

Petrogenium.

Training courses

2019/2020



- Performance Improvement
- QHSSE and Sustainability
- Process Technology

For further information please contact:
training@petrogenium.com
www.petrogenium.com

Contents

Performance Improvement

Introduction to Oil Refining	4
Hydrocarbon Economics and Upgrading	6
Fuel Oil and Fuel Oil Blending	8
Operational Excellence.....	10
Operations readiness Workshop	11
Structured Problem Solving & Root Cause Analysis (RCA)	12

QHSSE and Sustainability

Safety in Process Design	14
Corrosion control in crude units	16

Process Technology

Distillation Operation and Design	18
Fundamentals of Hydrotreating	20
Catalytic Reforming	22
Hydrocracking	24
Thermal Cracking Process	26
Energy & Utility Systems	28
Amine Treating and Sour Water Stripping	30
Sulphur Recovery and Tail Gas Treating	32

Petrogenium. Lecturers	34
Registration form	39

Introduction

Sharing experience and best practices – because experience matters

Petrogenium. was founded in 2015 with the mission to help clients within the energy intensive industries to improve their margins, reduce waste and optimise operating costs in a safe manner by sharing best practices, experience from seasoned industry professionals who have operated and managed top quartile manufacturing sites themselves.

It is our experience that clients value most of all the transfer of knowledge and best practises. It is for this reason that we have initiated various Petrogenium. training programmes.

Our training programmes are designed for professional staff working in the Oil & Gas industry in Upstream, Midstream or Downstream markets. New hires or staff working on new process units at gas processing sites, refineries or LNG plants, will benefit from our very experienced teachers and their hands-on expertise.

Our Courses contain many real life examples as our lecturers were in the same boat as you. We explain the process unit line-up, economic drivers, process and safeguarding controls, but also how to monitor the unit and examples of frequent troubleshooting issues from an owner perspective.

Typically, we tailor our courses to the client process unit site configuration and we deliver the course on site for operators, engineers and supervisors. Nevertheless, we also conduct the highly popular Introduction to Oil Refining Course at the Petrogenium. Headquarters in Amsterdam, the Netherlands.

Our courses deliver immediate value – the learnings can be directly applied in the field. We hope you enjoy glancing through this Course Catalogue and look forward to your contact with our Training Department at training@petrogenium.com for further questions.

Petrogenium. Team

Introduction to Oil Refining

Lecturers: Wim Bosch, Selwyn Maduro

Learning objectives

The Petrogenium. Introduction to Oil Refining course is a basic skill course for professionals starting to work in the refining business. The course is taught on awareness level and will be invaluable to all professionals, who started their career in or recently joined the refining industry.

Who should attend?

New oil refining personnel and professionals who work in the downstream Supply & Trading, Marketing, IT, Legal, Finance and Human Resources functions. Staff from other industries (e.g. catalyst manufacturers, equipment manufacturers, IT service suppliers, business consultants) who have business interface with the oil refining sector will also highly benefit from this course.

What will you learn

After completion of the course participants will have solid understanding of:

- who refinery customers are and what products they require
- to identify the main and speciality products manufactured and describe their main characteristics, composition, etc.
- understand the flow of oil/gas from well via manufacturing plants to finished products in the market
- to explain the various refinery types/configurations and be able to construct a refinery flow scheme by clearly indicating product flows to and from the process units
- the origin of crude oil, characterise the different types of crude oils, explain the concept of crude oil valuation and identify different types of crude oil pricing.
- explain the concepts of refinery costs and margins and be able to give indications of these costs and margins
- identify the main refinery processes (which include distillation, treating, platforming, cracking and product blending), explain the main interfaces between these process units and identify the main elements which may have an impact on the quality of the manufactured products
- determine and explain the influence of feedstock and refinery configuration on product yields, margins (Hydrocarbon and Gross Refining Margin) and product qualities by using a Refining Simulation Model
- identify different Health, Safety and Environmental (HSE) aspects in a refinery.

The Petrogenium Introduction to Oil Refining Course

The Introduction to Oil Refining course will be held in Spring and Autumn at the Petrogenium headquarters in the Amsterdam Area, the Netherlands.

For inquiries on the upcoming dates, please contact training@petrogenium.com or look for course date updates on www.petrogenium.com/trainingacademy

Early Bird Bookings, received 45 days before course date: Course fee is 1,750.- Euro excl. VAT
Bookings received within 45 days to the course date: Course fee is 1950,- Euro excl. VAT

Lunch and beverages will be served during the course.

