.
Different types of furnaces and their characteristics.
Boiler technology. Operating conditions.
Construction of heat exchange areas and refractory materials.
Air and flue gas circulation: natural and forced draft.
Burner technology: fuel and air supply and mixture. Low NOx and ultra-low NOx burners technology.

INSTRUMENTATION
Distributed Control System: Architecture, characteristics and functionalities. Systems operation: control, graphics, alarming, trends, etc.
Safety Instrumented Systems. Applications and exercises.
Non-linearity of process; controller operating point. Application: loop tuning demo on a process dynamic simulator.

Reference: MATEQ1-EN-A  ☑️ Can be organized as an In-House course.
Contact: re.contact@ifptraining.com

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This course is also available in French: MATEQ1-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

## Corrosion & Risk Based Inspection

### Level: SKILLED

#### Purpose

This course provides a practical knowledge of pressure equipment and piping corrosion, and Inspection strategy based on risk analysis.

#### Audience

Experienced engineers, managers and technical staff involved in safe operation and integrity of pressure equipment installed in refineries, chemical and petrochemical plants.

#### Learning Objectives

Upon completion of the course, the participants will be able to:

- Identify operating windows beyond which corrosion phenomenon happen,
- Describe the RBI methodology for a petrochemical or chemical plant,
- Determine the probability and consequence of a failure,
- Set up a suitable inspection plan.

#### Ways & Means

- Active teaching methods are used to promote a pooling of experience, under the lead of inspection specialist.
- Actual accidents in refineries and chemical plants are analyzed to be aware of the risks.
- Wide use of samples, videos and pictures to develop practical case studies for pressure equipment such as piping, heat exchanger, reactor, distillation column, boiler, etc.

#### Learning Assessment

Final quiz.

#### Prerequisites

Provide evidence of a professional experience of at least 1 month, related to the concerned field.

#### More info

Professional knowledge of typical operating parameters in the Refining & Petrochemicals industries will be useful.

#### Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

### Course Content

#### CORROSION IN OIL & GAS INDUSTRIES & PETROCHEMICAL PLANTS - API 571

1.5 d

Each type of corrosion is studied along with possible prevention for piping, drums, columns, heat exchangers, boilers and furnaces already in service, or during a new plant design. Specific corrosion occurring in industrial units based on API 571:

- Metallurgical deterioration: brittle fracture, chromium precipitation, creep, fatigue.
- Hydrogen induced cracking, high temperature hydrogen attack, high temperature sulfur corrosion, oxidation, flue gas corrosion, naphthenic acid corrosion, polythionic acid corrosion, caustic soda stress cracking, amines corrosion, CO2 corrosion.
- Corrosion of alloys in chemical industry: corrosion by mineral acids, bases, nitrates, ammonia or chlorine.

Many corrosion case studies observed in process industry units: identification of corrosion root cause and mitigation to apply.

#### CORROSION PREVENTION & INSPECTION - API 510

1 d

Material selection and detailed engineering design to avoid corrosion.

- Identification of operating windows.
- Corrosion control by means of sampling, use of corrosion coupons and probes.
- Cathodic protection with sacrificial anodes or imposed current.
- Anticorrosion coatings and cladding.

Basic non-destructive testing: PT, MT, RT, UT and advanced non-destructive testing: phased array...

#### RISK BASED INSPECTION - API 581

1 d

Collect Design data and inspection data.

- Select Corrosion loops for each PID.
- Calculate probability of failure based on damage factor - Quantitative approach using API581 workflow.
- Calculate consequence of failure - Quantitative and semi quantitative approach using API581 workflow.
- Evaluate the overall risk on API matrix.
- Define inspection strategy: mitigations actions or inspection scheduling extension.
- Overview of available commercial software “RBEYE”.
- Example of industrial RBI strategy implemented.
- RBI semi quantitative approach based on simplified Excel spreadsheet.

#### APPLICATION OF THE RBI METHOD WITH MINI-PROJECTS CASE STUDIES

1.5 d

Application of API 581 RBI method using mini projects - Case studies as teamwork:

- Select the appropriate corrosion loops and pressure vessels.
- Identify the degradation.
- Apply API 581 workflow to define the probability of failure, the consequence of failure.
- Analyze the risk and propose risk mitigations with more efficient Non Destructive Testing or adjust inspection frequency.
- Apply RBI semi quantitative approach based on simplified excel spreadsheet and compare the 2 methods.
- Each group presents its RBI analysis and conclusion.

Reference: CORBIE-EN-A  Can be organized as an In-House course.

Contact: rc.contact@ifptraining.com

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<table>
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<tr>
<td>Rueil-Malmaison</td>
<td>22 March</td>
<td>26 March</td>
<td>€2,980</td>
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www.ifptraining.com
This course can be adapted to virtual classroom mode - Advanced Certificate

Corrosion & Corrosion Prevention Certification

Level: SKILLED

Purpose
This course provides a practical knowledge of pressure equipment and piping corrosion, and explains prevention strategies.

Audience
Experienced inspection, maintenance, HSE, process engineers, managers and technical staff involved in safe operation and integrity of pressure equipment installed in refineries, chemical and petrochemical plants.

Learning Objectives
Upon completion of the course, the participants will be able to:
- study steels and alloys degradation and corrosion,
- explain the operating parameters and fluid characteristics responsible of main corrosion phenomenon,
- identify field inspection recommendations on pressure equipment and piping to prevent corrosion failures.

Ways & Means
Active teaching methods are used to promote a pooling of experience, under the lead of inspection specialist.
Actual accidents in refineries and chemical plants are analyzed to be aware of the risks.
Wide use of samples, videos and pictures to develop practical case studies for pressure equipment such as piping, heat exchanger, reactor, distillation column, boiler, etc.

Learning Assessment
Knowledge assessment according IFP Training Certification specific standards.

Prerequisites
Provide evidence of a professional experience of at least 1 month, related to the concerned field.

Why an IFP Training Certification?
- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Corrosion & Corrosion Prevention Certification.
- Ready-to-use skills.

More info
Basic knowledge in corrosion will be useful.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: CICP-EN-A  
Only available as an In-House course. Contact: rc.contact@ifptraining.com

This course is also available in French: CICP-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

Failure Analysis & Repairs of Piping & Vessels

Course Content

INTRODUCTION TO METALLURGY & CORROSION 2 d
Ferrous and non-ferrous material: mechanical properties and chemical composition.
Plates, forging, castings, piping, rolling, welding, post weld heat treatment.
Standards and international codes. Pressure vessel manufacturing.
Definitions and basic mechanism: wet corrosion and dry corrosion.
Introduction to corrosion: main types of industrial corrosion: uniform, pitting, crevice, intergranular, stress
corrosion cracking, corrosion-erosion, galvanic, selective, corrosion under isolation.

INSPECTION & PREVENTION 1.5 d
Non-destructive testing, PT, MT, UT, IRIS, phased array, eddy current, RT.
Review specific hydrotest and leak test for towers, piping, heat exchanger, furnaces and boilers.
Anticorrosion painting and coatings, TSA. QA/QC: surface preparation, porosity control.
Insulation with appropriate QA/QC.
How to organize corrosion monitoring: guide to the development of an inspection program.

PRESSURE EQUIPMENT REPAIR WORKS: GENERAL PROCEDURES 1.5 d
Review of the technical inspection file: materials, heat treatments, identified degradation methods, history,
construction code.
Development of a repair method: sand blasting, cutting, forming, welding, heat treatments, NDT: criticality of the
repair work.
Welding processes SMAW, GTAW, GMAW: advantages and drawbacks. WPQR, WPS, WPQ.
Preheat, post weld heat treatments.
Hot tapping, nozzle reinforcements, weld overlays, cladding, temporary clamping.
Safety issues: hot works, height, simultaneous operation; working in confined spaces.
Examples of actual repair works (team works):
Cracking of a neutralization tower.
Tube plugging of tubular heat exchanger.
Modification of a soda concentrator.
Degradation of a petrochemical furnace.
Use of temporary repairs (clamps).
Replacement of pipe sections.
Execution of a “hot tap” repair.

Ways & Means
Active teaching methods are used to promote shared experience.
Wide use of samples, videos and pictures to develop practical case studies for pressure equipment.
Feedback in accidents in refineries and chemical plants.

Learning Assessment
Final quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month, related to the concerned field.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained
to adult teaching methods, and whose competencies are kept up-to-date.

Reference: ITRES-EN-A Only available as an In-House course.
This course is also available in French: ITRES-FR-A. Please contact us for more information.
Risk Based Inspection (RBI)

Course Content

<table>
<thead>
<tr>
<th>5 days</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FUNDAMENTALS OF RISK BASED INSPECTION</strong></td>
</tr>
<tr>
<td>API 580 overview, concept, probability and consequence of failure, risk ranking.</td>
</tr>
<tr>
<td>API 580 methodology, benefits and limits, workforce and schedule necessary to perform RBI study.</td>
</tr>
<tr>
<td>API 581 scope, probability of failure based on management factor and statistical failure frequency.</td>
</tr>
</tbody>
</table>

| 2 d |
| **QUANTITATIVE & SEMI-QUANTITATIVE RISK BASED INSPECTION APPROACH** |
| Corrosion loops based on process conditions. |
| Design data and inspection data identification. |
| Damage factors identification based on corrosion standards such as API 571. |
| Calculate probability of failure based on damage factor - Quantitative approach using API581 workflow. |
| Calculate consequence of failure - Quantitative and semi-quantitative approach using API581 workflow. |
| Evaluate the overall risk on API matrix. |
| Define inspection strategy: mitigations actions or inspection scheduling extension. |
| Overview of available commercial software “RBEYE”. |
| Example of industrial RBI strategy implemented. |
| RBI semi quantitative approach based on simplified Excel spreadsheet. |

| 2.5 d |
| **APPLICATION OF THE RBI METHOD WITH MINI-PROJECTS CASE STUDIES** |
| Application of API 581 RBI method using mini projects - Case studies as teamwork: |
| Select the appropriate corrosion loops and pressure vessels. |
| Identify the degradation. |
| Apply API 581 workflow to define POF, COF and overall risk. |
| Analyze the risk and propose: risk mitigation with more efficient NDT, adapt the inspection frequency. |
| Apply RBI semi quantitative approach based on simplified excel spreadsheet and compare the 2 methods. |
| Each group presents its RBI analysis and conclusion. |
Fresh Inspector Practical Training
Practical training using actual educational plant

Level: KNOWLEDGE

Purpose
This course provides a safe practical field training for inspectors, within a shutdown gas free plant.

Audience
This course is intended for new inspectors and maintenance supervisors involved in field inspection and maintenance of oil and gas industries. It is also beneficial for operation and project technical staff.

Learning Objectives
Upon completion of the course, the participants will be able to write an inspection report based on API 510.

Ways & Means
- Historical inspection files available.
- Shutdown gas free equipment, in service for several years, available for internal inspection.
- Pictures of corrosion during inspection of equipment can be taken as needed.
- Practical demonstration of non-destructive examination.
- Practical exercises on the actual educational plant.
- Some pedagogical activities of this course will take place in OLEUM's facilities (subject to availability).

Learning Assessment
Oral and written inspection report.

Prerequisites
Provide evidence of a professional experience of at least 1 month, related to the concerned field.

More info
Basic knowledge of pressure vessel technology, heat exchangers, furnace, boilers and piping and different forms of degradations and NDT will be useful.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

---

**Course Content**

**5 days**

**INSPECTION DATA COLLECTION**

| 1 d | Use a plot plan, process flow diagram, PID and isometric to localize the equipment to be inspected. Study the historical inspection file and collect the technical data available for each equipment: TEMA heat exchangers, vessels, distillation tower, furnace, piping. |

**PRACTICAL APPLICATION**

| 3 d | Perform internal and external inspection of pressure vessels and piping. Identify the components of various equipment. Confirm the type of degradation already mentioned in inspection files. Inspect equipment and discover new potential external or internal degradations. Achieve basic NDT (UT, PT) and identify alternative available non-destructive examination methods, based on the type of degradations observed. Witness contracted professional performing IRIS, PMI, metallurgical replica, phased array in the field on the equipment. Practical exercises on the actual educational plant. |

**INSPECTION REPORT & ORAL PRESENTATION**

| 1 d | Complete the inspection report for each pressure equipment inspected. Justify the condition of the pressure equipment: Good: ready for a new run of 5 years. Or poor: justify any recommendations for additional NDT or for repairs. Include NDT reports, pictures, drawings of your own equipment inspected. Oral presentation of your inspection report based on API 510. |

Reference: FIPE-EN-P

Can be organized as an In-House course.

Contact: rc.contact@ifptraining.com

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<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
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<tbody>
<tr>
<td>Martigues</td>
<td>12 April</td>
<td>16 April</td>
<td>€3,750</td>
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www.ifptraining.com
This course can be adapted to virtual classroom mode

Non-Destructive Testing for Petrochemical Industries

Course Content

5 days

BASIC & ADVANCED NDT TECHNIQUES

2 d

Visual test, Liquid Penetrant test (PT), Magnetic Test (MT), Radiographic Test (RT), Ultrasonic Testing (UT, TOFD, Phased Array, IRIS), Leak Testing (LT), Electromagnetic testing (ET), Positive Material Identification (PMI), Infrared Thermography (IR). Hardness, Acoustic Emission, Magnetic Flux Leakage.

For each technique, study:
- The basic physical principles.
- The type of degradation to be detected.
- The limitations and exclusions.
- The pros and cons compared to other NDT.
- Safety and health features.

NDT certification according to ISO and ASNT. Dates of expiration and re-issue.

PRACTICAL APPLICATION

3 d

Visual:
- Identify local or generalized corrosion, read color and aspect of rust/corrosion compound to obtain preliminary clues about the degradation type.
- Select appropriate light intensity.

Penetrant test and magnetic test:
- Surface preparation methods, different types of penetrants and developers.
- Observation of the cracks.

Thickness UT, shear wave, TOFD:
- Surface preparation, types of probes.
- Analysis of the various signals.

Radiography - X rays and gamma rays:
- Understand the relationship between energy and time exposure.
- Review safety issues during field or shop choosing.
- Read radiographic films to analyze remaining thickness and cracks.
- Discover new developments such as digital radiography.

IR thermography: after appropriate tuning, manipulate the camera to see hot spots.

Hardness:
- Practice Brinell, Rockwell or Vickers methods; compare results for carbon steel and stainless steel.
- Practice test on base metal, heat affected zone, and weld and infer the tensile strength.

PMI: practice the method on different metallurgies.

Reference: NDTIW-EN-A

Only available as an In-House course.

Contact: rc.contact@ifptraining.com
This course can be adapted to virtual classroom mode - Graduate Certificate Inspector Certification

**Course Content**

**Module 1: MATERIAL & STATIC EQUIPMENT**
5 d
- Metallurgy of ferrous and non-ferrous material used in process industries, structure of steels and alloys. Mill certificate review.
- Piping and flanges, different types of piping equipment: pipes, flanges and gaskets, valves, steam traps, bellows, safety valves, rupture discs; piping codes and standards, piping classes, pressure resistance (ISO-PN, series). Pipe supports. Insulation and tracing.
- Vessels: technology of separator drums; technology and internals of distillation columns and reactors; storage tanks - different types (atmospheric, pressurized, cryogenic…); design, technology; main safety and operating equipment; reliability criteria.
- Thermal equipment: TEMA standard heat exchangers; thermal performance (fluid flow distribution, characteristics & technology). Different types of furnaces and their characteristics. Boiler technology.

**Module 2: REGULATIONS - RELIEF VALVES & RUPTURE DICS**
5 d
- Local rules and international regulations applicable for pressure equipment. Pressure equipment directive requirements.
- International construction codes: ASME VIII, EN 13445. Thickness calculation for shell, bottom, pressure and vacuum, reinforcements of nozzles, pressure test. Existing equipment: study local and international practices: API 510, ASME B16.5 & B31.3, API 570 and 571.
- Pressure relief valves and rupture disc technology and installation. Available technologies and selection criteria for liquid and gas: API 521 & API 520 part 1, international codes, norms, material, spring, orifice size, bellows. Field installation (API 520 part 2): connections, pressure drop, supports, noise, plugging risks. Periodic inspection and maintenance API 527, pop test, kellog test. Study cases.

**Module 3: CORROSION & CORROSION PREVENTION**
5 d
- Different types of industrial corrosion: thinning (corrosion under isolation, corrosion-erosion, galvanic, high temperature sulfur corrosion, oxidation…), cracking (hydrogen induced cracking, high temperature hydrogen attack, intergranular, stress corrosion, amine cracking…), pitting (passivation…), metallurgical deterioration (brittle fracture, creep, fatigue).
- Corrosion prevention: material selection, detailed engineering design; corrosion control by means of sampling, use of corrosion coupons and probes; inhibitors.

**Module 4: INSPECTION, NON-DESTRUCTIVE TESTING & REPAIR WELDINGS**
5 d
- Basic and advanced NDT techniques: visual inspection. Liquid Penetrant Test (PT), Magnetic field Test (MT), Radiographic Test (RT), Ultrasonic Testing (UT), TOFD, phase array, Leak and pressure Testing (LT), Electromagnetic Testing (ET), Positive Material Identification (PMI), Infrared Thermography (IR), Acoustic Emission (AE), Practical use.

**Module 5: INDIVIDUAL PROJECT: REPAIR WORKS ON PRESSURE VESSEL OR PIPING**
5 d
- Case study - Project: subject submitted by the lecturer: study of pressure equipment degradations and consequences.
- Evaluate the damage and its potential kinetics of evolution (remaining life for thinning or risk of cracks propagation). Advise repair or modification, non-destructive testing and inspection in accordance with the applicable specifications and standards.
- Turnaround scheduling, including definition and selection of milestones. Check feasibility for on line temporary repair or hot work during plant shutdown. Individual project oral presentation.

**Module 6: PAINTINGS, COATINGS & CATHODIC PROTECTION**
5 d

**Module 7: RISK BASED INSPECTION (RBI)**
5 d
- Identification of the degradation mechanism for a corrosion loop based on API 571. Description of API 580 RBI methodology for a petrochemical or chemical plant. Probability and consequence of a failure using API 581 workflow and simplified alternative tools. Identification and ranking of piping and pressure vessels in a risk matrix. Expand inspection periodicity or set up an inspection strategy (mitigation by means of more efficient NDT, design improvement or Process safety management enhancement).
- Mini projects application to study cases as teamworks.

**Module 8: FINAL PROJECT - PRACTICAL INSPECTION**
5 d
- Practical external and internal inspection of a pressure vessel during a plant shutdown and an external on line piping inspection.
- Preparation: identify the design conditions, the inspection history and detail the inspection strategy.
- On site: plan theNDT, perform vessel and piping inspection according to the specifications; identify any corrosion. Write an inspection report based on the actual tests, update the RBI and propose an updated inspection strategy. Individual oral presentation and evaluations related to the IFP Training Certification.

**Reference**: INS-EN-A  Only available as an In-House course.

Contact: rc.contact@ifptraining.com
Energy Efficiency & Renewable Energy

Introduction to Renewable Energies ................................................................. p. 105
Process Energy Efficiency Improvement for Industrial Plants ...................... p. 106
Day-to-Day Energy Optimization for Industrial Plants ................................... p. 107

Exchangers, Process Furnaces & Boilers

Thermal Equipment ............................................................................................. p. 108
Heat Exchangers Certification ........................................................................... p. 109
Furnaces: Safe Operation & Optimization ....................................................... p. 110
Boilers Safe Operation & Optimization ......................................................... p. 111
Cogeneration - Combined Cycles .................................................................... p. 112
This course can be adapted to virtual classroom mode

Introduction to Renewable Energies

Level: AWARENESS

Purpose

This course provides an overview of renewable energies and their development status.

Audience

Engineers, supervisors from process, operation, engineering or R&D department of industrial plants.

Learning Objectives

Upon completion of the course, participants will be able to:

- list the technical and economic status of the various renewable energy production channels,
- describe the problem of energy storage in connection with the intermittent production,
- list the barriers to the development of these sectors.

Ways & Means

This session is done in collaboration with Kerdos Energy, expert company in energetic transition and sustainable development for industries, from strategy to technical expertise.

Numerous data from industrial projects.

Learning Assessment

Quiz at the end of the training session.

Prerequisites

To have a 1 month of proven professional experience in the refining or petrochemical industry.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

<table>
<thead>
<tr>
<th>3 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENERGETIC CONTEXT 0.25 d</td>
</tr>
<tr>
<td>Energetic worldwide context. Place of renewable energies in the energy world.</td>
</tr>
</tbody>
</table>

RENEWABLE ENERGIES: DIFFERENT TYPES OF PRODUCTION 2 d

For each production line, the following point are detailed: state of maturity in the world, in Europe & France, the main companies and different technologies, the barriers and economical support programs to develop renewable energies.

Bioenergies: biogas, biofuels.
Wind: on and offshore.
Solar: thermal or photovoltaic.
Marine energies.
Geothermal energy/geothermics.
Hydraulic power.

PROBLEMS LINKED TO ENERGY STORAGE 0.5 d

Main challenges.
Available technologies and future development: different types of processes (physical and chemical).
Comparison of their characteristics: yield, power, availability, intensity, duration.
Network and smart grids.

SOCIETAL ACCEPTANCE OF NEW & RENEWABLE ENERGIES 0.25 d

Societal consequences and problems linked to new energies development.
Impact on the production development.
Monitoring and control tools, communication challenges and constraints, managing the relationships with partners.

Reference: INTENOU-EN-A

Can be organized as an In-House course.

Contact: rc.contact@ifptraining.com

Location Start Date End Date Tuition Fees excl. VAT

Rueil-Malmaison 14 September 16 September €2,120

This course is also available in French: INTENOU-FR-A. Please contact us for more information.
Process Energy Efficiency Improvement for Industrial Plants
Pinch Analysis

Level: EXPERT

Purpose
This course provides comprehensive and applied knowledge of pinch analysis and covers how to improve energy efficiency in existing plants or new projects.

Audience
Engineers from process, engineering, R&D departments of industrial plants in various industries (oil, gas, petrochemical, chemical, energy, paper, food, etc.).

Learning Objectives
Upon completion of the course, participants will be able to:
► define the constraints and stakes of energy efficiency,
► describe the main methods of energy analysis,
► implement an analysis of current energy needs in an industrial plant and make improvement proposals,
► propose ways and means for reducing energy consumption and CO2 emissions.

Ways & Means
► Practical course and case studies based on industrial data and adjustable to trainee’s concern.
► Use of an expert software to compare to the initial evaluation.

Learning Assessment
Quiz at the end of the training session.

Prerequisites
Engineer degree or equivalent experience in a transformation industry.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content 3 days

ENERGY EFFICIENCY & CONTEXT 0.5 d
Definition of Key Performance Indicators: energy intensity and efficiency, units and use. Motivations and constraints: energy dependence and regulation. Energy management system: PDCA (Plan, Do, Check, Act), ISO 50001 standard. Different approaches for energy efficiency: operation improvement, operating conditions optimization and other significant improvement solutions (pinch analysis, alternative technology, process design, best available techniques).

PINCH ANALYSIS & MAIN RULES 0.5 d
Composite curves (hot and cold streams): building, description and interest. Pinch point: characteristics and help for solutions design. Key parameters: $\Delta T_{\text{min}}$, integration ratio. Main rules: “cross pinch”, “plus or minus principle”… Illustration through examples (heat exchanger network, selection of a compressor). Advantage of an expert software dedicated to energy analyses.

METHODOLOGY FOR ENERGY ANALYSIS: MAIN STEPS & CASE STUDIES 2 d
Several case studies proposed and based on a methodology for energy analysis, adapted for industrial plants or new projects. At this step, trainees will be able to: Characterize the energy needs and potential of a process. Design the most consuming pieces of equipment. Define savings targets. Propose potential solutions and options. Simplify it in order to select most profitable and operational options.

Reference: AMENER-EN-P. Can be organized as an In-House course.

<table>
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<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
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<tbody>
<tr>
<td>Rueil-Malmaison</td>
<td>29 September</td>
<td>1 October</td>
<td>€1,940</td>
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</table>

This course is also available in French: AMENER-FR-P. Please contact us for more information.
This course can be adapted to virtual classroom mode

**Day-to-Day Energy Optimization for Industrial Plants**

**Level:** SKILLED

**Purpose**
This course aims to optimize energy consumption and operational costs by improving operation of thermal equipment and steam network balance.

**Audience**
Operation, technical staff & supervisors involved in the technology and operation of thermal equipment, and interested in energy consumption optimization of the plant.

**Learning Objectives**
Upon completion of the course, participants will be able to:
- list the key points of production and propose an economic use of steam and electricity,
- set the operating conditions and the right tunings for combustion optimization in furnaces and boilers,
- provide opportunities for improving energy balances.

**Ways & Means**
- Practical course and case studies based on industrial feedbacks.
- Numerous exercises to improve understandings.

**Learning Assessment**
Quiz at the end of the training session.

**Prerequisites**
Engineer diploma or equivalent experience in process industry.

**Expertise & Coordination**
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

### ENERGY BALANCE - EFFICIENCY & CONTEXT

**0.25 d**
KPI’s definition (Key Performance Indicators): energy intensity and efficiency, units and use.
Motivations and constraints: energy dependence and regulation.
Different approaches for energy efficiency: operation improvement, operating conditions optimization, significant improvement solutions, Best Available Techniques (BAT).

### ENERGY CONSUMPTION INSIDE FURNACES & BOILERS

**0.75 d**
Main type of furnaces and boilers. Operating conditions.
Heat balance, efficiency estimate. Scope and limitations to improve efficiency.
Material and equipment used to improve efficiency and heat recovery.
Applications and exercises:
- Heater efficiency estimate and flue gas composition calculation.
- Boiler operating conditions analysis - Heat recovery in radiant and convection zone.
- Impact of fuel composition on atmospheric emissions.

### ELECTRICITY & STEAM PRODUCTION

**1.25 d**
Cogeneration cycles: boiler-steam turbine, gas turbine-waste heat boiler.
Operating conditions (extraction or discharge pressure, single recovery or post-combustion waste heat boiler’s operation) and thermal performance.
Steam network operation and balance. Mechanical energy produced by steam expansion, energy recovery and electricity production optimization.
Sources of margin: technology and use of steam traps.
Application:
- Study of a power plant.
- Estimation of production cost for steam (HP, MP, LP) and electricity.

### HEAT & MECHANICAL ENERGY RECOVERY

**1.25 d**
Scope and limitations of heat recovery inside heat exchangers. Parameters impacting heat flux and heat transfer.
Sources of margin: heat exchangers performance follow-up, impact of fouling, cleaning strategy and optimum cleaning frequency calculation.
Low temperature heat recovery: heat pumps solutions or mechanical compression of gases (main operating constraints).
Mechanical energy recovery inside process-gas turbines.
Application:
- Heat exchanger train performance follow-up.
- Optimum cleaning frequency calculation.

### PROCESS OPERATION

**0.5 d**
Limitation of losses: mechanical (operating conditions) and thermal (insulation).
Ways to reduce energy consumption by adjusting operating conditions (pressure, recycle gas flowrate…), thermal integration.
Applications:
- Study of different flow control system on compressor.
- Impact of a distillation column operating parameters on energy consumption.
- Impact of a lack of thermal insulation.

**Reference:** MENERG-EN-A - Can be organized as an In-House course.

**Contact:** rc.contact@ifptraining.com

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<thead>
<tr>
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<tbody>
<tr>
<td>Rueil-Malmaison</td>
<td>15 June</td>
<td>18 June</td>
<td>€2,520</td>
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</tbody>
</table>

This course is also available in French: MENERG-FR-A. Please contact us for more information.
Thermal Equipment
Technology & Operation

Level: KNOWLEDGE

Purpose
This course provides in-depth knowledge of heat exchangers, furnaces and boilers installed in the Oil & Gas industry.

