YOUR TALENT
OUR EXPERTISE

A word from **the CEO**

Jean-Luc Karnik

For over 40 years, **IFP Training** has been offering training courses covering the entire Oil & Gas value chain as well as the Powertrain industry. Often referred to as a partner of excellence, we are proud of the strong relationships that we continue to build with our clients in order to accompany them in their workforce's competency development.

I would like to highlight the numerous programs that lead to the **certification of competencies** ensuring that your employees are able to work efficiently without compromising safety. I encourage you to have a look at the **career development paths** that we provide in various fields of expertise to help you to identify the programs needed to **strengthen your team** from within.

Today's industry context makes it more important than ever to count on training experts to help **develop your team**. Our team of 100 permanent instructors and network of 600 industry experts are continuously working to **understand your needs** and find the **right solution** for you.

IFP Training courses are taught using **active learning methods** combined with industry applicable and innovative techniques such as relevant case studies and dynamic simulators. We offer trainings of a renowned quality with a proven track record of **increasing business performance**.

Every year, some 15,600 industry professionals, including **managers, engineers, technicians or operators,** from more than 80 countries across the world, take part in one of our 1,400 training courses, whether it be scheduled or **customized** as an In-house course.

This catalog provides you with a glimpse into our courses in the world of Refining & Chemicals. With a panorama of services that we are constantly evolving, I am certain that we can provide you with the adequate solution that will contribute to the **success of your projects**.

Jean-Luc Karnik
Chief Executive Officer

A **Partner** of **Excellence**

Content

IFP Training Our **Difference**

IFP Training is the market leader in training for the Oil and Gas, Chemical and Powertrain industries. Our mission is to develop and certify the competencies of industry professionals. We create unique partnerships with our clients that thrive on trust and communication. This is key to building long-lasting relationships with them.

As part of IFP Energies nouvelles *(IFPEN)*, we have the knowledge of the Oil & Gas world at our fingertips. We offer integrated training courses that cover the entire Oil & Gas value chain as well as the powertrain industry. Through a variety of training techniques and methodologies, we create innovative training courses that provide your workforce with the skills they need to succeed. Our team of experts works closely with our clients to create customized training plans and deliver courses of value and quality.

Be part of something bigger, **The IFP Group**

IFPEN is an internationally recognized R&D center focused on improving industry technologies for energy, transport and the environment. Its research produces technological patents that are developed at an industrial scale via its subsidiaries who are leaders in their domain. They offer premium services to upstream and downstream companies. With this unique link between research and industrial worlds, **IFPEN** is also invested in education and professional training through a world-renowned university and a company dedicated to enhance professional competencies, **IFP School** and **IFP Training**.

▸ Some subsidiaries of the group:

BeicipFranlab · Axens IFP Group Technologies · HEURTEY PETROCHEM · PROSERNAT HEURTEY PETROCHEM • IFP Group Technologies

IFP School offers applied graduate programs, providing students and young professionals from all over the world with education in the fields of energy with particular emphasis on sustainable development and innovation. These programs are offered in France or partially abroad through partnerships with other prestigious universities. In the latter case, students attend the program in both **IFP School** and their home university and receive a dual degree.

Together, **IFP School** and **IFP Training** regularly set up Master's degree and graduate diploma programs abroad for Oil & Gas companies. Hence, **IFP School** & **IFP Training** together bring these ambitious programs to the client's door. This solution contributes efficiently to our customers' long-term strategic goal of preparing their leaders for tomorrow.

Thanks to the international and multidisciplinary reach of the **IFPEN group, IFP Training** has a wider range of expertise and resources than any other Oil & Gas training organization.

Your **Added Value**: IFP Training

When you partner with **IFP Training,** you confide in a **professional training organization** to increase your workforce's competencies.

Our team of industry experts engineers **tailored programs** aiming to deliver industry oriented and **applied training services**. These top-notch solutions have been provided for more than 40 years mainly through long standing relationship with our customers. This continuity is the key for understanding our **solid reputation**.

Our results-driven training courses allow you to confidently invest in the competencies of your employees. Your return on investment is maximized thanks to a **highly efficient workforce,** ensuring a **productive and safe environment.**

From **Upstream to Downstream** & All That's In Between

IFP Training's offer covers the entire Oil & Gas value chain, from the exploration and production to the refining, petrochemistry and trade of hydrocarbons. Our areas of expertise also include how engines are designed for optimal combustion as well as the economics and management aspects of the Oil & Gas industry. These vast fields of expertise brought together in a single training company make **IFP Training** one of a kind.

Our trainings are engineered for all categories of industry professionals, from **plant operators** and **technicians** to **engineers** and **managers**.

All our instructors exceed industry standards and our courses are constantly being updated with the most **relevant content**.

Innovative Courses Executed to Perfection

IFP Training's approach is focused on what is "**need-to-know**" rather than "nice-to-know". Educational design is essential to formalize field experience, technical expertise and theory to end up with an effective process for the learners to acquire and further develop knowledge, know-how and interpersonal skills.

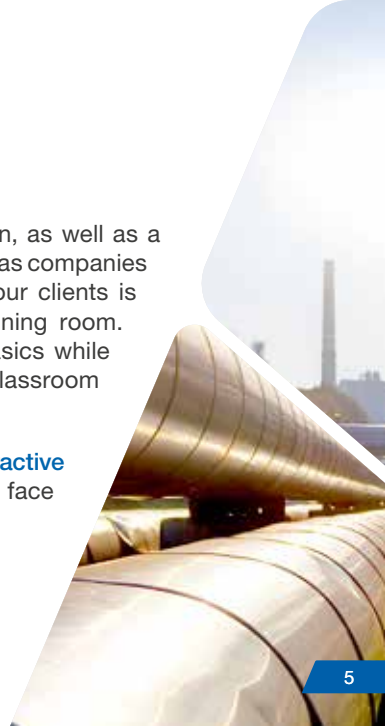
Our training methodology maximizes retention rates and participants' engagement through active learning techniques. Each course is built through **dynamic learning scenarios** keeping participants motivated and committed.

When participants are actively involved in a lesson, **they will remember more.**

RSI – Bringing your training experience to life

RSI is a leading international expert of process and control simulation, as well as a subsidiary of **IFP Training**. This collaboration allows us to provide Oil & Gas companies with **tailored simulation and training solutions**. The added value for our clients is bringing **real-case scenarios** encountered in their plant into the training room. With Operator Training Simulators *(OTS)*, newcomers will learn the basics while more experienced personnel will have the opportunity to face critical or emergency situations in a classroom environment.

Participants partake in a **unique learning experience** of both **instructor-led courses** and **interactive simulations**. This is the most efficient way to prepare your team to tackle complex processes and face unexpected situations.



Allow us to get inside
your world

Your Talent, **Our Expertise**

Depending on your expectations and constraints, **IFP Training** might either invite your personnel to join scheduled **public courses** in our training premises or specifically organize **tailored courses** at your own place. On demand, we can offer **long programs** that lead to an internationally recognized certification or a graduate degree in partnership with **IFP School**.

IFP Training provides **consulting services** ranging from competencies management, training center design, global certification approach, on-the-job coaching to training program engineering.

We also design **career paths** to help HR and management map out the development plan that is optimum for each employee.

In-House Training How, Where & When You Want

IFP Training's skilled and dedicated team is comprised of **100 permanent instructors** and a network of **600 industry experts**. Bolstered by their rich industry experience, We design **high-quality** and personalized training sessions from scratch, guaranteeing a **high success rate**. Our technical content is aligned with your expectations and we develop relevant study cases that allow an **immediate practice** of acquired knowledge.

It is valuable for the participant to be trained in the environment they work in, so that they can benefit from On-the-Job Training and On-Site coaching. Hence, we offer **flexible In-House training** services at your choice of location, in your training center or ours.

A number of our courses are available in an online and in-person **blended learning** format to fit better into your schedule.

Public Courses Scheduled All-Year-Round

IFP Training offers a portfolio of public courses that gives you the possibility to send over your employees to benefit from **industry applied training** and exchange with other professionals in a positive learning environment. There is a real interest in mixing in one classroom, participants coming from different industrial environments, representing different cultures, and specialists of different technical domains. This **cross fertilization of experiences** is particularly rich and one of the key reasons to register for our public courses.

Certifications & Diplomas

A Global Approach **to Certification**

IFP Training has designed an **all-around certification** offer aiming to guarantee the competencies of oil and gas industry professionals.

We deliver Certifications to professionals, who participate in our training courses. Moreover, we offer Accreditations for training centers, training methodology, programs and documentation, as well as training instructors.

Our courses that lead to Certification of industry professionals are designed for **operators, technicians and engineers**. An **IFP Training** Certification formally validates the competencies acquired during our training sessions. We offer four certificate levels, ranging from **Vocational**, **Graduate**, **Advanced** to **Executive** certificates.

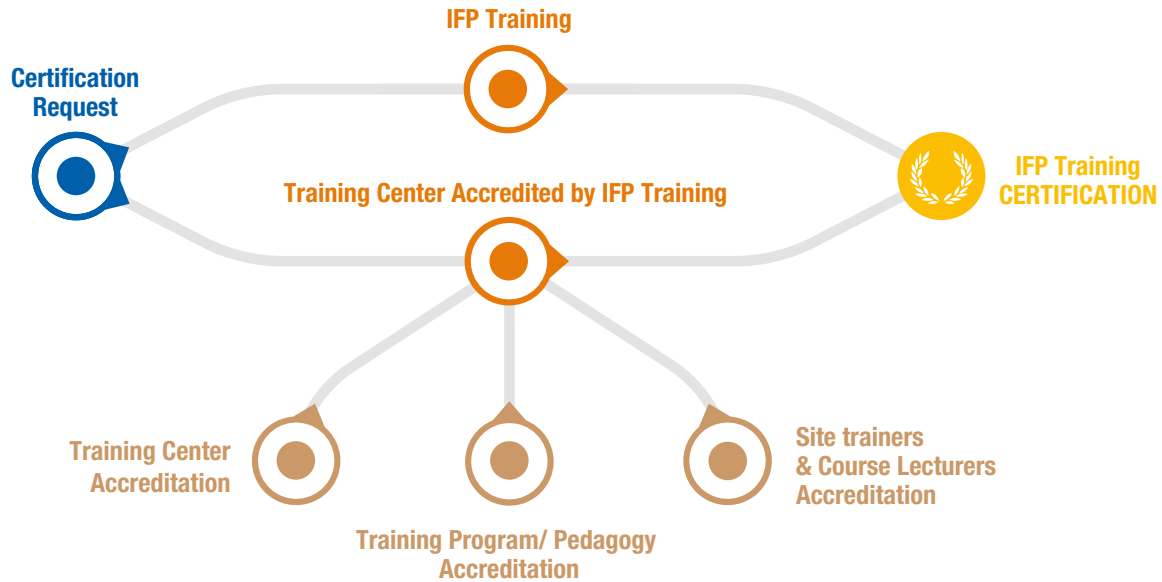
On the other hand, as an international certifying body, **IFP Training** offers a **5 years global and renewable accreditation**.

This accreditation concerns training centers that ambition to deliver training programs at the **IFP Training** standard and **IFP training** labeled.

This global accreditation, including a constant monitoring by **IFP Training**, includes three accreditation levels:

- **Training center accreditation**: compliance with design, equipment and organization criteria.
- **Programs, methodology and documentation accreditation**: compliance with training and educational engineering criteria.
- **Training instructors' accreditation**: qualification with respect to technical and educational requirements to ensure their capacity to deliver training sequences matching **IFP Training** criteria.

Once these three levels are granted, the training courses delivered will allow successful candidates to obtain an **IFP Training** certificate.



Master's Degrees & Graduate Diplomas from IFP School

Regularly **IFP Training** and **IFP School** join their efforts to offer a **Master's degree program** to companies looking to enhance the skills and knowledge of their most promising employees. Our customers rely on these long programs to develop their human resources and prepare their future leaders.

Consulting **Services**

Not only do we improve the skills of your workforce today, but we also plan for years ahead, helping you shape the way your organization operates, trains and recruits talents in the future.

Our Consulting services allow us to get inside your world to optimize your business processes:

- Competency Assessment
- Training Plan Auditing
- Training Plan Elaboration
- Training Program Design
- Design & Management of Training Centers
- Coaching

Throughout our experience, we have learned how to identify and eliminate core competency gaps within individual organizations. For HR teams, we offer the assessment and mapping of their workforce's competencies. We can create tailored training plans specific to your business and ensure the appropriate training is delivered for each job function. The training program may be extended by a coaching period to ease and encourage learners to efficiently apply the newly acquired skills and knowledge.

IFP Training also advises on the appropriate learning environment for your employees, with consultation on the design, management and certification of existing centers and the creation of manuals, benefitting future employees with a clear and consistent training plan.

Setting Clear **Career Paths**

IFP Training provides you with predetermined career development paths to help guiding HR, management, and employees on their developmental journey. Strengthening your team from inside and encouraging employee retention is highly valuable to any organization. We have solutions for professionals at any stage in their career, from Operators and Technicians right through to Junior and Senior Engineers.

A progression matrix depicts the skills and know-how needed to take the next steps towards future leadership positions. HR professionals can easily decide which courses would benefit their staff the most in order to prepare their leaders for tomorrow. This is not only an added value for your HR and management teams, but also for individuals who have a personal development path that leads them in the right direction to achieve their goals.

Unique **active learning approaches**

How do **we do it?**

We know that **motivation and commitment** lead to better learning. By combining our industry leading team of experts with our innovative training methods, we create **unique and dynamic** learning experiences of a quality that is never compromised.

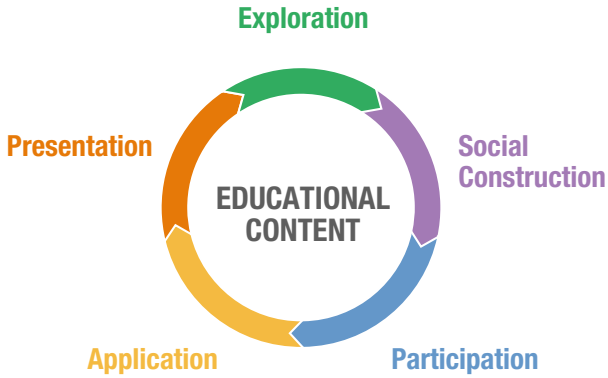
Our training methodology has been developed internally and is based on the last researches towards adult training pedagogy and innovative technologies.

Each of our courses is taught using its **specific scenario** composed of applied sequences to get participants thinking about how they would react to real life situations.

Pedagogy for Professional Training

The training methodology applied at **IFP Training** is based on the following conditions:

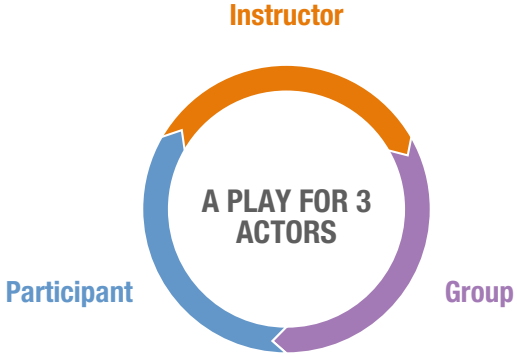
- **Motivation through meaning** given to the training
- **Commitment to the objectives**
- **Connection to trainees' daily work**
- **Link with what the trainees already know**
- **Tangible reality** through activities based on industrial situations
- **Learner enjoyment** combines learning with fun, practical activities, site visits, etc.
- **Trainees' active participation**
- **Immediate knowledge activation**
- **Regular training feedback**
- **Belonging to the learning group**
- **Individualization of the course**
- **Development of autonomy**
- **Innovative learning environment**



Our programs address these various approaches for improved competency enhancement, leading to effective and efficient professional development.

Active Learning Methods

Our active learning approaches are unique as they focus less on the formal, lectured style of learning and more on **collaborative learning**, bringing everyone together to share their skills and experiences in order to create a highly compelling learning environment. We strive to provide an **active learning environment** for every training, ensuring that your employees better retain acquired information. In order to captivate participants' attention, we combine both **practical and theoretical lessons** within our courses and constantly change and evolve the learning environment so that participants stay engaged.



The objective of active learning in **IFP Training** courses consists in putting the learner in an **active position**. He/she becomes an actor in the training process. This allows him/her to learn in an efficient and lasting way. In active pedagogy, the learner is not the only performer of the training course: to have a good balance in the training process, three actors successively take part during the training course, the **instructor**, the **participant** and the **group**.

PePS©: Pedagogy Per Situation

Based upon clear training objectives, **IFP Training**'s courses are formalized in a "**scenario**" which defines the sequence of educational steps through **situations**, **learning modes**, **activities** and **training tools**. The course design aims to obtain a **balance** between the time spent on **educational activities** and the one for **talks and lectures**.

For the best training efficiency, the learner must enjoy different ways of learning activities

SITUATIONS **LEARNING MODES** **ACTIVITIES** **TRAINING TOOLS**

Situations

The **SITUATIONS** correspond to the different sequences of a training day:

- Learning Conditions
- Motivation
- Application
- Evaluation
- Conclusion
- Reactivation
- Acquisition
- Appropriation
- Synthesis Anchoring
- ...

They are intentionally varied and alternate in order to accompany participants' progression.

Learning modes

The **LEARNING MODES** aim at maintaining the trainees' focus. For his/her training experience to be complete and have long-lasting knowledge, the trainee must switch between 5 main learning modes:

- Exploration
- Presentation
- Application
- Social Construction
- Participation

These different modes consist in switching the roles of the trainer as well as the trainees between learning, discovering, exploring, teaching, collaborative or cooperative learning, peer production…

The complementary situations and learning modes come together to build a solid and deeply rooted apprenticeship where the learner is at the center of the learning process.

Activites

The scenario offers various **ACTIVITIES** designed to achieve the learning objectives. The trainee's pleasure and motivation are maintained through the combination of interactive presentations, on-the-job training, team work, educational games…

IFP Training's method offers a wide variety of more than **30 learning activities**:

- Brainstorming
- Inquiry
- Collective quiz
- Questioning group
- Work in pairs
- Ice-breaker
- Lecture
- Exercise
- Conference game
- ...

The continuous switching between short periods contributes to maintaining attendees' focus and effective knowledge and skills building.

Training tools

To sustain the training scenario and organize the activities, both the trainer and attendees need to have access to various and combined **TRAINING TOOLS**:

- Audiovisual technics *(videos, interactive presentations, animations),*
- Computer software *(simulators, serious games),*
- Documents *(exercises, guides),*
- Various activities *(short lectures, exercises, hands-on workshops, individual and group work, mini projects based upon real cases, information gathering on documents and papers …),*
- Interactive teaching with dedicated instructors and tutors with extensive industry experience,
- Evaluation methods *(MCQ, short tests, reporting & presentations, etc.).*

In addition, relevant coaching and tutored sessions provide the opportunity to apply the newly acquired skills and practice them on real datasets. Learning by doing is the underlying principle of all hands-on activities.

Certifying the competencies of industry professionals

A Complete **Certification Solution**

Backed by our experience of more than 40 years as an international training expert, **IFP Training** applies the international standards of the Oil & Gas Industry to its practices, methodology and pedagogy. Our complete certification process ensures the quality of the trainings and guarantees that the learning objectives are achieved.

IFP Training's prestigious certification programs offer Oil & Gas industry professionals the opportunity to validate their expertise in a particular field, by certifying their competency level to an international standard. This constitutes a milestone in a career and offers employers the chance to evaluate and improve their workforce's competencies.

A Certification for **Every Industry Professional**

IFP Training awards certificates that formally attest the holder possesses the competencies set out in the specific requirements for each certification.

Four different certificate levels are available:

Vocational Certificate: for technicians or operators wishing to develop their skills and enhance their level of qualification,

Graduate Certificate: for engineers *(or equivalent)* looking to expand their field of competencies in the Oil & Gas industry and prove the mastery of their profession,

Advanced Certificate: for experts, future technical entity managers and employees with more than 10 years' experience in their field. The objective is to achieve a high level of specialization in a particular field,

Executive Certificate: for managers or high potentials, looking for a complete overview of the petroleum industry and the necessary competencies to fill top positions.

Certifications as Proof of a Level of Competency

IFP Training certifications are based upon programs aiming to develop formalized competencies foundations. These programs are built on 40 years of experience in partnering with our industry's main players and already constitute reference standards in the Oil & Gas world. They attest the certificate holder's level of competency and know-how thus providing employers with benchmarks for their employees' professional development.

Training Solutions in **Support of Professionalization**

For each of its certifications, IFP Training provides a comprehensive solution including the training program, assessments and award of certification.

However, some of the certifications offered may be provided independently of the associated training. In this case, they are aimed at experienced professionals seeking certification to validate professional skills they have learned on the field as a more visible recognition of their qualifications.

Training Tailored to Meet the Needs of Industry on the International Stage

IFP Training is the **"go-to" organization**, expert in Oil & Gas and engines. Thanks to our privileged position, we have been able to develop certifications enjoying **worldwide recognition**. The areas of competency listed in the certification requirements have been established in partnership with major players of the industry to meet their needs on the field. Maintaining close contact with the industry and staying aware of its ever-changing needs, **IFP Training** keeps on updating its target learning objectives for competencies to meet world market expectations. This long-standing and trusted partnership with the industry has earned worldwide recognition for **IFP Training** certifications.

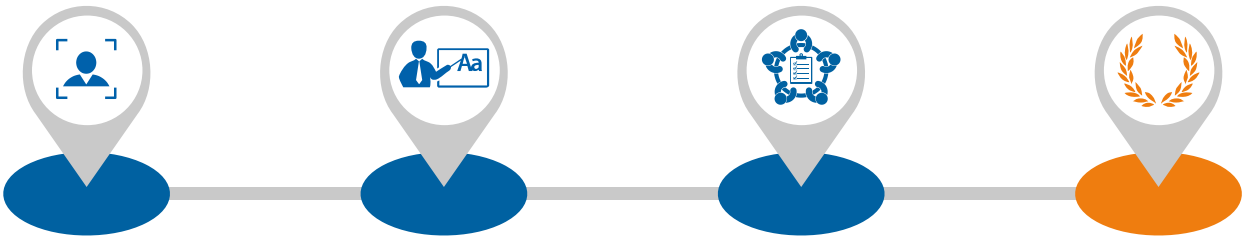
Clear & Transparent Rules

As a recognized, **independent and impartial body, IFP Training** fairly and equitably awards **high-level** professional certifications. Each one is based on a clearly established set of characteristics specified by **IFP Training:**

1. **detailed target learning objectives,**
2. **clearly defined acquired competencies,**
3. **formally established assessment procedures,**
4. **plainly worded certificates tailored to the international context,**
5. **a certification process in line with internationally advocated requirements for quality management system.**

The relevance and worthiness of **IFP Training** certifications are directly linked a combination of these elements.

The **certification process**



Selection

- Application of trainees
- Eligibility examination
- Selection of participants

Training

- Training scenario implementation
- Including sometimes on-the-job training sequences

Assessment

- Competencies assessment all-along the program
- Final assessment including sometimes a presentation in front of a jury

Certification

- Examination of the full Certification files
- Collective decision
- Certificates awards

Real Guarantees of Quality & Certification Validity

To provide candidates and companies with all the guarantees concerning the certifications, **IFP Training** has created a **quality management system** based on international quality standards.

These specify the general requirements for certification bodies and the steps to be taken to carry out **transparent, structured and impartial assessments** of formally defined, precise competencies before awarding individuals the relevant certificate.

The ultimate aim is to provide future certification holders and employers of the industry with trustworthy and credible assurances regarding the **IFP Training** certifications.

The Benefits of IFP Training Certification

Our certifications offer the best solution to industry challenges and guarantee a return on investment regarding competencies management and a world-renowned quality. Certifications benefit both the individual participant and his company since they favor **career progression** and **competencies improvement**, thereby contributing to performance and quality.

RETURN ON INVESTMENT

- Quick and direct enforcement of competencies
- Strong source of motivation for professionals
- More efficient teams in their daily activities

EFFICIENT AND DYNAMIC COMPETENCIES MANAGEMENT

- Capitalizes and helps develop knowledge and know-how of workforce
- Develops new skills to favor innovation and performance
- A lever of internal mobility

GUARANTEE OF QUALITY

- Guaranteed acquisition of skills
- Methodology ensuring transparency and equity
- Objectivity and neutrality in evaluating and granting the certification

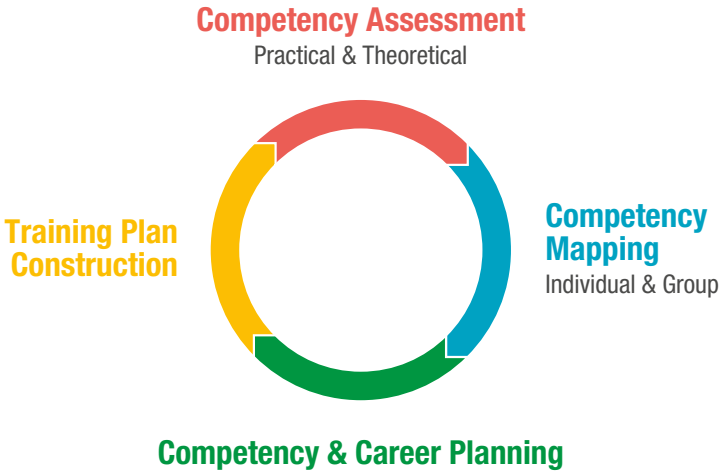
Your employees' expertise
at your fingertips

Competency Assessment System

It covers all aspects of IFP Training's methodology for competency management. It consists in validating the core strengths of your workforce, identifying where there is lack in competencies and improving the overall skills and knowledge of the concerned population. Using state-of-the-art technology, we have created our Competency Assessment System *(or C.A.S)* that allows for planning, analysis and management of your workforce's competencies

Our C.A.S. **Methodology**

IFP Training developed a comprehensive competence assessment methodology and can help you throughout the competence management life cycle, from its design to its implementation:



IFP Training's Competency Assessment System integrates with your internal HR structure, improving the efficiency of your HR processes.