Course Programme

Day 1

- Products
- Developments in main fuel qualities
- Overview on refinery configuration
- Yield/expense statement
- Refinery costs and margins
- Exercise: Refinery Simulation
- Introduction to crude quality
- Valuation of crude oil

Day 2

- Distillation theory
- Primary and vacuum distillation
- Conversion technologies
- Crude oil blending
- Exercise: Crude oil blending
- Reforming / Isomerisation
- Alkylation
- Exercise: Refinery Flow scheme
- Visbreaking / Thermal Cracking / Coking
- Exercise: V50

Day 3

- Fluid Catalytic Cracking
- Hydrocracking
- Gas and Liquid treating
- Hydrotreating
- Sulphur Recovery / Claus / Off gas treating
- Exercise: Optimum Refinery Programme
- Utilities and Energy Management
- Lubricating oils

Hydrocarbon Economics and Upgrading

Lecturers: Selwyn Maduro, Klaas Wieringa

Learning objectives

The Petrogenium. Hydrocarbon Economics and Upgrading course is centred around raising awareness on Refinery Margin and profitability in all aspects. It is important for analysts, schedulers, accountants and those selling to refiners and selling refined products to understand the purpose of a refinery's building blocks, how they are interrelated and how they impact product quality as well as overall refinery economics. The course will look at the refinery through a high level master planning lens.

Who should attend ?

The course is designed for Non-engineers who will benefit from knowledge of refinery processes as distillation, cracking and chemical treatment, e.g. those assigned in upstream, mid-stream, marketing, tax, legal and information technology functions.

What you will learn

- The properties of crude oil and refined products.
- The Refinery types and their complexity in relation to the different crude oils.
- The role of heavy oil upgraders and the effect of Shale Oil and Shale gas.
- The Petroleum chemistry (awareness level) and processing.
- The typical products of refining and their specifications (both performance and regulatory specifications).
- Product blending and Tank farm operation.
- How to manage sulphur in the refining process
- Understand the impact of the refinery operation on the environment (SO₂, CO₂) and the drive and impact of Bio fuels.
- The participant will also gain understanding how:
 - Costs
 - Proceeds
 - Products qualities
 - Volumes
 - Investments affect refinery economics.
- Discover LP modeling and refinery economics. Understand economic drivers that determine refinery, Tank farm/Blending profitability or why price at the pump is set where it is set.

- How the supply chain is constructed and how logistics and shipping can mitigate price fluctuations (contracts form e.g. hedging).
- The role and importance of Master planning.

Course Programme

Day 1

- | | |
|---|-----------------------------------|
| • What is Downstream | • Refinery Economics and Margins |
| • Crude Oil Supply and Demand | • Crude and Product Costs |
| • Regulatory and Specification Changes | • Operating Costs |
| • Overview of the refining processes and Product Blending | • Capital charges |
| • Oil Refinery and Petrochemical Integration | • Freight Rates and Fiscal Duties |
| | • Working Capital |
| | • Capital Investment |

Day 2

- | | |
|--|--|
| • The importance of Master planning | • Important Auxiliaries (Utilities, Environmental protection). |
| • The Strategic View | • Cost estimates |
| • Scenario Development | • Project execution |
| • Scenario Analyses | • Master planning results presentation |
| • LP Models and other tools | |
| • Economic analysis and sensitivities analysis | |

Fuel Oil & Fuel Oil Blending

Lecturer: Dr. Frans van den Berg

Learning objectives

In view of IMO's change in bunker fuel's sulphur 0.5% limit effective from 1 Jan 2020, the necessity for ensuring products, which meet the new sulphur limit, but are also stable and compatible with other products, has become more evident than ever.

The 2-day Fuel Oil (and Fuel Oil Blending) Course is providing participants with an introduction to the topic of marine fuel oil, its uses, specifications and components. In addition, the seminar provides numerous best practises on blending this product as well as guidelines to optimise product quality, assure stability and minimise give-away.

Who should attend?

This Petrogenium. course is intended for technical staff, supervisors and managers in refining, marketing, trading, economic planning and laboratories who need better technical understanding of bunker fuel and bunker fuel blending. It is also highly suited for Fuel oil traders as well as Bunker operators.

What You will learn

- Blending properties' calculation, pricing & application
- Blending components compatibility
- Blend control and Quality
- Optimisation in Bunker fuel blending
- Lab testing and Industry standards
- Fuel Oil blending economics
- Blending for Sulphur compliance 2020 and beyond

Course Programme

Day 1

- General Introduction
- Why blending
- Introduction to Fuel Oil
- Specifications and test methods
- Stability and Compatibility of bunker fuel
- Bunker fuel blending, components and tools
- Control of blending operations and quality assurance
- Storage and handling

Day 2

- Lab testing and industry standards (ISO 8217, ISO 9001, 17025, ASTM / IP / ISO test methodology)
- Blend economics including optimisation
- Blending for 0.5% Sulphur Compliance (IMO 2020)
- Fuel Oil complaints and complaints handling
- Bunker Fuel HSE aspects
- The future of bunker fuels
- Q+A Session

Operational Excellence

Lecturer: Han Gesink

Learning objectives

The Petrogenium. Operational Excellence course is a high intensity workshop for members of the leadership of a refinery or petrochemical plant who are aiming for better performance and control within their operations. Both with respect to Safety, Health and Environment as and Production performance. Since the workshop aims at jointly developing a view on what Operational Excellence can potentially bring to the company, participants should be in the position to develop a follow up to the workshop. Operational Excellence is all about competent people, working together in teams with an 'enterprise first' mind-set in a structured way with truly committed leadership.

Who should attend?

Senior Staff and professionals, members of the site leadership team.

What You will learn

- the principles and key success factors for Operational Excellence,
- to make an inventory of opportunities to improve and develop a way forward
- we will discuss the status of implementation of Operational Excellence in the Company.

Course Programme

Day 1

- Introduction to Operational Excellence
- Establish the status of Operational Excellence in Company

Day 2

- Develop a view on potential improvements
- Discuss and prioritise, develop and follow up on opportunities for improvement

Operations Readiness Workshop

Lecturer: Han Gesink

Learning Objectives

The Petrogenium. Operations Readiness Workshop is a customized, high intensity workshop for owner's representatives (i.e. the future Operator of a facility), the Commissioning and Start Up team, but also Engineering and Construction contractors aimed to ensure the transition from a project to operations is achieved without any flaws.

Who should attend ?

Senior Staff and professionals, members of the site leadership team but also Managing (Engineering & Construction) contractors.

You will learn

- Critical involvement of the Owner/Operator in all phases of the Project, from the definition phase to Commissioning/Start Up (CSU) and Production.
- Engagement between Engineering and Construction contractors for both preparation of Commissioning, Start Up and Production.
- Mitigation of risks to successful CSU / key success areas.

Major Deliverables of the workshop are:

- In depth understanding of requirements to bring the project to operations
- Development of plans (as appropriate) to ensure a start-up without surprises
- Methods to mitigate risks to successful commission and start up, critical owner involvement in all project phases.

Course Programme

Typically, the workshop programme will take 2 to 3 days and will be developed jointly with the Customer to tailor it to the specific needs and character of the project.

Structured Problem Solving & Root Cause Analysis (RCA)

Lecturer: Peter Bitter

Learning Objectives

The Petrogenium. Operations Readiness Workshop is a customized, high intensity workshop for owner's representatives (i.e. the future Operator of a facility), the Commissioning and Start Up team, but also Engineering and Construction contractors tasked with ensuring the transition from a project to operations is achieved without any flaws.

Who should attend

Reliability engineers, maintenance and operations team-leads and engineers and a selection of operations staff.

What you will learn

This course will be tailored to client needs. The ideal course size is 14 participants with one or 24 participants with a two lecturer course. Typically, the course is a 4 or 5-day program.