Audience
Engineers, technical staff and supervisors involved in the technology and operation of thermal equipment.

Learning Objectives
Upon completion of the course, participants will be able to:
- describe the technology of thermal equipment,
- compare operating conditions and implement an optimum, safe and reliable operation of heat exchangers and heaters,
- implement the main steps of start-up, shutdown and testing procedures.

Ways & Means
- Study of main components of burners, tube coils and refractory.
- Actual examples and applications from the refining, petrochemical and chemical industry.
- Trainee participation is continuously encouraged through the use of case studies selected by the trainees themselves.

Learning Assessment
Quiz.

Prerequisites
Good basic theoretical knowledge or several years of operation experience.

Expertise & Coordination
All IFP Training lecturers are experts in the course technical domain, and trained to pedagogical methods for adults.

Course Content

THERMAL EQUIPMENT & HEAT TRANSFER 0.5 d
Heat exchange conditions: convection coefficients, resistance caused by the walls and/or fouling. Overall heat transfer coefficient.
Heat transfer by radiation: parameters influencing heat transfer, type of fuel burned, tube temperature, fouling consequence.

HEAT EXCHANGERS TECHNOLOGY & SELECTION CRITERIA 1 d
TEMA standard heat exchangers, selection criteria for different types of shell, front ends and rear ends, floating end construction.
Tubes: length, diameter and gage, pattern and pitch, tube-to-tube sheet connection.
Baffles and support plates: type of transversal baffles, baffles cut, spacing.
Thermal performance: fluid flow distribution, geometrical characteristics and technological constraints.
Other types of heat exchanger: tubular or plate type, air coolers and condensers. Maintenance and cleaning.

HEAT EXCHANGERS PERFORMANCE & MAINTENANCE 0.75 d

FURNACES & BOILERS TECHNOLOGY 1.25 d
Different types of furnaces and their features. Operating conditions.
Boiler technology and operating conditions.
Efficiency of heat recovery: estimation rule. Parameters influencing heater efficiency.
Construction of heat exchange areas and refractory materials.
Air and flue gas circulation: natural and forced draft.
Burner technology: fuel and air supply and mixture. Low NOx and ultra-low NOx burners technology.

HEATERS OPERATION 0.5 d
On stream operation: monitoring of combustion and heating. Modifying operating conditions.
Control system: air/fuel ratio control, process fluid outlet temperature, steam pressure, feed water flow rate control, phenomena disrupting the steam drum level. Safety prescriptions on heaters, process fluid, combustion, fuel circuits.

Reference: THERMEQ-EN-P Can be organized as an In-House course. Contact: rc.contact@ifptraining.com

Location | Start Date | End Date | Tuition Fees excl. VAT
---|---|---|---
Bahrain | 21 June | 24 June | €3,150
# Heat Exchangers Certification

This course can be adapted to virtual classroom mode - Advanced Certificate

**Selection - Design - Performance Monitoring**

## Course Content

### HEAT TRANSFER LAW APPLIED TO HEAT EXCHANGERS

<table>
<thead>
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<th>Duration</th>
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### TEMA STANDARD TUBULAR HEAT EXCHANGERS - TECHNOLOGY & SELECTION CRITERIA

<table>
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<th>Duration</th>
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<tr>
<td>0.5 d</td>
<td>TEMA standard heat exchangers: nomenclature, different types of shell, floating heads and fixed front head. Selection criteria, advantages and drawbacks of the different types. Geometrical characteristics of TEMA heat exchangers and technological constraints. Technological solutions to improve film coefficient or reduce shell side pressure drops: tubes inserts, type of baffle… Application: selection of a TEMA type and fluid flow allocation according to a process data sheet.</td>
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### THERMAL & HYDRAULIC DESIGN - PERFORMANCE FOLLOW-UP

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<th>Duration</th>
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<tr>
<td>2.5 d</td>
<td>Heat exchanger design procedure: fluid flow allocation, TEMA type selection, heat exchange area estimate, area organization (tubes diameter and length, tube pattern and pitch), baffle (type, spacing and cut), shell side stream analysis, performance and geometrical hypothesis checking, acceptance criteria, reconsideration of initial design (number of shell in series or in parallel, number of tube passes…). Vibrations induced by flow in a shell: prediction, severity criteria, influence on design. Specific case of air coolers: technology, particularities of the design procedure, heat transfer and pressure drop on airside. Condensation or vaporization performance: two phase flow (patterns and pressure drop), condensation modes, film condensation, characteristics, boiling mechanisms, film boiling and convective boiling coefficient. Hydrodynamics of thermosiphon boilers. Application: Thermal and hydraulic design of a single-phase heat exchanger. Initial design of condenser and boiler.</td>
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### PLATE TYPE HEAT EXCHANGERS

<table>
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<th>Duration</th>
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<tr>
<td>0.5 d</td>
<td>Main type of plate heat exchangers: advantages and drawbacks. Limitations and application area. Main design rules and arrangement possibilities (parallel, series…). Application: heat exchange area to install in case of a perfect counter-current plate type HX.</td>
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</tbody>
</table>

## Prerequisites

- This course is a part of a professional framework of an expert in exchangers.
- An engineer diploma or 2 years experience in process industry is then requested.

## Why an IFP Training Certification?

- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Heat Exchangers Certification.
- Ready-to-use skills.

## Audience

Engineers and staff from the technical and process departments of refining, petrochemical and chemical companies.

## Learning Objectives

Upon completion of the course, participants will be able to:

- list advantages and drawbacks of TEMA Types and associate the most appropriate type with operating conditions and fluids properties,
- describe the heat exchange laws and identify key parameters impacting the exchange coefficients and pressure drops,
- define the required data used inHX design software and analyze the output file,
- elaborate, from a process data sheet, a TEMA specification data sheet used for HX construction.

## Ways & Means

- A case study is organized throughout the training program to select, design and check performances of a single phase shell and tube heat exchanger, from the process data sheet to the TEMA specification data sheet.
- Study of reboilers, condensers and air-cooled heat exchangers.
- Special emphasis on interaction between mechanical aspects and process requirements in the thermal and hydraulic design of heat exchangers.

## Learning Assessment

Quiz at the end of the training session.

Reference: HEDES-EN-A  - Only available as an In-House course. Contact: rc.contact@ifptraining.com

- This course is also available in French: ECHAL-FR-A. Please contact us for more information.

[www.ifptraining.com](http://www.ifptraining.com)
Furnaces: Safe Operation & Optimization
Application using dynamic simulator (CORYS IndissPlus)

Level: SKILLED

Purpose
This course provides in-depth knowledge of furnace operation in the petroleum and petrochemical industries. The course covers also the safety and reliability constraints.

Audience
Operators, panel operators, supervisors and plant managers of refining, chemical and petrochemical plants, involved in furnace operation.
Engineers and supervisors concerned with safety, optimization and operating issues of furnaces.

Learning Objectives
Upon completion of the course, participants will be able to:
- recognize the main operating and material constraints for an optimal, safe and reliable furnace operation,
- describe industrial combustion phenomena and calculate the air/fuel ratio for optimum combustion,
- identify bad-quality combustion from flue gas analysis and flame study, and implement corrective steps,
- list and apply the main steps of a furnace start-up procedure.

Ways & Means
- Use of a dynamic simulator to understand the impact of operating conditions on thermal performance and furnace operation.
- Use of case studies and exercises based on industrial situations.
- Special emphasis on safety issues and abnormal situations that can lead to accidents.

The course content can be tailored to different types of furnaces and includes specificities linked to some processing units such as the steam reformer or steamcracker.

Learning Assessment
Quiz at the end of the training session.

Prerequisites
To have a 1 month of proven professional experience in the refining or petrochemical industry.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

FURNACE CONSTRUCTION & OPERATING CONDITIONS 0.75 d
Different types of furnace and operating conditions. Scope and limitations for improving furnace efficiency.
Construction of heat exchange areas and refractory materials: tube bundle arrangement, insulation, type of material used and operating limits.

COMBUSTION - BURNERS - DRAFT 1.25 d
Combustion conditions: liquid and fuel gas characteristics, liquid spray.
Burners: fuel and air supply and mixture. Conventional and low NOx burners operation.
Combustion quality: analysis of the oxygen and the unburned material in the flue gases, control of combustion air flowrate and air/fuel ratio.
Combustion safety: flame detection, control and safety devices.
Air and flue gas circulation: natural draft, forced draft, pressure differential control, automatic safety devices. Damper or induced draft fan role.
Application:
- Natural and forced draft pressure profile drawing. Review of draft constraints.
- Different types of burners and spraying systems.

HEAT TRANSFER & FURNACE OPERATION 2 d
Heat transfer to the tube coil: control parameters. Impact of internal or external fouling.
Heat control: process fluid outlet temperature, fuel flowrate control.
Most important furnace temperature and constraints: skin temperature, bridgeway temperature, limits and risk of overcoming.
Application: furnace temperature profile and heat recovery distribution as a function of fuel burned and combustion air excess.

Start-up and shutdown: preparation, safe ignition procedures, ignition after a short shutdown, normal shutdown, emergency shutdown.

Incidents.
Troubleshooting. Prevention.
Application:
- Case study of furnace accidents.
- Start-up procedure study.

Reference: FURNSOO-EN-P. Only available as an In-House course.
Contact: rc.contact@ifptraining.com

This course is also available in French: FURNSOO-FR-P. Please contact us for more information.
This course can be adapted to virtual classroom mode

Boilers Safe Operation & Optimization

Level: SKILLED

Purpose
This course provides in-depth knowledge of boilers operating conditions and constraints for a safe and reliable operation.

Audience
Operators, panel operators, supervisors and plant managers involved in steam production facilities operation and optimization. Maintenance, instrumentation technicians and supervisors working on boilers.

Learning Objectives
Upon completion of the course, participants will be able to:

► operate the boilers safely, while following the rules of optimized combustion, feed-water quality, water and steam control,
► describe combustion rules and calculate the air/fuel ratio for optimum combustion,
► identify bad-quality combustion from flue gas analysis and flame study and implement corrective actions,
► list the main steps of a boiler start-up and shutdown procedure.

Ways & Means

► Use of case studies or exercises based on actual cases from the industry.
► Special emphasis on safety issues and abnormal situations that can lead to accidents.

Learning Assessment
Quiz at the end of the training session.

Prerequisites
To have a 1 month of proven professional experience in the refining or petrochemical industry.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good experience of the related topics and industrial experience, trained to adult teaching methods and whose competencies are kept up-to-date.

Course Content

BOILER DESCRIPTION & OPERATING CONDITIONS

0.75 d
Different types of boilers and their characteristics. Operating conditions. Fuel consumption. Distribution of the heat supply as a function of the steam pressure and temperature. Construction of the vaporization and superheating tube bundles, the economizer and the drum.

Application: calculation of heat distribution between water wall, superheaters, economizer and air preheater.

COMBUSTION - BURNERS

1.5 d

Application: flue gas composition calculation, air and flue gas pressure profile drawing.

STEAM PRODUCTION

0.75 d
Water preparation: drawbacks arising from the impurities in the water, water quality measurement, characteristics of feed water and water in the boiler, thermal degassing, water chemical conditioning. Control loop systems: steam pressure, feed water flow rate, superheated steam temperature, disruptions and control principles.

BOILER OPERATION

1 d
Steam generation inside tube coil and steam superheating. Heat flux, parameters influencing heat transfer, impact of fuel type, fouling impact. On-stream boiler operations: routine monitoring, operating condition changes, analysis of disturbances, soot blowers, drains, etc. Start-up and shutdown: preparation, ignition procedures, pressure build-up, connection to network, normal or emergency shutdown.

Application: study of start-up and shutdown procedure. Accident case studies.

Reference: BOILER-EN-A  Only available as an In-House course.

This course is also available in French: BOILER-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

Cogeneration - Combined Cycles
Performances & Operation

Course Content

| Level: SKILLED |
| Purpose |
This course deals with cogeneration units in existing plants or new projects.

| Audience |
Graduate engineers and technicians whose activities are related to the design and/or operation of these installations: engineers and technicians from engineering companies, technical and HSE support, operation team, personnel from insurance companies.

| Learning Objectives |
Upon completion of the course, participants will be able to:
- describe the process conditions related to the combined production of thermal and mechanical energy,
- assess and follow up on the performance of the different equipment of a cogeneration unit,
- analyze the operating conditions of a cogeneration cycle.

| Ways & Means |
Several practical applications related to actual industrial cases.

| Learning Assessment |
Quiz at the end of the training session.

| Prerequisites |
To have a 1 month of proven professional experience in the refining or petrochemical industry.

| Expertise & Coordination |
IFP Training trainer (permanent or contracted) having a good expertise and experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

COGENERATION: DIFFERENT CYCLES - GAS TURBINES & WASTE HEAT RECOVERY 1.25 d
Operating principle and operating conditions of cogeneration and combined cycles - Typical schemes.
Main parts of the different cycles:
- Boiler, steam turbine (back-pressure or condensation).
- Gas turbine, waste heat recovery boiler.
Energy balance and energy performances of each elementary operation: compression, combustion and expansion.
Efficiency enhancement, heat recovery from exhaust gases (air preheater, waste heat recovery boiler).
Different operating modes (simple waste heat recovery, post-combustion, separate boiler) and performances.
Application: comparison of performance, mechanical and thermal energy split.

COGENERATION: PRODUCTION OF STEAM 1 d
Boiler Feed Water (BFW) quality, description of the physical and chemical required treatments.
Description of conventional boilers and waste heat boilers: water circuit, steam circuit, fuel circuits.
Operating conditions - Fuel consumption per ton of steam, depending on boiler type and operating conditions.
Main process control loops: boiler feed water, pressure and steam temperature, combustion, flue gas circulation draft.
Combustion monitoring, analyzers, aim and meaning of each measured parameter. Safety equipment and sequences.

COGENERATION: STEAM END-USES 0.75 d
Steam as a heating medium and mechanical driving fluid.
Steam pressure level requirements, depending on the end-use. Steam network balancing.
Steam as a heating medium: conditions for its distribution and efficient utilization.
Steam turbines: operating principle, expansion work and efficiency, and produced energy.
Static expansion: expanded steam characteristics, steam de-superheating.

Reference: COGENE-EN-A
Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: COGENE-FR-A. Please contact us for more information.
Specifications, Technology & Performance

Rotating Equipment .......................................................................................................................................................................................................................... p. 114
Operation, Maintenance & Inspection of Rotating Machinery ............................................................................................................................ p. 115
Gas Compression & Expansion, Compressors & Turbines Certification .................................................................................................... p. 116
Gas Turbines .......................................................................................................................................................................................................................... p. 117
Centrifugal Pumps & Positive Displacement Pumps ................................................................................................................................................. p. 118
Steam Turbines .......................................................................................................................................................................................................................... p. 119
Reciprocating Compressors ....................................................................................................................................................................................................... p. 120
Centrifugal Compressors .............................................................................................................................................................................................................. p. 121
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Troubleshooting, Maintenance & Reliability

Machinery Failure Analysis & Repair Methods .......................................................................................................................................................... p. 125
Rotating Machinery Vibration Analysis ................................................................................................................................................................................... p. 126
Rotating Equipment Technicians Certification .......................................................................................................................................................... p. 127
This course can be adapted to virtual classroom mode

Rotating Equipment

Course Content

PUMPS
Different types of pumps, applications in the process industry.
Operating principle and technology of positive displacement pumps.
Performance curves of a centrifugal pump: head, efficiency, absorbed power, NPSH.
Technology of centrifugal pumps, different layouts.
Mechanical seals: different arrangements, related auxiliary systems.
Operating limits: cavitation, hammer shock, priming issues, case of 2 pumps running together.
Start-up and operation monitoring: specific case of hot pumps, LPG pumps, vacuum pumps.
Troubleshooting and common failures. Safety and prevention.

RECOUPRATING & ROTARY POSITIVE DISPLACEMENT COMPRESSORS
Different types of positive displacement compressors.
Reciprocating compressor architecture: number of stages, cylinders, overall layout, standard applications.
Technology of main components and auxiliaries.
Influence of process conditions on compressor performance: suction or discharge pressure, suction temperature, gas composition.
Flow control, specific safety devices. Start-up procedures. Troubleshooting.

CENTRIFUGAL & AXIAL COMPRESSORS
Description of different types of centrifugal and axial compressors: horizontal/radial split casing centrifugal compressors, axial compressors, integrally geared compressors.
Technology of main components and auxiliaries.
Compression mechanism through a compressor stage. Performance curves vs operating conditions.
Operation limits: low and high speed limits, stonewall, surge, typical anti surge protection systems.
Flow control: throttling valve, rotation speed control, inlet guide vanes. Specific precautions for start-up.
Troubleshooting. Safety.

TURBINES
Description of different types of turbines, typical applications.
Steam turbines, gas turbines, turbo-expanders.
Operating principle, classification and technology; exhaust conditions, expansion mechanism through a turbine stage.

Specifications, Technology & Performance

Level: KNOWLEDGE

Purpose
This course provides a good knowledge of the performance, technology and operation of rotating machinery.

Audience
Engineers, supervisors and technicians involved in rotating machinery operation, maintenance or engineering.

Learning Objectives
Upon completion of the course, participants will be able to:

- recognize the different types of rotating machinery and their main applications,
- explain operating principles and key performances of any rotating equipment,
- describe rotating machinery technologies.

Ways & Means

- Study of actual equipment and mechanical parts in the workshop.
- Use of drawings, datasheets, pictures and videos of actual equipment.
- Pumping test bench practical works.
- Incidents analysis and improvement proposals.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month related to the concerned field.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: ROTMACH-EN-A
Can be organized as an In-House course.

Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rueil-Malmaison</td>
<td>18 October</td>
<td>22 October</td>
<td>€3,000</td>
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</table>

This course is also available in French: ROTMACH-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

**Operation, Maintenance & Inspection of Rotating Machinery**

<table>
<thead>
<tr>
<th>Level: SKILLED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
</tr>
<tr>
<td>This course provides key competencies related to rotating machinery operation and maintenance tasks.</td>
</tr>
<tr>
<td><strong>Audience</strong></td>
</tr>
<tr>
<td>Engineers, supervisors and technical staff involved in rotating machinery maintenance and technical inspection.</td>
</tr>
<tr>
<td><strong>Learning Objectives</strong></td>
</tr>
<tr>
<td>Upon completion of the course, participants will be able to:</td>
</tr>
<tr>
<td>&quot;explain how to operate rotating machinery (pumps, compressors, steam turbines),&quot;</td>
</tr>
<tr>
<td>&quot;explain the key points for fluid flow and gas compression/expansion theory and practical applications,&quot;</td>
</tr>
<tr>
<td>&quot;list the key points for rotating machinery maintenance and inspection operations,&quot;</td>
</tr>
<tr>
<td>&quot;explain how to achieve these operations,&quot;</td>
</tr>
<tr>
<td>&quot;list the main failure modes related to each here above listed rotating machinery,&quot;</td>
</tr>
<tr>
<td>&quot;participate in the machinery reliability improvement process.&quot;</td>
</tr>
<tr>
<td><strong>Ways &amp; Means</strong></td>
</tr>
<tr>
<td>Interactive lecture.</td>
</tr>
<tr>
<td>Case studies based on industrial and actual feedback.</td>
</tr>
<tr>
<td>Practical work in workshops on actual equipment.</td>
</tr>
<tr>
<td>Use of dynamic simulators: pumps, compressors, steam turbines.</td>
</tr>
<tr>
<td><strong>Learning Assessment</strong></td>
</tr>
<tr>
<td>Quiz.</td>
</tr>
<tr>
<td><strong>Prerequisites</strong></td>
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<tr>
<td>Provide evidence of a professional experience of at least 1 month related to the concerned field.</td>
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<td><strong>Expertise &amp; Coordination</strong></td>
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</tr>
</tbody>
</table>

**Course Content**

<table>
<thead>
<tr>
<th>CENTRIFUGAL PUMPS</th>
<th>2 d</th>
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</thead>
<tbody>
<tr>
<td>Main parts: casing, rotor, mechanical seals, bearings, coupling, auxiliary systems.</td>
<td></td>
</tr>
<tr>
<td>Fluid flow key points with a pumping system.</td>
<td></td>
</tr>
<tr>
<td>Operation: performance curves, flow control, start-up and shutdown, general troubleshooting.</td>
<td></td>
</tr>
<tr>
<td>Maintenance: assembly and dismantling procedures, main checks.</td>
<td></td>
</tr>
<tr>
<td>Typical defaults and failure modes.</td>
<td></td>
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<tr>
<td>Applications with a dynamic simulator.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>RECIPIROCATING &amp; CENTRIFUGAL COMPRESSORS</th>
<th>2 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main parts: casing, crankshaft/rotor, packings/mechanical seals, bearings, coupling, auxiliary systems.</td>
<td></td>
</tr>
<tr>
<td>Gas compression key points. Single and multistage compression.</td>
<td></td>
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<tr>
<td>Operation: performance curves, flow control, start-up and shutdown, monitoring, protection curves, general troubleshooting.</td>
<td></td>
</tr>
<tr>
<td>Maintenance: assembly and dismantling procedures, main checks.</td>
<td></td>
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<tr>
<td>Typical defaults and failure modes.</td>
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<tr>
<td>Applications with dynamic simulators.</td>
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<table>
<thead>
<tr>
<th>TURBINES &amp; EXPANDERS</th>
<th>1 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various types of turbines: steam and gas turbines, expanders. Typical applications.</td>
<td></td>
</tr>
<tr>
<td>Main parts: casing, rotor, seals, governors, bearings, coupling, auxiliary systems.</td>
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<tr>
<td>Gas and steam expansion: key points.</td>
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<tr>
<td>Operation: performance curves, speed and power control, start-up and shutdown, monitoring, overspeed protection, general troubleshooting.</td>
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<tr>
<td>Maintenance: assembly and dismantling procedures, main checks.</td>
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<tr>
<td>Typical defaults and failure modes.</td>
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<table>
<thead>
<tr>
<th>LUBRICATION SYSTEMS MAINTENANCE/OIL ANALYSIS</th>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose, different types of lubricants and lube systems.</td>
<td></td>
</tr>
<tr>
<td>Lubrication equipment maintenance: key points.</td>
<td></td>
</tr>
<tr>
<td>Oil analysis. Reports. Case studies.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BEARINGS MAINTENANCE</th>
<th>1 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antifriction bearings: clearances/interferences assessments and checks, assembly procedures.</td>
<td></td>
</tr>
<tr>
<td>Sleeve and til pad journal and thrust bearings.</td>
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<tr>
<td>Shaft rotation in an oil bearing.</td>
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<tr>
<td>Clearances checks.</td>
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<tr>
<td>Instrumentation checks and fitting procedures. Case studies.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>COUPLINGS &amp; ALIGNMENT</th>
<th>0.5 d</th>
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<tbody>
<tr>
<td>Different types of couplings and related problems.</td>
<td></td>
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<tr>
<td>Various alignment methods, tolerances.</td>
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<table>
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<tr>
<th>ROTORS &amp; SHAFTS</th>
<th>0.5 d</th>
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<tr>
<th>RUPTURE MODES</th>
<th>1 d</th>
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<tbody>
<tr>
<td>Rupture mechanisms.</td>
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<tr>
<td>Surface damage</td>
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<tr>
<td>Fatigue, wear and tear. Rupture face analysis.</td>
<td></td>
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<tr>
<td>Case studies.</td>
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</table>

<table>
<thead>
<tr>
<th>USE OF VIBRATION ANALYSIS</th>
<th>1.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different types of measurements and sensors.</td>
<td></td>
</tr>
<tr>
<td>Typology of typical defaults affecting rotating machinery. Spectrum analysis and various techniques for diagnosis. Case studies.</td>
<td></td>
</tr>
</tbody>
</table>

Reference: OMIRM-EN-A

Contact: rc.contact@ifptraining.com

This course is also available in French: OMIRM-FR-P. Please contact us for more information.
Advanced Certificate
Gas Compression & Expansion, Compressors & Turbines Certification
Applications with IndissPlus dynamic simulator

Level: EXPERT

Purpose
This course provides a clear understanding of the performance and technology of these types of equipment.

Audience
Graduate engineers, new engineers and staff supervisors from the maintenance, process or operation department of refineries and petrochemical plants.

Learning Objectives
Upon completion of the course, participants will be able to:
- learn about operating characteristics and standards,
- explain how to adapt to process operating conditions,
- list main operating problems and propose solutions.

Ways & Means
- Extensive use of digital applications related to industrial equipment.
- Interactive course.
- Specific, detailed and high level documentation.
- Use of a dynamic simulator (centrifugal compressor + steam turbine).

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month related to the concerned field.

Why an IFP Training Certification?
- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Gas Compression & Expansion, Compressors & Turbines Certification.
- Ready-to-use skills.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content 4 days

GAS COMPRESSION & EXPANSION 1 d
Ideal gas law and practical application; isentropic, polytropic compression; mass and volume capacity.
Practical compression laws: discharge temperature, power of compression.
Mollier diagram for gas and steam. Euler law, applications for compressors and turbines, characteristic curves.
Velocities triangle. Impulse, reaction, type of blades.
Mach number: effect on temperature, pressure and density; subsonic and supersonic machines.
Dimensionless coefficients, specific speeds.

COMPRESSIONS, TURBINES & EXPANDERS PERFORMANCE & OPERATION 2 d
Axial and centrifugal compressors:
- Characteristic curves: invariant representations.
- Surge and stonewall; range of working efficiency.
- Capacity control methods. Start-up and vibration monitoring.
Steam turbines:
- Characteristics of a turbine: speed, specific consumption, efficiency.
- Influence of inlet and exhaust steam states.
- Speed governor and control systems. Safety devices.
- Turbo-expanders:
  - Technology and main uses.
  - Safety devices.

TECHNOLOGY & ENGINEERING ASPECTS OF COMPRESSORS & TURBINES 1 d
Technology:
- Casings, diaphragms, stator, blades.
- Rotor, journal and thrust bearings, internal and shaft seals, coupling.
Engineering:

Reference: CCTAV-EN-P. Can be organized as an In-House course.
Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
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<tr>
<td>Bahrain</td>
<td>13 September</td>
<td>16 September</td>
<td>€3,150</td>
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</table>

This course is also available in French: CCTAV-FR-P. Please contact us for more information.
This course can be adapted to virtual classroom mode

Gas Turbines

**Level:** EXPERT

**Purpose**

This course provides a good knowledge of gas turbine technology and enhance competency in the selection, operation and maintenance of gas turbines.

**Audience**

Engineers and managers involved in gas turbine operation, maintenance, engineering and purchasing.

**Learning Objectives**

Upon completion of the course, participants will be able to:

- Explain gas turbine operation,
- List selection criteria based on process conditions,
- Participate in a gas turbine troubleshooting analysis,
- Implement a gas turbine maintenance plan.

**Ways & Means**

- Case studies of actual gas turbines.
- Various illustrations of actual systems.
- Interactive course
- Groupwork: overall study of a gas turbine.

**Learning Assessment**

Quiz.

**Prerequisites**

Provide evidence of a professional experience of at least 1 month related to the concerned field.

**Expertise & Coordination**

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

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**Course Content**

5 days

**GAS TURBINE EQUIPMENT**

Classification: typical cycles, heavy duty and aeroderivative designs, applications.
Presentation: main components. Standard and specific machines available.
Construction and design: compression, combustion, expansion. Rotor dynamics, coupling.
Auxiliary equipment:
- Internal cooling, lubrication, control system, safety devices.
- External auxiliaries: air inlet filters, exhaust stack.

**PERFORMANCE**

Thermodynamics: ideal and actual gas, behavior during compression and expansion, isentropic and polytropic processes.
Centrifugal and axial compression. Performance, stability and other limits.
Combustion operation. Influence of fuel type. Afterburning for cogeneration purposes. Low NOx designs.
Expansion: single or double shaft design operation. Performance influence of atmospheric conditions, fuel selection. API charts.
Available load characteristics: rotation speed, T₃firing temperature, IGV influences. Open cycle, combined cycle examples.
Case studies: actual performance vs. basic design; troubleshooting and solutions.

**SELECTION**

Selection criteria according to availability, operational and maintenance requirements.
Bidding: significant information for data sheet definition.

**OPERATION**

Start-up and shutdown operation: sequences and trips. Air filtering, lubrication and fuel systems operation.
Performance monitoring and mechanical operation. Maintenance during operation: compressor cleaning devices.
Maintenance objectives and scheduling: operation, load, fuel influences; inspection schedules.
Factors related to available load: rotation speed, T₃, IGV. Typical approaches related to Brayton cycle, cogeneration, combined cycle.

---

**Reference:** TAG-EN-A

Contact: rc.contact@ifptraining.com

Can be organized as an In-House course.

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Rueil-Malmaison</td>
<td>15 March</td>
<td>19 March</td>
<td>€3,150</td>
</tr>
</tbody>
</table>

This course is also available in French: TAG-FR-P. Please contact us for more information.
Blended Learning
This course offers a combination of online and face-to-face training sequences

Centrifugal Pumps & Positive Displacement Pumps
Applications with CORYS dynamic simulator

Level: SKILLED

Purpose
This course covers the centrifugal and positive displacement pumps technology and their operating conditions.

Audience
Engineers and technicians involved in centrifugal and positive displacement pump operation, maintenance or engineering.

Learning Objectives
Upon completion of the course, participants will be able to:
- describe the behavior and the operation of pumps,
- participate actively in troubleshooting analysis and help to diagnose failures,
- identify main parameters in pump selection.

Ways & Means
Actual examples from the refining, petrochemical and chemical industry.
Active participation is encouraged through case studies.
Use of a centrifugal pump dynamic simulator.
E-learning session previously to the presentational one.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month related to the concerned field.

Course Content

E-learning: HYDRODYNAMICS BASICS

Module 1: BASICS IN FLUID FLOW
Pipe system:
- Liquid flows in pipes: friction losses.

Module 2: BASICS IN CENTRIFUGAL PUMP TECHNOLOGY
Centrifugal pump construction, main components.
Internal forces and mechanical criteria: balancing, wear ring clearances.

CLASSROOM TRAINING

HYDRODYNAMICS APPLIED TO A PUMPING SYSTEM 1.5 d
Pump performance:
- Flow in a pump, velocities triangle, internal flow and energy losses.
- Theoretical and practical head: characteristic curve.
- Other characteristics: efficiency, power, NPSH required.
- Changes in characteristics vs. rotation, viscosity, impeller shape, cavitation.
Pipe system:
- System curve, resistance of flow and throttling control.
- Operating point: normal and maximum capacities, change in fluid characteristics and incidence on operating conditions.

Exercises with a dynamic simulator.

CENTRIFUGAL PUMP TECHNOLOGY & SELECTION 1.5 d
Centrifugal pump:
- Impeller and pump shape, suction operating conditions.
Mechanical seal:
- Selection according to API 682 standard and type.
- Friction face heating.
- Safety and environment: typical arrangements (single, dual, dry seal).
- Specific solutions: canned motor pump, magnetic drive pump.
Installation:
- Suction and discharge pipe design.
- NPSH available; base plate and grouting.
- Ancillary lines and equipment.
- Coupling and driven machines.
- Safety and environment.

POSITIVE DISPLACEMENT PUMP TECHNOLOGY & PERFORMANCE 0.5 d
Technology: different types of pumps (rotary and reciprocating pumps). Operation and performance of the different types of pumps.
Influence of clearance, internal leaks, nature of product on flow rate and pressure. Flow rate control.
Installation guidelines: position of tanks, line diameters, metering drums, pulsation dampeners, pressure valves.

PUMP OPERATION 0.5 d
Preparation: filling and draining. Start-up/shutdown: priming, hammer shock, risks to the process and the pump.
Monitoring parameters (vibration levels, noises, bearing housing temperature, motor intensity, pressures).
Parallel and serial operation. Safety conditions.
Reliability: types and source of failures (wear, ruptures, cavitation, leakages); improvement methods.
Exercises with dynamic simulator.

Reference: PC-EN-B Can be organized as an In-House course.
Contact: re.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>9 August</td>
<td>12 August</td>
<td>€3,150</td>
</tr>
</tbody>
</table>
This course can be adapted to virtual classroom mode

Steam Turbines
Applications with CORYS IndissPlus dynamic simulator

Level: SKILLED

Purpose

This training provides an appropriate knowledge of steam turbine technology, performance and operation.

Audience

Engineers and technicians in charge of steam turbine operation, maintenance and steam turbine projects.

Learning Objectives

Upon completion of the course, participants will be able to:

- explain the operating principles of steam turbines,
- recognize operating problems,
- implement a steam turbine troubleshooting monitoring.

Ways & Means

Study of industrial cases:

- different examples of steam turbines design and on-site layout,
- use of a dynamic simulator to demonstrate typical features.

Learning Assessment

Quiz.

Prerequisites

Provide evidence of a professional experience of at least 1 month related to the concerned field.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

<table>
<thead>
<tr>
<th>STEAM TURBINE PERFORMANCE</th>
<th>1.25 d</th>
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<table>
<thead>
<tr>
<th>TECHNOLOGY</th>
<th>1.5 d</th>
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<table>
<thead>
<tr>
<th>STEAM TURBINE CONTROL SYSTEMS</th>
<th>0.75 d</th>
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<table>
<thead>
<tr>
<th>OPERATION</th>
<th>1 d</th>
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</thead>
<tbody>
<tr>
<td>Lubrication and sealing devices. Important parameters for turbine operation. Monitoring of steam circuit and lubrication circuit. Start-up and shutdown sequences of different types of turbines. Incidents occurring in the steam network, the machine or the ancillary equipment. Safety and prevention.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DYNAMIC SIMULATION - APPLICATIONS</th>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation and start-up of a steam turbine driving a centrifugal compressor.</td>
<td></td>
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</tbody>
</table>

Reference: EXTAV-EN-A. Can be organized as an In-House course. Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rueil-Malmaison</td>
<td>12 April</td>
<td>16 April</td>
<td>€3,000</td>
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</tbody>
</table>

This course is also available in French: EXTAV-FR-P. Please contact us for more information.
This course can be adapted to virtual classroom mode

Reciprocating Compressors
Applications with CORYS IndissPlus dynamic simulator

.level: SKILLED

Purpose
This training improves participants’ skills on technology, operation and maintenance of reciprocating compressors.

Audience
Engineers and technicians involved in the operation, inspection and maintenance of reciprocating compressors.

Learning Objectives
Upon completion of the course, participants will be able to:
- list the different parts of a compressor and explain their characteristics,
- explain the evolution of compressor operating parameters,
- implement appropriate monitoring for each type of compressor,
- be involved in troubleshooting activities.

Ways & Means
- Actual examples from the Oil & Gas and petrochemical industries.
- Trainee participation is continuously encouraged through case studies selected by the lecturer or proposed by the trainees.
- Use of a dynamic simulator (start-up/shutdown, general operation, disturbances/troubleshooting).

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month related to the concerned field.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

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Course Content

<table>
<thead>
<tr>
<th>Category</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECHNOLOGY</td>
<td>1.5 d</td>
</tr>
<tr>
<td>Construction and design philosophies.</td>
<td></td>
</tr>
<tr>
<td>Components of reciprocating compressors: frame, cylinders, piston and rings, piston rod and crank head, crankshaft and connecting rods, bearings, compartment distance piece, specific emphasis on valves.</td>
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</tr>
<tr>
<td>Auxiliary systems: pulsation dampeners, frame lube oil circuit, cooling systems, forced feed lubricator. Safety devices.</td>
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</tr>
<tr>
<td>PERFORMANCES</td>
<td>1 d</td>
</tr>
<tr>
<td>Ideal gas compression: discharge temperature, power.</td>
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<tr>
<td>Actual compression: valve behavior, leakages, internal thermal exchanges.</td>
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<tr>
<td>Indicator diagram.</td>
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<tr>
<td>Efficiency, compression power.</td>
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<tr>
<td>Case studies: discharge temperature and power calculation, indicator card plotting, efficiency calculation.</td>
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<tr>
<td>COMPRESSOR PROCESS OPERATION</td>
<td>0.5 d</td>
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<tr>
<td>Start-up, shutdown. Performances control.</td>
<td></td>
</tr>
<tr>
<td>Influence of compression ratio, gas composition and suction temperature.</td>
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<tr>
<td>Multistage compressors.</td>
<td></td>
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<tr>
<td>Case study: air compression.</td>
<td></td>
</tr>
<tr>
<td>MAINTENANCE &amp; TROUBLESHOOTING</td>
<td>1 d</td>
</tr>
<tr>
<td>Machine monitoring: noise, vibration and temperature.</td>
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<tr>
<td>Typical defects and failures on: valves, piston rings and packings, piston rod…</td>
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<tr>
<td>Dismantling and assembly procedures and reports.</td>
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<tr>
<td>Safety devices and prevention.</td>
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<tr>
<td>Case studies: typical failures on reciprocating compressors.</td>
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</tr>
<tr>
<td>DYNAMIC SIMULATION - APPLICATIONS</td>
<td>1 d</td>
</tr>
<tr>
<td>Use of a dynamic simulator.</td>
<td></td>
</tr>
<tr>
<td>Exercises on start-up and shutdown phases.</td>
<td></td>
</tr>
<tr>
<td>Applications using disturbances generated by the lecturer.</td>
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</tr>
</tbody>
</table>

Reference: EECV-EN-A
Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: EECV-FR-P. Please contact us for more information.
This course can be adapted to virtual classroom mode

Centrifugal Compressors
Applications with CORYS IndissPlus dynamic simulator

Level: SKILLED

Purpose
This course emphasizes the technology, the performance and operation of centrifugal compressors.

Audience
Engineers and technicians involved in operation, monitoring and maintenance of centrifugal compressors.

Learning Objectives
Upon completion of the course, participants will be able to:
- describe the technology of centrifugal compressors,
- explain operating conditions and main disturbances,
- be involved in troubleshooting analysis.

Ways & Means
- Case studies based on industrial feedback.
- Interactive course
- Various technical drawings of actual compressors.
- Use of a dynamic simulator.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month related to the concerned field.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

<table>
<thead>
<tr>
<th>TECHNOLOGY</th>
<th>1.25 d</th>
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</thead>
<tbody>
<tr>
<td>Different types of centrifugal compressors. Architecture of a centrifugal compressor. Technology of the main components: stator, rotor, bearings, thrust bearing, seals. Vibrations, critical speed, dynamic balancing. Auxiliary equipment: lubrication system, buffer gas, balancing line, etc. Safety devices: axial displacement, vibrations, bearing and thrust bearing temperatures, oil pressure, etc.</td>
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<table>
<thead>
<tr>
<th>PERFORMANCES</th>
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<table>
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<tr>
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<tr>
<th>DYNAMIC SIMULATION - APPLICATIONS</th>
<th>1.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of a dynamic process simulator. Exercises on start-up and shutdown phases. Applications using disturbances generated by the lecturer.</td>
<td></td>
</tr>
</tbody>
</table>

Reference: ECC-EN-A  Only available as an In-House course.
This course is also available in French: ECC-FR-P. Please contact us for more information.

Contact: rc.contact@ifptraining.com

www.ifptraining.com
e-Learning

Basics in Fluid Flow

E-Learning: Centrifugal Pumps & Positive Displacement Pumps

Level: SKILLED

Purpose

This e-learning module provides basic information on fluid flow basics. These modules are integrated into some of our Blended Learning courses but can also be followed independently. For any information please contact us at the following address: contact@ifptraining.com.

Audience

All professionals, interested in pump design, operation, maintenance, troubleshooting.

Learning Objectives

Upon completion of the course, participants will be able to explain basics concepts in hydrodynamics of pumping systems.

Learning Assessment

Quiz.

Prerequisites

Provide evidence of a professional experience of at least 1 month related to the concerned field.

Course Content

FLUID FLOW FOR PUMPS

Energy units, friction losses calculation, system curve assessment, operating point control with system curve control.

Reference: PC1E-EN-E  Only available as an In-House course. Contact: rc.contact@ifptraining.com

This course is also available in French: PC-FR-P. Please contact us for more information.
e-Learning
Basics in Centrifugal Pump Technology
E-Learning: Centrifugal Pumps & Positive Displacement Pumps

**Level: SKILLED**

**Purpose**
This e-learning module provides basic information on centrifugal pump technology. These modules are integrated into some of our Blended Learning courses but can also be followed independently. For any information please contact us at the following address: contact@ifptraining.com.

**Audience**
All professionals, interested in pump design, operation, maintenance, troubleshooting.

**Learning Objectives**
Upon completion of the course, participants will be able to describe the basic construction of a centrifugal pump.

**Learning Assessment**
Quiz.

**Prerequisites**
Provide evidence of a professional experience of at least 1 month related to the concerned field.

**Course Content**

**CENTRIFUGAL PUMP TECHNOLOGY**
Single stage centrifugal pump presentation, multistage centrifugal pump presentation.

Reference: PC2E-EN-E  Only available as an In-House course.
Contact: rc.contact@ifptraining.com

www.ifptraining.com
Specifications, Technology & Performance

Graduate Certificate

NEW

Rotating Engineer Certification

Level: KNOWLEDGE

Course Content

Module 1: STATIC EQUIPMENT, SAFETY AT WORKPLACE

Module 2: PUMPS (engineering, operation, technology)
- Pumps types. Selection. Bidding. Fluid flow: friction losses; system curve, operating point; parallel and serial arrangements. Centrifugal and positive displacement pumps: standards, constructions; performances vs design and operating conditions; affinity laws. Operation, major troubles. Installation, commissioning. Applications with dynamic simulator (centrifugal pump) and test benches.

Module 3: PUMPS (maintenance)

Module 4: ON THE JOB TRAINING 1
- GIP: Application of the previous module(s) content to an actual equipment. (Proposed by the tutor or the instructor). Group or individual work, depending on OJT conditions. Topic: maintenance or design activity on a given equipment. The trainees will be requested to prepare a written report and a 20 minutes presentation about “Pumps”: safety work permit, risk analysis, safeguards; ... process role of the selected compressor; technical topics (maintenance activities, calculations, ...); results analysis (accuracy, acceptance criteria). ... The trainer will present its work to other trainees and lecturer during the next module.

Module 5: RECIPIROCATING COMPRESSORS (engineering, operation, technology)

Module 6: RECIPIROCATING COMPRESSORS (maintenance)

Module 7: ON THE JOB TRAINING 2
- GIP: Application of the previous module(s) content to an actual equipment. (Proposed by the tutor or the instructor). Group or individual work, depending on OJT conditions. Topic: maintenance or design activity on a given equipment. The trainees will be requested to prepare a written report and a 20 minutes presentation about “Reciprocating compressor”: safety work permit, risk analysis, safeguards; ... process role of the selected compressor; technical topics (maintenance activities, calculations, ...); results analysis (accuracy, acceptance criteria). ... The trainer will present its work to other trainees and lecturer during the next module.

Module 8: CENTRIFUGAL & AXIAL COMPRESSORS (engineering, operation, technology)
- Centrifugal and axial Compressors: types, standards, construction and technology; bidding. Compression mechanism through a compression stage: performances curves vs operating conditions and rotor design; affinity laws. Operation, major troubles. Installation, commissioning. Applications with dynamic simulator.

Module 9: CENTRIFUGAL & AXIAL COMPRESSORS (maintenance)
- Continuous trainees assessment. Practical work in the workshop: maintenance & inspection activities on a complete machine or on basic elements.

Module 10: ON THE JOB TRAINING 3
- GIP: Application of the previous module(s) content to an actual equipment. (Proposed by the tutor or the instructor). Group or individual work, depending on OJT conditions. Topic: maintenance or design activity on a given equipment. The trainees will be requested to prepare a written report and a 20 minutes presentation about “Centrifugal compressor”: safety work permit, risk analysis, safeguards; ... process role of the selected compressor; technical topics (maintenance activities, calculations, ...); results analysis (accuracy, acceptance criteria). ... The trainer will present its work to other trainees and lecturer during the next module.

Module 11: STEAM & GAS TURBINES, EXPANDERS (engineering, operation, technology)
- Steam turbines, gas turbines, expanders: types, standards, construction and technology, selection, bidding; thermodynamical cycles, expansion mechanism through a stage; performances vs operating conditions, rotor design, turbine control, overspeed device, emissions to atmosphere control and fumes treatment; operation, major troubles; installation, commissioning.

Module 12: STEAM & GAS TURBINES, TURBOEXPANDERS (maintenance)

Module 13: ON THE JOB TRAINING 4
- GIP: Application of the previous module(s) content to an actual equipment. (Proposed by the tutor or the instructor). Group or individual work, depending on OJT conditions. Topic: maintenance or design activity on a given equipment. The trainees will be requested to prepare a written report and a 20 minutes presentation about “Turbine/expander”: safety work permit, risk analysis, safeguards; ... process role of the selected compressor; technical topics (maintenance activities, calculations, ...); results analysis (accuracy, acceptance criteria). ... The trainer will present its work to other trainees and lecturer during the next module.

Module 14: ROTATING EQUIPMENT (monitoring, predictive maintenance, troubleshooting, failure analysis)

Module 15: ON THE JOB TRAINING 5
- GIP: Application of the previous module(s) content to an actual equipment. (Proposed by the tutor or the instructor). Group or individual work, depending on OJT conditions. Topic: maintenance or design activity on a given equipment. The trainees will be requested to prepare a written report and a 20 minutes presentation about “rotating equipment troubleshooting”; safety work permit, risk analysis, safeguards; ... process role of the selected compressor; technical topics (measurements, maintenance activities, calculations, ...); results analysis (accuracy, acceptance criteria). ... The trainer will present its work to other trainees and lecturer during the next module.

Module 16: FINAL ASSESSMENT
- Last OJT presentation to the classroom. Written or a practical test about all the training content, according to the IFP Training Certification procedure.

Reference: ROTENG-EN-P  Only available as an In-House course.

Contact: rc.contact@ifptraining.com
This course can be adapted to virtual classroom mode

Machinery Failure Analysis & Repair Methods

Level: EXPERT

Purpose
This course enhances the maintenance staff skills through a clear understanding of machinery failure analysis.

Audience
Maintenance supervisors, engineers and technicians involved in rotating machinery maintenance and technical inspection.

Learning Objectives
Upon completion of the course, participants will be able to:
- Prevent mechanical failures and reduce operating costs,
- Apply a methodology to identify the type and the failure root cause,
- Propose improvements on machinery reliability.

Ways & Means
- Case studies based on industrial and actual feedback.
- Interactive course.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month related to the concerned field.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

**FAILURE ANALYSIS**

3 d

Rupture phenomena:
- Ruptures study: material characteristics, influences of metallurgy and surface treatment, design parameters, consequences due to the modification of material behavior.
- Characteristics of the main kind of ruptures: tensile and compressive stress with necking appearance, influence of the resilience and the transition temperature with regards to the service temperature, mechanical fatigue.
- Rupture face analysis: mechanisms of rupture, surface morphology.
- Solutions to avoid rupture: design parameters, limiting stresses, operating conditions and limitations.

Wear phenomena:
- Wear study: friction principle with friction factor and wear rate, tribology.
- Characteristics of the main kind of wear: adhesive wear depending on the lubrication mode, abrasive wear through particle presence, erosive wear due to flow, mechanical surface fatigue on gears and bearings.
- Morphology of a worn surface: temperature colors, scratching, scoring, seizure.
- Solutions to avoid wear: design parameters, limiting friction, operating conditions.

Case studies: rupture and wear examinations of machinery parts (bearings, mechanical seals, rotors), analysis of some failures on process centrifugal pumps, reciprocating and centrifugal compressors and gearbox.

**REPAIR & RENOVATION WORK**

2 d

Repair philosophy: integrating all the criteria to choose the best solution: repair or replacement.
- Different modes of repair: welding, surface treatment, metal striching, deposits (HVOF application).
- Costs: repair costs, delivery time, on site capabilities.
- Case studies: description of different approaches used to repair some machines and components.
Rotating Machinery Vibration Analysis

Course Content

4 days

BASIC DEFINITIONS - OVERALL MEASUREMENTS
0.75 d
- Frequency and amplitude. Displacement, velocity, acceleration.
- Different types of vibration: periodic, random, shocks.
- Overall measurements: limitations, severity charts, high frequency techniques for anti-friction bearings, practical recommendations.

RESONANCE
0.5 d
- Using phase to study resonance. Identifying and solving problems.

TOOLS FOR DIAGNOSIS
0.5 d
- FFT analyzers: Fourier transforms and actual plots. Accelerometers, fixation methods.
- Selecting analysis parameters: scales, units, windows. Using special functions: zoom, cepstrum, envelope detection.
- Using non-contacting probes for monitoring large machinery running on plain or tilt-pad bearings.

MACHINERY DEFECTS & VIBRATION SIGNATURE
2 d
- Unbalance. Shaft and coupling misalignment.
- Antifriction bearings - Typical defects.
- Plain or tilt pad bearings instabilities.
- Mechanical looseness, cracks, friction between rotor and static parts. Gear failures.
- Electromagnetic defects of induction electric motors.
- Drive belt vibration.

PRACTICAL MACHINERY VIBRATION MONITORING
0.25 d
- Vibration control policy: machinery improvement program. Different policies according to the type of machinery and its criticality.
- Developing an effective program.

Level: SKILLED

Purpose

This course assesses the cause and evolution of mechanical failures by analysis of vibration signals. It emphasizes the implementation of an efficient predictive maintenance program.

Audience

Engineers, supervisors and technicians involved in the technical inspection and maintenance of rotating equipment.

Learning Objectives

Upon completion of the course, participants will be able to:
- explain the measurement devices: sensors, analyzers, software…,
- recognize standard signatures of the most common mechanical failures,
- decide the kind of signal treatments to apply, in order to understand failure details and evaluate its severity,
- implement a maintenance plan for each machine based on the criticality.

Ways & Means

- Study of industrial cases.
- Various illustrations of actual systems.
- Use a professional measurement tools & software and/or test benches.
- The practical approach makes the course suitable for full-time vibration specialists.

Learning Assessment

Quiz.

Prerequisites

Provide evidence of a professional experience of at least 1 month related to the concerned field.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.
Vocational Certificate

Rotating Equipment Technicians Certification

Course Content

Level: SKILLED

Purpose

Improve rotating equipment technicians performance in safety, quality and work efficiency. This course will provide an IFP Training Certification according to the IFP Training procedures.

Audience

Machinery technicians from refineries and petrochemical plants.

Learning Objectives

Upon completion of the course, participants will be able to:
- perform monitoring, checks and repairs of rotating equipment in workshop and on the field.
- write maintenance procedures for rotating equipment.
- achieve an alignment and recognize vibration standard signatures.
- prevent mechanical failures and participate in the machinery reliability improvement process.

Ways & Means

- Training split into thematic modules and “On the Job Training” (OJT). To give participants the opportunity to better assimilate the content of the previous course module, and apply the studied subjects to the facilities.
- Workshop practice.
- Exercises on site.
- Intermediate and final practical tests to evaluate trainee according to IFP Training Certification procedure.

Learning Assessment

Knowledge assessment according IFP Training Certification specific standards.

Prerequisites

Provide evidence of a professional experience of at least 1 month related to the concerned field.

Why an IFP Training Certification?

- An international recognition of your competencies.
- A Vocational Certificate delivered.
- An expertise confirmed in Rotating Equipment Technicians Certification.
- Ready-to-use skills.

Module 1: MATERIAL - PIPING - VALVES (maintenance basics, safety during works) 5 d

Materials and norms. Piping standards: pipes, nominal diameter, thickness, resistance to internal pressure, standards related to pressure equipment. Piping classes. Maintenance.

Piping accessories: different types of valves, check valves, relief valves, steam traps, line support, flanges, gaskets and gaskets.

Occupational safety, work prevention. Identification and analysis of hazards during maintenance and construction works.

Risks related to equipment opening, isolation, blinding work, circuit lockout and tagging procedure.

Prevention: work permit types and validity; purpose & use, job safety analysis, responsibilities.

Module 2: ROTATING EQUIPMENT (technology) 5 d


Centrifugal compressors: technology of main components and ancillaries: operating window and troubleshooting.


Module 3: PUMPS (maintenance) 5 d

Bearings, lubrication, sealing, coupling and alignment: different types of technical and maintenance procedures. Rotors and shafts: balancing, shaft assembly, run-out check.

Practical work in the workshop: completion of different antifriction bearings assemblies, alignment operation of a centrifugal pump and driver shaft, completion of geometrical checks, pump assembly.

Module 4: ON THE JOB TRAINING 1 5 d

OJT:

Application of the previous module(s) content to the actual plant.

According to a subject submitted by the lecturer, the trainees will be requested to prepare a written report and 20 minutes presentation about “Pumps”: safety (work permit, risk analysis, safeguards…), process role of the selected pumps, maintenance procedures (tools and check-list), results analysis (accuracy, acceptance criteria…), each team has to identify the priorities for an assigned machinery subject submitted by the lecturer.

The trainee will present its work to other trainees and lecturer during other modules.

Module 5: RECIPROCATING COMPRESSORS (maintenance) 5 d

Valves, cylinders, pistons: assembly, alignment, rings and bands assembly, rod drop control.

Rod packing seals, rods: stuffing box parts control and assembly, rod geometrical control, crosshead junction, clearance adjustment. Crankcase, crank shaft and cranks: crankshaft bearings control, stress measurement, bearings alignment. Assembly of cranks and crosshead, typical clearances, tightening torque. Auxiliary systems: maintenance of main lubrication circuit.

Practical work in the workshop: if available, maintenance & inspection activities on a complete machine or on basic elements.

Module 6: CENTRIFUGAL COMPRESSORS & STEAM TURBINES (maintenance) 5 d

Centrifugal parts overhaul: impellers and rotor, diaphragm, counter casing and casing, mechanical seals. Checks. Steam turbine parts overhaul: blade replacement and cleaning, turbine labyrinth seals, mechanical over speed system tuning, routine maintenance. Use of specific tools.

Common turbinomachinery parts assembly and maintenance: labyrinth sealing systems, tilt pad bearings, tilt pad thrust bearings, related rotating equipment, couplings and alignment, rotor dimensional checks and rotor balancing according to API specifications.

Case studies: centrifugal compressor and steam turbine troubleshooting; assembly/disassembly procedures studies.

Practical work in the workshop if available.

Module 7: ROTATING EQUIPMENT (condition monitoring & troubleshooting) 5 d

Troubleshooting analysis. Monitoring results analysis: vibrations levels, lubrication and seal circuit parameters, abnormal values, oil quality.


Machine monitoring devices; process operating parameters (monitoring and analysis of the machine process data and logs). Monitoring tools dedicated to the machine type: vibration monitoring, PV card indicator, rod drop, bearings temperature. Failure analysis and inspection tools.

Material analysis: non-destructive tests and destructive tests after rupture. Solutions to avoid failure: design parameters, stress limitations, operating conditions, online monitoring.

Case studies: rupture and wear examinations of typical machine components (bearings, mechanical seals, rotors, crankshaft).

Module 8: ON THE JOB TRAINING 2 & FINAL TEST 5 d

OJT (3 days):

Application of the previous module(s) content to the actual plant. The subject is submitted by the lecturer.

At the end of the OJT period, the trainees will be requested to prepare a written report and a 20 minutes presentation about “Compressors/steam turbines maintenance”: process role of the selected machinery, selected maintenance specification review, safety (work permit, risk analysis, safeguards…), detailed maintenance procedures (checks and overhaul/repair), results analysis (accuracy, acceptance criteria…).

Final test (2 days):

- Presentation of OJTs to the classroom.

Written test about all the training contents according to the IFP Training Certification procedure.

Reference: TECMT-EN-P. Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: TECMT-FR-P. Please contact us for more information.
<table>
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</table>
Advanced Certificate

Instrumentation & Process Control Certification

Level: EXPERT

Purpose
This course provides a good overview of instrumentation and control systems and facilitates communication with experts.

Audience
Junior engineers and technicians from process industries.

Learning Objectives
Upon completion of the course, participants will be able to:
- read and understand a P&ID,
- identify the technology used for field instrumentation.

Ways & Means
- 50% of practice on mini process skids with industrial equipment.
- Illustration of process control using dynamic simulators (IndissPlus de CORYS).

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month, related to the concerned field.

Why an IFP Training Certification?
- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Instrumentation & Process Control Certification.
- Ready-to-use skills.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

**INSTRUMENT LOOPS**
0.5 d
Function, constitution, signal types. Tag naming conventions and symbolization.

**SENSORS & TRANSMITTERS**
1.5 d
Technologies to measure and detect the pressure, temperature, level and flow.
Working principles. Selection criteria according to process needs.

**CONTROL VALVES & ON/OFF VALVES**
1 d
Technologies and working principle.
Specification criteria.
Accessories: limit switches, solenoid valves, positioners…

**PROCESS CONTROL**
1.5 d
Controller role and performance criteria.
ON/OFF and PID controller.
Conventional control schemes: split-range, cascade, ratio, override, feed forward.
Introduction to advanced process control.

**CONTROL & SAFETY SYSTEMS**
0.5 d
Role, architecture and functions of a Distributed Control Systems (DCS). Separation of control and safety systems.
Introduction to Safety Instrumented Systems (SIS).

---

Reference: ICP-EN-P
Can be organized as an In-House course.
Contact: rc.contact@ifptraining.com

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<td>Bahrain</td>
<td>30 May</td>
<td>3 June</td>
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</table>

This course is also available in French: ICP-FR-P. Please contact us for more information.

www.ifptraining.com
This course can be adapted to virtual classroom mode

Design & Operation of a Safety Instrumented System (SIS)

Level: SKILLED

Purpose
Understand how a risk can be reduced by an instrumented safety barrier.

Audience
Engineers and technical staff involved in design of SIS.

Learning Objectives
Upon completion of the course, participants will be able to:
- determine the Safety Integrity Level (SIL) of a simple system,
- identify the need to implement a Safety Instrumented System (SIS),
- apply knowledge of the main topics of the IEC61511 standard methodology to design a SIS system.

Ways & Means
- Step by step case study.
- Study of SIS on mini processes test benches.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a basic knowledge in safety and instrumentation.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

3 days

SIS & SAFETY BARRIERS
Different safety instrumented systems: PSS, ESD, F&G, HIPS, ESP.
Links between the different SIS - Global architecture.
Control loop: basic knowledge; elements constituting a SIS.

SIS & INDUSTRIAL RISK CONTROL
Use of safety reviews (HAZOP & LOPA & HAZOP) to determine the need for a Safety Instrumented Function (SIF).
Concept of independent protective layers.
Use of a risk matrix to determine the level of SIL required for each RIS.

SIS SPECIFICATION
Role of functional analysis.
FIS allocation, cause and effect matrix, redundancy and common mode.
Typical design.
Simple SIL calculations. Analysis of supplier documentation.
SIL level and frequency of testing.

SIS-FR-P: Please contact us for more information.

Reference: SIS-EN-A

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: SIS-FR-P. Please contact us for more information.
**Introduction to Industrial Electricity**

**Course Content**

<table>
<thead>
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</table>

### FUNDAMENTALS IN INDUSTRIAL ELECTRICITY

**Characteristics of electrical power supply for industrial plants.**
**Principles of electrical distribution:**
- Main technical characteristics of the electrical distribution and the grid. One line electric distribution diagram.

**Application:** overall online diagram.

**SUBSTATION EQUIPMENT & SWITCHGEAR**

**Purposes and use of these types of equipment.**
- Transformers: overall technology and troubleshooting.
- Circuit breakers: technology and switchboard.
- Operation and maintenance of main electrical equipment.
- Electricity control system. Failures monitoring and corrective actions.
- Electrical protections.

**ELECTRICAL HAZARDS**

**Electrical shocks. Direct and indirect contacts.**
- Prevention against electrical shocks, Lock-Out Tag-Out procedure (LOTO).

**INTRODUCTION TO MOTORS**

**Different type of motors. Operation and technology. Working principle of induction and synchronous motors.**
- LV & HV motors. Troubleshooting.

**DESCRIPTION OF STEAM TURBINES GENERATORS**

**Electrical power generating set. Technology. Coupling.**
- Main technical characteristics of these types of equipment.

---

**Ways & Means**

- Numerous drawings and datasheets used in the industrial plants.
- Daily quiz to reactivate the key points.
- Practical exercises and case studies.

**Learning Objectives**

Upon completion of the course, participants will be able to:
- learn the fundamentals of electricity,
- identify equipment used for the grid,
- discover electric motors and generators,
- apply electrical safety rules.

**Learning Assessment**

Knowledge assessment quiz.

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**Reference:** ELECBAS-EN-P

- Only available as an In-House course.

**Prerequisites**

Provide evidence of a professional experience of at least 1 month, related to the concerned field.

**Expertise & Coordination**

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.
Electrical Maintenance for Industrial Plants

Course Content

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<td>CHARACTERISTICS OF PLANT ELECTRICAL DISTRIBUTION</td>
<td>0.5 d</td>
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<tr>
<td>Purpose of electrical distribution, characteristics of the grid. One</td>
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<tr>
<td>line electrical diagram. Main grid, auxiliary grid, safety grid.</td>
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<tr>
<td>Application to a typical grid.</td>
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<tr>
<td>SUBSTATION EQUIPMENT &amp; WORKING PRINCIPLE OF SWITCHGEAR - MAINTENANCE</td>
<td>2 d</td>
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<tr>
<td>Purposes and uses of equipment, as well as its first level maintenance.</td>
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<tr>
<td>Operation and technical characteristics.</td>
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<tr>
<td>Transformers: purpose of transformer on a power grid; operating</td>
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<tr>
<td>principle, single phase to tri phases; windings connection and</td>
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<tr>
<td>protections. Preventive maintenance.</td>
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<tr>
<td>Circuit breakers: operating principle, technologies, main failures.</td>
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<tr>
<td>Cables, switchboards, equipment, relays, diesel generators, batteries,</td>
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<tr>
<td>chargers and UPS. Equipment monitoring.</td>
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<tr>
<td>Gas insulated substation: principle and technology.</td>
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<tr>
<td>SAFETY EQUIPMENT &amp; RELIABILITY</td>
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<tr>
<td>Main types of protections. Earthing system choice LV&amp;HV: advantages</td>
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<tr>
<td>and drawbacks. Selectivity of protections: mains techniques. Protection</td>
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<tr>
<td>relays. Insulation monitoring.</td>
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<tr>
<td>Hazardous area (ATEX) equipment: standards and maintenance rules.</td>
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<tr>
<td>LockOut - Tag-Out procedures (LOTO).</td>
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<tr>
<td>INDUCTION &amp; SYNCHRONOUS MOTORS</td>
<td>1 d</td>
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<tr>
<td>Operation and technical characteristics (intensity, efficiency, power</td>
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</tr>
<tr>
<td>factor and torque). Field of use of power and voltage range HV &amp; LV.</td>
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<tr>
<td>Technology and hazardous area (ATEX). Variable speed drive, type of</td>
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<tr>
<td>drives; consequences on the grid. Electrical protection of motors.</td>
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<tr>
<td>Synchronous motors: torque control, excitation, different technologies.</td>
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<tr>
<td>Induction motors: various types of starting according to the mechanical</td>
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<tr>
<td>load and power of the motor. Constraints from the grid; maximal</td>
<td></td>
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<tr>
<td>numbers of launches. Applications and case studies.</td>
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<tr>
<td>STEAM TURBINES GENERATORS</td>
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<tr>
<td>Main parameters of the steam turbine generator. Technology and</td>
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<tr>
<td>operation of the electrical generator. Isolated mode and coupling of</td>
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<tr>
<td>the generator: impact on the grid. Application: maintenance case</td>
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<tr>
<td>studies.</td>
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</table>

Reference: ELECMAI-EN-P Only available as an In-House course. Contact: rc.contact@ifptraining.com
This course can be adapted to virtual classroom mode

Electrical Motors: Technology, Operation & Maintenance

Level: EXPERT

Purpose
This course focuses on the technical development of industrial electrical motors.

Audience
Electrical and mechanical engineers, supervisors, technicians involved in electrical motors maintenance and operation.

Learning Objectives
Upon completion of the course, participants will be able to:
- explain the operation and the main failures of electrical motors,
- list the diagnostic tools and monitoring equipment in operation,
- describe main setting rules.

Ways & Means
- Visit of a motor repair workshop.
- Interactive course.
- Motor disassembly and assembly in case of an available workshop.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month related to the concerned field.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content 5 days

OPERATION PRINCIPLE & TECHNOLOGY 2 d

VARIABLE SPEED FEATURES 1 d
Power and Hi/LV range, fields of use and typical applications. Speed and motor control as well as network consequences. Synchronous motor: torque control and various technologies. Induction motor: standard starting methods depending on mechanical load, motor power and network capacity; limiting conditions due to the grid; number of start constraints. Electronic starting method (soft starter).

INSTALLATION 0.5 d

FAILURE DIAGNOSIS IN OPERATION 0.5 d
Bearings: temperature, vibration, lubrication monitoring. Mechanical failures.

CONTROL & REPAIR TECHNIQUES - PRACTICAL WORK 1 d

Reference: EIMEA-EN-A
Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: EIMEA-FR-A. Please contact us for more information.

www.ifptraining.com
Vocational Certificate

Electrical Technicians Certification

Course Content

Module 1: ELECTRICITY FUNDAMENTALS, PROCESS & SAFETY
5 d

- Process and electrical equipment: process constraints due to electrical power supply; introduction to electrical drawings.
- Physics: pressure, force, temperature and electrical units used in Oil & Gas processes. Main physical parameters of high voltage cells.
- Safety at work: general hazards and electrical risks in a petrochemical plant; electrical hazardous area; protections layers concept; work permit and prevention. Application on an electrical equipment maintenance.

Module 2: INDUSTRIAL ELECTRICITY BASIS - PLANT ELECTRICAL NETWORK & GRID
5 d

- Main parameters of an industrial electrical power supply. Electrical distribution drawings. Existing electric distribution diagram and grid.
- Wiring and connecting switchgear inside electrical cabinets. Replace/repair an equipment in a cabinet. Checks and inspection.
- Practical works in a workshop according to available equipment.
- Hazards: electrical shocks, direct and indirect contact, collective and personal protective equipment, hazardous areas.
- Mini-study (1 day team work) for an assigned electrical system: detail specific hazards and barriers, critical process variables, critical pieces of equipment and critical operations.

Module 3: ELECTRICAL HAZARDS - ATEX - LOCKOUT/TAG-OUT PROCEDURES
5 d

- Electrical protection: electrical hazards for human body and material; equipotential connections, grounding protection.
- Different voltage magnitude. Hazardous area and different electrical equipment installed in ATEX zones; maintenance constraints.
- Electrical authorizations - Role and commitments related to work permits.
- Lock Out & Tag Out rules before and after maintenance works. Case study and practical works on a switchgear.
- Mini-study (1 day) for an assigned electrical substation: Identify the grounding system & the possible existing defaults.

Module 4: ON THE JOB TRAINING 1 (Electrical Network)
5 d

- OJT: Application of the previous module(s) content to the actual plant.
- According to a subject submitted by the lecturer, the trainees will be requested to prepare a written report and 20 minutes presentation about "Electrical Network": safety (work permit, risk analysis, safeguards…); detailed network and grid; results analysis (accuracy, acceptance criteria…).
- The trainee will present its work to other trainees and lecturer during other modules.

Module 5: ELECTRICAL MAINTENANCE
5 d

- Electrical distribution monitoring: main, auxiliary and safety grid; inspection and failure detection systems; LV & HV cells (standards and technology); maintenance procedures.
- Transformers: overall technology, troubleshooting, operating and maintenance procedures; winding connections.
- Circuit breakers: technology and switchboard: maintenance, replacement and settings.
- Practical works: rack-in/out procedures; main parameters of cables, switchboards, relays, diesel generators, batteries, chargers, UPS.
- Steam/gas turbines generators: voltage control and excitation systems; impact of the generator coupling on the grid.
- Application: electrical parts replacement and malfunction consequences.
- Practical works: applications are performed on representative operating technical substation.

Module 6: ELECTRICAL MOTORS (Maintenance & Inspection)
5 d

- Technology: working principle of an induction and synchronous motors; features (power, current, torque and power factors); protective modes vs. external environment (temperature classes, protection class index, hazardous area motors, main “EEx” protection); electrical and thermal protection.
- Variable speed technology: motor power and network capacity, limiting conditions due to the grid; number of starts.
- Control and repair techniques: bearings, lubrication control; main mechanical failures.
- Coil insulation repairs: technology and quality; electrical tests (electrical resistance, insulation, polarization…).
- Practical work: dismantling of a LV motor; inspection, electrical insulation checks; reassembly the motor.
- Visit of a motor repair workshop (if possible): Identification of main components on existing motor equipment.

Module 7: ON THE JOB TRAINING 2 & FINAL TEST (Electrical Maintenance)
5 d

- OJT (3 days): Application of the previous module(s) content to the actual plant. The subject is submitted by the lecturer.
- At the end of the OJT period, the trainees will be requested to prepare a written report and 20 minutes presentation about “Electrical Maintenance”: safety (work permit, risk analysis, safeguards…); topics studied during the previous modules: results analysis (accuracy, acceptance criteria…).
- Final test (2 days): Practical work: installation of a LV switchgear.

Reference: ELECTEC-EN-P
Only available as an In-House course.

Contact: rc.contact@ifptraining.com
Maintenance & Works Supervision

- Maintenance Policy & Equipment Reliability
  Maintenance Management & Equipment Availability Certification ................................................................. p. 136

- Maintenance & Works Supervision
  Routine Maintenance Optimization .................................................................................................................... p. 137
  Turnaround Management ................................................................................................................................ p. 138
  Equipment Basic Maintenance .......................................................................................................................... p. 139
  Maintenance Engineer Certification .................................................................................................................. p. 140
  Graduate Diploma of Petroleum Studies in Maintenance ................................................................................ p. 141
This course can be adapted to virtual classroom mode - Advanced Certificate

Maintenance Management & Equipment Availability Certification

Level: EXPERT

Purpose
This course aims to increase skills on how to implement a customized maintenance policy and to provide the practical tools to implement reliability improvement processes. This course is part of the advanced professional framework in industrial maintenance. It can be certified, under the conditions set out in "prerequisites".

Audience
This course is intended for engineers and maintenance managers in the process industries. It is also suitable for managers directly concerned with operating costs and equipment management.

Learning Objectives
Upon completion of the course, participants will be able to:
- implement and optimize maintenance policy,
- understand reliability analysis and improvement techniques,
- set objectives in terms of the company’s overall efficiency,
- implement an effective subcontracting policy,
- set up conditions for the successful management of plant turnarounds.

Ways & Means
- Many workshops and case studies illustrating the techniques and topics studied.
- The delivery method is interactive and based on participants’ own experience.

Learning Assessment
Knowledge assessment according IFP Training Certification specific standards.

Prerequisites
Provide evidence of a professional experience of at least 1 month, related to the concerned field. The conditions for certification are:
- possess an engineering degree,
- or a minimum of 10 years of industry experience.

Why an IFP Training Certification?
- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Maintenance Management & Equipment Availability Certification.
- Ready-to-use skills.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

MAINTENANCE POLICY 1.5 d

IMPROVING THE RELIABILITY & MAINTENANCE COSTS 2 d

IMPROVING THE MAINTENANCE WORK MANAGEMENT 1 d

TURNAROUND MANAGEMENT 0.5 d

Reference: GEMA-EN-A. Can be organized as an In-House course. Contact: rc.contact@ifptraining.com

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<td>28 November</td>
<td>2 December</td>
<td>€3,150</td>
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This course is also available in French: GEMA-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

Routine Maintenance Optimization

Level: SKILLED

Purpose
This course provides in-depth knowledge related to the organization, monitoring and optimization of routine maintenance.

Audience
Staff involved in management and work coordination: maintenance, operation and support department.

Learning Objectives
Upon completion of the course, participants will be able to:
- perform detailed preparation work,
- identify the various roles and responsibilities involved,
- control all aspects of routine maintenance.

Ways & Means
- Sharing of participants’ best practices.
- Many practical exercises.
- Applications and case studies dealing with routine maintenance optimization.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month, related to the concerned field.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

ROUTINE MAINTENANCE & MAIN OBJECTIVES 2 d
Types of maintenance: preventive, corrective, condition based, predictive.
Optimized maintenance policy requirement: budget, technical and safety goals.
Maintenance costs optimization: failure global costs, inefficiency costs.
Equipment reliability management: criticality assessment, performance monitoring and control, reliability indicators (MTBF, MTTR, etc.).
From notification to work completion: request, notification, emergency, preparation, planning, material, job safety analysis.
Cost estimate and control. Work acceptance criteria.
Team responsibility: maintenance, operation, safety.
Applications and exercises.
Work planning: tasks sequencing, procedures and work scheduling.
Resources optimization.
How to supervise and control works on site.

CONTRACTING 1 d
Purpose, efficiency conditions. How to select, supervise and control contractors.
Upgrading plans.
From failure management to equipment management: maintenance improvements.

ON-SITE WORKS SUPERVISION, QUALITY & SCHEDULE MANAGEMENT 2 d
Occupational health and safety.
Risks dealing with hot works, lifting, works at heights, scaffoldings, electrical, piping, high pressure cleaning, work in confined spaces.
Lock-out tag-out procedures.
Personal protective equipment.
Quality control plan: audit, quality audits, contractor management.
Progress monitoring: physical progress, indicators (KPIs), schedule and critical path. Statements and checks on site.
Work acceptance: use of checklists, punch lists, interfaces management with production and inspection department.

Reference: RMO-EN-A
Only available as an In-House course.

Contact: rc.contact@ifptraining.com

www.ifptraining.com
This course can be adapted to virtual classroom mode

Turnaround Management

Course Content

5 days

TURNAROUND REQUIREMENTS

1 d

Turnaround justification: local regulation, maintenance, projects, plant availability.

Turnaround frequency and objectives: schedule, safety compliance, duration and cost.

Typical data used for a turnaround: economic incentives, scope definition.

Steering committee, organization and Key Performance Indicators. Financial breakdown and cost estimate.

TURNAROUND PREPARATION

2 d

Detailed scope, work-list analysis.

Work preparation: tasks sequencing, procedures, long-term material and spare parts orders.

Critical operation identification and preparation.

Cost estimation.

Scheduling: overview, detailed planning and milestones.

Safety plan - Logistics.

Scope challenge: internal and external review.

Team building techniques.

Contracting policy: clear understanding of the different types of contracts: lump sum, reimbursable, unit rates.

Purchasing plan.

Contracting procedure.

SUPERVISION OF TURNAROUND ACTIVITIES

2 d

Planning and quality control.

Cost control activities during works.

Management of changes and contingencies.

Mechanical completion, commissioning and start-up activities: acceptances certificates; organization.

Unplanned and additional works management.

Reporting and turnaround assessment.

Occupational health and safety. Lock-out/tag-out procedures.

Risks dealing with hot works, lifting, works at heights, scaffoldings, electrical, piping, high pressure cleaning, work in confined spaces.


Ways & Means

Numerous applications and cases studies.

An interactive delivery method that draws on participants' experiences.

Trainees mini-projects based on a standard plant.

Learning Assessment

Knowledge assessment quiz.

Prerequisites

Provide evidence of a professional experience of at least 1 month, related to the concerned field.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: OTAU-EN-A

Only available as an In-House course.

Contact: rc.contact@ifptraining.com
This course can be adapted to virtual classroom mode

Equipment Basic Maintenance

Level: **KNOWLEDGE**

**Purpose**
To provide in-depth knowledge related to the equipment technology and maintenance.

**Audience**
Engineers from various disciplines: process, maintenance, operation, mechanical, inspection, HSE and supervisors.

**Learning Objectives**
Upon completion of the course, participants will be able to:
- provide basic understanding of rotating machinery and static equipment installed on plants,
- describe the operating principle of this equipment,
- list the basic maintenance practices, and reliability criteria.

**Ways & Means**
- Sharing of participants’ best practices.
- Numerous exercises.
- Applications and case studies.
- Visit of running plant or workshop if available.

**Learning Assessment**
Quiz.

**Prerequisites**
Provide evidence of a professional experience of at least 1 month, related to the concerned field.

**Expertise & Coordination**
IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

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### Course Content

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#### BASICS IN STATIC EQUIPMENT  
1.5 d
- Different types of piping valves and flanges types, valve types, safety valves and rupture discs, standards main failure modes and repairs
- Distillation columns: operating principle; technology, fundamentals.
- Different types of heat exchangers and vessels: technology, selection criteria.
- Furnaces and boilers: operating principle; technology, control and safety features.
- Tanks: different types of storage tanks: fixed and floating roof, etc.

**Case studies, exercises and applications.**

#### ROTATING EQUIPMENT  
2.5 d
- Centrifugal and positive displacement pumps: types, technology and selection criteria.
- Centrifugal and positive displacement compressors: types, technology and selection criteria; operation.
- Steam turbines and gas turbines: types, technology; operation and maintenance.
- Basic machinery reliability, maintenance and troubleshooting.
- Auxiliaries, lubrication and maintenance of rotating equipment.
- Risks and failures dealing with these types of rotating equipment.
- Preventive and corrective maintenance.
- Vendor recommendations vs. operating constraints.
**Case studies, exercises and applications.**

#### MAINTENANCE GENERAL PRACTICES  
1 d
- Types of maintenance: preventive, corrective, condition-based.
- Fundamentals of reliability analysis and improvement methods: FMECA: failure modes, effects and their criticality analysis, failure trees, Reliability Centered Maintenance (RCM).
- How to use Key Performance Indicators to measure, evaluate and enhance equipment performances.

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Reference: EBM-EN-A

*Only available as an In-House course.*

Contact: rc.contact@ifptraining.com

www.ifptraining.com
Graduate Certificate

Maintenance Engineer Certification

Level: KNOWLEDGE

Purpose

This course provides solid maintenance training in maintenance. The purpose is to use a Model of Excellence for maintenance management, safety in construction works, detailed knowledge of main equipment and basic knowledge of Oil & Gas processes.

Audience

Graduate engineers, new engineers, maintenance supervisors and staff involved in petrochemical plants maintenance.

Learning Objectives

Upon completion of the course, participants will be able to:

► recognize the technology and operation of the main equipment,
► quote the corrosion basics and learn how to apply risk evaluation techniques,
► list the maintenance management fundamentals.
► explain safety and environmental issues.

Ways & Means

► Sharing of participants’ best practices.
► Practical exercises.
► Applications and case studies dealing with maintenance.
► Site visits.
► Dynamic simulations for some items such as process or instrumentation.
► Safety practical exercises.
► For almost all modules, mini-projects (team work) including oral presentation.

Learning Assessment

Knowledge assessment according IFP Training Certification specific standards.

Prerequisites

A degree corresponding to 4 or 5 years of higher education, such as a French 'Diplôme d’ingénieur' (in 5 years), an American BS (in 4 years), or another equivalent degree.

Why an IFP Training Certification?

► An international recognition of your competencies.
► A Graduate Certificate delivered.
► An expertise confirmed in Maintenance Engineer Certification.
► Ready-to-use skills.

More info

This course is composed of 15 modules of 5 days each. It includes all the evaluations related to the IFP Training Certification.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

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<td>STATIC EQUIPMENT - THERMAL EQUIPMENT - CORROSION</td>
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Purpose


Prerequisites

A degree corresponding to 4 or 5 years of higher education, such as a French ‘Diplôme d’ingénieur’ (in 5 years), an American BS (in 4 years), or another equivalent degree.

Why an IFP Training Certification?

► An international recognition of your competencies.
► A Graduate Certificate delivered.
► An expertise confirmed in Maintenance Engineer Certification.
► Ready-to-use skills.

More info

This course is composed of 15 modules of 5 days each. It includes all the evaluations related to the IFP Training Certification.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: INGMTN-EN-P

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: INGMTN-FR-P. Please contact us for more information.
This course can be adapted to virtual classroom mode - Graduate Certificate
Graduate Diploma of Petroleum Studies in Maintenance

Level: EXPERT

Purpose
The set of public courses hereunder leads to a graduate diploma of petroleum studies in Maintenance within 4 years after the first attendance to one of the courses listed. All of them are independent. About fees & dates of each course, see details in our course directory. An additional fee will be charged due to GD administration. For more information about additional fee, contact our representative in our office in Bahrain at mohamed.skhiri@ifptraining.com.

Audience
Any person in accordance with IFP School criterias.

Learning Assessment
Quiz.

Prerequisites
A degree corresponding to 4 or 5 years of higher education, such as a French ‘Diplôme d’ingénieur’ (in 5 years), an American BSc (in 4 years), or another equivalent degree.

Why an IFP Training Certification?
- An international recognition of your competencies.
- A Graduate Certificate delivered.
- An expertise confirmed in Graduate Diploma of Petroleum Studies in Maintenance.
- Ready-to-use skills.

More info
For more information, contact our representative in our office in Bahrain at mohamed.skhiri@ifptraining.com.

Course Content

REFINING PROCESSES & PETROLEUM PRODUCTS 5 d
INSTRUMENTATION & PROCESS CONTROL CERTIFICATION 5 d
THERMAL EQUIPMENT 5 d
CENTRIFUGAL PUMPS & POSITIVE DISPLACEMENT PUMPS 5 d
KEY POINTS FOR COMPRESSORS & TURBINES OPERATION & INSPECTION 5 d
MAINTENANCE MANAGEMENT & EQUIPMENT AVAILABILITY CERTIFICATION 5 d
CORROSION & CORROSION PREVENTION CERTIFICATION 5 d
UTILITIES - ENVIRONMENT MANAGEMENT 5 d
PIPING & INSTRUMENTATION DIAGRAM - PID (Project) 5 d
SAFETY IN PLANT OPERATION 5 d
COMMISSIONING & START-UP OF PROCESS UNITS 5 d
TURNAROUND MANAGEMENT 5 d

Reference: GDMAINT-EN-A  Only available as an In-House course.  Contact: rc.contact@ifptraining.com

www.ifptraining.com
Operation in the Downstream Industry

- **Vocational Training Courses for Operation Teams**
  
  - Console Operator Training ................................................................. p. 143
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  - Train the Trainers ........................................................................................ p. 151
This course can be adapted to virtual classroom mode

Console Operator Training

Level: KNOWLEDGE

Purpose

Provide the necessary knowledge to adapt quickly and efficiently to the console position.
Operate the units in a proactive and optimized way.
Analyze complex situations and react quickly, to disturbances and situations of emergency.

Audience

Experienced field operators moving on to panel/console operator positions in transforming and/or separation units processing continuously.

Learning Objectives

Upon completion of the course, participants will be able to:
- Communicate and work effectively in shifts teams,
- Explain the processes using available documents,
- Identify the risks for the equipment and ensure that the necessary preventive actions are taken,
- Adapt unit tuning to operate safely and optimize production, product quality and operating costs,
- Determine the possible causes of disturbances and alarms, and react appropriately and methodically,
- Prepare, start and stop a unit safely,
- Analyze and handle in a global manner the operation of a generic installation,
- Transpose the acquired method to get ready to operate specific processes.

Ways & Means

- Training involves on-site (pilot unit) teamwork on a real industrial petrochemical plant.
- Reminders of theoretical and technical fundamentals, case studies and realistic situation management using generic dynamic simulators or pedagogical units.
- Quiz to validate the acquisition.
- Some pedagogical activities of this course will take place in OLEIM’s facilities (subject to availability).

Learning Assessment

Quiz, cases studies and practical exercises.

Prerequisites

- 2 years of experience as operator.
- Have passed the knowledge tests related to the fundamentals of the technology and operation of the equipment.
- Possibility of e-learning.

More info

Customized simulators may be used in this training program. Esta formación se puede proponer en español.

Expertise & Coordination

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

WELCOME-ASSESSMENT

Welcome, safety, PPE distribution. Presentation of the training.
Continuous learning assessment (including quizzes, case studies and practical exercises using simulators and pedagogical units, included in the various modules).

PROCESS CONTROL, AUTOMATION & DCS

Process control and automation.
- Fluid mechanics: pressure, flow rates, fluid flow, pressure drops.
- Reading of PID/PF, control schemes and safety logigrams.
- Safety Instrumented Systems (SIS).
- DCS and operational support tools: Architecture and system components. Separation between control and safety systems.
- Use of de safety logic diagrams, cause and effect matrix. Alarming. Fire and gas.
- Start-up happy device.
- SOE (Sequence Of Event); defaults view (restitution).
- Awareness to defaults from the system.
- Application to diagrams and DCS displays from the Pedagogical Unit.
- Simulators: surfing on DCS; analysis of the behavior of control loops; split-range; PID tuning; impact of D, I and O parameters; typical instrument failures.

THERMAL EQUIPMENT

Heat exchangers: principles, resistance to heat transfer.
- Simulator applications: heat transfer in shell/tubes reboiler (fed with steam or hot oil) and air condenser. Heat balance. Follow-up; troubleshooting.
- Furnaces - Applications on a real furnace and using a generic simulator:
- Console operator checking: process control scheme monitoring, tuning principles, operation, alarms, safety devices, shunt...
- Start-up/shutdown: sequence of ignition and shutdown, tripping; role-playing between console/plant operators.

ROTATING EQUIPMENT

Centrifugal pumps - Simulator applications:
- Impact of pump suction pressure drop; possible causes.
- Start-up, trips, console/field operator communication.
- Centrifugal and reciprocating compressors:
- Simulator applications console operator checkings (control, alarm management, operating guidance).
- Start-up and shutdown sequences: full-scale volumetric compressor and generic simulator applications.

PRODUCTS - PROCESSES - OPTIMIZATION

Products - Processes:
- Industrial chemistry reminding. Composition and physico-chemical properties of feeds and products.
- Commercial products quality requirements, specification and standard tests. Scheduling, management and optimization.
- General simulator of a process unit: influence of the main operating parameters on the operation, consequences on process and products. Importance of material and thermal balances. Consequences of a quality deviation or a need for re-routing.
- Binary and multiple draw-off distillation columns:
- Liquid-vapor equilibria for pure components and mixtures.
- Operating parameters and control loops. Parameters for adjustments and optimization.
- Awareness of optimization:
- Analyzers/estimators; benefits, constraints, limitations. Advanced control concepts.
- Valuation and optimization (feedstocks management, targeted yields, over-quality and off-specification cost). Stop management and origins, interlinked utilities/processes: management of flare and FG networks (SO, bubble, gas emissions to the atmosphere, environment).
- Simulator applications: optimization of products qualities, change in feed quality, loss of reboiler, lack of overhead condensation, maximum flow rate increase and bottleneck search, restart after tripping.

INTEGRATED PLANT SAFE OPERATION, demonstration unit

Safe behavior:
- Radio communication, responsibility sharing. Shift handover. Transmission of know-how.
- Console checkings on a stabilized unit, warning thresholds, connection with operating ranges. Inertia and interference.
- Unit monitoring with anticipation, priority and alarm management.
- HSE in operation:
- Risks related to operation of equipment, to decommissioning-commissioning and start-up of equipment, specific prevention measures.
- Routine operations. Permit to work, work order, consignations and isolations, alarm inhibition/by-pass.
- Awareness of simultaneous operations management (SIMOPS).
- Emergency operation and crisis management.
- Impact of operations on air emissions and water treatment.

- Start-up and shutdown of the unit:
- Use of procedures, comprehension/justifications of different steps (initial, steady state and final).
- Understanding the unit’s hold-up and response dynamics.
- Transient phase management. Start after tripping.
- Troubleshooting, disturbances:
- Unexpected behavior during start-up/shutdown steps and steady state: analysis and reaction, mass balance during start up steps. Incidents, malfunctions, wrong information from instruments, blockage of On/Off valve, practice of emergency operations, etc.

Reference: FBMOCIR-EN-A Can be organized as an In-House course.
Contact: rc.contact@ifptraining.com

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<th>Location</th>
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<tbody>
<tr>
<td>Martignies</td>
<td>8 March</td>
<td>2 April</td>
<td>€9,000</td>
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This course is also available in French: FBMOCIR-FR-A. Please contact us for more information.

www.ifptraining.com
Vocational Training Courses for Operation Teams

Vocational Certificate
Refining & Petrochemicals Operations Shift Supervisor Certification

Level: SKILLED

Purpose
Develop and reinforce operations team management skills.

Audience
People planned to be assigned to a new position as operations shift supervisor or team leader.

Learning Objectives
Upon completion of the course, participants will be able to:
► describe their responsibilities and the ones from their different team members,
► operate safely their plants within and outside daily time schedule,
► communicate efficiently with their team and the different daily employees,
► take care about safe co-activities within their area on a daily basis and also during turnarounds,
► manage abnormal situation and emergency response,
► be committed in each team member’s improvement as well as in site continuous improvement.

Ways & Means
► Interactive delivery method with intensive feedback/sharing from participants’ knowledge and experience.
► Team work on different exercises and real incident case studies.
► Feedback analysis of selected real accidents.
► Role playing simulation.

Learning Assessment
Quiz.

Prerequisites
Technical knowledge of the refining and/or petrochemical installations, their operating conditions, maintenance and HSE aspects.

Expertise & Coordination
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

10 days

ROLES & RESPONSIBILITIES WITHIN SITE ORGANIZATION 2 d
Site’s rules and procedures daily field application. HSE objectives and equipment integrity ownership.
Basic tools used at operations shift supervisor’s position: risk analysis, incident report, management of change…
Commitment and implementation for new site’s initiatives.

DAILY PLANT AREA MANAGEMENT 4 d
Potential problems: risk underestimation, interfaces and procedures improperly managed, requirements/field presence less than adequate.
Plant operations from the field: housekeeping, routine activity follow-up, information reporting from outside and panel operators, sampling and analysis results usage, equipment integrity, operational issues reporting within site organization.
Plant supervision from the panel: respect of operating windows and safety devices, (un)validation of abnormal situations, anticipation of potential impacts on other plant areas, utilities and water treatment. Monitoring of consumptions, atmospheric and water effluents. Operating cost reduction and economical optimization impact.
Interfaces with other services: procedures writing/validation, equipment (de)commissioning, permit to work validation and field activity follow-up. Products swaps between areas, product reception and shipping activities with third parties.
Specific operations management: abnormal operations, special operations, emergency response.

DAILY TEAM MANAGEMENT 4 d
Human behavior: information quality, workload management, individuals’ and team’s motivation.
Activity organization: shift handover, information sharing, planning and priorities management. Task request, delegation and controls.
Team meeting: organization, preparation, progression, deliverables and follow-up. Lessons learned, safety toolbox, best practices…
Operational problems solving: listing facts, brainstorming, decision making.
Up & down communication: relations with different persons. Solving dispute issues within the team.
Operational budget administration: responsibilities, regulation and usual risks.
Commitment regarding HSE approach, reacting to unsafe acts and conditions, enforcing safety rules. Continuous improvement.
Individual and team motivation: achievable targets (HSEQ, reliability, profitability…). Exemplary behavior, commitment and proactivity. Individual yearly appraisal, coaching, training.
Auto-evaluation of one’s own behavior: leadership, communication and motivation/warning to employees, information sharing.

Reference: CDQRC-EN-P
Contact: rc.contact@ifptraining.com

This course is also available in French: CDQRC-FR-P. Please contact us for more information.
## Panel Operator Certification

**Course Content**

**WELCOME (if in OLEUM facilities)**
Welcome/safety, PPE distribution. Presentation of the training.

**PANEL OPERATOR DUTIES & CONTROL ROOM ACTIVITIES**
2 d

- Plant operator role within the operation team; control room staff. Reporting and handover duties.
- Plant documentation: inventory, content, usage, role and duties of the panel operator.

**BASIC PROFESSIONAL TRAINING**
2 d

- Heat exchange: exchange mechanisms, resistance to heat transfer.
- Liquid-vapor equilibrium of pure substances and mixtures.
- Simulators: impact of operating parameters on the chemical reaction performances, heat exchanges through various types of heat exchangers, separation in a flash drum.

**PROCESS CONTROL, AUTOMATION & DCS USAGE**
6 d

- Controllers operating principles, inputs/outputs, internal parameters and tuning.
- Complex control loops (cascade, split range, multiple calculation blocks). Advanced control basics.
- Distributed Control System (DCS):
  - Automation:
    - Safety instrumented systems: PSS, ESD, HIPS, EDP; architecture with respect to DCS. Safety logics and cause & effect matrix.
    - PLCs and automation:grafet analysis, study of specific sequences.
    - Simulators: furnace safety logics.

**EQUIPMENT OPERATION**
8 d

- Pumps, compressors, drivers:
  - Simulators: start-up and shutdown, operation and control of various process units (for instance: two-product distillation columns, multi draw-off distillation column, amine absorption and regeneration, sulfur recovery unit, hydrotreater unit).
- Thermal equipment: heat exchangers, air coolers, furnaces, boilers:
  - Simulators: fouling of a heat exchanger; changing fuel supplied to burners, coil fouling, start-up and shutdown of a furnace.
- Specific equipment for a given assignment unit (gas turbines, solid handling, extruders…).

**PRODUCTS & PROCESSES**
8 d

- Composition and physico-chemical properties of feeds and products.
- Commercial product quality requirements, specification and standard tests. Mixing rules.
- Process units: role, principles, main equipment, specific hazards. Influence of the main operating parameters on the operation, consequences on process and products. Material balance.
- Distillation, absorption, stripping.
- Utilities: flare systems, air production, effluent treatment units, steam, water treatments…
  - Simulators: start-up and shutdown, operation and control of various process units (for instance: two-product distillation columns, multi draw-off distillation column, amine absorption and regeneration, sulfur recovery unit, hydrotreater unit).

**INTEGRATED PLANT SAFE OPERATION**
6 d

- Panel operator safe behavior:
  - Radio communication, other communication equipment. Teamwork, responsibility sharing. Transmission of know-how.
  - Alertness, forward thinking plant operation. Alarm management.
  - Application: role plays using the simulators (with panel operator views and FODs).
- HSE in operation:
  - Product, equipment and process-related risks; prevention and protection.
  - Risks related to operation of equipment, to decommissioning-commissioning and start-up of equipment, specific prevention measures.
  - Routine operations. Permit to work, work order, consignations and isolations.
  - Special operations: SIMOPS, black start. Emergency operation and crisis management.
  - Impact of plant operation on gas release into the atmosphere and on the wastewater treatment unit; minimization of releases.
  - Integrated plant operation:
    - Steady state runs: routine checks, operating windows, integrated plant behavior (inertia, interferences).
    - Global performances, margin optimization/impact of quality gaps.
  - Identification, analysis and reaction to upsets and equipment failures; stabilization.
  - Simulators: field rounds on a running process unit; commissioning, start-up and shutdown procedures, justifications of different steps; inhibition management; operations in downgraded situations; practice of emergency operations.

**ASSESSMENT**
3 d

- Continuous assessment (including practical exercises on simulators).
- Final test with real-life situation simulation exercises to validate objectives.

Reference: FBMOC-EN-P

**Only available as an In-House course.**

Contact: rc.contact@ifptraining.com

This course is also available in French: FBMOC-FR-P. Please contact us for more information.

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**Course Information**

- **Level:** KNOWLEDGE
- **Purpose:** This course makes possible a rapid mastery of panelist skills. The facilities are optimized and operated in a pro-active way. Successful participants will be granted the “Panel Operator” Certification.
- **Audience:** Experienced field operators moving to panel operator positions in refining and petrochemical plants.
- **Learning Objectives:** Upon completion of the course, participants will be able to:
  - Communicate and work effectively with shift colleagues.
  - Explain in detail the processes using various documents (PFDs, P&IDs, control schemes, logic diagrams).
  - Identify risks related to equipment operation and process; to enforce adequate preventive actions.
  - Adjust the plant process parameters to optimize production rate, product quality and operating costs, minimize losses and releases.
  - Analyze the process key parameters to determine disturbance causes, and take appropriate corrective and preventive actions.
  - Prepare, start and shutdown a unit in safe conditions.
- **Ways & Means:**
  - Case studies and applications on generic dynamic simulators: 80% of the time spent in the training center.
  - Reminding of necessary theoretical and technical fundamentals directly through simulator handlings.
  - Training involves on-site work and supervision from mentors in the plant.
  - Permanent interactive delivery method.
  - Some pedagogical activities of this course can take place in OLEUM’s facilities (subject to availability).
- **Learning Assessment:**
  - Continuous assessment, final test with real-life situation simulation exercises.
- **Prerequisites:**
  - To perform all the tasks of a field operator, in full compliance with SHE rules (at least for two areas).
- **More info:** Customized simulators may be used in this training program. Esta formación se puede proponer en español.
- **Expertise & Coordination:**
  - IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.
**Vocational Certificate**

**Field Operator Certification**

An established methodology for training operators in Oil & Gas/Chemical industry

**Level: KNOWLEDGE**

**Purpose**

This course provides the knowledge and know-how for the specific field operator position. Successful participants will be granted the “Field Operator” Certification.

**Audience**

Newly recruited operators in the refining, petrochemical and chemical industries.

**Learning Objectives**

Upon completion of the course, participants will be able to:

- monitor the facilities in an autonomous way, in compliance with Safety and Environmental rules,
- safely perform all routine operations related to operator duties, as well as the key non-routine ones,
- identify equipment deficiencies, explain their root causes, and take appropriate action,
- communicate effectively with their colleagues.

**Ways & Means**

The training program is structured by alternating:

- Classroom training (2-week sessions) including theoretical and practical courses.
- On-The-Job training (typically 1-month sessions) 100% on-site, in their facilities, with instructors’ help.

Even during classroom training, lots of practical exercises and applications. Instructors having extensive Oil & Gas downstream experience, helped by company mentors. Continuous assessment completed by a final exam in front of a jury.

**Learning Assessment**

Continuous assessment.

**Prerequisites**

To be eligible for this training course, the candidate must have an academic scientific knowledge equivalent to British O levels A or year 13 (UK).

Having already been pre-recruited by an Oil & Gas company.

**More info**

Including classroom training, On-The-Job training and job practice under control, the typical duration of the program is 1 year. Esta formación se puede proponer en español.

**Expertise & Coordination**

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

**CLASSROOM TRAINING (theoretical & practical)**

**Professional basic training (10 days)**

- Physical parameters; liquid vapor equilibria notions; fluid flow; heat transmission.
- Chemistry: basic notions, industrial chemical reactions.

**Products and processes (10 days)**

- Quality tests, specifications; sampling safety procedures; refining processes; safety aspects.
- Storage tanks, reception and expedition facilities; utilities; environmental protection; energy.

**Equipment operation and safety (35 days)**

- Pressure vessels (columns, drums, reactors) description and operation.
- Rotating equipment (centrifugal and positive displacement pumps, compressors, steam turbines, electric motors).
- Thermal equipment (heat exchangers, furnaces, boilers).
- Instruments (sensors/actuators), process control.
- Safety in plant operation.

**ON THE JOB TRAINING**

Presentation, initial recommendations and safety instructions:

- General technical information: presentation of the refinery, main feeds and products.
- Safety: safety rules, specific instructions, control and protection, prevention, fire extinction exercises.
- Injury and life protection: preparation of rescuer degree.

General training on the job:

- On different production units: equipment identification; operation follow-up.
- Identification of operator tasks, responsibilities of each member on the shift team.

Specific job position study:

- Process, feeds and product characteristics, circuits.
- Equipment field control; safety; operational instructions, procedures.

Controlled practice in job position:

- Achievement of the various tasks involved in the job, under control of the assigned people on the shift team.

**KNOWLEDGE ASSESSMENT**

Continuous assessment during training modules. Final written exam at the end of the theoretical training.

Rating of practical exercises and on-the-job trainings, based on presentations and written reports.

Personal job-based final report, describing assigned unit and operator day-to-day activities, rated.

Final examination to confirm proficiency (knowledge of circuits, equipment and processes, job practice).

Reference: BOAVAL-EN-P

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: BOAVAL-FR-P. Please contact us for more information.
Vocational Certificate

Field Operator Training Course

Level: KNOWLEDGE

Course Content 180 days

Purpose

This course provides the basic know-how for holding safely and effectively a field technician position. Successful participants will be granted the “Field Operator” Vocational Certificate.

Audience

Newly recruited operators in the refining, petrochemical and chemical industries.

Learning Objectives

Upon completion of the course, participants will be able to:
- execute basic monitoring of field equipment, in compliance with Safety and Environmental rules,
- under shift leader guidance, safely perform all routine operations related to operator duties,
- communicate effectively with their colleagues within the shift team and at the shift handover.

Ways & Means

- Split of training activities between classroom training, OJO (On-the-Job Orientation) and OJT (On-the-Job Training).
- During classroom training, minimum theoretical lectures, with key-points, and lots of practical exercises, applications and workshops.
- Observations and work on the field (OJO), with the IFP Training instructor, to apply each topic covered during the course.
- Assistance of company mentors for the field parts of the course, followed by the student during his day-to-day activities.

Learning Assessment

- Continuous assessments all-along the program.
- Final assessment including a report presentation in front of a jury.

Prerequisites

- To be eligible for this training course, the candidate must have an academic scientific knowledge equivalent to British O levels A or year 13 (UK).
- Having already been pre-recruited by an Oil & Gas company.
- Although not mandatory, a technical education is desirable.

Expertise & Coordination

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

CLASSEMENT TRAINING (theoretical & practical)

Module 1: Safety basics, piping
- Risks of the areas. Preventive actions in place on sites to cover these risks. Collective prevention. PPE.
- Piping description, basic operation of piping networks and accessories. Equipment isolation. Flex hoes.

Module 2: Instrumentation - Schematization

Module 3: Exchangers
- Most common types of exchangers, role of each component, related risks and safety systems.
- Control of exchanger status during rounds. Main operating tasks (switch, isolation, commissioning).

Module 4: Pumps
- Pump types, operating principle. Purpose and description of auxiliaries. Risks related to the pump and its environment.
- Single-stage pump field monitoring. Basic operations (switching, commissioning, de-commissioning).

Module 5: Furnaces & Boilers
- Heater types, operating principle, main characteristics. Operating parameters. Role of each key equipment part.

Module 6: Compressors
- Most common compressor types, purpose and operating principle. Purpose and description of auxiliaries.

Module 7: Processes and Products
- Risks related to processes, operating conditions. Main characteristics of the products present in his sector.
- Tank monitoring. Basic routine tasks (loading/unloading, purging/venting, sampling, chemicals addition).

Module 8: Steam turbines - Job practice
- Shift handover (communication, priorities). Field technician rounds (observations, data collection, reporting).

ON THE JOB ORIENTATION

ON THE JOB TRAINING

Site presentation, safety instructions, main feeds and products, protection and prevention.

Field training with the assistance of IFP Training instructor and company mentor:
- Equipment identification, follow-up of basic operations.
- Identification of technician tasks and responsibilities, specific company rules and procedures.
- Process highlights, feeds and product characteristics, process and utility networks.
- Field basic monitoring of each equipment of the unit.

Practice of each basic field operation, under control of the company mentor.

ASSESSMENT

Continuous assessment (in class and on the field) during training modules.

Final examination on the field to confirm proficiency (knowledge of circuits, equipment and processes, job practice).

Professional behavior assessment.

Reference: FOT-EN-P

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

www.ifptraining.com
Operator Basic Training Course

**Level:** KNOWLEDGE

**Purpose**

This course provides operators with the knowledge and know-how required for safe, efficient and reliable field operations.

**Audience**

Operators of oil refineries or chemical plants, without any operator certification background.

Technicians or staff to be retrained as operators in the chemical, petrochemical or oil industries.

**Learning Objectives**

Upon completion of the course, participants will be able to:

- monitor each main type of equipment on the field, detect and report abnormal situations,
- execute on the field the day-to-day operating tasks related to each main type of equipment,
- strictly apply safety rules, to effectively use collective and personal protective equipment,
- communicate effectively with shift colleagues.

**Ways & Means**

IFP Training classroom training uses interactive delivery methods (tutorials, case studies, role playing).

During classroom training, short practical on-site exercises on specific pieces of equipment.

In between IFP Training classroom modules, On-the-Job Orientation on Clients’ assigned unit.

**Learning Assessment**

Continuous assessment.

**Prerequisites**

At least 6 months of professional experience in industrial site operation.

**More info**

Esta formación se puede proponer en español.

**Expertise & Coordination**

IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

**PIPING - VESSELS - STORAGE TANKS - DRAWINGS**

6 d

Valves, fittings, flexible hoses, safety devices/interlocks. Vessels, storage tanks. Identification symbols for various items of equipment.

Block diagrams, flow sheet, P&I. Introduction to isometric drawings.

Field applications: equipment recognition, practical exercise of line-plotting, demonstration equipment in the workshop (when available).

**INSTRUMENTATION & CONTROL DEVICES**

7 d

Physical variables used in process operations (pressure, temperature, flowrate, density, specific gravity).

Components of a control loop. Instrumentation: workings and operation.

Field applications: practical exercise on control loops, demonstration loops (if available), work on Man-Machine Interface in control room.

**HEAT EXCHANGE EQUIPMENT**

7 d

Heat, energy and heat transfer. Heat exchangers: technology, main types, workings and operation.

On-site practical exercise on a heat exchanger.

Furnaces and boilers: technology, combustion, draft and operation.

On-site practical exercise on furnaces/boilers.

**ROTATING MACHINERY**

8 d

Fluid flows.

Rotating machinery field recognition.

Centrifugal and positive displacement pumps.

On-site practical exercise on pumps.

Centrifugal and reciprocating compressors.

Single stage, back-pressure steam turbines.

On-site practical exercise on a compressor or turbine.

Electric motors operation.

Extruder.

**PROCESSES - PRODUCTS - SAMPLING & TESTING - UTILITIES**

5 d

Basic chemistry. Chemical products and chemical solutions: composition and hazards.

Chemical reactions.

Vapor pressure and boiling point.

Distillation: principles of the separation, distillation columns.

Products. Quality control tests. Sampling.

Principles of manufacturing processes.

Notion of material and heat balance.

Manufacturing process diagram.

Utilities: flare network, wastewater treatment, cooling water, air production.

On-site practical exercise on different processes (main equipment, operating conditions).

**OPERATORS’ TOOLS - SKILLS & ORGANIZATION**

2 d

Plant documentation: inventory, content, usage.

Radio communication. Teamwork.

Reporting and handover duties.

Role plays.

**SAFETY**

5 d

Product hazards: flammability, toxicity, physical hazards.

Job Safety Analysis for field operators’ routine activity (equipment check, circuit alignment, sampling, etc.).

Emptying processes: blind and gasket fitting, degassing and inerting, entering a vessel.

Example of procedures for equipment shutdown and start-up.

Safe behavior.

Field hazard recognition and prevention means plotting.

Case studies - Group work. Lessons learned.

**ASSESSMENT (duration included in the previous chapters)**

Continuous assessment: written tests and oral presentations.
This course can be adapted to virtual classroom mode

**Assistance in Operator Recruitment**

**Level: SKILLED**

**Purpose**
This service makes it possible to assist the Human Resources Department in selecting and pre-recruiting potential field operators.

**Learning Objectives**
This service is aimed at selecting candidates with a profile, abilities and a personality adapted to the field operator job.

**Learning Assessment**
Tests.

**Prerequisites**
No prerequisites for this course.

**More info**
This service is particularly recommended when organizing a “Field operator certification” training, to maximize the chances of success. Este servicio se puede proponer en español.

**Expertise & Coordination**
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

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**Course Content**

**REVIEWING CANDIDATE APPLICATIONS**
Receipt and review of the applications transmitted by the company. Pre-selection of the files.

**TEST IMPLEMENTATION (in the company’s facilities)**
Reception of the candidates. Conduct of aptitude tests. Conduct of personality tests. Distribution of a motivation questionnaire. Test correction.

**ANALYSIS & SYNTHESIS OF THE TESTS**
Analysis of the results, interpretation. Drawing of a summary table. Presentation of the results and conclusions.

**INTERVIEW IMPLEMENTATION (maximum number of 8 a day)**
Convocation of the selected candidates for an interview. Individual interview of about 45 minutes per candidate, aimed at assessing mainly:
- The candidate’s general profile.
- The main behavioral characteristics (dynamism, self-confidence, attitude, interests).
- The aspirations (human, professional).
- The motivation shown for the operator job.
- The ability to find fulfillment when working as an operator.
- The chances to successfully attend the Field Operator Certification training.

**ANALYSIS & SYNTHESIS OF THE INTERVIEWS**
Wrap-up meeting and conclusions with the company’s personnel.

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Reference: RECRUT-EN-A. Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: RECRUT-FR-A. Please contact us for more information.
Mentors Training Course
Supervision of field operators following a certification training

Course Content

2 days

GENERAL OBJECTIVES OF OPERATOR TRAINING
0.25 d
Field Operator Certification program organization.
Teaching method and knowledge assessment.
Conditions for granting the certification.

TRAINING ORGANIZATION & RELATIONSHIPS
0.25 d
Training book: a standardized document to improve trainee follow-up and communication with trainers.
Synchronization of the topics seen in class with working practice. Mentors/trainers meetings in the field.
Mentors’ missions (integration, on-the-job practical training, verification of acquired knowledge).
Final briefing and participation to the final board of examiners.

MENTOR’S TOOL BOX
1 d
Teaching know-how:
Communication techniques, questioning, listening, observing, reformulating, development.
Assessment techniques: assessment preparation by the mentor, running the assessment meeting.
What approach to adopt when a trainee is unsuccessful.
Technical knowledge:
From a real company situation, how to develop training exercises.
Learning the installation during interventions, detecting and using interesting situations for training.
Accepting one’s limitations; developing strategies to retrieve information.

PRACTICAL APPLICATION: OPERATOR’S INSPECTION ROUTINE CHECKS
0.5 d
From a video shot on a plant: case study and mentor’s experience.
Observation of the sequence by the participants to make comments and suggest improvements.

Reference: TUTBO-EN-A  Only available as an In-House course.
Contact: rc.contact@ifptraining.com

This course is also available in French: TUTBO-FR-A. Please contact us for more information.
Train the Trainers

Course Content

EFFECTIVE CLASSROOM TRAINING PRESENTATION 1 d
The classroom environment: guidance on how to form groups, optimize room set-up, use training aids and media. Agenda and organization of training courses. Strategies to motivate adult participants (influential factors). Speech management: schedule, importance of time and repetition, open and closed questions. How to encourage trainee active participation. Coping with difficult situations (hostility, stress, conflict). How to finishing the presentation effectively (key-point participative review).

Applications: ice-breaking game, perform a technical presentation.

TEACHING TECHNIQUES 1 d
The communication process and communicating in a teaching situation. Transmission of information (distortion of information, loss of information from the sender to the receiver). Characteristics of adult mentality (motivation, resistance to change, curiosity). Teaching styles, methods and climate (influence on trainees’ behavior).

Applications: welcome a newcomer, perform a shift relief.

DESIGNING & STRUCTURING A TRAINING PROGRAM 1 d
Preparing a training program (what, who, where, when and how), from simple to complex ones. Training planning (well prepared and flexible). Training supports (manuals, textbooks, presentations, exercises). Definition of learning objectives, verification of their achievement (types of evaluation, timing, frequency). Use of visual and audiovisual aids, of physical equipment, of field visits.

Applications: build an operator training program, create an exam.

APPLICATION TO INDUSTRIAL TRAINING IN THE PLANT 2 d
Training on actual plant documents: P&IDs, operating procedures, equipment drawing, control loop. Training on the field: equipment understanding and monitoring, safety assessment. Use of major industrial incident reports for training and sensitization purposes. Short training presentations by participants, feedback lessons with the complete group.

Applications: create and discuss operating procedures, field training on pumps, use of accident reports for training.

Levels: SKILLED

Purpose
Learn how to effectively train technicians in operating facilities.

Audience
Personnel in charge of training and technical competency enhancement programs.

Learning Objectives
Upon completion of the course, the participants will be able to:
- plan in detail the training program of a new technician,
- transfer technical knowledge to newcomers, in the class and on the field,
- evaluate knowledge acquisition.

Ways & Means
- Participants are required to practice all the concepts (workshops, exercises, field games).
- Case studies in class and on the field, some participants playing the role of trainees.

Learning Assessment
Quiz.

Prerequisites
5 years of professional experience in an industrial site.

More info
Upon specific request of a customer, this course may be shortened and focused on training operators on the field only. Esta formación se puede proponer en español.

Expertise & Coordination
IFP Training trainer(s) (permanent or contracted) having expertise and experience in the topics covered, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: TRAIN-EN-A
This course is also available in French: TRAIN-FR-P. Please contact us for more information.
HSE Design & Intervention

Introduction to Process Safety Engineering ................................................................. p. 153
Analysis of Technological Risks .................................................................................. p. 154

Safety in Plant Operations

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Field Safety Audit ........................................................................................................ p. 163
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Environment

Waste Water Treatment from Refinery & Petrochemical Units .................................... p. 167

Industrial Safety Engineer

Industrial Safety Engineer Certification ........................................................................ p. 168
This course can be adapted to virtual classroom mode

Introduction to Process Safety Engineering

Level: KNOWLEDGE

Purpose

This course provides an overview of safety reviews in a project and highlights the main principles to design and maintain the prevention, mitigation and protection barriers.

Audience

Managers, engineers, technicians in charge of the design, the modification, the maintenance or the operation of industrial facilities.

Learning Objectives

Upon course completion, the participants are able to:

- be instrumental in the safety reviews done during a project or plant modification,
- improve process safety practices and reinforce the integration of the human factor from the design stage,
- strengthen the integration of the human factor from the design stage.

Ways & Means

The pedagogy is active and builds on the experience of the participants and the knowledge of the site:

- several exercises and applications (50% case studies or tutorial exercises), with a "rolling case" on a typical processing unit
- safety impact of a simple modification,
- identification of safety barriers with the impact of their maintenance on their effectiveness,
- a number of visual aids: videos, learning from incidents (Texas City, Buncefield, Achinsk…).

Learning Assessment

Quiz.

Prerequisites

Provide evidence of a basic technical knowledge in process, instrumentation, static and dynamic equipment.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/ or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content 5 days

RISK IDENTIFICATION 1.25 d

Risk identification and acceptability with respect to people, environment and assets - Risk - Risk assessment matrix.
Review of hazardous phenomena: gas dispersion, toxic release, thermal radiation, overpressure blast.
Preliminary risk quantification: evaluation of risk consequences (grass root project or revamping) based on HAZID/HAZOP reviews.

INHERENT SAFETY DESIGN & LAYOUT OPTIMIZATION 5 d

Layout optimization based on safety reviews: safety distances, fire zones, deluge zones.
Reducing hazardous inventories, leak control systems, disposal system (flare, diked area…) and drainage systems, equipment sealing.

TYPE OF SAFETY BARRIERS 0.25 d


PREVENTION BARRIERS 1.5 d

Pressure equipment and atmospheric storage tanks: selection of material of construction, corrosion, pressure resistance - Piping classes.
Overpressure and negative pressure protection: pressure safety valves, rupture discs: selection criteria, design, implementation, inspection.
Safety Instrumented Systems (SIS) and Safety Integrity Level (SIL) - Typical architecture of Safety Instrumented Systems: hierarchy, interaction with process control system and Fire & Gas system.
Flammability control: minimizing ignition sources, hazardous area classification, equipment selection and location in hazardous areas.

DETECTION, MITIGATION & PROTECTION SYSTEMS 0.75 d

Fire and gas detection system: technology of sensors, selection and location - Cause and effect matrix, voting - Relationship with mitigation systems.
Passive fire and blast protection: description of material, location, monitoring and inspection - Identification of surface/elements to be protected.
Active firefighting systems: extinguishing agents (water, foam, dry chemicals, inert/inhibition gas).
Fixed systems with water or foam: elements of the fire main system (main ring, fire water pumps, consumers, water tank, foam solution), application rate.

DAY-TO-DAY INDUSTRIAL RISK MANAGEMENT 0.75 d

Human factors: functioning of the human being - Examples of systems embedding human behavior or human error: equipment accessibility, plant ergonomics, graphic display design, alarm management…
Management Of Change (MOC): technical, organizational and human expertise (reliability of documentation, suitability/application of the procedures, corporate’s specifications…).
Maintaining the efficiency of the barriers - Example of a risk management tool: the bow tie.
Analysis of Technological Risks
HAZID, HAZOP, LOPA...

Level: SKILLED

Purpose
This course makes it possible to select the appropriate safety reviews and know how to implement them.

Audience
This training is intended for personnel responsible for analyzing HSE risks during design or on existing installations.

Learning Objectives
Upon completion of the course, participants will be able to:
- actively participate in reviews, exploit the results of risk analysis,
- select safety reviews according to the context (new project, modifications) and prepare them.

Ways & Means
- Simulation of hazard reviews on simple processes.
- Use of HAZOP Manager© if requested in advance.

Learning Assessment
Quiz.

Prerequisites
- Provide evidence of a professional experience of at least 3 months within Safety, Operation, Maintenance department belonging to process industry, or in an Engineering, or also in an insurance company.
- Ability to read PFD’s and PID’s.

More info
The training is divided into 5 modules. Each method corresponds to a specific 1-day module (except Module 3 - HAZOP, 1.5 days) which can be delivered separately. Module 1 (0.5 day) must be taken during the course about the first selected method. Knowledge of the HAZOP method essential to the practice of LOPA.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of risk analysis and reviews, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

Module 1 - RISK & ACCEPTABILITY CRITERIA
0.5 d
Risk representation - Risks to people, property and the environment:
- Potential hazard definition, risk levels, risk matrix, acceptable residual risk.
- Safety reviews and risk analysis methods.
Objectives and implementation conditions: integration into the project planning.
Overview of the different reviews and methods. Impact on the Safety Management System (SMS). Selection of the most appropriate method according to the context: new project, existing site and modifications, updating of hazard studies, authorization to operate...

Module 2 - HAZID METHOD (HAZard Identification)
1 d
Organization: identification of attendees, scheduling the review, documentation, preparation, keywords list development.
Animation and conduct of reviews. HAZID review simulation on a simple case.
Preparation of the review report, follow-up and closure of actions/recommendations.
Fields of application of the HAZID method: APR, design reviews, constructability.

Module 3 - HAZOP METHOD (HAZard & OPerability)
1.5 d
Organization: identification of attendees, scheduling the review according to the studies development phase, documentation, preparation of the review, cutting of the PIDs.
Animation and conduct of reviews. HAZOP review simulation on a simple case.
HAZOP quantified.
Preparation of the review report, follow-up and closure of actions/recommendations.
What-if - Check-list: complementarity with the HAZOP method, interests and limits.

Module 4 - LOPA METHOD (Layer Of Protection Analysis)
1 d
Complementarity with HAZOP review. Principle of LOPA.
Concept of safety barriers - Determination of IPL (Independent Protection Layers).
Evaluation of the need for a SIF (Safety Instrumented Function).
Determination of the required SIL (Safety Integrity Level). Understanding of calculation elements (supplier data, databases).
Preparation/animation of reviews, according to IEC 61 511. Simulation of a LOPA on a simple case.

Module 5 - USE OF QRA (Quantitative Risk Assessment)
1 d
Quantitative Risk Assessment (QRA):
- Scenario determination, Fault Tree analysis (FTA), Event Tree Analysis (ETA).
Bow tie: principle, construction and use. Safety barriers.
Use of QRAs: determination of design principles and criteria for the safety of an installation.
HSE concept. DAL (Design Accidental Loads).

Reference: REVSEC-EN-P  Only available as an In-House course.
Reference: REVSEC-FR-P Please contact us for more information.
Contact: rc.contact@ifptraining.com

This course is also available in French: REVSEC-FR-P. Please contact us for more information.
Blended Learning

This course offers a combination of online and face-to-face training sequences

Safety in Plant Operation

Level: KNOWLEDGE

Purpose

This course provides trainees with a better understanding of product and equipment risks in order to ensure safe operation.

Audience

Operating personnel (operators, panel operators, shift leaders, engineers) in refineries and petrochemical/chemical plants; any staff involved in operations (maintenance, SHE department).

Learning Objectives

Upon completion of the course, participants will be able to:

- identify and assess the risks inherent to product handling, equipment use and operations,
- measure the possible consequences on safety, health and the environment,
- apply recommended preventive measures,
- adopt the most appropriate behavior to counter risks.

Ways & Means

- E-learning modules before the training to learn & refresh knowledge about risks.
- Workshop: preparation of shutdown, decommissioning or/and commissioning, start-up procedure for a typical unit.
- Case studies and analysis of incidents and accidents.

Learning Assessment

Quiz.

Prerequisites

Provide evidence of a professional experience of at least 3 months within Safety, Operation, Maintenance, or Engineering department belonging to process industry.

More info

This course is also available in Dutch, Italian and Spanish. This training is carried out in Blended Learning:

- 1st: e-learning including four modules, carried out individually and in advance by the participants via IFP Training LMS.
- 2nd: training session in classroom with all the participants.

Expertise & Coordination

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

4 days

E-learning: PRODUCTS HAZARDS – PREVENTION & OPERATING PRECAUTIONS

Module 1 - OCCUPATIONAL HEALTH & SAFETY

Vocabulary and safety indicators.
Potential hazards in facilities.
Hazardous products classification.

Module 2 - FLAMMABILITY

Combustion phenomenon.
Ignition sources and consequences of a combustion.
Preventive measures against ignition risks.

Module 3 - OCCUPATIONAL HEALTH

Products toxicity.
Specific risks from most common products used in plants.
Chemical risk prevention.

Module 4 - FLUIDS BEHAVIOR

Pressure in a vessel.
Heat addition consequences.
Heat removal consequences.

TRAINING SESSION (4 days)

PRODUCTS RISKS: PREVENTION & OPERATING PRECAUTIONS 1 d

Case studies involving products risks analyzed in subgroups, in order to strengthen information from the e-learning. Share ideas with the entire group. Lessons learned.

SAFETY IN PROCESS OPERATIONS 2.75 d

Precautions and risks related to the use of utilities: inert gases, liquid water, steam, air, gas oil, fuel gas.
Safety related to blowdown and drainage toward: flare, slops, tanks, oily water…
Blinding lockout/tag-out procedures: conditions for installing blinds or spades.
Degassing-inerting: steam, nitrogen, water, vacuum …
Works permits: different types and use.
Enter into vessels. Atmosphere analysis: oxygen content, explosivity, toxicity.
Start-up: checks, accessibility and cleanliness, line up, nitrogen, water, steam or vacuum deaeration.
Tightness testing, commissioning and start-up.

HANDS-ON ACTIVITIES ON A TYPICAL UNIT DECOMMISSIONING 2.75 d

Case study, common thread of this training, used as a workshop with different groups of trainees in order to apply the different topics for decommissioning and commissioning & Start Up. Procedure writing with instructions for each step. Presentation to the group, sharing & discussions. Lessons learned.

IMPLEMENTATION OF THE PRINCIPLES & GUIDELINES 0.25 d

Preparation of shutdown, decommissioning or/and commissioning, start-up procedure for a typical unit.
Common thread throughout the training, carried out sequentially during the session, in order to increase mutual understanding of decommissioning principles. Lessons learned.

HUMAN BEHAVIOR & SAFETY MANAGEMENT 0.25 d

Human factors. Safety barriers, compliance with procedures, risk of routine.
Employees’ involvement: commitment and responsibility.
Available tools to improve safety: procedures, risk assessment, safety meetings, accident investigation and reporting, audits, field observations, emergency drills.

Reference: SECOP-EN-B
Can be organized as an In-House course.
Contact: rc.contact@ifptraining.com

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<th>Start Date</th>
<th>End Date</th>
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<td>Rueil</td>
<td>27 September</td>
<td>30 September</td>
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This course is also available in French: SECOP-FR-B. Please contact us for more information.
Blended Learning
This course offers a combination of online and face-to-face training sequences

Safety in Storage & Loading Operation

**Level:** KNOWLEDGE

**Purpose**

This course provides a better understanding of product and equipment risks in order to increase safety behavior in storage and (un)loading activities.

**Audience**

Operating personnel (operators, panel operators, shift leaders, young engineers and terminal managers) in refineries and petrochemical/chemical plants and any staff involved in operations (maintenance, SHE department).

**Learning Objectives**

Upon completion of the course, participants will be able to:
- identify and rank the risks inherent to the products handled and stored, and to the equipment used for chemical and oil storage,
- measure the possible consequences on safety, health and the environment,
- apply preventive recommended measures,
- adopt the most appropriate behavior in accordance with the risks.

**Ways & Means**

- E-learning modules before the training to learn & refresh knowledge about risks.
- Workshop: decommissioning and commissioning procedure for a typical unit selected based on trainees’ origins (atmospheric tanks, under pressure storage, recovery unit, etc.).
- Case studies and analysis of incidents and accidents.
- Agenda can be adapted to professional needs from the group of attendees.

**Learning Assessment**

Quiz.

**Prerequisites**

Provide evidence of a professional experience of at least 3 months within oil or chemicals storage or (un)loading activities.

**More info**

This training is carried out in Blended Learning:
- 1st: e-Learning including four modules, carried out individually and in advance by the participants via IFP Training LMS.
- 2nd: training session in classroom with all the participants.

**Reference:** SECORSE-EN-B

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This course is also available in French: SECORSE-FR-B. Please contact us for more information.

**Expertise & Coordination**

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

**E-learning: PRODUCTS HAZARDS - PREVENTION & OPERATING PRECAUTIONS**

**Module 1 - OCCUPATIONAL HEALTH & SAFETY**


**Module 2 - FLAMMABILITY**

Combustion phenomenon. Ignition sources and consequences of a combustion. Preventive measures against ignition risks.

**Module 3 - OCCUPATIONAL HEALTH**

Products toxicity. Specific risks to most common products in plants. Chemical risk prevention.

**Module 4 - FLUIDS BEHAVIOR**


**TRAINING SESSION (4 days)**

**PRODUCTS RISKS: PREVENTION & OPERATING PRECAUTIONS**

Case studies involving products risks analyzed in subgroups, in order to strengthen information from the e-learning. Share ideas with the entire group. Lessons learned.

**EQUIPMENT RELATED RISKS - SAFETY DEVICES**

Atmospheric and under pressure storage tanks; different kinds of construction, pressure and vacuum resistances, safety devices (vents, relief valves, hydraulic safety shut-off valves, positive safety valves, etc.).

Safety in tank storage operation. Typical incidents. Loading/unloading tank trucks, railcars, tankers, etc.: loading stations layout (top or bottom fillings), safety devices & safety instrument systems, vapor recovery.

**SAFETY IN STORAGE TANKS COMMISSIONING & DECOMMISSIONING OPERATIONS**

General decommissioning approach with 5 different steps. “Zero energy” approach. Understanding & complying to procedures, risks from routine.

Draining-purging-blowdown: safety and environmental aspects. Degassing-inerting-cleaning: HP cleaning and pumping liquid wastes, type of pumping according to products (volumetric pump, vacuum).

Lockout/Tag-out procedure (LOTO): type of LOTO according to different activities planned. Works permits: endorsement and responsibilities. Activities with specific risks: confined space entry. Gas test, ventilation, supervision.

**HANDS-ON ACTIVITIES ON A TYPICAL STORAGE EQUIPMENT DECOMMISSIONING**

Case study, common thread of this training, used as a workshop with different groups of trainees in order to apply the different topics. Procedure writing with instructions for each step. Presentation to the group, sharing & discussions. Lessons learned.
E-learning

Occupational Health & Safety
Products Hazards - Prevention & Operating Precautions

Level: KNOWLEDGE

Purpose
This e-learning module take place within a development path regarding safety in plant operation. These modules are integrated into some of our Blended Learning courses but can also be followed independently. For any information please contact us at the following address: contact@ifptraining.com.

Audience
All industrial plant staff faced with products hazards.

Learning Objectives
Upon completion of the course, participants will be able to:
- discriminate potential hazards in facilities,
- categorize products hazards.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 3 months within Safety, Operation, Maintenance, or Engineering department belonging to process industry.

More info
This module is also available in French.

VOCABULARY & SAFETY INDICATORS

POTENTIAL HAZARDS IN FACILITIES
Occupational risk reduction: human, organizational, technical factors.

Hazardous products classification
SGH recommendation, CLP regulation: objective and field of application. Hazards classification and linked definition. Hazardous material characteristics: where can you found relevant information?

Only available as an In-House course. Contact: rc.contact@ifptraining.com

Reference: SEC01-EN-E
This course is also available in French: SEC01-FR-E. Please contact us for more information.

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E-learning

Flammability

Products Hazards - Prevention & Operating Precautions

Level: KNOWLEDGE

Purpose

This e-learning module take place within a development path regarding safety in plant operation.

These modules are integrated into some of our Blended Learning courses but can also be followed independently.

For any information please contact us at the following address: contact@ifptraining.com.

Audience

All industrial plant staff faced with products hazards.

Learning Objectives

Upon completion of the course, participants will be able to:

- describe inflammation mechanism,
- identify potential ignition sources,
- recommend relevant preventive measures.

Learning Assessment

Quiz.

Prerequisites

Provide evidence of a professional experience of at least 3 months within Safety, Operation, Maintenance, or Engineering department belonging to process industry.

More info

This module is also available in French.

Course Content

COMBUSTION PHENOMENON

Combustion definition.

Elements necessary to achieve combustion.

Gaseous, liquid and solid combustible materials.

Oxidizers: oxygen in the air and strong oxidizers.

IGNITION SOURCES & CONSEQUENCES OF A COMBUSTION

Ignition sources: energy required level.

Ignition sources in industrial plant.

Possible consequences of a combustion.

PREVENTIVE MEASURES AGAINST PRODUCT HAZARDS CLASSIFICATION

Action on one of the three elements from the fire triangle.

Explosimeter operating principles.

ATEX area: definition and precautions associated.
E-learning

Occupational Health
Products Hazards - Prevention & Operating Precautions

Level: KNOWLEDGE

Purpose
This e-learning module take place within a development path regarding safety in plant operation. These modules are integrated into some of our Blended Learning courses but can also be followed independently. For any information please contact us at the following address: contact@ifptraining.com.

Audience
All industrial plant staff faced with products hazards.

Learning Objectives
Upon completion of the course, participants will be able to:

- describe mechanism of action of a toxic material on the body,
- use the information contained in a material safety datasheet.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 3 months within Safety, Operation, Maintenance, or Engineering department belonging to process industry.

More info
This module is also available in French.

Course Content

PRODUCTS TOXICITY
Poisoning: ingestion, metabolism and elimination. Acute toxicity, chronic toxicity. Threshold limit values.

SPECIFIC RISKS FROM MOST COMMON PRODUCTS USED IN PLANTS
Anoxia phenomenon.

CHEMICAL RISK PREVENTION
Chemical risk assessment.
Material safety datasheet understanding.
Gas detection means and personal protective equipment.

Reference: SECO3-EN-E
This course is also available in French: SECO3-FR-E. Please contact us for more information.

Contact: rc.contact@ifptraining.com
E-learning

Fluids Behavior
Products Hazards - Prevention & Operating Precautions

Level: KNOWLEDGE

Purpose
This e-learning module take place within a development path regarding safety in plant operation. These modules are integrated into some of our Blended Learning courses but can also be followed independently. For any information please contact us at the following address: contact@ifptraining.com.

Audience
All industrial plant staff faced with products hazards.

Learning Objectives
Upon completion of the course, participants will be able to:
♦ describe consequence of pressure in a vessel,
♦ anticipate temperature variation of a fluid contained within an equipment.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 3 months within Safety, Operation, Maintenance, or Engineering department belonging to process industry.

More info
This module is also available in French.

Course Content

PRESSURE IN A VESSEL
Definition and reminder of physical units. Pressure effect in a vessel full of, gaseous, liquid gas, or liquid. Vaporizing pressure curve analysis.

HEAD ADDITION CONSEQUENCES
Case of a vessel full of, gaseous, liquid gas, or liquid. Specific phenomena: BLEVE, slop-over, froth-over, boil-over.

HEAD REMOVAL CONSEQUENCES
Collapsing risks due to vacuum. Freezing due to pressure drop.

Reference: SECO4-EN-E. Only available as an In-House course. Contact: rc.contact@ifptraining.com

This course is also available in French: SECO4-FR-E. Please contact us for more information.
Safety in Maintenance & Construction Works

Course Content

**OCCUPATIONAL HEALTH & SAFETY**
0.25 d
Hazard, risk, accident: definitions and differences.
Occupational hazards: related to products, operation and equipment, workplace, and human behavior.
Identification and classification of hazards during execution of maintenance and construction works.

**PRODUCT-RELATED HAZARDS & PRECAUTIONS**
0.5 d
Product-related hazards in refineries, petrochemical and chemical plants: main properties (flammable, explosive, toxic, noxious, corrosive, asphyxiating, harmful for the environment), CMR specific case.
Toxicology: threshold limit values.
Flammability: explosive atmosphere (combustible products: gaseous, liquid and solid); oxidizers; ignition sources (flames, self-ignition temperature, sparks and static electricity, etc.).
Preventive measures and precautions: during normal conditions, before and during hot works, in the event of leaks.

**WORK-RELATED HAZARDS**
2.5 d
Decommissioning: risks related to equipment opening and line breaking, isolation procedure, blinding and spading work. Lockout tag-out procedure.
Material transportation equipment, manual and mechanical handling.
Lifting: recommendations regarding lifting equipment, worksite organization, and team composition.
Work in confined spaces: vessel opening, ventilation, gas testing, entry permit, risk variation during work execution.
Work at height: rules for installing and using scaffolding, MEWP (Mobile Elevating Work Platform), and harnesses.
Hot works: welding, cutting and heating, grinding.
High pressure cleaning: use of cleanup tank trucks. Specific risks linked to vacuum pumping.
Miscellaneous works: excavation works, abrasive blasting, painting.
Hazardous radiation: working with radioactive sources, X-ray work, specific risks.
Risks related to electrical work and devices.
Specific Personal Protective Equipment (PPE), recommended for each kind of works.

**RISK MANAGEMENT & PREVENTION**
0.75 d
Safety procedures: work permit types and validity; purposes, application, job safety analysis, precautions, constraints; commitment and responsibility of contractors, maintenance.
SHE and issuing operation department; permit endorsement.
Planning and monitoring safety of contracted works on site: coordination with contractors, co-activity and interface management; preparation of prevention plan and risk assessment.
Hazards resulting from unsafe acts and/or unsafe conditions: sources of hazards, task/risk analysis, managing contractors and subcontractors.
Management Of Change (MOC).

Reference: SECTRA-EN-P
Only available as an In-House course.
Contact: rc.contact@ifptraining.com
This course is also available in French: SECTRA-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

**HSE Daily Involvement**

**Course Content**

**2 days**

<table>
<thead>
<tr>
<th>Module</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACHIEVING SAFETY COMMITMENT</strong></td>
<td>0.25 d</td>
</tr>
<tr>
<td>Continuous HSE improvement process. Employer and personal roles and responsibilities. Deliverables.</td>
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</tr>
<tr>
<td><strong>SAFETY BEHAVIOR AT WORK</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td><strong>PARTICIPATING TO COLLECTIVE IMPROVEMENT PROCESSES</strong></td>
<td>0.75 d</td>
</tr>
<tr>
<td>Plant HSE policy up-to-date: top management direction, Key Performance Indicator (KPI) objectives &amp; follow-up, actions implemented &amp; follow-up. Corresponding experience and skills. Tools used on a daily basis: procedures, experience sharing, task risk analysis, Management Of Change…</td>
<td></td>
</tr>
<tr>
<td><strong>INDIVIDUAL BEHAVIOR - HUMAN RELIABILITY</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>HSE awareness, acting as the owner: observation, reacting to errors and standards not respected. Human reliability.</td>
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</tbody>
</table>

**Purpose**

This course provides a positive overview & understanding of implemented tools from plant’s Health Safety Environment (HSE) Management System to reinforce personal and collective commitment.

**Audience**

All plant staff (operation, maintenance, engineering, laboratory, contractors…).

**Learning Objectives**

Upon completion of the course, participants will be able to:

- realize HSE is embedded in each of their tasks,
- understand their role and responsibilities regarding HSE processes and expected results,
- use main implemented HSE tools,
- enforce their HSE involvement in their daily job.

**Ways & Means**

Use of site HSE tools:

- easy practical application of risk assessment and incident analysis methods,
- sharing of experiences (videos, case studies).

**Learning Assessment**

Quiz.

**Prerequisites**

Provide evidence of a professional experience of at least 3 months within its own company.

**Expertise & Coordination**

IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Reference: SHEINO-EN-A  Only available as an In-House course. Contact: rc.contact@ifptraining.com
NEW Field Safety Audit

Level: KNOWLEDGE

Purpose
This course provides techniques to employees in order to improve human behavior during field safety assessments of various activities on site.

Audience
Site’s employees and contractors (SHE, operation, maintenance, projects, laboratory...).

Learning Objectives
Upon completion of the course, participants will be able to:
- explain the role of the field safety audit in the site’s Safety Management System,
- effectively design, conduct and manage a safety audit on the field,
- apply a positive approach to safety audit.

Ways & Means
Teamwork with case studies, incident analysis, simulations and role-playing.
- Real site audits (according to site’s opportunities) and reports writing.
- Site audits debrief: analyzes/exchanges on the different situations met.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 3 months within Safety, Operation, Maintenance, or Engineering department belonging to process industry.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

FIELD SAFETY AUDIT AS A MAJOR TOOL FROM SAFETY MANAGEMENT

0.5 d
Management commitment regarding safety:
- Apply and enforce site’s Safety policy.
- Be exemplary in your behavior.
- Be vigilant and reactive to the situations encountered, avoid routine, and develop proactivity.
Safety results and performance improvements:
- Risk pyramid: accident, near miss, hazardous situation & hazardous acts, occupational illness.
- Main focuses for field audit.
Objectives and benefits of audits:
- Assess site’s staff involvement regarding Safety.
- Correct hazardous situations & acts (immediate and / or planed actions).
- Continually look for improvements.
- Develop critical thinking, avoid routine phenomenon

FIELD SAFETY AUDIT PROCESS

0.75 d
Different steps:
- Preparation for the visit.
- Field visit: observation, information gathering, verbal communication, finding solutions.
- Post-visit: information processing, writing of the report, communication of the results, action plan, follow-up of the action plan, feedback to the people observed.
Communication techniques before, during and after the audit:
- Contact with people observed.
- Active listening.
- Dialogue.
- Communication of the results: validation, assessment of safety level.
Observation techniques:
- Observation cycle: decide, stop, observe, act, report, and follow.
- Observing man at work.
- Observing work environment: equipment integrity, protections, safety rules, procedures, order and cleanliness, work permit.
- Examples of guide sheets.

PRACTICAL EXERCISES WITH FIELD SAFETY AUDITS BY TRAINEES

0.75 d
Targeting of the audit: location, activity, persons…
Performing field safety audit with associated behavior and communication.
Report writing with facts observed, immediate actions and proposals for improvement.
Audit report presentation to the group and discussion.
Use of specific audit procedure and guidelines from the site.

Reference: AUDSECU-EN-P
This course is also available in French: AUDSECU-FR-P. Please contact us for more information.

Contact: rc.contact@ifptraining.com
Safety Leadership

Level: KNOWLEDGE

Purpose
This course provides knowledge, skills and motivation to first line management and intermediate management to be aligned with company standards and expectations.

Audience
From intermediate managers to line supervisors in operation, maintenance, technical, HSE and support staff.

Learning Objectives
Upon completion of the course, participants will be able to:
- understand and explain main company safety values,
- assess their position and realize their main gaps,
- build a personal action plan and engage their commitment to progress,
- demonstrate their personal impact on company safety culture,
- explain how to act and to communicate accordingly.

Ways & Means
Teamwork with intensive use of case studies, incident analysis, simulations and role playing.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 3 months within its own company.

More info
This course is adapted to company HSE current performances and objectives, implemented Management System, main tools used.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

COMPANY SAFETY CULTURE
0.5 d
Safety culture definitions. Different milestones for safety culture buildup. The essential key role of a Safety Management System.
Assessing safety culture maturity.
What are my safety values? What are the company’s safety culture embedded values? Closing gaps between my safety values and my company’s safety values.

MY IMPACT ON THE COMPANY’S SAFETY CULTURE
2.25 d
My day-to-day behavior:
Commitment, given the right example, reacting to deviations and unsafe conditions, positive point reinforcements, up-and-down communication, catalyst for sharing and teamwork. Integration of intercultural aspects.
Managing my team:
Safety communication: safety message from top management, findings and actions from incident analysis or assessment.
Controlling application of company’s dedicated process in different activities: risk assessment (task risk assessment, work permit), procedures (up-to-date, field application), incident analysis, safety critical devices (by-pass, test), operating windows, shift handover...
Motivating my staff: teamwork, delegating actions ownership, yearly employee assessment, training plans.
Working with others:
Participating in the different company’s dedicated processes: unit risk assessment (What-If, HAZOP), Management Of Change, emergency drills, incident analysis, Key Performance Indicator reporting, Safety Management System reviews, assessments.
Influencing the organization:
Behavior and communication on the field. Detection and analysis of weak signals from the field, from processes and organization. Proactive acts. Effective communication. Well-balanced reporting.

COURSE OUTCOMES & PERSONAL COMMITMENT TO SAFETY
0.25 d
Group discussion about main highlights of the course according to attendees. Sharing of some personal to-do lists to influence safety culture in my company.

Reference: SAFLEAD-EN-P
Only available as an In-House course.
Contact: rc.contact@ifptraining.com
**Improve Your HSE Management System**

**Level:** SKILLED

**Purpose**
This course provides key knowledge in order to improve the existing HSE Management System and use main associated risk analysis methods.

**Audience**
Senior staff, managers, supervisors and graduate engineers, in charge of coordinating and improving their site’s Health Safety Environment Management System.

**Learning Objectives**
Upon completion of the course, participants will be able to:
- define the operational objectives of a HSE management system,
- assess the fundamental requirements for an effective HSE management system,
- apply and improve existing tools,
- improve system processes and performances.

**Ways & Means**
- Practical exercises for the different methods and techniques presented.
- Case studies to reinforce different topics.
- Sharing of experiences between trainees.
- Use of risk assessment, incident report, field assessment, etc.
- HSE management system failures: case studies.

**Learning Assessment**
Quiz.

**Prerequisites**
Provide evidence of an established background within its own company.

**Expertise & Coordination**
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

**Course Content**

**HSE MANAGEMENT SYSTEM OBJECTIVES**
0.25 d
Tools for assessing risks, preventing accidents, making use of lessons learnt and improving communication. Main features of regulatory requirements in the EU and USA (Seveso II or CoMAH, OSHA PSM). Employers’ and employees’ legal responsibilities.

**HSE MANAGEMENT SYSTEM STRUCTURE**
0.25 d
Principles, scope, organization and responsibilities to ensure continuity and progress. Communication from the line management to the field actors and vice versa, benefits from sharing experience, safety indicators and audits.

**HSE MANAGEMENT SYSTEM IMPROVEMENT**
1 d
Commitment and responsibilities of the management. Employee involvement, information and training. Process safety management. Hazard analysis during project development, change implementation, start-up and normal operation. Operating requirements, procedures and practices. Critical process parameters and operating ranges. Mechanical integrity and material inspection plan. Managing changes in technology, chemicals, equipment, facilities, procedures, organization, etc. Managing contractors and subcontractors in plants. Incident investigation and reporting. Managing the documentation. Compliance audits.

**RISK ASSESSMENT METHODS**
1 d
Different risks (accident, fire, explosion, product release, spill, industrial disease, etc.). Different tools implemented and used by the site for different purpose. Risk assessment: use of criticality matrix, probability and consequences. Risk prevention and mitigation methods.

**HUMAN FACTORS**
0.25 d

**HSE MANAGEMENT SYSTEM EVALUATION & FOLLOW-UP**
0.25 d
Reactive and proactive monitoring using of lead and lag indicators, implementation of a reporting system. Organization of safety audits, plant management participation in safety reviews. System evaluation: organization, resources, process and evaluation criteria. Consequences of inconsistencies in organization, procedures and field application.

Reference: SHEMAN-EN-P
Only available as an In-House course.

Contact: rc.contact@ifptraining.com

www.ifptraining.com
Technological Risk Awareness

Level: KNOWLEDGE

Purpose
This training course helps to develop a culture of technological risk and highlights the fundamental role of each individual in industrial risk management.

Audience
This course is aimed at the technical personnel of operation, maintenance, inspection, process…

Learning Objectives
Upon completion of the course, participants will be able to:
- identify risk situations and related safety barriers,
- better assess the consequences of defective/not respected barriers and the severity of potential accidents,
- help maintain and improve safety barriers.

Ways & Means
- Alternating sequences of technical inputs and applications/brainstorming in sub-groups.
- Use of educational games.
- Analysis of typical case studies in the industry and learning from incidents.

Learning Assessment
Quiz.

Prerequisites
Provide evidence of a professional experience of at least 1 month within its own company.

Expertise & Coordination
IFP Training instructor (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

TECHNOLOGICAL RISK CONTROL 0.25 d
Progress tools for the company: brand image, moral imperative, technical challenge, economic interests.
Risks and acceptability: hazard potential, initiating event, top event, probability of occurrence, severity, risk level, safety barriers, residual risks.
Hazardous phenomena, effects on personnel and on facilities (overpressure, thermal flux, toxic cloud…).

ACCIDENT SCENARIO 0.25 d
Analysis of accidents: learning lessons, sharing of Learning From Incidents (LFI).
Intended barriers: technical, organizational, human, prevention, protection, active, passive.

RISK ANALYSIS 0.25 d
Risk analysis during initial design and later modification: examples of risk analysis methods.
Bow-tie to "quantify" the importance of everyone’s involvement.

ON SITE TECHNOLOGICAL RISK MANAGEMENT 0.25 d
Individual behavior: human strengths and limitations, respect for safety rules and systems, involvement in maintaining barriers, feedback from the filed, maintaining vigilance, leading by example.
Management and maintenance of barrier effectiveness: main actors, every one’s role before and after a failure, identification and management of activities at risk, management of changes, management of barrier inhibitions/shunts and compensatory measures, consequences of disregarding barriers.
Key Performance Indicators (KPIs).

Reference: RISQTEC-EN-P  Only available as an In-House course.
Contact: rc.contact@ifptraining.com
This course is also available in French: RISQTEC-FR-P. Please contact us for more information.
Waste Water Treatment from Refinery & Petrochemical Units

### Level: SKILLED

#### Purpose
This course provides a deeper knowledge of waste water treatment processes.

#### Audience
Daily and shift staff in charge of operating waste water treatment units and networks. Operators of waste units undergoing transformation to waste treatment units. Laboratory, process, and project engineers and staff.

#### Learning Objectives
Upon completion of the course, participants will be able to:
- identify the impact of pollution on the environment,
- adapt treatment operating parameters to the properties of incoming polluted water issued from refinery or petrochemical plant,
- improve the operation and maintenance of equipment,
- react effectively in adverse situations,
- set a basis for regulation.

#### Ways & Means
Equipment demos (material, pictures and videos).

#### Learning Assessment
Quiz.

#### Prerequisites
Provide evidence of a professional experience of at least 3 months within waste water treatment unit.

#### Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of the related topics, trained to adult teaching methods, and whose competencies are kept up-to-date.

### Course Content

<table>
<thead>
<tr>
<th>Local &amp; Regional Regulations</th>
<th>0.25 d</th>
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<tbody>
<tr>
<td>Operating permit: structure, contents, key chapters, elaboration and updating process. Waste water specifications. Penalties in case of violation (formal requirements, fines).</td>
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</table>

<table>
<thead>
<tr>
<th>Waste Water Characteristics</th>
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<table>
<thead>
<tr>
<th>Physico-Chemical Water Treatment Processes</th>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process water stripping: typical process scheme, optimum operating conditions. Settling of insoluble hydrocarbons and sludge. Settling velocity. Settler design types and improvements. Dissolved air floatation: equipment, flocculation additives, additive mix and operating parameter optimization. Filtration: various equipment, sand, active carbon beds, other filtration media.</td>
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<table>
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<tr>
<th>Biological Treatment of Waste Water</th>
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<table>
<thead>
<tr>
<th>Biological Sludge Treatment</th>
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</table>

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Reference: TER-EN-P | Only available as an In-House course.

This course is also available in French: TER-FR-P. Please contact us for more information.

Contact: rc.contact@ifptraining.com

www.ifptraining.com
Industrial Safety Engineer Certification

Level: SKILLED

Purpose
This course provides a deeper knowledge on how to master the main aspects of the industrial safety engineer position.

Audience
Engineers recently assigned to the HSE department in the following industries:
- Oil & Gas (upstream and downstream),
- Petrochemical and chemical,
- Transport, storage, and distribution of crude oil, petroleum products, and natural gas.
Also available for experienced personnel designed to evolve in HSE function.

Learning Objectives
Upon completion of this course, participants will be able to effectively perform the function of HSE engineers as to:
- Implement tools and techniques required for an integrated management of safety.
- Apply a practical and behavioral know-how.

Ways & Means
- Practical workshops on industrial equipment.
- Site visit and studies based on industrial documents.
- Real-life firefighting exercises.
- Lecturing by industry experts.
- Real incidents and accident case studies.
- Continuous validation, in order to obtain certification.

Learning Assessment
Refer to certification referential

Prerequisites
Engineering degree or equivalent experience within process industry.

Why an IFP Training Certification?
- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Industrial Safety Engineer Certification.
- Ready-to-use skills.

Reference: SECUIND-EN-P

This course is also available in French: SECUIND-FR-P. Please contact us for more information.

Contact: rc.contact@ifptraining.com

Course Content 35 days

WELCOME - PRESENTATION
1 d
Initial competency assessment.
Role of HSE engineer within company. Mission and responsibilities of the safety engineer.

RISKS RELATED TO FLUIDS BEHAVIOR
4 d
Process mapping. Products knowledge.
Gas compression and expansion. Liquid-vapor equilibrium. Energies at stake.
Pressure in a vessel and consequences of heat addition or withdrawal. Risk assessment and operating precautions.

RISKS RELATED TO EQUIPMENT
5 d
Piping - Thermal equipment - Storage equipment - Pressure vessels.
Transport - Loading/offloading units: tank trucks, tank rail cars, cargo ships.
Rotating machinery: pumps, compressors, steam turbines, gas turbines ...
Instrumentation and process control.

INHERENTLY SAFER DESIGN
5 d
Taking industrial risk into account.
Layout based on risk analysis. Implementation of safety barriers: kinds and criteria of effectiveness.
Prevention and care against fire and explosion hazards: control or removal of flammable mixtures, sources of ignition. Control of emission sources.
Knowledge of pressure equipment and atmospheric storage - Protection against overpressure and depressions. Introduction to instrumented safety systems (SIS). Reliability level.

MITIGATION & PROTECTION MEANS
5 d
Gas detectors, fire detectors (smoke, flames, heat, etc.), liquid hydrocarbons detectors.
Passive and active fire protection.

CONTROL OF RISKS RELATED TO WORK ON FACILITIES
5 d
Safety during commissioning and decommissioning operations.
Lockout tag-out procedures.
Safety in maintenance and construction works: specific risks and corresponding precautions. Permit to work. Integration of safety in preparation, implementation and work surveillance.

HSE RISK MANAGEMENT
5 d
Health, Safety and Environment Management System (HSE-MS): structure, implementation and administration of a HSE management system.
Setting up an HSE culture.
Risk assessment methods: HAZID, HAZOP, Bow tie analysis, QRA.
Prevention tools and means, crisis and intervention management. Human factors.
Management of change - Improvement and maintenance of safety barriers HSE approach in projects.

ENVIRONMENT PROTECTION
2 d
Importance of environment protection for human being, for company. Awareness - Sustainable development.
Environment impact assessment.
Air, water and soil protection. Origin, nature, treatment and reduction of pollutions.
Waste management: sorting and elimination routes.

INDUSTRIAL HYGIENE - HEALTH AT WORK
2 d
Professional risks: chemical risks, physical risks, toxicological risks.
Risk management: work station assessment, material safety data sheet, medical check-up.

FINAL ASSESSMENT - SESSION SYNTHESIS
1 d
Project Management
Engineering Contracts

Level: KNOWLEDGE

Purpose
Engineering contracts related to refining, petrochemicals and chemicals significant capital projects.

Audience
Project engineers from owners or contractors, involved in the project-related contractual processes.

Learning Objectives
Upon completion of the course, the participants will be able to:
- select the best type and scope for the engineering contract,
- organize the tendering process and select the best bidder.

Ways & Means
Practical case studies.

Learning Assessment
Multiple-choice questionnaire.

Prerequisites
- Provide evidence of a professional experience of at least 1 month, related to the concerned field.
- Know the main phases of Oil & Gas project process.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and experience of Project Engineering contracts, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

CONTRACTUAL STRATEGY

BIDDING & SELECTION PROCESS

CONTRACT CONTENTS

CONTRACT ADMINISTRATION

Reference: CONTRAC-EN-P Can be organized as an In-House course. Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
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<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
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<td>Rueil-Malmaison</td>
<td>1 December</td>
<td>3 December</td>
<td>€1,940</td>
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</tbody>
</table>
Practicing Commissioning

Course Content

**COMMISSIONING & START-UP PHASES IN PROJECT CYCLE**

0.5 d
End precommissioning, mechanical completion, commissioning, ready for start-up, start-up permit, performance test runs, temporary and final acceptance.

**SPECIFIC RISKS TO COMMISSIONING & START UP**

0.5 d
Fluid behavior and energy associated hazards. Chemical and physical hazards. Flammability.
Main risks induced by equipment, such as rotating, pressure vessels, thermal or naked flame equipment.
Risks related to utilities start-up: inert gas, nitrogen, steam, instrument air, water, fuel gas, diesel.
Risks evolution from construction to start-up. Transient phases. Safety reviews. Managing leaks.

**WHAT TO DO BEFORE COMMISSIONING PROCESS UNITS**

1.5 d
End of construction: visual control and checks for static and rotating equipment (no energy, no fluid). Cold clamping. Check of installation standards for piping and instrumentation.
Precommissioning activities: hydraulic tests and process equipment cleaning.
Mechanical completion.
Particular case of Utilities facilities: pre-commissioning, commissioning and start-up (ready for operations).

**COMMISSIONING OF PROCESS UNITS & START UP**

1.5 d
Chemical cleaning, flushing and blowing. Equipment drying and dynamic testing.
Particular case of instrumentation - Loops and DCS tests. Synchronization.
Preparation for the start-up of rotating equipment.
Prestart-up checks before oil-in. Plant line-up and test run.
Start-up: leak tests, air removal, oil-in. Heating up and hot bolting.
Update of documentation.

Reference: PRACOM-EN-P
Can be organized as an In-House course.

Contact: rc.contact@ifptraining.com

<table>
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<td>Martigues</td>
<td>13 September</td>
<td>16 September</td>
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</table>
This course can be adapted to virtual classroom mode - Advanced Certificate

Management of Site Projects Certification

Level: KNOWLEDGE

Purpose
This course provides an overview of management of significant refining, petrochemicals or chemicals projects (more than 10 M€).

Audience
Technical engineers (from owners or from engineering contractors) involved in such projects.

Learning Objectives
Upon completion of the course, participants will be able to:
- lead the preliminary stages: initiation, feasibility studies, economics, risk assessment, basic engineering, FEED,
- plan and control execution: detail engineering, procurement, construction, commissioning.

Ways & Means
Highly interactive sessions using examples from actual industrial projects.

Learning Assessment
Multiple-choice questionnaires.

The certification is granted to the participants having obtained an average rating of at least 60%.

Prerequisites
- Provide evidence of a professional experience of at least 1 month, related to the concerned field.
- Know the main activities of downstream Oil & Gas facilities (no project knowledge required).

Why an IFP Training Certification?
- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Management of Site Projects Certification.
- Ready-to-use skills.

More info
Course consistent with the PMI standards. Worth 30 PDU.

Expertise & Coordination
IFP Training trainer (permanent or contracted) having a good expertise and experience of Project Management, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

<table>
<thead>
<tr>
<th>5 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEASIBILITY STUDIES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC ENGINEERING &amp; CONTRACTING</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>DETAIL ENGINEERING</td>
</tr>
<tr>
<td>Organization charts, project manager roles and responsibilities. Interface definition and management. Detail engineering management: process, main deliverables, project reviews, engineering systems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>0.5 d</th>
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</thead>
<tbody>
<tr>
<td>PROCUREMENT</td>
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</table>

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<tr>
<th>1 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTRUCTION</td>
</tr>
</tbody>
</table>

Reference: MRSPROJ-EN-A  Only available as an In-House course.  Contact: rc.contact@ifptraining.com
This course can be adapted to virtual classroom mode

Engineering Studies during Project

<table>
<thead>
<tr>
<th>Level: KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
</tr>
<tr>
<td>Technical understanding and sequencing of engineering studies.</td>
</tr>
<tr>
<td>Audience</td>
</tr>
<tr>
<td>This training is intended for the personnel of contractors and engineering firms involved in the design phases of projects.</td>
</tr>
<tr>
<td>Learning Objectives</td>
</tr>
<tr>
<td>At the end of the training, participants will be able to:</td>
</tr>
<tr>
<td>- define deliverables according to the study phase, for the main disciplines,</td>
</tr>
<tr>
<td>- verify the proper execution of studies and interface management,</td>
</tr>
<tr>
<td>- evaluate the consequences of a modification, before its integration into the project.</td>
</tr>
<tr>
<td>Ways &amp; Means</td>
</tr>
<tr>
<td>- Examples and diagrams from oil &amp; gas projects, discussed in the form of exercises.</td>
</tr>
<tr>
<td>- Mini-project offering practical applications for different engineering disciplines.</td>
</tr>
<tr>
<td>Learning Assessment</td>
</tr>
<tr>
<td>Multiple-choice questionnaires.</td>
</tr>
<tr>
<td>Prerequisites</td>
</tr>
<tr>
<td>Provide evidence of a professional experience of at least 1 month, related to the concerned field.</td>
</tr>
<tr>
<td>Expertise &amp; Coordination</td>
</tr>
<tr>
<td>Permanent or contracted IFP Training trainer, with engineering expertise, trained in adult education and maintained in methods, and whose competencies are kept up-to-date.</td>
</tr>
</tbody>
</table>

**Course Content**

<table>
<thead>
<tr>
<th>UNDERSTANDING OF PROJECT ORGANIZATION</th>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different types of project: size, Greenfield vs. brownfield projects.</td>
<td></td>
</tr>
<tr>
<td>Project structure. Main project phases. Design studies scheduling.</td>
<td></td>
</tr>
<tr>
<td>Overview of design studies, from pre-project to detailed engineering phase</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROLE OF ENGINEERING IN A PROJECT</th>
<th>1 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope of works (SOW) of the engineering activities and basis of design (BOD).</td>
<td></td>
</tr>
<tr>
<td>Roles of contractors and subcontractors.</td>
<td></td>
</tr>
<tr>
<td>Its missions: studies, procurement, construction, project management. Identification of deliverables by phases.</td>
<td></td>
</tr>
<tr>
<td>Conduct of studies on a project. Document management/validation (engineering, customer, vendors, subcontractors).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MAIN DELIVERIES &amp; DISCIPLINE TASKS</th>
<th>2.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of the study basis. Applicable codes and standards. Kick off meeting.</td>
<td></td>
</tr>
<tr>
<td>Identification of tasks and deliverables during the study phases until the start of the purchasing process.</td>
<td></td>
</tr>
<tr>
<td>Detailed review of deliverables for the different engineering disciplines: process, health, safety and environment, layout, piping, materials/corrosion, equipment, instrumentation and automation, civil engineering/structures - Naval architecture/weight control for offshore project.</td>
<td></td>
</tr>
<tr>
<td>Integration of supplier documents in the study process. Management of interfaces between the different disciplines.</td>
<td></td>
</tr>
<tr>
<td>Management of study subcontracting.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REVIEWS &amp; OPTIMIZATION</th>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most used review methods: HAZID, HAZOP. Design reviews, 3D model review.</td>
<td></td>
</tr>
<tr>
<td>Optimization: energy efficiency review. Value engineering.</td>
<td></td>
</tr>
<tr>
<td>Evaluation of alternatives and optimal decision-making.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KEYS TO SUCCESS</th>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interfaces management, Coordination between engineering, procurement and construction activities.</td>
<td></td>
</tr>
<tr>
<td>Internal constraints of the engineering schedule: interfaces between disciplines, vendor input.</td>
<td></td>
</tr>
<tr>
<td>How to take into account the geopolitical environment of the project, the constraints of objectives and means.</td>
<td></td>
</tr>
<tr>
<td>Adequacy of the deadlines of completion to the context. Deliverables related to the critical path. Management Of Change (MOC).</td>
<td></td>
</tr>
</tbody>
</table>

Reference: MANEI-EN-A  
Only available as an In-House course. 
Contact: rc.contact@ifptraining.com

This course is also available in French: MANEI-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

Commissioning & Start-Up of Process Units
Industrial Units

Level: KNOWLEDGE

Purpose
Prepare participants to manage commissioning and start-up operations.

Audience
Supervisors, engineers and technicians of oil/chemical companies or engineering, involved in the commissioning and start-up of new units.

Learning Objectives
Upon completion of the course, participants will be able to:
► plan and manage precommissioning, commissioning and start-up activities of a project,
► conduct or delegate these activities while controlling the specific constraints related to these operations,

Ways & Means
Cases studies on the precommissioning, commissioning and start-up of typical units.

Learning Assessment
Quiz.

Prerequisites
► Provide evidence of a professional experience of at least 1 month, related to the concerned field.
► Know the main industrial units.

Expertise & Coordination
IFP Training trainer(s), permanent or contracted, having a good expertise and/or experience in commissioning and start-up, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

PROJECT BACKGROUND & COMMISSIONING PHASES 2 d
Main phases of a project.
Engineering studies (FEED, Detail) and anticipation of commissioning activities.
Project contract type and impact on commissioning activities.
Integration of commissioning activities into the project process: mechanical completion, pre-commissioning, commissioning and start-up activities during the project steps.

ORGANIZATION 1 d
Commissioning procedures. Interfaces with the different engineering disciplines according to the types of contract.
Plant/project breakdown into systems and subsystems. Execution plan for commissioning and start-up.
Setting up of commissioning/start-up teams. Split of responsibilities. Preparation of the list of precedents.
Start-up phases: pre-commissioning, commissioning and preparation for start-up, performance tests, provisional acceptance, mechanical guarantees, final acceptance. Hand over.

SAFETY 0.25 d
Risks related to the auxiliary fluids and the introduction of hydrocarbons. Risk evolution between construction, commissioning and start-up. Control of the risks related to modifications during the different phases.
Pre-Start-up Safety Review (PSSR).

END OF CONSTRUCTION - PRECOMMISSIONING 0.75 d
Precommissioning activities: static verification of equipment, hydraulic tests and equipment cleaning, involvement of operations in the mechanical completion, punch-list, actions follow-up and close out.

COMMISSIONING 0.75 d
Commissioning activities. Cleaning, flushing, blowing and drying. Dynamic testing.
Synchronization of control loops and Programmable Logic Controller (PLC).

START-UP & ACCEPTANCE 0.25 d
Start-up permit: checks required before oil-in. Leak tests, air removal, raw materials introduction.
Transition towards industrial production: performance tests, temporary and final acceptance, responsibility transfer.

Reference: OPDEM-EN-A
Can be organized as an In-House course.
Contact: rc.contact@ifptraining.com

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date</th>
<th>End Date</th>
<th>Tuition Fees excl. VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>15 November</td>
<td>18 November</td>
<td>€3,150</td>
</tr>
</tbody>
</table>

This course is also available in French: OPDEM-FR-A. Please contact us for more information.
This course can be adapted to virtual classroom mode

Management of Small Projects
Existent Facilities

Course Content

**5 days**

### PRELIMINARY ENGINEERING

2.5 d

### CONTRACTING & DETAIL ENGINEERING

1 d

### PROCUREMENT

0.5 d
Equipment procurement: purchasing, expediting, inspection, transportation. Quality control plan.

### CONSTRUCTION - START-UP

1 d

---

**Ways & Means**

- Numerous examples from actual Refining/Petrochemical projects.
- Case study.

**Learning Assessment**
Multiple-choice questionnaires.

**Prerequisites**

- Provide evidence of a professional experience of at least 1 month, related to the concerned field.
- Know the main activities of an Oil & Gas site.

**More info**
Course consistent with the PMI standards. Worth 30 PDU.

**Expertise & Coordination**
IFP Training trainer (permanent or contracted) having a good expertise and/or experience of managing small projects, trained to adult teaching methods, and whose competencies are kept up-to-date.

---

Reference: GPP-EN-A  
Only available as an In-House course.

This course is also available in French: GPP-FR-A. Please contact us for more information.

Contact: rc.contact@ifptraining.com

www.ifptraining.com
This course can be adapted to virtual classroom mode

Process Diagrams (PFD-PID)

PFDs & P&IDs

Level: KNOWLEDGE

Purpose

This course provides practical keys to read and use process diagrams.

Audience

Technical staff using process diagrams.

Learning Objectives

Upon completion of the course, participants will be able to:

- use the symbols of a PID legend,
- read process diagrams,
- efficiently participate to a PID review.

Ways & Means

- Use of a set of complex PIDs to understand process flow, instrumentation loops, equipment characteristics…
- PID review with checklist/HAZOP initiation.

Learning Assessment

Quiz.

Prerequisites

- Provide evidence of a professional experience of at least 1 month, related to the concerned field.
- Know the main equipment (rotating, static, thermal, instrumentation).

Expertise & Coordination

IFP Training trainer(s), permanent or contracted, having a good expertise and/or experience in Engineering, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

3 days

<table>
<thead>
<tr>
<th>BLOCK DIAGRAM &amp; PROCESS FLOW DIAGRAM (PFD)</th>
<th>0.5 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splitting a process in blocks. Elaborating a block diagram. Use of a PFD, added value compared to the block diagram. Type of information included in a PFD. Symbols used for each element. Importance of Utility Flow Diagrams (UFD). Complementarity with process flow diagrams.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PIPING &amp; INSTRUMENTATION DIAGRAM (PID)</th>
<th>1 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose of PIDs: users from engineering phase to operation. Process and utilities PIDs. Key elements indicated on PIDs. PID legend. Typical symbols. Design and organization of a PID, level of detail. Notes, holds, comments. Contents of a PID. Evolution according to design/operation phases. Documents associated with a PID.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P&amp;ID REVIEWS</th>
<th>0.5 d</th>
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</thead>
</table>
# General Layout

**Level:** KNOWLEDGE

## Purpose
This course provides knowledge on how to elaborate a general layout and take into account the various constraints.

## Audience
Engineers and technicians involved in Oil & Gas projects.

## Learning Objectives
Upon completion of the course, participants will be able to:
- produce the equipment layout for a project, taking into account constraints from various disciplines, suppliers, site infrastructure, regulations and company standards,
- optimize layout,
- be efficient while a design review.

## Ways & Means
- Develop a general arrangement on an easy case.
- Review a layout using HAZID methodology.

## Learning Assessment
Quiz.

## Prerequisites
Provide evidence of a professional experience of at least 1 month, related to the concerned field.

## Expertise & Coordination
IFP Training trainer(s), permanent or contracted, having a good expertise and/or experience in Engineering, trained to adult teaching methods, and whose competencies are kept up-to-date.

## Course Content 3 days

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REVIEWS &amp; OPTIMIZATION</strong> 1 d</td>
<td>Design reviews using HAZID methodology. Final layout including validated actions from reviews or equipment supplier data. Use of 3D models. Inter-unit connection optimization. Storage area and paved areas optimization.</td>
</tr>
</tbody>
</table>

Reference: IMPLANT-EN-P

Only available as an In-House course.

Contact: rc.contact@ifptraining.com

This course is also available in French: IMPLANT-FR-P. Please contact us for more information.
# Structures & Civil Engineering

## Purpose
Civil engineering: metal and concrete structures, foundations, buildings.

## Audience
Technical staff from owners or engineering contractors, involved in capital projects.

## Learning Objectives
Upon completion of the course, participants will be able to:
- prepare and interpret civil work specifications,
- perform basic calculations on steel and concrete structures,
- analyze civil subcontractor bids and select the most reliable and effective bidder.

## Ways & Means
Understanding technology and design with various applications and exercises.
Review of civil and structure works in existing refining and chemical facilities.

## Learning Assessment
Multiple-choice questionnaires.

## Prerequisites
Provide evidence of a professional experience of at least 1 month, related to the concerned field.
Know the main equipment used in Oil & Gas industry and get basics in resistance of materials.

## Expertise & Coordination
IFP Training trainer(s), permanent or contracted, having a good expertise and/or experience of Civil Engineering, trained to adult teaching methods, and whose competencies are kept up-to-date.

## Course Content

<table>
<thead>
<tr>
<th>Course Content</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOUNDATION DESIGN</strong></td>
<td>1 d</td>
</tr>
<tr>
<td><strong>CONCRETE STRUCTURE DESIGN</strong></td>
<td>1 d</td>
</tr>
<tr>
<td><strong>STEEL STRUCTURE DESIGN</strong></td>
<td>2 d</td>
</tr>
<tr>
<td><strong>STRUCTURE RESISTANCE TO FIRE RADIATION &amp; BLAST OVERPRESSURE</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Structural behavior of wall and beams under fire radiation and blast overpressure. Design of blast-proof buildings.</td>
<td></td>
</tr>
<tr>
<td><strong>ON SITE WORK CONTROLS</strong></td>
<td>0.5 d</td>
</tr>
<tr>
<td>Key control parameters for steel structures and concrete structures. Concrete manufacturing controls.</td>
<td></td>
</tr>
</tbody>
</table>

Reference: GENCIST-EN-P

This course is also available in French: GENCIST-FR-P. Please contact us for more information.

Contact: rc.contact@ifptraining.com

www.ifptraining.com
Registration

Identify on the course program the course reference, the price, the location and the dates you are interested in; as well as the contact name for registration.

So that your registration is done in the best conditions, please follow the procedure below:

- **3 weeks minimum** before the beginning of the course → register preferably on our website:
  
  https://www.ifptraining.com

  or send the fully completed registration form (downloadable on our website or available from one of our secretarial departments).

- **2 weeks minimum** before the beginning of the course → Please make the full payment
  
  - By check payable to IFP Training, 232 avenue Napoléon Bonaparte – 92852 RUEIL MALMAISON CEDEX
  
  - By bank transfer to IFP Training
    
    NATIXIS n° 30007 99999 04165583000 12
    
    IBAN: FR76 3000 7999 9904 1655 8300 012 – NATXFRPPXXX

  Should a sponsoring organization (like OPCA in France) pay for the course, please specify it on the registration form.

  Do not hesitate to contact us for a late registration.

**Tuition fee includes instruction, documentation as well as meals and beverage breaks.**

**IFP Training will send to the authorized person indicated on the registration form:**

- a written confirmation by mail

- one or several invitations for the participants

- useful information about the training course (access to the training center, training hours, etc.).

Who should you send your registration form to?

The registration form can be sent by **email**, mail or fax.

It should be sent to the entity organizing the course you have chosen. This entity appears at the bottom of the course program.

All enrolments are considered as accepted orders as soon as the enrolment confirmation issued by IFP Training has been received and implies the client’s full commitment to these Terms & Conditions which prevail over all other Client documents, including general purchasing conditions.
Your Contacts

Exploration & Production

Rueil-Malmaison
- Geosciences & Reservoir Engineering
- Production & HSE
  Engineering & Project Management
232 avenue Napoléon Bonaparte
92852 Rueil-Malmaison Cedex - France
Secretarial Department
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Fax + 33 (0)1 47 08 92 83
ep.contact@ifptraining.com

Pau
- Drilling & Completion
- Production & HSE
  Engineering & Project Management
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64000 Pau - France
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ep.contact@ifptraining.com

Refining & Chemicals

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Fax + 33 (0)2 35 38 62 03
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Solaize
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rc.contact@ifptraining.com

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Secretarial Department
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Fax + 33 (0)2 35 38 62 03
op.certif@ifptraining.com

IC Engines & Lubricants

232 avenue Napoléon Bonaparte
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Secretarial Department
Tel. + 33 (0)1 41 39 12 00
Fax + 33 (0)1 47 08 92 83
ml.contact@ifptraining.com

Economics & Management

232 avenue Napoléon Bonaparte
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Secretarial Department
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Fax + 33 (0)1 47 08 92 83
em.contact@ifptraining.com

IFP Training Middle-East
contact.middleeast@ifptraining.com
Tel. +973 17 21 01 38

IFP Training Congo
contact.congo@ifptraining.com
Tel. +242 (0)6 655 43 43
Tel. +33 (0)1 41 39 12 12

General Contact Information: Tel. + 33 (0)1 41 39 12 12 - contact@ifptraining.com
General Terms of Sale

1. Purpose and scope
The purpose of these General Conditions of Sale (hereinafter referred to as the “GTC”) is to define, both in France and internationally:
- on the one hand, the organization and implementation of In-house training sessions (including via virtual classes) by IFP Training on behalf of the client (hereinafter the "Client"), signatory of the Training Order defined below;
- on the other hand, the general conditions for participation in the Public training sessions (including via virtual classes) organized by IFP Training.

2. Order provisions
Every request is placed on the basis of an IFP Training commercial proposal (serving as the special terms for the present GTC), particularly setting specific conditions for training services to be provided, the price and the payment terms (hereafter the “Training Order”).

For In-house training sessions
Unless indicated otherwise, IFP Training commercial proposals are valid for a three-month (3) period from the date of dispatch of the IFP Training commercial proposal to the client.
The Training Order shall be submitted by the Client at least five (5) weeks before the starting date of the first requested session. IFP Training reserves the right to refuse late orders.
The Training Order will be binding upon IFP Training once IFP Training has received the following documents:
- the IFP Training commercial proposal initialed on each page, with the last page containing the handwritten indication “Accepted and Agreed”, as well as the Client’s signature and commercial stamp, if any;
- these GTC with initials on each page;
- contact details of the invoice’s recipient, and all information to be contained in the invoice.
As such, the Training Order is made up of the following documents, in decreasing order of priority:
1. IFP Training commercial proposal;
2. IFP Training GTC;
3. all other documents referred to in the IFP Training commercial proposal.
Client’s acceptance of the IFP Training commercial proposal constitutes its firm and definitive commitment to the Training Order and implies the non-applicability of its own general terms of purchase, even if mentioned in the Client purchase request.
For training sessions delivered via virtual classes, the connection links will be sent to the Client at least five (5) days before the training session to allow the Client to carry out connection tests.

For Public training sessions
All inscriptions to training sessions shall be carried out three (3) weeks prior to the session start date. IFP Training reserves itself the right to accept late enrolment. The number of participants per session is limited.
Enrolment will be confirmed once the organization center receives a fully complete enrolment form via email, fax or mail. Incomplete enrolment forms will not be accepted. Enrolment will be final once payment has been received in full or once an acceptance certificate from a sponsoring organization has been received.
All enrolments are considered as accepted orders as soon as the enrolment confirmation issued by IFP Training has been received and implies the client’s full commitment to these Terms & Conditions which prevail over all other Client documents, including general purchasing conditions.
If the entire cost of the session is not paid two (2) weeks before the training session begins, IFP Training reserves itself the right to reopen to the Client purchase request.

3. Invoicing and payment
3.1. Price
For In-house training sessions
Invoicing and payment schedule is defined in the commercial proposal. Unless indicated otherwise in said proposal, quoted prices are in Euros and exclusive of taxes; VAT at the applicable rate and/or any possible duties and/or taxes withheld at the source according to the applicable legislation shall be added. Prices are firm and not subject to revision.
For Public training sessions
Enrolment fees cover training (teaching, practical activities, simulators and other IT tools, documentation, supplies) as well as break-time related costs (refreshments). And do not cover transport and accommodation. The price on the order form is indicated in Euros, tax not included. VAT at the current rate will be added to the indicated price plus any other withholding taxes.
All training sessions, once started, have to be paid in full. Upon request, IFP Training may decide to apply reduced enrolment fees for job seekers.

3.2. Payment
Payment will be made by bank transfer to the beneficiary IFP Training: NATIXIS account No. 3000799999 0416558300 12 IBAN: FR76 3000 7999 9904 1655 8300 012 – BIC: NATXFRPP00X
Payment by a third party organization (such as accredited collecting funds for training): if Client makes a third party pay for the training, it must so inform IFP Training at the time of the Training Order. In this case, IFP Training will make its reasonable efforts to provide the documents requested by the Client (possible translation at the Client’s expense).
The Client will ensure that payment is made by that third party. In case of non-payment or partial payment by said third party for any reason whatsoever, all sums not received by IFP Training on the due date will be borne by the Client.
For Public training sessions, the training session will only be accessible to the Client once that IFP Training has been paid in full. By check to the order of:
IFP Training - 232, Avenue Napoléon Bonaparte
F-92852 Rueil-Malmaison Cedex
Via bank transfer to IFP Training above mentioned account.
A duplicate is available provided that the Client requested it on the enrolment form.
If the Client wishes to pay using a sponsoring organization, the following procedures should be followed:
- before the start of the session, a request for direct billing should be issued and accepted;
- this shall be indicated explicitly on the enrolment form;
- the Client ensures the completion of payment by the designated organization.
IFP Training will provide the Client with all documents needed to make a sponsoring request.
If the sponsoring organization only bears part of the training cost, the remaining amount will be charged to the Client. Only payments by sponsoring organizations before the first day of training will ensure enrolment and access to the training.
If, for whatever reason, the sponsoring organization doesn’t pay, the Client will be charged the full training amount. At the end of the session IFP Training will send the sponsoring organization an invoice along with a copy of the certificate of attendance signed by the participant.

3.3 Late payment
Pursuant to the provisions of article L441-6 of the French Commercial code, all sums not paid on their due date will require Client to pay late payment penalties equal to three (3) times the French legal interest rate.
These penalties are due until full payment. In the event of late payment,
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the Client will also owe to IFP Training a fixed compensation of forty (€40) Euros for collection costs. Should collection costs be higher than such fixed compensation, IFP Training can demand additional compensation from the Client by providing supporting proof.

IFP Training also reserves the right to interrupt the performance of the services if an invoice is not paid on or before the due date, without prejudice to any other recourse.

4. Cancellation and deferral - Modification of services

4.1 Cancellation and deferral conditions

For in-house training sessions

By the Client: Any request for cancellation or deferral of all or part of the Training Order by Client shall be notified to IFP Training in writing, with acknowledgment of receipt, no later than three (3) weeks before the session date. This three (3) week delay is counted from the date of reception by IFP Training of said request.

(i) In case of deferral:

Any deferral requested less than three (3) weeks before the session date will be considered by IFP Training as a session cancellation. The conditions of (i) or (ii) below will then apply.

(ii) In case of partial cancellation of the Training Order (i.e. cancellation of one or more sessions):

For any Training Order or part thereof cancelled while giving the required three-weeks prior written notice, the Client will only pay the expenses already incurred by IFP Training (including internal preparation costs) that cannot be deferred.

For any session cancelled between one and three (3) weeks before the session date, the Client will have to pay 60% of the price of the cancelled session.

For any session cancelled with a notice given less than one (1) week before the session date, the Client will have to pay 100% of the cancelled session’s price.

Full payment is required for every session performed, however partial. The Training Order will remain valid for all non-cancelled sessions.

(iii) In case of the Training Order’s total cancellation:

The provisions of (i) will be applicable to the entirely cancelled Training Order and to the total price of the Training Order.

By IFP Training: IFP Training reserves the right to cancel or defer any session providing a three-(3) week prior notice, by e-mail, fax or letter. No compensation will be paid to the Client but IFP Training undertakes to agree with Client on a new session date within four (4) months.

For Public training sessions

By the Client: Cancellation by the Client shall be sent in writing to IFP Training. In the eventuality of a cancellation, even due to force majeure, less than 14 calendar days before the beginning to the session, 50% of the enrolment fee will be charged by IFP Training, except if a participant from the same company takes the participant’s place. Such a replacement must be communicated to IFP Training and confirmed by sending a new enrolment form.

In case of non-cancelled enrolments (including absenteeism or dropout), 100% of the enrolment fee will be charged by IFP Training. In case of an unforeseen departure, justified by the Client, the participant may be authorized to take part in a later session with the prior consent of IFP Training.

By IFP Training: IFP Training reserves itself the right to cancel or postpone a session, especially if there are an insufficient number of participants. The Client will be notified by telephone at least 2 weeks before the session was due to begin. The cancellation will be confirmed in writing. The payments received will be fully refunded. No compensation on behalf of IFP Training will be given to the Client due to cancellation or postponement of a session.

4.2 Modification of services

Any modification of the training services requires an amendment to the Training Order.

IFP Training must be given prior written notification of any change of the number of session participants, such changes being subject to the following conditions:

- Any downward adjustment of the number of the Client’s session participants can be considered by IFP Training as a partial cancellation of the session in question and will thereby be managed according to the rules listed in article 4.1 (i) that will be applied to the unit cost per participant indicated in the commercial proposal (or, failing that, by dividing the total Training Order amount by the number of Client’s participants).

- Any additional participant will be subject to prior approval of IFP Training and to an additional commercial proposal.

- Any request for a change of the number of participants must be submitted to IFP Training no later than one (1) week before the concerned session date.

Client can replace a participant with another, after notifying IFP Training.

5. Conditions for performance of the services

To fulfill the Training Order, IFP Training will perform the services proposed at the commercial proposal accepted by Client through qualified trainers.

- Performance site:

The site where the training services will be performed is indicated in the Training Order. Should the training be provided outside of an IFP Training site, the Client will ensure the access of IFP Training and its trainers to the premises where the sessions will be held, and will provide them with all material and equipment (i.e. computer, projector, screen…) needed for the performance of the services on the site in accordance with IFP Training specifications.

The delivery of services can also be carried out through virtual classes.

- Client’s information and obligations:

Client will provide IFP Training with the information and data specified in IFP Training commercial proposal, as well as all information needed to facilitate the services’ performance.

In case of late delivery of said needed information, IFP Training may decide to defer the concerned sessions and shall so inform the Client. In this case, IFP Training and the Client will jointly agree on new dates for these sessions. All data and information provided by the Client will be kept confidential by IFP Training. At the Client’s written request, such data and information can be returned to the latter at the end of the Training Order.

The Client bears sole responsibility for the data and information that it provides to IFP Training for the performance of services. The data and information provided by the Client remain its property.

For virtual classroom training, the Client will have to ensure beforehand, and throughout the training session, that its technical environment is permanently compatible with IFP Training’s distance learning platform. After the first connection test, the Client may not claim any incompatibility or defect in access to the service. Moreover, the Client states to be aware of and accept the characteristics and limits of the transmission of information via the Internet network, as well as the costs involved in connecting to this network. In addition, the Client acknowledges that it is his/her responsibility to ensure that the technical characteristics of the equipment he/she uses allow him/her access to the training session under good conditions and to take all appropriate measures to be protected from contamination by possible malicious programs.

The Client is entirely responsible for the management and use of the identifiers and passwords communicated by IFP Training for the training session and is responsible for the safekeeping of these identifiers and passwords. Consequently, it is up to the Client to implement all precautionary measures necessary for their protection and conservation. The Client is responsible for the consequences of their use. IFP Training shall in no case be held responsible for any fraudulent use of the Client’s login and password. The Client undertakes to inform IFP Training of any fraudulent use of the username and password as soon as he or she becomes aware of it.
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The Client may under no circumstances make the training session available to a third party and strictly refrains from any other use, in particular any adaptation, modification, translation, arrangement, distribution, decompilation, without this list being exhaustive.

1. For the certifying courses: the issuance of the certification will be subject to full payment of the price of the training session.

2. In the case of short-term training course (training course of a maximum duration of three (3) days), the payment will be made when signing the Contract.

6. Information technology and freedoms

Information of a personal nature provided by the Client to IFP Training for the performance of the session may be communicated to the contractual partners of IFP Training and to the trainers for the purposes of the services. Pursuant to the provisions of French law No. 78-17 of January 6th 1978, the persons in question can at any time exercise their rights to access, oppose and rectify said information within the IFP Training files.

7. Property rights to the pedagogical documents

Parties shall be bound by an obligation of confidentiality with regard to all documents and information specified as confidential during the training session, whatever their format. The Parties undertake to ensure compliance with this obligation by all their personnel and, more generally, by any person put in contact with the other Party by one Party during the training session.

All educational documents and information transmitted by a Party within the framework of the training sessions belong to the said Party and/or its contractual partners and/or trainers and their use, disclosure or copy is prohibited unless prior written agreement has been obtained from the Disclosing Party.

Under no circumstances may these GTS be interpreted as conferring, expressly or implicitly, on the recipient Party the grant by the disclosing Party of a license right, or a promise to grant a license right, for any direct or indirect reproduction, adaptation, modification, representation or dissemination by the recipient Party, in any form whatsoever, of all or part of the documents (in particular educational documents produced by IFP Training) transmitted by the disclosing Party, its partners and/or its trainers, as the case may be, transmitted by the Disclosing Party as part of the training sessions.

The Client agrees not to remove any proprietary notices presented on educational documents sent by IFP Training as part of the services.

8. Advertising

Any use by Client of the “IFP Training” name for promotional or advertising purposes must have received the prior written approval of IFP Training.

IFP Training reserves the right to mention the Client as being one of the IFP Training Clients for advertising purposes, on any support and medium.

9. Undeclared labor - Subcontracting

IFP Training fully complies with French labor, fiscal and social laws pertaining to its trainers.

IFP Training may subcontract the performance of part of the training services to qualified partners, who shall also comply with French labor, fiscal and social laws pertaining to their trainers. In no way does subcontracting release IFP Training from its obligations and liabilities pursuant to the present General Terms of Sale.

10. Force majeure

For the purposes of this GTC, the term force majeure (hereinafter referred to as “Force Majeure”) shall have the definition provided for in Article 1218 paragraph 1 of the Civil Code.

The Parties agree to consider as a Force Majeure event notably extreme weather conditions, lightning or fire, any requirement demanded for the protection of public safety, strikes, social movements from the personnel of the prevented Party or from the personnel of its subcontractor(s).

The Party that is prevented from executing its obligations under the present Training Order because of the occurring of a Force Majeure event shall inform the other Party(ies), as quickly as possible by any means, confirmed in writing by the dispatching of registered letter with an acknowledgement of receipt, within a five (5) working days period following the occurrence of said event, indicating the nature of its circumstances and, as far as possible, its estimated duration and the extent of the impediment.

This Force Majeure event shall result in the suspension for the prevented Party and/or any other Party which is directly impacted by said event of its obligations under the Training Order. Therefore, no Party shall be held liable for the delay in the execution, or for the inexecution of all or part of its obligations under the Training Order is this delay or this inexecution is due to the occurrence of a Force Majeure event.

The Party having invoked the Force Majeure event shall:

- make its best efforts in order to limit and/or mitigate as much as possible its consequences in order to timely resume the execution of the Training Order;
- continue the execution of the contractual obligations that are not affected by the Force Majeure event;
- inform the other Party(ies) in writing of its termination.

The suspended obligations shall be executed again as soon as the Force Majeure event has ceased. The contractual deadlines shall be extended by the duration of said event. Should the effects of the Force Majeure event continue beyond a thirty (30) working days period from its occurrence, the Parties shall seek to reach agreement in order to decide on the further course of action for the execution of the Training Order.

In case of a Force Majeure occurrence lasting more than thirty (30) consecutive days, the Party faced with such Force Majeure occurrence can immediately terminate, by the dispatching of registered letter with an acknowledgement of receipt, the Training Order, without compensation to the other Party.

11. Termination

The Training Order may be terminated by either of the Parties in the event of non-performance by the other Party of one or more of its obligations in accordance with the Training Order. Termination shall only become effective one (1) months after the dispatching by the Party claiming non-performance of a registered letter with acknowledgement of receipt unless the breaching Party has cured its non-performance.

12. Liability - Insurance

Except in case of wilful misconduct, IFP Training and the Client will respectively deal with the consequences of accidents that may occur during the performance of the Training Order and involving their own personnel, including the session participants that they directly or indirectly employ as well as their property or any property in their custody, irrespective of the author of the damages.

For the training courses carried out via virtual classes, the impossibility of using the purchased service for any reason whatsoever, in particular due to incompatibility with the Client’s equipment, can under no circumstances give rise to compensation or cancellation of the training session with IFP Training.

Accordingly, each party waives any recourse against the other for any damages caused to persons and property, except in case of wilful misconduct.
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Each Party shall be solely liable for any loss, damage or injury to third parties resulting from the performance of the said Party’s obligations by it or on its behalf under the Training Order.

Moreover, under no circumstances can IFP Training be held liable for any financial, commercial or other damage directly or indirectly caused by the use of any information provided by IFP Training within the framework of the training sessions.

In all other cases, Client acknowledges that the liability of IFP Training is strictly limited, for direct damages, to the price of the Training Order and excludes any indirect damages.

In view of the above provisions, IFP Training and the Client shall ensure that their respective insurers waive any subrogation rights against the Parties. Should IFP Training or Client fail to ensure this waiver, the defaulting party will bear the financial consequences.

Client undertakes to obtain and maintain, for the duration of the session and at its own expenses, the validity of all insurance policies needed in order to cover the risks, liabilities, direct or indirect damages and illnesses that could be suffered by the participant(s), its personnel or its property, obtained from duly solvent insurance companies.

At its expenses, IFP Training undertakes to subscribe and maintain the validity of the insurance needed for the coverage of its liabilities under the Training Order.

13. Personal data
As the person responsible for processing its personnel file, the Customer undertakes to inform each employee (hereinafter referred to as the User) that:
- personal data concerning him/her are collected and processed by IFP Training for the purposes of conducting and monitoring training and prospecting and promotion;
- the connection, the training path and the follow-up of the Users’ knowledge are data accessible to its services and in particular to the staff;
- in accordance with the provisions of the French Data Protection Act of 6 January 1978 in its version in force at the time of the Order, as well as the provisions of the General Data Protection Regulation (EU Regulation 2016/679 of the European Parliament and of the Council of 27 April 2016 applicable as from 25 May 2018), the User has a right to access, modify, rectify and delete his personal data (hereinafter “Rights”) concerning him and that for this purpose, an online request specifying the identity and e-mail address of the applicant can be addressed to IFP Training.

The Rights provided for in the preceding paragraph may be exercised by contacting customer service at the following email address: gdpr@ifptraining.com or by writing to IFP Training Service Marketing 232 avenue Napoléon Bonaparte, 92852 Rueil-Malmaison Cedex - France.

The Client is responsible for the conservation and confidentiality of all personal data concerning the User to which he has had access.

The personal data collected by IFP Training are necessary for the execution of the training referred to in the GTC and may be used for prospecting and promotion purposes. They are kept as long as the User has an Account not closed and within three months following the closing date. IFP Training nevertheless reserves the right to archive any personal data it may have collected in execution of the Order, for the duration of the limitation of liability actions. In this case, IFP Training will ensure the security and confidentiality of the archived data storage to which only IFP Training will be able to access for the exclusive purpose of a possible litigation whose resolution requires the judicial communication of said data.

14. Miscellaneous provisions - Litigation
14.1 The fact that a Party does not invoke the benefit of a clause of the Order does not entail a waiver by it of the benefit of that clause.

If one or more of the provisions hereof were to prove null and void under an applicable law or decree or a final judicial decision, it (they) would then be deemed unwritten. However, the other provisions would remain in full force and effect.

A notification by registered letter with acknowledgement of receipt shall be deemed to have been sent on the date appearing on the stamp affixed by the postal services.

Upon completion of the training session and/or in the event of early termination of the Order for any reason whatsoever, the provisions of Articles 6, 7, 8, 12 and 13 shall remain in effect.

The present General Terms of Sale are subject to French law. Any dispute, not resolved amicably between the Parties within one (1) month, and relating to the validity, performance or interpretation of these General Terms of Sale shall be subject to the jurisdiction of the Commercial Court of Nanterre, including in cases of multiple defendants.

14.2 Fight against corruption
IFP Training and the Client undertake to fight against corruption in all its forms, public or private, active or passive both vis-à-vis their suppliers or subcontractors and vis-à-vis their principals.

In this respect, the Client undertakes to comply with French anti-corruption legislation, similar legislation applicable at the place of execution of the Order when all or part of the Order is carried out outside France, as well as IFP Training’s charter of good conduct, which can be accessed on its website at the following address: www.ifptraining.com

For all matters relating to the Order, the Parties state and guarantee that they do not and will not give or offer to give, directly or indirectly, any sum of money or any other pecuniary or non-pecuniary benefit to anyone for the purpose of obtaining the Order or facilitating its execution.

The Parties undertake to keep all accounting documents and other evidence of payments made or received and expenses incurred by them in connection with the Order during its term and at least three (3) years from the date of expiry or termination of the Order. Each Party or a third party appointed by it shall have the opportunity to audit such documents, subject to reasonable notice to ensure compliance by the other Party with the provisions of this clause.

In case of violation of this clause by one of the Parties, the other Party reserves the right to suspend, for a period not exceeding three (3) months; and/or terminate the Order automatically, without any formality, and at the sole discretion of the said Party.