An assessment system identifies a workforce's strengths and weaknesses. It is an efficient method to build relevant Individual Development Plans and maintain and develop your teams' skills.

It is also a way to verify and ensure the operating rules and installation integrity are being respected. This approach has now become an international standard and increases the third parties' trust.

Our C.A.S. **Tool**

Our methodology relies on a tool that brings it to life by creating visual plans and data sets for you to interpret and analyze. This tool keeps track of your entire workforce competencies and provides detailed reports for HR and managers.

Customizable

- User interface
- Composition of the assessment *(topics, competences, criteria, …)*

Upgradeable to meet the industry

- Innovative competences
- Adaptable to any site specificities *(Onshore, Offshore, LNG, …)*

A continuous quality-enhancement cycle

Comprehensive reporting

- Employees view
- Management view

User friendly

- Tool suitable to all IT systems
- Easy-to-use interface

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

Energy & Thermal Equipment	Duration	Dates	Location	Tuition fee (H.T.)	Reference	Page
Energy Efficiency & Renewable Energy						
NEW Day-to-Day Energy Optimization for Industrial Plants	5 d		In-house course		EMT/MENERG-E	98
Process Energy Efficiency Improvement for Industrial Plants	3 d	25 - 27 September	Martigues	€1,790	EMT/ANAENERG-E	99
Exchangers, Process Furnaces & Boilers						
Thermal Equipment	5 d	18 - 22 September	Martigues	€2,910	EMT/THERMEQ	100
Heat Exchangers Certification	5 d		In-house course		EMT/HEDES	101
Furnaces: Safe Operation & Optimization	4 d		In-house course		EMT/FURNSOO	102
Tubular Furnaces	4 d		In-house course		EMT/FURNDES	103
Boilers Safe Operation & Optimization	4 d		In-house course		EMT/BOILER	104
Refrigeration Unit Operation	3 d		In-house course		EMT/GRFRIG-E	105
Cogeneration - Combined Cycles - Waste Heat Recovery	3 d		In-house course		EMT/COGENE-E	106

Rotating Equipment	Duration	Dates	Location	Tuition fee (H.T.)	Reference	Page
Specifications, Technology & Performance						
Rotating Equipment	5 d	11 - 15 September	Lyon	€2,910	MTE/ROTMACH	108
Centrifugal Pumps & Positive Displacement Pumps	5 d		In-house course		MTE/PC-E	109
Gas Compression & Expansion: Compressors & Turbines Certification	4 d	9 - 12 May	Lyon	€2,330	MTE/CCTAV-E	110
Gas Turbines Certification	5 d	15 - 19 May	Lyon	€2,850	MTE/TAG-E	111
Rotating Machinery Selection	4 d		In-house course		MTE/SELECT-E	112
Reciprocating Compressors	5 d		In-house course		MTE/EECV-E	113
Centrifugal Compressors	5 d		In-house course		MTE/ECC-E	114
Steam Turbines	5 d		In-house course		MTE/EXTAV-E	115
Troubleshooting, Maintenance & Reliability						
Machinery Failure Analysis & Repair Methods	5 d		In-house course		MTM/RUPT-E	116
Machinery Vibration	4 d		In-house course		MTM/PAVIB-E	117
Operation, Maintenance & Inspection of Rotating Machinery	15 d		In-house course		MTM/OMIRM	118
NEW Rotating Machinery: Troubleshooting Analysis	5 d		In-house course		MTM/RMTS	119

Instrumentation, Control & Electricity	Duration	Dates	Location	Tuition fee (H.T.)	Reference	Page
Instrumentation, Control & Electricity						
Instrumentation & Process Control Certification	5 d	28 August - 1 September	Martigues	€2,910	IR/INPC	122
Advanced Process Control	4 d		In-house course		IR/PRCONT	123
Multivariable Predictive Control	4 d		In-house course		IR/MPC	124
Design & Operation of a Safety Instrumented System (SIS)	3 d		In-house course		SEC/SIS-E	125
Introduction to Industrial Electricity	5 d		In-house course		IR/ELECBAS	126
Electrical Maintenance for Industrial Plants	5 d		In-house course		IR/ELECMAIN	127
Electrical Motors: Technology, Operation & Maintenance	5 d		In-house course		IR/OMIEM	128

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

Project Management	Duration	Dates	Location	Tuition fee (H.T.)	Reference	Page
Project Management						
Downstream Project Management Certification	5 d	27 November - 1 December	Rueil	€2,870	PGP/MRSMPROJ	158
Engineering Management	3 d	30 May - 1 June	Rueil	€2,250	PL/EMGB	159
Quality & Risk Management in Projects	3 d	2 - 4 May	Rueil	€2,250	PL/QAQCGB	160
Contracts & Procurement	5 d	13 - 17 November	Rueil	€3,400	PL/CPGB	161
Estimation & Cost Control	4 d	14 - 17 March	Rueil	€2,330	PGP/EMCOU-E	162
Commissioning & Start-Up of Process Units	4 d		In-house course		SEC/OPDEM-E	163
Project Management	5 d		In-house course		PGP/GPP-E	164

Engineering Studies	Duration	Dates	Location	Tuition fee (H.T.)	Reference	Page
Engineering Studies						
Processes Representation	3 d		In-house course		PGP/PROCREP	166
General Layout	3 d		In-house course		PGP/GENELAY	167
Civil Engineering	5 d		In-house course		PGP/CIVILENG	168

Economics	Duration	Dates	Location	Tuition fee (H.T.)	Reference	Page
Paris Energy Summits						
International Oil Summit	1 d	27 April	Paris	€990	PEH/IOS	170
International Gas, Renewable & Electricity Summit	1 d	9 November	Paris	€990	PEH/IGS	171
Energy Economics						
Overview of Petroleum Economics	4 d	5 - 8 December	Rueil	€2,490	ENE/OPE	172
Overview of Natural Gas Economics	4 d	27 - 30 June	Rueil	€2,690	ENE/ONE	173
Liquefied Natural Gas Economics	4 d	19 - 22 September	Rueil	€3,200	ENE/LGE	174
Trading Economics						
Oil Markets & Trading	3 d	30 May - 1 June	Rueil	€2,260	TRT/OMT	175
Shipping: General Features, Chartering Contracts & Operations	4 d	11 - 14 April 12 - 15 December	Rueil Rueil	€2,950 €2,950	TRT/CFS	176
Downstream Economics						
Planning & Economics of Refinery Operations	4 d	17 - 20 October	London	£3,300	EAV/PERO	177
Refinery Operation Management & Linear Programming	5 d		In-house course		EAV/ROM	178
Economic Framework of Refining	5 d	29 May - 2 June	Rueil	€3,140	EAV/EFR	179
Economic Optimization of Refining Operations	5 d	11 - 15 December	Rueil	€3,270	EAV/REO	180
Refining & Petrochemicals Synergies	2 d	22 - 23 November	Rueil	€1,470	EAV/SRP	181
Profitability Analysis of Downstream Investment Projects	3 d	16 - 18 May	Rueil	€2,000	EAV/PDP	182
Downstream Module	60 d	18 April - 13 July	Rueil	€12,550	EAV/DOM	183
Finance & Management						
Price Risk Management in Energy Markets	3 d	17 - 19 October	Rueil	€2,450	GIP/PRM	184
Investment Profitability Studies in the Oil & Gas Industry	4 d	25 - 28 April	Rueil	€2,780	GIP/IPS	185

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

Engineer Training Program

Introductory Training Courses

	Sessions during this period	Pages
Junior Engineers	**TECHNICAL INFORMATION**	
	Refining Processes & Petroleum Products	30
	Base Oil Production	32
	Natural Gas	38
	Petrochemicals	37
	ECONOMICS	
	Refining	179
	Liquefied Natural Gas	39

Core Technical Training Courses

	Sessions during this period	Pages
Junior Engineers	**FUNDAMENTALS COURSES**	
	Petroleum Refining & Petrochemicals	48
	Process Engineering	44, 45, 50
	PRO II/PROVISION Simulation Software	51
	EQUIPMENT	
	Rotating Equipment	108
	Thermal Equipment	100
	Instrumentation & Process Control	122
Experienced Engineers	**PETROLEUM PRODUCTS, REFINING & PETROCHEMICAL PROCESSING**	
	Petroleum Products	84
	Catalysts	61
	Distillation	54, 58, 63
	Processing of Petroleum Light Cuts & Middle Distillates	36, 59, 60, 70
	Processing of Petroleum Heavy Cuts	60, 67, 69, 70
	Alkylation	68
	Hydrogen Manufacturing	70
	Petrochemicals & Polymer Manufacturing	76
	Utilities	36
	SAFETY, OPERATION	
	Operational Safety	146
	Maintenance Safety	149
	Commissioning, Start-Up of Process Units	163

Specialized Technical Training Courses

	Sessions during this period	Pages
Experienced Engineers	**DESIGN & OPERATION OF EQUIPMENT**	
	Rotating Equipment	79, 108, 109, 110, 111, 113
	Thermal Equipment	99, 101, 102, 103, 106
	Cooling Systems	105
	Analytical Methods	86
	Off-Site Operation	88
	MAINTENANCE	
	Rotating Equipment	108, 118
	Corrosion	93
	Inspection Plan	92
	Maintenance Management	130
	Turnaround Management	132
	SAFETY, ENVIRONMENT	
	SHE Management	153
	Process Hazard Reviews	145
	Safety Engineering	144
	PROJECTS	
	Project Management	158, 164
	Estimation & Cost Control	162

Operator & Chief Operator Training Program

Introductory Training Courses

Newly Recruited Operators

Sessions during this period	Pages
Field Operator Certification	136
Operator Basic Training Course	141

Specialized Professional Training Courses

Experienced Operator / Boardmen / Panel Operators

Sessions during this period	Pages
OPERATION OF EQUIPMENT	
Pumps	109
Compressors	114
Steam Turbines	115
Furnaces	102
Boilers	104
Refrigeration Unit	105
Process Control	122
Transfer & Storage	87
SAFETY	
Operational Safety	146
Safety in Maintenance & Construction Works	149
OPERATION OF PROCESS UNITS	
Distillation	54
Atmospheric & Vacuum Distillation	63
Catalytic Reforming, Isomerization	64, 65
Hydrotreatments	62
Catalytic Cracking (FCC)	67
Alkylation	68
Hydrocracking	69
Visbreaking	73
H_2S Removal & Sulfur Recovery	72
Hydrogen Manufacturing	70
Coker	74
Panel Operator Training Course	137

Advanced Training Courses

Chief Operators / Foremen

Sessions during this period	Pages
Refinery Foremen Training Course	138
Advanced Process Control	123

Engineer Training Program

Specialized Training Courses

Mechanical Technicians / Experienced Technicians from Maintenance or Inspection Departements

Management Training Courses

Maintenance Supervisors

Refining, Petrochemicals & Natural Gas

Refining

Petrochemical

Gas

Refining Processes & Petroleum Products

Purpose

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

Audience

Level: FOUNDATION
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:

- learn about the composition, main characteristics and new trends of petroleum products,
- understand 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 summary per unit is built to highlight key process variables.

Prerequisites

No prerequisites for this course.

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.

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.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	24 April	28 April	€2,870
Al Jubail	15 October	19 October	€3,090
Rueil	13 November	17 November	€2,870

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

Introduction to Refining

Purpose

This course provides a basic technical information on refining processes.

Audience

Level: DISCOVERY

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:

- learn about the main refining processes and their operating characteristics,
- understand the manufacturing scheme of petroleum products,
- understand the main constraints and trends in the refining industry.

Ways & Means

Active participation of trainees through interactive games.

Prerequisites

No prerequisites for this course.

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.rueil@ifptraining.com**

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

Base Oil Production

Refining & Environment

Purpose

This course provides a deepen technical knowledge of lube base stocks manufacturing with an overview of the business environment.

Audience

Level: DISCOVERY
Technical staff from oil or lubricant industries, or subcontractors interested in base oil refining technology and environment.

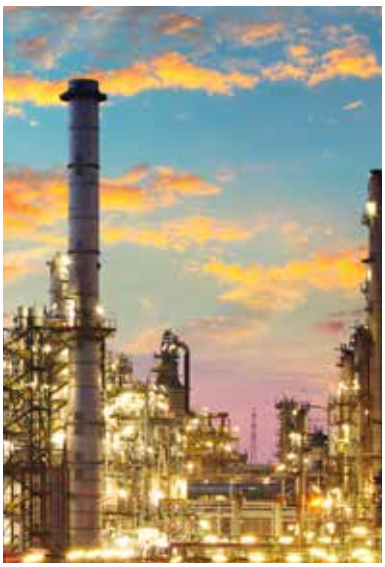
Learning Objectives

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

- gain an overview of lubricant uses, classifications and markets,
- understand the relation between quality requirements, processes used and composition of lube base stocks and by-products,
- learn about main operating parameters and their impact on performance.

Prerequisites

No prerequisites for this course.



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 — *0.75 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 — *1.5 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.

Operation and troubleshooting:
- 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.
- Study of the industrial risks of this operation.
- Disturbances and incidents.

Reference: RPC/BOR Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

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

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

Level: DISCOVERY

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:

- learn about the role of specific equipment in various processes,
- identify the operating conditions and constraints for different phases of operation,
- understand the industry's terms and conditions.

Prerequisites

No prerequisites for this course.

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.rueil@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

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

Level: DISCOVERY

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.

Prerequisites

No prerequisites for this course.

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.rueil@ifptraining.com**

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

Recent Developments in Oil Refining Technologies

Purpose

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

Audience

Level: ADVANCED
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,
- deepen knowledge of recent developments in oil refining processes,
- learn 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.

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.

Course Content

5 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: SOx, CO_2, NOx, 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 SOx and NOx emissions.

GASOLINE & SULFUR REDUCTION STRATEGIES — *0.5 d*

Sulfur distribution in FCC gasoline and selective HDS.
Alternate sources of gasoline:
Light olefins oligomerization.
New trends in alkylation.

ULTRA - LOW SULFUR DIESEL PRODUCTION & VGO DEEP HYDROTREATMENT — *0.5 d*

New generation catalysts and their performance.
Diesel hydrotreater units: investigation of new and existing means of achieving ULSD.
FCC feed pretreatment.

HYDROCRACKING FOR VACUUM DISTILLATES & RESIDUES — *0.75 d*

High pressure hydrocracking, mild hydrocracking.
Recent technologies: catalysts, energy recovery, fractionation.
Various technologies available: fixed bed, ebullient bed, moving bed.

HYDROGEN BALANCE — *0.25 d*

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

THERMAL CONVERSION OF RESIDUES — *0.5 d*

Renewal of an old process: delayed coker and residue destruction.
Purification of the products and hydrogen consumption.
Integration into the framework of crude upgrading.

CRITICITY OF SULFUR UNITS — *0.5 d*

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

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

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

Utilities & Waste Treatment

Purpose

This course provides a complete knowledge of processes to produce utilities (water, steam, power, air), equipment involved and supply networks, including collection networks and wastewater treatment units.

Audience

Level: FOUNDATION
Engineers and supervisors from the production and technical departments of refining and petrochemical sites.

Learning Objectives

Upon completion of the course, participants will be able to design and operate utility units in their broad outlines.

Ways & Means

- Videos or slide shows to demonstrate the implementation of different technologies.
- Practical application exercises on the design and/or operation of each utility.
- Numerous learning games or quizzes to test participants' learning.

Prerequisites

No prerequisites for this course.

Course Content

5 days

WASTEWATER TREATMENT *1 d*

Main properties, requirements and specifications of users.
Pretreatment: filtration, settling, decarbonation, softening.
Fire water network: design features, main pieces of equipment, function of foam and water.
Cooling water: open, semi-open, and closed circuits, cooling towers, design and operation.
Seawater cooling circuits, related problems, technical solutions.
Demineralization: ion exchange resins, reverse osmosis, degasing, finishing treatments.

STEAM PRODUCTION & SUPPLY *1 d*

Network: pressure levels, types of users, network structure and control, turbines, static expansions.
Water-tube boiler: water and steam circuits, air and exhaust stack (equipment and control), fuel origin, selection and optimization, types of burners, combustion follow-up, process control.
Other types of boilers: fire-tube boilers, CO boilers, steam cracking boilers, etc.

POWER PRODUCTION & SUPPLY *1 d*

Quality requirements: power and voltage levels, other characteristics.
Power production: turbo-generators, gas turbines, cogeneration units.
Electrical network: key-equipment, transducers, earthing, back-up, problems of reliability.

COMPRESSED AIR & AIR GAS *0.5 d*

Process requirements: users' specifications and reasons, air supply criticality.
Air instruments: compressors, dryers, supply network, back-up.
Production of nitrogen: design, uses and risks. Uses of oxygen and CO_2.

HEATING NETWORKS *0.5 d*

Fuel networks: gaseous, liquid, solid. Waste gas recovery.
Flare networks and systems. Networks of atmospheric and pressurized drains.
Hot oil: main uses, oil furnaces, oil quality, networks.

WASTEWATER COLLECTION & TREATMENT *1 d*

Source of pollution, specifications of wastewater effluents, networks. Controls.
Oily water treatment (settling, flotation, biological treatment), process water stripping, finishing.
New technologies for industrial and domestic wastewater treatment. Recycling options.

Reference: RAF/REF3 Only available as an In-House course.

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

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

Production of Base Chemicals & Commodity Polymers

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 & technologies available mainly in the polyolefins field.

Audience

Level: DISCOVERY

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 & samples.

Prerequisites

No prerequisites for this course.

Course Content

5 days

MAIN INDUSTRIAL OLEFINIC & AROMATIC INTERMEDIARIES — 0.25 d

Main production processes and main uses of:
- Olefinic and diolefinic hydrocarbons: ethylene, propylene, butenes, butadiene.
- Aromatics hydrocarbons: benzene, toluene, ethylbenzene, xylenes.

STEAM CRACKING & TREATMENT OF THE CUTS PRODUCED — 2 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:
- Steam cracker effluent separation train, main characteristics & 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.

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 — 0.5 d

Analysis of FCC process: Nature of the feed stock, implementation of the catalyst & principle of reactor & regenerator set.
Composition & treatment of cracked gases.
Modification of the process for maximization of light cuts C_3 & C_4 production.

POLYMER TYPES & NATURE — 0.25 d

Polymer constitution: monomers, macromolecules, building blocks.
Various kinds of polymer: fibers, elastomers, plastics.
Plastic types: thermoplastics and thermosets.

POLYMER PRODUCTION - ASSOCIATED PROPERTIES — 0.5 d

Type of reaction & 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 & 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.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Al Jubail	22 October	26 October	€3,090

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

Natural Gas

Production - Treatments - Transport - End Uses

Purpose

This course provides a comprehensive review of the techniques involved in natural gas production, processing and transport, complemented with an overview of natural gas valorization channels.

Audience

Level: FOUNDATION
Professionals from all sectors, involved or interested in the natural gas industry.

Learning Objectives

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

- learn about fundamentals of natural gas composition, characteristics, production and field processing,
- understand technical issues and specific constraints of natural gas transport and storage,
- review the various end-user markets available for valorizing natural gas,
- grasp key natural gas chain economic issues.

Ways & Means

- Highly interactive training by industry-specialist lectures.
- Numerous applications and illustrations.

Prerequisites

No prerequisites for this course.

Course Content

5 days

NATURAL GAS: TYPES & PRODUCTION TECHNIQUES — *0.75 d*

Types and characteristics of natural gas fields. Production techniques.
Different types of natural gases (condensate, wet or dry gas) and characterization parameters.
Constitution of natural gas well effluent, properties and specific hazards.
Case of associated gases: recovery techniques, characteristics, composition, etc.

END USES OF NATURAL GAS - MAIN QUALITY REQUIREMENTS — *0.25 d*

End uses of natural gases: fuel (domestic and industrial uses), conversion into other energy types (electricity production and cogeneration), automotive fuel (Natural Gas for Vehicles - NGV and conversion into liquid automotive fuels GTL), chemical valorization, etc.
Quality requirements for commercial natural gases and associated products (ethane, LPG, condensates) - Examples of quality standards.

NATURAL GAS PROCESSING — *2 d*

Gas dehydration (drying) and Hydrate formation inhibition:
- System behavior. Moisture content of a saturated gas.
- Applications: moisture content of different gases having various compositions.
- Hydrate formation inhibition by injection of inhibitors: MeOH, MEG, DEG, LDHI, etc.
- Gas dehydration: TEG units, Molecular Sieves, etc.
- *Application: summary design of TEG unit.*

Gas sweetening: removal of acid components (H_2S and/or CO_2):
- Different techniques applicable for gas sweetening:
  - Chemical solvent processes. Amine units (MEA, DEA, DGA, MDEA, etc.).
  - Physical solvent processes.
  - Hybrid (physico-chemical) solvent processes.
  - Overview of other techniques.
- Conversion of H_2S: sulfur production (CLAUS process) and tail gas processing.
- *Application: summary design of an amine unit.*

Natural Gas Liquids (NGL) extraction (removal of heavy components):
- External refrigeration loop.
- Joule-Thomson expansion.
- Turbo-Expander.
- *Application: calculation of cryogenic loop used for NGL extraction.*

Examples of gas field development schemes:
- Gas fields development options: onshore or offshore processing, single-phase or multiphase export pipelines, “Wet” or “Dry” development.
- *Other treatments: mercury removal, conversion or adsorption of mercaptans (RSH), etc.*

TRANSPORT OF NATURAL GAS IN LIQUID PHASE - LNG OPTION — *1 d*

Liquefaction processes: principle, typical operating conditions, technology.
LNG tanks: Single or Double or Full Containment (self-standing, membrane). Hazards.
LNG transport: LNG carriers (MOSS spheres, Membrane, …), export and receiving terminals.
LNG regasification at the receiving terminals, options for refrigeration duty recovery.

TRANSPORT & STORAGE OF NATURAL GAS IN GAS PHASE — *0.5 d*

Gas pipes: technology, capacities, equipment, recompression units, operating conditions, etc.
Underground storage (old reservoirs, aquifers, salt domes, etc.). Required treatments at outlet.

NATURAL GAS ECONOMICS — *0.5 d*

Resources, production and markets.
Natural gas marketing: competition of other energy sources and consequences on gas contracts (prices and duration), cost of transport and its impact on the structure of the gas chain.
Future of the natural gas.

Reference: PROD/NATGAS Can be organized as an In-House course. Contact: **exp.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	9 October	13 October	€3,370

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

Liquefied Natural Gas (LNG)

Hazards - Technology - Operation - Economics

Purpose

This course provides a comprehensive technical and economic review of the Liquefied Natural Gas industry.

Audience

Level: FOUNDATION

Professionals involved or interested in the LNG industry: technical and managerial staff in the LNG industry, equipment providers, personnel from engineering companies, etc.

Learning Objectives

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

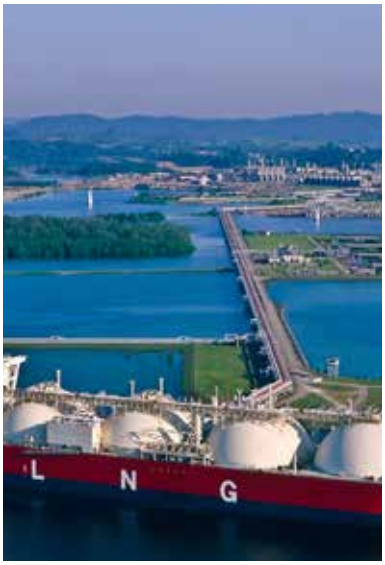
- review the structure of an LNG chain and the world map of LNG plants,
- understand main LNG physical properties and specificities,
- assess LNG facilities'hazards and HSE issues, along with risk mitigation and prevention techniques,
- grasp main liquefaction processes'operating principles, conditions and constraints,
- gain an overview of the technology of equipment used in the LNG industry,
- grasp the essence of LNG markets and contracts.

Ways & Means

- Highly interactive training by industry-specialist lecturers.
- Numerous applications, illustrations and videos.

Prerequisites

No prerequisites for this course.



Course Content

5 days

THE LNG WORLD — *0.5 d*

The LNG Chain. Order of magnitude and trends. Location of main plants worldwide.
Base load LNG plants. Peak shaving LNG plants. Small LNG plants for LNG fueled vehicles.
Receiving terminals. Regasification techniques. Satellite regasification techniques.

LNG SPECIFIC PROPERTIES & ASSOCIATED HAZARDS — *0.5 d*

Physical properties: Liquid-vapor equilibrium, density, ratio of vapor methane / LNG, heat of vaporization, heat of combustion, …
Safety aspects: flash point, fire point, auto-ignition point, minimum spark energy, flammability limits, deflagration.
LNG vaporization, Rapid Phase Transition (RPT), radiation levels, stratification / roll-over, sloshing, LNG clouds ignition.
Asphyxiation risks, cryogenic liquids jets, piping behavior.

LNG HAZARD PREVENTION & MITIGATION MEASURES — *0.5 d*

LNG spillage control at design stage and in operation.
LNG clouds control in operation.
LNG fires control at design stage and in operation.

LIQUEFACTION & REGASIFICATION PROCESSES — *0.75 d*

Feed pretreatment: sweetening, dehydration, NGL extraction, Hg and aromatics removal.
Different liquefaction processes: Pure component refrigerants, Pure component(s) and mixed refrigerant(s), mixed refrigerants.
Peak shaving simplified scheme.
Regasification process.

LNG STORAGE, LOADING / OFFLOADING & TRANSPORT — *0.75 d*

LNG tanks: single or double or full containment (self-standing, membrane). Hazards.
Jetty head, jetty trestle, harbor.
LNG carriers: common features, technology, cargo operations, safety systems.

TECHNOLOGY OF LNG SPECIFIC EQUIPMENT — *1 d*

LNG cryogenic heat exchangers: spiral wound heat exchangers, aluminum brazed heat exchangers.
Technology of the cryogenic compressors and their drivers (gas turbines).
LNG Vaporizers: Open Rack Vaporizers (ORV), Submerged Combustion Vaporizers (SCV), etc.
Safety and environmental aspects.
Submerged LNG pumps: in-tank retractable pumps, cargo pumps, HP canned send out pumps, etc.
Liquid cryogenic turbo-expanders, cryogenic valves.
Cryogenic personnel protection items.

LNG PLANT OPERATION — *0.25 d*

Day to day activities in an LNG plant. Experience of some plants.

LNG TRENDS - RESEARCH & NEW DEVELOPMENTS — *0.25 d*

LNG trends since the 70's. Equipment and concept development. Future developments.

LNG ECONOMIC ASPECTS — *0.5 d*

Gas markets: natural gas reserves and production, worldwide gas demands distribution, international natural gas trade.
LNG contracts: specificities of LNG contracts, pricing, shipping contracts.
LNG markets trends.

Reference: PROD/LNG Can be organized as an In-House course. Contact: **exp.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Dubai	4 June	8 June	€3,240
Rueil	13 November	17 November	€4,690

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

Gas Valorization

Production & Utilization of Syngas

Purpose

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

Audience

Level: DISCOVERY
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.

Prerequisites

No prerequisites for this course.

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 shiping, …
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*

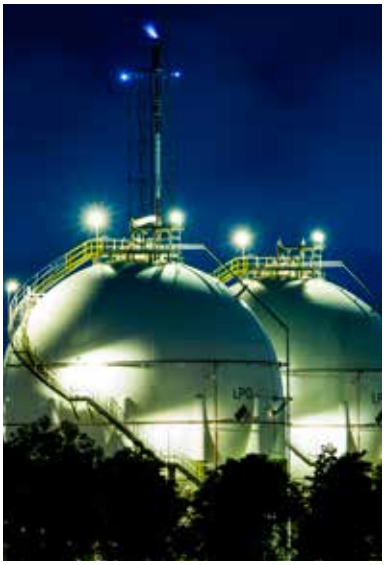
Composition and feedstocks (natural gas, hydrocarbons, coal).
Different modes of syngas production: steam reforming, partial oxidation (POx), autothermal reforming.
Gas production from biomass: advantages, yields, constraints. Example of a biorefinery.

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

Location	Start Date	End Date	Tuition Fees
Rueil	14 November	16 November	€1,830

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

Gas-To-Liquids Technologies

Purpose

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

Audience

Level: DISCOVERY
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.

Prerequisites

No prerequisites for this course.

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/disadvantages 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.rueil@ifptraining.com**

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

Applied Chemical Engineering

Advanced Certificate

Applied Chemical Engineering Certification

to Oil, Gas & Chemical fields

CERTIFICATION

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

Level: ADVANCED
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.

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 Objectives

Upon completion of the course, the participants will be able to:
- describe the main properties of fluids and phenomenas in process engineering,
- understand the operating conditions of equipment used in the process,
- to explain the reasons for controls implemented.

Course Content

10 days

Module 1: LIQUID-VAPOR EQUILIBRIA & DISTILLATION — 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.

Prerequisites

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

More info

Training session splitted in three independent modules. To pretend to certification, it is necessary to follow the whole.

Why an IFP Training Certification?

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

Reference: GCA/PEA Can be organized as an In-House course.

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

Location	Start Date	End Date	Tuition Fees
Rueil	21 August	1 September	€5,290

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

Applied Chemical Engineering for the Refining & Petrochemical Industries

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

Level: FOUNDATION
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.

Prerequisites

No prerequisites for this course.

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.

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.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	4 September	22 December	€19,120

Select Thermodynamic Models for Simulation

Purpose

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

Audience

Level: ADVANCED

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

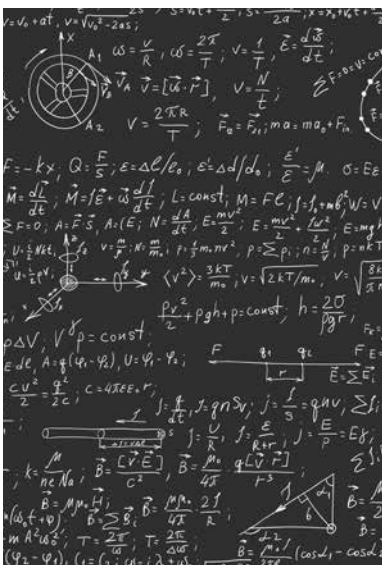
- Subjects are presented from a practical point of view.
- Specific data file including data, diagrams, charts and correlations used in the different technical areas of chemical engineering.
- Many practical applications based on real data.

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.



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

Location	Start Date	End Date	Tuition Fees
Rueil	10 October	12 October	€2,020

NEW Troubleshooting in the Oil & Gas Industry

Purpose

This course provides a better understanding of what troubleshooting is and an overview of how to solve basic troubleshooting cases on refining and petrochemical plants.

Audience

Level: PROFICIENCY

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:

- select the right element in the theoretical and practical "toolboxes" to perform a troubleshooting case study,
- 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.

Prerequisites

No prerequisites for this course.

Course Content

3 days

WHAT IS TROUBLESHOOTING *0.25 d*

What is troubleshooting? Typical cases seen in refineries and petrochemical plants.
How to start with a troubleshooting case.

TROUBLESHOOTING "TOOLBOXES" *0.75 d*

Theoretical "toolbox": summary of the main rules, laws, orders of magnitude often used during a troubleshooting exercise on site. For instance: mass and energy balances, pressure and pressure drop behavior, thermodynamical laws, …
Practical "toolbox": discussion and presentation of the principal field tools used in troubleshooting for temperature, pressure, flows measurements, chemical analysis, gamma scanning, … - Advantages and drawbacks, precautions of uses.
Exercises to implement, on real cases studies, the theoretical and practical toolboxes.

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 *0.75 d*

Overview of the main causes of malfunction of equipment (troubleshooting check-lists):

Air cooler (optimization, potential problems, fouling and cleaning, fogging system).
Exchangers (performances, velocity influence, potential problems, fouling and cleaning, water exchanger, tubes inserts types and influence, …).
Reboilers and condensers (functioning, potential problems, application, …).
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, …).
Drums (carry-over, settling efficiency, …).
Pumps and compressors.

CASES STUDIES *1 d*

Realistic troubleshooting case study on industrial units.
The objective of these exercises is to summarize and practice all the elements discussed during the first days of the course: theoretical toolbox, practical toolbox, methodology and equipment troubleshooting.
The industrial case studies are issued from the following typical units of refining and petrochemical industries:

Atmospheric and vacuum distillations (circulating, circulating reflux management, internals degradation, side stripper, vapor injection, internals, …).
Catalytic units: HDS, DHC, Reforming unit (functioning, ΔP problems, …).
Sweetening units: Merox, amine and sulfur units.
Steam crackers.

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

Location	Start Date	End Date	Tuition Fees
Rueil	6 June	8 June	€2,020

Graduate Certificate

Petroleum Refining & Petrochemicals Certification

Processes, Equipment & Safety

CERTIFICATION

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

Audience

Level: FOUNDATION

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

Ways & Means

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

Learning Objectives

Upon certification, participants will be able to:

- understand the basics of refining techniques,
- 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 refinery operations,
- explain economic industry issues.

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.

CRUDE OIL & VACUUM DISTILLATION — 6 d

Typical distillation units: process diagrams, operating conditions, separation quality.
Corrosion and desalting.
Operation and control of multidraw-off columns; vacuum systems.

PROCESSING OF LIGHT CUTS & MIDDLE DISTILLATES — 7 d

Catalytic reforming, isomerization, hydrotreatment, sweetening of light cuts and sulfur recovery.

PROCESSING OF HEAVY CUTS — 7 d

Overview of conversion processes: thermal processes, catalytic processes.
Visbreaking, coking processes, FCC, RFCC, distillate hydrocracking, residue hydrocracking.

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.

SAFETY IN OPERATIONS — 8 d

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

PRODUCTION OF OLEFINS & AROMATICS — 12 d

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.

PETROLEUM ECONOMICS — 5 d

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

Prerequisites

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

Why an IFP Training Certification?

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

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

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

Chemical Reaction Engineering

Purpose

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

Audience

Level: ADVANCED

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.

Prerequisites

No prerequisites for this course.

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.
- Upflow 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.rueil@ifptraining.com**

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

Reactor Engineering

Purpose

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

Audience

Level: ADVANCED

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.

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.

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.rueil@ifptraining.com**

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

Practice of PRO-II/Provision or HYSYS Simulation Software

Purpose

This course aims to present an overview of the use of the PROII/PROVISION or HYSYS software programs.

Audience

Level: FOUNDATION
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.

Prerequisites

No prerequisites for this course.

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”).

PROII 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.rueil@ifptraining.com**

Processes

Separation Processes

Refining Processes

Petrochemical & Chemical Processes

Advanced Certificate

Distillation Certification

Optimization & Troubleshooting

Practical Simulator Training (RSI IndissPlus simulator)

CERTIFICATION

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

Audience

Level: ADVANCED

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

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 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,
- deepen their knowledge of the detection and effects of deficiencies.

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, such as a depropanizer, a debutanizer and 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 control systems based on quality measurement.
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).*

EQUIPMENT TECHNOLOGY & TROUBLESHOOTING — *1 d*

Trays: technology, workings; 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.

Prerequisites

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 Distillation.
- Ready-to-use skills.

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

Location	Start Date	End Date	Tuition Fees
Rueil	29 May	2 June	€3,250
Al Jubail	10 December	14 December	€3,500

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

Operation of a Binary Distillation Column - Level 1

Practical Simulator Training (RSI IndissPlus simulator)

Purpose

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

Audience

Level: PROFICIENCY
Experienced field operators preparing for console operations.

Learning Objectives

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

- grasp the basic properties of hydrocarbon mixtures and the effects of pressure on temperature profiles and composition,
- learn how to operate a binary column with two compounds in the feed,
- understand column control loops and objectives,
- achieve proper separation to keep products on spec.

Ways & Means

Use of a virtual column modeled on RSI IndissPlus dynamic simulator.

Prerequisites

No prerequisites for this course.

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.
- 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: 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.

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

Contact: **rc.rueil@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 (RSI IndissPlus simulator)

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

Level: PROFICIENCY

Console operators and production supervisors, shift supervisors.

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

Use of a virtual column modeled on RSI IndissPlus dynamic simulators.

Prerequisites

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

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.
Separation quality 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.

SIMULATOR TRAINING

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.

Reference: PSE/CCDSS-E Only available as an In-House course. Contact: **rc.rueil@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 (RSI IndissPlus simulator)

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

Level: PROFICIENCY

Console operators in charge of multiple-draw-off columns, production supervisors, shift supervisors.

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 RSI IndissPlus dynamic simulator.

Prerequisites

Participating to the course in "Distillation: Normal Operation, Optimization & Upsets" is recommended.

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.
- 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 fractionators.

SIMULATOR TRAINING

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.

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

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

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

Distillation Column Internals

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

Level: ADVANCED

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 disadvantages,
- 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 using an equipment sizing software.

Prerequisites

No prerequisites for this course.

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 disadvantages 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.rueil@ifptraining.com**

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

Light Cuts Processing

Purpose

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

Audience

Level: FOUNDATION
Engineers and supervisors of 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 case studies based on real industrial situations.

Prerequisites

No prerequisites for this course.

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 of catalysts - 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: H_2 balance, 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 and their characteristics.
Role and types of catalysts in relationship 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 reaction, 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: reversible chemical reactions and operating parameters.
Industrial process and operating parameters as air/H_2S ratio, steam production.
Sulfur recovery unit: Claus chemical reactions.
Process control and impact on environment: causes for sulfur emission increase.
Tail gas treatments: process principles, operating conditions.

Reference: RAF/REF1 Can be organized as an In-House course. Contact: **rc.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	26 June	30 June	€2,510

Heavy Cuts Processing

Purpose

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

Audience

Level: FOUNDATION
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.

Prerequisites

No prerequisites for this course.

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

Location	Start Date	End Date	Tuition Fees
Rueil	18 September	22 September	€2,510

Catalysts in Refining Processes

Purpose

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

Audience

Level: ADVANCED

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.

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.

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 production of catalysts.

OPERATION & PERFORMANCE CONTROL OF INDUSTRIAL CATALYSTS *3.25 d*

The following items are presented 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 on the catalytic activity and 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 hydrogenation and 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 *0.5 d*

Precautions in the transport and the manipulation of catalysts.
Follow-up of performances, from the start-up to the regeneration; metals recovery.

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

Location	Start Date	End Date	Tuition Fees
Lyon	20 November	24 November	€2,800

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

Hydrotreatment Processes

Purpose

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

Audience

Level: PROFICIENCY
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,
- assess how to meet main breakthroughs for ultra-low desulfurization requirements.

Ways & Means

- Applications, teamwork, case studies and interactive workshops based on typical real situations.
- Potential use of a dynamic simulator.

Prerequisites

No prerequisites for this course.

More info

Der Vortrag über dieses Thema kann auch auf Deutsch gehalten werden.

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.
Loading of the catalyst. Internals in the reactor.
Presulfiding procedures: role, steps and details of the different methods.

OPERATION OF A DISTILLATE HYDROTREATMENT UNIT *0.75 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, partial pressure of hydrogen, 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.
Hydrogen manufacturing or enrichment processes.

SPECIFIC DEVELOPMENTS TO MEET THE ULTRA-LOW DESULFURIZATION OF GASOLINE & DIESEL FUELS *0.25 d*

High performance catalysts, grading materials, advantage of the dense loading, technology of the reactor and exchangers, operating conditions, recycle gas treatment, hydrogen purification, advanced process control.

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

Location	Start Date	End Date	Tuition Fees
Rueil	**18 April**	**21 April**	**€2,100**

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

Crude Oil & Vacuum Distillation

Purpose

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

Audience

Level: PROFICIENCY

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

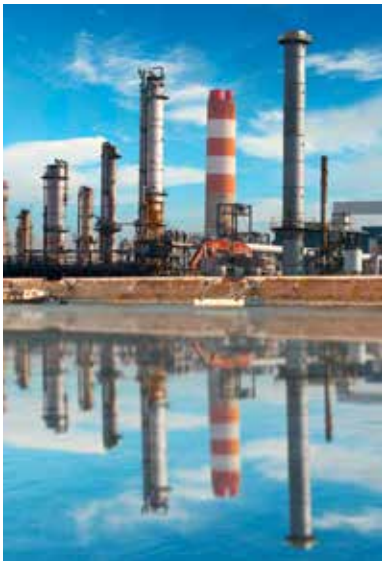
- Applications, teamwork, case studies and interactive workshops based on typical real situations.
- Possible use of a dynamic simulator for crude oil distillation unit operation issues.

Prerequisites

No prerequisites for this course.

More info

Realizado en Español si requerido.Der Vortrag kann auch auf Deutsch gehalten werden.



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 stripping: steam stripping and heat 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 anti-corrosion 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*

Stripping shutdown.
Failure of one pumparound pump.
Loss of part of the feed, etc.

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

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

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

Catalytic Reforming for Refining & Petrochemicals

Purpose

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

Audience

Level: PROFICIENCY

Engineers, senior operations personnel or technical supervisory staff interested or involved in the operation, optimization and 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,
- grasp the essence of catalyst regeneration,
- 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.

Prerequisites

No prerequisites for this course.

More info

Der Vortrag über dieses Thema kann auch auf Deutsch gehalten werden.

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.
Influence of feedstocks origins and characteristics on the performances of the units: IBP, FBP, composition (N,A, etc.), physical properties, impurities content.
Current yields and properties of the reformate in relation with severity.

OPERATING PARAMETERS OF A CATALYTIC REFORMER *1 d*

Process flow diagrams and operating parameters of a catalytic reforming unit: semi-regenerative and continuous regenerative. Main control loops.
Material balance. Energy consumption.
Semi-regenerative processes:
- Operating variables: WABT, WAIT, H_2/HC ratio, flow rates, water and chlorine injection, recycle gas and hydrogen rich gas characteristics, flash drum conditions.
- Main equipment and metallurgy: features of reactors, heat exchangers and furnace technology, corrosion issues.

Low pressure technology: continuous regenerative processes.
Low pressure equipment, recontacting section, catalyst circulation: lifts, ΔP control, seal legs, nitrogen loops for regeneration, etc.
Analyzers and process control.

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 semi-regenerative and continuous regenerative processes.
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.
Catalyst composition and selectivity, poisons and ageing factors.
Catalyst activity follow up and cycle length prediction for semi-regenerative units.
Catalyst regeneration. Role of each step for an optimal activity. Operating parameters for CCR regeneration loops.

OPERATION & OPTIMIZATION FOR CATALYTIC REFORMING *1 d*

Unit operation: monitoring the operating variables and optimization, for semi-regenerative and regenerative units. Operation case studies.
Flexibility of the continuous process. 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*

RON or aromatic content decrease: causes, diagnostic and remedies.
Moisture in the feed, sulfur peak, chlorine peak: diagnosis and remedies.
Recycle or separation problems, recycle gas analysis.
Reactor temperature run-off.
Specific troubles of CCR units: catalyst circulation, regeneration loops, chilling system, nitrogen lift pollution.
CCR operation with catalyst regeneration problems.

FROM A REFINING TOOL TO A PETROCHEMICAL TOOL *1 d*

Outlets and main use of BX (Benzene, Xylenes), ethylbenzene.
Technical key points to manage with: catalytical, operating conditions in order to adapt the catalytic reforming unit.
Basic scheme to upgrade benzene and paraxylene.
Benzene recovery unit: implementation of an extractive distillation section.
Implementation of an aromatic loop: addition of an isomerization section to optimize the paraxylene recovery unit.
Operating conditions for a typical arrangement. Main associated key steps during start-up and shutdown. Main operating variables and parameters.

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

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

Isomerization

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

Level: PROFICIENCY

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.

Prerequisites

No prerequisites for this course.

More info

Der Vortrag über dieses Thema kann auch auf Deutsch gehalten werden.

Course Content

2 days

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

Quality specifications of gasolines, reformulated gasoline and future trends.
Octane improving processes, and place and 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. Influence of the operating parameters and reactors arrangement.
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 (H_2 or low octane paraffins).

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.
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.rueil@ifptraining.com**

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

NEW Hydrotreatment Processes on Simulator

Application on RSI IndissPlus simulator

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

Level:
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:

- know the operation and optimization of the steady state operation of the HDT unit,
- understand the phenomenon involved in deviations or troubles,
- react in the correct direction to restabilize this process.

Ways & Means

Each case study with the simulator consists of the following steps:

- objective of the case study, action by the trainees: operation/settings, stabilization.
- study of final state and operating conditions: operating parameters, composition and characteristics of process flows.
- mass balance, ratios, heat balance, operating conditions and performance.
- consequences for operation policy.

Prerequisites

No prerequisites for this course.

Course Content

5 days

STUDY OF INITIAL SIMULATED STEADY CASE *1 d*

Position and role of each process.
Characteristics, composition and properties of process streams, operating conditions.
Functioning of unit and equipment: main process scheme, operating circuits, main pieces of equipment, control systems.
Significance of the process parameters of the units: mass balance, temperatures, pressures, recycle flow rate, amine washing flow rates (if any), recontacting system.
Operating conditions related to various operating cases (different feed composition).
Heat balance and heat integration.
Profile of important parameters along the unit (pressure, temperatures, …).
Analytical survey.

REMINDING ON THE MAIN OPERATING PARAMETERS & RELATED IMPACT *1.5 d*

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.
Their impact on operation of the process illustrated with the simulator handlings.

OPERATION OF THE UNIT: SIMULATED PROCESS OPTIMIZATION *1 d*

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, SIS study.
Operating deviations:
- Feed or hydrogen composition rash 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.rueil@ifptraining.com**

Fluid Catalytic Cracking Operation

Optimization & Troubleshooting

Purpose

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

Audience

Level: PROFICIENCY

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.

Prerequisites

No prerequisites for this course.

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.rueil@ifptraining.com**

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

Alkylation (HF or H_2SO_4)

Purpose

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

Audience

Level: PROFICIENCY

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.

Prerequisites

No prerequisites for this course.

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.rueil@ifptraining.com**

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

Hydrocracking

Purpose

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

Audience

Level: PROFICIENCY

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.

Prerequisites

No prerequisites for this course.

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.rueil@ifptraining.com**

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

Hydrogen Production Unit

Steam Reforming

Purpose

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

Audience

Level: PROFICIENCY
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.

Prerequisites

No prerequisites for this course.

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.rueil@ifptraining.com**

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

Gas Purification with PSA

Pressure Swing Adsorption (PSA)

Purpose

This course provides a comprehensive understanding of the operating of PSA gas purification units.

Audience

Level: PROFICIENCY

Engineers, shift leaders, panel operators and technical staff interested or involved in the purification of hydrogen by means of PSA (Pressure Swing Adsorption).

Learning Objectives

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

- know about PSA cycles and how gas flows between adsorbers,
- grasp the essence of possible methods for improving operational reliability,
- investigate how to switch to lower modes and operation within those modes,
- understand the safety issues and operating risks involved in this process.

Prerequisites

No prerequisites for this course.

Course Content — 2 days

PRINCIPAL FEATURES OF PSA CYCLES — *0.25 d*

Principles of gas adsorption on different solids called adsorbents.
Breathing capacity of an adsorbent and related limits.
Dynamic phenomena of adsorption and gas response.
Multi-beds units, cyclic adsorption/desorption and steps of a PSA process.

DETAILED STUDY OF PSA CYCLES — *0.25 d*

Representation of a PSA cycle: graphical or tabular.
Phase time and cycle time of a PSA.
Gas circulation from and to adsorbers for each step of the cycle.
Application: cycles study of a PSA unit operated by the participants.

DEFINITION OF OPERATING PARAMETERS — *0.25 d*

Separation yield and productivity of a PSA unit.
Influence of the different pressure levels on the cycle.
Purity-performance relationship, parameters for follow-up.
Application: study of PSA units operated by the participants.

PSA OPERATION & RELIABILITY — *0.5 d*

Good operational practice to increase the reliability of an industrial PSA.
Critical follow-up on the control display and anticipating actions.
Operational drift: leaking valve, progressive drop of purity, loss of production; identification of the causes and remedies.
Transition conditions to a lower mode or to shut down.
Application: workshop related to operation with typical case studies.

START-UP STEPS — *0.25 d*

Typical start-up procedures and start-up conditions.
Related risks and precautions.

SWITCH OVER TO LOWER MODES — *0.25 d*

Transition from normal mode to lower modes and back.
Description of a lower mode due to failure of an adsorber or of a valve-set, optimization of lower modes, diagnosis and solutions.
Transition steps and related cycles. Impact on the production.
Application: case studies related to operation of lower modes.

SAFETY & RISKS ASSOCIATED TO HYDROGEN PSA — *0.25 d*

Pressure vessels, containment, ATEX risks.
Loading and unloading of adsorbents.

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

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

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

H_2S Removal & Sulfur Recovery Processes

Application on RSI IndissPlus simulator

Purpose

This course provides a deeper understanding of the operating and monitoring of sulfur recovery processes with proper HSE measures.

Audience

Level: PROFICIENCY

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 NOx and SOx emissions,
- avoid the most common deficiencies by applying preventive measures.

Ways & Means

Use of a dynamic simulator for amine and Claus units to simulate operating conditions.

Prerequisites

No prerequisites for this course.

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 flow rate 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.

TAIL GAS CLEAN-UP PROCESSES — *0.75 d*

Process flow schemes: CLAUSPOL, SCOT and SULFREEN.
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 NOx monitoring.
Principle, main equipment, operating parameters, water quality follow-up.

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

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

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

Visbreaking

Purpose

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

Audience

Level: PROFICIENCY
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.

Prerequisites

No prerequisites for this course.

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.rueil@ifptraining.com**

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

Cokefaction

Purpose

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

Audience

Level: PROFICIENCY
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 centres, 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.

Prerequisites

No prerequisites for this course.

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 *1 d*

Process flow diagram and example of a delayed coker unit with operating conditions and control setup.
Material balance, yields, recycle ratio, energy consumption.
Impact of operating parameters on products and on coke production.
Follow up of the heater and skin temperatures.

OPERATION OF THE DELAYED COKER DRUMS *1 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 *0.75 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.rueil@ifptraining.com**

Extra Heavy Crude Oil Upgrading

Purpose

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

Audience

Level: PROFICIENCY

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.

Prerequisites

No prerequisites for this course.

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.

H2S 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.rueil@ifptraining.com**

Base Chemicals & Polymers Manufacturing*

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.

Prerequisites

No prerequisites for this course.

More info

Locations:
Rueil-Malmaison (Paris)
Ferrara (Italy)
Alençon (France)

** This program is the second part of a 16-month Master degree program at IFP school. It is highly recommended that participants be familiar with topics covered in the course "Applied Chemical Engineering for the Refining and Petrochemical Industries" (refer to GCA/ACE).*

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 & 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.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	26 February (2017)	29 June (2018)	€19,420

Production of Paraxylene - Aromatic Loops

Purpose

This course provides a thorough technical understanding of catalytic reforming and other processes of paraxylene recovery.

Audience

Level: PROFICIENCY

Engineers, senior operations personnel or technical supervisory staff interested or involved in the operation, optimization and 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 through an analysis of the catalyst's activity,
- optimize the process for achieving the targeted yield in BTX,
- 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.

Prerequisites

No prerequisites for this course.

Course Content

5 days

SOURCES, OUTLETS & MAIN INDUSTRIAL USES OF AROMATIC INTERMEDIARIES — 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

Arrangements available related to downstream markets.
Naphtha to paraxylene typical scheme.
Alternate schemes.

HIGH SEVERITY - CATALYTIC REFORMING FOR RINGS GENERATION — 0.25 d

Technologies available: semi-regenerative and regenerative.
Main differencies.
Influence of feedstocks origins and characteristics on the performances of the units.
Constraints.
Current yields and properties of the reformate in relation with severity.

OPERATING PARAMETERS OF A CATALYTIC REFORMER — 1 d

Process flow diagram and operating parameters of a continuous catalytic reforming unit. Main control loops.
Material balance. Energy consumption.
Operating variables: WABT, WAIT, H_2/HC ratio, flow rates, water and chlorine injection, recycle gas and hydrogen rich gas characteristics, flash drum conditions.
Main equipment and metallurgy: features of reactors, heat exchangers and furnace technology, corrosion issues.
Specificities for low pressure technology:
Low pressure equipment, recontacting section, catalyst circulation: lifts, ΔP control, seal legs, nitrogen loops for regeneration, etc.
Analyzers and process control.

CATALYTIC REFORMING REACTIONS & CATALYSTS — 0.5 d

Review of the characteristics of all the chemical reactions: thermodynamics and kinetics.
Influence of the operating parameters on the production of C_6-C_8 aromatics, hydrogen, octane number, and other yields. Consequences for the process.
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.
Catalyst composition and selectivity, poisons and ageing factors.
Catalyst regeneration. Role of each step for an optimal activity. Operating parameters for CCR regeneration loops.

OPERATION & OPTIMIZATION FOR CATALYTIC REFORMING — 0.5 d

Unit operation: monitoring the operating variables and optimization, for regenerative units.
Flexibility of the continuous process towards maximizing the yield in BTX. Performance follow up.
Maximizing the performances of the unit under constraints or limit conditions.
Main steps for start-up and shutdown.

REFORMATE SEPARATION TRAIN — 0.25 d

Different schemes and purposes.
Focus on C_8 cut treatment.
C_8 cut composition ex reformate.

PARAXYLENE RECOVERY UNIT — 1.5 d

Technologies available: PAREX and ELUXYL processes.
Principles and details of an ELUXYL process.
Main operating parameters.
Main steps for start-up and shutdown.

REFINING UPGRADING — 0.5 d

Refining composition.
Catalytic isomerization reactions and catalysts.
Schemes available.
Operating conditions.
Main steps for start-up and shutdown.

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

Location	Start Date	End Date	Tuition Fees
Rueil	24 April	28 April	€2,750

Extractive Distillation

Purpose

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

Audience

Level: PROFICIENCY
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.

Prerequisites

No prerequisites for this course.

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.rueil@ifptraining.com**

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

Ethylene Compression & Hypercompressors

Purpose

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

Audience

Level: PROFICIENCY

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.

Prerequisites

No prerequisites for this course.

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 shut-down 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.rueil@ifptraining.com**

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

Extrusion & Pelletizing Polymers

Purpose

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

Audience

Level: PROFICIENCY
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.
- Case studies based on industrial situations.

Prerequisites

No prerequisites for this course.

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 and different cross section areas: feeding system, filling, melting, degassing, compression, transport, granulation.
Different types of screws, advantages and disadvantages.
Different types of extruders: single screw, conter-rotating or corotative twin screw, BUSS type mixers, advantages and disadvantages.

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, pressure monitoring, calculating the percentage of blocked holes the die plate heating system. The pelletizer, speed, water flow, knife adjustment, 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.
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.rueil@ifptraining.com**

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

Operation of a Chemical Production Unit

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

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

Learning Objectives

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

- understand the role of chemical reactions and reactants in the production process,
- know 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.

Prerequisites

No prerequisites for this course.

More info

Confidentiality agreement if necessary.

Course Content

2 days

MAIN SECTIONS OF THE UNIT *0.25 d*

Process flow scheme of the unit, specifically in the reaction section.
Main operating conditions: temperature, pressure, flow rates, concentrations, profiles, 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, kinetics, complete or incomplete, 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.rueil@ifptraining.com**

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

Petroleum Products, Analysis, Transfers & Storage

Petroleum Products & Analysis

Transports & Storage

Petroleum Products

Purpose

This course provides a deeper knowledge of petroleum products' characteristics and understand their manufacturing scheme.

Audience

Level: PROFICIENCY
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 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.

Ways & Means

Up-to-date information on commodities thanks to close contacts with industry and IFP Energies nouvelles experts.

Prerequisites

No prerequisites for this course.

Course Content

5 days

WORLDWIDE MARKET - PRICE & COST MANAGEMENT *0.5 d*

World oil consumption: price variation, demand, production.
Main petroleum products: worldwide demand, trading, consumption, prices and taxes.

ORIGIN & COMPOSITION OF PETROLEUM PRODUCTS *0.5 d*

Composition and main characteristics of crude oils.
Classification and characteristics of petroleum products.
Principle of oil refining processes and of the formulation of commercial products: main properties of blending components, blending.
Standard quality control tests: standards and testing organizations, test principles, accuracy of the methods, specifications.

PROPERTIES, CHARACTERISTICS & FORMULATION OF COMBUSTIBLE PRODUCTS *3.25 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 - Behavior at low temperature - Corrosiveness - air pollution: engine emission specifications - Storage stability - Manufacturing schemes - Main additives incorporated in the refinery - Performance additives added at the terminal.
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: octane numbers, catalytic converters, benzene and aromatic content, addition of oxygenated compounds, impact of the formulation on the engine emissions.
Jet A1: market trend, caution to avoid impurities during transfers.
Automotive Diesel Oil:

- problems raised by the high share of Diesel vehicles in the car pool,
- lack of lubricating power of Low sulfur ADO: injection pump protection; interest of agrofuels,
- consequences of Euro 6 standard: new post-treatment systems,
- impact of the specifications on the manufacturing schemes.

Heating oil: problems related to the high cracked fuel content; differences of composition between ADO and HO.
Heavy fuel oils: stability of visbroken fuels, environmental constraints: sulfur, particles, Nitrogen oxides and heavy metals emissions.

MAIN NON-ENERGY PRODUCTS *0.75 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:
Lube base oils manufacturing and composition of lubricants: base oils and additives.
Properties and characteristics of base oils: viscosity index, cold properties, oxidation stability, …
Waxes: a high value by-product.

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

Location	Start Date	End Date	Tuition Fees
Rueil	12 June	16 June	€2,800

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

Current & Future Automotive Fuels

Purpose

This course provides a deeper knowledge of changes brought to motor fuels by the evolution in engine technologies.

Audience

Level: ADVANCED
Engineers and technicians in all industries concerned with motor fuel quality improvement.

Learning Objectives

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

- master current and future motor fuel characteristics,
- analyze factors affecting motor fuel quality: end use, regulations and engine technologies,
- understand issues of air pollution constraints and air quality improvement.

Ways & Means

World-class experts from the R&D of IFP Energies nouvelles.

Prerequisites

No prerequisites for this course.

Course Content

3 days

GASOLINE — *1 d*

Market trends and shares of different gasoline fuels.
Design and operation of the alternative engine with spark ignition (gasoline), description of fuel injection systems.
Required properties for automotive gasoline. Considering the present and future evolution, the key points are developed as follows:

- Volatility: vapor pressure and ASTM distillation. Volatility influence on the engine operation.
- Combustion: decisive factors, nature and incidence of knock, definition and measure of the gasoline octane numbers.
- Toxicity: benzene, aromatics and olefins content.
- Corrosiveness and stability: mercaptans.

Exhaust gas pollution: gas composition and impact on the environment, pollution reduction.
Manufacturing scheme of automotive fuels. Characteristics of petroleum stocks produced in refineries.

DIESEL FUEL — *1 d*

Market trends, problems due to the important development of Diesel engines.
Design and operation of the alternative engine with compression ignition (Diesel).
Required properties for Diesel fuel. Considering the present evolution, the following points are particularly developed:

- Viscosity: impacts on equipment of the injection circuit and on the injection quality.
- Combustion: auto-ignition delay. Definition and cetane number measurement.
- Influence of the cetane number on the combustion quality.
- New regulation (Euro 6): impacts on after-treatment for Diesel engines.
- Cold flow properties: cloud point and Cold Filtering Plugging Point (CFPP).

Pollution by exhaust gases of the Diesel engine: particles, HAP, NOx.
Diesel fuel formulation and manufacturing.

ALTERNATIVE FUELS & BIOFUELS — *1 d*

For each alternate fuel, pro and cons, performances and necessary car modifications are analyzed.
Gaseous fuel: Liquefied Petroleum Gas (LPG-Motor Fuel), Natural Gas Vehicles (NGV) and Dimethyl Ether (DME).
Liquid fuels: ethers, Gas-To-Liquids (GTL), Coal-To-Liquids (CTL) and other bases.
First generation biofuels: ethanol, ethers (ETBE and MTBE), E10, E85, biodiesel B30, B100.
Second generation biofuels: Biomass-to-Liquids (BTL and NExBTL).
Emulsions: Diesel-Water Emulsion.

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

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

Analytical Methods & Techniques Applied to Hydrocarbons & By-Products

Purpose

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

Audience

Level: FOUNDATION
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.

Prerequisites

No prerequisites for this course.

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.rueil@ifptraining.com**

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

Properties, Formulation, Transfer & Storage of Petroleum Products

Purpose

This course provides a deeper knowledge of routine operations in refining and petrochemical storage facilities.

Audience

Level: PROFICIENCY

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:

- recognize 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.

Prerequisites

No prerequisites for this course.

Course Content

8 days

PROPERTIES OF CRUDE OIL & PETROLEUM PRODUCTS — *2.75 d*

Crude oils: main constituents, properties, initial fractionation into petroleum fractions.

Petroleum products:

- LPG, gasoline, jet fuel, automotive Diesel oil, heating oil, heavy fuel oils, bitumen.
- Main specifications determined by end use, manufacturing constraints, storage and safety in product handling.
- Changes in product quality.

Bases and alternative fuels: ETBE and RSME.

MANUFACTURING OF PETROLEUM PRODUCTS — *1.25 d*

Components: manufacturing scheme, simplified process diagrams of refineries and petrochemical units.

Finished products formulation:

- Main rules for blending the bases.
- Manufacturing finished products: economic aspects (give-away, added profit).
- Manufacturing additives, blending of bases.
- On-line optimization manufacturing.

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.rueil@ifptraining.com**

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

Automation of Refinery Offsite Operations

Purpose

This course provides a thorough understanding of the principles behind operating and managing refinery offsite operations.

Audience

Level: ADVANCED
Managers, technical and operating staff in the Oil & Gas industry interested or involved in offsite operations.

Learning Objectives

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

- understand the distinction between onsite/offsite operations in a refinery,
- know about issues of custody transfer and terminal operations,
- assess all elements of tank farm management storage needs, control, instruments, safety, environment, oil movement, scheduling, etc,
- be familiar with the refinery's crude oils and products blending operations,
- analyze offsite automation projects planning, economics and strategic implementation.

Ways & Means

Active participation through teamwork, analysis of real-life case studies and simulated demonstration of automation systems.

Prerequisites

No prerequisites for this course.

Course Content — 5 days

OVERVIEW OF OFFSITE OPERATIONS — *0.5 d*

Overview of refining processes.
Distinction and economics of offsite operations.
Custody transfer problems and challenges.
Terminal operations (marine, pipeline and trucks).

TANK FARM MANAGEMENT — *1.5 d*

Tank farm fundamentals.
Automatic Tank Gauging (ATG) system.
Tank inventory information management.
Tank quality analysis and prediction.
Fugitive tank emission measurement and control.
Oil movement and control.
Planning and scheduling.

BLENDING SYSTEMS & OPERATIONS — *1 d*

Blending operations.
Crude blending.
Product (gasoline, Diesel, fuel, lube) blending.
Blending modes and configurations.
Field equipment and instrumentation.
Analyzers and sampling systems.
Regulatory blend control.
Blend trim control.

ADVANCED BLEND CONTROL & OPTIMIZATION SYSTEMS — *1 d*

Advanced blend control strategy.
Blend models.
Blend optimization.
Refinery wide planning.
Offline blend optimizer.
Online blend control and optimization.
Data reconciliation and feedback.
Interfaces with other systems.
System architecture.
Over-all integration.

PLANNING, JUSTIFYING, IMPLEMENTING & REALIZATION — *0.5 d*

Project identification.
Data gathering and analysis.
Economical justification.
Where and how to start?
Required enterprise changes.
Project implementation phases and strategy.
How to realize and sustain benefits?
Putting it all together - Myths and facts.

SIMULATED DEMONSTRATION OF OPTIMIZATION & AUTOMATION SYSTEMS — *0.5 d*

Introduction and examples of linear programming.
Crude blending simulation and LP.
Offline blend optimization of fuel products.
Online tanks quality tracking system.
Online blend control and optimization.

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

Equipment, Materials, Corrosion & Inspection

Technology

Materials & Corrosion

Maintenance & Inspection

NEW Introduction to Equipment Technology

Purpose

This course provides a good knowledge of equipment technology, including thermal, static and rotating equipment.

Audience

Level: FOUNDATION
Engineers & 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 & 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.

Prerequisites

No prerequisites for this course.

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 & 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 & EN material.

THERMAL EQUIPMENT *1.5 d*

TEMA standard heat exchangers & other types: tubular or plate type, air coolers and condensers. Performances.
Different types of furnaces, technology and 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. Low NOx and ultra low NOx burner technology.
Flare systems. Safety operation.

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 & 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.rueil@ifptraining.com**

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

NEW Static Equipment

Purpose

This course provides in-depth knowledge related to static equipment technology.

Audience

Level: PROFICIENCY

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).

Prerequisites

No prerequisites for this course.

Course Content

5 days

PIPING - FLANGES — *1 d*

Different types of piping equipment: 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*

Vessels: technology of separator drums; technology and internals of distillation columns & reactors.

Storage Tanks: Different types (atmospheric, Pressurized, cryogenic, …).

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 & steel structure. Effect of alloying elements.

Structure of steels and alloys. 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. Performance follow-up: influence of fouling.

Different types of furnaces and their characteristics.

Boiler technology. Operating conditions.

Efficiency of heat recovery: estimation rule. Parameters influencing heater efficiency.

Construction of heat exchange areas and refractory materials.

Air and flue gas circulation: natural and forced draft.

Burner technology: fuel and air supply and mixture. Low NOx and ultra-low NOx burners technology.

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 & 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 Only available as an In-House course.

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

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

Risk Based Inspection (RBI)

Purpose

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

Audience

Level: FOUNDATION
Managers, 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:

- describe the RBI methodology for a petrochemical or chemical plant,
- identify the degradation mechanism for a corrosion loop,
- determine the probability and consequence of a failure,
- set up a suitable inspection plan.

Ways & Means

An interactive course based on actual case studies.

Prerequisites

No prerequisites for this course.

Course Content

3 days

OWNER - USER INSPECTION ORGANIZATION *0.5 d*
Owner-user responsibilities for pressurized equipment inspection.

HOW TO DESIGN A RATIONAL METHOD OF INSPECTION *0.5 d*
Review of RBI based on API 581.

QUANTITATIVE & SEMI-QUANTITATIVE RISK BASED INSPECTION APPROACH *1 d*
Comparison of the qualitative and quantitative RBI-API 581 approaches.
Damage and inspection “manuals” (API 571).
Inspection plan preparation and/or revision. Keys for a successful inspection plan.
Advantages of the risk-based study. Other professional documents.
Inspection using “Corrosion loop”.

EXAMPLES OF APPLICATION OF THE RBI METHOD *1 d*
Technical expertise.
Risk based inspection analysis presentation.
Corrosion monitoring and diagnosis tools.
Use of inspection results and technical experts.
Documentation related to damage types (corrosion or mechanical damages) and prevention strategies.
Case studies of process plant inspection plan.

Reference: EIM/PLINS-E Only available as an In-House course.

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

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

Advanced Certificate

Corrosion & Corrosion Prevention Certification

CERTIFICATION

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

Audience

Level: PROFICIENCY

Experienced engineers, managers and technical staff involved in safe operation and integrity of pressure equipment installed in refineries, chemical and petrochemical plants.

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 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.

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.
Pressurized vessel 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 — *1.5 d*

Each type of corrosion is studied together with possible prevention for pressurized vessel and piping already in service, or during a new plant design.
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 — *1.5 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.
Anti-corrosion coatings and cladding.
Non-destructive testing.
Risk Based Inspection.

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 Degradation - Corrosion & Corrosion Prevention.
- Ready-to-use skills.

Reference: MCO/CICP-E Only available as an In-House course.

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

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

Non-Destructive Testing for Petrochemical Industries

Purpose

This course explains basic and advanced non-destructive testing methods used in the petroleum industry.

Audience

Level: FOUNDATION
Experienced 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 non-destructive examination methods based on technical diagnosis.

Ways & Means

- Case studies to identify the most suitable non-destructive examination for various degradations.
- Practical demonstration of non-destructive examination in a workshop.

Prerequisites

No prerequisites for this course.

Course Content

3 days

BASIC & ADVANCED NDT TECHNIQUES *2 d*

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.

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.

PRACTICAL APPLICATION *1 d*

Demonstration of several NDT techniques performed on samples by qualified personnel in a dedicated workshop.

Reference: MCO/NDTIW Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

Painting & Coating for Corrosion Resistance

Purpose

This training covers the fundamentals of anticorrosion painting systems and the quality control.

Audience

Level: PROFICIENCY
Engineers & technical staff involved in the equipment maintenance including painting and coating issues.

Learning Objectives

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

- identify the main types of industrial painting,
- choose the most efficient painting features,
- supervise and inspect efficiently painting works.

Ways & Means

- Learning process including case studies.
- Visit of a paint workshop or a control laboratory.

Prerequisites

There are no prerequisites for this training.

Course Content

4 days

CHARACTERISTICS & PROPERTIES OF PAINTINGS & COATINGS — *1.25 d*

Paint components. Binders and plastifiers, pigments, fillers, colorants, additives, solvents.
Physical characteristics of paint. Fluidity at different temperatures, % solids, lifetime, hardening, drying, safety problems; atmospheric conditions consequences. Paint manufacture and recent developments.
Different types of industrial paint:

Physically drying paints, oxidative paints, chemical polymerization paints, anticorrosion systems for aggressive environments.
Advantages and drawbacks of the different types of paints.
Paints for special environments (abrasive, high temperature, low temperature) and for different materials (stainless steel, galvanized steel, aluminum, concrete, etc.).
Composition of a paint system (role of coats and compatibility).

PAINT APPLICATION IN INDUSTRY — *1.5 d*

Preparation of surfaces:

Rust scales, roughness, surface profile, degree of care, preparation by organic solvents, preparation by high pressure water jetting, wire brushing, blast cleaning, sponge jet.
Tests on samples, chemical conversion of surfaces (passivation, phosphating, chromating, oxalating, etc.).

Applications:

Main paintings parameters: use of brush, rollers, spraying, composition, surface tension, viscosity, temperature, solvent volatility, speed of jet leaving gun, type of jet and regulation, spray gun and equipment handling.
Compressed air.
Airless high pressure spraying (principle, installation, regulation, tests, etc.).
Thermal spray aluminum.

INSPECTION, CONTROL & COMMISSIONING — *1.25 d*

Paint defects, causes, control procedures. Control of raw materials and finished products, application control, coating control:

Causes of deterioration (chemical, mechanical, photochemical, biological, etc.). Prevention and repair techniques.

Specifications and rules. European standards, ISO, etc. and safety regulations : qualification of painting systems:

Qualifications of painters. Inspection and control: tests performed on painted equipment and structures.

Reference: EIM/SACPE-E Only available as an In-House course.

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

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

Energy & Thermal Equipment

Energy Efficiency & Renewable Energy

Exchangers, Process Furnaces & Boilers

NEW

Day-to-Day Energy Optimization for Industrial Plants

Purpose

This course aims to optimize energy consumption and operational costs by improving operation of thermal equipment and steam network balance.

Audience

Level: PROFICIENCY

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 an economic use of steam and electricity,
- identify the source of main pollutants and ways of reducing emissions,
- 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 & case studies based on industrial feedbacks.
- Numerous exercises to improve understandings.

Prerequisites

No prerequisites for this course.

Course Content

5 days

ENERGY BALANCE - EFFICIENCY & CONTEXT *0.5 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 *1 d*

Main type of furnaces and boilers. Operating conditions, Material used to improve efficiency and heat recovery.
Heat balance, efficiency estimate. Scope and limitations to improve efficiency.
Pollutants and techniques to reduce emissions. Low-NOx Burners.
Applications & 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 operating costs and atmospheric emissions.

ELECTRICITY & STEAM PRODUCTION & USE *1.5 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.

HEAT & MECHANICAL ENERGY RECOVERY *1.5 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.

Reference: EMT/MENERG-E Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

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

Process Energy Efficiency Improvement for Industrial Plants

Pinch Analysis

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

Level: ADVANCED

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,
- carry out 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 & case studies based on industrial data and adjustable to trainee's concern.
- Use of an expert software to compare to the initial evaluation.

Prerequisites

No prerequisites for this course.

Course Content

3 days

ENERGY EFFICIENCY & CONTEXT *0.5 d*

Definition of some evaluation 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 or steps.
- 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.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Martigues	**25 September**	**27 September**	**€1,790**

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

Thermal Equipment

Technology & Operation

Purpose

This course provides in-depth knowledge of heat exchangers, furnaces and boilers installed in industrial petrochemical plants.

Audience

Level: FOUNDATION
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, cleaning and testing procedures.

Ways & Means

- Study of main components of burners, tube coils & 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

There are no prerequisites for this training.

Course Content

5 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 & OPERATION *1 d*

Heat exchanger performance follow-up: influence of fouling.
Optimum cleaning interval estimate, preparation, safe cleaning procedure.
Inspection of exchanger bundles. Hydraulic pressure test: case of U tube bundle and floating head heat exchangers.
Start-up procedure: Main steps for a safe start-up.

FURNACES & BOILERS TECHNOLOGY *1.5 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 & air supply and mixture. Low NOx and ultra-low NOx burners technology.

OPERATION *1 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.martigues@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Martigues	18 September	22 September	€2,910

Advanced Certificate

Heat Exchangers Certification

Selection - Design - Performance follow-up

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

Level: PROFICIENCY

Engineers and staff from the technical and process departments of refining, petrochemical and chemical companies.

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.

The course is delivered by IFP Training in collaboration with Heat Transfer Research, Inc. (HTRI©) Experts.

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.

Course Content

5 days

HEAT TRANSFER LAW APPLIED TO HEAT EXCHANGERS — *1 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.

Optimum cleaning interval estimate.

TEMA STANDARD TUBULAR HEAT EXCHANGERS - TECHNOLOGY & SELECTION CRITERIA — *1 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.

Other types of heat exchanger: tubular or plate type, air coolers and condensers. Main types, advantages and limitations.

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: particularities of the design procedure, heat transfer and pressure drop on air side.

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.

Plate type heat exchangers: main design rules and arrangement possibilities (parallel, series, …).

Application:

Thermal and hydraulic design of a single phase heat exchanger.

Initial design of condenser and reboiler.

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.
- Ready-to-use skills.

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

Contact: **rc.rueil@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 from RSI

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

Level: PROFICIENCY

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 steam cracker.

Prerequisites

No prerequisites for this course.

Course Content

4 days

FURNACE CONSTRUCTION & OPERATING CONDITIONS *0.5 d*

Different types of furnace & 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 *1.5 d*

Combustion conditions: liquid and gas fuel characteristics, liquid spray.
Burners: fuel and air supply and mixture. Conventional and low NOx burners operation.
Combustion quality: analysis of the oxygen and the unburned material in the flue gases, control of combustion air flow rate 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.
Diagnostic facilities; troubleshooting.
Application:
Case study of furnace accidents.
Start-up procedure study.

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

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

Tubular Furnaces

Selection Criteria - Design and Monitoring

Purpose

This course provides in-depth knowledge of critical design rules for tubular furnaces used in the petroleum and petrochemicals industries.

Audience

Level: ADVANCED

Project or process control engineers in refineries or petrochemical plants, involved in furnace design and performance follow-up.

Learning Objectives

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

- list the main industrial issues of furnace technology, operating conditions and constraints,
- structure process data and define key criteria for furnace design,
- identify pollution sources and ways to reduce emissions.

Ways & Means

- Course delivered by IFP Training experts and furnace design engineers from Heurtey Petrochem SA.
- Case study used throughout the course to design the main characteristics of radiant and convection zones.

Prerequisites

No prerequisites for this course.

Course Content

4 days

FURNACE TECHNOLOGY *1 d*

Different types of furnaces and selection criteria.
Furnace construction and design codes. Heat Distribution & Furnace efficiency.
Process conditions: fluid characteristics, operating conditions, required efficiency.
Consequences on the furnace technology and tube coil material.
Insulating material: main characteristics, installation and use.

BURNERS - ENERGY CONSUMPTION - POLLUTANT EMISSION *0.5 d*

Efficiency of tubular furnaces: design and operating parameters. Different types of burners, selection criteria, combustion performance and flame length. Impact on fuel consumption and operating costs. Pollutant characteristics: Impact of fuel quality and operating conditions on pollutant emissions. Scope for reducing emissions (CO_2, NOx, SOx, particulates).

CONSTRAINTS & DESIGN RULES *1.5 d*

Process study: furnace type selection.
Process data: process and auxiliary fluids (water-steam, etc.), operating conditions, efficiency, furnace duty, allowable heat losses, process constraints (coke formation, thermal degradation, etc.).
Fuel selection: combustion mass and heat balance.
Heat exchange area calculation: heat transfer in the radiant and the convection zone, mean/maximum heat flux.
Tube skin temperature and flue gas temperature estimate.

SAFETY DEVICES - OPERATION *1 d*

Construction codes and rules relating to safety (peepholes, explosion doors, access, fire protection).
Safety and control system on tube coil. Operating constraints.
Safety specifications on heaters, combustion, fuel circuits.
Air and flue gas circulation: natural and forced draft, control and safety system.
Recommendations for a Safe & Reliable operation.

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

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

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

Boilers Safe Operation & Optimization

Purpose

This course provides in-depth knowledge of boilers operating conditions and constraints for a safe and reliable operation.

Audience

Level: PROFICIENCY
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 & flame study and implement corrective actions,
- list and apply the main steps of a boiler start-up & 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.

Prerequisites

No prerequisites for this course.

Course Content

4 days

BOILER DESCRIPTION & OPERATING CONDITIONS *0.5 d*

Different types of boilers and their characteristics. Operating conditions. Fuel consumption. Distribution of the heat supply as a function of the steam pressure. Construction of the vaporization and superheating tube bundles, the economizer and the drum.

COMBUSTION - BURNERS *1.5 d*

Combustion conditions: fuel characteristics.
Conventional and low Nox 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 *1 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 & 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.rueil@ifptraining.com**

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

Refrigeration Unit Operation

Process & Utility Industrial Units & HVAC Systems

Purpose

This course provides a clear understanding of cooling system technology, performance and operating issues.

Audience

Level: PROFICIENCY
Engineers, technicians, maintenance staff involved in refrigeration unit operation in process plants.

Learning Objectives

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

- explain the technology and operating principles of cooling systems,
- analyze the technical solutions implemented for the installation of cooling systems,
- To participate in a troubleshooting analysis.

Ways & Means

- Use of participants' experience and teamwork.
- Course material and case studies based on actual examples from the industry.

Prerequisites

No prerequisites for this course.

Course Content

3 days

COOLING CYCLE & GAS COMPRESSION *0.5 d*

Liquid/vapor balance; enthalpy diagrams. Liquid coolant properties (R22, R134 A, R717, CO_2, etc.).
Basic cooling cycle, evolution on the enthalpy diagram. Gas compression in an actual compressor: temperature, pressure and enthalpy changes. Examples of different cooling cycles integrated within specific process units: chilled water, cryogenic storage, etc.

HEAT TRANSFER & COMPRESSORS *1.25 d*

Heat transfer efficiency; consequence to operation costs. Technology.
Typical condenser and vaporizer designs, related operation constraints. Troubleshooting.
Reciprocating - Screw and centrifugal compressors.
Operating conditions; flow control; power control.
Compressor descriptions; oil and seal technologies; oil separators.
Oil properties, selection criteria, viscosity. Troubleshooting.

REFRIGERATION UNIT CONTROL *0.5 d*

Pressure, level, flow and temperature controls. Internal and external disturbances.
Adaptation of the refrigeration cycle on the enthalpy diagram. Automatic and manual adjustments for different process requirements.

ON LINE MONITORING & TROUBLESHOOTING - HVAC SYSTEM *0.75 d*

Start-up and shutdown. Monitoring: temperatures, ΔT, pressures, oil carry over, oil quality, exchanger fouling, leakage, air entrance, air purge, moisture problem. Replacement of CFC by HFC.
Troubleshooting studies. HVAC system equipment and operation features - International standards.
Natural or forced ventilation, air handling equipment: humidity control, filtration and cleaning.
Heating or cooling: heat pump operation with reverse cooling cycle and defrost control.

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

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

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

Cogeneration - Combined Cycles - Waste Heat Recovery

Performances & Operation

Purpose

This course deals with cogeneration units in existing plants or new projects.

Audience

Level: DISCOVERY

Graduate engineers and technicians whose activities are related to the design and/or operation of these installations: engineers and technicians from engineering companies, technical & 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.

Prerequisites

No prerequisites for this course.

Course Content

3 days

COGENERATION: DIFFERENT CYCLES *0.5 d*

Operating principle 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.

Mechanical and thermal energy split.

COGENERATION: PRODUCTION OF STEAM *0.75 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 & sequences.

COGENERATION: STEAM END-USES *0.75 d*

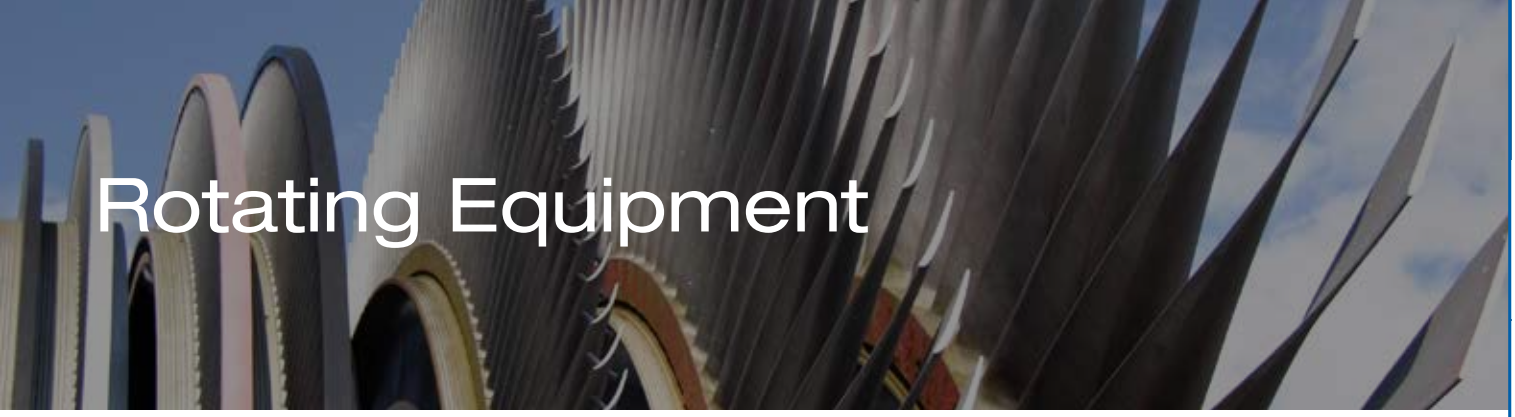
Steam as a heating medium and mechanical driving fluid.
Steam pressure level requirements, depending on the end-use. Steam network balancing.
Steam as a heating medium: conditions for its distribution and efficient utilization.
Steam turbines: operating principle, expansion work and efficiency, and produced energy.
Static expansion: expanded steam characteristics, steam de-superheating.

COGENERATION: GAS TURBINES & WASTE HEAT RECOVERY *1 d*

Operating principle - Operating conditions.
Energy balance and energy performances of each elementary operation: compression, combustion and expansion.
Energy performances and efficiency.
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.

Reference: EMT/COGENE-E Only available as an In-House course. Contact: **rc.rueil@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

Purpose

This course provides a good knowledge of the performance, technology & operation of rotating machinery.

Audience

Level: FOUNDATION
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 this equipment,
- describe the technology of the rotating machinery and the main operating constraints.

Ways & Means

- Use of cutaway drawings, pictures & videos of actual installed equipment.
- Study of actual cases based on industrial cases.
- Demo of dynamic simulations for compressors and Steam Turbines.

Prerequisites

No prerequisites for this course.

Course Content

5 days

PUMPS *1.5 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 architectures.
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.

RECIPROCATING & ROTARY POSITIVE DISPLACEMENT COMPRESSORS *1 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 philosophy. Troubleshooting.

CENTRIFUGAL COMPRESSORS *1 d*

Description of a multi-stage centrifugal compressor.
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.

STEAM TURBINES *0.75 d*

Description of a 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 TURBINES *0.75 d*

Gas turbine design and performance, main types, industrial and aero derivative engines, pressure and temperature profiles through the machine.
Influence of environmental conditions: temperature, elevation. Impact of suction and exhaust friction losses on turbine performance. De-rating from ISO conditions.

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

Location	Start Date	End Date	Tuition Fees
Lyon	11 September	15 September	€2,910

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

Centrifugal Pumps & Positive Displacement Pumps

Purpose

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

Audience

Level: PROFICIENCY
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 analyses 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.

Prerequisites

There are no prerequisites for this training.

Course Content

5 days

HYDRODYNAMICS APPLIED TO A PUMPING SYSTEM — *2 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:
- Liquid flows in pipes: friction losses.
- System curve, resistance of flow and throttling control.
- Operating point: normal and maximum capacities, change in fluid characteristics and incidence on operating conditions.

Technical application: study of a distillation column reflux line and the pump installed.

CENTRIFUGAL PUMP TECHNOLOGY & SELECTION — *2 d*

Centrifugal pump:
- Construction and technology: API and ISO specifications.
- Internal forces and mechanical criteria: balancing, wear ring clearances.
- Impeller and pump shape, suction operating conditions.

Mechanical seal:
- Selection according to API 682 standard & 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 & 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 & 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.

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

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

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

Advanced Certificate

Gas Compression & Expansion: Compressors & Turbines Certification

CERTIFICATION

This course provides a clear understanding of the performance and technology of these types of equipment.

Audience

Level: PROFICIENCY

Graduate engineers, new engineers and staff supervisors from the maintenance, process or operation department of refineries and petrochemical plants.

Ways & Means

- Extensive use of digital applications related to industrial equipment.
- Specific, detailed & high level documentation.
- Use of a dynamic process simulator (centrifugal compressor + steam turbine).

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.

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 & 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. Typical mechanical failures.

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

Prerequisites

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

Why an IFP Training Certification?

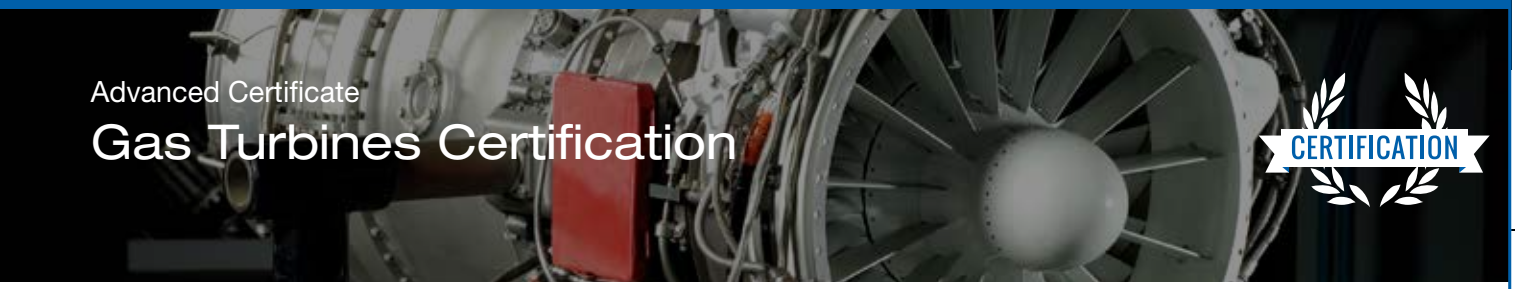
- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Gas Compression & Expansion: Compressors & Turbines.
- Ready-to-use skills.

Reference: MTE/CCTAV-E Can be organized as an In-House course.

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

Location	Start Date	End Date	Tuition Fees
Lyon	9 May	12 May	€2,330

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



Advanced Certificate

Gas Turbines Certification

CERTIFICATION

This course provides a good knowledge of gas turbine technology and enhance competency in the selection, operation and maintenance of gas turbines.

Audience

Level: PROFICIENCY

Engineers and managers involved in gas turbine operation, maintenance, engineering and purchasing.

Ways & Means

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

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.

Course Content

5 days

GAS TURBINE EQUIPMENT *2 d*

Classification: typical cycles, heavy duty and aeroderivative designs, applications.
Presentation: main components. Standard & 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 NOx 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 & 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).

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.
- Ready-to-use skills.

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

Location	Start Date	End Date	Tuition Fees
Lyon	15 May	19 May	€2,850

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

Rotating Machinery Selection

Purpose

This training emphasizes the selection of rotating machinery for refining, petrochemicals and chemical engineering.

Audience

Level: PROFICIENCY
Engineering & new construction staff, in charge of definition, selection or supply of rotating equipment dedicated to plant construction or revamping project.

Learning Objectives

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

- explain operating principle and specific characteristics of main rotating equipment,
- list every single feature related to the equipment selection,
- collaborate with any individual involved within the procurement process.

Ways & Means

Topics are illustrated by numerous industry actual cases and applications.

Prerequisites

No prerequisites for this course.

Course Content

4 days

DESCRIPTION & APPLICATION AREAS OF ROTATING EQUIPMENT *2 d*

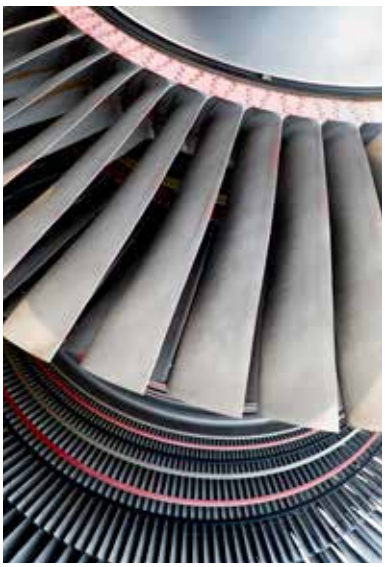
Positive displacement and centrifugal pumps:
- Main types of pumps and their application, main characteristics.
- Operating principle and technology of positive displacement pumps.
- Performance curves of a centrifugal pump: head, efficiency, absorbed power, NPSH.
- Relationship with the installation: structure, driving machine, process circuit.

Alternative and centrifugal compressors:
- Main types of compressors and their application, main characteristics.
- Factors related to compressors performance: pressure ratio, capacity, power, efficiency, operating point and sensitivity to process parameters.
- Relationship with the installation: structure, driving machine, process circuit.

Driving machine - Spare parts:
- Performance criteria required by driven machine: power, shared components such as lubrication, monitoring systems.
- Spare parts: criticality of spare parts management related to the type of rotating equipment.

DEVELOPMENT OF SPECIFICATIONS *2 d*

Operation constraints.
Operating domains using single or several operating points, nominal flow, minimum, rated, maximum flow.
Constraints due to API and ISO standards.
Characteristics of process circuits.
Factors having an influence on equipment reliability.
Process of selection to determine the type of rotating machine to be used. Price, delivery time, Reliability.
Different components to be specified: bearings, couplings, gearbox, sealing and lubrication systems. API, ISO and ATEX standards.
Ancillary systems for lubrication and mechanical sealing. Safety equipment.



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

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

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

Reciprocating Compressors

Purpose

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

Audience

Level: PROFICIENCY
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.
- Using a dynamic process simulator to illustrate phases of start-up, shutdown, including some generated disturbances.

Prerequisites

No prerequisites for this course.

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, crankshaft and cylinders lubrication, and cooling systems, 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, suction temperature. Multistage compressors: behavior.
Case study: air compression.

MAINTENANCE & TROUBLESHOOTING *1 d*

General aspects: noise, vibration, temperature; monitoring.
Typical defects and failures on: valves, piston rings and packings, piston rod, etc.
Dismantling and assembly procedures and reports.
Case studies: typical failures encountered in reciprocating compressors.

DYNAMIC SIMULATOR (IndissPlus by RSI) APPLICATIONS *1 d*

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

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

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

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

Centrifugal Compressors

Purpose

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

Audience

Level: PROFICIENCY
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 & main disturbances,
- be involved in troubleshooting analyses.

Ways & Means

- Case studies based on industrial feedback.
- Various technical drawings of actual compressors.
- Use of a dynamic process simulator.

Prerequisites

No prerequisites for this course.

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 & 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: intake pressure and temperature, nature of the gas, rotation speed.

OPERATION *0.5 d*

Flow rate control. Adaptation to service conditions.
Surge and antisurge devices. Conventional control. Start-up and shutdown.
Monitoring the compressor and auxiliary equipment under normal operating conditions. Troubleshooting.

DYNAMIC SIMULATION (IndissPlus by RSI) *1.5 d*

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

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

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

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

Steam Turbines

Purpose

This training provides a good understanding of steam turbine technology, performance & operation.

Audience

Level: PROFICIENCY

Operation and technical department staff from process or power plants in charge of steam turbine operation and maintenance. Engineering personnel responsible of steam turbine projects, from design to installation.

Learning Objectives

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

- explain the operating principles of steam turbines,
- recognize typical operating problems,
- implement a steam turbine systematic troubleshooting monitoring.

Ways & Means

Study of industrial cases:

- Various illustrations of actual systems.
- Use of a dynamic process simulator (IndissPlus by RSI) to demonstrate typical features related to start-up.

Prerequisites

No prerequisites for this course.

Course Content

5 days

STEAM TURBINE PERFORMANCE — *1.25 d*

Steam characteristics, inlet and exhaust conditions. Ideal and actual expansion.
Monitoring steam characteristics on the Mollier diagram: expansion, heating, consumption, 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, etc.

OPERATION — *1 d*

Lubrication and sealing devices.
Important factors in turbine operation.
Monitoring of steam circuit and lubrication circuit.
Start-up and shutdown sequences of different types of turbines.
Incidents occurring in the steam circuit, the machine or the ancillary equipment.

DYNAMIC SIMULATION (IndissPlus by RSI) — *0.5 d*

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

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

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

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

Machinery Failure Analysis & Repair Methods

Purpose

This course enhances the maintenance staff skills through a clear understanding of machinery failure analysis.

Audience

Level: ADVANCED
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 & actual feedback.

Prerequisites

No prerequisites for this course.

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 & 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 & 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.rueil@ifptraining.com**

Machinery Vibration

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

Level: ADVANCED
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:

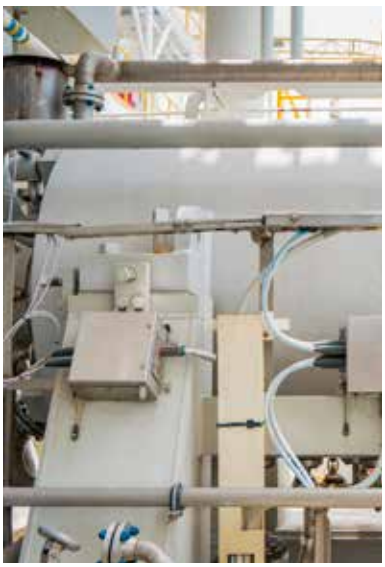
- explain the measurement devices: sensors, analyzers, software, etc,
- recognize standard signatures of the most common mechanical failures,
- decide the kind of signal treatments to apply, in order to understand failure details and evaluate its severity,
- implement a maintenance plan for each machine based on the criticality.

Ways & Means

- Study of industrial cases.
- Various illustrations of actual systems.
- Use a professional measurement software and/or test benches.
- The practical approach makes the course suitable for full-time vibration specialists.

Prerequisites

It is advised to have a basic mechanical knowledge or experience in vibration monitoring.



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 defaults.
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.rueil@ifptraining.com**

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

Operation, Maintenance & Inspection of Rotating Machinery

Purpose

This course provides a rotating machinery skill, including lubrication and troubleshooting, through vibration analysis and other preventive techniques.

Audience

Level: FOUNDATION
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 the machines and their elements are running,
- list the mechanical consequences of specific operating conditions,
- describe the failure modes of each component,
- participate in the machinery reliability improvement process.

Ways & Means

- Pumps, compressors and turbines manufacturing site visits.
- Workshop and practical exercises.
- Case studies based on industrial & actual feedback.

Prerequisites

No prerequisites for this course.

Course Content

15 days

TECHNOLOGY & OPERATION OF MAIN ROTATING MACHINES (pumps, compressors, turbines, electrical motors) — 5 d

Technology:
- Main parts of the machines: casing, rotor, bearing, coupling.
- Ancillaries: flushing, heating and cooling, lubrication systems.
- Maintenance: assembly and dismantling procedures, inspection, clearance, adjustment, roughness.

Operation and performance:
- Process side
  - Operational parameters; head, flow, rpm, efficiency.
  - Characteristic curves. Control. Start-up, routine monitoring.
  - Consequence of internal wear.
- Mechanical part:
  - Stresses in machines. Influence on lifespan, on damage.
  - Failure prevention; monitoring, repair quality.

Troubleshooting:
- Internal leakages. Unbalancing. Wear and failures.

Practical exercises (time included in above items):
- *Recording and plotting pressure of a centrifugal pump.*

Plant visits: centrifugal pumps manufacturer; centrifugal compressors and steam turbines manufacturer.

TECHNOLOGY & MAINTENANCE — 5 d

Lubrication:
- Purpose, different types of oil and grease. Practical exercises.

Bearings:
- Antifriction bearings: types, lifespan, mounting, applications, related problems.
- Plain and pad bearings, thrust bearings: operation, maintenance, incidents.

Coupling and alignment:
- Different types of couplings & related problems.
- Different methods of alignment, tolerances, practical part.

Sealing devices for pumps and compressors:
- Mechanical pump seals, types, operation, related problems.
- Installation, geometrical checks.
- Other seals for positive displacement pumps and reciprocating compressors.

Rotors and shafts:
- Balancing: eccentricity, tolerances. Assembling on shaft: effect on balancing.
- Geometrical shaft controls.

Practical exercises:
- *Bearing mounting and overhaul. Geometrical shaft control. Shaft alignment.*
- *Mechanical seal mounting.*

Plant visit: machine component manufacturer.

FORECASTING BREAKDOWNS — 5 d

Study of ruptures, wear and other failures:
- Standard damage to machines: onset of problems and causes of failures, influences of metallurgy and surface treatments.
- Fatigue, wear and tear. Rupture face analysis.
- *Case studies: rupture and wear examinations of typical parts, analysis of some centrifugal pump breakdowns.*

Use of vibration analysis:
- Different types of measurements and sensors.
- Monitoring of turbomachines rotor behavior.
- Spectrum analysis applied to pumps, fans.
- Diagnosis.

Management of machinery reliability:
- Reliability centered maintenance.
- Detection of Bad Actors.
- Improving reliability through failure analysis and diagnosis.
- Monitoring the maintenance activity performance.

Practical exercises:
- *Measurement and analysis of vibrations.*
- *Machinery component failures, analysis on examples.*

Reference: MTM/OMIRM Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

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

NEW Rotating Machinery: Troubleshooting Analysis

Purpose

This course aims to enhance the maintenance staff skills through a clear understanding of online monitoring & failure analysis.

Audience

Level: PROFICIENCY
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 & actual feedback.
- Teamwork: mini projects dedicated to industrial cases.

Prerequisites

No prerequisites for this course.

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: troubleshooting analysis of pumps, compressors and turbines.

MACHINE MONITORING DEVICES — *1 d*

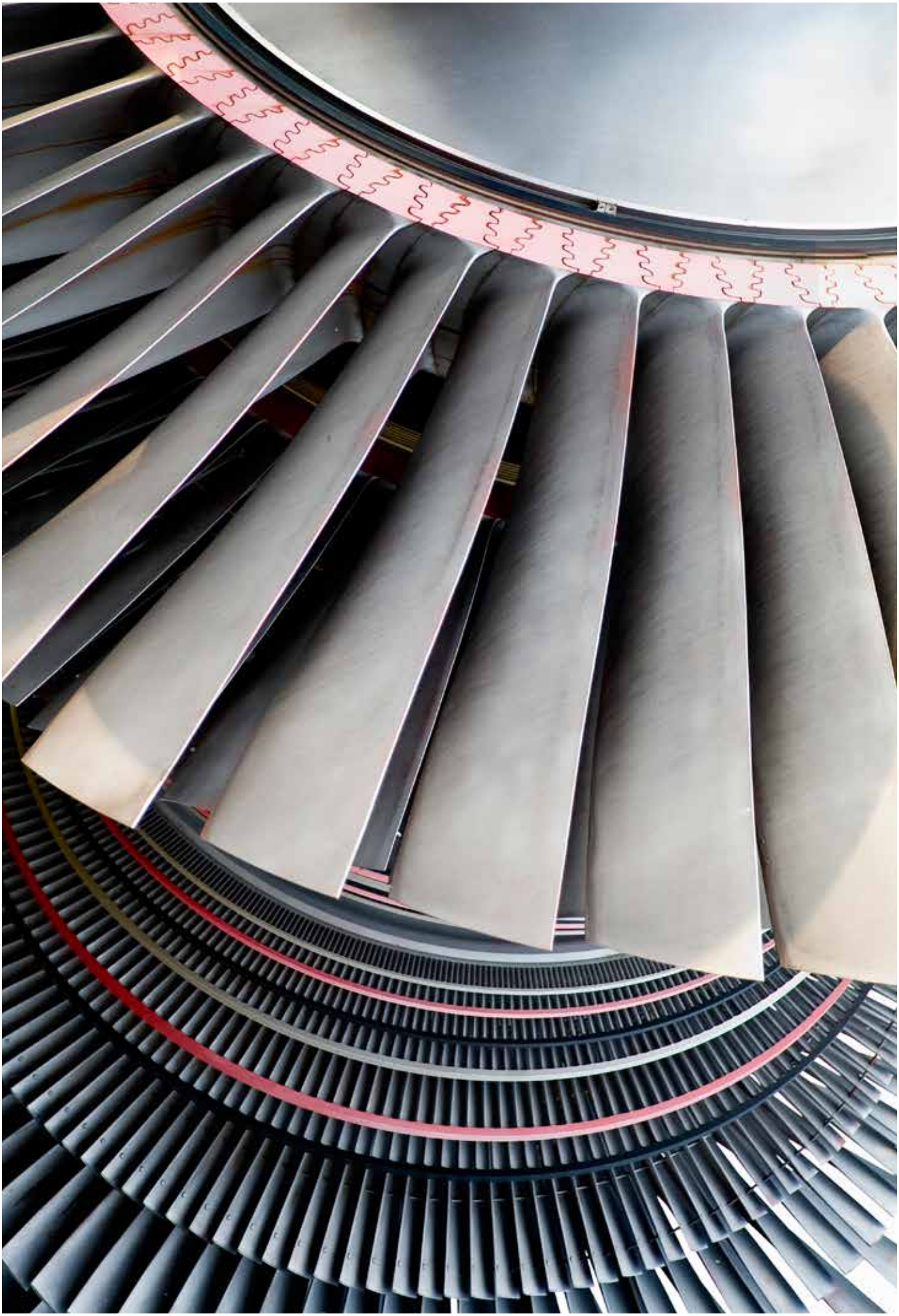
Process operating parameters: monitoring and analysis of the machine process data & logs.
Monitoring tools dedicated to the machine type: vibration monitoring, PV card indicator, rod drop, bearings temperature.

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 gear box.
Understanding a vibrations & oil analysis report.

Reference: MTM/RMTS Only available as an In-House course.

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



Instrumentation, Control & Electricity

Advanced Certificate

Instrumentation & Process Control Certification

Application on RSI IndissPlus dynamic process simulator

CERTIFICATION

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

Level: PROFICIENCY
Engineers and technicians from process industries.

Ways & Means

- Practice on mini process skids with industrial equipment.
- Use of process dynamic simulators.
- Daily quiz to reactivate the key-points.

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.

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 & 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 & 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 *1.5 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.

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.
- Ready-to-use skills.

Reference: IR/INPC Can be organized as an In-House course. Contact: **rc.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Martigues	28 August	1 September	€2,910

*This course is also available in French: **IR/ICP**. Please contact us for more information.*

Advanced Process Control

Application on RSI IndissPlus simulator

Purpose

This course provides an overview of advanced technologies used to improve process control quality and efficiency.

Audience

Level: ADVANCED
Engineers and technical staff involved in the improvement of a plant process control.

Learning Objectives

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

- get a tool box with several APC technologies.
- select one of these technologies according to process challenges.
- estimate cost and benefit of APC (Advanced Process Control) implementation.

Ways & Means

- Case studies.
- Use of a process simulator.

Prerequisites

Basic knowledge in instrumentation & process control.

Course Content

4 days

CONVENTIONAL CONTROL LIMITATIONS — *1 d*

Controlled, manipulated and anticipation variables.
Step test. Transfer function.
Performance criteria of a single control loop.
Cascade and feed-forward control benefits.
Tuning and limitation of PID controllers.
Applications:
PID controller tuning on process simulator.
Debutanizer control improvements.

PREDICTIVE CONTROL: IMPROVE QUALITY OF PRODUCTS — *1 d*

Inferential Control - Data Validation and Reconciliation (DVR).
Model Predictive Control (MPC).
Non Linear Control - Neural networks.
Application: cases studies of typical usage in refining process.

MULTIVARIABLE CONTROL: IMPROVE PROCESS EFFICIENCY — *1 d*

Multivariable Control - Dynamic Matrix Control (DMC).
Real Time Optimizer (RTO).
Examples of Architecture and project implementation.
Application: decoupled controllers studied on process simulator.

APC PROJECT MANAGEMENT — *1 d*

APC Project cost & benefit.
APC Software & Hardware specification.
Definition of project milestones.
Application: APC project Front End Engineering Design.

Reference: IR/PRCONT Only available as an In-House course.

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

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

Multivariable Predictive Control

Purpose

This course provides advanced & practical knowledge of multivariable predictive control.

Audience

Level: ADVANCED
Engineers, technicians and operation supervisors involved in the design, implementation and maintenance of Advanced Predictive Control (APC) projects.

Learning Objectives

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

- learn the fundamentals of multivariable predictive control: setting time, step response, prediction, dynamic control and optimization,
- use a software for dynamic model identification, controller design, off-line closed loop simulation, robust tuning,
- enhance skills required to specify, execute and maintain an APC application.

Ways & Means

Developed with the assistance of AXENS - IFP Group Technologies. About 30% of the course is devoted to workshops using AXENS software tools.

Prerequisites

Basic knowledge in instrumentation & process control.

Course Content

4 days

INTRODUCTION TOPICS — *0.5 d*

PID limitations and the need for advanced control.
Basics of multivariable predictive control.
Presentation of APC architecture and lab exercise toolbox: Axens S2 APC suite.

MODEL IDENTIFICATION — *1 d*

Data pre-processing: noise elimination and concatenation of data sets.
Model building: identification techniques, validation and model reduction.
Dynamic model matrix assembly and export to controller.
Lab exercise: hands on tutorial and development of Gasoline Desulfurization Unit model (GDU model).

DYNAMIC SIMULATION — *1 d*

Open-loop predictions for model validation.
Closed-loop control and robust tuning.
Introduction to on-line optimization: LP cost and external targets.
Lab exercise: hands on tutorial and development of simulation for control of GDU.

AUTOMATED STEP TEST — *1 d*

Off-line sequence design, tuning and simulation.
On-line execution and follow-up.
Lab exercise: hands on tutorial and development of automated step test simulation for GDU.

APC PROJECT METHODOLOGY & OVERVIEW OF ON-LINE TOOLS — *0.5 d*

Application build: configure.
Real time management: monitor.
Production interface: web access.
Maintenance: report.

Reference: IR/MPC Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

Design & Operation of a Safety Instrumented System (SIS)

Purpose

This course ensures that design, operation and maintenance of a SIS will meet the expected risk reduction.

Audience

Level: PROFICIENCY
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.

Prerequisites

Basic knowledge in safety and instrumentation.

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.rueil@ifptraining.com**

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

Introduction to Industrial Electricity

Purpose

This course provides an overview on industrial electricity; how it is generated & distributed in petrochemical plants.

Audience

Level: DISCOVERY
Operators, supervisors & 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 & case studies.

Prerequisites

No prerequisites for this course.

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 & the grid. One line electric distribution diagram.
Application: overall online diagram.

SUB STATION EQUIPMENT & SWITCHGEAR — *2 d*

Purposes and use of these types of equipment.
Transformers: overall technology & troubleshooting.
Circuit breakers: technology & switchboard.
Operation and maintenance of main electrical equipment.
Electric Control System. Failures Monitoring and corrective actions.
Basics in electrical protections.

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).

MOTORS — *0.5 d*

Different type of motors. Operation and technology. Working principle of induction & synchronous motors.
LV & HV motors. Troubleshooting.

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.rueil@ifptraining.com**

Electrical Maintenance for Industrial Plants

Purpose

This course provides a better understanding of electrical equipment such as generators, motors & power grids. It includes performances, operation, main failures, hazards & safety.

Audience

Level: FOUNDATION
Electrical technicians, supervisors & 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 & its structure,
- master electrical equipment including motor operating principles,
- detect the main disturbances & failures related to electrical motors,
- understand the roles of the safety parts.

Ways & Means

- Drawings and datasheets used in the industrial plants.
- Practical exercises & case studies.

Prerequisites

Basic knowledge in electricity.

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.*

SUB STATION EQUIPMENT & WORKING PRINCIPLE OF SWITCHGEAR — *2 d*

Purposes and uses of equipment, as well as its maintenance first level.
Operation & technical characteristics.
Transformers: purpose of transformer on a power grid; operating principle, single phase to tri phases; windings connection & protections.
Circuit breakers: operating principle, technologies, main failures.
Cables, switchboards, equipment, relays, diesel generators, batteries, chargers and UPS.
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 & 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. *Application: failures and maintenance.*

STEAM TURBINES GENERATORS — *0.5 d*

Mechanical characteristics of the steam turbine generator. Technology and operation of the electrical generator.
Isolated mode & coupling of the generator: impact on the grid.
Application: maintenance and failures.

Reference: IR/ELECMAIN Only available as an In-House course.

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

Electrical Motors: Technology, Operation & Maintenance

Purpose

This course deals with technical development in terms of operation and maintenance of electrical motors.

Audience

Level: ADVANCED
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 & monitoring equipment in operation,
- describe main setting rules.

Ways & Means

- Visit of a motor repair workshop.
- Motor disassembly & assembly in an available workshop.

Prerequisites

No prerequisites for this course.

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 characteristics.
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 & constraints for a motor installation.
Skid and shim. Shaft alignment. Comparison to reference data.

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*

Bearings assembly, housing repair, clearance and concentricity control.
Part identification in workshop.
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: standards and mechanical balancing quality, 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.rueil@ifptraining.com**

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

Maintenance & Works Supervision

Maintenance Policy & Equipment Reliability

Maintenance & Works Supervision

Advanced Certificate

Maintenance Management & Equipment Availability Certification

CERTIFICATION

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

Level: ADVANCED

Engineers, supervisors and staff involved in maintenance and equipment availability enhancement.

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 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.

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 & 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 & 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.

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.
- Ready-to-use skills.

Reference: OMT/GEMA-E Can be organized as an In-House course. Contact: **rc.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	15 May	19 May	€2,640
Al Jubail	26 November	30 November	€2,590

*This course is also scheduled in French: **OMT/GEMA**. Please contact us for more information.*

Routine Maintenance Optimization

Purpose

This course provides in-depth knowledge related to the organization, monitoring and optimization of routine maintenance.

Audience

Level: PROFICIENCY
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.

Prerequisites

The participants need to have basic maintenance knowledge.

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.rueil@ifptraining.com**

Turnaround Management

Purpose

This course provides an overall strategy to achieve the main turnaround objectives: safety, deadline and budget compliance.

Audience

Level: PROFICIENCY
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.

Prerequisites

The participants need to have basic maintenance knowledge.

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 & 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.rueil@ifptraining.com**

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

NEW Equipment Basic Maintenance

Purpose

To provide in-depth knowledge related to the equipment technology and maintenance.

Audience

Level: DISCOVERY
Engineers from various disciplines: process, maintenance, operation, mechanical, inspection, HSE, instrumentation, electrical, …

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.

Prerequisites

No prerequisites for this course.

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.

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 & maintenance.
Basic machinery reliability, maintenance and troubleshooting.
Auxiliaries, lubrication and maintenance of rotating equipment.
Risks and failures dealing with these types of rotating equipment. Prevention.
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).

Reference: OMT/EBM Only available as an In-House course.

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

Graduate Certificate

Maintenance Engineer Certification

CERTIFICATION

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

Level: FOUNDATION

Graduate engineers, new engineers, Maintenance supervisors & staff involved in petrochemical plants maintenance.

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.
- Each team have to: identify the priorities for an assigned subject, according to the module studied, list specific hazards & barriers, decide of critical equipment, identify operation and maintenance procedures.

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 related to maintenance and construction works in Refining and Petrochemicals plants.

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 & 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 O&G 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 & 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 & 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 & work acceptance phases. Plant start-up.
Plant Turnaround justification and frequency. Organization, scope, challenge, schedule. Financial breakdown. KPI's.
Job safety analysis. Risks due to works on site: lifting, scaffolding, welding, confined spaces, cleanings, Xrays, etc. LOTO procedure and prevention, work permit.

Module 15: FINAL PROJECT — 5 d

Team work. Subject dealing with technical & 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.

Prerequisites

The participants need to have a basic technical knowledge.

More info

This course is composed of 15 modules of 5 days each. It includes all the evaluations related to the IFP Training Certification.

Why an IFP Training Certification?

- An international recognition of your competencies.
- A Graduate Certificate is obtained.
- An expertise confirmed in Maintenance Engineer.
- Ready-to-use skills.

Reference: OMT/MAINENG Only available as an In-House course.

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

*This course is also available in French: **OMT/INGMAINT**. Please contact us for more information.*

Refinery Operation

Vocational Certificate

Field Operator Certification

An established methodology for training operators in Oil & Gas/Chemical industry

CERTIFICATION

This course provides the knowledge and know-how for the specific field operator position.
Successful participants will be granted the “Field Operator” Vocational Certificate.

Audience

Level: FOUNDATION
Newly recruited operators in the refining, petrochemical and chemical industries.

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 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.

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).

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.Detailed content may be sent on request.

Reference: OPE/BO-E Only available as an In-House course.

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

*This course is also available in French: **OPE/BOALT**. Please contact us for more information.*

Panel Operator Training Course

Purpose

This course provides a deeper knowledge and know-how necessary to become a panel operator.

Audience

Level: FOUNDATION
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:

- describe the specific duties of their position and the control room organization,
- 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,
- analyze the process to determine disturbance causes, and take appropriate corrective and preventive actions.

Ways & Means

- Training involves on-site work and supervision from mentors in the plant.
- Case studies and applications on generic dynamic simulators: half of the course takes place in the training center.
- Interactive delivery method.

Prerequisites

Excellent technical knowledge of the assigned unit or group of units (field experience).

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 — 4 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, heat exchanges, 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).
- *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: structure of the ESD system on a two-phase drum; 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: operation of two pumps in parallel, pumps switch; changes in operating conditions, capacity control, 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, …*

Specific equipment for a given assignment unit (gas turbines, solid handling, extruders, …).

PRODUCTS & PROCESSES — 6 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 waste water treatment unit.

Integrated plant operation:
- Steady state runs: routine checks, integrated plant behavior (inertia, interferences), global performances.
- 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.rueil@ifptraining.com**

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

Refinery Foremen Training Course

Purpose

This course provides a comprehensive training on products, processes, equipment and safety, to enhance competencies and develop skills for a safe and efficient management of refinery operations.

Audience

Level: PROFICIENCY
Foremen, shift leaders, panelists and technicians (maintenance, inspection, laboratory, analysis, research department), with no previous vocational certificate.

Learning Objectives

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

- supervise the production of petroleum products in specifications,
- analyze and criticize the operating conditions of processes and equipment in order to optimize their use,
- manage the inherent risks of products, equipment and human behavior; thus contributing to operational safety,
- communicate efficiently with shift and day colleagues, to enforce compliance with instructions.

Ways & Means

- Practical applications, case studies and manipulations on dynamic simulators. Role plays.
- Review and wrap-up session at the end of each phase of the course.
- Site visits.

Prerequisites

Knowledge of the group of units in charge, including field and panel activities.

Course Content

50 days

BASIC TRAINING — *11 d*

Physico-chemical properties of hydrocarbons and petroleum cuts.
Properties of fluids. Liquid/vapor equilibria.
Fluid flow. Heat, energy, heat transfer.
Industrial and catalytic chemical reactions.
The basic training is illustrated by many practical applications of actual examples from refineries.

SAFETY & ENVIRONMENT IN OPERATIONS — *6 d*

Hazards related to products and equipment.
Safety in operations. Integrated safety systems and process safety.
Work related hazards. Managing contractors and subcontractors.
Environmental issues and related constraints.
Case studies. Group work.

EQUIPMENT — *13.5 d*

Metal and corrosion processes. Preventive measures.
Static equipment, vessels, storage tanks.
Rotating machinery (centrifugal and volumetric pumps, centrifugal and volumetric compressors, steam turbines): workings and technology; operation and disturbed situations; constraints and limits on equipment operation.
Heat exchangers and air coolers: operation, test and monitoring.
Furnaces and boilers: operating conditions, firing control, typical problems, typical start-up procedures.
Instrumentation and control: operation and instrumentation, working of control loops.
Advanced process control.
Practical control exercises on a dynamic simulator.
Technical visits to manufacturer's factories or industrial plants complete the lessons.

PRODUCTS & PROCESSES — *11.5 d*

Crude oil and petroleum products: characteristics, blending rules, reception and shipping, quality control tests, sampling.
Distillation operation: binary and multiple draw off.
Workshop on a dynamic simulator.
Refinery processes: characteristics of the feeds and products, analysis of operations, tuning parameters, performance criteria and optimization, study of operating disturbances:
- Atmospheric distillation (study on a simulator), desalting, vacuum distillation.
- Catalytic reforming.
- Hydrotreatment, hydrodesulfuration and H_2 production.
- Conversion processes: hydrocracker, FCC, coker.
- Finishing processes.
- Sulfur recovery and tail gas treatment.
- Bitumen manufacturing.

Manufacturing process diagram.
Material balance.
Utilities: energy production, distribution and consumption, flares, cooling water, waste waters treatment, boiler feed water.
Energy management. Production optimization.

INTEGRATED PLANT SAFE OPERATION - TEAM MANAGEMENT — *5 d*

Team management. Management of change.
Radio communication, other communication equipment. Teamwork, responsibilities sharing. Transmission of know-how.
Alertness, forward thinking plant operation. Alarms management.
Application: role plays.

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 waste water treatment unit.

Steady state runs: routine checks, integrated plant behavior (inertia, interferences), global performances.
Identification, analysis and reaction to upsets and equipment failures; stabilization.

CONTINUOUS EVALUATION — *3 d*

Reference: OPE/MTRAF-E Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

Mentors Training Course

Supervision of field operators following a certification training

Purpose

This course provides help to mentors in order to fulfill their mission in the operator training program.

Audience

Level: PROFICIENCY
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.

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.

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.rueil@ifptraining.com**

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

NEW Train The Trainers

Purpose

This course provides a deeper knowledge on how to effectively train technicians in operating facilities.

Audience

Level: PROFICIENCY
Personnel in charge of training and technical competency enhancement programs.

Learning Objectives

Upon completion of the course, 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.

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.

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.rueil@ifptraining.com**

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

Operator Basic Training Course

Purpose

This course provides newly hired operators with the basic knowledge required for a rapid and effective integration.

Audience

Level: FOUNDATION
Newly hired operators for oil refineries or chemical plants.
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.

Prerequisites

None, apart from being already hired by an Oil & Gas or Chemical company for a field operator position.

Introduction

For each equipment type: principle, technology, ancillary systems, monitoring, basic operations, risks, safety devices, good practices.

Course Content

40 days

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, waste water 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 shut-down 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.rueil@ifptraining.com**

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

HSE

Safety Engineering

Purpose

This course provides an overview of safety studies in a project and shines a light on how to define the main principles behind the design of systems of prevention, detection, mitigation and protection.

Audience

Level: FOUNDATION
Managers, engineers, technicians in charge of the design, the modification, the maintenance or the operation of industrial facilities.

Learning Objectives

To understand and apply the Codes and Standards used for Safety in Process design.
Upon completion of the course, participants will be able to:

- use the consequence analysis at the very beginning of the project,
- apply the main codes and Standards for Safety Design (NFPA, API).

Ways & Means

The main principles for safe design in simple installations are applied:

- interactive lecturing, by experienced lecturer(s),
- numerous exercises and applications (50% case studies or tutorial exercises),
- a number of Visual aids (Videos, Learning from Incidents (Texas City, Buncefield, Flixborough)).

Prerequisites

Basic knowledge in Process, Instrumentation, Static and Dynamic Equipment.

Course Content

5 days

RISK IDENTIFICATION *1 d*

Risk identification and acceptability with regards to people, environment and assets - Hazard and risk - Residual risk - Risk assessment matrix.
Review of 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 *0.5 d*

Layout optimization based on safety reviews: Safety distances - Fire zones - Deluge zones - Escape, egress and access systems.
Minimizing the inventory: leak control, disposal (flare, diked area, …) and drainage systems.

TYPE OF SAFETY BARRIERS *0.25 d*

Safety barriers: technical, organizational, human; prevention, mitigation, protection, active/passive.

PREVENTION BARRIERS *1 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.

DETECTION *0.5 d*

Fire & Gas system: technology of sensors, selection and location - Cause and Effect Matrix, Voting - Relationship with mitigation systems.

MITIGATION & PROTECTION SYSTEMS *1.25 d*

Minimizing ignition sources: ATEX, area classification, ventilation.
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. Preliminary sizing of main ring, pumps and water/foam solution tank.
Semi-fixed and mobile systems: description and operation of equipment.

HUMAN FACTORS *0.25 d*

Functioning of the human being - examples of systems embedding human behavior or human error: equipment accessibility, plant ergonomics, synoptic/graphic display design, alarm management, …

MANAGEMENT OF CHANGE *0.25 d*

Management of Change (MOC): technical, organizational and human expertise (reliability of documentation, suitability/application of the procedures, corporate specifications, …).
Maintaining the efficiency of the barriers - Example of risk management tools: the bow tie.

Reference: SEC/SAFENGRC-E Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

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

Implementing Safety Review

HAZID, HAZOP, LOPA, …

Purpose

This course provides a deeper knowledge of selection and implementation of process hazard reviews.

Audience

Level: FOUNDATION

Staff involved in process design, facilities operation, maintenance and safety, whose duty is to implement or participate in process hazard reviews, for new and/or existing facilities.

Learning Objectives

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

- take an active part in the process hazard reviews/methodologies,
- prepare process hazard reviews, organize the review team, identify participants based on their experience and background and define their individual task,
- select and prepare reviews, adapted to the context.

Ways & Means

- Simulation of hazard reviews on simple processes: HAZID, HAZOP, LOPA.
- Construction of a bow tie and calculation of frequency.
- Short exercises using the risk matrix.

Prerequisites

Ability to read PFD's and PID's.

Course Content

4 days

RISK & ACCEPTABILITY CRITERIA *0.5 d*

Hazard representation.
Risk matrix, impact on workers, assets and the environment.
Risk and hazard concepts, gravity and probability levels. Acceptable residual risk.

SAFETY REVIEWS

Objectives.
To plan and implement the reviews during the various project phases or on existing facilities.
Selection of the most appropriate methodology, in accordance with the context: new project, existing facilities and revamping, updating of previous studies, operating permit.

QUALITATIVE & SEMI-QUANTITATIVE METHODS *2.25 d*

HAZID: HAZards IDentification (preliminary hazards analysis, design review, constructibility).
HAZOP: HAZard and OPerability analysis. Quantified HAZOP.
What-If and Check-List Methods: comparison with HAZOP method, limits.
Implementing the methods:
Organization: to identify participants, to plan the review, to prepare the technical documentation.
To facilitate and lead the review. To prepare the report, follow-up, monitoring and close out of the review findings.

QUANTITATIVE METHODS *1.25 d*

Bow tie: principles, construction and use. Safety barriers. Frequency calculation.
Quantitative Risk Analysis (QRA): selection of scenarios, evaluation of consequences and probability.
Layer Of Protection Analysis (LOPA): principles, IPL identification (independent protection layers), Safety Instrumented Function (SIF) with associated SIL (safety integrity level), preparation and organization of reviews; interaction with HAZOP findings.

Reference: SEC/HAZOP-E Only available as an In-House course.

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

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

Safety in Plant Operation

Purpose

This course provides trainees with a better understanding of product and equipment risks in order to ensure safe operation.

Audience

Level: FOUNDATION
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.

Prerequisites

No prerequisites for this course.

More info

This course is also available in Dutch, Italian and Spanish.

Course Content

5 days

PLANT OPERATIONS & SAFETY — *0.25 d*

Hazard and risk identification.
Safety, health, environmental consequences.
Risk management: technical, organizational and human aspects.

PRODUCT-RELATED RISKS — *2 d*

Flammability:
- Explosive atmosphere: combustible products (gaseous, liquid and solid). Oxidizers. Ignition sources; flames, self-ignition temperature, sparks and static electricity, pyrophoric products, etc.
- Preventive measures and precautions: during normal conditions, during draining and sampling; in the event of leaks; with regard to storage tanks; during loading and unloading; during repair work.
- Risks and precautions related to BLEVE.

Fluid behavior and related risks:
- Pressure in a vessel and consequences of an increase or decrease in temperature: thermal expansion, vaporization, collapsing due to vacuum, freezing due to pressure drop, etc.
- Risk assessment and preventive measures.

Chemical and physical hazards involving personnel:
- Poisoning: ingestion, metabolism and elimination. Prevention.
- Burns caused by heat sources and chemical products.

SAFETY IN PROCESS OPERATIONS — *2.5 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 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.

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.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Al Jubail	26 November	30 November	€3,090

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

Safety in Operation Related to Chemical & Oil Storage

Purpose

This course provides a better understanding of product and equipment risks in order to increase safety behavior in storage and discharge operations.

Audience

Level: PROFICIENCY

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.

Prerequisites

No prerequisites for this course.

Course Content

4 days

PLANT OPERATIONS & SAFETY — *0.25 d*

Specific hazard inventory and consequences: accident, environmental and health damages.
Risk management tools: organizational, human behavior and technical aspects.

PRODUCT-RELATED RISKS — *1.25 d*

Flammability:
- Explosive atmosphere: flammable product occurrence.
- Ignition sources: hot works, sparks and static electricity, self-ignition temperature.
- Oxidizers and pyrophoric products.
- Preventive measures and precautions: hazard operations and behavior to be followed: draining, sampling, product loading or unloading, repair works, motor vehicle traffic, hazardous area, etc.

Fluid behavior and related risks:
- Pressure in a vessel (Sphere, tanks, wagons, pipes, etc.) and consequences of a temperature increase or decrease: thermal expansion, vaporization, collapsing due to vacuum, freezing due to pressure drop, BLEVE, Boil-over, water hammer, etc.
- Risk assessment and preventive measures.

Risks for human health:
- Toxicity: risk assessment, main ways of poisoning, prevention and protection.
- Thermal and chemical burns: equipment lay-out, product handling, Personal Protective Equipment (PPE).

Product interaction: during storage (Bulk, barrel, etc.), transport (rail, road, shipment) and hazardous chemical reaction.
Hazmat transportation: loading rate, vehicle identification, Material Safety Data Sheet (MSDS), driver certificate, etc.

PLANT RELATED RISKS - SAFEGUARDING EQUIPMENT — *0.75 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 lay-out (top or bottom), safe automation and facilities, vapor recovery.

SAFETY IN STORAGE TANKS COMMISSIONING & DECOMMISSIONING OPERATIONS — *1.5 d*

Successive stages: utilities used (nitrogen, water, air, gas oil, etc.).
Draining-blowdown: depressurization, degassing, inerting.
Lock out/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 Only available as an In-House course.

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

Laboratory Safety

Purpose

This course provides an insight on how to improve day-to-day SHE performance in laboratory activities.

Audience

Level: FOUNDATION
Technicians working in the control and research laboratories of refineries and chemical plants, and their first-line management. Pilot plant technicians and personnel from safety services.

Learning Objectives

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

- evaluate risks related to day-to-day routine work and to improve their behavior,
- identify risks related to chemicals, test equipment and the industrial environment,
- select and apply the most appropriate risk prevention methods,
- enforce safety commitment at work and off-the-job.

Ways & Means

- Practical work based on actual lab incidents and accidents.
- Equipment demos (hardware, pictures, videos).

Prerequisites

No prerequisites for this course.

Course Content

3 days

PRODUCT HAZARDS *1.25 d*

Flammability and explosivity:
Explosive atmosphere, flammable gases, oxidizers, flash sources.
Fire prevention: electrical equipment standards in explosive areas, hazardous area classification, grounding, inerting.
Fixed and portable detection equipment. Extinguisher types and uses.
Hazardous chemical reactions:
Compatibility between chemicals. Thermal decomposition. Precautions for storage, use and disposal.
Hazards related to physical properties of fluids:
Effects of pressure and vacuum. Pressure vessels. Thermal expansion. Vaporization. Freezing. Filling limits.

HEALTH HAZARDS *0.5 d*

Health hazards of chemicals: toxic, corrosive, carcinogenous, inert gases, thermal burns.
Intoxication: main mechanisms, body penetration, metabolism, elimination routes.
Collective and individual prevention and protection methods.
Medical surveillance.

LAB EQUIPMENT HAZARDS *0.25 d*

Equipment acceptable operating limits: pressure, temperature, corrosion, regulatory requirements.
Precautions during construction, installation and connection. Pressure-relief systems.
Utility networks: check valves, flexible connections, tagging, isolation, flow control.
Hazards related to small equipment: grassware, hand tools, rotating equipment.
Specific lab equipment hazards: X-fluorescence, chromatography, MNR, laser particle size.
Development lab equipment for finished product testing and applications.

LAB BUILDING DESIGN *0.75 d*

Laboratory classes depending on types of products handled. Ventilation systems. Desks and tables.
Rooms for specific purposes: chemical warehouse, gas storage, sample retention, vacuum system, washing.
Management of products: storage, labeling, reference sample renewal. Inventory of toxic products.
Lab chemical waste management: segregation, recycling, disposal routes, reporting.

SAFE BEHAVIOR (key topic discussed during the whole course) *0.25 d*

Individual behavior:
Typical hazardous behaviors observed, importance of being a role model. Individual accountability.
Behavioral observations: focus on human behavior, communication skills, commitment and action plans.
Risk management:
Risk identification and evaluation in day-to-day routine operations. Routine prevention. PPE. Sensitization.
Change management. Identification of risks related to analytical changes (equipment, chemicals, samples).
Quality systems:
Safety procedures (understanding and compliance). Operating instructions. Safety precautions in test methods.
Material Safety Data Sheets: understanding, use, filing.
Role of HSE Department and of the Safety Committee. Continuous improvement through incident feedback.

Reference: SEC/SECALAB-E Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

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

Safety in Maintenance & Construction Works

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

Level: FOUNDATION

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.

Prerequisites

No prerequisites for this course.

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), gas detection (LEL), precautions, ATEX requirements.
Pressure and temperature related hazards.
Toxicology: limits, specific cases: asbestos, H_2S, benzene; biological risks.

WORK-RELATED HAZARDS *2.5 d*

Material transportation equipment, manual and mechanical handling.
Decommissioning: risks related to equipment opening and line breaking, isolation procedure, blinding and spading work, circuit lockout and tagging procedure.
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, ladders and harnesses.
Use of tools and construction equipment: portable, power and air actuated tools; abrasive blasting; painting; high pressure cleaning, use of cleanup tank trucks and flexible hoses, chemical cleaning; rigging, lifting, hoisting.
Hot works: welding, cutting and heating, grinding.
Hazardous radiation: working with radioactive sources, X-ray work, specific risks.
Risks related to electrical work and devices: classification of hazardous area and equipment requirements; current effects through the human body.

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.
Danger resulting from unsafe acts and/or unsafe conditions: sources of hazards, task/risk analysis, managing contractors and subcontractors.
Management of Change (MOC).
Personal Protective Equipment (PPE).

Reference: SEC/SECTRA-E Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

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

Waste Water Treatment

Purpose

This course provides a deeper knowledge of waste water treatment processes.

Audience

Level: PROFICIENCY
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).
- Visit of a waste water treatment unit.

Prerequisites

No prerequisites for this course.

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.rueil@ifptraining.com**

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

Plant SHE Process Daily Involvement

Purpose

This course provides a positive overview of the plant SHE processes.

Audience

Level: FOUNDATION
All plant staff, from operation, maintenance, engineering to laboratory.

Learning Objectives

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

- understand the individual's role in the plant SHE process and results expected,
- take over the plant SHE tools,
- enforce your SHE involvement in your daily job.

Ways & Means

Use of plant SHE tools:

- Easy practical application of risk analysis methods.
- Sharing of experiences (videos, case studies).

Prerequisites

No prerequisites for this course.

Course Content

2 days

SAFETY COMMITMENT FOR THE PLANT & THE EMPLOYEE *0.25 d*

Employer and employee safety regulatory requirements.
Safety improvement policy: moral requirement, economic features, technical challenge.
Employer and employee legal responsibilities.
Ensure one's own and occupational environment protection.

RISK UNDERSTANDING - HAZARD MANAGEMENT TOOLS *0.75 d*

Risk management: target, field of application, staff concern.
Work-accident consequence assessment:
- Different accident scripts (fire, explosive or toxic gas leak, etc.) and effect quantification.
- Taking risk into account in daily assignments.

Hazard analysis methods:
- Target: risk assessment, protection and prevention means.
- Overview of main hazard analysis methods (HAZOP, CCC, etc.).
- Risk analysis adaptation and use in standard process operations (product emptying, sampling, decommissioning, etc.).
- Management of change.

PUBLIC BEHAVIOR *0.5 d*

Plant safety policy: top management choice, safety KPI follow-up, means implementation, whole coherence.
Tools: safety instructions, procedures, check-list, experience sharing, occupational task risk analysis, group work (interest, constraints, limits, etc.).
Expertise available: top management, SHE team, medical unit, experts.

INDIVIDUAL BEHAVIOR - HUMAN RELIABILITY *0.5 d*

Management and individual exemplary behavior (rules & instruction agreement, personal protective equipment compliance).
Team work induction.
Development of one's sense of observation, reaction in front of a new or unusual situation.
Awareness of one's stake and role in SHE process.
Human reliability: to be taken into account in prevention tools and risk analysis.

Reference: SEC/SHEINVOL Only available as an In-House course.

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

NEW Safety Leadership

Purpose

This course provides knowledge of how to align first line management and intermediate management with company standards & expectations.

Audience

Level: FOUNDATION

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 company safety values,
- assess your position and realize their main gaps,
- build a personal action plan and engage their commitment to progress,
- demonstrate your personal impact on company safety culture,
- explain how to act and to communicate accordingly.

Ways & Means

Team work with intensive use of case studies, incident analysis, simulations and role playing.

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.

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 team work. 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: team work, 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 & 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.rueil@ifptraining.com**

Improve Your SHE Management System

Purpose

This course provides key knowledge in order to improve the existing SHE management system and evaluate hazard analysis methods more efficiently.

Audience

Level: ADVANCED

Senior staff, managers, supervisors and graduate engineers, in charge of coordinating and improving their site's Safety Health Environment Management System.

Learning Objectives

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

- define the operational objectives of a SHE management system,
- assess the fundamental requirements for an effective SHE 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.
- SHE Management System failures: case studies.

Prerequisites

No prerequisites for this course.

Course Content

3 days

SHE 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 UE and USA (Seveso II or CoMAH, OSHA PSM).
Employers' and employees' legal responsibilities.
Examples of guidelines: OHSAS 18001, 18002, ILD, OSH-2001, etc.

SHE MANAGEMENT SYSTEM STRUCTURE — *0.25 d*

Principles, fields of application, 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.

SHE 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.

HAZARD ANALYSIS METHODS — *1 d*

Different risks (accident, fire, explosion, product release, spill, industrial disease, etc.).
Operating permit application and regulatory requirements.
Qualitative and quantitative risk analysis.
Process Hazard Analysis (PHA) methods:
- Check-lists.
- What-if analysis.
- Hazard and Operability analysis (HAZOP).
- Causes, Consequences, Compensation (CCC).
- Failure Modes Effects and Criticality Analysis (FMECA).
- Fault Tree Analysis.

Criteria for selecting the most appropriate PHA method.
Risk assessment: use of criticality matrix, probability & consequences.
Important safety systems, SIS (Safety Interlock System) classification, protection layers and redundancy.
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.

SHE MANAGEMENT SYSTEM EVALUATION & FOLLOW-UP — *0.25 d*

Risk Control System (RCS), reactive and proactive monitoring through the use of lagging and reacting 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 and procedures.

Reference: SEC/SHE-E — Only available as an In-House course.

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

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

Root Cause Analysis

Effective Incident Investigation

Purpose

This course provides a thorough methodology to investigate incidents with a team.

Audience

Level: FOUNDATION
Investigation committee leaders in charge of analyzing HSE or Reliability incidents.

Learning Objectives

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

- effectively define a problem,
- create and manage the investigation committee,
- find root causes related to management systems,
- identify the best solutions,
- communicate with and convince management.

Ways & Means

Practical exercises at each step of the method, based on actual refining/chemical situations:

- Role playing on the second day, based on actual and complex cases.
- Demonstration of existing software supporting the method.
- Upon request, specific site culture, procedures, software packages and actual incidents can be used.

Prerequisites

No prerequisites for this course.

Course Content

2 days

PRINCIPLE & KEY STEPS *1 d*

Immediate action following the incident: initial investigation, gathering of physical and visual evidence, interview of witnesses and documentation of their reactions, pictures, field visit.
Team selection: selection of facilitator and team members, validation by Management.
Problem definition: difference between events and problems, circumstances, actual and potential impacts, prioritization.
Understanding causes: various methods to start a cause and effect chart. Difference between chronological and logical relationships, key role of the barriers, identification of missing and inadequate barriers.
Active failure: understanding of human error and its various possible causes, relationship with the barriers.
Conditions: relationship between active failures and conditions. Understanding that conditions belong to the cause and effect relationship. Importance of considering conditions as causes. Cause categories by type: equipment, hardware, organization, procedures, people, roles and responsibilities.
Management Systems: definition, importance for the company to take them into account. Main Management Systems at the source of incidents, interest of predefined Management System categories.
Recommendations: how to move from the cause and effect chart to recommendations. Exploring possible solutions. Techniques to find creative options. Validity check (SMART recommendations). Prioritization of valid recommendations.
Action plan: management involvement, reasons and consequences. Presentation techniques. Final validation.
Reporting: base elements of a clear and complete report.

PRACTICAL INVESTIGATIONS *1 d*

Application n°1: application of the whole method on a simple case, by teams of 3, everybody having the same information, and the Trainer providing additional necessary information, as requested. Feedback from one team, group discussion.

Application n°2: role play by teams of 4 to 5, each participant knowing specific information. Nominated facilitator having no information available. Feedback from one team, group discussion. Closing comments from the Trainer.

Reference: SEC/INCANA Only available as an In-House course.

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

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

Advanced Certificate

Industrial Safety Engineer Certification

Prevention - Protection - Mitigation

CERTIFICATION

This course provides a deeper knowledge on how to master all aspects of the industrial safety engineer position.

Audience

Level: PROFICIENCY

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.

Experienced personnel intended to advance their profession in HSE.

Ways & Means

- Practical tutorials on industrial equipment.
- Site visit and studies.
- Real-life firefighting exercises.
- Lecturing by industry experts.
- Real incidents and accidents case studies.

Learning Objectives

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

- master technical knowledge, rules and regulations,
- apply a practical and behavioral know-how,
- implement tools and techniques required for an integrated management of safety.

Course Content

60 days

WELCOME - PRESENTATION - MID TERM & FINAL ASSESSMENT — 1 d

RISKS RELATED TO FLUIDS BEHAVIORS — 2 d

Gas compression and expansion. Liquid-vapor equilibrium. Energies at stake.
Pressure in a vessel and consequences of heat addition or withdrawal: thermal expansion, vaporization, vacuum, freezing due to gas expansion, …
Risk assessment and operating precautions.

RISKS & PRECAUTIONS RELATED TO EQUIPMENT — 6 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.

FLAMMABILITY PREVENTION - PRECAUTIONS - FIREFIGHTING — 18 d

Combustion phenomenon: combustion of gaseous, liquid and solid mixtures. Combustion effects. BLEVE phenomenon, boil over, back draft and flash over.
Precautions and prevention against risks of fire and explosion: control or suppression of flammable mixtures and ignition sources. ATEX zones classification.
Materials' behavior with fire. Gas detectors, fire detectors (smoke, flame, heat, …).
Protection and firefighting: extinguishants (water, powder, foam, inhibiting gases), mobile and fixed firefighting equipment.
Firefighting strategies: basic rules, means and methods of intervention, emergency plans.
Practical exercises on real fires.

ENVIRONMENT PROTECTION — 3 d

Importance of environment protection for human being, for company.
Air, water and soil protection. Origin, nature, treatment and reduction of pollutions.
Waste management: sorting and elimination routes.
Awareness - Sustainable development.

INDUSTRIAL HYGENE - HEALTH AT WORK — 3 d

Professional risks: chemical risks, physical risks, toxicological risks.
Collective and personal protection equipment.
Risk management: work station assessment, material safety data sheet, medical check-up, …
Occupational medicine - Prevention.

SAFETY DURING COMMISSIONING & DECOMMISSIONING ACTIVITIES - SAFETY IN MAINTENANCE & CONSTRUCTION WORKS - SAFETY IN LABORATORY — 11 d

Safety during commissioning and decommissioning operations: risks and precautions related to auxiliary fluids (nitrogen, water, air, steam, …). Draining and venting of equipment.
Process, mechanical, electrical lock out. Neutralizing, washing, degassing, inerting of facilities. Gas tests. Vessels/confined space entry. Re-commissioning.
Safety in maintenance and construction works: specific risks and corresponding precautions. Permit to Work. Integration of safety in preparation, implementation and work surveillance.

RISK MANAGEMENT — 16 d

Global approach to prevention: human means, technical means, human factors.
Health, safety and environment management system (HSE-MS): Structure, implementation and administration of a HSE management system.
Risk assessment: risk assessment methods (HAZID, HAZOP, What-If, …), preventions means, crisis and intervention management.
Financial shields to deal with accidents - Insurances. HSE approach in projects.
Safety engineer job: mission (research, operational, functional, liaison, …), responsibilities, and required skills.

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.
- Ready-to-use skills.

Reference: SEC/SECUIND-E Only available as an In-House course.

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

*This course is also available in French: **SEC/SECUIND.** Please contact us for more information.*

Project Management

Advanced Certificate

Downstream Project Management Certification

CERTIFICATION

This course provides an overview of management of Oil & Gas Downstream significant projects (more than 10 million euros), from initiation to closure.

Audience

Level: PROFICIENCY

Technical engineers (from Owners or from Engineering Contractors) involved in Oil & Gas Downstream projects.

Ways & Means

- Highly interactive sessions using examples from actual industrial projects.
- Refining case study used throughout the course, at each project stage.

Learning Objectives

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

- lead the preliminary stages: initiation, feasibility studies, economics, risk assessment, FEED,
- plan and control execution: detail engineering, procurement, construction.

Course Content

5 days

PRELIMINARY STUDIES

Project initiation *1.5 d*

Introduction: global context of Oil & Gas Downstream (project types, project stages).
Project initiation studies: economic evaluation, conceptual studies, technical deliverables. Licensors.
Preliminary project planning (global schedule/constraints, cost estimate principles, main feasibility issues).

Feed & contracting *1.5 d*

Technical package deliverables. Project team organization, FEED contract types and management.
HSE design: tools & techniques, project reviews. Quality/Risk management principles and tools.
Optimization of execution schedule. Budget approval. Project Execution Plan, EPC contracting strategy.
Engineering contract types and possible scopes. Contractor selection process. Long Lead Items.

EXECUTION

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*

Critical path. Optimization of construction schedule with vendors. Contingency plans.
Construction challenges, subcontract types, construction strategy. Construction execution plan.
Field HSE management, progress control, field quality management during Construction. Change management.
Custody transfer: commissioning, start-up, performance tests. Contractual consequences. Warrantees.

Prerequisites

Technical knowledge of Downstream Oil & Gas operations (no project knowledge required).

More info

Course consistent with the PMI standards and the 5th edition of the PMBOK. Worth 30 PDU.

Why an IFP Training Certification?

- An international recognition of your competencies.
- An Advanced Certificate delivered.
- An expertise confirmed in Downstream Project Management.
- Ready-to-use skills.

Reference: PGP/MRSMPROJ Can be organized as an In-House course.

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

Location	Start Date	End Date	Tuition Fees
Rueil	27 November	1 December	€2,870

Engineering Management

Application to Oil & Gas Upstream Projects

Purpose

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

Audience

Level: FOUNDATION

Anyone wishing to gain a clear understanding of engineering activities and their execution by a contractor.
This includes project engineers and engineering managers.

Learning Objectives

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

- coordinate all engineering activities, deliverables, work sequence and interfaces,
- evaluate the main risks: schedule, vendors, interfaces, quality and how to mitigate them,
- control engineering execution: critical issues and controls/KPI to put in place,
- use best practices, including management of changes, progress control, etc.

Ways & Means

- Half of the training is devoted to hand-on exercises on engineering discipline and management tasks.
- Quiz at the end of each section to test knowledge acquisition.
- Interactive pedagogy: trainees are constantly led to think and learn by themselves.

Prerequisites

No prerequisites for this course.

Course Content

3 days

GAINING A DEEP UNDERSTANDING OF ENGINEERING *0.5 d*

Organization and role of engineering in a project: parties involved, scope and sub-contracting.

ENGINEERING DISCIPLINE OVERVIEW *1.5 d*

Design basis and criteria.
Engineering activities and deliverables.
Input, output, content and constraints, sequence.
In the various disciplines: process, equipment/mechanical, plant layout, health, safety & environment (HSE), civil engineering, material & corrosion, piping, plant model, instrumentation and control, electrical, field engineering.

KEYS TO A SUCCESSFUL ENGINEERING EXECUTION *1 d*

Understanding the schedule requirements: typical critical path of an oil & gas project, consequences for engineering, matching the procurement and construction schedule.
Internal constraints of the engineering schedule: interfaces between disciplines, vendor input, best practices.
Interface management: challenge and best practice.
Implementation of changes: challenge and best practice.
How to meet the main challenge of delivering on schedule?
EPC execution model & the resulting key milestones for engineering + benchmarks.
What to put in place to control a contractor?
How to effectively monitor progress, factors that could impact progress, meaningful KPI, requirements for progress reports?

Reference: PL/EMGB Can be organized as an In-House course. Contact: **rc.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	30 May	1 June	€2,250

Quality & Risk Management in Projects

Application to Oil & Gas Upstream Projects

Purpose

This course provides a deeper knowledge on the importance and management of quality for projects, and on how to continuously improve project practices.

Audience

Level: FOUNDATION

Anyone involved in the management of industrial projects, in particular oil & gas projects.

Learning Objectives

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

- handle management of and by quality in projects, the stakes involved and benefits of feedback,
- apply quality assurance, quality control, quality tools, human and material quality resources in the development of projects,
- continuously improve project development methods to create added value for the company.

Ways & Means

- Extensive use of examples from actual exploration & production projects.
- Practical exercises: project objectives, surveillance plan, experience feedback, risk analysis.

Prerequisites

No prerequisites for this course.

Course Content

3 days

QUALITY MANAGEMENT SYSTEM *0.5 d*

Management of and by quality. Quality improvement cycle. ISO-9001 standard. Application to projects.
Integrated management systems (quality, safety and health, environmental, security, social, societal).
Project reference standard. Internal and external customer satisfaction. Management commitment.
Project objectives, key performance indicators, role of project team.

QUALITY PROCESS & ORGANIZATION *0.5 d*

ISO-10006 standard: common points and differences with respect to ISO-9001.
Links between management and project process, identification and cartography of project processes.
Project organization and quality responsibilities, involvement of the management team and quality independence vs. organization efficiency.
Key documents: execution plan, quality plan, procurement plan, EHS plan.
Project quality plan associated list of project management procedures.
Related processes: interface management, documentation management, change management, risk management.

QUALITY CONTROL DURING EXECUTION *0.5 d*

External and internal quality audits.
Surveillance plan: key principles, definition of surveillance levels and tasks, document control, meetings, management of non-conformances, management of records .
Surveillance during procurement and construction: organization, methods, tools and resources needed for quality control at supplier's premises.

QUALITY FEEDBACK & CONTINUOUS IMPROVEMENT *0.5 d*

Continuous improvement of processes.
Key Performance Indicators. Periodical surveillance meetings and follow-up of actions.
Feedback: gathering, use for improvement, benchmarking.
Principle of supplier's document review. Document approvals and updates.
Use of project non-conformances for improvement purposes.
Quality records. Project as-built documentation.

RISK MANAGEMENT SYSTEM *1 d*

Definition of risk, gravity, probability, criticality.
Risk identification methods, qualification, prioritization.
Risk register: organization, owners, meetings and stakeholders.
Tools to monitor and update the risk register.
Tools to put in place a risk mitigation system.
Methods to follow up on progress and results.

Reference: PL/QAQCGB Can be organized as an In-House course. Contact: **rc.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	2 May	4 May	€2,250

Contracts & Procurement

Application to Oil & Gas Upstream Projects

Purpose

This course provides a comprehensive understanding of project contract and procurement issues as seen by an oil company and a contractor.

Audience

Level: PROFICIENCY
Project engineers strongly involved in contractual issues of upstream Oil & Gas projects.

Learning Objectives

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

- grasp the increasingly challenging contractual relations involved in an Oil & Gas project,
- apply proven methods to solve the issues and put successfully a project in the right contractual framework.

Ways & Means

The course is illustrated by numerous examples taken from actual exploration & production project.

Prerequisites

No prerequisites for this course.

More info

Durations are only for information and may vary depending on course attendants'knowledgeThis module is part of the course E-740CTraining E-740C may be validated, on request, as such when all modules have been done

Course Content

5 days

INTRODUCTION — *0.5 d*

Different types of contracts.

CONTRACTING STRATEGY — *0.75 d*

Assignment of main equipment.
Endorsement of the design dossier.
Interfaces between contracts.
Contractors.
Local content.
Monopole/oligopole.
Single sourcing/open book tendering.
Patrimonial contracts (JOA, PSA, …).
Design competition.
Interfaces between patrimonial agreements and operations contracts.

CALL FOR TENDER PROCEDURES — *0.75 d*

Tendering phase.
Prequalification.
Instructions to tenderers.
Tender schedule.
Tender evaluation procedure.
Inflation and currency hedging.
Final selection and contract award.
Single source contract.
Contractor bid preparation.

EPC CONTRACT CONTENT & CORE ARTICLES, EXHIBITS — *1 d*

Agreement (articles and annexes).
Exhibits.
Examples of main articles.
Vendor lists.

EPC CONTRACT, LIABILITY & INSURANCE — *0.5 d*

Insurance basis.
Knock for knock principle.
Risk management process.
Risk assessment and reduction.
Claim control for projects.

PROCUREMENT, EXPEDITING, STOCK MANAGEMENT, TRANSPORTATION, CUSTOMS — *0.5 d*

Procurement strategy.
Procurement management process.
Long lead items & critical equipment.
Procurement management organization.
Company control of procurement.
Inspection.
Procurement systems.
Material control.
Logistics and incoterms.

CONTRACT ADMINISTRATION — *0.5 d*

Progress measurement and control.
Change orders.
Claim management.
Closing, reception and warranties.

NEGOTIATION — *0.5 d*

Principles and methodology.
Case study.

Reference: PL/CPGB Can be organized as an In-House course. Contact: **rc.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	13 November	17 November	€3,400

Estimation & Cost Control

Purpose

This course provides a thorough knowledge on how to estimate and control the cost of Oil & Gas Downstream projects.

Audience

Level: FOUNDATION
Engineers 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, using an accurate database,
- evaluate the accuracy of this cost estimate and the main risks of cost overrun,
- contribute to project cost optimization and value engineering,
- control the cost of a project during execution.

Ways & Means

- Each type of estimating method is illustrated by a practical cost estimating exercise (possibly on Excel).
- Use of Internet references (AACEI, Oil & Gas Journal, well-known software tools and databases).
- Group discussions to share feedback experience from participants on actual projects.

Prerequisites

Operational knowledge of the Project Management process.

More info

Course consistent with the PMI and AACE standards. Worth 24 PDU.

Course Content

4 days

PROJECT COST ESTIMATING METHODS — *2.5 d*

Project Management Process reminder, including deliverables at each stage.
Definitions, cost references, AACE classes. Direct and Indirect costs. WBS. CAPEX vs OPEX.
Order of magnitude estimate (Chilton factors). Typical accuracy and traps. Localization factors.
Factored estimate (Lang/Guthrie factors). Escalation, Nelson-Farrar indices.
Cost of main equipment, of works, of engineering services. Owner costs.
Semi-detailed estimate, detailed estimate. Key role of engineering studies.
Elements needed for final approval by Owner and EPC contract endorsement.

COST RISK MANAGEMENT — *0.5 d*

Project risk identification and evaluation. Potential impact on cost estimate. Action plan.
Allowances and contingencies, evaluation through statistical and deterministic methods.

COST CONTROL — *1 d*

Principles and purpose of cost control. Responsibilities of Owner and EPC Contractor.
Cost optimization: brainstorming process, Owner roles and responsibilities. Typical ideas.
Cost reporting: frequency, consistency with budget/WBS, presentation.
Relationship between cost control and progress control. Cost forecast to complete.
Cost reduction during execution. Cost Controller duties. Action plan monitoring.
Change management: impact of changes, evaluation, decision-making, communication within Owner.

Reference: PGP/EMCOU-E Can be organized as an In-House course. Contact: **rc.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	14 March	17 March	€2,330

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

Commissioning & Start-Up of Process Units

Purpose

This course provides key knowledge to prepare the participants to join or work with a start-up team.

Audience

Level: PROFICIENCY
Supervisors, engineers and technicians of refining, petrochemical and engineering companies.
Operating and technical staff responsible for the commissioning and start-up of a new or upgraded plant.

Learning Objectives

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

- place the commissioning and start-up activities within the last phases of a project,
- conduct or delegate the corresponding tasks while controlling the specific risks related to these operations,
- schedule and organize the commissioning and start-up works.

Ways & Means

- Numerous applications and cases studies.
- An interactive delivery method that draws on participants' experiences.

Prerequisites

No prerequisites for this course.

More info

This course is also available in Spanish.

Course Content

4 days

ORGANIZATION & RISKS MANAGEMENT *1 d*

Main steps: pre-commissioning, mechanical completion, commissioning, ready for start-up, start-up permit, performance test runs, temporary and final acceptance. Responsibilities of partners.
Plant breakdown into systems and sub-systems.
Reference documents: equipment specifications, PIDs, technology transfer manual, control loops, diagrams, …
Commissioning and start-up schedule.
Risks related to transient phases and utilities start-up: explosive atmospheres, nitrogen, steam, air, fuel gas.
Fluid behavior and related hazards: pressure, temperature, thermal expansion, vacuum, water hammer.
Changing risks between construction and start-up. .
Management of changes.
Practical case studies on a typical process unit.

END OF CONSTRUCTION - PRECOMMISSIONING *1 d*

Pre-commissioning activities: hydraulic tests and equipment cleaning.
Mechanical acceptance, punch list classification, follow-up and close out.
Practical checks on construction standards: static equipment, instrumentation, utilities systems.
Standard pre-commissioning checks for rotating equipment.
Practical exercise: verification of static equipment installed on-site - Case study on a typical process unit.

COMMISSIONING *1 d*

Commissioning activities. Cleaning: chemical cleaning, flushing and blowing.
Equipment drying and dynamic testing.
Practical exercise: steam flushing.
Preparation for the start-up of rotating equipment.
Case study on a typical process unit.

START-UP & ACCEPTANCE *1 d*

Pre-start-up safety review - Start-up acceptance: checks required before oil-in.
Start-up: leak tests, air removal, plant feeding.
Transition towards industrial production: start-up and performance tests, temporary acceptance certificate, mechanical warranty period, final acceptance certificate.
Case study on a typical process unit.
Practical exercise: group work to establish acceptance checklists or commissioning and start-up procedures on equipment.

Reference: SEC/OPDEM-E Only available as an In-House course.

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

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

Project Management

Minor Projects within Existing Facilities

Purpose

This course provides knowledge on specific features of small projects implemented in operating facilities.

Audience

Level: FOUNDATION
Supervisors and Engineers (process, plant projects, maintenance, operations) and Engineering Contractor staff.

Learning Objectives

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

- apply proven project management practices to small projects, during FEED and execution,
- define an organization and execution plan for small projects, suited to the site structure,
- monitor critical interfaces with Production and Maintenance, at each stage of the projects,
- identify SHE design risks of small projects, and adapt them accordingly.

Ways & Means

- Numerous examples from actual refining/chemical projects.
- A project case study is used throughout the course (exercises performed by the participants) for all stages.
- Various games and knowledge verification quizzes to enhance understanding of the key features.

Prerequisites

No prerequisites for this course.

More info

Course consistent with the PMI standards and the 5th edition of the PMBOK. Worth 30 PDU.

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 optimization, Value Engineering. Cost estimating methods, accuracy and confidence level. Contingencies.
Project Execution Plan: organization chart, objectives, priorities, milestones, constraints. Interface management.
SHE design risk identification and assessment. Overview of the main methods (HAZID, HAZOP).

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*

Procurement of equipment: specifications, purchasing, expediting, inspection, transportation. Quality Control Plan.
Planning and scheduling for equipment supply and field construction. Scheduling tools. Critical path. Contingency plans.

CONSTRUCTION / START-UP — *1 d*

Specific risks associated with revamp projects (technical, economical, SHE). Field works during Turnarounds.
Construction strategy (use of maintenance or other construction contractors). Construction management and methods.
Subcontractor field supervision and control. Safety, Health and Environment Management. Change Management.
Precommissioning. Mechanical Completion, management of punch-list items, Commissioning, Provisional Acceptance.
Post-startup activities, technical and financial closure, Final Acceptance, bank warranty.

Reference: PGP/GPP-E Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

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

Engineering Studies

Processes Representation

PFDs & P&IDs

Purpose

This course provides practical keys to read, understand and use process diagrams.

Audience

Level: PROFICIENCY
Technical staff using process diagrams.

Learning Objectives

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

- explain the symbols of a PID legend,
- read and understand a process described with PFD or PIDs,
- efficiently participate to a PID review.

Ways & Means

- Various examples issued from refining/ chemical processes.
- Use of a set of complex PIDs to understand process flow, instrumentation loops, equipment characteristics, …
- PID review with checklist/HAZOP initiation.

Prerequisites

Basic knowledge of industrial equipment (rotating, static, thermal, instrumentation).

Course Content

3 days

BLOCK DIAGRAM *0.25 d*

Splitting a process in blocks. Elaborating a block diagram.

PROCESS FLOW DIAGRAM (PFD) *0.25 d*

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 (P&ID) *1 d*

Purpose of PIDs: users from engineering phase to operation.
Process and utilities P&IDs. Key elements indicated on PIDs.
Elaboration, rules, organization of a PID, level of detail. notes, holds, comments.
Contents of a P&ID: equipment, piping, instrumentation, links between them. Incorporation of packages and skids. Evolution according to design/operation phases.
PID symbols (PID 0 or PID legend): typical symbols (ISA-5-1984).
Documents associated with a PID (piping classes, isometrics, …).

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: PGP/PROCREP Only available as an In-House course. Contact: **rc.rueil@ifptraining.com**

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

General Layout

Purpose

This course provides knowledge on how to elaborate a general layout and take into account the various constraints.

Audience

Level: FOUNDATION
Engineers and technicians involved in Oil & Gas projects.

Learning Objectives

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

- produce the equipment layout of a project, taking into account all constraints imposed by the various disciplines, as well as suppliers, site infrastructure, regulations and company standards,
- optimize layout,
- efficiently participate to a design review.

Ways & Means

- Examples issued from refining/chemical projects.
- Develop a general arrangement on a practical case.
- Design review using HAZID methodology.

Prerequisites

Basic knowledge of the Oil & Gas industry.

Course Content

3 days

PRELIMINARY LAYOUT *1 d*

European regulations for: safety distances, noise, environment, works. International standards.
Use of Blocs Diagrams, Process Flow Diagrams and Piping & Instrumentation Diagrams.
General layout: process units, storage facilities. Utilities. Technical & administrative buildings. Site access (road, rail, sea).

LAYOUT CRITERIA & CONSTRAINTS *1 d*

Review of constraints generated by the various disciplines. Associated layout criteria.
Health, Safety and Environmental constraints.
Location of naked flame. Area classification.
Use of the results of Quantitative Risk Assessment (QRA). Safety distances.
Access, Egress, Escape and Rescue: structures at height, congested areas, access of rescue team.
Firefighting equipment layout. Fire zones.
Health. Ergonomics. Noise concerns at fence.
Maintainability: lifting and storage area, access to equipment.
Site circulation: management of vehicle flows (cars, trucks, railcars), forbidden access/areas to vehicle.
Planning and scheduling: data availability at each project stage, management of Holds and Change Requests.

PLOT PLAN REVIEWS *0.5 d*

Design reviews using HAZID methodology.
Final layout (including validated actions from reviews or equipment supplier data). Use of 3D models.

LAYOUT OPTIMIZATION *0.5 d*

Inter-unit connection optimization: above-ground/underground. Storage area optimization.
Optimization of paved areas. Specificity of packages or integrated modules/skids.

Reference: PGP/GENELAY Only available as an In-House course.

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

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

Civil Engineering

Purpose

This course provides an understanding of civil engineering (structures and foundations).

Audience

Level: FOUNDATION
Technical staff from engineering or contractor.

Learning Objectives

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

- prepare and interpret civil work specifications in line with European regulations,
- perform basic calculations on steel and concrete structures,
- analyze civil subcontractor bids and select the most reliable and effective bidder,
- define field work quality control plan for civil works.

Ways & Means

- Understanding technology and design with various applications & exercises.
- Review of civil works in existing refining & chemical facilities.

Prerequisites

Basic knowledge of equipment used in oil & gas industry. Basics in resistance of materials.

Course Content

5 days

BASIC TECHNOLOGY INFORMATION & REGULATIONS *1 d*

Definition of terms and key characteristics of civil works. Design parameters.
Scope and contents of European regulations (EUROCODES).
Characteristics of materials used (steel, concrete). Concrete specifications and manufacture.

STEEL STRUCTURE DESIGN *1 d*

Main elements of a steel structure (beams, poles, reinforcements). Types of structures.
Parameters impacting structure stability. Assembly types. Principles of determination of structure resistance to weight, equipment and weather conditions. Transmission of loads to the foundations.
Typical guide specification sent to a civil work subcontractor. Evaluation of bid response quality.

CONCRETE STRUCTURE DESIGN *1 d*

Principle of resistance of concrete structures. Limit states calculation. Evaluation of concrete behavior for various efforts: compression, bending, shearing. Determination of reinforcements. Importance of steel adherence and covering.
Typical design specification sent to a civil work subcontractor. Evaluation of bid response.

FOUNDATION DESIGN *1 d*

Surface foundations technology. Sizing. Anchoring. Foundation stability.
Verification of required surface and applied pressure. Soil stability and resistance.
Deep foundations, piles (type and depth). Connection between piles and above-ground foundations.

FIELD WORK CONTROLS *1 d*

Key control parameters for steel structures and concrete structures. Concrete manufacturing controls.

Reference: PGP/CIVILENG Only available as an In-House course.

Contact: **rc.rueil@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*

Purpose

The **International Oil Summit**, held in Paris since 1999, has been recognized as a large industry success. Each year, the summit brings together more than 200 participants, including ministers, prominent leaders from both national and international oil companies as well as journalists. The distinguished key speakers aim to open constructive discussions concerning a wide range of issues confronting the oil industry.

Audience

This summit is intended for professionals in the oil business, consumers, government advisers, policy makers, academics, bankers, economists, lobbyists and consultants who seek to remain up to date with important industry information.

Agenda

1 day

FUTURE OF THE OIL INDUSTRY

The oil market. Competition between oil and other energy sources.
The impact of technological advances on production and processing costs.
Demand in the 21st century and the share of oil in the global energy market taking into consideration competition and environmental constraints.

PRODUCING COUNTRIES: MEETING THE NEW CHALLENGES OF THE OIL SECTOR

With the participation of ministers from the main oil producing countries.

NOC & IOC: COMPETITION OR COOPERATION?

Oil industry developments (mergers and acquisitions) and their impact on costs.
Possible cooperation strategies between producing countries and international companies.
OPEC/non-OPEC relations and producer/consumer dialogue.

DEBATE: BETWEEN IOC, NOC & SERVICE COMPANIES IN THE CONTEXT OF LOW BARREL PRICES

How to improve profitability?
Increasing the profitability of new projects and maintaining their start-up.
Increasing the profitability of ongoing production (technical & organization aspects).

Reference: PEH/IOS

Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Paris	27 April	27 April	€990

International Gas, Renewables & Electricity Summit

Jointly organized with *IFP Énergies nouvelles & Petrostrategies*

Purpose

The International Gas Summits, held in Paris since 1996, have recorded large successes. From 2016, the International Gas Summit becomes the International Gas, Renewables & Electricity Summit.
Each conference brings together more than 200 participants, including ministers, prominent corporate leaders and journalists.
Wide issues facing the natural gas, Renewables & Electricity industry around the world are open for debate following presentations from distinguished speakers.
In 2017, as in the previous summits, CEOs of leading energy companies such as ENGIE (ex GDF Suez), Gazprom, Shell, Sonatrach, Statoil, Total, …, are invited to take part.

Audience

Professionals in the Gas Business, Consumers, Buyers, Power Generators, Regulators and Government Advisers/Policy Makers, Academics, Bankers, Economists, Lobbyists and Consultants.

Agenda

1 day

The International Gas, Renewables and Electricity Summit will discuss the challenges and issues of the gas industry, of the development of the electricity production, including the rapid surge of renewable sources, expecially wind and solar.
Ministers, CEOs and executives will as usual exchange arguments in a lively debate.

Reference: PEH/IGS

Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Paris	**9 November**	**9 November**	**€990**

Overview of Petroleum Economics

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

Level: FOUNDATION
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.

Prerequisites

No prerequisites for this course.

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: ENE/OPE Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	5 December	8 December	€2,490

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

Overview of Natural Gas Economics

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

Level: FOUNDATION

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 welcom 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 & calculations on quantities.
- Videos.

Prerequisites

No prerequisites for this course.

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: ENE/ONE Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	27 June	30 June	€2,690

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

Liquefied Natural Gas Economics

Purpose

This training provides an overview of the economic and contractual aspects of the LNG (Liquefied Natural Gas) value chain.

Audience

Level: FOUNDATION
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.

Prerequisites

No prerequisites for this course.

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 & 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.
New trends in the LNG industry: FLNG, FSRU, small scale LNG.

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: ENE/LGE Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	19 September	22 September	€3,200

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

Oil Markets & Trading

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

Level: PROFICIENCY
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 petroleum products,
- review the different oil trading markets by type of transaction,
- understand the importance of maritime transport costs in oil supply economics,
- comprehend the hedging techniques available for protection against fluctuations in prices.

Ways & Means

- Syndicate works on case studies.
- Case studies.

Prerequisites

Bachelor's degree +3 and/or a minimum 3 years of working experience in Downstream.

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 study.

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
Rueil	30 May	1 June	€2,260

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

Shipping: General Features, Chartering Contracts & Operations

Purpose

This training provides participants a thorough knowledge of the technical, operational and commercial conditions concerning the transport of hydrocarbons by sea as well as an introduction to the legal and financial aspects of the shipping.

Audience

Level: PROFICIENCY
Professionals in the oil industry, involved in the supply, shipping, distribution activities and who need to improve their knowledge in operational and contractual aspects of shipping.

Learning Objectives

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

- assess nautical capacity and technical criteria of a ship in particular for the transport of hydrocarbons,
- understand the risks associated with maritime activities (boating, environmental, policy, …), as well as the regulations and related procedures,
- integrate into their reflection operational and strategic constraints that apply to the ship-owner or the carrier,
- negotiate in the best possible conditions contract litigations deriving from oil products marine operations,
- understand the tanker chartering market better.

Ways & Means

Illustration of actual cases.

Prerequisites

Minimum of 3 years of working experience in oil business and/or seagoing shipments of oil products.

Course Content

4 days

VESSEL SPECIFICATIONS — 0.5 d

Maritime vocabulary: position, distance, speed, …
Ship measurements: tonnage, displacement, dimensions, …
Anatomy of a ship: main features.
Nature of cargoes: dry, wet, specialties.
Ships offering: various types, age profile, specific focus on oil tankers and gas carriers.

SHIPPING FINANCIAL & LEGAL ASPECTS - BASICS OF INTERNATIONAL MARITIME LAWS — 0.25 d

Elements of financing and profitability: type of fund raise, appreciation on current financial situation.
Current state of the shipbuilding industry.
The link between states and ship-owners: notions on the registration of ships, the world fleet by flag, by investing countries.
General notions of maritime legislation: territorial waters, EEZ, traffic separation, arctic waters, …
Seaways: main maritime routes, Panama and Suez Canal, port network.
Piracy: legal, operational and financial consequences.

RISKS CONTROL & ENVIRONMENTAL PROTECTION — 0.75 d

Impact on the environment: ITOPF statistics, Oil spills, GHG emissions, …
International regulations: IMO conventions, MARPOL, SOLAS, STCW, ILO, ISPS, …
Green regulations: air pollution, EEDI, ECA zone, BWM, ship recycling.
Impact on international shipping: SEEMP, engine technology, scrubbers, bunkering alternatives, financial impact.
Procedures for the transport of oil products: SIRE, TMSA, Vetting process.

THE SHIPPING CHAIN & THE PORT COMMUNITY — 0.25 d

The Seaport: main features.
The maritime transportation occupations: agents, forwarders, stevedore's, customs, …
The handling of the ship in the port: port authority, pilot and tugs, peers main features, …
Operating expenses of ships: fixed and variable costs, disbursement account, …
The maritime transportation "contract": Hague Visby, Rotterdam Rules, B/L, …

SHIPPING EXPLOITATION & OPERATIONS — 0.75 d

The bunkering market: products, players, contracts, market organization, PLATTS, BUNKERWIRE.
Risk management: basis of Hedging, Futures, Swaps, Options.
The marine lubricants market: products, players, contractual aspect.
Quantity measurements: industry commonly agreed procedures ROB, OBQ, VEF, VAR, ISGOTT, specific focus on Gas.
Cargo loading procedure: interface ship/shore, planning, sampling, pumping rates, topping off.
Ship To Ship (STS) operations: planning and notice, POAC role, …
Claim handling: quantity, quality.

THE FREIGHT MARKET - PRICING MECHANISMS — 0.5 d

Organization and operating evolutions in ship management.
Freight market organization: players and segmentation.
Freight rates structure: WORLDSCALE, BALTIC.
Risk management: FFA.
Market insights: appreciation of the market situation for various classes of oil tankers and gas carriers.

LPG & LNG SHIPPING MARKETS — 0.25 d

Introduction.
LPG shipping market.
LNG shipping market: contract conditions, current and evolutions, …
LNG Liquefaction Regasification plants.
LNG market insights: appreciation of current situation.

CHARTERING AGREEMENT & CHARTER PARTY — 0.75 d

Chartering agreement principles: different types, main terms, standard clauses, rider clauses.
Chartering agreement main definitions: Laycan, NOR, Laytime, example of calculation, Demurrage, Detention, Retention, …
Main litigation causes.
Role and responsibilities: split between charterer and ship-owner depending on charter type.
Coming to a chartering agreement: various steps and procedures, role of the broker.
Charter party specific clauses: force majeure, war risk, slow steaming, virtual arrival, …
Some litigation cases: practical examples.

Reference: TRT/CFS Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	11 April	14 April	€2,950
Rueil	12 December	15 December	€2,950

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

Planning & Economics of Refinery Operations

In collaboration with the Energy Institute, London

Purpose

This course provides a better understanding of the essential elements of refinery operations and investment economics, to review the various parameters which affect refinery profitability and to develop a working knowledge of the management tools used in the refining industry.

Audience

Level: PROFICIENCY

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:

- assess the latest trends in product specifications, and refining schemes,
- calculate product value, refinery margins and process unit margins,
- simulate and to optimize refinery operations, crude oil selection and product manufacturing,
- analyze the results of an linear programming model optimization,
- evaluate the profitability of a new process unit.

Ways & Means

- Case studies and exercises derived from present refinery situations.
- Economic optimization using Excel.
- Quiz.

Prerequisites

Basic notions of Microsoft Excel.

Course Content

4 days

TECHNICAL OVERVIEW — *0.25 d*

Brief technical presentation of the main refining units: distillation, conversion, etc.
Refinery scheme evolution.

REFINING INDUSTRY — *0.5 d*

World petroleum product demand and evolution of the crude oil supply.
Refining supply: overcapacity, types and quantity.
Main challenges: deep conversion, new product specifications, petrochemical integration, environment, etc.
Projects and perspectives.

REFINERY 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.

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.

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/PERO

Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
London	17 October	20 October	£3,300

Refinery Operation Management & Linear Programming

Purpose

This course provides an in-depth understanding of the techniques used for decision-making operations concerning supply and refining.

Audience

Level: PROFICIENCY
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 selection 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.

Prerequisites

Knowledge of refining unit operations.

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

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

Level: FOUNDATION

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.

Prerequisites

Basic notions of Microsoft Excel.

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
Rueil	29 May	2 June	€3,140

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

Economic Optimization of Refining Operations

Purpose

This course allows the participants to acquire the main economic challenges of running a refinery and and a better understanding of the oil markets (crude oil and petroleum products) in order to optimize refining operations.

Audience

Level: PROFICIENCY
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.

Prerequisites

Basic notions of Microsoft Excel.

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
Rueil	11 December	15 December	€3,270

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

Refining & Petrochemicals Synergies

Purpose

This course provides a complete review of the main refining and petrochemical specificities, as well as the identification of the possible synergies. It highlight the economic gains achievable from refining-petrochemicals integration.

Audience

Level: PROFICIENCY
Staff from refining and petrochemistry 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 petrochemical sectors,
- identify the possible synergies between refining and petrochemistry,
- 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.

Prerequisites

- Basic knowlegde of refining and petrochemical unit operations.
- Basic notions of Microsoft Excel.

Course Content

2 days

TECHNICAL REVIEW OF REFINING & PETROCHEMISTRY *0.5 d*

Main petroleum and petrochemical products: key product specifications review.
Refining and petrochemical schemes.
HSE specifications: refining (H_2S, etc.), petrochemicals (product instability, etc.).

SYNERGIES BETWEEN REFINING & PETROCHEMISTRY *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
Rueil	22 November	23 November	€1,470

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

Profitability Analysis of Downstream Investment Projects

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

Level: PROFICIENCY
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.

Prerequisites

Basic notions of Microsoft Excel.

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
Rueil	16 May	18 May	€2,000

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

Downstream Module

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.

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

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) — 22 d

Mid and downstream business: oil refining, petrochemicals and products.
Utility management: coal, gas and power.
Renewables and Environmental Management.

COMMODITIES 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.

STRATEGIC MARKETING & MANAGEMENT — 8 d

Role of marketing in the firm and in the economy.
Marketing organization.
Measuring the firm's competitiveness.
Designing a development strategy.

ADVANCED ECONOMETRICS — 5 d

Applied probability and statistics.
Applications of statistical and probabilistic concepts.

INDEPENDENT STUDY — 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
Rueil	18 April	13 July	€12,550

Price Risk Management in Energy Markets

Purpose

This training provides a better understanding of the principles and techniques for Oil & Gas price risk management.

Audience

Level: PROFICIENCY

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.

Prerequisites

Bachelor's degree +3 and/or a minimum 3 years of working experience in oil Supply chain or oil 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: GIP/PRM Can be organized as an In-House course. Contact: **eco.rueil@ifptraining.com**

Location	Start Date	End Date	Tuition Fees
Rueil	17 October	19 October	€2,450

Investment Profitability Studies in the Oil & Gas Industry

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

Level: FOUNDATION

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.

Prerequisites

Participants need to be comfortable with the use of Microsoft Excel.

Course Content

4 days

FINANCIAL ENVIRONMENT — *0.5 d*

Value creation and management.
Basic principles of corporate finance and accounting.
Projects and sources of financing.
Risks and cost of financing.

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 — *1 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
Rueil	25 April	28 April	€2,780

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