Course Programme

Day 1

Kick-off and introduction

- Kick off, introductions, course objectives and expectations
- Specifics of problem solving.
- Summary of investigation methods:

- 5 Why, Tripod, RCA, Causal Reasoning, Structured Problem Solving.
- Various exercises: group work and report out

Day 2

Structured problem analysis and solving

- Why a structured approach
- Facilitation lecture
- Structured problem solving in 5 phases
 1. Incident capture, risk assessment, ranking and prioritisation
 2. Problem identification and problem statement
 3. Data collection (timeline; drawings; trends; data assessment)

4. Cause and Effect Diagram and validation (verification and elimination)
 5. Failure scenarios and cause selection
 6. Solution development and selection decisions
 7. Implementation plans and learning sessions
- Various exercises: group work and report out

Days 3

Full Day work on a case study

- Split in teams and exercise analysing and solving a problem
- Incident description and risk ranking

- Problem statement
- Timeline development and data analysis
- Cause and Effect Diagram.
- Report out

Day 4

Full Day work on a 2nd case study

- Split in teams and exercise analysing and solving a Problem
- Incident description and risk ranking
- Problem statement
- Timeline and data analysis

- Cause and Effect Diagram.
- Failure scenarios and cause selection
- Solution development and Implementation plans
- Report out

Day 5

Management of change, process safety culture

- Presentation of case studies

- Lessons learned session
- Any client specific subject(s)
- Evaluation

Safety in Process Design

Lecturers: Ronald Holleboom, Louk Kuijten

Learning Objectives

The Petrogenium. Safety in Process Design course is an indispensable course for all engineers in the oil refining, petrochemical and gas-processing (LNG) industry. This very popular course addresses all basic issues involved in technical safety and operability of a process plant. The course provides awareness on the implementation of basic technical safety principles into a process, awareness in applying and supporting company QHSSE policies and regulations already at the (process) design stage.

Who should attend ?

The course is designed for engineers or technologists who recently joined the industry but is also highly beneficial to experienced engineers or selected operations staff.

What you will learn

- types of risks related to oil and gas
- Assess and quantify risks
- How to manage risks
- Get familiar with safety related equipment
- Learn how to conduct a plant change procedure

Course Programme

Day 1

Kick-Off and Introduction

- Kick off, Introductions, Course objectives and Expectations
- Process Safety versus personal safety. History of process safety developments and Industry Major Incidents.
- Process safety Management

- Processes including risk management:
- Hazard identification, Bowtie, LOPA, ALARP, Hierarchy of Controls, process safety Critical Elements, Activities, Positions.
 - Group Exercise

Day 2

Codes and standards for Safe Design, active protection

- Safe Design: Pressure and Temperature
- Over pressure protection, flare systems

- Overtemperature protection: Emergency depressuring
- Material selection and degradation

Days 3

Continue active protection, Passive protection / escalation control

- Safeguarding Instrumented Functions
- Release Detection Systems, ROV, TSO

- Fire protection
- Area Classification/ATEX/Site Lay out
- Exercise (optional)
- Safeguarding Memorandum

Day 4

Static electricity, reactive hazards, fire and explosions

- Static Electricity
- Reactive Hazards
- Flammability, Ternary Diagrams

- Exercise(s)
- Types of fires/explosions (VCE, BLEVE, Flash, Pool), Dispersion, Toxicity
- Process and Operational Safety/MOC/Transient conditions

Day 5

Management of Change, Process safety culture

- MOC exercise(s) - Risk Screening Form
- Getting the right Process Safety Culture
- Process Safety Fundamentals

- Measuring the health process safety: leading, lagging indicators (pyramid)
- Process Safety Reviews
- Discussion of client specific subject(s)

Corrosion control in crude units

Lecturer: Henk Helle

Learning objectives

The Petrogenium. Corrosion Control in Crude Distillation Units course has the key objective to provide understanding and guidance to staff, with the purpose to learn and understand the impact, behaviour and treatment/control of fouling and corrosion at crude distillation unit at your refinery complex. Over many years the Petrogenium experts gathered deep technical expertise in the control of corrosion and combatment of fouling in crude units and associated equipment.

The course is an interactive and will be valuable for staff at all refineries, specifically for those with a history of corrosion issues.

Who should attend ?

Operators, inspectors, integrity-, process- and project engineers and service company representatives; engineers & managers responsible for the reliable and safe design and operation of crude units. Non-refinery personal , e.g. service providers, chemical vendors and engineering contractors. Those involved in the design of crude units or equipment for crude units may also benefit.

You will learn

- The challenges of overhead corrosion, high temperature corrosion and fouling
- Crucial process steps as desalting, caustic injection and overhead protection are treated in depth;
- The pitfalls of opportunity crudes
- To operate a crude unit safer, more reliably and more sustainable.

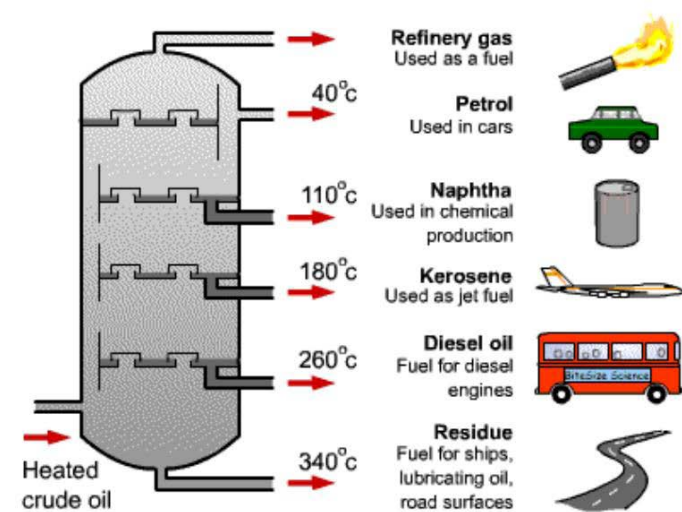
Course Programme

Day 1

- Crude units
- Threats to integrity
- Protections, barriers and verifications
- Feedstock: types and contaminants
- High temperature sulfidic corrosion and naphthenic acid corrosion
- Aqueous corrosion in the column top and overhead system corrosion

Day 2

- Desalters and desalter operation
- Caustic addition to crude: How
- Overhead protection by injection of water, ammonia , inhibitors, amines:
- Why and how?
- Fouling: causes, effects and remedies
- Monitoring and inspection: methods and strategies



Fractional distillation is used in oil refineries to separate crude oil into useful substances (or fractions) having different hydrocarbons of different boiling points

Distillation Operation and Design

Lecturers: Eugen Hofmann, Jari Marci

Learning objectives

The Petrogenium. Distillation course is the basic building block to provide awareness on the fundamentals of Distillation and its application in oil refining. The course will introduce the fundamentals and theory behind distillation as well as provide an overview of industrial distillation equipment. Key focus of the course will be the most important distillation processes of the (atmospheric) crude oil distillation unit (CDU) as well as the vacuum distillation unit (VDU). Secondary applications like 2-cut splitters and stabilizers will also be addressed.

Who should attend ?

The course is designed for operational staff and (process) engineers on all levels on crude oil and vacuum distillation units or other distillation sections and typically is customized to the actual location / refinery.

What You will learn

This course will provide understanding, raise awareness of design aspects and provide guidance to refinery staff on optimal operation of their distillation units.

Course Programme

Day 1

Introduction and Basics:

Distillation basics and theory

- Modelling of Vapour-Liquid equilibria, Raoul's law, partial pressure
- Column modelling, tray efficiency, rate based models
- Setting of operating conditions (pressure, temperature limits, operating window).

Distillation equipment, types, features and limitations

- Distillation trays, valves and downcomers
- Random and structure packing
- Inlet and outlet devices, distributors and draw-off trays
- Heat transfer in distillation units
- Miscellaneous equipment (vacuum sets, drums, accumulators)

Process control in distillation units

Troubleshooting

- Jet flooding, foaming, entrainment
- Downcomer limitations
- Column turndown
- Materials and corrosion aspects

Day 2

Applications and Refinery Units:

CDUs

- Types and line-ups, operation, monitoring and optimisation
- Product specifications: Flash point, Cloud points, distillation (initial/final) boiling points

HVUs

- Types and line-ups, operation, monitoring and optimisation
- Maxwell-Bonnell Temperature
- Product specifications: Cloud Points, Conradson Carbon Residue

Others distillation units:

- Stabilizers
- LPG splitters
- Stripper-dryer columns

Fundamentals of Hydrotreating

Lecturer: Ed Ouwerkerk, Charu Ehrenreich

Learning objective

The Petrogenium. Hydrotreating course provides an unique perspective and will raise awareness of design aspects and provide guidance to refinery staff on optimal operation of their hydrotreating facilities. Over many years the Petrogenium. experts gathered deep technical expertise in the operation, optimisation and troubleshooting of all Hydroprocessing and Hydrotreating technologies and their associated equipment. This knowledge and resulting best practices were collected and built the foundation for the course.

Who should attend?

The course is designed for refinery technologists, process engineers & economists and operational staff who work with hydroprocessing catalysts and processes.

What You will learn

- To operate your plant safely
- To optimise the margin, catalyst & energy usage
- To select the best catalyst for future cycles
- To guide improvement projects for your plant

Course Programme

Day 1

Basics, Kinetics & Operations

- Introduction to the hydrotreating process
- Hydrotreating capacity exercise

- Basic & ULSD kinetics
- Operational aspects
- Reactor internals

Day 2

Applications and Refinery Units

- Fouling
- Wash water
- Unit safeguarding
- Catalyst selection

- Catalyst handling
- Unit performance monitoring
- Refinery optimisation & LP or gas treating & SRU

Day 3

- Materials & corrosion
- Troubleshooting
- FCC gasoline HT & gasoil dewaxing

- Site HT overview & panel Q&A
- Clean fuels impact / revamp approach

Catalytic Reforming

Lecturers: Fredrik Sandelin, Wim Bosch

Learning objective

The Petrogenium. Reforming course provides an unique perspective to the operation and optimization of Catalytic Reforming units for Gasoline or Aromatics production. Over many years the Petrogenium. experts gathered deep technical expertise in the operation, optimization and troubleshooting of all Reforming technologies and their associated equipment. This knowledge and resulting best practices were collected and built the foundation for the course.

Who should attend?

The course can be tailored either to an (process) engineering or to an operational staff audience. If desired and existing at the client location, various Isomerisation and/or integration to Petrochemical complexes modules can be combined to a holistic Light Ends Conversion course.

Course Programme

Day 1

- Introduction to catalytic Reforming
- Theory
- Catalysts
- Feedstocks and contaminants
- Review of refinery process flow diagram and plant visit
- Review operating window of catalytic reforming unit

Day 2

- Water/chloride injections and control
- Review how catalyst performance normalisation is done
- Procedures – start-up, shutdown, emergency procedures
- Catalyst loading and unloading
- Energy consumption of the catalytic reforming unit
- Platformate splitting and benzene hydrogenation

Day 3

- Catalyst regeneration
- Review of critical parts of the regeneration procedure
- Control and safeguarding of unit
- Mass and heat balance of unit (e.g. on the basis of a test run)
- Planning of a cycle – assessing the optimum recycle gas ratio, balancing target cycle length versus energy consumption
- Common problems in catalytic reforming units

Hydrocracking

Lecturer: Bob Scheffer

Learning Objectives

The Petrogenium Hydrocracking course is an extensive awareness course for engineers and operational staff dealing with all aspects of Hydrocracking units. In addition, also planning and procurement staff may find the course valuable as aspects and pitfalls of the catalyst testing and procurement best practices will be discussed.

Who should attend ?

- Oil refining personnel, those involved in hydrocracking. Researchers and professionals who work in hydro processing.
- Staff from Catalyst Manufacturers, who are involved in production of research of hydrocracking catalysts.
- Staff involved in refinery optimisation, and maximising synergies between refinery processes.

What You will learn

- Learning how to make optimal use of hydrocracking units
- Understanding the types of reactions and kinetics: HDN, HDS, hydrogenation
- Explanation of catalysts: compositions, hydrogenation function, acidity and properties
- Catalyst manufacture: Support, Zeolite, Extrusion, Calcination, Impregnation, Quality control & Analyses
- Commercially available hydrocracking catalysts: Topsoe, ART, Axens, Criterion
- Feedstocks: type and contaminants
- Catalyst handling: reactor loading, ensuring trickle flow, heat release etc., presulphiding procedures, unloading
- Catalyst testing: Best Practices pretest, during, and post testing, WABT, temperature profile, WHSV, recycle cutpoint, pressure, gas to oil ratio, Critical Measurements
- Calculations: conversion, Hydrogen consumption, Normalizations of WABT's
- Corrosion: high-temperature, aqueous, wash-water injection to prevent corrosion
- Safety aspects: Catalysts, H₂S, Polycyclic Aromatics, NH₃, Sulphiding Compounds, Ni(CO)₄
- Troubleshooting: Reasons for malperformance in hydrocrackers, how to identify malperformance and How to rectify malperformance
- Invitation to tender/technical offer preparation: What data we should have to prepare a good technical forecast and how to prepare a technical forecast based on pilot plant data

Course Programme

Day 1

Hydrocracking schemes

Product properties

- Types of reactions and kinetics
- Kinetics: HDN, HDS, