IFP Training

2020 TRAINING COURSES

REFINING & CHEMICALS

www.ifptraining.com

A Word from the Executive Board

Benoît MOUREZ, Rémi MOUCHEL & Loïc DU RUSQUEC

IFP Training

45 years of expertise
15000 participants per year
80 nationalities represented
650 permanent lecturers & associated experts

A new management for new challenges

Last July, IFP Training changed its governance by setting up an Executive Board. Rémi Mouchel, Benoît Mourez and Loïc du Rusquec will lead the company throughout this challenging period of energy transition.

An integrated part of the IFP Group

In 2019, our Group celebrated the 100th anniversary of both the first oil training course held in France and the creation of the first French oil laboratory. A century later, IFP, now IFP Energies nouvelles (IFPEN), is internationally recognized as a major applied research and education player in the fields of energy, transport and environment. From research to industry, technological innovation is central to all its activities.

As an integrated part of the IFP Group, IFP Training benefits from its multidisciplinary innovative research projects as well as from the Group subsidiaries' expertise, bringing together the know-how of its leading worldwide industrial players and the agility of its innovative startup companies.

To ensure tomorrow's energy competencies

Today, energy companies operate in some of the most challenging and uncertain context and are looking hard for innovative solutions to improve their safety, efficiency and environmental sustainability. In these conditions, skilled workforce is the most powerful assets that companies have.

Based on its 45 years of international experience and in response to sector demand, IFP Training has developed a range of high added-value services and effective solutions for workforce competency development that can be customized to your organization's needs.

IFP Training's competency-based training solutions cover Exploration & Production, Refining & Petrochemicals, Powertrains, Energy Transition, Economics & Management. Our innovative and engaging teaching methodology is based on a unique scenarization of our sessions. Using simulation-based courses and immersive learning technologies allows professionals to visualize, understand in-depth industrial equipment details, and increase their knowledge retention. In addition to our face-to-face sessions, IFP Training provides online and blended learning.

Over the years, IFP Training has partnered with national & private energy companies, as well as international institutions to jointly run competency development services particularly through the accreditation process.

We invite you to browse our new 2020 offer in order to find a response to your organizational needs in workforce development.

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 succeed in your today and tomorrow's challenges.

Content

Course index

Tuition fees include instruction and documentation as well as meals and beverage breaks

Course index

Processes	Duration	Dates	Location	Tuition Fees excl. VAT	Reference	Page
Separation Processes						
Distillation Column Design	4 days	19-22 May	Rueil-Malmaison	€3,000	PSE/DESIGN-E	46
Distillation Certification - Optimization & Troubleshooting	5 days	22-26 June	Rueil-Malmaison	€3,450	PSE/DSS-E	47
Operation of a Binary Distillation Column - Level 1	4 days	In-house course			PSE/ICD-E	48
Operation of a Binary Distillation Column - Level 2	5 days	In-house course			PSE/CCDSS-E	49
Operation of a Multiple-Draw Distillation Column	5 days	In-house course			PSE/DSMSS-E	50
Column Internals	2 days	In-house course			PSE/INCOL-E	51
Refining Processes						
Catalysts in Refining Processes	5 days	16-20 November	Lyon	€3,100	RAF/CATAL-E	52
Light Cuts Processing	5 days	In-house course			RAF/REF1	53
Heavy Cuts Processing	5 days	In-house course			RAF/REF2	54
Hydrotreatment Processes	4 days	In-house course			RAF/HDT-E	55
Hydrotreatment Processes	4 days	In-house course			RAF/HDTS-E	56
Crude Oil & Vacuum Distillation	5 days	In-house course			RAF/DADSV-E	57
Catalytic Reforming for Refining & Petrochemicals	5 days	In-house course			RAF/CAREF-E	58
Light Gasoline Isomerization	2 days	In-house course			RAF/ISOM-E	59
Fluid Catalytic Cracking Operation	5 days	In-house course			RAF/FCCSS-E	60
Alkylation (HF or H_2SO_4)	4 days	In-house course			RAF/ALKY-E	61
Hydrocracking	4 days	In-house course			RAF/HCK-E	62
Hydrogen Production Unit	3 days	In-house course			RAF/HMP-E	63
H_2S Removal & Sulfur Recovery Processes	3 days	In-house course			RAF/PFCS-E	64
Visbreaking	3 days	In-house course			RAF/VISCO-E	65
Cokefaction	3 days	In-house course			RAF/COKER	66
Extra Heavy Crude Oil Upgrading	5 days	In-house course			RPC/UPGRADE	67
Petrochemical & Chemical Processes						
Base Chemicals & Polymers Manufacturing	80 days	2 March-26 June	Rueil-Malmaison	€21,630	PCH/PPM	68
Production of Paraxylene - Aromatic Loops	5 days	7-11 September	Rueil-Malmaison	€3,240	PCH/ARO-E	69
Cracking & Chemical Treatments of Purification	5 days	In-house course			PCH/RCIVAPO-E	70
Selective Hydrogenation of the Steamcracker	3 days	In-house course			PCH/HYDVAPO-E	71
Extractive Distillation	3 days	In-house course			PSE/DISTEXT-E	72
C_4 Cut: Valorization Routes	2 days	In-house course			PCH/C4CUT-E	73
Ether Production MTBE or ETBE	2 days	In-house course			RAF/ETBE-E	74
Commodity Polymers Manufacturing	3 days	In-house course			RPC/PPLAS-E	75
Polymers Fundamentals	5 days	In-house course			PCH/POLYFUND-E	76
Industrial Polymerization	5 days	In-house course			PCH/INDPOLY-E	77
Polymer Reaction Engineering	5 days	In-house course			PCH/POLYENG-E	78
Rheology - Polymers Characterization	5 days	In-house course			PCH/RHEO-E	79
Main Polymers PE/PP/PS	5 days	In-house course			PCH/MAINPOLY-E	80
Ethylene Compression & Hypercompression for LDPE Units	4 days	In-house course			MTE/ETHCO-E	81
Chlorine & PVC Value Chain	2 days	In-house course			PCH/PVC-E	82
Production of Synthetic Elastomers	3 days	In-house course			PCH/ELAST-E	83
Polymers Extrusion & Pelletizing	3 days	In-house course			PCH/EXTRU-E	84
Compounding Polymers Processes	4 days	In-house course			PCH/CPP-E	85
Operation of a Chemical Production Unit	2 days	In-house course			PCH/CRC-E	86
Acrylic Acid & Lights Acrylates Units	2 days	In-house course			PCH/ACRYL-E	87
Chemical Fertilizer Manufacturing	4 days	In-house course			RPC/FERTIL-E	88
Chlorine & Derivatives Production	2 days	In-house course			RPC/FABCL-E	89

Tuition fees include instruction and documentation as well as meals and beverage breaks

Course index

Tuition fees include instruction and documentation as well as meals and beverage breaks

Course index

Tuition fees include instruction and documentation as well as meals and beverage breaks

Course index

Tuition fees include instruction and documentation as well as meals and beverage breaks

Course index

Tuition fees include instruction and documentation as well as meals and beverage breaks

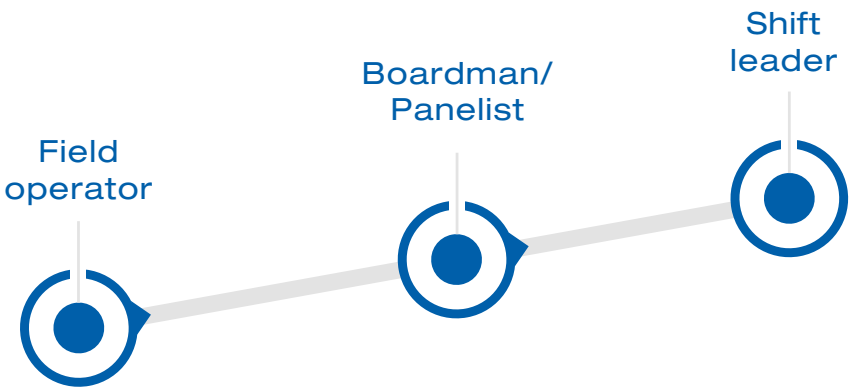
Course calendar

Title of the course	Location	Duration	January	February	March	April	May	June	July	August	September	October	November	December	Page
Refining, Petrochemicals & Natural Gas															
Refining															
Refining Processes & Petroleum Products	Bahrain Rueil	5 d			29 ▶ 02	20 ▶ 24					07 ▶ 11				16
Base Oil Production	Lillebonne	3 d					05 ▶ 07								19
Recent Developments in Oil Refining Technologies	Rueil	4 d										06 ▶ 09			22
Petrochemicals															
NEW Production of Base Chemicals & Commodity Polymers	Bahrain	4 d				20 ▶ 24									24
Applied Chemical Engineering															
Applied Chemical Engineering Certification	Rueil	10 d								24 ▶ 04					30
Applied Chemical Engineering for the Refining & Petrochemical Industries	Rueil	80 d									01 ▶ 18				31
Applied Thermodynamics	Bahrain	5 d			08 ▶ 12										32
Troubleshooting in the Oil & Gas Industry	Bahrain	3 d											09 ▶ 11		35
Processes															
Separation Processes															
Distillation Column Design	Rueil	4 d					19 ▶ 22								46
Distillation Certification - Optimization & Troubleshooting	Rueil	5 d						22 ▶ 26							47
Refining Processes															
Catalysts in Refining Processes	Lyon	5 d											16 ▶ 20		52
Petrochemical & Chemical Processes															
Base Chemicals & Polymers Manufacturing	Rueil	80 d			02 ▶ 26										68
Production of Paraxylene - Aromatic Loops	Rueil	5 d									07 ▶ 11				69
Petroleum Products, Analysis, Transfer & Storage															
Petroleum Products & Analysis															
Petroleum Products - Properties & Manufacturing Schemes	Rueil	5 d											30 ▶ 04		91
Transfer & Storage															
Operations in Oil Storage Depots & Chemical Terminals	Martigues	5 d						29 ▶ 03							94
Equipment, Materials, Corrosion & Inspection															
Technology															
Recent Developments & Innovation in Equipment	Martigues	5 d										12 ▶ 16			98
Static Equipment	Martigues	5 d								24 ▶ 28					100
Materials & Corrosion															
Corrosion & Risk Based Inspection	Rueil	5 d				06 ▶ 10									101
Maintenance & Inspection															
Fresh Inspector Practical Training	Martigues	5 d				06 ▶ 10									105
Energy & Thermal Equipment															
Energy Efficiency & Renewable Energy															
Introduction to Renewable Energies	Rueil	3 d									15 ▶ 17				109
Process Energy Efficiency Improvement for Industrial Plants	Rueil	3 d									29 ▶ 01				110
Day-to-Day Energy Optimization for Industrial Plants	Rueil	4 d						16 ▶ 19							111
Exchangers, Process Furnaces & Boilers															
Thermal Equipment	Bahrain	4 d						22 ▶ 25							112

Course calendar

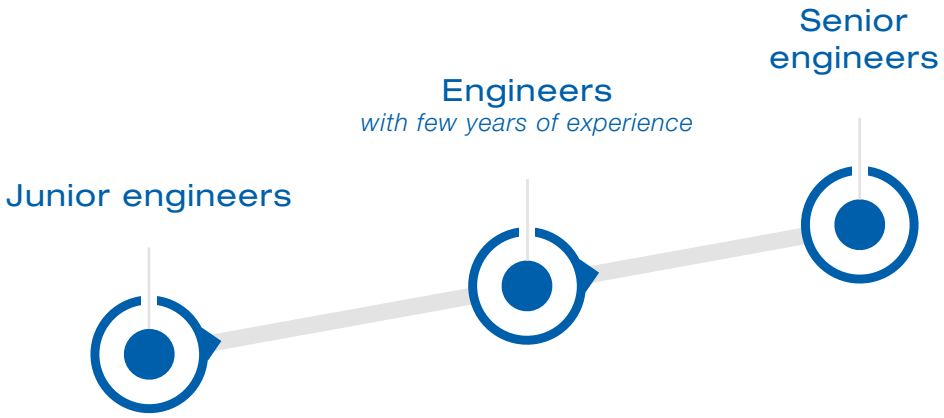
Title of the course	Location	Duration	January	February	March	April	May	June	July	August	September	October	November	December	Page
Rotating Equipment															
Specifications, Technology & Performance															
Rotating Equipment	Rueil	5 d										19 ▶ 23			118
Gas Compression & Expansion, Compressors & Turbines Certification	Bahrain	4 d									14 ▶ 17				119
Gas Turbines Certification	Rueil	5 d			16 ▶ 20										120
NEW Centrifugal Pumps & Positive Displacement Pumps	Bahrain	4 d								10 ▶ 13					121
Key Points for Compressors & Turbines Operation & Inspection	Rueil	5 d						15 ▶ 19							122
Steam Turbines	Rueil	5 d				06 ▶ 10									123
Troubleshooting, Maintenance & Reliability															
Operation, Maintenance & Inspection of Rotating Machinery - Part 1	Martigues	5 d						29 ▶ 03							128
Operation, Maintenance & Inspection of Rotating Machinery - Part 2	Martigues	5 d							06 ▶ 10						129
Instrumentation, Control & Electricity															
Instrumentation & Process Control Certification	Bahrain	5 d					31 ▶ 04								135
Maintenance & Works Supervision															
Maintenance Policy & Equipment Reliability															
Maintenance Management & Equipment Availability Certification	Bahrain	5 d											29 ▶ 03		143
Operation in the Downstream Industry															
Vocational Training Courses for Operation Teams															
Console Operator Training	Martigues	20 d			09 ▶ 03										150
Selection & Training of the Production Staff															
Soft Skills Toolbox	Bahrain	5 d							12 ▶ 16						159
HSE															
Safety in Plant Operations															
NEW Safety in Plant Operation	Bahrain	4 d									28 ▶ 01				163
NEW Safety in Storage & Loading Operation	Bahrain	4 d							06 ▶ 09						164
Project Management															
Engineering Contracts	Rueil	3 d												01 ▶ 03	177
Practicing commissioning	Martigues	4 d									14 ▶ 17				178
Commissioning & Start-Up of Process Units	Bahrain	4 d											09 ▶ 12		182
Economics															
Paris Energy Summits															
International Oil Summit	Paris	1 d				16									189
International Gas & Power Summit	Paris	1 d											19		190
Energy Economics															
Overview of Petroleum Economics	Rueil	4 d												01 ▶ 04	191
Overview of Natural Gas Economics	Rueil	4 d									08 ▶ 11				192
Liquefied Natural Gas Economics	Rueil	4 d												15 ▶ 18	193
Trading Economics															
Oil Markets & Trading	Rueil														
Downstream Economics															
Economic Framework of Refining	Rueil														
Economic Optimization of Refining Operations	Rueil														
Refining & Petrochemicals Synergies	Rueil														
Profitability Analysis of Downstream Investment Projects	Rueil														
Downstream Module	Rueil														
Finance & Management															
Price Risk Management in Energy Markets	Rueil	3 d										14 ▶ 16			201
Investment Profitability Studies in the Oil & Gas Industry	Rueil	3 d					26 ▶ 28								202

Operator, Panelist & Shift Leader Training Path



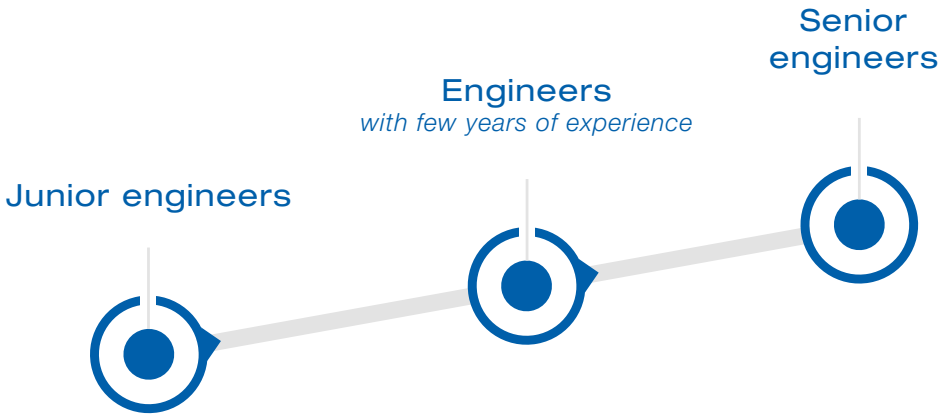
Sessions	Duration	References Pages
FIELD OPERATOR		
INITIAL TRAINING PROGRAM		
Field Operator Training Course	180 days	OPE/FOT-E
Field Operator Certification	60 days	OPE/BO-E
Operator Basic Training Course	40 days	OPE/FTBO-E
PROFICIENCY TRAINING		
Centrifugal Pumps & Positive Displacement Pumps	5 days	MTE/PC-E
Compressors	5 days	MTE/EECV-E & MTE/ECC-E
Steam Turbines	5 days	MTE/EXTAV-E
Furnaces: Safe Operation & Optimization	4 days	EMT/FURNSOO
Boilers Safe Operation & Optimization	4 days	EMT/BOILER
Properties, Formulation, Transfer & Storage of Petroleum Products	8 days	MVS/PCTS-E
Safety in Plant Operation	5 days	SEC/SAFETY
BOARDMAN/PANELIST		
INITIAL TRAINING PROGRAM		
Panel Operator Certification	35 days	OPE/FBMOC-E
PROFICIENCY TRAINING		
Distillation	4 to 5 days	PSE/ICD-E & PSE/CCDSS-E & PSE/DSMSS-E
Light Cuts Processing	5 days	RAF/REF1
Heavy Cuts Processing	5 days	RAF/REF2
Refining Processes	4 to 5 days	p. 52 to 67
Petrochemical & Chemical Processes	2 to 5 days	p. 68 to 89
Instrumentation & Process Control Certification	5 days	IR/INPC
SHIFT LEADER		
INITIAL TRAINING PROGRAM		
Refining & Petrochemicals Operations Shift Supervisor Certification	10 days	OPE/CDQRC-E
PROFICIENCY TRAINING		
Safety in Maintenance & Construction Works	4 days	SEC/SECTRA-E
Commissioning & Start-Up of Process Units	4 days	PGP/OPDEM-E
Day-to-Day Energy Optimization for Industrial Plants	5 days	EMT/MENERG-E

Engineers
Training Path



JUNIOR ENGINEERS		
Sessions	*Duration*	*References*
REFINING - PETROCHEMISTRY - GAS		
Refining Processes & Petroleum Products	5 days	RPC/RPPP
Base Oil Production	3 days	RPC/BOR
Production of Base Chemicals & Commodity Polymers	5 days	RPC/PETRO-E
Commodity Polymers Manufacturing	3 days	RPC/PPLAS-E
Economic Framework of Refining	5 days	EAV/EFR
Liquefied Natural Gas Economics	4 days	GER/LGE
ENGINEERS WITH FEW YEARS OF EXPERIENCE		
CHEMICAL ENGINEERING		
Petroleum Refining & Petrochemicals Certification	85 days	GCA/PETREF
Applied Chemical Engineering Certification	10 days	GCA/PEA
Applied Chemical Engineering for the Refining & Petrochemical Industries	80 days	GCA/ACE
Reactor Engineering	5 days	GCA/REACT-E
Practice of PRO-II/Provision or HYSYS Simulation Software	2 days	GCA/PRO2-E
Troubleshooting in the Oil & Gas Industry	3 days	RPC/TBS
EQUIPMENT		
Rotating Equipment	5 days	MTE/ROTMACH
Thermal Equipment	5 days	EMT/THERMEQ
Instrumentation & Process Control Certification	5 days	IR/INPC
PETROLEUM PRODUCTS - REFINING & PETROCHEMICAL PROCESSES		
Recent Developments in Oil Refining Technologies	5 days	RPC/RECENT
Petroleum Products	5 days	APD/PP-E
Catalysts in Refining Processes	5 days	RAF/CATAL-E
Distillation Certification	5 days	PSE/DSS-E
Distillation Column Internals	2 days	PSE/INCOL-E
Crude Oil & Vacuum Distillation	5 days	RAF/DADSV-E
Light Cuts Processing	5 days	RAF/REF1
Hydrotreatment Processes	4 days	RAF/HDT-E
Heavy Cuts Processing	5 days	RAF/REF2
Fluid Catalytic Cracking Operation	5 days	RAF/FCCSS-E
Hydrocracking	4 days	RAF/HCK-E
Hydrogen Production Unit	3 days	RAF/HMP-E
Base Chemicals & Polymers Manufacturing	80 days	PCH/PPM
Utilities - Environment Management	5 days	RAF/REF3
SAFETY - OPERATION		
Safety in Plant Operation	5 days	SEC/SAFETY
Safety in Maintenance & Construction Works	4 days	SEC/SECTRA-E
Commissioning & Start-Up of Process Units	4 days	PGP/OPDEM-E

Engineers
Training Path



SENIOR ENGINEERS		
Sessions	*Duration*	*References*
DESIGN & OPERATION OF EQUIPMENT		
Ethylene Compression & Hypercompressors for LDPE Units	4 days	MTE/ETHCO-E
Rotating Equipment	5 days	MTE/ROTMACH
Day-to-Day Energy Optimization for Industrial Plants	5 days	EMT/MENERG-E
Thermal Equipment	5 days	EMT/THERMEQ
Storage of Petroleum Products: Storage Equipment & Tank Operation	5 days	MVS/DEPOTS-E
Analytical Methods & Techniques Applied to Hydrocarbons & By-Products	5 days	APD/AMT-E
Automation of Refinery Offsite Operations	3 days	APD/AUTOOFF
Corrosion & Corrosion Prevention Certification	5 days	MCO/CICP-E
Risk Based Inspection (RBI)	5 days	EIM/PLINS-E
SAFETY - ENVIRONMENT		
Improve Your SHE Management System	3 days	SEC/SHE-E
Implementing Safety Review	4 days	SEC/REVSEC-E
Introduction to Process Safety Engineering	5 days	SEC/SAFENGRC-E
Design & Operation of a Safety Instrumented System (SIS)	3 days	SEC/SIS-E
MAINTENANCE		
Maintenance Engineer Certification	75 days	OMT/MAINENG
Maintenance Management & Equipment Availability Certification	5 days	OMT/GEMA-E
Turnaround Management	5 days	OMT/TURNMAN
PROJECTS		
Management of Small Projects	5 days	PGP/GPP-E
Management of Site Projects Certification	5 days	PGP/MRSMPROJ

Refining, Petrochemicals & Natural Gas

Refining

Petrochemicals

Gas

Refining Processes & Petroleum Products

Level: FOUNDATION

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 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

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

5 days

PETROLEUM PRODUCTS — *1.25 d*

Energy and non-energy products and their main uses, CO_2 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).

REFINING PROCESSES — *2.75 d*

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.

Hydrorefining processes:
- Main features of impurities removal by catalytic hydrogen treatment.
- Main refining applications.
- Example of ULSD hydrotreatment 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, CO_2 emissions at the outlet of the refinery.

Other processes for production of petroleum products: GTL, synthetic crude oils.

MANUFACTURING FLOWSHEETS — *0.25 d*

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.
Virtual visit of a refinery using the augmented reality will enable the trainees to gain a direct understanding of the field life.

MAIN ECONOMIC FEATURES OF REFINERY OPERATION — *0.75 d*

Prices of crude oils and products, operating costs, economic margin of a refinery.
Examples of flexibility in operation and its economic consequences.

Reference: RPC/RPPP — Can be organized as an In-House course. — Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	29 March	2 April	€3,150
Rueil-Malmaison	20 April	24 April	€3,100
Rueil-Malmaison	7 September	11 September	€3,100

This course is also available in French: RPC/BRP. Please contact us for more information.

Utilities - Environment Management

Level: FOUNDATION

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

Basic knowledge of Oil & Gas downstream processes and operations.

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

5 days

BFW QUALITY - STEAM PRODUCTION *1 d*

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.

ELECTRICAL POWER PRODUCTION & SUPPLY *0.5 d*

Quality requirements: power and voltage. Production: generators, gas turbines, cogeneration.
Electrical network: key-equipment, transducers, grounding, back-up supply, safety and reliability.

COMPRESSED AIR GASES *0.5 d*

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 O_2 and CO_2.

INDUSTRIAL WATER NETWORKS *1 d*

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.

AIR POLLUTION MECHANISMS & PREVENTION *1 d*

Main atmospheric pollutants (CO_2, SO_x, NO_x, VOC). Environmental impacts (global warming, acid rains, ozone).
Measurement of atmospheric pollution, reaction procedures.
Main sources of pollution. Prevention methods: combustion and storage equipment.
Vapor recovery units. Sensitization. Flare systems. Vent and drain networks.

WATER POLLUTION & WASTE WATER TREATMENT *0.5 d*

Pollution sources in refining. Waste water effluent typical specifications. Quality control.
Treatment of oily water (settling, floatation, biological) and process water. Finishing options.

ENVIRONMENTAL MANAGEMENT SYSTEM *0.5 d*

Other pollution mechanisms: soil, solid waste, noise, smells. Prevention and remediation.
Importance of environmental regulations. Environmental impact assessment. ISO 14001 standard.

Reference: RAF/REF3 Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RPC/UTILENV. Please contact us for more information.

Introduction to Refining

Level: DISCOVERY

Purpose

This course provides a basic technical information on refining processes.

Audience

Non-technical professionals in the Oil & Gas industry or related sectors interested in the oil refining business.

Learning Objectives

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

- state the role of the main refining processes and their operating characteristics,
- describe the manufacturing scheme of petroleum products,
- sum up the main constraints and trends in the refining industry.

Ways & Means

- Active participation of trainees through interactive games.
- The use of 2D/3D photos and videos makes it possible to understand the size of the devices and units presented.

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

3 days

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: RPC/ITR-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RPC/ITR. Please contact us for more information.

Base Oil Production

Refining & Environment

Level: DISCOVERY

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

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

3 days

CLASSIFICATION & PROPERTIES OF BASE OILS — *0.25 d*

Commercial lubricant function and composition, purpose of additive introduction, demand structure.
Mineral base oil classification, market trends.
Main quality criteria in relation with chemical composition, specifications.

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*

Composition of vacuum distillates and residue: influence on refining.
Conventional manufacturing scheme vs. base oil manufacture by hydrotreatment: units' purpose, products quality.
Rerefining of drained lubricants.

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…
- Hydrorefining: hydrocracking of vacuum distillates and deasphalted oil.
- Hydrodewaxing: hydroisomerization of slack wax/gatsch.
- Hydrofinishing: hydrofinishing of lube basestocks, paraffins and microwaxes; white oils manufacturing principles (required properties).

SAFETY IN BASE OIL REFINING — *0.25 d*

Overview of the main specific risks in base oil refining.
REX of accidents.

Reference: RPC/BOR — Can be organized as an In-House course. — Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Lillebonne	**5 May**	**7 May**	**€3,000**

This course is also available in French: RPC/RHB. Please contact us for more information.

Place & Role of Equipment in Refining & Chemical Processes

Furnaces, Heat Exchangers, Pumps, Compressors, Dryers or Filters

Level: DISCOVERY

Purpose

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

Audience

Suppliers or subcontractors for 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

- Active participation of trainees through interactive games.
- The use of 2D/3D photos and videos makes it possible to understand the size of the devices and units presented.

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

6 days

This is a modular course and the example herein is divided into three 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 — *2 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.
Means of gas storage: surface, underground.

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 INDUSTRY — *2 d*

Steamcracking: cracked gas and cryogenic compressors.
Ammonia: air blower, cryogenic compressor.
Urea: CO_2 compressor.
Nitric acid: air blower.
Sulfuric acid: air blower.
Methanol: make-up compressor, air blower.

Reference: RPC/ITREQ-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RPC/ITREQ. Please contact us for more information.

Safe Working in the Refining Units

Risks Related to Products & Processes

Level: DISCOVERY

Purpose

This course provides a technical information on the processes and highlights the risks related to the products and processes used to better anticipate the constraints associated with safety in preparation to works and interventions.

Audience

Technical, manager or safety correspondent in a subcontracting company.

Learning Objectives

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

- describe the composition and the main characteristics of petroleum products, in particular those related to risks of flammability and toxicity,
- identify the function and the operating conditions of the main refining units as well as risks associated with the operating conditions of the equipment involved,
- explain to their staff the main hazards related to each type of refining unit.

Ways & Means

The course focuses on safety in daily interventions, in relation to each unit and each product produced in order to highlight the risks and the way to get protected from them.

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

2 days

CRUDE OILS - PETROLEUM CUTS - COMMERCIAL PRODUCTS *0.25 d*

Main components of petroleum products: hydrocarbon families and main impurities; risks related to the presence of aromatic compounds and benzene in particular, risks related to the presence of H_2S.
Crude oils: properties, classifications, yields of petroleum cuts.
Main characteristics of commercial products, link with their composition, changes in the market structure and the product characteristics.
Risks related with flammability, LEL, UEL.

CRUDE OIL INITIAL FRACTIONATION *0.75 d*

Operating principle, schemes of the industrial units, operating conditions:
- Crude oil atmospheric distillation.
- Separation of gases and gasolines.
- Atmospheric residue vacuum distillation.

Risks of corrosion, crude desalting.
Purpose of the quality control tests related to volatility: vapor pressure, flash point; impact on the storage method.
Risks related to pressure: justification of the protection devices against overpressure, flare network.
Risks related to temperature: protection of personnel, risks of self-ignition in case of leak.
Specific risks related to the operation of furnaces: hazards of a pressurized furnace, depression and air supply to burners, risks related to the flow rate decrease in the passes, safety devices.
Risks related to the firing phases of a furnace.

CATALYTIC REFORMING - ISOMERIZATION *0.25 d*

Problem due to the improvement in octane number in gasoline cuts.
Principle of the processes, main equipment, operating conditions, role and action mode of the catalysts.
Justification of shutdowns for regeneration.
Risks related to hydrogen: LEL, UEL, corrosion, metallurgy aspect.

HYDROREFINING - SULFUR CHAIN *0.5 d*

Problem due to the presence of sulfur in petroleum products.
Principle of the impurity removal from the petroleum cuts by hydrorefining: application to gasoil desulfurization.
Amine washing units, sulfur production units (Claus units), principle of complementary treatments (CLAUSPOL, SULFREEN, SCOT).
Justification of the shutdowns for regeneration.
Specific risks related to H_2S: toxicity, flammability, corrosion; specific risks related to the formation of pyrophoric compounds; metallurgy aspect.
Specific risks related to the presence of nitrogen in a vessel.

CONVERSION UNITS *0.25 d*

Interest of heavy cut conversion, characteristics of the feedstock to be converted.
Conversion process principle, coke formation mechanism and consequences, industrial unit schemes, operating conditions: visbreaking of residue, fluid catalytic cracking (FCC), hydrocracking.
Yields and quality of the products.

Reference: RPC/SECURAF-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RPC/SECURAF. Please contact us for more information.

Recent Developments in Oil Refining Technologies

Level: ADVANCED

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

No prerequisites for this course.

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

4 days

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: SO_x, CO_2, NO_x, COV's.
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 SO_x and NO_x 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: RPC/RECENT 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 October	9 October	€2,520

Air Separation Unit

Level: PROFICIENCY

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 personnels.

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

No prerequisites for this course.

Expertise & Coordination

Technical expert in the field of Air Separation Unit.

Course Content

3 days

PRINCIPLES OF AIR SEPARATION UNIT — *0.5 d*

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 — *1.5 d*

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 — *0.5 d*

Introduces to oxygen risk, reactivity of material with oxygen, design of O_2 installation.
Review of incidents in air separation units, causes and preventive measures.
Safe operation and maintenance of equipment.
Anoxia, deficient atmosphere.

BASIC CONTROL PRINCIPLE — *0.5 d*

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

Reference: RAF/ASU Only available as an In-House course.

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

Blended Learning

NEW

Production of Base Chemicals & Commodity Polymers

Level: FOUNDATION

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

- Detailed course material.
- Pictures of main equipment and samples.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

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

4 days

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

Catalytic action.
Industrial applications.
Catalytic reactors examples.

Module 4 - POLYMERS

Introduction to polymers.
Polyethylene.
Polypropylene.

CLASSROOM TRAINING (4 days)

STEAMCRACKING & TREATMENT OF THE CUTS PRODUCED — *1.75 d*

Steamcracking:
- Implementation of cracking reactions: furnaces, quench systems, primary separation.
- Yields, operating variables affecting the severity of treatment, influence of the feedstock nature.

Compression and purification of the cracked gases:
- Implementation of compression.
- H_2S and CO_2 removal by caustic washing.
- Gas drying by adsorption.
- Cooling: propylene and ethylene chilling cycles, cold box.

Separation and treatment of steam cracker effluents:
- Steamcracker effluent separation train, main characteristics and purifications of the cuts: selective hydrogenations of acetylene from the C_2 cut, of propyne and propadiene from the C_3 cut, removal of carbon monoxide.
- Treatments of the C_4 cut: production of 1,3- butadiene, recovery of isobutene from raffinate, upgrading of 1- butene in raffinate 2…
- Upgrading of pyrolysis gasoline production of motor fuels, benzene and other aromatics recovery.
- Alternative olefins production.

PRODUCTION OF AROMATICS — *0.5 d*

Analysis of the catalytic reforming process, implementation of the catalyst, yields, operating variables.
Associated processes: hydrodealkylation, isomerization…
Treatment of cuts produced in those transformation processes:
- Aromatics and non-aromatics separation processes: liquid-liquid extraction, extractive distillation.
- Aromatics separation processes: distillation, adsorption, crystallization, application to paraxylene.

Aromatic complex arrangement. Highlighting of the aromatic loop.

CATALYTIC CRACKING FCC — *0.25 d*

Analysis of FCC process: nature of the feedstock, implementation of the catalyst and principle of reactor and regenerator set.
Composition and treatment of cracked gases.
Modification of the process for maximization of light cuts C_3 & C_4 production.
FCC dedicated processes for maximizing the production of C_3 and C_4 light olefins.

ON PURPOSE PROPYLENE PROCESSES — *0.25 d*

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 — *0.5 d*

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 — *0.75 d*

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: polyethylenes (PE), polypropylenes (PP), polystyrenes (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: RPC/PETRO-E — Can be organized as an In-House course. — Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	20 April	24 April	€3,150

This course is also available in French: RPC/PETRO. Please contact us for more information.

Introduction to the Petrochemical Industry

Level: DISCOVERY

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

- Various pedagogical activities (quizzes, games…) allow the acquisition of the different technico-economical basis.
- A glossary of the main technical terms used in the petrochemical industry helps to become familiar with the technical language of the domain quickly.

Learning Assessment

Quiz.

Prerequisites

No prerequisites required 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

1 day

ORIGINS & USES OF OLEFINIC & AROMATIC INTERMEDIATES *0.25 d*

Main units: steamcracking unit, catalytic reforming unit, fluid catalytic cracking unit.
Outlets and main industrial uses of olefinics, diolefinics and aromatics hydrocarbons.
Opening on the petrochemistry of the main plastics.

THE DIFFERENT STEPS OF THE PETROCHEMICALS INDUSTRY *0.25 d*

Analysis of the different paths of synthesis.
Main polymer manufacturing.
Risks related to products and processes.
Interactions with refining (objectives, advantages, flow and services exchanges…).

PETROCHEMICAL ECONOMICS & MANAGEMENT *0.25 d*

General economic environment.
Main markets for olefins, C_4 cuts and aromatics.
Economics of a steamcracking unit using the different feeds.

SITUATION TODAY & FUTURE TRENDS *0.25 d*

Main challenges of the petrochemical industry on an international scale with emphasis on the shale Oil & Gas development in the US and the impact on the European market.
Future projects, strategy of the main actors, financial and political stakes.
Impact of the environmental regulations and climate change on the economics of the petrochemical industry.
Future trends for biosourced products and the related challenges.

Reference: RPC/DECPETRO-E Only available as an In-House course.

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

This course is also available in French: RPC/DECPETRO. Please contact us for more information.

Let's Talk about Polymers!

Level: DISCOVERY

Purpose

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

Audience

Staff of the company.

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

- Notions illustrated thanks to samples of your own polymers.
- Pictures of units: general overview.
- As a matter of fact, data from the units have to be provided to fit the client unit conditions and polymers production.

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

1 day

INTRODUCTION TO THE POLYMER WORLD *0.25 d*

Plastics: some data about.
Manufacturing processes: the downstream industry.
A set of definitions: what is a plastic, a polymer, a monomer…

FOUR DIFFERENT POLYMER PRODUCTIONS *0.75 d*

Origin of the feedstock.
Processes implemented on site.
Expected properties of the polymers.
Markets targeted in terms of end-use products.

Reference: RPC/DECPOLY Only available as an In-House course.

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

Gas Valorization

Production & Utilization of Syngas

Level: DISCOVERY

Purpose

This course provides a technical and economic information regarding the various options for valorizing gas.

Audience

Professionals interested in technical information about the different ways to valorize gas.

Learning Objectives

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

- grasp the essence of gas markets, including natural gas and syngas ($CO + H_2$),
- understand the importance of syngas: production modes and valorization channels,
- learn about the various technologies and their conditions of implementation,
- learn about the latest projects under consideration.

Ways & Means

Industry experts share their views of current developments.

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

3 days

NATURAL GAS *1 d*

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.

SYNGAS PRODUCTION *1 d*

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.

SYNGAS VALORIZATION *0.5 d*

Maximization of hydrogen production in the refineries through the shift reaction.
Chemical synthesis: production of alcohol like Methanol, Ammonia and other chemical compounds.
GTL Complex (Gas-To-Liquid): production of liquid hydrocarbons from gas through Fischer Tropsch reaction.
Coal gasification.
Electrical energy production, steam and hydrogen for refining industry: IGCC (Integrated Gasification Combined Cycle).

ECONOMIC ASPECTS OF GAS VALORIZATION *0.5 d*

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.

Reference: RPC/SYNGAS-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Gas-To-Liquid Technologies

Level: DISCOVERY

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.

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

2 days

NATURAL GAS MARKETS *0.5 d*

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.

GTL TECHNOLOGIES *1.25 d*

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.

Projects in the frame of GTL production.
Fischer-Tropsch manufacturing processes: reactions, catalysts and process schemes.
Existing units for Fischer-Tropsch and projects in the frame of GTL production.
Finishing processes for products upgrading, oligomerization and hydrocracking downstream Fischer-Tropsch units: reactions, catalysts and process schemes.
Existing units and projects in the frame of GTL production.

GTL PROJECTS & ISSUES *0.25 d*

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).

Reference: RPC/GTL-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Applied Chemical Engineering

Advanced Certificate

Applied Chemical Engineering Certification

to Oil, Gas & Chemical fields

Level: ADVANCED

Purpose

This course provides a more in-depth knowledge on the operation and operating conditions of the material and processes in refining, petrochemical and heavy chemistry sites as well as a strong foundation in the use of process simulation software.

Audience

Engineers and technicians whose activities are related to the operation of industrial sites: production, maintenance, plant projects, process control, laboratory, engineering, R&D, etc.
Every type of activities is concerned: refining, petrochemistry, heavy chemistry, engineering.

Learning Objectives

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

- describe the main properties of fluids and phenomena in process engineering,
- understand the operating conditions of equipment used in the process,
- to explain the reasons for controls implemented.

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.

Prerequisites

It is recommended that participants have notions of thermodynamics (the basics learnt during engineering studies are sufficient).

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.

Expertise & Coordination

Trainers having industrial experience in Applied Chemical Engineering.

Course Content

10 days

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.
- Liquid-vapor equilibria. Calculation principle.
- 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 traffics, 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.

Reference: GCA/PEA — Can be organized as an In-House course. — Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	**24 August**	**4 September**	**€5,710**

This course is also available in French: GCA/GENCHIM. Please contact us for more information.

Advanced Certificate

Applied Chemical Engineering for the Refining & Petrochemical Industries

CERTIFICATION

Level: FOUNDATION

Purpose

This course provides a comprehensive understanding of the refining and petrochemistry chain involved and the equipment used in the refining and petrochemical industry.

Audience

Engineers interested in applied chemical engineering relating to Oil & Gas products, refining processes and polymers.

Learning Objectives

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

- understand the refining and petrochemical manufacturing schemes,
- grasp the fundamentals of chemical engineering,
- master the fundamentals of polymer chemistry,
- acquire the bases for investment decisions and capital budgeting in the refining and petrochemical industries.

Ways & Means

- Applications using process dynamic simulators (RSI IndissPlus simulator).
- Applications using static simulation software (PRO II).
- Two practical one week sessions, including pilot testing and site visits, are scheduled between September and December in Normandy and in the south of France.

Learning Assessment

In the case certification is selected by the participant, 4 written and 1 oral tests have to be taken all along the program.

Prerequisites

This course being a part of a IFP School Master program, the English and the academic level of the participant must be in line with a Master level. IFP School will accept the candidate referring to his TOIC or TOEFL score and his resume.

Why an IFP Training Certification?

- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Applied Chemical Engineering for the Refining & Petrochemical Industries.
- Ready-to-use skills.

More info

This course is administered alongside IFP School “Processes & Polymers Master” candidates. The course content corresponds to the first trimester of the Masters program.

Expertise & Coordination

Refining and petrochemical technical experts from IFP Training.

Course Content

80 days

CHEMICAL ENGINEERING FUNDAMENTALS — 12 d

Thermodynamics applied to liquid-vapor equilibria.
Hydrocarbon physico-chemistry.
Fluid dynamics.
Heat transfer.
Thermodynamics. Kinetics. Catalysis and chemical reactions.
Industrial reactor design.

PETROLEUM PRODUCTS & REFINING PROCESSES — 20 d

Crude oil and petroleum products.
Distillation (theory and dynamic simulation).
Introduction to Provision simulation software (PROII) usage and application in a distillation project.
Refining processes, process flow sheets and visit of a refinery.

INDUSTRIAL EQUIPMENT & INSTRUMENTS — 17 d

Materials and corrosion.
Static equipment.
Rotating machinery.
Heat exchangers, furnaces and boilers.
Instrumentation. Process control.
Introduction to HTRI software usage and application in a heat-exchanger project.

MONOMERS & POLYMERS MANUFACTURING — 17 d

Olefins and aromatics in petrochemistry.
Polymer chemistry, structure and characterization.
Industrial reactor design of polymer reactors.
Visits of a steamcracker unit, polymer units and plastic converters companies.

ECONOMICS — 1 d

Economics of supply and refining operations.

CASE STUDIES — 13 d

Two projects based on conception, design and cost estimation of an industrial distillation column (with PROII) and different heat exchangers (with HTRI).
Two workshops are organized to design a CSTR styrene polymerization reactor and a LLDPE gas phase reactor.
These studies are carried out by trainees with instructor guidance.

Reference: GCA/ACE Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	1 September	18 December	€20,810

Applied Thermodynamics

Level: ADVANCED

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

No prerequisites for this course.

Expertise & Coordination

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

Course Content

5 days

PHYSICAL & CHEMICAL PROPERTIES OF HYDROCARBONS *1 d*

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 *1 d*

Properties of pure substances, vapor pressure, thermodynamic diagrams (P-t, h-t, h-S, h-P), application to frigorific cycles, 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 *1 d*

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 *0.5 d*

Processes based on liquid vapor equilibria selectivity, liquid-liquid equilibria selectivity, adsorption selectivity, liquid-solid equilibria selectivity, permeability…

DISTILLATION PROCESS *1.5 d*

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

Reference: GCA/ATHERMO Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	8 March	12 March	€3,150

Select Thermodynamic Models for Simulation

Level: ADVANCED

Purpose

This course leads to select and validate, through an efficient methodology, the right thermodynamic model for different processing conditions.

Audience

Experienced chemical or process engineers involved in process simulation or design of new processes.

Learning Objectives

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

- gain a practical understanding of fluid behavior,
- understand the link between molecular structures and fluid behavior,
- identify and validate the best thermodynamic model applied to some of industry-based cases.

Ways & Means

- Subjects are presented from a practical point of view.
- Specific data file including data, diagrams, charts and correlations used in the different technical areas of chemical engineering.
- Many practical applications based on real data.

Learning Assessment

Quiz.

Prerequisites

Understanding of fluid phases behavior and process simulation.

More info

Instructors are world-class experts in Thermodynamics from IFP Energies nouvelles and industry experts.

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

3 days

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-Hugins; 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_4 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: GCA/THERMO Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Piping & Instrumentation Diagram - PID (Project)

Level: PROFICIENCY

Purpose

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

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

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

5 days

PROJECT DEFINITION *0.5 d*

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…

ENGINEERING DIAGRAMS (PID'S) *2 d*

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 and start-up and shutdown piping: steam/condensate networks, hot oil, drain systems.
Other auxiliary piping: off-spec., start-up and shutdown piping.

ENGINEERING RULES & STANDARDS *2 d*

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…

RELIEF SYSTEM DESIGN BASIS *0.5 d*

Definition of risks.
Flare stack and flare main header and sub-headers design.
Safety valves design.
Emergency shut down diagram.
Depressurization.

PROJECT (TREATED ALL ALONG THE COURSE)

Conception of a mini PID from a process flow scheme. Application of rules.

Reference: GCA/PID-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Troubleshooting in the Oil & Gas Industry

Level: PROFICIENCY

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.

Prerequisites

Knowledge of refining and petrochemicals unit operation and equipment encountered in the Oil & Gas 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

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 check-lists):

- *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.*
- *Instrumentation and valves.*
- *Ions exchanger unit.*

Troubleshooting case study on industrial units.
The objective of these exercises is to summarize and practice all the elements discussed during the course.

Reference: GCA/TBS — Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	9 November	11 November	€3,150

Graduate Certificate

Petroleum Studies Refining & Petrochemicals

CERTIFICATION

Level: ADVANCED

Purpose

The set of public courses hereunder leads to a graduate diploma of petroleum studies in Refining & Petochemicals 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.

Prerequisites

No prerequisites for this course.

Why an IFP Training Certification?

- An international recognition of your competencies.
- A Graduate Certificate delivered.
- An expertise confirmed in 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

60 days

APPLIED THERMODYNAMICS	*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*
LIGHT CUTS PROCESSING	*5 d*
HEAVY CUTS PROCESSING	*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*
PRODUCTION OF BASE CHEMICALS & COMMODITY POLYMERS	*5 d*

Reference: GCA/GDPETREF Only available as an In-House course.

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

Graduate Certificate

Petroleum Refining & Petrochemicals Certification

Processes, Equipment & Safety

CERTIFICATION

Level: FOUNDATION

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

Candidates are required to have prior knowledge of products, processes, technologies and the safe operation of units in downstream processes.

Why an IFP Training Certification?

- An international recognition of your competencies.
- A Graduate Certificate delivered.
- An expertise confirmed in Petroleum Refining & Petrochemicals 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

85 days

PHYSICO-CHEMICAL PROPERTIES OF HYDROCARBONS & PETROLEUM CUTS — 5 d

Organic compounds, crude oil and petroleum products.
Quality control - Standard tests - Blending rules.

APPLIED THERMODYNAMICS — 5 d

Properties of pure substances.
Fluid properties: liquid-vapor equilibria of hydrocarbons mixtures, of non-ideal mixtures, of non-identified components.
K values from modern numerical methods.

DISTILLATION COURSE & PROJECT WITH PROII — 10 d

Classical industrial column design, short cut methods.
Operating parameters, optimization, process control parameters.
Internal equipment.
Practice of PROII/PROVISION, process simulation, simplified design of equipment, economic evaluation and optimization.

HEAT TRANSFER EQUIPMENT — 5 d

Heat transmission.
Heat exchangers: sizing and performances, operation.
Furnaces and boilers: performances, operating conditions, combustion, operation, safety.

FLUID FLOW - ROTATING MACHINERY — 10 d

Characteristics of liquid and gas simple phase flow; gas compression laws, expansion.
Technology and operation of pumps, compressors, steam turbines, gas turbines, electrical motors.

INSTRUMENTATION & PROCESS CONTROL — 5 d

Instrumentation, controllers, valves, control loops implementation.
PID tuning, monovariable control limits, multivariable control.

REFINING PROCESSES - PRINCIPLES & OPERATION — 20 d

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:

- Atmospheric and vacuum distillation of crude oil, Catalytic reforming, isomerization, hydrotreatment, sweetening of light cuts and sulfur recovery.
- Conversion of heavy cuts and related units: visbreaking, coking, FCC, RFCC, distillate hydrocracking, residue hydrocracking.
- Base oil refining.

PETROCHEMICAL PROCESSES - PRINCIPLES & OPERATION PRODUCTION OF OLEFINS & AROMATICS — 12 d

Production of olefins and aromatics:

- Sources, outlets and main industrial uses of olefinic and aromatic intermediaries.
- Steam cracking and treatment of the cuts produced.
- Fluid catalytic cracking (FCC) and production of aromatics.
- Economics of petrochemicals.

Production of convenience polymers (PP, PE, PS, PVC, PET):

- Nature and types of polymers.
- Implementation principles and techniques.

Production of syngas:

- Main processes: steam reforming, partial oxidation (POX).
- Valuation of synthesis gas: combined cycles.

SAFETY - UTILITIES - ENVIRONMENT IN OPERATION — 8 d

Process safety:

- Product and equipment related risks, safety in process operation.
- Hazard analysis in design and operation.

Utilities:

- Steam networks.
- Electricity generation and networks.
- Production and distribution networks for air, fire and cooling water; flare.

Environmental control:

- Air pollution sources, detection and technologies for reduction.
- Sources of aqueous pollution; waste water treatment, regulation and controls.

PETROLEUM ECONOMICS — 5 d

Evolution of the demand for derived products, international oil markets.
Short-term refinery management.

Reference: GCA/PETREF — Only available as an In-House course.

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

Chemical Reaction Engineering

Level: ADVANCED

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.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

3 days

CHEMICAL REACTIONS *0.75 d*

Thermodynamics and kinetics of the chemical reactions.
Consecutive, competitive reactions. Selectivity, yield and conversion.
Catalysts: main characteristics, shape, structural, textural and mechanical properties. Activity and selectivity.
Kinetics of the catalytic reactions: adsorption, on-surface reaction and desorption. Deactivation. Simplified mechanisms and kinetic laws.
Multiphase reactions: mass transfer at the interface. Intra-granular diffusion for catalytic reactions with a solid catalyst. Importance of specific interfacial area for liquid-liquid reactions.
Notion of chemical regime, external mass transfer or intragranular limitation.
Heat of reaction: production, temperature gradients, diffusion and elimination.
The different parameters are studied using examples from the chemical industry, with one selected case study ("training case study") followed through the training session.

MAIN CHARACTERISTICS OF CHEMICAL REACTORS *0.5 d*

Batch, semi-batch or continuous reactors: management of productivity, control of the yield.
Flow in reactors: perfectly stirred or plug flow. Non-ideal reactors: representation via axial dispersion, CSTR in series. Residence time distribution.
Control of the temperature profiles in reactors: adiabatic behavior, with thermal exchange. Influence on the results.
Stability of the exothermic reactions.
Criteria of choice: this part is covered through analysis of situations, including the training case study.

TECHNOLOGICAL FEATURES OF THE REACTORS *1 d*

Performances of mass and heat transfer. Monitoring the type of flow. Constraints in the catalyst formulations.
Consequences on technological choice:

- Fixed beds, fluidized or circulating beds for gas-solid reactors.
- Bubble columns, reactive absorption columns, etc., for gas-liquid systems.
- Stirred reactors, single or multiphase; criteria for choosing of the impeller.
- Up-flow or trickle bed for 3 phase fixed beds.

Criteria for technological choice, basic design rules.
This section is mainly covered through the use of case studies, including the training case study.

FROM THE SELECTION OF THE REACTOR TO THE OPTIMIZATION OF THE OPERATING CONDITIONS *0.75 d*

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.
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.
- Selection criteria.
- Use of several reactors.
- Choice of the operating conditions.
- Expected performances.

Reference: GCA/GRC-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: GCA/GRC. Please contact us for more information.

Reactor Engineering

Level: ADVANCED

Purpose

This course provides a thorough understanding of reactor engineering and the use of multiphase flow reactors in processing plants.

Audience

Engineers and engineering staff in charge of designing or operating reactors in the oil refining industry.

Learning Objectives

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

- identify the different types of multiphase reactors and their operating parameters,
- learn about gas liquid trickle bed reactor, gas-solid fluidized bed and gas-liquid-solid fluidized bed, including flow regimes and technologies, in relation to processes such as hydrotreatment of distillates, hydroconversion of residue, FCC and Fischer Tropsch.

Ways & Means

Numerous industry-based case studies.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

More info

Other items such as choice of the most adequate technology, reactor scale-up criteria can be included in a customized course program.

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

REACTOR ENGINEERING: MANIFOLD REACTORS *0.5 d*

The importance of multiphase flow, catalyst shape, contact and reaction parameters, e.g. contact time, reaction kinetics, heat of reaction, deactivation.
Overview and analysis of these parameters through several examples of refining processes.

REACTOR ENGINEERING: FUNDAMENTALS *1 d*

Ideal reactors: ideal concepts and theory of flow through reactors (CSTR and plug flow reactors, CSTRs in series, axial dispersion, etc.). Residence time distribution; analysis to characterize real systems.
External mass transfer limitations: mass transfer concept and theory through gas-liquid interphase in reactive and non-reactive systems.
Determination of limiting step: chemical kinetics, internal diffusion, external transfer. Consequences on reactor performance.
Examples.

GAS-LIQUID TRICKLE BED REACTORS (focus on HDT) *1.25 d*

Multiphase flow through fixed bed on trickle bed in relation to hydrotreatment HDT processes.
Main features and variables of HDT processes in the refining industry.
Flow regimes (trickle flow, pulsed flow, bubble flow); discussion on mapping as a function of operating conditions.
Relevant fixed bed properties (bed density and particle size) as well as their impact on operation.
Pressure drop throughout the bed as a function of operating conditions. Fluid and bed properties; presentation of different models and correlations. Discussion.
Mass transfer limitation in the specific HDT case.
Design considerations. Understanding of the role of internals (tray distributors, quench systems).
Simple calculation methods enabling the estimation of reactor performances.

GAS-SOLID FLUIDIZED BED & CIRCULATING FLUIDIZED BEDS (focus on FCC) *1.5 d*

FCC application: fluidized bed and circulating fluidized beds. Main features and variables of FCC processes in the refining industry.
Fluidization regimes and mapping as a function of operating conditions. Bubble properties and relevance on fluidized bed operation. Correlations are provided to estimate and describe fluidized bed hydrodynamics.
Specific technologies related to fluidized bed and circulating fluidized beds:

- Standpipes enabling large catalyst circulation.
- Gas distributors such as perforated plates, bubble caps, spargers and rings.
- Gas-solid separation systems such as negative or positive pressure cyclones.

Pressure balance of a circulating fluidized bed.

GAS-LIQUID SOLID FLUIDIZED BED (focus on hydroconversion & Fischer-Tropsch) *0.75 d*

Three phase fluidized bed: mainly hydroconversion and Fischer-Tropsch applications.
Ebullated bed involving fluidization of large particles: flow regimes, influence of operating conditions and particle properties, description of bed hydrodynamics.
Slurry reactors involving fluidization of small particles: flow regimes, influence of operating conditions and particle properties, description of bed hydrodynamics.

Reference: GCA/REACT-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: GCA/GRC. Please contact us for more information.

E-learning

NEW

Hydrocarbon Types & Impurities

Production of Base Chemicals & Commodity Polymers

Level: FOUNDATION

Purpose

This e-learning module provides a 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

Carbon and hydrogen valence. Hydrocarbon classification: paraffins, isoparaffins, naphthenes, aromatics and olefins. Hydrocarbon ranges in petroleum products.

IMPURITIES

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

Reference: GCA/GCA1-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: GCA/GCA1. Please contact us for more information.

E-learning

NEW

Distillation Process

Production of Base Chemicals & Commodity Polymers

Level: PROFICIENCY

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: GCA/GCA2-E Only available as an In-House course.

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

This course is also available in French: GCA/GCA2. Please contact us for more information.

E-learning

NEW

Introduction to Catalysts

Production of Base Chemicals & Commodity Polymers

Level: PROFICIENCY

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: GCA/GCA3-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: GCA/GCA3. Please contact us for more information.

E-learning

NEW

Polymers

Production of Base Chemicals & Commodity Polymers

Level: PROFICIENCY

Purpose

This e-learning module provides a brief introduction to main properties of polymers with a special focus on the most relevant ones in the market: polyethylene and polypropylene.

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 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 transition from a short monomer building block to a long polymeric chain,
- describe the behavior of polymeric molecules,
- list the key properties of main synthetic polymer types,
- describe the main features of polyethylene,
- describe the main features of polypropylene.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

More info

This module is available in French.

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.

Reference: GCA/GCA4-E Only available as an In-House course.

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

This course is also available in French: GCA/GCA4. Please contact us for more information.

Practice of PRO-II/Provision or HYSYS Simulation Software

Level: FOUNDATION

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

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

2 days

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: GCA/PRO2-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Processes

Separation Processes

Refining Processes

Petrochemical & Chemical Processes

Distillation Column Design

Level: PROFICIENCY

Purpose

To provide a comprehensive knowledge of the design methods of an industrial distillation tower.

Audience

Process engineers.

Learning Objectives

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

- know the operation of refining separation processes based on L/V equilibrium: distillation, absorption, stripping, azeotropic and extractive distillations, columns with side draw off,
- know the short cut methods and how to get all the necessary information for final design,
- be able to design an industrial classical distillation tower,
- know the operating variables and control systems used for industrial distillation columns and to be able to choose the relevant process control scheme.

Ways & Means

- Lectures with a lot of practical exercises related to industrial situations and case studies (by simulation).
- Specific and detailed documentation.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

4 days

REMINDER ABOUT SEPARATION PROCESSES USED IN THE PETROLEUM INDUSTRY — *0.5 d*

Processes based on liquid-vapor equilibria, liquid-liquid equilibria, adsorption selectivity, liquid-solid equilibria, permeability.

STEPS INVOLVED IN THE DESIGN OF A CLASSICAL DISTILLATION COLUMN — *1 d*

Study basis: feed characteristics, pseudo-components, products specifications), other constraints, key components, estimated material balance. Operating pressure: selection, profile, control.
Heat balance: condenser and reboiler duties, industrial configurations.
Separating power: number of theoretical trays, liquid and vapor traffics, feed inlet location.
Basics for economic optimization.

SHORT CUT METHODS FOR HYDROCARBON SEPARATION — *0.5 d*

Total reflux (Fenske method). Minimum reflux (Maxwell and Underwood methods). General correlation of Gilliland-Maxwell.
Practical application to the predesign of simple refinery towers.

OPERATING PARAMETERS OF AN INDUSTRIAL DISTILLATION COLUMN — *0.25 d*

Material balance, separation quality, graphical representation.
Pressure.
Heat balance.
Flow rates.
Concentration and temperature profiles.

SEPARATING POWER OF AN INDUSTRIAL DISTILLATION COLUMN — *0.5 d*

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 — *0.25 d*

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 — *1 d*

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: PSE/DESIGN-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	19 May	22 May	€3,000

Advanced Certificate

Distillation Certification - Optimization & Troubleshooting

Practical Simulator Training (CORYS IndissPlus simulator)

CERTIFICATION

Level: ADVANCED

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.

Learning Assessment

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

Prerequisites

To have a basic knowledge of liquid-vapor equilibria and the main principles of operation of distillation columns.

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.

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.
Heat balance. Reflux and reboiling ratio and selectivity assessment.
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: PSE/DSS-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	22 June	26 June	€3,450

Operation of a Binary Distillation Column - Level 1

Practical Simulator Training (CORYS IndissPlus simulator)

Level: PROFICIENCY

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.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

4 days

BASICS OF DISTILLATION *0.75 d*

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 *0.75 d*

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 *2.5 d*

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: PSE/ICD-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: PSE/ICD. Please contact us for more information.

Operation of a Binary Distillation Column - Level 2

Practical Simulator Training (CORYS IndissPlus simulator)

Level: PROFICIENCY

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.

Learning Assessment

Quiz.

Prerequisites

It is recommended that participants first follow the course "Operation of a Binary Distillation Column - Level 1" in order to benefit fully from this program.

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: PSE/CCDSS-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: PSE/CCDSS. Please contact us for more information.

Operation of a Multiple-Draw Distillation Column

Practical Simulator Training (CORYS IndissPlus simulator)

Level: PROFICIENCY

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.

Learning Assessment

Quiz.

Prerequisites

Participating to the course in "Operation of a Binary Distillation Column - Level 2" is recommended.

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 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 pumparounds, and partial condensation, overflash.
Overhead condensation: and various control systems.
Liquid and Vapor traffics, 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 pumparounds: 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 pumparounds 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.

Reference: PSE/DSMSS-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: PSE/DSMSS. Please contact us for more information.

Column Internals

Level: ADVANCED

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.

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.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

2 days

TECHNOLOGY & FUNCTIONING OF TRAYS — *1 d*

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 — *0.75 d*

Random packing, structured packing, grids.
Technology of a packed bed in operation.
Operating range and pressure drop.
Recent evolution of packing.
Liquid or vapor distributors, collectors and redistributors.
Impact on the working and performance 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 — *0.25 d*

Advantages and drawbacks of trays and packed beds, costs.
Respective technical performances: capacity, pressure drops, flexibility, implementation.
Detection of disturbances in the field and data analysis.
Potential solutions and efficiency.
Gammametry: method and examples of diagrams.
Example:
Revamping an existing column.
Case study of disturbed equipment, diagnosis and remedy.

Reference: PSE/INCOL-E Only available as an In-House course.

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

This course is also available in French: PSE/INCOL. Please contact us for more information.

Catalysts in Refining Processes

Level: ADVANCED

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.

Learning Objectives

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

- grasp the role and the basic mechanism of a catalyst,
- 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.
- Possible intervention by an expert from IFP Energies nouvelles.

Learning Assessment

Quiz.

Prerequisites

It is recommended that participants be familiar with the contents of the “Refining Processes and Petroleum Products” course (refer to the corresponding training session) in order to benefit fully from this 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.

Course Content

5 days

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*

The following items are covered for each refining unit: process and chemical reaction characteristics, selection and developments of catalytic formula, catalyst implementation, process flow diagram; process performances and catalyst monitoring. The specific features for the corresponding type of catalyst are emphasized.

Catalytic reforming catalysts:
- Precautions for start-up, monitoring and maintaining catalyst activity, incidents. Regeneration steps.
- Catalytic formulas for the regenerative process.
- Solution for benzene removal.

Isomerization catalysts:
- Different types of catalysts and process arrangement. Impact on the resulting octane number.
- Influence of poisons; operational constraints linked to the type of catalyst.

Catalytic cracking catalysts:
- Zeolite structure and design for yield optimization.
- Analysis of catalyst ageing.
- Improvements of LCO and propylene yields.
- Improvements in catalyst regeneration. Metal passivation and solutions for vanadium effects.
- Additives for emission reduction; adaptation for residue treatment.

C_3/C_4 Alkylation catalysts:
- Mechanisms of liquid homogeneous HF and H_2SO_4 catalysis.
- Process performance and particular constraints.

Hydrotreatment and hydrocracking catalysts:
- Active phase structure, sulfiding at start-up.
- Specific issues in treating unsaturated cuts from coker, visbreaker and FCC.
- Evolution of catalytic formulas and processes for heavy cuts and residue hydrotreatment.
- Selective hydrotreatment of FCC gasolines minimizing octane loss.
- Adaptation of catalytic formulas for heavy feedstock hydrocracking.

Catalysts for Claus converter and tail gas treatment:
- Claus catalysts. Impact of sulfur deposition and temperature on conversion.
- COS and CS_2 hydrolysis. Deactivation and regeneration.
- Adaptation to tail gas treatment processes.

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 AND PILOT FACILITIES OF IFP ENERGIES NOUVELLES *0.25 d*

Different stages of testing at micro-pilot, pilot and semi-industrial scale.

Reference: RAF/CATAL-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Lyon	16 November	20 November	€3,100

Light Cuts Processing

Level: FOUNDATION

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

No prerequisites for this 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.

Course Content

5 days

PETROLEUM PRODUCTS — *0.25 d*

Origin and characteristics of naphtha cuts.
Octane properties and hydrocarbon (HC) families. Quality requirements.
Gasoil and Diesel oil: cetane, cold flow and other properties.

CATALYTIC REFORMING — *1.25 d*

Refinery octane pool: processes for octane improvement-gasoline sources.
Process basics: thermodynamics and kinetics of chemical reactions. Hydrogen production.
Role and types of catalysts - Activation, ageing, poisoning.
Industrial units: process flow scheme of SR and CCR, operating conditions, performances.
Operating variables (WABT, WHSV, H_2/HC ratio, recycle gas composition, pressure).
Management of hydrogen production, impact of feed properties and operating conditions.
Shutdown, regeneration and startup.
Catalyst regeneration steps and control.

ISOMERIZATION OF LIGHT GASOLINES — *0.5 d*

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.

HYDROREFINING PROCESSES — *2 d*

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, H_2/HC ratio, PPH_2, etc.).
Catalyst loading map; cycle length optimization.
Main refining applications and specific operating features, example of gasolines and middle distillates desulfurization.

SWEETENING OF LIGHT CUTS — *0.25 d*

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.

SULFUR RECOVERY — *0.75 d*

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.

Reference: RAF/REF1 Only available as an In-House course.

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

Heavy Cuts Processing

Level: FOUNDATION

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

No prerequisites for this 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.

Course Content

5 days

OVERVIEW OF CONVERSION PROCESSES *0.25 d*

Origins and characteristics of conversion unit feeds.
Different types of conversion processes (principles, performance, operating ranges, economics): thermal cracking processes, catalytic cracking without hydrogen, catalytic cracking with hydrogen.

THERMAL CONVERSION PROCESSES *1.5 d*

Visbreaking and effects on quantity and stability of heavy fuel oils.
Delayed coking: process characteristics, process flow diagram, purification of the cracked products with hydrogen and end destination.
Management of coke drum switch and main steps of the decoking procedure, coke handling.
Flexicoking and fluid coker: principle, integration in the refinery and power.

CATALYTIC CRACKING *1.25 d*

Main fluid catalytic cracking processes.
Catcracking feed characteristics.
Mechanisms of catalytic cracking reactions and mode of action of FCC catalysts.
Yields and characteristics of FCC effluents with overview of purification treatments: propylene recovery, alkylation, ETBE and gasoline pool, LCO hydrotreatment.
Analysis of FCC operating balances.
Summary of operating parameters in the reaction section and in the regenerator.
FCC alternates to treat residues (R2R, HOC, etc.).
Maximization of C_3 and C_4 olefins, gasoline or cracked gasoil (LCO) production.
Presentation of different process schemes.

DISTILLATE HYDROCRACKING *1.25 d*

Different reactions of the hydrocracking process.
Catalysts: hydrotreating and hydrocracking; poisons and regeneration.
Hydrocracking processes: different types, process flow diagram, operating conditions.
Analysis of hydrocracking operating: parameters, hydrogen balance, sulfur balance.
Associated unit: hydrogen production, sulfur recovery.
Product yields and quality utilizations.

RESIDUE PROCESSING *0.5 d*

Overview of existing processes to upgrade vacuum residues: hydrotreatment, hydroconversion.
Associated units.
Refinery configurations with deasphalting unit.

LUBE BASE STOCKS MANUFACTURE *0.25 d*

Classification and required properties of base oils.
Main lube base stocks manufacturing schemes: vacuum distillation unit, deasphalting, extraction, dewaxing, hydrofinishing.

Reference: RAF/REF2 Only available as an In-House course.

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

Hydrotreatment Processes

Level: PROFICIENCY

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 dynamic simulator.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

4 days

OBJECTIVES OF HYDROTREATMENT PROCESSES *0.5 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 *1 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, PPH_2, recycle rate, 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 *1 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.
Hydroisomerization of the C_4 cut out of the FCC to feed alkylation unit.
Hydrotreatment of middle distillates: kerosene and gas-oil, LCO processing.
Desulfurization of vacuum gasoil to FCC units.
Residues demetallization processes.
Hydrotreatments in lube oil manufacturing.

Reference: RAF/HDT-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RAF/HDT. Please contact us for more information.

Hydrotreatment Processes

Simulator assisted training

Level: PROFICIENCY

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.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

4 days

STUDY OF INITIAL SIMULATED STEADY CASE *1 d*

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.

OPERATION OF THE UNIT: MAIN OPERATING PARAMETERS & OPTIMIZATION *2.5 d*

Each operating parameter impact on operation is illustrated thanks to simulator handlings.
Reactor temperatures, pressure drop and H_2 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.

TROUBLESHOOTING *1.5 d*

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.

Reference: RAF/HDTS-E Only available as an In-House course.

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

Crude Oil & Vacuum Distillation

Level: PROFICIENCY

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 dynamic simulator for crude oil distillation unit operation issues.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

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

IMPACT OF CRUDE OIL QUALITY ON PRODUCTS — *0.5 d*

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.

OPERATING CONDITIONS OF AN ATMOSPHERIC & VACUUM DISTILLATION UNITS — *2 d*

Material balance: cut points, product characteristics, separation quality, fractionation capability.
Top condensation and pressure in the column - Partial pressures.
Feed vaporization: inlet temperature, overflash.
Product side stripping.
Heat balance of the column - Pumparounds and heat integration.
Modern internals for crude oil distillation column.

DESALTING & CORROSION CONTROL — *0.5 d*

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.

SAFETY & ENVIRONMENTAL CONCERNS — *0.5 d*

Process risks: H_2S, inflammability, auto-inflammation.
Risks related to main equipment: furnace, pumps, vacuum system.
Heat recovery optimization and energy consumption.
Efficient and low energy consumption vacuum equipment (steam ejector vs. liquid ring pump).

PROCESS CONTROL, OPERATION & TROUBLESHOOTING OF MULTI-DRAW-OFF COLUMNS — *1 d*

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 the atmospheric column.
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.

DISTURBANCES & TROUBLESHOOTING — *0.5 d*

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.

Reference: RAF/DADSV-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RAF/DADSV. Please contact us for more information.

Catalytic Reforming for Refining & Petrochemicals

Level: PROFICIENCY

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.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

5 days

THE CATALYTIC REFORMER WITHIN THE REFINERY SCHEME *0.5 d*

Quality specifications of gasolines; reformulated gasoline and future trends.
Octane improving processes, integration within the refining processes.
Needs in hydrogen. Aromatic complex overview, need for benzene, toluene and xylenes.

CATALYTIC REFORMING REACTIONS & CATALYSTS *1 d*

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 promotors 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 *1 d*

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, H_2/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.
Analyzers and process control.

OPERATION & OPTIMIZATION FOR CATALYTIC REFORMING *1 d*

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 *0.5 d*

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 *1 d*

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

Reference: RAF/CAREF-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RAF/REFCAT. Please contact us for more information.

Light Gasoline Isomerization

Level: PROFICIENCY

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.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

2 days

THE ISOMERIZATION PROCESS IN THE REFINERY OCTANE POOL *0.75 d*

Quality specifications of gasolines, reformulated gasoline and future trends.
Role of isomerate in the octane pool.
Comparison of different types of isomerization processes and performances, integration within the refining processes.
Feedstock and product properties, minimum benzene schemes.

ISOMERIZATION CHEMICAL REACTIONS & CATALYSTS *0.25 d*

Review of the characteristics of the chemical reactions. Thermodynamics and kinetics considerations for optimization of the yield.
Characteristics of the different generations of catalysts. Contaminants and poisons, consequences on the process arrangement. Operating precautions.

OPERATING PARAMETERS *0.25 d*

Process flow and parameters of an isomerization unit, for the three main categories of catalysts.
Material balance.
Operating variables: temperature and temperature profile, difference of temperature, H_2/HC ratio, flow rates, feed and make-up gas characteristics, recycle flow rates.

OPERATION & TROUBLESHOOTING *0.75 d*

Unit operation: influence of operating variables on performance catalyst activity monitoring.
Operation of the separation sections (deisohexanizer, molecular sieves, etc.) and monitoring of the recycle of the paraffins with low octane number.
Optimization criteria. Maximizing the performances of the unit under limit conditions.
Case studies - Disturbances: diagnosis, causes and remedies (RON decrease, moisture in the feed, high benzene in the feed, sulfur peak, chlorine peak, recycle or separation issues).
Reactor temperature run-off.
Main steps of start-up and shutdown.

Reference: RAF/ISOM-E Only available as an In-House course.

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

This course is also available in French: RAF/ISOM. Please contact us for more information.

Fluid Catalytic Cracking Operation

Optimization & Troubleshooting

Level: PROFICIENCY

Purpose

This course provides a comprehensive understanding of operating, monitoring and optimizing the catalytic section of the FCC process.

Audience

Engineers and technical staff interested or involved in the design or the operation of an FCC unit.

Learning Objectives

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

- understand the exact role and process of an FCC unit,
- analyze the importance and impact of operating parameters on product quality,
- know about main potential incidents, their origin, consequences on safety, health and the environment,
- apply the most common preventive measures.

Ways & Means

Applications, case studies based on typical industrial situations.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

5 days

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; ΔP 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 C_3 & C_4 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 pumparound, etc.
Main interlock configurations.

Reference: RAF/FCCSS-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RAF/FCC. Please contact us for more information.

Alkylation (HF or H_2SO_4)

Level: PROFICIENCY

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

Applications, case studies based on typical industrial situations.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

4 days

ALKYLATION PRINCIPLES *0.5 d*

Octane manufacturing in the refining process scheme and C_7/C_8 alkylate cuts.
Alkylate characteristics and constraints imposed on the production of gasoline.
Various types of alkylation processes and related simplified process flow diagrams.
Principle features of processes with solid catalyst.

FEED & PRODUCTS *0.5 d*

Origins of the feed: C_3 and C_4 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 alkylate: RON, MON, RVP, final point, etc.

CHEMICAL REACTIONS & CATALYSTS *0.5 d*

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 (H_2SO_4); respective properties and safety.
Impact, performances and consumption of the liquid acid used.

OPERATING PARAMETERS OF THE REACTION SECTION *1 d*

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.

OPERATING PARAMETERS OF SEPARATION SECTION *0.5 d*

Separation of the isobutane recycle, influence of the nC_4 and C_3 content.
Separation of the entering nC_4.
Role and benefit of a depropanizer for the mass balance.

OPERATION OF THE NEUTRALIZING SECTION *0.5 d*

Neutralization with caustic solid or liquid (HF).
Neutralization with acid then caustic: principles, operation and monitoring (H_2SO_4).

OPERATION & TROUBLESHOOTING *0.5 d*

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 (H_2SO_4).
Upsets: compressor failure, mechanical failure.

Reference: RAF/ALKY-E Only available as an In-House course.

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

This course is also available in French: RAF/ALKY. Please contact us for more information.

Hydrocracking

Level: PROFICIENCY

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

Applications, case studies based on typical industrial situations.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

4 days

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 *0.75 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 *2 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: RAF/HCK-E Only available as an In-House course.

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

This course is also available in French: RAF/HCK. Please contact us for more information.

Hydrogen Production Unit

Steam Reforming

Level: PROFICIENCY

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 SMR unit 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

Applications, case studies based on typical industrial situations.

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

3 days

PURPOSE OF STEAM REFORMING *0.25 d*

Hydrogen in the oil industry: resources and consumption.
Main hydrogen manufacturing processes.
Objective of the successive steps: desulfurization, steam reforming, CO shift, hydrogen purification.

ANALYSIS OF SMR OPERATING CONDITIONS *1.5 d*

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, CO_2 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 *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 & TROUBLESHOOTING *0.25 d*

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: RAF/HMP-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RAF/VAPOREF. Please contact us for more information.

H_2S Removal & Sulfur Recovery Processes

Application on CORYS IndissPlus simulator

Level: PROFICIENCY

Purpose

This course provides a deeper understanding of the operation and the monitoring, including HSE considerations, of common processes for elimination of H_2S 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 H_2S conversion train and their impact on NO_x and SO_x 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.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Skilled chemical engineer.

Course Content

3 days

OVERVIEW OF SULFUR REMOVAL & RECOVERY — *0.25 d*

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.

AMINE UNITS — *0.75 d*

Chemical reaction between amines and H_2S.
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).

SULFUR RECOVERY UNITS — *1 d*

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: H_2S/SO_2 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, H_2S degassing from sulfur product, safety.
Shutdown situations and consequences, safety issues, ISS.
Use of a dynamic simulator to illustrate the impact of parameter changes.

TAIL GAS CLEAN-UP PROCESSES — *0.75 d*

Process flow schemes: sub-dewpoint Claus or amine route.
Operating parameters and impact on process and sulfur yields.
Influence of the H_2S/SO_2 ratio.
Sources of usual operation troubles for each process: improper regeneration, catalyst ageing…
Impact on the CLAUS unit optimization.

SOUR WATER STRIPPER OFF-GAS TREATMENT — *0.25 d*

Sour water characteristics. Ammonia content. Ammonia conversion and NO_x monitoring.
Principle, main equipment, operating parameters, water quality follow-up.

Reference: RAF/PFCS-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RAF/PFCS. Please contact us for more information.

Visbreaking

Level: PROFICIENCY

Purpose

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

Audience

Operators, control panel operators, supervisors and personnel from refineries, research centres 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

No prerequisites for this 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.

Course Content

3 days

VISBREAKING PROCESS & FEEDSTOCKS *0.5 d*

Role of the conversion processes of the heavy residues fraction: visbreaking, thermal cracking.
Fractionation of the cracked effluents and integration of visbreaking in the refinery scheme.
Origins and physical properties of the feeds.
Routine quality control tests and impurity concentrations (sulfur, nitrogen, metals).
Structure of residues: asphaltenes, maltenes and resins.

THERMAL CRACKING REACTIONS *0.25 d*

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.

PRODUCTS OF THE VISBREAKING UNIT *0.5 d*

Stability of the visbroken residues. Problem of asphaltenes floculation. Practical tests for assessing stability. Changes in stability during thermal cracking. Influence of the diluents used to adjust the viscosity. Compatibility of fuel bases.
Main characteristics and yields of other products. Problems raised for subsequent treatments.
Applications: changes in stability of a residue under the effect of diluents; limits of fuels compatibility.

ANALYSIS OF THE WORKING CONDITIONS OF A VISBREAKING UNIT *0.75 d*

Process flow diagram, operating conditions, main controls.
Material balance, yields, energy consumption.
Process performance analysis: conversion, viscosity reduction, diluent saving, reduction of fuel pool, upgrading value provided by visbreaking.
Cracking conditions. Temperature profile in furnace and residence time.
Role and effect of injecting steam or naphtha, pressure and pressure drop.
Fractionating the products.
Monitoring the fouling of the equipment.
Application: study of a recorded case of a visbreaker in operation.

OPERATION OF THE UNIT *0.5 d*

Operating variables. Influence on the severity of the thermal treatment.
Effects on the yields and the product quality.
Operating the visbreaker furnace. Coke deposition mechanism. Main parameters having an influence on its formation. Precautions to be taken. Effects of coking on the furnace and monitoring the skin temperature of the tubes.
Adjusting the severity.

INCIDENTS & TROUBLESHOOTING *0.5 d*

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.

Reference: RAF/VISCO-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RAF/VISCO. Please contact us for more information.

Cokefaction

Level: PROFICIENCY

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

No prerequisites for this 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.

Course Content

3 days

ROLE OF THE COKER COMPLEX IN THE REFINERY *0.5 d*

Heavy cuts in the refinery: origins, nature, characteristics and composition.
Basic features of coker units compared to other conversion processes.
Delayed coker and differences with other coking processes: flexicoker and fluidcoker.

CHEMICAL ASPECTS OF CRACKING *0.25 d*

Characteristics of primary and secondary cracking, reactions of different hydrocarbons.
Parameters influencing the severity of cracking: temperature, residence time, pressure, feed quality, etc.

ANALYSIS OF INDUSTRIAL OPERATING CONDITIONS *0.5 d*

Process flow diagram and example of a delayed coker unit with operating conditions and control setup.
Impact of operating parameters on products and on coke production.

OPERATION OF THE DELAYED COKER DRUMS *0.75 d*

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.
Parameters having an impact on the duration of each step and time saving details.
Monitoring of the block valves.
Cutting equipment: technology and operation.
Safety related issues.

PRODUCTS & RELATED TREATMENTS *0.5 d*

Fractionation operation and switch management.
Gas plant and light ends separation.
Naphtha and gasoil fractionation. Hydrotreatment, hydrogen management.
Different types of coke, characteristics, handling and storage.
Water handling, treatment and recycle.

INCIDENTS, TROUBLESHOOTING & SOLUTIONS *0.5 d*

Main incidents: foamover causes and consequences, longer cycles, coking phenomena outside the drums, misoperation of one block valve.
Consequences and classic solutions for these incidents.

Reference: RAF/COKER Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Extra Heavy Crude Oil Upgrading

Level: PROFICIENCY

Purpose

This course provides a broad technical information on heavy crude upgrading and conversion processes.

Audience

Engineers and staff from upstream and downstream sectors interested or involved in heavy crude upgrading projects or in conversion processes.

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.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

5 days

CRUDE OIL PROPERTIES *0.5 d*

Main physical and chemical properties and standard tests of crude oils.
Extra heavy crude properties in contrast to classical crude oils.

UPGRADER PRINCIPLES & OBJECTIVES *0.5 d*

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.

ATMOSPHERIC & VACUUM DISTILLATION *0.75 d*

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.
Crude oil desalting unit: purpose, operating conditions, specific solutions to process heavy crude oils. Corrosion and corrosion prevention in atmospheric and vacuum distillation units.

THERMAL CONVERSION UNITS: VISBREAKING & DELAYED COKING *1 d*

Heavy cuts thermal conversion processes.
Visbreaking: feed and products, product properties, process flow diagram, operating conditions; specific equipment: furnace, soaker, separation section, stability of heavy cracked fuel oils.
Delayed coking:
General description of coking processes: chemical reactions, process performances.
Delayed coking process description: feed and products, material balance, product properties; process flow diagram, operating conditions; technology of furnace and coke drums; coke types and users; operation of a delayed coking unit: coking cycle, decoking cycle and switch management, coke handling.
Others coking processes: fluid coking, flexicoking.
Integration of flexicoking units in upgrading schemes of heavy crudes.

UPGRADER HYDROTREATMENTS TO PROCESS NAPHTHA & DISTILLATE *0.5 d*

Origin of feeds and related characteristics.
Hydrotreatment chemical reactions and hydrogen consumption.
Hydrotreatment catalysts: composition, role and mode of action.
Hydrotreatment processes: process flow diagram, operating conditions, products characteristics.

UPGRADER HYDROCRACKER (HCK) OR MILD HYDROCRACKER (MHC) *0.5 d*

Main methods of cracking heavy cuts: thermal, catalytic and hydrocracking processes.
Specific hydrocracking chemical reactions: exothermicity, hydrogen consumption.
Hydrocracking catalysts: composition, main properties and poisons.
Mild hydrocracker (MHC) unit: process flow diagram, feed and products, material balance.

HYDROGEN MANUFACTURING PLANTS *0.5 d*

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.
Steam reforming furnace and steam production. CO conversion (operating conditions, catalyst). Hydrogen purification (principle of a PSA unit, flow diagram and performances).
Gasification processes (POX, partial oxidation).
Feeds: heavy cuts, residues…
Gasification process principle, material balance, simplified process flow sheet and operating conditions. Soot trapping and ash management. Gas washing and purification, CO conversion.

H_2S REMOVAL & SULFUR RECOVERY PROCESS *0.25 d*

Overview of sulfur removal and recovery.
Amine units: process flow scheme and operating conditions, safety issues.
Sulfur recovery units: process principle, chemical reactions, thermal stage, catalytic stages, sulfur recovery, tail gas incineration; process scheme, operating conditions, sulfur yield.
Tail gas treatment: Sulfreen, Clauspol, SCOT; principles and operating conditions.

OTHER CONVERSION PROCESSES *0.5 d*

Deasphalting units: vacuum residues structure and properties; deasphalting principles: different deasphalting solvents, overall flow sheet, operating conditions; integration of deasphating units in conversion schemes.
Residue hydroconversion processes: examples of feed properties. Metals in catalytic hydroconversion processes, fixed bed technologies; ebullated bed technologies.

Reference: RPC/UPGRADE Only available as an In-House course.

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

Advanced Certificate

Base Chemicals & Polymers Manufacturing*

CERTIFICATION

Level: ADVANCED

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

No prerequisites for this course.

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:
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.
Life cycle analysis of products.

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

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	**2 March**	**26 June**	**€21,630**

Production of Paraxylene - Aromatic Loops

Level: PROFICIENCY

Purpose

This course provides a thorough technical understanding of aromatics production and paraxylene recovery.

Audience

Engineers, senior operations personnel or technical supervisory staff interested or involved in the operation, optimization and monitoring of aromatics production units. Engineers from research centers and engineering companies involved in the design 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 for achieving the targeted yield in benzene, toluene and paraxylene,
- detect potential deficiencies by troubleshooting in order to solve it easily.

Ways & Means

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

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior lecturer, expert in the manufacturing of petrochemical intermediates.

Course Content

5 days

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*

Technologies: semi-regenerative and regenerative (CCR).
Feedstocks - Yield - Severity - Products.
Operating parameters - Process flow diagram of a continuous catalytic reforming unit - Main equipment.
Reactions and catalyst - Chemical reactions: thermodynamics and kinetics.
Catalyst properties: role of the acidic and metallic functions.
Catalyst composition and selectivity, poisons and ageing factors. Catalyst regeneration.
Reformate splitter: Different schemes and purposes - C_8 cut composition ex reformate.

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.

C_8 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*

Standard pyrolysis gasoline composition.
Treatment process schemes - Aromatics upgrading. Available technologies.

Reference: PCH/ARO-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	7 September	11 September	€3,240

Cracking & Chemical Treatments of Purification

Level: PROFICIENCY

Purpose

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

Audience

Operating personnel in steamcracking plants: experienced outside operators, panel operators, foremen and all technicians involved in the working 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 steamcracking complex, 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

- Case studies done in groups based on typical running situations presented in the course.
- Possible intervention of operators experienced in the daily operation of the plant.

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

5 days

BLOCK DIAGRAM OF THE STEAMCRACKER UNIT *0.25 d*

Roles of the various sections.
Feedstock origins, products types, yields.

MAIN PETROCHEMICAL INTERMEDIATES *0.25 d*

Definition of hydrocarbon families. Feedstock composition.
Potential outlets and main industrial uses of olefinic, diolefinic and aromatics hydrocarbons.

CHEMICAL REACTIONS & CATALYSIS *1 d*

Chemical reactions, chemical reaction uses for the mass balance production.
Studies of the thermodynamic conditions to make the chemical reaction feasible.
Chemical reactions limited by the chemical balance, rules to outline the shift in the chemical balance.
Speed of chemical reactions. Effect of a catalyst, catalyst behavior. Poisons and inhibitors.
Nota: these basic elements have been provided throughout the course as they enhance the understanding of the different topics.

STEAMCRACKING *1 d*

Onsite unit description; operating conditions of the different sections, product yields.
Analysis of technical characteristics of desired transformations.
Elements of pyrolysis monitoring: definitions of the severity and the selectivity.
Influence of the operating parameters/pressure, temperature, flowrate, steam dilution ratio on the unit performances.
Impact of the feedstock origin on product yields.
Regulation and advanced process control.

CRACKED GASES PURIFICATION *0.25 d*

Main washing systems for cracked gases: choice of systems implemented.
Amine washing system: absorption and regeneration.
Caustic soda washing system and treatment of waste caustic sodas.
The sequence of washing stages.
Influence of the operating parameters on the washing quality.

DRYING OF CRACKED GASES *0.25 d*

Adsorption-desorption balance.
Operation of cracked gases dryers during the drying and regeneration steps, drying optimization (temperature/run relationship).

TREATMENTS WITH HYDROGEN *1.5 d*

Role and purpose of the different hydrogenation processes, chemical reaction characteristics, main types of catalysts implemented.
Purification of hydrogen by methanation.
Studies of selective hydrogenation units for C_2, C_3 and C_4 cuts and hydrotreatment units for pyrolysis gasolines: analysis of the operating conditions of the unit, operating parameters of the plant, case studies for unit adjustment, main incidents.

DISTURBANCES - INCIDENTS *0.5 d*

Incidents on the furnace: loss of feed flowrate, high temperature on one or more paths - Loss of heat - Loss of water hardening…
Incidents on gas washing towers: loss of topping up of washing base, abnormal temperature of the base, loss of water washing at outlet of the tower.
Incidents on dryers: insufficient regeneration, humid gas at outlet.
Incidents on selective hydrogenations: management of feedstock inhibitors, changes of hydrogen quality, loss of activity and/or selectivity.
Nota: this part is delivered through case studies and analysis of feedback of on-site incidents.

Reference: PCH/RCIVAPO-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: PCH/RCIVAPO. Please contact us for more information.

Selective Hydrogenation of the Steamcracker

Level: PROFICIENCY

Purpose

To improve the knowledge of the selective hydrogenation processes of C_2, C_3, C_4 cuts and pyrolysis gasolines for better control of their operation.

Audience

Operating personnel of the steam cracker manufacturing units: experienced operators, panel operators, chief operators and all technicians concerned with 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

- Case studies handled in groups, based on typical situations of conduct of the sections studied.
- Possible intervention of an operator reporting his industrial experience of the operation on a daily basis.

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

3 days

SELECTIVE HYDROGENATION OF THE C_2 CUT — *1.25 d*

Origin, characteristics and valuation of the C_2 cut: origin and state of availability of the cut, average composition, specifications of ethylene produced.
Demonstration of the impurity to be removed. Choice of the implementation of the treatment in relation to the nature of the impurity.
Situation and operating principle of the selective hydrogenation section within the steam cracker: arrangement of the reactors, characteristics of the reactions involved in the process, induced stresses.
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: detailed diagram of the installation (regulations implemented, standard operating conditions, available analyzers) - Conduct parameters (composition of the feedstock and hydrogen-rich gas, associated flow rates, CO content, molar ratio H_2/C_2H_2, pressure, start-up temperature and Δt of the reactor...) - Performance monitoring (conversion rate, ethylene gain) - Analysis of the control views of the digital operation and related modules.
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 attached procedures.

SELECTIVE HYDROGENATION OF THE C_3 CUT — *0.5 d*

Origin, characteristics and valuation of the cut C_3: origin and state of availability of the cut, average composition, specifications of the propylene produced.
Demonstration of the impurities to be removed. Choice 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 C_2 section and that of the C_3 section: positioning of the section, reactions involved, catalyst.
Diagram of the installation, 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 C_4 CUT — *0.5 d*

Origin, characteristics and valuation of the cut C_4: origin and state of availability of the cut, average composition, specifications of the butadiene 1-3 produced.
Demonstration of the impurities to be removed, associated constraints - General diagram of the installation.
The main differences between the selective hydrogenation of the C_4 cut and those of the C_2 and C_3 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 C_5^+ cut: provenance and state of availability of the cut, average composition.
Demonstration of the impurities to be eliminated, associated constraints - General diagram of the installation.
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 security and associated procedures.
Hydrogenation 2nd stage.
Role of section.
Types of catalysts.
Operating conditions and performance.

Reference: PCH/HYDVAPO-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Extractive Distillation

Level: PROFICIENCY

Purpose

This course provides a deeper technical understanding of an extractive distillation column and its principle.

Audience

Anyone involved in the operation of extractive distillation columns (engineers, shift leaders, panel operators, field operators).

Learning Objectives

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

- know about the action of the solvent,
- explain the significance of operating parameters,
- analyze the effect of each parameter acting on the operation of the column and on the qualities of products,
- counteract the most frequent incidents.

Ways & Means

- Implementation of static simulation results with C_4/ACN and C_6/NMP treatment.
- Working groups to study operating situations that could arise.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

3 days

SOLVENT EFFECT ON LIQUID-VAPOR EQUILIBRIA *0.75 d*

Typical composition of cuts to be treated: C_4 and C_6 cuts of a steamcracker or other units.
Natural volatility of compounds and focus on impurities to be removed, highlighting constraints and treatments available.
Action of the solvent and effects on relative volatilities of compounds for separation.
Effects of pressure, solvent ratio and feed composition.

BEHAVIOR OF AN EXTRACTIVE DISTILLATION COLUMN *0.75 d*

Feed composition. Qualities required.
Mass balance, product recovery ratio, losses of solvent.
Analysis of operating parameters: pressure and its control system, solvent ratio, solvent temperature, thermal balance and liquid-vapor traffics.
Concentration profile: HC and solvent, behaviors in extractive and non-extractive zones.
Meaning of temperatures and of its profile.

DOWNSTREAM TREATMENT *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 tuned parameters.
Modification impact of: solvent ratio, reboiler ratio, solvent temperature and other parameters depending on the process configuration.

UPSETS & INCIDENTS *0.5 d*

Solvent: decrease in flowrate, temperature modification, regeneration trouble and loss of recycling.
Feed: unexpected change in flowrate or composition.

Reference: PSE/DISTEXT-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: PSE/DISTEXT. Please contact us for more information.

C4 Cut: Valorization Routes

Level: FOUNDATION

Purpose

This course provides a better understanding of the different routes to upgrade a raw C_4 cut coming out a steamcracker.

Audience

Anyone involved in C_4 cut treatment from operating staff to traders.

Learning Objectives

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

- quote the differences among the hydrocarbon of the C_4 cut,
- list the economic interests,
- precise the role of the separation and transformation processes implemented in the C_4 cut treatment.

Ways & Means

Notions illustrated thanks to some pictures.

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

2 days

ORIGIN & ECONOMICS OF THE C_4 CUT — *0.25 d*

Simplified scheme of C_4 cut production.
Standard composition of the C_4 cut: hydrocarbon nature, typical concentration depending on the severity of the source process.
Main uses of the C_4 hydrocarbons.

UPGRADING SCHEMES — *0.25 d*

Several options.
How to select the right one.

1,3-BUTADIENE RECOVERY — *1 d*

Comparison of standard distillation conditions and extractive distillation.
Constraints of an extractive distillation process. Solutions available to tackle the issues.
Case based on a pre-feed hydrogenation treatment of the extractive distillation.
Principle of the implementation of the selective hydrogenation and limitation of the treatment - Consequences.
Configurations available: extractive distillation in 1 step or in 2 steps.
1-3 butadiene on specification - Superfractionation.

RAFFINATE-1 TREATMENT - UPGRADING OF ISOBUTENE — *0.25 d*

Several options- How to select the right one.
MTBE or ETBE production scheme. Process characteristics.

RAFFINATE-2 TREATMENT - UPGRADING OF BUTENES — *0.25 d*

Several options - How to select the right one.
1-butene and 2-butenes production schemes.

Reference: PCH/C4CUT-E Only available as an In-House course.

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

Ether Production MTBE or ETBE

Level: PROFICIENCY

Purpose

This course provides a comprehensive understanding of the operating, monitoring and optimizing of an ether production unit.

Audience

Shift leaders and technical staff involved in this process.

Learning Objectives

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

- explain the chemical reactions and the catalyst operating constraints,
- justify the effect of various control parameters,
- improve the efficiency of ether production units.

Ways & Means

- Experience sharing.
- Applications, case studies based on your own typical industrial situations.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this 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.

Course Content

2 days

ETHER END USE *0.25 d*

MTBE or ETBE addition to provide unleaded gasolines. Octane number and other physicochemical properties.
Specification of oxygenated compounds in gasoline.
Other uses of MTBE or ETBE. Comparison of characteristics of different ethers.

ETHERIFICATION REACTION *0.5 d*

Nature of reactants and products.
Main characteristics of the reaction: chemical equilibrium, reaction tendencies, effects of parameters on the conversion rate at equilibrium, impact of isobutene/alcohol ratio.
Rate of reaction constraints.
Catalyst implementation: nature, mechanism, poisoning.

ANALYSIS OF AN INDUSTRIAL ETHER UNIT *0.5 d*

Process flow diagram, control loop schemes.
Nature of feedstocks: isobutene and alcohol (methanol or ethanol) origin. Impurities to be aware of specifications.
Feed preparation.
Reaction section: MTBE or ETBE reactor specificities and associated operating conditions.
Separation section: MTBE or ETBE recovery zone. Distillation step. Implementation of azeotropic distillation.
Separation performance.
C_4 raffinate treatment. Water washing.
Alcohol recovery and recycling: for methanol and ethanol, phenomenon involved in the distillation step. Objectives and constraints of the recycle loop.

OPERATION - DISTURBANCES *0.75 d*

Impact of operating variables: isobutene/alcohol ratio, temperature, recycle rate, pressure, flowrate.
Optimization criteria. Catalytic activity monitoring.
Catalyst handling procedures.
Instrumented safety systems.
Main steps for start-up and shutdown.
Case studies: disturbances, incidents.

Reference: RAF/ETBE-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Commodity Polymers Manufacturing

Level: FOUNDATION

Purpose

This course provides a comprehensive information on polymers and polymerization processes used to produce polyethylenes, polypropylenes, polyvinylchloride and polystyrene.

Audience

Professionals interested in polymers production.

Learning Objectives

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

- explain the principles of polymerization techniques and the main characteristics of manufactured polymers,
- describe the operating conditions of polymerization processes,
- grasp the essence of plastics manufacturing and outlets.

Ways & Means

- Presentation of plastics sample from plants.
- Presentation of end uses application samples.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior-lecturer expert in the process development and the production of polymers at the industrial stage.

Course Content

3 days

POLYMER TYPES & NATURE *0.25 d*

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

POLYMER PRODUCTION - ASSOCIATED PROPERTIES *1 d*

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 *1.75 d*

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: polyethylenes (PE), polypropylenes (PP), polystyrenes (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: RPC/PPLAS-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: RPC/PPLAS. Please contact us for more information.

Polymers Fundamentals

Level: FOUNDATION

Purpose

This course provides a global knowledge of polymers science.

Audience

Professionals interested in polymers properties.

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.

Ways & Means

- Detailed course material.
- Case study on polymer properties.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior-lecturer expert in the process development and the production of polymers at the industrial stage.

Course Content

5 days

POLYMER REACTIONS *1.5 d*

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

POLYMER CHARACTERISTICS - MACROMOLECULAR CHAIN LENGTH & MOLECULAR WEIGHT *0.75 d*

Number average - Weight average.
Measurement systems: Gel Permeation Chromotagraphy (GPC), solution and melt (intrinsic) viscosity - Molecular weight distribution - Polydispersity index.

POLYMER CHARACTERISTICS - POLYMER MORPHOLOGY *1 d*

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 *0.75 d*

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 *1 d*

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.

Reference: PCH/POLYFUND-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Industrial Polymerization

Level: FOUNDATION

Purpose

This course gives to the participants a broader technical understanding of the processes and the products for polymerization industry.

Audience

Graduate engineers and technical supervisory staff involved in polymer production units and R&D development.

Learning Objectives

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

- increase knowledge of the reaction mechanisms involved in polyolefins production,
- get an in-depth review of the technico-economic framework of the polyolefins production units.

Ways & Means

- Detailed course material.
- Pictures/videos of main equipment and samples.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior-lecturer expert in the process development and the production of polymers at the industrial stage.

Course Content

5 days

MAIN CHARACTERISTICS OF PETROCHEMICAL & POLYMER BUSINESS *1 d*

Risk management in the polymer industry.
Upstream of petrochemicals.
Mass balance of the world petrochemical industry.
Pricing mechanisms.

CATALYTIC SYSTEMS USED FOR POLYOLEFINS PRODUCTION *1 d*

Review of the various types of catalytic systems for polyolefins.
Mass and heat transfer in the heterophasic polymerization of polyolefins.
Multigrain model of the growing particles and variations around this model.

POLYMERS & POLYOEFINS *2 d*

Various polymer families: commodities, engineering, high performance polymers.
Polyolefins: HPPE, catalytic PE and PP and their exceptional growth (diversity, adaptability).
Project management in petrochemical industry. Patent strategy. Staging of projects. Order of magnitude of investment cost for polyolefins. Economic analysis.
Polymers and environment. Is their development sustainable? How do they contribute to energy savings? Life cycle analysis. Bio polymers.
Conclusion on methodology of polymer development.
Catalytic polymerization of propylene: Ziegler Natta or Metallocene catalysts.
Various types of polypropylene applications: fibers, injection, BOPP…
Various processes: technology and operating parameters.
Importance of residence time distribution. Heterophasic copolymers. The Spherizone example.
Main industrial problems encountered in polymerization plants, with many examples from polyolefins (specifically polypropylene) plants.
Polymer finishing. Extrusion. Storage. Logistics. Supply chain.
Wrap-up of the four-day lecture.

VISIT OF PETROCHEMICAL SITE (if possible) *1 d*

Reference: PCH/INDPOLY-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Polymer Reaction Engineering

Level: PROFICIENCY

Purpose

This course provides a better understanding of the highlights of polymer reaction engineering.

Audience

Process, project and technology engineers whishing to improve their technical knowledge.

Learning Objectives

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

- have a global knowledge of polymer science (structure, conformation and characterization),
- describe the polymer reaction engineering (product by process, differences with small molecule processes),
- understand the underlying motivations and constraints encountered in developing processes for the productions of commodity polymers,
- describe the different sections after the production of solid particle.

Ways & Means

Applications and case studies organized in small groups, based on typical situations encountered in the normal or abnormal operation of these units.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior-lecturer expert in the process development and the production of polymers at the industrial stage.

Course Content

5 days

POLYMER CHEMISTRY & CHARACTERIZATION *2 d*

Main characteristics of polymerization reaction: reaction enthalpy, polymerization initiation and termination.
Polymer structure - Configuration - Properties relationships.
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.

POLYMER REACTION ENGINEERING *1 d*

Definition of polymer reaction engineering.
Place of the reactor in the whole process.
Chain growth versus step growth polymerization.
Comparison of bulk, solution, suspension, emulsion polymerizations, examples for each one.
Case study: PE gas phase production in fluidized bed reactors: operation and troubleshooting.

POLYMER PRODUCT & SUPPLY CHAIN MANAGEMENT *2 d*

Particulate operations and equipment, characterization of individual particles.
Rheology of powders.
Fluidization, fluidized bed.
Centrifugal operations.
Classifiers, scrubbers, filtration, sedimentation, drying, devolatilization.
Pneumatic conveying, cause of fines generation, electrization.
Twin screw extruders, static mixers, granulation, cyclones, elutriation, mixing silos.
Elutriation, conveyors, cyclones, silos, bag filters.
Examples of industrial applications.

Reference: PCH/POLYENG-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Rheology - Polymers Characterization

Level: PROFICIENCY

Purpose

This course provides a technical understanding of polymers behavior.

Audience

Professionals interested in polymers rheology and characterization.

Learning Objectives

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

- link properties and conformation of the polymer,
- have an overview of the main characterization methods to reach high quality product,
- discuss operating parameters of polymer processing.

Ways & Means

Videos to illustrate the different methods of characterization.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior-lecturer expert in the process development and the production of polymers at the industrial stage.

Course Content

5 days

POLYMER STRUCTURE - PROPERTIES RELATIONSHIP *1.5 d*

Description of the different scales from the chemical structures (microscopic scales) to macroscopic properties.

SPECIFIC TECHNIQUES OF ANALYSIS FOR MOLECULAR STRUCTURE *0.25 d*

Processing processes.
Morphology.
End-use properties.
The following techniques will be described: molecular weight distribution, melt index, intrinsic viscosity, gel permeation chromatography, rheology.

MAIN COMMERCIAL THERMOPLASTICS, RELATED PROPERTIES & APPLICATIONS *0.75 d*

Technical and commercial specifications.
Quality test at plant (on-line, off-line, at-line measurements).
Certificate of analysis.
Product data sheets.
Customer claims management.

RHEOLOGY OF POLYMERS PROCESSING *2.5 d*

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

Reference: PCH/RHEO-E Only available as an In-House course.

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

Main Polymers PE/PP/PS

Level: PROFICIENCY

Purpose

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

Audience

Engineers and technical staff interested in these polymers production.

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

No prerequisites for this course.

Expertise & Coordination

Senior-lecturer expert in the process development and the production of polymers at the industrial stage.

Course Content

5 days

MAJOR 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.
Order of magnitude of investment costs.
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.

IMPLEMENTATION OF POLYMERIZATION - MAIN POLYETHYLENE & POLYPROPYLENE PROCESSES *1 d*

Techniques implemented in polymers production: solution, bulk, emulsion, suspension or slurry, gas phase.
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 *3 d*

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...
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 (hyper compressors, let-down 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 *0.5 d*

Main design and operation characteristics.
How to treat run-away in case of thermal initiation.

Reference: PCH/MAINPOLY-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Ethylene Compression & Hypercompression for LDPE Units

Level: ADVANCED

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

No prerequisites for this course.

Expertise & Coordination

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

Course Content

4 days

ETHYLENE BEHAVIOR DURING COMPRESSION — *1 d*

Ideal gas equation and implementation; isentropic compression; mass and volume capacity. Supercritical gas behavior.
Practical compression laws: discharge temperature, power of compression.
Pressure-enthalpy diagram for ethylene: for primary compressors and hypercompressors.
Main limitations: risks of condensation, overheating, decomposition, grease deposits.
Case studies: ethylene compression from 1 to 3000 bar.

PRIMARY COMPRESSORS BEHAVIOR & OPERATION — *1 d*

Indicator diagram for ideal and actual cases.
Influence of process temperatures and pressures.
Dead volume: impact on the intake of the machine.
Capacity control: different methods.
Power, efficiency.
Behavior of multistage reciprocating compressors.
Typical troubleshooting.
Operation: start-up and shutdown difficulties.
Cases studies: industrial ethylene compression, troubleshooting.

HYPERCOMPRESSORS BEHAVIOR & OPERATION — *1 d*

Compression ratio limitation due to axial loads on the crankshaft.
Interstage pressure control, risk of rods overbendings or plunger/seals breaks.
Discharge temperature limitation due to decomposition and oligomer deposits.
Lubrication operation and survey: crankshaft, oil seal and cooling. Criticity of the oil type.
Machine safety - PROGNOST™ type monitoring: axial vibrations, rod drop, oil temperatures and pressures, process temperatures and pressures.
Typical defaults, solutions and diagnosis.
Cases studies: various cases of troubleshooting.

TECHNOLOGY OF PRIMARY COMPRESSORS — *0.5 d*

Main components: frame, cylinders, piston, piston rings, piston rod, crankhead, crankshaft, distance pieces, valves, rod seals.
Auxiliaries: pulsation dampeners, crankshaft, seals and cylinder lubrication systems, cooling systems, safety devices.
Capacity control technology: main components (unloaders, clearance pockets).
Application: various compressor parts demonstrations.

TECHNOLOGY OF HYPERCOMPRESSORS — *0.5 d*

Main differences with classical reciprocating compressors.
Hypercompressor description: valves, cylinders, seals.
Auxiliaries:
- Construction and survey.
- Crankshaft lubrication.
- Rod seal lubrication.
- Oil seal and cooling.
- Drains.

Reference: MTE/ETHCO-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: MTE/ETHCO. Please contact us for more information.

Chlorine & PVC Value Chain

Level: PROFICIENCY

Purpose

This course provides comprehensive information on an industry once considered as being part of chemicals, now an important component of petrochemicals.

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 have an overview of the industrial chain leading to the production and use of these economically important and still fast developing polymer family, in spite of its very poor environmental reputation among public and ecologists.

Ways & Means

- Detailed course material.
- Pictures/videos of main equipment and samples.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior-lecturer expert in the process development and the production of polymers at the industrial stage.

Course Content

2 days

CHLORINE PRODUCTION & USE *0.75 d*

Chlorine: a very reactive chemical; both an advantage (used in many synthesis) and a drawback (high toxicity). Difficult to handle; strict safety rules, transport to be avoided as much as possible.

Principle of salt solution electrolysis, with coproduction of hydrogen and caustic soda, in fixed ratios. Move from mercury cells to more environment friendly membrane technology. Innovation going on with new Oxygen Depolarized Cathode development.

Main markets for caustic soda and Chlorine. Unusual price effects linked to fixed production ratio. Close to 60% of chlorine going to polymer production, with VCM/PVC being the main single market.

Analysis of typical chlorination process, combining direct use of chlorine and indirect use of recycled HCl. Examples of chloromethanes production and of VCM production, by both ethylene route and acetylene route from coal.

PVC PRODUCTION & USE *1.25 d*

PVC, a very versatile polymer. Presentation of the various types of PVC products (general purpose and specialties) and of their main markets. Analysis of the added value from salt, electricity and ethylene to PVC.

General purpose PVC. Main product characteristics. Presentation of the suspension process and the mass process.

Analysis of the batch Suspension process, review of all technology developments towards minimizing cycle time, hence minimizing fixed production costs. Necessity of compounding stage for PVC →no product differentiation at polymerization.

Specialty PVC: copolymers, emulsion, micro-suspension, chlorinated PVC. Their major uses, their production.

High toxicity of VCM: how PVC industry reacted when it was discovered.

The future of PVC? Very bad reputation: the worst polymer according to Greenpeace. But still growing fast, although banned in some countries. The cheapest and the only commodity polymer with less than 50% hydrocarbon content. A polymer for the future?

Reference: PCH/PVC-E Only available as an In-House course.

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

Production of Synthetic Elastomers

Level: PROFICIENCY

Purpose

This course provides technical information of the polymerization and main processes used to produce synthetic elastomers: SBR, BR, IR, NR, IIR, CR…

Audience

Professionals in the oil or petrochemical industry interested in polymers and elastomers processes.
Specifically for fresh engineers and technical staff, as well as subcontractors, service providers…

Learning Objectives

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

- grasp the main principles of polymerization techniques and the key characteristics of manufactured elastomers,
- review the manufacturing processes in the elastomers industry,
- identify the various techniques of elastomers processing, their main end uses and related market share.

Ways & Means

- Detailed course material.
- Pictures/videos of main equipment and samples.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior-lecturer expert in the production of synthetic elastomers at the industrial stage.

Course Content

3 days

POLYMER TYPES & NATURE - MAIN ELASTOMERS *0.5 d*

Polymer constitution: monomers, macromolecules, building blocks.
Various kinds of polymer: fibers, elastomers, plastics.
Main elastomers: styrene-butadiene-styrene, polybutadiene, polyisoprene, nitrile rubber, butyl rubber, chloroprene rubber…
Relative economic status of different categories of elastomers.

POLYMERIZATION OF ELASTOMERS - RELATED PROPERTIES *1 d*

Type of reaction and basic characteristics of polymer reactions: polyaddition, polycondensation, heat of reaction, activation mode, catalytic systems, etc.
Different arrangements of monomer building blocks in polyaddition: atactic, syndiotactic or isotactic polymers; random, alternated, block, grafted polymers and others.
Influence of monomer arrangements on the properties of elastomers.
Relationship between end uses and main elastomer properties. Impact of glass transition temperature.
Main tests used to get elastomer characterization: solution viscosity, Mooney viscosity, gel permeation chromatography, tensile test.
Shore hardness, relaxation test, etc.
Test signification, relationship with polymer structure.
Consequences regarding the elastomer processing techniques (formulation, vulcanization, extrusion, injection, etc.).

INDUSTRIAL IMPLEMENTATION OF POLYMERIZATION - MAIN ELASTOMERS PROCESSES *1.5 d*

Techniques implemented to produce polymers: solution, bulk, emulsion, suspension, gas phase techniques.
Advantages and drawbacks of those different techniques, consequences on industrial implementation of the processes.
Examples applied to main processes used to manufacture major synthetic elastomers, continuous and batch processes.
Flow charts and principles of processes. Typical operating conditions.
Influence of operating parameters (temperatures, pressures, monomers ratio and proportion of any chemicals involved in the reaction) regarding the quality control of the elastomer.

Reference: PCH/ELAST-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Polymers Extrusion & Pelletizing

Level: PROFICIENCY

Purpose

This course provides the know-how for an autonomous job position in the operation and maintenance of extruders and pelletizers.

Audience

Operating staff in charge of driving extruders and ancillary equipment. Technicians involved in the operation or maintenance of this type of installation.

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

- Content may be customized for a particular type of machine or for products if information is provided at least one month in advance.
- Otherwise, standard products are covered: PolyEthylene, PolyPropylene. It can be implemented on specialties polymers and compounds.
- Case studies based on industrial situations.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior lecturer expert in the design and operation of polymer extruders at the industrial stage.

Course Content

3 days

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*

Drivetrain: the drivers and launch, variable speed drives, gearboxes, sustained efforts, safety and overload structure of abutments, the extruder auxiliary.
Extruder: power, force feeder, preventing jams; 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 knifes speed, water flow, water temperature, monitoring of pellets size.
Principle of heat exchange in the die plate and temperature control.

AUTOMATION & SAFETY *0.25 d*

Review of the machine logic (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).
Consequences: monitoring the temperature as a function of grade and load.
Required power: the influence of the load, the MI and temperature recommendations.
Equipment reliability.
Application: study of possible causes of troubles, solutions, points to be checked.

Reference: PCH/EXTRU-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: PCH/EXTRU. Please contact us for more information.

Compounding Polymers Processes

Level: ADVANCED

Purpose

This course provides the know-how for an autonomous job position in the operation and maintenance (first level) in compounding polymers area.

Audience

Operating staff in charge of a compounding plant.

Learning Objectives

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

- know about the phenomena in each sectors of these processes,
- use of all equipment and analyze of the settings, security and automation,
- interpret drifts and incidents in order to react efficiently and in safety ways.

Ways & Means

- Content may be customized for a particular type of machine or for products if information are provided at least one month in advance. Otherwise, standard products are covered: PE, PP, PVDF, etc.
- Case studies based on industrial situations.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior lecturer expert in the extrusion/ compounding of polymers at the industrial stage.

Course Content

4 days

PROCESS DESCRIPTION *0.5 d*

Aim of the extrusion, general layout description and the various steps of the polymer treatment.
Operating principle and different cross section areas: Storage area, conveying system, feeding system…
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.
Granulation.
Different types of pellets handling.

TECHNOLOGY & OPERATION OF THE COMPOUNDING AREA *1.75 d*

Conveying system: lean phase, strand phase, fluid phase, stabilized fluid phase, stabilized slug, slug, hydraulic. Advantages and drawbacks (dust, angels hair).
Feeding system: gravimetric, single screw/spiral, double screws/spirals, belt system, vibrating system, side feeder, agitators, venting system… Advantages and drawbacks.
Drivetrain: the drivers and launch, variable speed drives, gearboxes, sustained efforts, safety and overload structure of abutments, the extruder auxiliary.
Extruder: power, force feeder, preventing jams, different section of screw and barrel, vent, temperatures adjustments, starting diverter valve and start-up operation, fouling filters monitoring and filter changing device.
Die plate: technology, pressure monitoring, calculating the percentage of blocked holes, die plate heating system. Principle of heat exchange in the die plate and temperature control. Risk of damage.
Pelletizer: speed calculating, water flow, knife adjustment, monitoring of pellets size. Parameters adjustment to have a good pellets.
Pellets handling: centrifugal dryer, fluid bed dryer, classifier screen, rotary valves. Advantages and drawbacks.

AUTOMATION & SAFETY *0.5 d*

Review of the machine logic (flow charts, logic diagrams). Link between automation sequences feeders, extruder, pelletizing, pellets handling.

PRODUCT QUALITY *0.25 d*

Different grades manufactured, specifications in relation to the applications.
Laboratory tests: equipment procedures, visualization of various types of defects. Fluidity, viscosity dynamic, kinematic viscosity, definition, effect of shear rate, melt index (MI).

INFLUENCE OF OPERATING PARAMETERS *1 d*

Monitoring the temperature as a function of grade and load.
Required power: the influence of the load, the MI and temperature recommendations.
Rules to heat the extruder after period of shut down (cold to hot).
How to start the extruder.
Die plate purge before start.
Analysis of bad cut and actions.
Which parameters are important to follow to have a good reliability and productivity, always in safety conditions.
How to identify bad actors.
Cartography of extruder behavior.
Safety of operators.
Application: study of possible causes of troubles, solutions, points to be checked.

Reference: PCH/CPP-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Operation of a Chemical Production Unit

Level: FOUNDATION

Purpose

This course provides the know-how for an autonomous job position in the operation and maintenance of chemical production units, such as polymerization, fertilizers, chlorine, etc.

Audience

Operating or maintenance technicians, operating staff in chemical production facilities.

Learning Objectives

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

- understand the role of chemical reactions and reactants in the production process,
- learn about the operating constraints induced by the chemical reactions implemented in a production unit,
- grasp the impact of operating conditions on the production facilities' output.

Ways & Means

Content may be customized for a particular process if information is provided at least one month in advance.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

More info

Confidentiality agreement if necessary.

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

2 days

MAIN SECTIONS OF THE UNIT *0.25 d*

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 *0.5 d*

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 *0.25 d*

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 *0.5 d*

Mass balance, heat balance.
Operating parameters and impact on yields and purity, by-products and purification operations if pertinent.
Advanced operation: yields and related modifications, selectivity and impacting parameters, feed composition.
Reaction cycle: duration, parameters profiles as a function of time.
Operation of the downstream fractionation and purification units.

OPERATION & DISTURBANCES *0.5 d*

Nature and origins of disturbances: consequences, diagnostic, parades.
Specific safety measures around the reactor.

Reference: PCH/CRC-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: PCH/CRC. Please contact us for more information.

Acrylic Acid & Lights Acrylates Units

Level: PROFICIENCY

Purpose

To provide a deeper understanding of the processes implemented in acrylic acid and acrylates production in order to operate with more efficiency.

Audience

Unit staff and others collaborators involved in this unit.

Learning Objectives

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

- explain the main operating conditions and trends,
- precise the physical & chemical principle associated with the main steps of the processes.

Ways & Means

- Notions illustrated thanks to examples taken from your unit itself.
- Search of active participation of the trainees implementing case studies.
- As a matter of fact, data from the unit have to be provided to fit the client unit conditions.

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

2 days

PROCESSES PRESENTATION *0.25 d*

Origin of raw materials.
Bloc diagrams - Main zones.
Composition of inlet & outlet streams.

TECHNICAL KEY POINTS OF THE PROCESSES *1.75 d*

For each one:
- Reaction zone characteristics: principle, chemical reaction, need of a catalyst or not.
- Main control loops of the reaction zone.
- Daily operating conditions.
- Responses on disturbances.

Recovery zone characteristics: principle of separation processes, implementation.
Main control loops of equipment:
- Daily operating conditions.
- Responses on disturbances.

Reference: PCH/ACRYL-E Only available as an In-House course.

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

Chemical Fertilizer Manufacturing

Level: DISCOVERY

Purpose

This course brings technical information on the characteristics and the manufacturing of chemical fertilizers.

Audience

Everybody working in the petrochemicals industry or in the sector of chemical fertilizers.
Young engineers and beginners in the field of petrochemistry.
Staff from subcontractors and service companies involved in the manufacture of these compounds (laboratory, maintenance…).

Learning Objectives

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

- define the different families of chemical fertilizers, their markets and the structure of the production chains,
- recognize the industrial functioning conditions of the workshop for the production of solid fertilizers and their intermediates,
- identify the risks related to the various production workshops,
- understand the interconnection between the workshops.

Ways & Means

- Specific documentation designed to be used as a reference after the course.
- Possibility of experts in the field coming to talk about their experience.

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

4 days

CHEMICAL FERTILIZERS & THEIR USES — *0.75 d*

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 chains of production.

PRODUCTION WORKSHOPS — *2.25 d*

Ammonia synthesis:
- Synthesis gas production from hydrocarbon steamreforming.
- Ammonia synthesis loop.

Urea production:
- Characteristics of urea synthesis. Various processes.
- 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:
- Characteristics of natural phosphates. Properties of the final products.
- 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:
- Raw materials. Product formulations. Generalities on the processes.
- Risks: decomposition, pollution.
- Various types of workshops. Comparison of principles and performances.

STUDY OF WORKSHOPS ON SITE — *1 d*

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

Reference: RPC/FERTIL-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Chlorine & Derivatives Production

Level: DISCOVERY

Purpose

This course brings technical information on the production, the main industrial applications and the uses of chlorine compounds.

Audience

Professionals in the chlorochemistry sector: equipment provider, services, subcontractors, insurance…

Learning Objectives

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

- describe the origin, the outlets and the applications of chlorine compounds and also of the products using chlorine in their production chain,
- 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 some of its derivatives.

Ways & Means

The content of this course can be adapted to client needs.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Senior-lecturer expert in the process development and the production of polymers at the industrial stage.

Course Content

2 days

ORIGIN & USES OF CHLORINE & ITS DERIVATIVES *0.25 d*

Natural chlorine: various natural forms, salts, chlorides, minerals…
Chlorine in daily life: factor of health, hygiene and cleanliness. Raw material for staples.
Overview of chlorine and derivative uses in France and worldwide.
Main raw material: the salt (sodium chloride), availability and distribution.

PRODUCTION PROCESSES FOR CHLORINE & DERIVATIVES *0.75 d*

Preparation of brine: extraction of sea salt and "gemme" salt. Purification and filtration processes of brine, quality criteria.
Electrolysis:
- Generalities on electrolysis process, rules of proportions for production.
- Industrial implementation of the process. Membrane electrolysis workshop: diaphragm and mercury. Recent evolution of the various means of production.
- Operating conditions of these various workshops and specific consumption of electrical energy.
- Safety and pollution prevention in the workshops.

Chlorine treatment:
- Chlorine desiccation, compression and liquefaction.
- Storage and transport of liquid chlorine.
- Safety and elimination of chlorinated effluents. Management of bleach workshop, inert treatment.

Hydrogen treatment: cooling, desiccation, demercurization and uses.
Concentration and soda treatments: various processes.

VINYL CHLORIDE & PVC MANUFACTURING *0.5 d*

Generalities on the various DCE production processes: direct chlorination, balanced process, oxychlorination.
Industrial implementations: catalysts, fixed or fluidized beds.
CVM production by pyrolysis: DCE cracking, by-product separation and CVM purification.
Flexibility of the processes and integration depending on various schemes to minimize the production of chlorhydric acid and the consumption of energy.
CVM polymerization.
Generalities of industrial polymerization processes: main steps, exothermicity, polymer purification, shaping.
Various processes and industrial constraints: polymerization in emulsion, in suspension, in mass.

PRODUCTION OF SOME OTHER CHLORINE DERIVATIVES *0.25 d*

Bleach, protection products, catalysts, chlorinated solvents, frigorific fluids.

ECONOMICS OF THE CHLORINE INDUSTRY *0.25 d*

Production cost structure.
Costs related to the supply of salt and electrical energy.
Market trends and international integration.
Recycling of chlorinated products.

Reference: RPC/FABCL-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Petroleum Products, Analysis, Transfer & Storage

Petroleum Products & Analysis

Transfer & Storage

Petroleum Products - Properties & Manufacturing Schemes

Level: PROFICIENCY

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

No prerequisites for this course.

Expertise & Coordination

Technical expert in the area of the refining optimization and the manufacturing of the petroleum products.

Course Content

5 days

ORIGIN & COMPOSITION OF PETROLEUM PRODUCTS *0.5 d*

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 reproductibility).

PROPERTIES & FORMULATION OF ENERGY PRODUCTS *3.5 d*

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

Market trends - Volatility characteristics - Combustion properties - Air pollution: engine emission specifications - Storage stability - Manufacturing schemes - Main additives incorporated in the refinery.
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.
Jet A1: market trend, agro-fuels incorporation.
Automotive Diesel oil: problems raised by the high A.D.O 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.
Heavy fuel oils: stability of visbroken fuels. Modifications of the refining scheme related to the coming marine fuels standard (in 2020).

MAIN NON-ENERGY PRODUCTS *0.5 d*

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 *0.5 d*

Oil price variation, refining margin, product prices.
Trading, pricing mechanism, marketing strategies.

Reference: APD/PP-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	**30 November**	**4 December**	**€2,980**

This course is also available in French: APD/PP. Please contact us for more information.

Current & Future Fuels: Development & Evolution of Biofuels

Level: ADVANCED

Purpose

This course provides a thorough understanding of the evolution of motor fuels, which is closely linked to the reduction of the vehicle emissions. The first 2 days deal with the current fuels, while alternative fuels are treated during days 3 and 4.

Audience

Engineers, and technicians from all industries concerned by motor fuel evolution: car makers, refining, fuels traders, agro-fuels manufacturers…

Learning Objectives

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

- list the key properties for automotive fuels (now and in the future),
- identify the main trends of fuel evolution due to: new regulations and/or new motor technologies,
- describe how catalytic converters allow a significant reduction of the contaminants from the exhaust gases,
- describe the different ways to manufacture the main alternative fuels, and the impacts of those on the vehicle emissions.

Ways & Means

Use of pedagogical games. The first 2 days are dedicated to the current fuels and presented by a refining expert. The 2 following days, alternative fuels (current and next generations) are presented by experts of the different branches.

Learning Assessment

Multiple choice quiz at the end of the session.

Prerequisites

No prerequisites for the 4 day course. The participants who wish to follow only the second part of the session, should have followed the course “Petroleum Products - Properties & Manufacturing Schemes” or have a solid knowledge of current fuels.

More info

It is possible to follow only the last two days of the course, in particular for the participants who would have already followed the course “Petroleum Products - Properties and Manufacturing Schemes”.

Expertise & Coordination

Technical expert in the area of petroleum product manufacturing.

Course Content

4 days

GASOLINE — *1 d*

Market trends and shares of different gasoline grades.
Principle of the spark-ignition engine.
Required properties for automotive gasoline:
- Volatility: vapor pressure and ASTM distillation. Volatility influence on the engine operation.
- 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).
Manufacturing scheme of automotive fuels. Characteristics of bases produced in refineries.

DIESEL FUEL — *1 d*

Market trends.
Principle of the compression-ignition engine.
Required properties for Diesel fuel:
- Combustion: auto-ignition delay. Definition and measure of the cetane number. Influence of the cetane number on the combustion quality. Chemical composition/combustion quality relationship.
- Cold flow properties: cloud point and Cold Filtering Plugging Point (CFPP).

Pollution by exhaust gases: particles, NO_x:
- 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 CO_2 emissions of the vehicles.
Alternative fuels for diesel engines: fatty acid esters and hydrotreated oils.
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.

Reference: APD/AUTFUEL Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: APD/CARBAUT. Please contact us for more information.

Analytical Methods & Techniques Applied to Hydrocarbons & Derivatives

Level: FOUNDATION

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

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

5 days

ELEMENTARY ANALYSIS — *0.25 d*

Analysis of the elements: C, H, O, N, S, Ni, V, etc.
Potentiometric analysis, sulfur, nitrogen.

SPECTROMETRY — *2 d*

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 — *1.5 d*

Analytical and separating distillation.
Gas chromatography (GC).
Liquid chromatography (LC).
Supercritical fluid chromatography (SFC).
Gel permeation chromatography (GPC).

COMBINATIONS - ADVANTAGES - IMPLEMENTATION — *0.5 d*

Combination PC-MS.
Combination LC-MS.
Combination GC-DEA (DiElectric thermal analysis).

CHROMATOGRAPHY SPECIFIC DETECTORS — *0.5 d*

Analysis sulfur and nitrogen.

ONLINE ANALYSIS — *0.25 d*

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: APD/AMT-E Only available as an In-House course.

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

Operations in Oil Storage Depots & Chemical Terminals

Level: PROFICIENCY

Purpose

From the properties of the petroleum products, the storage equipment and associated hazards, this training course aims to meet the needs for safe operations in oil storage depots, chemical and petrochemical terminals.

Audience

Staff involved in operations of oil storage depots.

Learning Objectives

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

- list the main properties of petroleum products,
- recognize the elements of atmospheric storage tanks, loading and unloading facilities,
- identify the hazards and risks of the operations of storage, loading and unloading,
- select the appropriate means to mitigate these risks.

Ways & Means

Case studies based on industrial situations.

Learning Assessment

Final quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Technical expert in the field of storage and transfer operations of petroleum products.

Course Content

5 days

PROPERTIES OF PETROLEUM PRODUCTS MANAGED IN OIL DEPOTS *0.5 d*

Detailed breakdown of petroleum products.
Properties related to their safe storage and handling.
Product specifications and blending consequences.
Exercise: cross contaminations.

STORAGE OF PETROLEUM PRODUCTS *1 d*

Various types of storage tanks (fixed roof, floating roof, floating screen) and operating facilities.
Heating and mixing systems.
Safety equipment (level switches…), firefighting facilities (sprinklers, foam…).
Safe operation.
Measurement equipment: gauging well, level, temperature, sampling.

MEASUREMENT OF QUANTITIES: RECEIVED, STORED, DELIVERED *0.75 d*

Static measurement: level, temperature, density, volume.
Dynamic measurement: working conditions, sensors (flowmeter, density meter, viscosity meter, pressure meter).
Metrology aspect: calibration methods.
Operating product losses: evaporation, overflow, leaks…
Origin and consequences of errors of measurement.
Mass balance.
Case study: unloading kerosene from a ship to a fixed roof tank.

LOADING UNLOADING OPERATIONS *1.75 d*

Equipment in connection with loading and unloading facilities. Corresponding safe operating conditions.
Marine bulk loading/unloading:
Loading station layout: various types of arms and adaptation to operating conditions, balancing, manual and hydraulic control, grounding.
Loading arms and safety accessories: quick coupling, movement detection, breakaway coupling, drainage systems.
Fixed firefighting equipment on board, on shore, safety checklist.
Rail and road bulk loading/unloading:
Safety and operating equipment on tank trucks and rail cars: breathing valves, Gestra type valves, hydraulic valves, and high level switch.
Truck and rail car loading stations: loading arms (top, bottom), quantity measurement and control systems.
Safety equipment: vacuum breaker, dead man valve, overflow protection, bonding.
Procedures.

PRODUCT HAZARDS & OPERATING PREVENTIVE MEASURES *1 d*

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: MVS/DEPOTS-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Martigues	**29 June**	**3 July**	**€3,000**

This course is also available in French: MVS/DEPOTS. Please contact us for more information.

Properties, Formulation, Transfer & Storage of Petroleum Products

Level: PROFICIENCY

Purpose

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

Audience

Operation staff (field operators, panel operators, supervisors…) in reception, blending of crude or petroleum products, storage or shipping facilities.
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 the functioning parameters of transfer by gravity or by pump,
- recognize the elements of atmospheric storage tanks,
- identify risks for safety, equipment and accounting in storage operations and develop measures appropriate to control such risks.

Ways & Means

Case studies based on industrial situations: products transfers, products formulations.

Learning Assessment

Final quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Technical expert in the field of storage and transfer operations of petroleum products.

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:
- Principle of the blenders: on-line optimization manufacturing, additisation.
- 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, overflowing, 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 making ready for use.

Reference: MVS/PCTS-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: MVS/PCTS. Please contact us for more information.

Fuel Manufacturing - In Line Blending Optimization

Level: ADVANCED

Purpose

This course provides a thorough understanding of the product manufacturing principles: in line blending monitored by a global optimizer.

Audience

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

Knowledge of the specifications and of the constituents of the petroleum products.

Expertise & Coordination

In line blend optimization expert.

Course Content

3 days

GASOLINES, DIESEL FUELS, HEAVY FUELS SPECIFICATIONS *0.5 d*

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.

BASES & ADDITIVES *0.25 d*

Nature, origin and characteristics of the bases.
Additives: best practices for additisation - Properties optimized by additives.

BLENDING LAWS USED BY THE OPTIMIZER *0.75 d*

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).

BLEND OPTIMIZATION: SP95 & ADO MANUFACTURING *0.75 d*

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.

BLEND MONITORING *0.5 d*

Different steps in the calculation of the optimizer - Dynamic optimization of the application.
Algorithm principle: integration cycles, optimization cycles, dynamic regulation.
Blend manufacturing: how to treat infeasibilities.

UPSETS - STUDY CASES *0.25 d*

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.

Reference: APD/AUTOOFF Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Equipment, Materials, Corrosion & Inspection

Technology

Materials & Corrosion

Maintenance & Inspection

Recent Developments & Innovation in Equipment

Level: ADVANCED

Purpose

This course provides a range of recent and newest technologies implemented in Oil & Gas plants worldwide.

Audience

Engineers involved in process technology, maintenance, operation, projects and interested in recent process plants technologies.

Learning Objectives

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

- get a broad vision of future of new technologies, energy optimization and maintenance enhancement,
- support their own professional development,
- gain in-depth knowledge of recent developments.

Ways & Means

- Many workshops and case studies illustrating the new techniques and topics studied.
- Equipment manufacturers participation when feasible and adapted.
- The delivery method is interactive and based on participants' own experience.

Learning Assessment

Final 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

5 days

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 NO_x and ultra low NO_x 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, NO_x/CO_2 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: EIM/RDIET Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Martigues	12 October	16 October	€2,980

Introduction to Equipment Technology

Level: FOUNDATION

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, 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

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

5 days

PIPING, VESSELS & MATERIALS *1.5 d*

Symbols and equipment representation on P&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.

INTRODUCTION TO THERMAL EQUIPMENT *1.5 d*

TEMA standard heat exchangers and other types: tubular or plate type, air coolers and condensers.
Different types of furnaces, technology and characteristics.
Boiler technology. Operating conditions. Construction of heat exchange areas and refractory materials.
Burner technology: fuel and air supply. Low NO_x and ultra-low NO_x burner technology.
Flare systems. Safety operation.

BASICS IN ROTATING EQUIPMENT *2 d*

Different types of pumps.
Centrifugal pump performance curves: head, efficiency, shaft power, NPSH3.
Centrifugal pump technologies. Mechanical seals: various arrangements, ancillary systems.
Common failures and related root causes.
Reciprocating compressor architecture: number of stages, cylinders, overall layout, standard applications.
Technology of main components and ancillaries. Flow control, specific safety devices. Start-up procedures and troubleshooting.
Centrifugal compressor: description, technology of main components and auxiliaries.
Performance curves, influence of suction conditions and gas composition.
Operating window: low and high speed limits, stonewall, surge, typical anti surge protection systems. Typical failures and related root causes.
Introduction to other types of rotating equipment: positive displacement pumps, other rotary positive displacement compressors, blowers, steam turbines, gas turbines, motors.

Reference: MTE/TMPP-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: TMA/TMPPC. Please contact us for more information.

Static Equipment

Level: PROFICIENCY

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

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

5 days

PIPING - FLANGES — *1 d*

Different types of piping equipment per ASME B31.3: pipes, flanges & gaskets, valves, steam traps, bellows, safety valves, rupture discs…
Piping codes and standards. Piping classes. Criteria for selection and installation. Use and technology.
Pressure resistance: PN, series, impact of temperature. Symbols and equipment representation on PID's. Insulation.
Main risks in case of failure, common problems. Corrective and preventive maintenance.

VESSELS & STORAGE TANKS — *1 d*

ASME VIII Vessels: technology of separator drums; technology and internals 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.

METALLURGY OF FERROUS & NON FERROUS MATERIAL USED IN PROCESS INDUSTRIES — *0.75 d*

Overview of materials and steel structure. Effect of alloying elements.
Structure of steels and alloys ASTM and EN. Behavior during operating conditions. Behavior to the pressure and depression of the equipment.
Calculation conditions. Various types of corrosion mechanisms. Prevention: material selection, design, coatings…

THERMAL EQUIPMENT — *1.25 d*

TEMA standard heat exchangers. Thermal performance: fluid flow distribution, geometrical characteristics and technological constraints.
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 NO_x and ultra-low NO_x burners technology.

INSTRUMENTATION — *1 d*

Sensors, transmitters, control valves. Instrument tags and symbolization on P&ID drawings. ISA standard.
Distributed Control System: Architecture, characteristics and functionalities. Systems operation: control, graphics, alarming, trends, etc.
Safety Instrumented Systems. *Applications and exercises.*
Process identification. Control strategies: split-range, cascade, feed forward, multivariable. Tuning of a PID controller.
Non-linearity of process; controller operating point. *Application: loop tuning demo on a process dynamic simulator.*

Reference: EMT/MATEQ1-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Martigues	**24 August**	**28 August**	**€3,000**

This course is also available in French: TMA/MATEQ1. Please contact us for more information.

Corrosion & Risk Based Inspection

Level: PROFICIENCY

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

Professional knowledge of typical operating parameters in the Refining & Petrochemicals industries.

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

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, CO_2 corrosion.
Corrosion of alloys and plastics 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 NDT 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: MCO/CORBI-E 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 April	10 April	€2,980

Advanced Certificate

Corrosion & Corrosion Prevention Certification

Level: PROFICIENCY

Purpose

This course provides a practical knowledge of pressure equipment and piping corrosion, and explains prevention strategies.

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:

- 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

- Basic knowledge in corrosion.
- Professional experience in the refining & petrochemicals industries.

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.

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

METALLURGY USED FOR PRESSURE EQUIPMENT & PIPING MANUFACTURING — *1 d*

Ferrous and non-ferrous material: microstructure, composition, mechanical properties.
Plates, forging, castings, piping, rolling, welding, post weld heat treatment.
Pressure equipment manufacturing.

USUAL TYPES OF CORROSION & DETERIORATIONS — *1 d*

Different types of industrial corrosion: uniform, pitting, crevice, intergranular, stress corrosion cracking, corrosion-erosion, galvanic, selective.
Definitions and basic mechanism: wet corrosion, dry corrosion.
Metallurgical deterioration: brittle fracture, chromium precipitation, creep, fatigue.

TYPES OF CORROSION IN OIL & GAS INDUSTRIES & PETROCHEMICAL PLANTS - API 571 — *1.5 d*

Use API 571 to study each type of corrosion along with possible prevention for pressurized vessel and piping.
Application to old plants already in service, or during design of new plants.
Specific corrosion occurring in industrial installations:

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, CO_2 corrosion.

Specific corrosion existing 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 — *1.5 d*

Material selection and detailed engineering design to avoid corrosion based on API 510 principles.
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.
Non-destructive testing.
Risk Based Inspection according to API 581.

Reference: MCO/CICP-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: MCO/CICP. Please contact us for more information.

Failure Analysis & Repairs of Piping & Vessels

Level: DISCOVERY

Purpose

This course introduces the repair works procedures of metallic piping as well as pressure vessels in the petroleum and chemical industries.

Audience

Engineers and Technical Staff involved in safe operation and integrity of pressure vessels and piping installed in refineries, chemical and petrochemical plants.

Learning Objectives

Upon completion of this course, the trainees will be able to:

- participate in the development repair procedure related to piping and pressure vessels,
- list the main industrial corrosion types,
- identify the safety issues related to hot work and working inside a vessel,
- list the main practical procedures for temporary or long term repairs,
- understand & supervise welding, post weld heat treatments, non destructive testing, inspection file update.

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.
- Actual accidents in refineries and chemical plants are analyzed.

Learning Assessment

Final 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

5 days

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.
Hot tapping, nozzle reinforcements, weld overlays, cladding, temporary clamping.
Preheat, post weld heat treatments.
Safety issues: hot works, height, simultaneous operation; working in confined spaces.
Examples of actual repair works (team works):

- Cracking of a neutralization tower.
- Tubes plugging of tubular heat exchanger.
- Modification of a soda concentrator.
- Degradation of a petrochemical furnace.
- Replacement of pipe sections.
- Execution of a "hot tap" repair.

Reference: EIM/ITRES-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: EIM/ITRES. Please contact us for more information.

Risk Based Inspection (RBI)

Level: FOUNDATION

Purpose

This course covers the necessary background for setting up RBI for static equipment.

Audience

Managers, experienced engineers and staff involved in inspection, maintenance and operation in the petroleum, petrochemical and chemical industries.

Learning Objectives

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

- identify the degradation mechanism for a corrosion loop,
- 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

An interactive course based on actual case studies.

Learning Assessment

Final quiz.

Prerequisites

Basic knowledge of petrochemical and refineries process.

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

FUNDAMENTALS OF RISK BASED INSPECTION — *0.5 d*

API 580 overview, concept, probability and consequence of failure, risk ranking.
API 580 methodology, benefits and limits, workforce and schedule necessary to perform RBI study.
API 581 scope, probability of failure based on management factor and statistical failure frequency.

QUANTITATIVE & SEMI-QUANTITATIVE RISK BASED INSPECTION APPROACH — *2 d*

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.

APPLICATION OF THE RBI METHOD WITH MINI-PROJECTS CASE STUDIES — *2.5 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 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.

Reference: EIM/PLINS-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: EIM/PLINS. Please contact us for more information.

Fresh Inspector Practical Training

Practical training using actual educational plant

OLEUM

Level: FOUNDATION

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

- Basic knowledge of pressure vessel technology, heat exchangers, furnace, boilers and piping.
- Basic knowledge of different forms of degradations and NDT.

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.
For each equipment: TEMA heat exchangers, vessels, distillation tower, furnace, piping, study the historical inspection file and collect the technical data available.

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.
Discover new 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: EIM/FIP-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Martigues	**6 April**	**10 April**	**€3,750**

Non-Destructive Testing for Petrochemical Industries

Level: FOUNDATION

Purpose

This course explains basic and advanced non-destructive testing methods used in the Oil & Gas industry as well as the chemical industry.

Audience

Experienced operation and maintenance engineers, managers and technicians involved in the technical aspects of the Oil & Gas, refineries and chemical industries.

Learning Objectives

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

- identify available non-destructive examination methods,
- select effective non-destructive examination methods based on the type of degradation, equipment and material,
- evaluate external on stream NDT and internal NDT during plant shutdown,
- understand maintenance work linked to NDT applications.

Ways & Means

- Case studies to identify capabilities and limitations of each NDT.
- Practical demonstration of non-destructive examination in a workshop.

Learning Assessment

Final quiz.

Prerequisites

- Basic knowledge of pressure vessel technology, heat exchangers, furnace, boilers and piping.
- Basic knowledge of different forms of degradations.

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

BASIC & ADVANCED NDT TECHNIQUES — *2 d*

Visual test, Liquid Penetrant test (PT), Magnetic Penetrant 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: MCO/NDTIW Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Graduate Certificate

Inspector Certification

CERTIFICATION

Level: ADVANCED

Purpose

This training aims to increase skills on inspection of static equipment. This course will provide an IFP Training Certification according to the IFP Training procedures.

Audience

Engineers, supervisors and staff involved in Inspection of equipment.

Learning Objectives

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

- list the main material used in the oil and gas or petrochemical plants,
- select the main standards and codes used for pressure vessels and piping,
- describe the components of pressure vessel, piping and accessories,
- understand steels and alloys equipment degradations in the Oil & Gas and chemical industries,
- select appropriate NDT and alternative prevention tools to monitor corrosion effectively,
- review repair welding processes used in Oil & Gas industry,
- supervise and control efficiently contracted painting jobs and other protection devices,
- learn RBI strategy for a petrochemical or chemical unit.

Ways & Means

- Active teaching methods are used to promote individuals experience.
- Learning process including case studies.
- Visits of construction or repair workshops.
- Each participant can present its daily work and analysis: regulations and local guidelines used, repair methods and code, welding specifications, NDT, qualification of controllers.
- Mini-projects team works according to detailed program.
- Practices in workshops if possible.
- Individual project to finalize the program.
- Practical internal inspection of pressure vessel during shutdown and external inspection of piping.

Learning Assessment

Knowledge assessment according IFP Training Certification specific standards.

Prerequisites

Basic process and technical knowledge.

Why an IFP Training Certification?

- An international recognition of your competencies.
- A Graduate Certificate delivered.
- An expertise confirmed in Inspector Certification.
- Ready-to-use skills.

More info

This course is composed of 8 modules of 5 days each. It includes all the evaluations related to the IFP Training Certification. In case of a local training, the customer will supply all the material and equipment needed for the course, including workshop and tools.

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

40 days

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 under 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 discs 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.
Welding: cutting processes, forming, welding used on vessels and pipework (SMAW, GTAW, GMAW, SAW…). Welding parameters and weldability of main materials (CS, SS, LAS…). Welding Procedure Qualification Record (WPQR) - Welding Procedure Specification (WPS) - Welder Performance Qualification (WPQ). Post weld heat treatment. Welding safety and health issues.

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 possibility for on line temporary repair or hot work during plant shutdown. Individual project oral presentation.

Module 6: PAINTINGS, COATINGS & CATHODIC PROTECTION — 5 d

Characteristics and properties of paintings and coatings. Paint components. Binders and plastifiers, pigments, fillers, colorants, additives, solvents. Physical characteristics. Paint manufacture and recent developments. Different types of industrial paint and for special environment. Composition of a paint system (role of coats and compatibility). Inspection, control and commissioning. Cathodic protection - Principles and applications. Wet corrosion mechanisms and prevention. Principles of cathodic protection. Impressed current and sacrificial anodes. Design and selection of cathodic protection systems. Performance monitoring. Field potential measurement. Monitoring in sea water and in soil. Norms and standards (EN 15257).

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. Extend inspection periodicity or set up an efficient 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 the NDT; 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: EIM/INSP-E Only available as an In-House course.

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

Energy & Thermal Equipment

Energy Efficiency & Renewable Energy

Exchangers, Process Furnaces & Boilers

Introduction to Renewable Energies

Level: DISCOVERY

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

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

3 days

ENERGETIC CONTEXT *0.25 d*

Energetic worldwide context.
Place of renewable energies in the energy world.

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.
Hydrogen: production means, current and future prospects, storage.
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: EMT/INTENNOU-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	**15 September**	**17 September**	**€2,120**

This course is also available in French: EMT/INTENNOU. Please contact us for more information.

Process Energy Efficiency Improvement for Industrial Plants

Pinch Analysis

Level: ADVANCED

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 CO_2 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

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

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: ΔT_{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: EMT/ANAENERG-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	**29 September**	**1 October**	**€1,940**

This course is also available in French: EMT/ANAENERG. Please contact us for more information.

Day-to-Day Energy Optimization for Industrial Plants

Level: PROFICIENCY

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

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

4 days

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: EMT/MENERG-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	16 June	19 June	€2,520

This course is also available in French: EMT/MENERG. Please contact us for more information.

Thermal Equipment

Technology & Operation

Level: FOUNDATION

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.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

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

Course Content

4 days

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*

Heat exchanger performance follow-up: influence of fouling.
Inspection of exchanger bundles. Hydraulic pressure test: case of U tube bundle and floating head heat exchangers.

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 NO_x and ultra-low NO_x 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.
Safe and reliable operation: main recommendations. Start-up and shutdown: preparation, safe ignition procedures.

Reference: EMT/THERMEQ Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	22 June	25 June	€3,150

Advanced Certificate

Heat Exchangers Certification

Selection - Design - Performance monitoring

CERTIFICATION

Level: ADVANCED

Purpose

This course provides detailed understanding of heat exchangers technology. It covers also thermal and mechanical calculation methods used to design exchangers and their performance monitoring.

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 in HX 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.

Prerequisites

This course is a part of a professional framework of an expert in Exchangers. A basic technical knowledge 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.

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.

Course Content

5 days

HEAT TRANSFER LAW APPLIED TO HEAT EXCHANGERS — *0.5 d*

Heat exchange conditions: convection coefficients, resistance caused by the walls and by fouling.
Overall heat transfer coefficient. Mean heat potential in a heat exchanger as a function of fluid distribution, specific case of phase change. Transferred heat flow rate across an installed surface. Influence of installed area and fouling.

Application:

Evaluation of exchange area requirements as a function of fluid flow distribution.
Thermal performance follow-up and prediction.

TEMA STANDARD TUBULAR HEAT EXCHANGERS - TECHNOLOGY & SELECTION CRITERIA — *0.5 d*

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.

THERMAL & HYDRAULIC DESIGN - PERFORMANCE FOLLOW-UP — *3 d*

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 reboilers.

Application:

Thermal and hydraulic design of a single-phase heat exchanger.
Initial design of condenser and reboiler.

PLATE TYPE HEAT EXCHANGERS — *1 d*

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.

Reference: EMT/HEDES Only available as an In-House course.

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

This course is also available in French: EMT/ECHAL. Please contact us for more information.

Furnaces: Safe Operation & Optimization

Application on dynamic simulator IndissPlus

Level: PROFICIENCY

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

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

4 days

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 NO_x 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, bridgewall temperature, limits and risk of overcoming.
Application: furnace temperature profile and heat recovery distribution as a function of fuel burned and combustion air excess.
On-stream furnace operations: monitoring of combustion and heating. Modifying operating conditions. Analysis of disturbances. Key points for safe operation.
Start-up and shutdown: preparation, safe ignition procedures, ignition after a short shutdown, normal shutdown, emergency shutdown.
Incidents: explosive atmosphere in the radiant section, tube rupture, unbalancing of the heat, etc.
Troubleshooting. Prevention.
Application:

Case study of furnace accidents.
Start-up procedure study.

Reference: EMT/FURNS00 Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: EMT/ECFOUR. Please contact us for more information.

Boilers Safe Operation & Optimization

Level: PROFICIENCY

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

No prerequisites for this course.

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

4 days

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 vaporization screens, superheaters, economizer and air preheater.

COMBUSTION - BURNERS *1.5 d*

Combustion conditions: fuel characteristics.
Conventional and low NO_x burner technology and operation.
Combustion quality: analysis of oxygen and unburned material in the flue gases.
Safe combustion: flame detection, control and safety devices on the fuel circuits.
Air and flue gas circulation. Flue gas pressure profile in the boiler, draft control.
Application: flue gas composition estimate, 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: disruptive factors and control principles.

BOILER OPERATION *1 d*

Steam generation inside tube coil and steam superheaters.
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: EMT/BOILER Only available as an In-House course.

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

This course is also available in French: EMT/ECCHAUD. Please contact us for more information.

Cogeneration - Combined Cycles - Waste Heat Recovery

Performances & Operation

Level: DISCOVERY

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

No prerequisites for this course.

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.

Course Content

3 days

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*

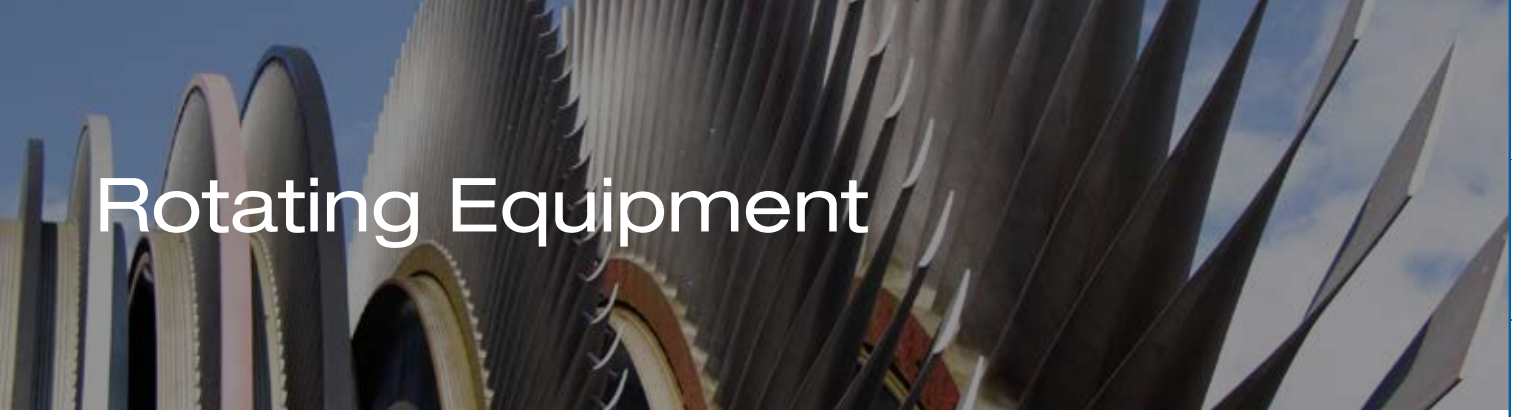
Boiler Feed Water (BFW) quality, description of the physical and chemical required treatments.
Description of conventional boilers and waste heat boilers: water circuit, steam circuit, fuel circuits.
Operating conditions - Fuel consumption per ton of steam, depending on boiler type and operating conditions.
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: EMT/COGENE-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: EMT/COGENE. Please contact us for more information.



Rotating Equipment

Specifications, Technology & Performance

Troubleshooting, Maintenance & Reliability

Rotating Equipment

Level: FOUNDATION

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 these equipment,
- describe the technology of the rotating machinery and the main operating constraints.

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

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

5 days

PUMPS *1.75 d*

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 ancillary 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.

RECIPROCATING & ROTARY POSITIVE DISPLACEMENT COMPRESSORS *1.25 d*

Different types of positive displacement compressors.
Reciprocating compressor architecture: number of stages, cylinders, overall layout, standard applications.
Technology of main components and ancillaries.
Influence of process conditions on compressor performance: suction or discharge pressure, suction temperature, gas composition.
Flow control, specific safety devices. Start-up procedures. Troubleshooting.

KINETIC COMPRESSORS *1 d*

Description of different type of compressors: horizontal/radial split casing centrifugal compressors, axial compressors, integrated gear compressors.
Technology of main components and ancillaries.
Pressure increase process for a compressor stage. Performance curves, influence of suction conditions and gas composition.
Operating window: low and high speed limits, stonewall, surge, typical anti surge protection systems.
Flow control: throttling valve, speed variation, inlet guide vanes. Specific precautions for start-up. Troubleshooting.
Safety.

TURBINES *1 d*

Description of different turbines, different families, standard applications.
Steam turbines, gas turbines, turbo-expanders.
Operating principle, classification and technology: exhaust conditions, expansion process through the machine.
Operation: start-up and performance monitoring. Speed control, safety devices.

Reference: MTE/ROTMACH Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	19 October	23 October	€3,000

This course is also available in French: TMA/MATEQ2. Please contact us for more information.

Advanced Certificate

Gas Compression & Expansion, Compressors & Turbines Certification

Applications with IndissPlus dynamic simulator

CERTIFICATION

Level: ADVANCED

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.
- Specific, detailed and high level documentation.
- Use of a dynamic simulator (centrifugal compressor + steam turbine).

Learning Assessment

Quiz.

Prerequisites

The participants need to have a basic technical knowledge of the refining & petrochemicals industries.

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.

COMPRESSORS, 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.
- Balance and critical speeds. Lubrication and seal systems. Standard mechanical failures.

Engineering:
- API specifications. Information required for bidding. Factory acceptance tests.

Reference: MTE/CCTAV-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	14 September	17 September	€3,150

This course is also available in French: MTE/CCTAV. Please contact us for more information.

Advanced Certificate

Gas Turbines Certification

CERTIFICATION

Level: ADVANCED

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

- Study cases of industrial machinery.
- Various illustrations of actual systems.
- Interactive group study of gas turbine operation.

Learning Assessment

Quiz.

Prerequisites

The participants need to have a basic technical knowledge of the Refining & Petrochemicals industries.

Why an IFP Training Certification?

- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Gas 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

5 days

GAS TURBINE EQUIPMENT *2 d*

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.
Ancillary equipment:
Internal cooling, lubrication, control system, safety devices.
External ancillaries: filtering, exhaust stack.

PERFORMANCE *1.5 d*

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 NO_x designs.
Expansion: single or double shaft design operation. Performance influence of atmospheric conditions, fuel selection. API charts.
Available load characteristics: rotation speed, T_3 firing temperature, IGV influences. Open cycle, combined cycle examples.
Case studies: actual performance vs. basic design; troubleshooting and solutions.

SELECTION *0.5 d*

Selection criteria according to availability, operational and maintenance requirements.
Bidding: significant information for data sheet definition.

OPERATION *1 d*

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, T_3, IGV. Typical approaches related to Brayton cycle, cogeneration (combined cycle).

Reference: MTE/TAG-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	**16 March**	**20 March**	**€3,150**

This course is also available in French: MTE/TAG. Please contact us for more information.

Blended Learning

NEW

Centrifugal & Positive Displacement Pumps

Applications with CORYS dynamic simulator

Level: PROFICIENCY

Purpose

This course covers the centrifugal and positive displacement pumps technology and their operating conditions.

Audience

Engineers and technical staff 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 presential one.

Learning Assessment

Quiz.

Prerequisites

The e-learning session must have been completed before the presential one.

More info

This training is carried out in Blended Learning:

- 1st step: e-learning, composed of two 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

4 days

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: MTE/PC-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	**10 August**	**13 August**	**€3,150**

This course is also available in French: MTE/PC. Please contact us for more information.

Key Points for Compressors & Turbines Operation & Inspection

Level: PROFICIENCY

Purpose

This course provides basic knowledge of the performance, technology and operation of compressors and turbines.

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 compressors and turbines and their main applications,
- explain operating principles and key performances of these equipment,
- describe their technology and the main operating constraints.

Ways & Means

- Use of drawings, datasheets, pictures and videos of actual equipment.
- Interactive lecture.
- Industrial case studies.

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

5 days

GAS COMPRESSION *0.5 d*

Thermodynamics: isentropic and actual compression, discharge temperature and compression power forecastings.

RECIPROCATING & ROTARY POSITIVE DISPLACEMENT COMPRESSORS *1.5 d*

Different types of positive displacement compressors.
Reciprocating compressor architecture: number of stages, cylinders, overall layout, typical applications.
Technology of main components and ancillaries.
Influence of process conditions on compressor performance: suction or discharge pressure, suction temperature, gas composition.
Flow control, specific safety devices. Start-up procedures. Troubleshooting.
Key points for general inspection.

CENTRIFUGAL COMPRESSORS *1 d*

Description of different type of compressors: horizontal/radial split casing centrifugal compressors, axial compressors, integrated gear compressors.
Technology of main components and auxiliaries.
Pressure increase process for a compressor stage. Performance curves, influence of suction conditions and gas composition.
Operating window: low and high speed limits, stonewall, surge, typical anti surge protection systems.
Flow control: throttling valve, speed control, inlet guide vanes. Specific precautions for start-up. Troubleshooting. Safety.
Key points for general inspection.

TURBINES *2 d*

Gas expansion thermodynamics; application to steam and gas turbines.
Description of different turbines, different families, standard applications.
Steam turbines, gas turbines, turbo-expanders technology.
Gas and steam turbines operation and performance.
Start-up and performance monitoring. Speed control, safety devices.
Key points for general inspection.

Reference: MTE/KPCTOI Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	15 June	19 June	€3,000

Steam Turbines

Applications with CORYS IndissPlus dynamic simulator

Level: PROFICIENCY

Purpose

This training provides an appropriate knowledge of steam turbine technology, performance and operation.

Audience

Operation and technical department staff 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 process simulator to demonstrate typical features.

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

5 days

STEAM TURBINE PERFORMANCE — *1.25 d*

Steam properties, inlet and exhaust conditions. Ideal and actual expansion.
Monitoring steam characteristics on the Mollier diagram: expansion, heating, efficiency, etc.
Expansion mechanisms: impulse stage, reaction stage and different types of multistage turbine.
Overall performance. Efficiency, steam consumption related to power supply.
Application: analysis of industrial turbine operation.

TECHNOLOGY — *1.5 d*

Main types of turbines, new designs.
Technical components: rotor, wheels, casing, bearings and thrust bearings, sealing devices.
Vibrations and critical speeds. Condenser and vacuum devices.
Application: study of different types of turbines and related auxiliary systems.
Practical workshop: study of component parts using a dismantled turbine.

STEAM TURBINE CONTROL SYSTEMS — *0.75 d*

Speed control systems. Controllers: characteristics of conventional and digital controllers.
Equipment technology: sensors, transmitters, controllers.
Safety devices: overspeed, vibrations, temperature.

OPERATION — *1 d*

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.

DYNAMIC SIMULATION - APPLICATIONS — *0.5 d*

Preparation and start-up of a steam turbine driving a centrifugal compressor.

Reference: MTE/EXTAV-E 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 April**	**10 April**	**€3,000**

This course is also available in French: MTE/EXTAV. Please contact us for more information.

Reciprocating Compressors

Applications with CORYS IndissPlus dynamic simulator

Level: PROFICIENCY

Purpose

This training improves participants' skills on technology, operation and maintenance of reciprocating compressors.

Audience

Engineers and technical staff 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

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

5 days

TECHNOLOGY *1.5 d*

Construction and design philosophies.
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.
Auxiliary systems: pulsation dampeners, frame lube oil circuit, cooling systems, forced feed lubricator.
Safety devices.

PERFORMANCES *1 d*

Ideal gas compression: discharge temperature, power.
Actual compression: valve behavior, leakages, internal thermal exchanges.
Indicator diagram.
Efficiency, compression power.
Case studies: discharge temperature and power calculation, indicator card plotting, efficiency calculation.

COMPRESSOR PROCESS OPERATION *0.5 d*

Start-up, shutdown. Performances control.
Influence of compression ratio, gas composition and suction temperature.
Multistage compressors.
Case study: air compression.

MAINTENANCE & TROUBLESHOOTING *1 d*

Machine monitoring: noise, vibration and temperature.
Typical defects and failures on: valves, piston rings and packings, piston rod…
Dismantling and assembly procedures and reports.
Safety devices and prevention.
Case studies: typical failures on reciprocating compressors.

DYNAMIC SIMULATION - APPLICATIONS *1 d*

Use of a dynamic simulator.
Exercises on start-up and shutdown phases.
Applications using disturbances generated by the lecturer.

Reference: MTE/EECV-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: MTE/EECV. Please contact us for more information.

Centrifugal Compressors

Applications with CORYS IndissPlus dynamic simulator

Level: PROFICIENCY

Purpose

This course emphasizes the technology, the performance and operation of centrifugal compressors.

Audience

Operation and technical department staff 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.
- Various technical drawings of actual compressors.
- Use of a dynamic simulator.

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

5 days

TECHNOLOGY *1.25 d*

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.

PERFORMANCES *1.75 d*

Changes in gas velocity and pressure in a centrifugal compressor.
Mass and volume flow rate as a function of pressure, temperature and gas composition.
Discharge temperature, power absorbed as a function of the gas composition and the operating conditions.
Compressor performance: influence of process parameters, impeller velocity and geometry.
Characteristic curves of the circuit and the compressor.
Influence of the operating conditions: inlet pressure and temperature, gas composition, rotation speed.

OPERATION *0.5 d*

Flow rate control. Adaptation to service conditions.
Surge and antisurge devices. Standard control. Start-up and shutdown.
Monitoring the compressor and auxiliary equipment during operating conditions. Troubleshooting and safe operation.

DYNAMIC SIMULATION - APPLICATIONS *1.5 d*

Use of a dynamic process simulator.
Exercises on start-up and shutdown phases.
Applications using disturbances generated by the lecturer.

Reference: MTE/ECC-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: MTE/ECC. Please contact us for more information.

E-learning

NEW

Basics in Fluid Flow

Centrifugal Pumps & Positive Displacement Pumps

Level: PROFICIENCY

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

No prerequisites for this course.

Course Content

FLUID FLOW FOR PUMPS

Energy units, friction losses calculation, system curve assessment, operating point control with system curve control.

Reference: MTE/PC1-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

E-learning

NEW

Basics in Centrifugal Pump Technology

Centrifugal Pumps & Positive Displacement Pumps

Level: PROFICIENCY

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

No prerequisites for this course.

Course Content

CENTRIFUGAL PUMP TECHNOLOGY

Single stage centrifugal pump presentation, multistage centrifugal pump presentation.

Reference: MTE/PC2-E Only available as an In-House course.

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

Operation, Maintenance & Inspection of Rotating Machinery - Part 1

Level: FOUNDATION

Purpose

This course provides key competencies related to rotating machinery operation and maintenance tasks.

Audience

Engineers, supervisors and technical staff involved in rotating machinery maintenance and technical inspection.

Learning Objectives

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

- explain how to operate rotating machinery (pumps, compressors, steam turbines),
- explain the key points for fluid flow and gas compression/expansion theory and practical applications,
- list the key points for rotating machinery maintenance and inspection operations,
- explain how to achieve these operations,
- list the main failure modes related to each here above listed rotating machinery,
- participate in the machinery reliability improvement process.

Ways & Means

- Interactive lecture.
- Case studies based on industrial and actual feedback.
- Use of dynamic simulators : pumps, compressors, steam turbines

Learning Assessment

Quiz.

Prerequisites

Basic knowledges in engineering.

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

CENTRIFUGAL PUMPS — *2 d*

Main parts: casing, rotor, mechanical seals, bearings, coupling, auxiliary systems.
Fluid flow key points with a pumping system.
Operation: performance curves, flow control, start-up and shutdown, general troubleshooting.
Maintenance: assembly and dismantling procedures, main checks.
Typical defaults and failure modes.
Applications with a dynamic simulator.

RECIPROCATING & CENTRIFUGAL COMPRESSORS — *2 d*

Main parts: casing, crankshaft/rotor, packings/mechanical seals, bearings, coupling, auxiliary systems.
Gas compression key points. Single and multistage compression.
Operation: performance curves, flow control, start-up and shutdown, monitoring, protection curves, general troubleshooting.
Maintenance: assembly and dismantling procedures, main checks.
Typical defaults and failure modes.
Applications with dynamic simulators.

STEAM TURBINES — *1 d*

Main parts: casing, rotor, seals, governors, bearings, coupling, auxiliary systems.
Steam expansion key points.
Operation: performance curves, speed and power control, start-up and shutdown, monitoring, overspeed protection, general troubleshooting.
Maintenance: assembly and dismantling procedures, main checks.
Typical defaults and failure modes.
Applications with a dynamic simulator.

Reference: MTM/OMIRM1 Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Martigues	29 June	3 July	€3,000

Operation, Maintenance & Inspection of Rotating Machinery - Part 2

Level: FOUNDATION

Purpose

This course provides key competencies related to rotating machinery operation and maintenance tasks.

Audience

Engineers, supervisors and technical staff involved in rotating machinery maintenance and technical inspection.

Learning Objectives

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

- explain how to operate rotating machinery (pumps, compressors, steam turbines),
- explain the key points for fluid flow and gas compression/expansion theory and practical applications,
- list the key points for rotating machinery maintenance and inspection operations,
- explain how to achieve these operations,
- list the main failure modes related to each here above listed rotating machinery,
- participate in the machinery reliability improvement process.

Ways & Means

- Interactive lecture.
- Case studies based on industrial and actual feedback.

Learning Assessment

Quiz.

Prerequisites

Basic knowledges in engineering.

Expertise & Coordination

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

Course Content

5 days

LUBRICATION SYSTEMS MAINTENANCE/OIL ANALYSIS — *0.5 d*

Purpose, different types of lubricants and lube systems.
Lubrication equipment maintenance: key points.
Oil analysis. Reports. *Case studies.*

BEARINGS MAINTENANCE — *1 d*

Antifriction bearings: clearances/interferences assessments and checks, assembly procedures.
Sleeve and tilt pad journal and thrust bearings:
- Shaft rotation in an oil bearing.
- Clearances checks.
- Instrumentation checks and fitting procedures.
- *Case studies.*

COUPLINGS & ALIGNMENT — *0.5 d*

Different types of couplings and related problems.
Various alignment methods, tolerances.

ROTORS & SHAFTS — *0.5 d*

Balancing: API/ISO definitions, tolerances. Balancing methods.
Geometrical shaft checks.

RUPTURE MODES — *1 d*

Rupture mechanisms.
Surface damage
Fatigue, wear and tear. Rupture face analysis.
Case studies.

USE OF VIBRATION ANALYSIS — *1.5 d*

Different types of measurements and sensors.
Typology of typical defaults affecting rotating machinery.
Spectrum analysis and various techniques for diagnosis.
Case studies.

Reference: MTM/OMIRM2 Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Martigues	6 July	10 July	€3,000

Machinery Failure Analysis & Repair Methods

Level: ADVANCED

Purpose

This course enhances the maintenance staff skills through a clear understanding of machinery failure analysis.

Audience

Maintenance supervisors, engineers and technical staff 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.

Learning Assessment

Quiz.

Prerequisites

Basic mechanical background.

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

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.

Reference: MTM/RUPT-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Rotating Machinery Vibration Analysis

Level: ADVANCED

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

Supervisors and technical staff 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, etc.,
- 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

It is advised to have a basic mechanical knowledge or experience in vibration monitoring.

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

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*

Simple system behavior: amplitude and phase. Actual rotor and bearings systems. Critical speeds.
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.

Reference: MTM/PAVIB-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: MTM/DIAVIB. Please contact us for more information.

Rotating Machinery: Troubleshooting Analysis

Level: PROFICIENCY

Purpose

This course aims to enhance the maintenance staff skills through a clear understanding of online monitoring and failure analysis.

Audience

Maintenance supervisors, engineers and all technical staff involved in rotating machinery maintenance, reliability and technical inspection.

Learning Objectives

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

- facilitate troubleshooting investigation from failure analysis and monitoring,
- prevent mechanical failure and reduce operating costs,
- explain operating constraints,
- propose improvements on machinery reliability.

Ways & Means

- Case studies based on industrial and actual feedback.
- Teamwork: mini projects dedicated to industrial cases.
- Use of a dynamic simulator for centrifugal pump, reciprocating compressor, centrifugal compressor, steam turbine.

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

5 days

TROUBLESHOOTING ANALYSIS *2.5 d*

Drop of the machine performance analysis: loss of flowrate, loss of process fluid pressure, increase of process fluid temperature.
Monitoring results analysis: high vibrations levels, lubrication and seal circuit parameters, abnormal values, oil quality.
Component failures: seal leakages, bearing damages, rotor sags, impeller cracks, misalignment.
Hydraulic phenomena: cavitation, unpriming, volute effect, surge.
Reliability improvements to increase time between failures.
Applications, exercises and dynamic simulator: troubleshooting analysis of pumps, compressors and turbines.

MACHINE MONITORING DEVICES *1 d*

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 & INSPECTION TOOLS *1.5 d*

Material analysis: Non Destructive Tests (liquid penetration inspection, radiography, magnetic particle inspection, ultrasonic inspection). Destructive tests after rupture: hardness, welding sample test, tensile test. Analysis of the specific failure surface morphology.
Performance analysis: vibration analysis reports, thermographic analysis report, efficiency follow-up reports, noise analysis reports, oil analysis reports. Appreciation of standard failures.
Solutions to avoid failure: design parameters, stress limitations, operating parameter conditions, online monitoring.
Case studies: rupture and wear examinations of typical machine components (bearings, mechanical seals, rotors, crankshaft); analysis of most common failures on centrifugal pumps, reciprocating compressors, centrifugal compressors and gearbox.
Understanding vibrations and oil analysis reports. Use of a Portable Data Analyzer, when available.

Reference: MTM/RMTS Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Vocational Certificate

Rotating Equipment Technicians Certification

CERTIFICATION

Level: FOUNDATION

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

Basic knowledge in technical and rotating equipment.

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.

More info

This course is composed of 8 modules of 5 days each. It includes all the evaluations related to the IFP Training Certification. In case of a local training, the customer will supply all the material and equipment needed for the course, including workshop and tools.

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

40 days

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, filters, flanges 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.
Work at height, high pressure cleaning, chemical cleaning. Lifting risks.
Prevention: work permit types and validity; purpose & use, job safety analysis, responsibilities.

Module 2: ROTATING EQUIPMENT (technology) — 5 d

Pumps: different types of pumps. Technology of centrifugal pumps and positive displacement pumps. Mechanical seals: different layouts, related ancillary systems. Start-up and operation monitoring: specific case of hot pumps, LPG pumps, vacuum pumps. Troubleshooting.
Reciprocating and rotary positive displacement compressors: different types of positive displacement compressors. Reciprocating compressor architecture: number of stages, cylinders. Ancillaries. Safety devices. Troubleshooting.
Centrifugal compressors: technology of main components and ancillaries; operating window and troubleshooting.
Steam turbines: different families and standard applications. Classification and technology. Operation: start-up and performance monitoring. Speed control, safety devices.

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

Compressor 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 turbomachinery 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.
Component failures: seal leakages, bearing damages, rotor sags, impeller cracks, misalignment. Hydraulic phenomena: cavitation, unpriming, volute effect, surge. *Applications and exercises.*
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), 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: MTM/TECMT-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: MTM/TECMT. Please contact us for more information.

Instrumentation, Control & Electricity

Advanced Certificate

Instrumentation & Process Control Certification

Applications with CORYS IndissPlus dynamic process simulator

Level: ADVANCED

Purpose

This course provides a good knowledge of instrumentation and control systems and facilitates communication with experts to specify, design, operate and improve control systems.

Audience

Engineers and technicians from process industries.

Learning Objectives

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

- read and understand a P&ID,
- select optimal technology for sensors and valves,
- increase control loop performance.

Ways & Means

- Practice on mini process skids with industrial equipment.
- Use of process dynamic simulators.
- Daily quiz to reactivate the key points.

Learning Assessment

Knowledge assessment according IFP Training Certification specific standards.

Prerequisites

Engineering degree in the process industries or equivalent professional experience.

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

5 days

INSTRUMENT LOOPS — *0.5 d*

Function, constitution, signal types. Tag naming conventions and symbolization on Piping & Instrument Diagrams (P&ID).
Control loop and Safety Instrumented Function (SIF).
Application: control and safety loops identification on P&ID.

SENSORS & TRANSMITTERS — *1.5 d*

Technologies to measure and detect the pressure, temperature, level, flow and weight.
Working principles and configuration parameters.
Selection criteria according to process needs.
Applications: mini-process skids workshops (pressure, level and flow measurement).

CONTROL VALVES & ON/OFF VALVES — *1 d*

Technologies and working principle.
Specification parameters (C_v, trim characteristics, air failure, leak class, etc.).
Failure modes.
Accessories (limit switches, solenoid valves, positioners, etc.).
Applications:
C_v calculation and valve selection process.
Mini-process skids workshops: positioner role.

PROCESS CONTROL — *1.25 d*

Controller role and performance criteria.
ON/OFF and PID controller.
Controller tuning methodologies.
Conventional control schemes: split-range, cascade, ratio, override, feed forward, decoupling.
Introduction to advanced process control.
Application: loop tuning on a process dynamic simulator.

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). Multiple safety layers principle.
Application: DCS and safety system operation on process skids.

KNOWLEDGE ASSESSMENT — *0.25 d*

Assessment quiz. Correction.

Reference: IR/INPC Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	31 May	4 June	€3,150

This course is also available in French: IR/ICP. Please contact us for more information.

Design & Operation of a Safety Instrumented System (SIS)

Level: PROFICIENCY

Purpose

This course ensures that design, operation and maintenance of a SIS will meet the expected risk reduction.

Audience

Engineers and technical staff involved in design, operation and maintenance of SIS.

Learning Objectives

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

- specify the expected risk reduction factor,
- understand the Safety Integrity Level (SIL) concept,
- use the IEC 61511 methodology for design and operation.

Ways & Means

- Step by step case study.
- Case studies occurred in industrial plants.
- Proactive teaching methodologies and numerous exercises.

Learning Assessment

Knowledge assessment quiz.

Prerequisites

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 & INDUSTRIAL RISK MANAGEMENT *0.75 d*

Identification of required Safety Instrumented Function (SIF) with safety reviews (LOPA & HAZOP).
Concept of Independent Protection Layer (IPL).
Determination of required Safety Integrity Level (SIL) using a risk matrix.

SIS DESIGN *1.5 d*

Functional Specification: SIF allocation, cause/effect matrix, functional analysis, redundancies and fault tolerance requirements according to SIL.
System specification: Safety Programmable Logic Controller (S-PLC), Man Machine Interface (MMI).
Software specification: voting, maintenance bypasses and sensor signal analysis. Actuators discrepancy management.
Hardware specification: recommended technologies for sensors and actuators.
SIS validation: required documents; Factory and Site Acceptance Tests (FAT - SAT).

SIS OPERATION *0.75 d*

Management of bypasses and changes.
Definition, implementation and optimization of inspection, and test program.

MINI-PROJECT

Step by step application of IEC methodology to a small process unit:
Risk and IPL analysis.
SIS specification.
Test definition including periodicity.
Test procedure validation.

Reference: SEC/SIS-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: SEC/SIS. Please contact us for more information.

Vocational Certificate

Instrumentation Technicians Certification

CERTIFICATION

Level: FOUNDATION

Purpose

Improve instrumentation technicians performance in safety, quality and work efficiency. This course will provide an IFP Training Certification according to the IFP Training procedures.

Audience

Instrumentation technicians from refineries and petrochemical plants.

Learning Objectives

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

- range, configure and commission instruments,
- troubleshoot field instruments and instrument loops,
- perform calibration checks in workshop and on the field,
- write maintenance procedures related to instrumentation.

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 modules and apply the studied subjects to the facilities.
- Workshop practice.
- Exercises on site.
- If available, use of dynamic benches.
- Use of process simulators.
- Intermediate and final tests to evaluate trainee according to IFP Training certification procedure.

Learning Assessment

Knowledge assessment according IFP Training Certification specific standards.

Prerequisites

Basic knowledge in technical and instrumentation.

Why an IFP Training Certification?

- An international recognition of your competencies.
- A Vocational Certificate delivered.
- An expertise confirmed in Instrumentation Technicians Certification.
- Ready-to-use skills.

More info

This course is composed of 7 modules of 5 days each. It includes all the evaluations related to the IFP Training Certification. In case of a local training, the customer will supply all the material and equipment needed for the course, including workshop and tools.

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

35 days

Module 1: PHYSICS & PROCESS FUNDAMENTALS — 5 d

Physics: mass, force, pressure, temperature, flowrate, density concept and units. *Application: pressure gage, temperature gage and displacer level working principles.*
Process, products and drawings: processing and conversion units overview. Process flow diagram, equipment symbolization. Main properties of products. *Applications: process scheme, use of P&ID's.*
Electricity fundamentals, voltage, intensity, power, Ohm law. *Applications on a transmitter loop load calculation and wirings.*
Safety at work: hazards and risks, protections layers concept, work permit, hazardous area. *Application and case studies.*

Module 2: SENSORS & TRANSMITTERS — 5 d

Local instruments: pressure, temperature, flow and level gages. P&ID symbolization. Range and accuracy.
Process specification. Hook up sketches. *Practical applications: gages selection and replacement. Practical works.*
On/Off sensors: pressure, temperature, level and flow switch. working principles. P&ID symbolization. ON/OFF loops wirings. Range and calibration procedures. *Applications on Process switch calibration and replacement.*
Transmitters, pressure, temperature, level and flow transmitter. Working principles. P&ID symbolization. Process specification. 2 wires and 4 wires Analog loops wirings. Range and calibration procedures. Accuracy calculation. *Applications and practical works.*

Module 3: AUTOMATIC VALVES — 5 d

On/Off valves: process use, technologies, P&ID symbolization, limit switches and solenoid valves, hook up sketches and electrical drawings. *Applications on ON/OFF valve overhaul and troubleshooting. Practical works.*
Control valves: process use, technologies, process specification and sizing, positioners, P&ID symbolization, hook up sketches and electrical drawings, applications on positioner calibration, control valve overhaul, specification and selection.
Applications and practical works.

Module 4: ON THE JOB TRAINING 1 & MINI-PROJECT (safety & sensors) — 5 d

OJT (3 days)

*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 **a written report and 20 minutes presentation** about "Sensors calibration in process units": process role of the selected sensors; safety (work permit, risk analysis, safeguards…); detailed calibration procedures (tools and checklist); results analysis (accuracy, acceptance criteria…).*
The trainee will present its work to other trainees and instructor duringan other module.

Mini-Project - Team Work (2 days)

Each team has to identify the priorities for an assigned instrumentation subject submitted by the lecturer.
Specific hazards and barriers, critical process variables, critical pieces of equipment, critical operations.
Team oral presentation of the results.

Module 5: MAINTENANCE OF DCS (Distributed Control System) LOOPS — 5 d

DCS: technologies, controller, DCS architecture, power supplies. *Application: DCS architecture review. Practical works.*
Control schemes: single, cascade and split-range control, ratio and overrides, controller tuning.
Application: PID controller tuning (workshop on process simulators).
DCS loops troubleshooting: DCS loops drawings, troubleshooting methodology. *Applications: DCS loops wiring analysis (from field to control room); DCS loops maintenance procedure writing. Applications and practical works.*

Module 6: AUTOMATISMS, SEQUENCES & SAFETY SYSTEMS — 5 d

PLC and relays: technologies, controller, power supplies, programming tools. *Application: electrical motor commands review (on site).*
Logic: logic gates, typical function blocs (bypass, voters…). *Application: PLC programming (in workshop).*
Safety Instrumented Systems (SIS): process role, safety matrix, SIL, SIS specific requirements for maintenance.
Troubleshooting methodology. *Applications and practical works.*
Applications: SIS loops wiring analysis; PLC logic diagram analysis; SIS loops test procedure writing; test of a safety transmitter.

Module 7: ON THE JOB TRAINING 2 & FINAL TEST (valves, DCS & PLC) — 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 "Valves, DCS and PLC loops maintenance in process units": process role of the selected loops and control valves; safety (work permit, risk analysis, safeguards…); selected instrument specification review; detailed maintenance procedures (calibration and overhaul); 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: IR/INSTECH — Only available as an In-House course.

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

Introduction to Industrial Electricity

Level: DISCOVERY

Purpose

This course provides an overview on industrial electricity; how it is generated and distributed in petrochemical plants.

Audience

Operators, supervisors and engineers from any department.

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.

Ways & Means

- Numerous drawings and datasheets used in the industrial plants.
- Daily quiz to reactivate the key points.
- Practical exercises and case studies.

Learning Assessment

Knowledge 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

5 days

FUNDAMENTALS IN INDUSTRIAL ELECTRICITY *1 d*

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 *2 d*

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 *1 d*

Electrical shocks. Direct and indirect contacts.
Collective and personal protective equipment. Hazardous areas. Basics in safety.
Prevention against electrical shocks, LockOut TagOut Procedure (LOTO).

INTRODUCTION TO MOTORS *0.5 d*

Different type of motors. Operation and technology. Working principle of induction and synchronous motors.
LV & HV motors. Troubleshooting.

DESCRIPTION OF STEAM TURBINES GENERATORS *0.5 d*

Electrical power generating set. Technology. Coupling.
Main technical characteristics of these types of equipment.

Reference: IR/ELECBAS Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Electrical Maintenance for Industrial Plants

Level: FOUNDATION

Purpose

This course provides a better understanding of electrical equipment such as generators, motors and power grids. It includes performances, operation, maintenance, hazards and safety.

Audience

Electrical technicians, supervisors and inspectors, operation and maintenance staff as well as reliability engineers.

Learning Objectives

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

- understand a plant grid and its structure,
- master electrical equipment including motor operating principles,
- detect the main disturbances and failures related to electrical motors,
- list main maintenance procedures on these types of equipment,
- understand the roles of the safety parts.

Ways & Means

- Drawings and datasheets used in the industrial plants.
- Practical exercises and case studies.

Learning Assessment

Knowledge assessment quiz.

Prerequisites

Basic knowledge in electricity.

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

CHARACTERISTICS OF PLANT ELECTRICAL DISTRIBUTION — *0.5 d*

Purpose of electrical distribution, characteristics of the grid. One line electrical diagram.
Main grid, auxiliary grid, safety grid. *Application to a typical grid.*

SUBSTATION EQUIPMENT & WORKING PRINCIPLE OF SWITCHGEAR - MAINTENANCE — *2 d*

Purposes and uses of equipment, as well as its first level maintenance.
Operation and technical characteristics.
Transformers: purpose of transformer on a power grid; operating principle, single phase to tri phases; windings connection and protections. Preventive maintenance.
Circuit breakers: operating principle, technologies, main failures.
Cables, switchboards, equipment, relays, diesel generators, batteries, chargers and UPS. Equipment monitoring.
Gas insulated substation: principle and technology.

SAFETY EQUIPMENT & RELIABILITY — *1 d*

Main types of protections. Earthing system choice LV&HV: advantages and drawbacks.
Selectivity of protections: mains techniques. Protection relays. Insulation monitoring.
Hazardous area (ATEX) equipment: standards and maintenance rules.
LockOut - TagOut procedures (LOTO).

INDUCTION & SYNCHRONOUS MOTORS — *1 d*

Operation and technical characteristics (intensity, efficiency, power factor and torque).
Field of use of power and voltage range HV & LV. Technology and hazardous area (ATEX).
Variable speed drive, type of drives; consequences on the grid. Electrical protection of motors.
Synchronous motors: torque control, excitation, different technologies.
Induction motors: various types of starting according to the mechanical load & power of the motor. Constraints from the grid; maximal numbers of launches. *Applications & case studies.*

STEAM TURBINES GENERATORS — *0.5 d*

Main parameters of the steam turbine generator. Technology and operation of the electrical generator.
Isolated mode and coupling of the generator: impact on the grid.
Application: maintenance case studies.

Reference: IR/ELECMAIN Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Electrical Motors: Technology, Operation & Maintenance

Level: ADVANCED

Purpose

This course focuses on the technical development of industrial electrical motors.

Audience

Electrical and mechanical engineers, supervisors, technical staff 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.
- Motor disassembly and assembly in case of an available workshop.

Learning Assessment

Knowledge 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

5 days

OPERATION PRINCIPLE & TECHNOLOGY *2 d*

Working principle of induction and synchronous motors.
Features: power, current, torque and power factors.
Technology and main parameters.
Protective modes in regards with external environments: temperature classes, protection class index, hazardous area motors, ATEX protection.
Electrical and thermal protection of the motor as well as the use of temperature sensors.
API 541 asynchronous guidelines for refinery and petrochemical motors.
Efficiency motor's standards IEC 60 034-30/IEEE 112.

VARIABLE SPEED FEATURES *1 d*

Power and HV/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). Advantage for driven centrifugal machines.

INSTALLATION *0.5 d*

Main characteristics and constraints for a motor installation.
Skid and shim. Shaft alignment. Comparison to reference datasheets.

FAILURE DIAGNOSIS IN OPERATION *0.5 d*

Bearings: temperature, vibration, lubrication monitoring. Mechanical failures, vibration footprint.
Impact of magnetic rotor unbalancing and leak of current. Electrical impairment of the rotor: noise and vibration analysis.

CONTROL & REPAIR TECHNIQUES - PRACTICAL WORK *1 d*

Part identification in workshop.
Bearings assembly, housing repair, clearance and concentricity control.
Electrical insulation and phases balancing control.
Impact of frequency inverters and harmonics on electrical coils insulation and the bearings.
Coil insulation repairs: vacuum coils impregnation, technology and quality. Rewinding and coils positioning according to magnetic circuit's notches. Electrical controls (electrical resistance, insulation, polarization…).
Balancing: quality standards, unload and load tests. Repair specification: specification content as well as work acceptance.
Visit of a motor repair workshop.

Reference: IR/OMIEM Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: MTM/EIMEA. Please contact us for more information.

Vocational Certificate

Electrical Technicians Certification

CERTIFICATION

Level: FOUNDATION

Purpose

Improve electrical technicians performance in safety, quality and work efficiency.
This course will provide an IFP Training Certification according to the IFP Training procedures.

Audience

Electrical technicians from refineries and petrochemical plants.

Learning Objectives

At the end of the course, participants will be able to:
- apply electrical safety rules,
- identify equipment used for the grid,
- perform checks in workshop and on the plant,
- explain electric motors and generators technology,
- write/validate electrical maintenance procedures.

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 modules, and apply the studied subjects to the facilities.
- Workshop practice.
- Exercises on site.
- Intermediate and final tests to evaluate trainee according to IFP Training certification procedure.

Learning Assessment

Knowledge assessment according IFP Training Certification specific standards.

Prerequisites

Basic knowledge in technical and electricity.

Why an IFP Training Certification?

- An international recognition of your competencies.
- A Vocational Certificate delivered.
- An expertise confirmed in Electrical Technicians Certification.
- Ready-to-use skills.

More info

This course is composed of 7 modules of 5 days each. It includes all the evaluations related to the IFP Training Certification. In case of local training, the customer will supply all the material and equipment needed for the course, including workshop and tools.

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

35 days

Module 1: ELECTRICITY FUNDAMENTALS, PROCESS & SAFETY — 5 d

Electricity fundamentals. Voltage. Intensity. Power. Ohm law. Main characteristics of cables and wirings.
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/TAGOUT PROCEDURES — 5 d

Electrical protection: electrical hazards for human body and material; equipotential connections, grounding protection.
Fuses - Circuit breakers - Selectivity of protections: main techniques. Protection relays. LV & HV earthing system: protections and preventive measures. Reliability and safety.
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: racking-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)
Presentation of OJTs to the classroom.
Written test about all the training contents according to the IFP Training Certification procedure.

Reference: IR/ELECTECH — Only available as an In-House course.

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

Maintenance & Works Supervision

Maintenance Policy & Equipment Reliability

Maintenance & Works supervision

Advanced Certificate

Maintenance Management & Equipment Availability Certification

CERTIFICATION

Level: ADVANCED

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.

Audience

Engineers, supervisors and staff involved in maintenance and equipment availability enhancement.

Learning Objectives

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

- implement and optimize maintenance policy,
- understand reliability analysis and improvement techniques,
- 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

This course is part of the professional framework of an expert in Oil & Gas maintenance. A basic maintenance knowledge is then requested.

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

5 days

MAINTENANCE POLICY *1.5 d*

Safety, cost, schedule and quality objectives. Integration of the maintenance policy within the company.
Reliability methods: criticality Analysis, TPM, RCM. Various types of maintenance: corrective, preventive, condition-based.
Applications: criticality rankings, priorities and spare parts management.
Maintenance subcontracting: reasons, risks and control. Different types of maintenance contracts. Maintenance audits.
Inspection plans: goals of an inspection department, links with maintenance work.
Risks Based Inspection and basics in Safety Instrumented Systems (SIS).

IMPROVING THE RELIABILITY & MAINTENANCE COSTS *2 d*

FMECA, RCM, Fault Tree analysis: application, basic techniques, estimates and probabilities. Maintenance action plan and implementation.
Reliability Key Performance Indicators: MTBF, MTTR, availability.
"Bad actors" detection and classification.
Redundancies studies, on-site spare management and models.
Overall cost of failure: non efficiency costs.
Life Cycle Cost (LCC). Application to investment choices.
Spare parts management: risks and costs.

IMPROVING THE MAINTENANCE WORK MANAGEMENT *1 d*

Routine maintenance: from the notification to the work acceptance.
Work scheduling: task sequencing, procedures and work planning.
Resource optimization.
From failures management to equipment management.
Operation department contribution to maintenance optimization.
Requirements for safety. Prevention.
Analysis and action plans following accidents related to a maintenance department.

TURNAROUND MANAGEMENT *0.5 d*

Turnaround justification: local regulation, maintenance, projects. Standard data used for a turnaround. Steering committee, organization and Key Performance Indicators. Financial breakdown and cost estimate. Detailed preparation and works management.

Reference: OMT/GEMA-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	29 November	3 December	€3,150

This course is also available in French: OMT/GEMA. Please contact us for more information.

Routine Maintenance Optimization

Level: PROFICIENCY

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

The participants need to have basic maintenance knowledge.

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

ROUTINE MAINTENANCE & MAIN OBJECTIVES *2 d*

Types of maintenance: preventive, corrective, condition based.
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.
Work specifications: main chapters. Different types of contracts. Bidding.
Safety and quality management. Contractor selection, audits, partnerships. Key performance indicators. 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.
Job safety analysis. Prevention plans and work permits: regulation, education, constraints. Responsibility of the personnel.
Personal protective equipment.
Quality control plan: audit, quality audits, contractor management.
Progress monitoring: physical progress, indicators (KPI's), schedule and critical path. Statements and checks on site.
Work acceptance: use of checklists, punch lists, interfaces management with production and inspection department.

Reference: OMT/RMO Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Turnaround Management

Level: PROFICIENCY

Purpose

This course provides an overall strategy to achieve the main turnaround objectives: safety, deadline and budget compliance.

Audience

Engineers and staff (from maintenance, purchasing, project organization, and operation) involved in turnaround management for refining or petrochemical plants.

Learning Objectives

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

- list the various steps of turnaround preparation and execution,
- be aware of the typical errors and pitfalls in a turnaround context,
- recognize the conditions for successful turnaround management,
- determine the best practices to deal with own turnaround, in order to optimize cost, duration and safety.

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

The participants need to have basic maintenance knowledge.

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

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.
Scheduling: overview, detailed planning and milestones.
Safety plan - Logistics.
Scope challenge: internal and external review.
Team building techniques.
Contracting plan preparation: 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.
Job safety analysis. Prevention plans and work permits: regulation, education, constraints. Responsibility of the personnel.

Reference: OMT/TURNMAN Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: OMT/OTAU. Please contact us for more information.

Equipment Basic Maintenance

Level: DISCOVERY

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

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

5 days

BASICS IN STATIC EQUIPMENT *1.5 d*

Different types of piping valves and flanges types, valve types, standards and selection criteria.
Distillation columns: operating principle; technology, fundamentals.
All types of heat exchangers: technology, selection criteria.
Furnaces and boilers: operating principle; technology, control and safety features.
Tanks and vessels: different types of storage tanks: fixed & 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.
Main maintenance procedures.
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.

Reference: OMT/EBM Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Graduate Certificate

Maintenance Engineer Certification

CERTIFICATION

Level: FOUNDATION

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

The participants need to have a basic technical knowledge.

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

75 days

Module 1: PRODUCTS & PROCESSES IN OIL & GAS & PETROCHEMICAL PLANTS — *5 d*

Main processes: oil, reforming, isomerization, hydrorefining, conversion units. Gas treatment. Petrochemical and chemical processes. Manufacturing flowsheets. Control, Operation and safety.

Modules 2, 3, 4: STATIC EQUIPMENT - THERMAL EQUIPMENT - CORROSION — *15 d*

Overview of materials, steel structure. Static equipment technology: piping material, flanges, valves. Vessels, columns, reactors, storage tanks…

Standard heat exchangers. Different types of furnaces and their characteristics. Boiler technology. Operating conditions. Burner technology.

Standard and specific types of corrosion in Oil & Gas plants. Detailed description of all types. Corrosion prevention and monitoring. Inspection plan.

Modules 5, 6: INSTRUMENTATION, PROCESS CONTROL, ELECTRICITY — *10 d*

Sensors, transmitters, control valves. Distributed Control System. Safety Instrumented Systems.

Process identification. Control strategies. Tunings. Application: loop tuning on dynamic simulator.

Fundamentals in industrial electricity. Distribution and Network. Electrical hazards. Electrical cabinets and stations. Different types of motors. Transformers. ATEX standard. Industrial alternators.

Modules 7, 8, 9, 10: ROTATING EQUIPMENT: TECHNOLOGY, OPERATION & MAINTENANCE — *20 d*

Different types of pumps. Operating principle and technology. Performance curves.

Mechanical seals. Operating limits & troubleshooting. Start-up and operation monitoring. *Case studies.*

Different types of positive displacement compressors. Reciprocating compressor. Technology of main components and ancillaries. Process conditions on compressor performance. Safety.

Flow control, specific safety devices. Start-up philosophy. Troubleshooting. Use of a dynamic simulator.

Description of a multi-stage centrifugal compressor. Technology of components and ancillaries. Performance curves. Operating window: speed limits, surge, typical anti surge protection systems. Flow control. Transient phases. Troubleshooting. Safety. Dynamic simulator.

Steam turbine, different families, standard applications. Operating principle, classification and technology: number of stages, exhaust conditions, expansion process through the machine.

Operation: start-up and performance monitoring. Speed control, safety devices.

Gas turbine design and performance, main types. Influence of environmental conditions. Impact of suction and exhaust friction losses on turbine performance.

Modules 11, 12, 13, 14: MAINTENANCE MANAGEMENT, RELIABILITY & SAFETY — *20 d*

Maintenance policy: goals safety, costs, schedule, quality. Sub-contracting. Reliability and costs optimization: FMECA, RCM, FTA, TPM, MTBF, MTTR… Global cost of failure.

From notification to work completion: demand, notification, emergency, preparation, planning, material, job safety analysis. Costs estimate. Work planning: tasks sequencing, procedures and work scheduling. Resources optimization.

Precommissioning, commissioning and work acceptance phases. Plant start-up.

Plant turnaround justification and frequency. Organization, scope, challenge, schedule. Financial breakdown. KPI's.

Job safety analyzes. Risks due to works on site: lifting, scaffolding, welding, confined spaces, cleanings, X-rays, etc. LOTO procedure and prevention, work permit.

Module 15: FINAL PROJECT — *5 d*

Team work. Subject dealing with technical and maintenance.

Submission of an individual written report by the participant. Oral presentation of the findings to a Jury according to the IFP Training Graduate Certificate process.

Reference: OMT/MAINENG Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: OMT/INGMAINT. Please contact us for more information.

Graduate Certificate

Petroleum Studies in Maintenance

CERTIFICATION

Level: ADVANCED

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.

Prerequisites

No prerequisites for this course.

Why an IFP Training Certification?

- An international recognition of your competencies.
- A Graduate Certificate delivered.
- An expertise confirmed in 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

60 days

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: EIM/GDMAINT Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

See our website www.ifptraining.com for more information and contact Bahrain office.

Operation in the Downstream Industry

Vocational Training Courses for Operation Teams

Selection & Training of the Production Staff

Console Operator Training

OLEUM

Level: FOUNDATION

Purpose

Provide the necessary knowledge to adapt quickly and efficiently to the consoliste 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 pedagogical plant.
- Remindings 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 OLEUM's facilities (subject to availability).

Learning Assessment

Quiz, cases studies and practical exercises.

Prerequisites

- Perform all the tasks of a field operator safely.
- 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

20 days

WELCOME-ASSESSMENT — 0.5 d

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 — 4 d

Process control and automation:
- Fluid mechanics: pressure, flowrates, fluid flow, pressure drops.
- Reading of PID/PFD, 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 help device.
- SOE (Sequence Of Event); defaults view (restitution).
- Report of inhibition. Safety bypass. Safety interface.
- 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 P, I and D parameters; typical instrument failures.*

THERMAL EQUIPMENT — 3 d

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 — 3 d

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).*
- *Malfunctions/deficiencies: analysis, troubleshooting, diagnostics. Pumping conditions.*
- *Start-up and shutdown sequences: full-scale volumetric compressor and generic simulator applications.*

PRODUCTS - PROCESSES - OPTIMIZATION — 4.5 d

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.
- *Generic 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.
- Equipment function. Internal reflux, pumparounds. Heat balance.
- 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). Slop management and origins, interlinked utilities/processes: management of flare and FG networks (SO_2 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 — 5 d

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: OPE/FBMOCIR-E — Can be organized as an In-House course. — Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Martigues	**9 March**	**3 April**	**€9,000**

This course is also available in French: OPE/FBMOCIR. Please contact us for more information.

Vocational Certificate

Refining & Petrochemicals Operations Shift Supervisor Certification

CERTIFICATION

Level: FOUNDATION

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.
- Role playing simulation.

Learning Assessment

Quiz.

Prerequisites

- General technical knowledge: equipment, safety in operations and maintenance, processes, utilities, environment. Excellent technical knowledge of the assigned units with detailed operating conditions and associated physical phenomenon, hazards and equipment used.
- These knowledge and skills have to be completed before the training with other existing specific trainings if trainees' profile not fully matches prerequisites.

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: OPE/CDQRC-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: OPE/CDQRC. Please contact us for more information.

Vocational Certificate

Panel Operator Certification

CERTIFICATION

Level: FOUNDATION

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.

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.

Course Content

35 days

PANEL OPERATOR DUTIES & CONTROL ROOM ACTIVITIES — 2 d

Panel 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

Notions of industrial chemistry. Fluid mechanics: pressure, flowrates, fluid flow, pressure drops.
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

Process control:
Constitution of a control loop, symbols used. Sensors and transmitters. Control valves.
Controllers operating principles, inputs/outputs, internal parameters and tuning.
Complex control loops (cascade, split range, multiple calculation blocks). Advanced control basics.
Simulators: Valves characteristic curves. PID parameters tuning. Heat exchanger duty control. Split range configuration. Behavior analysis of complex control loops.
Distributed Control System (DCS):
Architecture and system components. Man - Machine Interface (MMI). Trends tools. Information flux between site and control room.
Automation:
Safety instrumented systems: PSS, ESD, HIPPS, EDP; architecture and relationship with DCS. Safety logics and cause & effect matrix.
PLCs and automation: grafcet analysis, study of specific sequences.
Simulators: furnace safety logics.

EQUIPMENT OPERATION — 8 d

For each: working principles, technology, ancillary systems, process control scheme monitoring, operation, alarms, safety devices.
Pumps, compressors, drivers:
Simulators: filters switch, operation of pumps; changes in operating conditions, capacity control of compressors, troubleshooting of a compressor; start-up of a steam turbine driven centrifugal compressor.
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, hydrotreatment 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 round 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: OPE/FBMOC-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: OPE/FBMOC. Please contact us for more information.

Vocational Certificate

Field Operator Certification

An established methodology for training operators in Oil & Gas/Chemical industry

CERTIFICATION

Level: FOUNDATION

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

- Having already been pre-recruited by an Oil & Gas company.
- Although not mandatory, a technical education is desirable.

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

60 days

CLASSROOM TRAINING (theoretical & practical) — *55 d*

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 — *5 d*

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: OPE/BO-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: OPE/BOALT. Please contact us for more information.

Vocational Certificate

Field Operator Training Course

CERTIFICATION

Level: FOUNDATION

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 assessment.

Prerequisites

- Participants should have already been recruited by Oil & Gas company.
- Although not mandatory, a technical education or background is desirable.

Why an IFP Training Certification?

- An international recognition of your competencies.
- A Vocational Certificate delivered.
- An expertise confirmed in Field Operator Training Course.
- 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

180 days

CLASSROOM TRAINING (theoretical & practical) — *40 d*

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 hoses.

Module 2: Instrumentation - Schematization

Common types/purpose of sensors. Automated valves. Control/Safety loop basics. Instrument field monitoring. PFD. P&ID: symbols, equipment identification, field verification, drawing from field. Isometric diagram highlights.

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.
Operating risks, safe behavior. Field monitoring. Normal shutdown/start-up. Identification of abnormal situations.

Module 6: Compressors

Most common compressor types, purpose and operating principle. Purpose and description of auxiliaries.
Field risks. Compressor monitoring. Identification of anomalies. Basic field operations (lubrication, drainage).

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 additivation).

Module 8: Steam turbines - Job practice

Purpose and operating principle of a steam turbine. Auxiliaries. Basic turbine monitoring. Commissioning/startup.
Shift handover (communication, priorities). Field technician rounds (observations, data collection, reporting).

ON THE JOB ORIENTATION — *80 d*

Practical application on the field, during two weeks, of the learnings of each of the classroom modules above.
Close supervision of an IFP Training instructor.

ON THE JOB TRAINING — *55 d*

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 — *5 d*

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: OPE/FOT-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Operator Basic Training Course

Level: FOUNDATION

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

No prerequisites for this course.

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

40 days

For each equipment type: principle, technology, ancillary systems, monitoring, basic operations, risks, safety devices, good practices.

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&ID. 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.

Reference: OPE/FTBO-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: OPE/FTBO. Please contact us for more information.

Assistance in Operator Recruitment

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

Decision taken by the company to undertake operator recruitment.

More info

This service is particularly recommended when organizing of 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.

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.

Reference: OPE/RECRUT-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: OPE/RECRUT. Please contact us for more information.

Mentors Training Course

Supervision of field operators following a certification training

Level: PROFICIENCY

Purpose

This course provides help to mentors in order to fulfill their mission in the operator training program.

Audience

Mentors in charge of training field operators onsite.

Learning Objectives

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

- insure the smooth integration of beginner operators in their shift team,
- train practically the beginner operators on the field,
- verify that they have actually acquired the required knowledge and competency,
- communicate effectively with the trainee and other stakeholders (in-house training department, IFP Training).

Ways & Means

- Role playing, putting the new trainers in various training situations on an industrial site.
- Extensive group discussions.
- Training situations based on actual incident reports.

Learning Assessment

Quiz.

Prerequisites

Excellent knowledge of the operating unit assigned to the trainee.

More info

This training course is also suitable for Operations staff mentoring colleagues to new positions. 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

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: OPE/TUTBO-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: OPE/TUTBO. Please contact us for more information.

Train the Trainers

Level: PROFICIENCY

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

- Good knowledge of the plant.
- Personal interest in educating others.

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.

Course Content

5 days

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.

Reference: OPE/TRAIN-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: OPE/TRAIN. Please contact us for more information.

Soft Skills Toolbox

Level: FOUNDATION

Purpose

This course aims at communicating in a better way in order to deal with most of the common professional situation.

Audience

Graduate engineers from all technical disciplines.

Learning Objectives

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

- put in practice the learned soft skill disciplines,
- write better technical reports,
- communicate efficiently with colleagues, customers and suppliers,
- avoid pitfall situations, related to soft skills and emotional intelligence.

Ways & Means

- Participative lecturing.
- Numerous case studies.
- Team work/mini-project.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

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

Course Content

5 days

COMMUNICATION SKILLS *0.5 d*

Interpersonal communication - Understanding people - Different styles recognition. Basic skills - Really listening - Tuning in - Meetings - Rapport - The empowering route. Bridging differences - Reaching agreement.

TEAM BUILDING *0.5 d*

People as working environment - Understanding ourselves and other people. Creating rapport - Handling conflicts. Managing your impression - Ten tips for intercultural harmony.

PRESENTATION SKILLS *0.5 d*

Your plan - Your audience - Your Message - Your opening and closing.
Your audio visual aids - Yourself - Miscellaneous.

TECHNICAL REPORT WRITING *0.5 d*

Identification and use of the key features engineering report-writing.

CONFLICT *0.5 d*

Exploring conflict - Knowing yourself - Understanding conflict - Values and perceptions. Resolving conflict situations.

COACHING & DEVELOPING PEOPLE *0.5 d*

Principles of coaching - Purpose, impact and importance of goals - Features of great goals - Deep questioning use - Sequencing questions employment - Summarization and reflection - Progress obstacles identification - Unhelpful assumptions avoidance.

MINI-PROJECT *2 d*

Reference: OPE/BOC-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	12 July	16 July	€3,150

HSE

Introduction to Process Safety Engineering

Level: FOUNDATION

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.

Ways & Means

The pedagogy is active and builds on the experience of the participants and the knowledge of the site:

- interactive lecturing, by experienced instructor(s),
- several exercises and applications (50% case studies or tutorial exercises),
- a number of visual aids: videos, learning from incidents (Texas City, Buncefield, Achinsk…).

Learning Assessment

Quiz.

Prerequisites

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 *1.5 d*

Risk identification and acceptability with respect to people, environment and assets - Hazard and risk - Residual 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 *0.25 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*

Safety barriers: technical, organizational, human; prevention, mitigation, protection, active/passive. Criteria of safety barriers' efficiency.

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 *0.5 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, utilization, 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 *1 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.

Reference: SEC/SAFENGRC-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: SEC/SAFENGRC. Please contact us for more information.

Analysis of Technological Risks

HAZID, HAZOP, LOPA…

Level: FOUNDATION

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

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

5 days

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):
Overview of the method. Evaluation of the consequences. Probability, IRPA, societal risk, FN curves.
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: SEC/REVSEC-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: SEC/REVSEC. Please contact us for more information.

Blended Learning

NEW Safety in Plant Operation

Level: FOUNDATION

Purpose

This course provides trainees with a better understanding of product and equipment risks in order to ensure safe operation.

Audience

Operating personnel (engineers, shift leaders and/or operators) 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

- 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

No prerequisites for this course.

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 figures.
Potential hazards in facilities.
Product hazards classification.

Module 2 - FLAMMABILITY
Combustion phenomenon.
Ignition sources and consequences of a combustion.
Preventive measures against ignition risks.

Module 3 - OCCUPATIONAL HEALTH
Products toxicity.
Some substances features.
Chemical risk prevention.

Module 4 - FLUIDS BEHAVIOR
Pressure in a vessel.
Consequences of adding heat to a substance.
Consequences of removing heat to a substance.

TRAINING SESSION (4 days)

PRODUCTS HAZARDS: PREVENTION & OPERATING PRECAUTIONS *1 d*
Case studiesinvolving product risks analyzed in subgroups, in order to strengthen concepts included in the e-learning.Share ideas with 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, work permits…
Entry 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.

IMPLEMENTATION OF THE PRINCIPLES & GUIDELINES
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 procedure, 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: SEC/SAFETY Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	28 September	1 October	€3,150

This course is also available in French: SEC/SECOP. Please contact us for more information.

Blended Learning

NEW Safety in Storage & Loading Operation

Level: PROFICIENCY

Purpose

This course provides a better understanding of product and equipment risks in order to increase safety behavior in storage and discharge operations.

Audience

Operating personnel (engineers, shift leaders and/or operators) 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

- 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.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

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.

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 figures.
Potential hazards in facilities.
Product hazards classification.

Module 2 - FLAMMABILITY
Combustion phenomenon.
Ignition sources and consequences of a combustion.
Preventive measures against ignition risks.

Module 3 - OCCUPATIONAL HEALTH
Products toxicity.
Some substances features.
Chemical risk prevention.

Module 4 - FLUIDS BEHAVIOR
Pressure in a vessel.
Consequences of adding heat to a substance.
Consequences of removing heat to a substance.

TRAINING SESSION (4 days)

PRODUCTS HAZARDS: PREVENTION & OPERATING PRECAUTIONS *0.75 d*
Case studies involving product risks analyzed in subgroups, in order to strengthen concepts included in the e-learning. Share ideas with entire group. Lessons learned.

PLANT RELATED RISKS - SAFEGUARDING EQUIPMENT *1 d*
Atmospheric and under pressure storage tanks: different kinds of construction, compressive and vacuum strength, safeguarding equipment (vents, relief valve, hydraulic safety shut-off valves, positive safety valves, etc.).
Safety in tank storage operation. Typical incidents.
Loading/unloading tank truck, tank wagon, oil tanker, etc.: loading station layout (top or bottom), safe automation and facilities, vapor recovery.

SAFETY IN STORAGE TANKS COMMISSIONING & DECOMMISSIONING OPERATIONS *2 d*
Successive stages: utilities used (nitrogen, water, air, gas oil, etc.).
Draining-blowdown: depressurization, degassing, inerting.
Lockout/Tag-out procedure: blinding, ventilation, confined space entry.
Works permits: endorsement and responsibilities.
Commissioning and start-up.

HUMAN BEHAVIOR & SAFETY CONTROL *0.25 d*
Strict discipline: understanding and compliance with procedure, safety barriers, risk of routine.
Employees' involvement: commitment and responsibility.
Risk level assessment: accident, near miss, unsafe acts.
Field agents: safety department, medical department, health safety and working conditions committees.

Reference: SEC/SAFETYSTO Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	6 July	9 July	€3,150

This course is also available in French: SEC/SECORSE. Please contact us for more information.

E-learning

NEW

Occupational Health & Safety

Products Hazards - Prevention & Operating Precautions

Level: PROFICIENCY

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

No prerequisites for this course.

More info

This module is also available in French.

Course Content

VOCABULARY & SAFETY FIGURES

Hazard, risk and accidents: definitions and associated consequences.
Occupational accidents: figures and trends.

POTENTIAL HAZARDS IN FACILITIES

Occupational risk reduction: human, organizational, technical factors.
Human being: advantages, weakness and limits.

PRODUCT HAZARDS CLASSIFICATION

REACH regulation, SGH recommendation, CLP regulation: objective and field of application.
Hazards classification and linked definition.
Hazardous material characteristics: where can you found relevant information?

Reference: SEC/SECO1-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: SEC/SECO1. Please contact us for more information.

E-learning

NEW

Flammability

Products Hazards - Prevention & Operating Precautions

Level: PROFICIENCY

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

No prerequisites for this course.

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 1 CONSEQUENCES OF A COMBUSTION

Ignition sources: energy required level.
Different ignition sources available on a plant: flames, static electricity, self-ignition temperature, sparks, pyrophoric products…
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.

Reference: SEC/SEC02-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: SEC/SEC02. Please contact us for more information.

E-learning

NEW

Occupational Health

Products Hazards - Prevention & Operating Precautions

Level: PROFICIENCY

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

No prerequisites for this course.

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.

SOME SUBSTANCES FEATURES

Anoxia phenomenon.
CMR compounds: identification and prevention.
Some toxic materials features: H_2S, carbon monoxide, ammonia.

CHEMICAL RISK PREVENTION

General prevention principle implementation.
Gas detection means and personal protective equipment.
Material safety datasheet analysis.

Reference: SEC/SEC03-E Only available as an In-House course.

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

This course is also available in French: SEC/SEC03. Please contact us for more information.

E-learning

NEW

Fluids Behavior

Products Hazards - Prevention & Operating Precautions

Level: PROFICIENCY

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 within a fluid under pressure.

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

More info

This module is also available in French.

Course Content

PRESSURE IN A VESSEL
Definition and reminder on physical quantities.
Pressure effect in a vessel full of, gaseous, liquid gas, or liquid.
Vaporizing pressure curve analysis.

TEMPERATURE INCREASE EFFECTS & CONSEQUENCES
Case of a vessel full of, gaseous, liquid gas, or liquid.
Specific phenomena: BLEVE, slop-over, froth-over, boil-over.

TEMPERATURE DECREASE EFFECTS & CONSEQUENCES
Collapsing risks due to vacuum.
Freezing due to pressure drop.

Reference: SEC/SEC04-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: SEC/SEC04. Please contact us for more information.

Safety in Maintenance & Construction Works

Level: FOUNDATION

Purpose

This course provides expert knowledge of risks related to construction and maintenance works and insight on how to promote safety practice and ensure safer work conditions and behavior.

Audience

Maintenance, operational and SHE staff who handle work permits and monitor contractors on operating plants. Contractors personnel, supervisors, engineers, foremen and crew leaders who implement maintenance and construction works.

Learning Objectives

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

- understand legal requirements, safety rules and practices,
- learn about collective protection measures and personal protective equipment required at work,
- be aware of the specific responsibilities of contractors and owners,
- improve individual behavior and obtain greater commitment from contractors' personnel for safer operations.

Ways & Means

- Detailed case studies based on actual accidents or incidents.
- Sharing of experiences among participants.

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

4 days

OCCUPATIONAL HEALTH & SAFETY *0.25 d*

Occupational safety, work conditions and prevention: accident causes and their consequences, investigation, reporting and cost impact - Occupational diseases.
Identification and analysis 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: SEC/SECTRA-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: SEC/SECTRA. Please contact us for more information.

HSE Daily Involvement

Level: FOUNDATION

Purpose

This course provides a positive overview & understanding of implemented tools from plant's Health Safety Environment (HSE) Management System.

Audience

All plant staff (operation, maintenance, engineering, laboratory…).

Learning Objectives

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

- realize HSE is embedded in each of their tasks,
- understand their role regarding HSE processes and expected results,
- use main plant 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

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

2 days

ACHIEVING SAFETY COMMITMENT *0.25 d*

Continuous HSE improvement process. Employer and personal roles and responsibilities. Deliverables.

SAFETY BEHAVIOR AT WORK *0.5 d*

Risk understanding and management for your position: identification, assessment and management with effective barriers. Contribution from a dynamic HSE Management System.

PARTICIPATING TO COLLECTIVE IMPROVEMENT PROCESSES *0.75 d*

Plant safety policy up-to-date: top management direction, Key Performance Indicator (KPI) objectives & follow-up, actions implemented & follow-up. Corresponding origination and skills.
Tools used on a daily basis: procedures, experience sharing, task risk analysis, Management Of Change…

INDIVIDUAL BEHAVIOR - HUMAN RELIABILITY *0.5 d*

HSE awareness, acting as the owner: observation, reacting to errors and standards not respected.
Human reliability.

Reference: SEC/SHEINVOL Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Safety Leadership

Level: FOUNDATION

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

No prerequisites for this course.

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

3 days

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: SEC/SAFLEAD Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Improve Your HSE Management System

Level: ADVANCED

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

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

3 days

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*

Human behavior, strengths and weaknesses, adaptation to evolving situations.
Ergonomics. User-friendly equipment, environment and procedures. Path for improvement.
Lessons learnt from human errors used positively for improvement. Communication, information and training.

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: SEC/SHE-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

Technological Risk Awareness

Level:

Purpose

This training course helps develop a culture of technological risk and highlights the fundamental role of each person 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 associated safety barriers,
- better assess the consequences of not operating/not respecting barriers and the severity of potential accidents,
- contribute to maintaining and improving 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

No prerequisites for this 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

1 day

TECHNOLOGICAL RISK CONTROL *0.25 d*

Tools of progress 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 humans and on facilities (overpressure, thermal flux, toxic cloud...).

ACCIDENT SCENARIO *0.25 d*

Analysis of accidents: taking into account lessons learned, sharing of Learning From Incidents (LFI).
Technical/organizational/human causes. Failing barriers.
Planned barriers: technical, organizational, human, prevention, protection, active, passive.

RISK ANALYSIS *0.25 d*

Risk analysis during design and 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: strong points and limits of the human being, respect for safety rules and systems, the stakes involved, involvement in maintaining barriers, feedback, maintenance of vigilance, exemplarity.
Management and maintenance of barrier effectiveness: actors, role of each before and after a failure, identification and management of risk activities, management of changes, management of barrier inhibitions/shunts and compensatory measures, consequences of disregarding barriers.
Key Performance Indicators (KPIs).

Reference: SEC/RISQTEC-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: SEC/RISQTEC. Please contact us for more information.

Waste Water Treatment

Level: PROFICIENCY

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.

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,
- 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

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

3 days

LOCAL & REGIONAL REGULATIONS *0.25 d*

Operating permit: structure, contents, key chapters, elaboration and updating process.
Waste water specifications. Penalties in case of violation (formal requirements, fines).

WASTE WATER CHARACTERISTICS *0.5 d*

Natural sources and components. Various uses of water in operating units. Effluent rejection points.
Nature of water pollutants (hydrocarbons, acidity, suspended matters, phenols, sulfides, mercaptans).
Analytical methods used in the laboratory and through on-line analyzers. BOD, COD, TOC.
Pollution mechanisms, impact on environment (insoluble, organic carbon, eutrophization, sludge).
Measurement of pollution: pollutant concentrations, quantities by unit of time. Typicals.

PHYSICO-CHEMICAL WATER TREATMENT PROCESSES *1 d*

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.

BIOLOGICAL TREATMENT OF WASTE WATER *0.75 d*

Growth of bacteria colonies. Required feed and nutrients. Biofiltration of process water.
Biological treatment technology: bacteria filters, activated sludge basins. Operating conditions.

BIOLOGICAL SLUDGE TREATMENT *0.5 d*

Thickening methods: settling, press filtration, flocculation-floatation, centrifugation.
Analytical test methods: dry matter, heat value, volatile fractions, heavy metals.
Treatment processes: digester, wet oxidation, thermal hydrolysis, incineration, smell control.

Reference: SEC/WASWATER Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: SEC/TER. Please contact us for more information.

Advanced Certificate

Industrial Safety Engineer Certification

Prevention - Protection - Mitigation

CERTIFICATION

Level: PROFICIENCY

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 accidents case studies.
- Continuous validation, in order to obtain certification.

Learning Assessment

Refer to certification referential

Prerequisites

Engineering degree or equivalent experience within the Oil & Gas 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.

More info

The training is divided into 6 modules of 5 days. The modules may or may not be interspersed with practical periods on the attendees worksite.

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

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*

Phenomenology: phenomena of combustion: combustion of gaseous mixtures, liquids and solids. Effect of combustion. BLEVE/boil-over/backdraft/flash-over.
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.
Firefighting strategies: basic rules, means and methods of intervention, organization and management of rescue, strategy of intervention. Emergency response plans.

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.
Prevention. Collective and personal protection equipment.
Risk management: work station assessment, material safety data sheet, medical check-up.

FINAL ASSESSMENT - SESSION SYNTHESIS — *1 d*

Reference: SEC/SECUIND-E Only available as an In-House course.

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

This course is also available in French: SEC/SECUIND. Please contact us for more information.

Project Management

Engineering Contracts

Level: PROFICIENCY

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

Good knowledge of the Oil & Gas project management 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

3 days

CONTRACTUAL STRATEGY *1 d*

Various engineering contract types, advantages and drawbacks. Selection of the best strategy.
Main equipment purchase. Validation of the FEED specifications.
Interfaces between contracts. Relationship with major international contractors and local design offices.
Management of single-source and monopoly situations. Open bid process.

BIDDING & SELECTION PROCESS *0.5 d*

Prequalification. Instructions to tenderers. Technical and administrative specifications.
Planning and scheduling. Bid evaluation process. Technical alignment. Selection of the best bidder.
Management of financial risks (inflation and exchange rate variations).
Final selection, contract award. Single-source contract. Negotiation process.
Preparation of the bid response by contractor. Regulations. Risk assessment and reduction.

CONTRACT CONTENTS *0.5 d*

Agreement (articles and attachments). Examples of the main chapters. Supplier lists.
Insurance and warranty provisions. Mutual no-claim agreements.

CONTRACT ADMINISTRATION *1 d*

Placing orders and modifications. Progress measurement and control.
Management of claims. Project closing, acceptance, activation of warranty.
Principles and process of negotiation during contract execution.

Reference: PGP/CONTRACT Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	1 December	3 December	€1,940

Practicing commissioning

Practical training using actual educational plant

OLEUM

Level: FOUNDATION

Purpose

This course provides practical knowhow so as to get the participants directly confront the reality of the field.

Audience

Operating and technical staff in charge of commissioning and start-up operations on field.

Learning Objectives

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

- anticipate the risks while commissioning and start-up operations,
- identify the key points of the most current operations,
- proceed to main pre-commissioning and commissioning activities.

Ways & Means

- Experience sharing through applications and cases studies on Oil & Gas units.
- 50% of practical exercises: practicing various activities from end of construction to start-up, on pedagogical units, full scale size, with OLEUM.
- Some pedagogical activities of this course will take place in OLEUM's facilities (subject to availability).

Learning Assessment

Quiz.

Prerequisites

No prerequisites for this course.

More info

Start on Monday 13h30, end on Friday 12h00.

Expertise & Coordination

IFP Training & OLEUM trainers, permanent or contracted, having a good expertise and/or experience in Commissioning & start-up, trained to adult teaching methods, and whose competencies are kept up-to-date.

Course Content

4 days

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.
Commissioning and start-up: a non-linear schedule. SIMOPS. Input data and reference documentation. Punch lists. Management of Change (MOC).

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: PGP/PRACOM-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Martigues	**14 September**	**17 September**	**€3,500**

Advanced Certificate

Management of Site Projects Certification

Level: FOUNDATION

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.
- Refining case study used throughout the course, at each project stage.

Learning Assessment

- Multiple-choice questionnaires.
- The certification is granted to the participants having obtained an average rating of at least 60%.

Prerequisites

Technical knowledge of downstream Oil & Gas operations (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

5 days

FEASIBILITY STUDIES *1.5 d*

Introduction: global context of Oil & Gas downstream (project types, project stages). Project initiation.
Feasibility studies: economic evaluation, technical studies, deliverables. Licensors.
Preliminary project planning (global schedule/constraints, cost estimate principles, main feasibility issues).

BASIC ENGINEERING & CONTRACTING *1.5 d*

Technical package deliverables. Project team organization, FEED contract types and management.
HSE design: tools and techniques, project reviews. Quality/risk management principles and tools.
Optimization of execution schedule. Budget approval. Project execution plan, risk management.
Contracting strategy: contract types and possible scopes. Contractor selection process. Long lead items.

DETAIL ENGINEERING *0.5 d*

Organization charts, project manager roles and responsibilities. Interface definition and management.
Detail engineering management: process, main deliverables, project reviews, engineering systems.

PROCUREMENT *0.5 d*

Management: procurement process, strategy, procurement of Long lead items, best bidder selection.
Quality control plans. Purchasing, expediting, inspection, shipping. Material control systems.

CONSTRUCTION *1 d*

Construction challenges, subcontract types, construction strategy. Construction execution plan and schedule.
Field HSE management, progress control, field quality management during construction. Change management.
Custody transfer: commissioning, start-up, performance tests. Contractual consequences. Warrantees.

Reference: PGP/MRSMPROJ Only available as an In-House course.

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

Engineering Studies during Project

Level: FOUNDATION

Purpose

Technical understanding and sequencing of engineering studies.

Audience

This training is intended for the personnel of contractors and engineering firms involved in the design phases of projects.

Learning Objectives

At the end of the training, participants will be able to:

- define deliverables according to the study phase, for the main disciplines,
- verify the proper execution of studies and interface management,
- evaluate the consequences of a modification, before its integration into the project.

Ways & Means

- Examples and diagrams from Refining/ Chemicals projects, discussed in the form of exercises.
- Mini-project offering practical applications for different engineering disciplines.

Learning Assessment

Multiple-choice questionnaires.

Prerequisites

Operational knowledge of the project process.

Expertise & Coordination

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.

Course Content

3 days

UNDERSTANDING OF PROJECT ORGANIZATION *0.25 d*

Project structure. Main project phases. Design studies scheduling.

ROLE OF ENGINEERING IN A PROJECT *0.25 d*

Its missions: studies, procurement, construction, project management. Identification of deliverables by phases. Conduct of studies on a project. Document management/validation (engineering, customer, vendors, subcontractors).

MAIN DELIVERIES & DISCIPLINE TASKS *2 d*

Analysis of the study basis. Applicable codes and standards. Kick off meeting.
Identification of tasks and deliverables during the study phases until the start of the purchasing process.
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.
Integration of supplier documents in the study process. Management of interfaces between the different disciplines.
Management of study subcontracting.

REVIEWS & OPTIMIZATION *0.25 d*

Most used review methods: HAZID, HAZOP. Design reviews, 3D model review.
Optimization: energy efficiency review. Value engineering.
Evaluation of alternatives and optimal decision making.

KEYS TO SUCCESS *0.25 d*

How to take into account the geopolitical environment of the project, the constraints of objectives and means. Adequacy of the deadlines of completion to the context. Deliverables related to the critical path. Control of modifications.

Reference: PGP/MANEI-E Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: PGP/MANEI. Please contact us for more information.

Project Cost Estimating

Level: FOUNDATION

Purpose

CAPEX estimate of Oil & Gas downstream projects, including financial risk.

Audience

Engineers (owner, contractor) involved in Oil & Gas downstream projects.

Learning Objectives

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

- estimate the cost of a project at its various stages
- evaluate the accuracy of this cost estimate and the main risks of cost overrun.

Ways & Means

Practical estimating exercise.

Learning Assessment

Quiz.

Prerequisites

Operational knowledge of the project management process.

More info

Course consistent with the PMI and AACE standards. Worth 24 PDU.

Expertise & Coordination

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

Course Content

4 days

PROJECT COST ESTIMATING METHODS *0.5 d*

Project management process reminder, including deliverables at each stage.
Definitions, cost references, AACE classes. Direct and Indirect costs. WBS. CAPEX vs. OPEX.

ESTIMATION DURING THE VARIOUS PHASES OF THE PROJECT *2.5 d*

Initial phase: Chilton factors, extrapolation method (comparison with similar projects). Typical accuracy and traps. Location factors.
Basic engineering/FEED: factored estimate (Lang/Guthrie factors), based on the cost of the main equipment.
Semi-detailed estimate: cost of main equipment and works. Owner costs. Key role of engineering studies.
Detailed studies: detailed estimate, use in the Project process. Elements needed for final approval by owner.
Corrective factors: Nelson-Farrar indices, location factors.
Adjustments required to these methods in estimating the cost of revamping projects.

OPTIMIZATION OF COSTS *0.25 d*

Value analysis: functional breakdown of the project, technical and economic analysis of each part.
Economic evaluation of process and technical alternatives. Decision-making.

ASSESSMENT OF FINANCIAL RISKS *0.75 d*

Project financial risk identification and quantification. Potential impact on cost estimate. Upper limit. Typical values used per phase. Allowances and contingencies. Associated action plans.

Reference: PGP/ESTIM-E Only available as an In-House course.

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

This course is also available in French: PGP/ESTIM. Please contact us for more information.

Commissioning & Start-Up of Process Units

Industrial Units

Level: FOUNDATION

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.
- Analysis of incidents occurred while precommissioning, commissioning or start-up phases.

Learning Assessment

Quiz.

Prerequisites

Basic knowledge of 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

4 days

ORGANIZATION *1 d*

Integration of commissioning activities into the project process: mechanical completion, pre-commissioning, commissioning and start-up activities during the project steps.
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: precommissioning, commissioning and preparation for start-up, performance tests, provisional acceptance, mechanical guarantees, final acceptance. Hand over.

SAFETY *0.5 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 *1 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 *1 d*

Commissioning activities. Cleaning, flushing, blowing and drying. Dynamic testing.
Synchronization of control loops and Programmable Logic Controller (PLC).

START-UP & ACCEPTANCE *0.5 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: PGP/OPDEM-E Can be organized as an In-House course. Contact: **rc.contact@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Bahrain	9 November	12 November	€3,150

This course is also available in French: PGP/OPDEM. Please contact us for more information.

Management of Small Projects

Existing Facilities

Level: FOUNDATION

Purpose

Project Management Process applied to small projects implemented in operating facilities.

Audience

Supervisors and engineers (process, plant projects, operations) and engineering contractor staff.

Learning Objectives

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

- manage the preliminary studies (feasibility, basic engineering, interfaces, risk management),
- plan, then control the project execution.

Ways & Means

- Numerous examples from actual Refining/Petrochemical projects.
- Case study.

Learning Assessment

Multiple-choice questionnaires.

Prerequisites

Technical knowledge of the operations 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.

Course Content

5 days

PRELIMINARY ENGINEERING *2.5 d*

Specific constraints of plant projects (resources, organization, schedule, management of several simultaneous projects). Stage-gate process: various stages from conceptual design to start-up.
Roles and responsibilities of the project manager. Integrated team. Project initiation, basic engineering.
Reviews of the technical packages with owner. Cost estimating methods, accuracy, contingencies.
Project execution plan (PEP): organization, objectives, priorities, milestones, constraints. Interface management.
SHE design risk identification and assessment. Overview of the main methods (HAZID, HAZOP).
Project planning and scheduling. Long lead items. Critical path. Schedule optimization.

CONTRACTING & DETAIL ENGINEERING *1 d*

Engineering contract types. Advantages and drawbacks. Management of an umbrella contract.
Detail engineering: regulatory compliance, owner corporate standards, deviations. List of deliverables.
Most common technical pitfalls. Control of detail engineering documents.

PROCUREMENT *0.5 d*

Equipment procurement: purchasing, expediting, inspection, transportation. Quality control plan.

CONSTRUCTION - START-UP *1 d*

Construction strategy (use of maintenance or subcontractors). Construction management plan.
Subcontractor field supervision and control. Field HSE management. Change management.
Mechanical completion, punch-list items, commissioning, acceptance. Closure. Warrantee.

Reference: PGP/GPP-E Only available as an In-House course.

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

This course is also available in French: PGP/GPP. Please contact us for more information.

Engineering Studies

Process Diagrams (PFD-PID)

PFDs & P&IDs

Level: FOUNDATION

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

Basic knowledge of industrial 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

BLOCK DIAGRAM & PROCESS FLOW DIAGRAM (PFD) *0.5 d*

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.

PIPING & INSTRUMENTATION DIAGRAM (PID) *1 d*

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.

P&ID REVIEWS *0.5 d*

Design reviews: focus on HSE and operability with HAZOP review.
Organization of the review, selection of attendees. Action plan. Validation. Reporting and follow-up process.

Reference: EC/PROCREP Only available as an In-House course.

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

This course is also available in French: EC/SCHEPRO. Please contact us for more information.

General Layout

Level: FOUNDATION

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

Basic knowledge of the Oil & Gas industry.

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

PRELIMINARY LAYOUT *1 d*

Regulatory aspects: safety distances, noise, environment, works. International standards.
Use of blocs diagrams, process flow diagrams and piping and instrumentation diagrams.
General layout: process units, storage facilities. Utilities. Technical and administrative buildings. Site access and escape ways. Tank farm layout.

KEY POINTS FOR LAYOUT *1 d*

Review of constraints generated by the various disciplines. Associated layout criteria.
Health, Safety and Environmental constraints. Use of the results of Quantitative Risk Assessment (QRA). Design inherently safer. Safety distances. Area classification. Ergonomics. Noise concerns.
Operation and maintainability: lifting and storage area, access to equipment.
Planning and scheduling: data availability at each project stage, management of holds and change requests.

REVIEWS & OPTIMIZATION *1 d*

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.

Reference: EC/GENELAY Only available as an In-House course. Contact: **rc.contact@ifptraining.com**

This course is also available in French: EC/IMPLANT. Please contact us for more information.

Structures & Civil Engineering

Level: FOUNDATION

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

Basic knowledge of equipment used in Oil & Gas industry. 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

5 days

FOUNDATION DESIGN — *1 d*

Surface foundations technology. Sizing. Anchoring. Foundation stability.
Verification of required surface and applied pressure. Soil stability and resistance.
Deep foundations. Connection between piles and above-ground foundations.

CONCRETE STRUCTURE DESIGN — *1 d*

Definition of terms and key characteristics of civil works. Design parameters.
Characteristics of materials. Resistance of concrete structures. Limit states calculation.
Evaluation of concrete behavior under compression, bending, shearing.
Determination of reinforcements. Importance of steel adherence and covering.
Typical design specification sent to subcontractor. Evaluation of bid response.

STEEL STRUCTURE DESIGN — *2 d*

Main elements of a steel structure. Types of structures. Parameters impacting structure stability.
Assembly types. Determination of structure resistance to weight, equipment and weather conditions.
Transmission of loads to the foundations. Typical design specification. Evaluation of bid response.

STRUCTURE RESISTANCE TO FIRE RADIATION & BLAST OVERPRESSURE — *0.5 d*

Structural behavior of wall and beams under fire radiation and blast overpressure. Design of blast-proof buildings.

ON SITE WORK CONTROLS — *0.5 d*

Key control parameters for steel structures and concrete structures. Concrete manufacturing controls.

Reference: EC/CIVILENG Only available as an In-House course.

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

This course is also available in French: EC/GENCIST. Please contact us for more information.

Economics

International Oil Summit

Jointly organized with *IFP Énergies nouvelles & Petrostrategies*

1 day

The International Oil Summit is an annual gathering of Energy and Oil Ministers, Heads of international organizations (IEA, OPEC, IEF...), CEOs and key industry leaders, from IOCs, NOCs and petroleum service sector, to discuss the most relevant issues of the oil sector.

AGENDA

Over the past years, the Summit has been the circle for policy makers and industry leaders to exchange views on ways and means to address a large spectrum of oil related issues; securing investment and meeting future oil demand, making successful arrangements leading to long lasting partnerships between NOCs and IOCs, addressing oil market volatility and its effects on investment, debating human resources related issues, improving dialogue among producing and consuming countries, and between oil and service companies on project management and risk sharing.
The Summit also look at avenues to successfully do business and implement sustainable energy policies in an increasingly carbon-constrained world, discuss the role of technology in meeting present and future energy security objectives.

SPEAKERS

The genuine debate in the Paris International Oil Summit has tremendously benefited from the participation of high caliber speakers. Past editions of the International Oil Summit welcomed Energy and/or Oil Ministers of Algeria, India, Iran, Iraq, Nigeria, Norway, Qatar, Saudi Arabia, United Arab Emirates, Venezuela… as well as CEOs and leaders from the petroleum industry such as Anadarko, BP, Chevron, CGG, Halliburton, Hellenic Petroleum, IFP Energies Nouvelles, Perenco, Petrobras, Repsol, Saudi Aramco, Schlumberger, Shell, Sonatrach, Statoil, Total, TechnipFMC, Vallourec, Saipem, etc.

WHY ATTEND?

The Summit is the only few gatherings bringing together Ministers, oil and service industry leaders to discuss the most important and relevant issues of the day. It allows policy makers and industry leaders to share concerns and objectives, thus narrowing gaps between energy policies and industry strategies. Participation in the Summit provides also an excellent opportunity for meetings, discussions and networking among attendees.
The Summit enjoys also excellent media coverage; some 50 journalists attend each year echoing oil industry concerns and views.

SPONSORSHIP

The International Oil Summit offers sponsors a unique opportunity in which they can increase their brand visibility amongst the key decision makers and main players of the petroleum sector, the press, influencers and other stakeholders. We have developed a range of packages designed for all budgets, with a range of benefits and avail ourselves to discuss details with our interested sponsors.

Reference: PEH/IOS

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

Location	Start Date	End Date	Tuition Fees
Paris	**16 April**	**16 April**	**€990**

International Gas & Power Summit

Jointly organized with *IFP Énergies nouvelles & Petrostrategies*

1 day

The International Gas and Power Summit is an annual high level event gathering key gas and power industry executives as well as policy makers, to discuss the most timely and relevant issues affecting the gas and power sectors.

AGENDA

Over the past years, the Summit has been the circle for policy makers and industry leaders to exchange views on ways and means to address a large spectrum of gas and power related issues and challenges; gas markets development, LNG trade and regional competition, regulatory framework shifts, players' strategies, future gas and power demand and investment needs, ageing generation capacity, incorporation of growing share of renewables in the energy mix, adjusting to international and national-level climate and energy policies, and other exogenous impacting factors.
The Summit also look at avenues to successfully do business and implement sustainable energy policies in an increasingly carbon-constrained world, and discuss the role of technology in meeting present and future energy security objectives.

SPEAKERS

The genuine debate in the Paris International Gas and Power Summit has tremendously benefited from the participation of high caliber speakers. Past editions of the International Gas and Power Summit welcomed officials, including Ministers, from Algeria, Qatar, Norway, Egypt… as well as Cedigaz, Cheniere, Dunkirk LNG, Engie, EDF, GECF, Hoegh LNG, IEA, NIOC, Saipem, Statoil, TechnipFMC, Tellurian Investments, Total, Sonatrach, Qatar Petroleum, Uniper, and many others.

WHY ATTEND?

The Gas and Power Summit is the only few gatherings bringing together Ministers, gas and power industry leaders to discuss the most important and relevant issues of the day. It allows policy makers and industry leaders to share concerns and objectives, thus narrowing gaps between energy policies and industry strategies. Participation in the Summit provides also an excellent opportunity for meetings, discussions and networking among attendees.
The Summit enjoys also excellent media coverage; some 50 journalists attend each year echoing oil industry concerns and views.

SPONSORSHIP

The International Gas and Power Summit offers sponsors a unique opportunity in which they can increase their brand visibility amongst the key decision makers and main players of the petroleum sector, the press, influencers and other stakeholders. We have developed a range of packages designed for all budgets, with a range of benefits and avail ourselves to discuss details with our interested sponsors.

Reference: PEH/IGS

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

Location	Start Date	End Date	Tuition Fees
Paris	**19 November**	**19 November**	**€990**

Overview of Petroleum Economics

Level: FOUNDATION

Purpose

This course aims to provide an overview of the petroleum sector so that participants may understand the oil operations and business, from upstream to downstream, and identify economic challenges.

Audience

This course is geared towards people from the energy and petroleum sectors, industrial partners, business men and financiers, as well as public administration staff.

Learning Objectives

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

- describe the different types of energy resources (conventional, unconventional, renewable & fossil),
- interpret the evolution of the factors affecting the energy supply and demand (crude prices, technology, reserves, geopolitics, geography, environment, etc.),
- identify the actors of the energy scene and their strategic guidelines,
- describe the main steps of the upstream sector,
- distinguish the different types of oil contracts and explain the main economic criteria to evaluate a project,
- summarize the operation of the physical and financial oil markets,
- explain the evolution of the refining sector and of the petroleum product markets.

Ways & Means

- Quiz and serious game on the fundamentals of the energy sector,
- Case study on the economic evaluation of an E&P project,
- Exercises on cargo transportation costs, hedging, and refining margins,
- Team games on factors affecting crude prices, the upstream sector, and oil trading.

Learning Assessment

Participants will be evaluated during the training through quiz and exercises.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

In-house or contracted IFP Training trainers having expertise and experience in oil sector economics.

Course Content

4 days

INTERNATIONAL ENERGY SCENE — *1 d*

Energy resources: definition, characteristics, conversion factor.
Energy demand and supply: evolution factors (reserves, technology, etc.) and scenarios.
History of the oil industry.
Determinants impacting crude oil prices today.
Strategies of actors: producer and consumer countries, national, independent and international oil companies, international organizations (OPEC, IEA, etc.).
Financial and political stakes, geographical and environment constraints.

UPSTREAM — *1 d*

Stages and technico-economic aspects of the Exploration-Production.
Reserve evaluation.
Economic criteria and evaluation method of an oil project.
Oil contracts and principle of the oil rent sharing.

MIDSTREAM — *1 d*

Business practices and pricing.
Physical markets (spot, forward): operation, reporting agencies.
Introduction to incoterms.
Pricing a cargo, freight rates.
Financial markets (futures): operation, hedging.

DOWNSTREAM — *1 d*

Refining processes and units.
Refining capacities, projects, strategies of actors.
Economic aspects of the refining sector: investments, costs and margins.
Environmental constraints, alternative fuels.
Petroleum product markets and marketing.

Reference: TRT/OPE Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	1 December	4 December	€2,630

This course is also available in French: TRT/EPE. Please contact us for more information.

Overview of Natural Gas Economics

Level: FOUNDATION

Purpose

This training provides an overview of the economic and contractual aspects of the natural gas value chain, all the way from production and transport to marketing.

Audience

This training is designed for professionals with experience in the oil industry who now need to broaden their understanding and knowledge of the natural gas business. Professionals from other sectors, such as banking or government, that require an understanding of the natural gas business to better assist their clients are also welcome to attend.

Learning Objectives

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

- evaluate the importance of natural gas in the world energy balance, and the strategies of the main industry actors,
- identify the outlets of natural gas and the new trends in gas industry,
- identify the main technical, economic and contractual features of the natural gas value chain, from the production well to the final consumer,
- explain the framework of liberalization of natural gas markets and its impact on gas contracts and prices.

Ways & Means

- Quizzes.
- Exercises on the costs of gas infrastructures.
- Examples of contracts and calculations on quantities.
- Videos.

Learning Assessment

Participants will be evaluated during the training through quizzes and exercises.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Permanent and contracted IFP Training trainers having expertise in technical and economic aspects of the gas chain.

Course Content

4 days

GLOBAL GAS SCENE — *0.75 d*

Importance of natural gas in the world energy balance.
Outlets for natural gas.
Reserves, production, development zones.
International gas markets.
Impact of unconventional gas on the world demand/supply and on gas prices.

STRUCTURE & COSTS OF THE NATURAL GAS CHAIN — *0.75 d*

Description of the gas chain and associated costs.
Gas treatment and transportation.
Storage costs and distribution costs.
Liquefied Natural Gas (LNG), FLNG, FSRU, small scale LNG.

LONG-TERM NATURAL GAS & LNG CONTRACTS — *1 d*

Contractual framework of Exploration-Production.
Structure and principles of a long-term contract.
Principles of take-or-pay, netback, indexation and gas price formulas.
Tolling agreements.

SPOT, FORWARD & FINANCIAL MARKETS — *0.5 d*

Spot and forward natural gas markets.
Why and how to access those markets?
Prices in the different markets.
Financial contracts, hedging strategies and examples.

GAS MARKETING IN A LIBERALIZED MARKET — *1 d*

Drivers and concepts of liberalization.
Principles of the EU gas directive, progress in various countries, take-or-pay issues.
Role of the regulator, network development, transport, tariffs, etc.
Contractual aspects between suppliers, transporters and distributors.

Reference: GER/ONE — Can be organized as an In-House course. — Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	8 September	11 September	€2,840

This course is also available in French: GER/EGN. Please contact us for more information.

Liquefied Natural Gas Economics

Level: FOUNDATION

Purpose

This training provides an overview of the economic and contractual aspects of the LNG (Liquefied Natural Gas) value chain.

Audience

This training is beneficial to professionals from the oil, gas or power industries or from the banking, insurance, and consulting sectors who need to understand LNG activities and their economic stakes.

Learning Objectives

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

- evaluate the economics of each part of the LNG value chain,
- analyze the basic structure of LNG contracts,
- identify the main LNG markets and their evolution,
- evaluate the profitability of investments in the LNG industry.

Ways & Means

- Quizzes.
- Videos.
- Examples of contracts.
- Exercises on LNG contracts.

Learning Assessment

Participants will be evaluated during the training through quizzes and case studies.

Prerequisites

No prerequisites for this course.

Expertise & Coordination

Permanent and contracted IFP Training trainers having expertise in technical and economic aspects of the liquefied natural gas (LNG) chain.

Course Content

4 days

GLOBAL GAS SCENE & LNG MARKETS *1 d*

Natural Gas uses, reserves, supply and demand.
New outlets for LNG (retail LNG).
International gas trades and importance of the LNG.
Evolution of the LNG trading and pricing.
Main LNG markets: America, Europe and Asia (mature markets: Japan and South Korea and emerging markets: China, India…).
Risks for the different LNG actors: liquefaction, shipping, portfolio players, buyers…
Unconventional gas and its impact on LNG markets.

TECHNICAL ASPECTS OF THE LNG CHAIN *1.5 d*

LNG: properties and specifications.
Design of the different parts of the LNG chain.
Liquefaction plants, LNG tankers, regasification terminals.
Main projects of LNG terminals in the world and their exploitation.
Capital expenditures and operating costs.
Economic evaluation of a LNG project.
Business structures of LNG projects:
- Classical “Buy/Sell” model.
- Processing model.

New trends in the LNG industry:
- Floating concepts: FLNG, FSRU.
- Small scale LNG.

LNG as a retail product:
- Retail LNG.
- LNG as a transportation fuel: land transportation (road and rail); LNG bunkering (infrastructures, opportunities and challenges).

LNG CONTRACTS *1.5 d*

Main features and important articles in LNG contracts.
LNG pricing: price formulae, indexation and net-back value.
Tolling agreements.
Impact of gas markets liberalization and third-party access to regasification terminals.
Coexistence between long-term contracts and short-term contracts.

Reference: GER/LGE Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	15 December	18 December	€3,380

This course is also available in French: GER/EGL. Please contact us for more information.

Oil Markets & Trading

Level: PROFICIENCY

Purpose

This training provides a better understanding of the structure of the markets, the uses and the impacts of physical and financial markets for crude oil and petroleum products.

Audience

All personnel in the petroleum or associated industries needing to improve their knowledge and understanding of crude oil and petroleum products trading and pricing mechanisms.

Learning Objectives

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

- analyze the parameters which influence prices of crude oil and prices of petroleum products,
- review the different oil trading markets by type of transaction,
- understand the importance of maritime transport costs in oil supply economics,
- comprehend hedging techniques available for protection against fluctuations in prices.

Ways & Means

- Syndicate works on case studies.
- Case studies.

Learning Assessment

Participants will be evaluated during the training through exercises and case studies.

Prerequisites

Bachelor's degree +3 and/or a minimum 3 years of working experience in Downstream.

Expertise & Coordination

In-house or contracted IFP Training trainers having expertise and experience in oil markets and trading.

Course Content

3 days

OIL SUPPLY & DEMAND FUNDAMENTALS — *0.25 d*

Energy resources.
Energy demand and supply.
Oil producing countries, OPEC, consuming countries, international oil companies: constraints and strategies.

SHIPPING — *0.25 d*

General features.
The market and its players-fixing of the freight rate (Worldscale).
Chartering contracts.
Risk control and environmental protection.

CRUDE & PETROLEUM PRODUCTS PHYSICAL TRADING — *1 d*

What is the value of a crude oil? The refiner's point of view.
Different types of contracts: long term, spot and forward.
Main oil markets and their features.
Key benchmark crudes.
The role of the PRAs (price reporting agencies).
Links between Trading and Shipping.
Products trading.
Main provisions of a sale/purchase contract.

EXCHANGES & FUTURES TRADING — *1 d*

The concept of volatility
Definition of a contract: the cases of WTI and Brent.
Exchanges and their organization: the cases of NYMEX and ICE.
Main Futures Markets.
Hedging principles.
Hedging imperfections, basis risk.
Market structure (contango, backwardation).
Case studies.

DERIVATIVES — *0.25 d*

Options: principles, basics and characteristics.
Interests and limits of options.
Swaps: principles, basics and characteristics.
Interests and limits of swaps.

HEDGING STRATEGIES - VARIOUS CASE STUDIES ON HEDGING — *0.25 d*

For a refiner.
For a crude oil producer.
For a marketer.
For an industrial consumer.

Reference: TRT/OMT Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	**27 May**	**29 May**	**€2,430**

This course is also available in French: TRT/MTP. Please contact us for more information.

Refinery Operation Management & Linear Programming

Level: PROFICIENCY

Purpose

This course provides an in-depth understanding of the techniques used for decision-making operations concerning supply and refining.

Audience

Managerial staff, supply planners, oil economists and personnel in charge of supply, planning, programs and product blending.

Learning Objectives

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

- optimize refinery operations, crude oil assessment and crude oil selection,
- analyze the results of a linear programming model optimization,
- help optimizing a planning, from preparation of optimal monthly programs up to daily operation scheduling.

Ways & Means

- Case studies and exercises derived from present refinery situations.
- Economic optimization using Excel software and the solver.
- Quiz.

Learning Assessment

Participants will be evaluated during the training through exercises and case studies.

Prerequisites

Knowledge of refining unit operations.

Expertise & Coordination

In-house or contracted IFP Training trainers having expertise and experience in refinery operations management and linear programming.

Course Content

5 days

OIL MARKETS & TRADING — *0.25 d*

Oil supply and demand fundamentals and evolution.
Petroleum physical trading (spot, forward).
Crude oil and petroleum product pricing: benchmark, quality differential, etc.
Financial trading (futures) and hedging strategies for a refiner.

REFINING CONTEXT — *0.5 d*

World petroleum product demand.
Refining supply: overcapacity, types and quantity.
Main challenges: deep conversion, new product specifications, petrochemical integration, environment, etc.
Projects and perspectives.

REFINING MARGINS & COSTS — *0.75 d*

Refinery margins and costs: definitions and evolution worldwide.
Unit margins and intermediate product valuation.
Case studies: crude oil arbitrage, Fluid Catalytic Cracking (FCC) unit margin.

OPTIMIZATION OF REFINING OPERATIONS - LINEAR PROGRAMMING — *2.5 d*

Linear programming (LP) principles: linear equation, objective function, profit maximization or cost minimization, Simplex method, graphic interpretation, etc.
Analysis of the LP results: optimum properties, marginal costs, domain of validity of the results, etc.
Case study on Excel: parametrization and preparation of a refinery model matrix (material balances, product specifications, utilities consumption, objective function, etc.); team work on the optimization of a cracking refinery and on the result analysis.

OPTIMIZATION OF REFINERY OPERATIONS - SCHEDULING — *1 d*

Principles of refining management: constraints, operations organization.
Monthly program to daily operations.
Optimization of margins from different process units.
Case study: management of typical sequential constraints (delays, processing problems, etc.).

Reference: EAV/ROM Only available as an In-House course.

Contact: **eco.rueil@ifptraining.com**

Economic Framework of Refining

Level: FOUNDATION

Purpose

This course provides a complete view of all the fundamental aspects and challenges of the economic framework in which the refining industry is evolving.

Audience

Technical, operating and engineering personnel working in the refining industry, trading and commercial specialists, independent consultants, process licensors, catalyst manufacturers and refining subcontractors.

Learning Objectives

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

- calculate product marginal value, refinery margins and process unit margins,
- identify cost savings in order to improve margins,
- simulate refinery operations and product blending,
- simulate and optimize refinery operations, crude oil selection and product manufacturing,
- analyze the result of a linear programming model optimization,
- evaluate project profitability.

Ways & Means

- Case studies and exercises derived from present refinery situations.
- Economic optimization using Excel.
- Quiz.

Learning Assessment

Participants will be evaluated during the training through exercises and case studies.

Prerequisites

Basic notions of Microsoft Excel.

Expertise & Coordination

In-house or contracted IFP Training trainers having expertise and experience in refining sector.

Course Content

5 days

TECHNICAL OVERVIEW — *0.25 d*

Brief technical presentation of the main refining units: distillation, conversion, blending, etc.
Refinery scheme evolution.

OIL MARKETS & TRADING — *0.25 d*

Oil supply and demand fundamentals and evolution.
Petroleum physical trading (spot, forward).
Crude oil and petroleum product pricing: benchmark, quality differential, etc.
Financial trading (futures) and hedging strategies for a refiner.

REFINING CONTEXT — *0.5 d*

World petroleum product demand.
Refining supply: overcapacity, types and quantity.
Main challenges: deep conversion, new product specifications, petrochemical integration, environment, etc.
Projects and perspectives.

REFINING MARGINS & COSTS — *1 d*

Refinery margins and costs: definitions and evolution worldwide.
Unit margins and intermediate product valuation.
Case studies: crude oil arbitrage, Fluid Catalytic Cracking (FCC) unit margin.

REFINERY BLENDING SIMULATION — *0.5 d*

Case study: managing the blending operation of a refinery taking into account the economic and technical (product specifications, capacities, etc.) constraints.

OPTIMIZATION OF REFINING OPERATIONS - LINEAR PROGRAMMING — *1 d*

Linear programming (LP) principles: linear equation, objective function, profit maximization or cost minimization, Simplex method, graphic interpretation, etc.
Analysis of the LP results: optimum properties, marginal costs, domain of validity of the results, etc.
Case study on Excel: explanation of a refinery model matrix (material balances, product specifications, utilities consumption, objective function, etc.); team work on the optimization of a cracking refinery and on the result analysis.

OPTIMIZATION OF REFINERY OPERATIONS - SCHEDULING — *0.5 d*

Principles of refining management: constraints, operational organization.
Monthly program to daily operations.
Optimization of margins from different process units.
Case study: management of typical sequential constraints (delays, processing problems, etc.).

INVESTMENT PROFITABILITY STUDIES — *1 d*

Value creation and capital cost, cash flows, discounting principle and inflation impact.
Standard global profitability analysis: cash flow schedule, economic criteria (net present value, internal rate of return, etc.).
Introduction to risk analysis.
Exercises on various investment profitability studies for refineries and petrochemical plants.

Reference: EAV/EFR Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	25 May	29 May	€3,300

This course is also available in French: EAV/CER. Please contact us for more information.

Economic Optimization of Refining Operations

Level: PROFICIENCY

Purpose

This course allows the participants to acquire the main economic challenges of running a refinery and a better understanding of the oil markets (crude oil and petroleum products) in order to optimize refining operations.

Audience

Engineers, independent consultants, subcontractors or managers from refining who need a better understanding of operation optimization.

Learning Objectives

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

- understand the economic issues and the main parameters influencing refining profitability,
- develop a working knowledge of management tools and models used in the industry,
- get a grasp of the input/output balances of the refining industry,
- calculate product value (intermediate, semi-finished or finished products), refinery margins and process unit margins; how cost and margins compare; how to simulate refinery operations and product blending,
- understand and analyze the refining margin from an operational point of view, considering the contribution of each unit operation,
- understand the notion of break-even point (as an evaluation tool for assessing the resilience of a refinery to economic changes),
- comprehend ways to optimize refinery operations, crude oil selection and product manufacturing, in order to improve profitability,
- gain a working knowledge in decision-making regarding future investments,
- better understand and use the various elements that contribute to refining margin improvement, such that: blending optimization, energy optimization, maintenance management, inventory management, analysis, performance monitoring…

Ways & Means

- Case studies.
- Example cost of give-away.
- Calculation of a working inventory.

Learning Assessment

Participants will be evaluated during the training through exercises and case studies.

Prerequisites

Basic notions of Microsoft Excel.

Expertise & Coordination

In-house or contracted IFP Training trainers having expertise and experience in economic optimization of refining operations.

Course Content

5 days

TECHNICAL OVERVIEW — *0.25 d*

Petroleum demand.
Crude oils - Qualities and characteristics.
Petroleum products - Characteristics and specifications.
Refining schemes and processes.

PRICE CONSTITUTION OF CRUDE OILS & PETROLEUM PRODUCTS — *1 d*

The different types of crude oils and their interactions.
Notions of incoterms (FOB, CIF…).
Price determination from reporting agencies (e.g.: Platt's and Argus).

REFINING MARGINS & COSTS — *1 d*

Definitions.
Different types of margins and indicators.
Principle of estimation of the real margin in a refinery from the reference indicator.
Refining variable and fixed costs.
Definitions and principle of a refinery break-even point.

REFINING MANAGEMENT ITEMS — *1 d*

Economic impact of unit yields.
Product valorization challenges.
Notion of constraint cost.
The use value of intermediate, semi-finished and finished products.
Examples.

VALUE & SIMULATION OF INTERMEDIATE & SEMI-FINISHED PRODUCTS — *0.75 d*

Value of a product depending on its use and the economic context.
Notion of marginal cost, netback value.
Capital gain or loss of separation, product blending or transformation operations; examples.
Case study of the premium "straight-run" for atmospheric residues.

HOW TO IMPROVE THE REFINING MARGIN DAILY? — *0.5 d*

Blending optimization.
Energy integration, maintenance management.
Monitoring and control of consumption (energy, chemicals, catalysts) and losses.
Inventory management, working inventory.
Organization, reactivity, employees training.
Implementation analysis and performance monitoring tools (KPI: Key Performance Indicators)…

OPTIMIZATION OF THE FEEDSTOCKS - KEY CRITERIA — *0.5 d*

Crude oil case study: tools and models used, basic knowledge of linear programming.
Case study.

Reference: EAV/REO Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	14 December	18 December	€3,450

This course is also available in French: EAV/OER. Please contact us for more information.

Refining & Petrochemicals Synergies

Level: PROFICIENCY

Purpose

This course provides a complete review of the main refining and petrochemicals specificities, as well as the identification of the possible synergies. It highlights the economic gains achievable from refining-petrochemicals integration.

Audience

Staff from refining and petrochemicals involved in production, planning, procurement, marketing, management control and investment.

Learning Objectives

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

- describe the main specificities of the refining and petrochemicals sectors,
- identify the possible synergies between refining and petrochemicals,
- explain the economic challenges and the main factors of these sectors' profitability,
- analyze the effects of these synergies.

Ways & Means

- Quiz, examples.
- Case studies and exercises in team work.

Learning Assessment

Participants will be evaluated during the training through exercises and case studies.

Prerequisites

- Basic knowledge of refining and petrochemicals unit operations.
- Basic notions of Microsoft Excel.

Expertise & Coordination

In-house or contracted IFP Training trainers having expertise and experience in refining and petrochemicals sectors.

Course Content

2 days

TECHNICAL REVIEW OF REFINING & PETROCHEMICALS *0.5 d*

Main petroleum and petrochemicals products: key product specifications review.
Refining and petrochemicals schemes.
HSE specifications: refining (H_2S, etc.), petrochemicals (product instability, etc.).

SYNERGIES BETWEEN REFINING & PETROCHEMICALS *1 d*

Utility exchanges: H_2, gas, fuel.
Supply: ethane, LPG, naphtha, atmospheric gasoil, vacuum distillate.
Product exchanges: pyrolysis gasoline, olefins.
Common treatment of the C4 cuts: BTX (Benzene-Toluene-Xylene) extraction.
Pooling services.

REFINING & PETROCHEMICALS ECONOMICS *0.5 d*

Refining and petrochemical margins and costs.
Location and unit severities effects.
Gains due to synergies.
Case study: economics of a refinery, of a steam cracker and of the integration of both (with some synergies).

Reference: EAV/SRP Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	**19 November**	**20 November**	**€1,570**

This course is also available in French: EAV/IRP. Please contact us for more information.

Profitability Analysis of Downstream Investment Projects

Level: PROFICIENCY

Purpose

This course provides an in-depth understanding of the concepts behind the theory of capital budgeting, leading to an improvement of the analysis in investment profitability studies.

Audience

Managers and staff concerned with decision affecting medium and long term cash flows (such as investment, disinvestment and acquisitions); people who need to improve their understanding of the theory and the practice of investment analysis.

Learning Objectives

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

- use tools related to an investment profitability analysis,
- incorporate terms of financing plans in equity profitability analysis,
- build complex computer models for cash flow analysis,
- carry out risk analysis of investment projects.

Ways & Means

Case studies and exercises derived from actual refinery situations.

Learning Assessment

Participants will be evaluated during the training through exercises and case studies.

Prerequisites

Basic notions of Microsoft Excel.

Expertise & Coordination

Contracted IFP Training trainers having expertise and experience in profitability analysis of downstream investment projects.

Course Content

3 days

ECONOMIC CRITERIA *0.75 d*

Value creation, capital cost and discount rate of a company.
Equity and debt, Corporate finance and return on capital, ROCE and ROE.
Cash flows and discounting principle.
Net Present Value (NPV), Internal Rate of Return (IRR), Pay-Out Time (POT), financial exposure, profitability index.

GLOBAL PROFITABILITY ANALYSIS *0.75 d*

Analysis of operating cash flows and economic criteria.
Return on capital employed.
Profit and Loss accounts and associated project income taxes.
Impact of taxation and inflation in profitability investment studies.
Choice of an investment program with a limited budget, scarcity cost of capital.

RISK ANALYSIS *0.5 d*

Risk analysis methodology.
Sensitivity analysis in investment decision, Spider and Tornado charts.
Limits of sensitivity analysis.

CASE STUDIES ON INVESTMENT PROFITABILITY *1 d*

Octane improvement: implementation of isomerization and/or alkylation process units.
Hydrocracker project.
Refinery project.
Steam cracker project.

Reference: EAV/PDP Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	**8 June**	**10 June**	**€2,160**

This course is also available in French: EAV/PPA. Please contact us for more information.

Downstream Module

Level: PROFICIENCY

Purpose

This course provides a better understanding of the downstream petroleum sector in its technical, economic, commercial and environmental dimensions (main refining units, key economic data and characteristics, management tools…).

Audience

Recently hired professionals, preferably with an engineering background, about to take up a position in downstream petroleum activities.
Staff from other petroleum sectors (upstream, chemicals, etc.) taking up a downstream managerial position or from government agencies with responsibilities for petroleum matters will also benefit from this course.

Learning Assessment

Participants will be evaluated during the training through exercises.

Prerequisites

No prerequisites for this course.

More info

This module is a part of a 16-month master degree program, Petroleum Economics and Management, run by IFP School.

Expertise & Coordination

In-house or contracted IFP Training trainers having expertise and experience in downstream petroleum sector.

Course Content

60 days

REFINING — 6 d

Crude oils and finished products.
Refining processes.
Deep upgrading.
Environmental constraints.
Consequences of the reduction of heavy fuel oil outlets.
Short-term refinery management.
Unit margins.

DECISION SCIENCES — 4 d

Linear programming: simplex, duality, economic interpretation, etc.
Refining supply and demand.
Refinery investments, costs and margins.
Dynamic programming, non-linear programming, MCP problems in their applications in Energy industries (Gas and Electricity).

DOWNSTREAM MANAGEMENT & SUSTAINABLE DEVELOPMENT (refining, gas, power & digitalization) — 30 d

Mid and downstream business: oil refining, petrochemicals and products.
Utility management: coal, gas and power.
Renewables and Environmental Management.

ENERGY MARKETS & TRADING — 5 d

Introduction to commodities markets (energy, soft, tropical & non-ferrous).
Physical oil markets.
OTC products.
Future markets. Options.
Risk management and hedging.

ADVANCED ECONOMETRICS — 5 d

Applied probability and statistics.
Applications of statistical and probabilistic concepts.

TERM PAPER — 10 d

Personal research work.

Reference: EAV/DOM — Can be organized as an In-House course. — Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	14 April	10 July	€13,020

Price Risk Management in Energy Markets

Level: PROFICIENCY

Purpose

This training provides a better understanding of the principles and techniques for Oil & Gas price risk management.

Audience

Professionals in the Oil & Gas industries impacted by the volatility of oil or gas prices: producers, marketers, refiners. Purchasing, planning and finance departments of energy consumers. Professionals from the bank sector who need to understand the specificities of Oil & Gas price risk management.

Learning Objectives

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

- review the ways of evaluating price risk,
- analyze and manipulate the exchange traded products used for hedging,
- understand the different over the counter products used in hedging strategies for different Oil & Gas activities.

Ways & Means

- Selected teaching methods: case studies.
- Hedging exercises.

Learning Assessment

Participants will be evaluated during the training through exercises and case studies.

Prerequisites

Bachelor's degree +3 and/or a minimum 3 years of working experience in oil Supply chain or oil Markets.

Expertise & Coordination

In-house or contracted IFP Training trainers having expertise and experience in price risk management in energy markets.

Course Content

3 days

OIL & GAS MARKETS — *0.25 d*

Physical Oil & Gas markets.
Markets structures and types of transactions.
Price references and pricing mechanisms.

PRICE EXPOSURE & RISK MANAGEMENT — *0.75 d*

Price risk: what is at risk?
How to monitor it?
How to mitigate the risk: definition of hedging.
How to account for the risk: Mark to Market and Value-At-Risk.

EXCHANGE TRADED PRODUCTS: FUTURES — *0.75 d*

Exchanges and their organization: NYMEX, ICE.
Main Futures contracts.
Electronic trading.
Hedging using Futures.
Basis risk and hedging imperfections.
Taking advantage of the market structure (contango, backwardation).

OTHER DERIVATIVE INSTRUMENTS: FORWARDS, SWAPS & OPTIONS — *0.75 d*

Forward contracts.
Swaps.
Clearing OTC transactions.
Options: pricing and sensitivities.
Options strategies: caps, floors, collars.

HEDGING STRATEGIES — *0.5 d*

Various examples.
Case study.

Reference: TRT/PRM Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	*Start Date*	*End Date*	*Tuition Fees excl. VAT*
Rueil-Malmaison	**14 October**	**16 October**	**€2,820**

Investment Profitability Studies in the Oil & Gas Industry

Level: FOUNDATION

Purpose

This course provides a better understanding of the concepts behind the theory of capital budgeting, thus helps improving the analysis in investment profitability studies. A number of computer case studies will be treated all along the course to apply the principles that are presented succinctly, which makes this course a very practical one.

Audience

Managers and staff concerned with decisions affecting medium and long-term cash flows, such as investment, disinvestment, acquisitions or leasing, who need to improve their understanding of the theory and practice of investment analysis.

Learning Objectives

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

- develop advanced computer models for the economic evaluation of Oil & Gas projects,
- incorporate specific financing plan through equity profitability analysis,
- analyze the economic results and carry out sensitivity analysis,
- incorporate the risk and uncertainty in the economic evaluation of Oil & Gas projects.

Ways & Means

Case studies simulated on computers.

Learning Assessment

Participants will be evaluated during the training through quizzes and case studies.

Prerequisites

Participants need to be comfortable with the use of Microsoft Excel.

Expertise & Coordination

IFP Training trainers having expertise and experience in Oil & Gas project economics.

Course Content

3 days

ECONOMIC EVALUATION CRITERIA — *0.5 d*

Corporate finance, capital costs and discount rate of the company.
Construction of project cash flows schedule.
Economic criteria for project evaluation: net present value (NPV), internal rate of return (IRR), payback period, etc.
Case studies: development of an oil field under concession.

GLOBAL PROFITABILITY ANALYSIS — *1 d*

Methodology for assessing the global profitability of capital invested.
Impact of taxation and inflation in profitability investment studies.
Choosing an investment program with a limited budget, scarcity cost of capital.
Case studies: accelerating production project (EOR) project of upgrading a refinery (Hydrocracking unit).

ECONOMIC COST ANALYSIS — *0.5 d*

Accounting cost vs. economic cost, after-tax cash outflows.
Total discounted cost, annual economic cost.
Economic depreciation, unit economic cost, optimal economic lifetime.
Cases studies: issues related to purchasing of equipment and definition of an optimal economic lifetime.

EQUITY PROFITABILITY ANALYSIS — *0.5 d*

Financing Oil & Gas projects, project finance and B.O.T. structures.
Various financing plans and debt repayment.
Analysis of equity cash flows, return on equity capital, financial leverage.
Case studies: construction of LNG plant and gas pipeline projects with specific financing.

RISK ANALYSIS — *0.5 d*

Introduction to risk analysis and risk discount rate: sensitivity analysis, Spider and Tornado diagrams.
Probability of success, economic risk analysis in oil exploration.
Economic study of an exploration project using Min, Mode and Max scenarios.
Case studies: valuation of a decision to acquire information (seismic or drilling) and pricing of an exploration bloc.

CASE STUDIES

Oil field development project.
Acceleration of production project with or without EOR (Enhanced Oil Recovery).
Isomerization vs. alkylation project.
FCC project (Fluid Catalytic Cracking).
Project of upgrading a refinery.
Hydrocracking unit project.
Polypropylene Plant Project.
LNG plant project with specific financing.
Gas pipeline project with specific financing.
Service station modernization project.
Gas-fired power plant project.
Valuation of a decision to acquire information (seismic or drilling).
Pricing of an exploration bloc.

Reference: GIP/IPS Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees excl. VAT
Rueil-Malmaison	26 May	28 May	€2,200

This course is also available in French: GIP/ERP. Please contact us for more information.

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

Tel. + 33 (0)1 41 39 11 60
Fax + 33 (0)1 47 08 92 83

ep.contact@ifptraining.com

Pau

- **Drilling & Completion**
- **Production & HSE**
  Engineering & Project Management

Rue Paul et Henri Courteault
64000 Pau - France

Secretarial Department

Tel. + 33 (0)5 59 30 82 50
Fax + 33 (0)5 59 30 68 76

ep.contact@ifptraining.com

Refining & Chemicals

Rueil-Malmaison

232 avenue Napoléon Bonaparte
92852 Rueil-Malmaison Cedex - France

Secretarial Department

Tel. + 33 (0)1 41 39 11 00
Fax + 33 (0)1 47 08 92 83
rc.contact@ifptraining.com

Martigues

Le Bâteau Blanc - Bât. C
Chemin de Paradis
13500 Martigues - France

Secretarial Department

Tel. + 33 (0)4 42 44 43 00
Fax + 33 (0)4 42 80 61 20
rc.contact@ifptraining.com

Lillebonne

Immeuble Futura 1
Rue A. Desgenetais
76170 Lillebonne - France

Secretarial Department

Tel. + 33 (0)2 35 39 60 77
Fax + 33 (0)2 35 38 62 03
rc.contact@ifptraining.com

Solaize

Rond-point de l'échangeur de Solaize
BP3 - 69360 Solaize - France

Secretarial Department

Tel. + 33 (0)4 37 37 68 20
rc.contact@ifptraining.com

CFA Lillebonne

Immeuble Futura 1
Rue A. Desgenetais
76170 Lillebonne - France

Secretarial Department

Tel. + 33 (0)2 35 39 60 70
Fax + 33 (0)2 35 38 62 03
op.certif@ifptraining.com

IC Engines & Lubricants

232 avenue Napoléon Bonaparte
92852 Rueil-Malmaison Cedex - France

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
92852 Rueil-Malmaison Cedex - France

Secretarial Department

Tel. + 33 (0)1 41 39 10 80
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 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 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 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 registration the places booked by the Client, after having informed them. If full payment is received IFP Training will, at least two (2) weeks prior to the start of the session, send a letter to the Client designated on the form to confirm their enrolment. A personal invitation will be attached to the letter and which provides all practical information about the session (schedule, directions, etc.).

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. 30007 99999 04165583000 12
IBAN: FR76 3000 7999 9904 1655 8300 012 – BIC: NATXFRPPXXX

- 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.

General Terms of Sale

These penalties are due until full payment. In the event of late payment, 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 (ii) or (iii) 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.

▶ Client's information required for the performance of the services:

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.

General Terms of Sale

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 and/or the information contained, to its non-participants at the session or to third parties; any use for the purpose of marketing, organizing or carrying out training activities (including internal training) is expressly prohibited.
The Recipient Party is responsible for any unauthorized use, copying or distribution of information or 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 present 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 willful 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.
Accordingly, each party waives any recourse against the other for any damages caused to persons and property, except in case of willful misconduct.
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.

General Terms of Sale

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: rgpd@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.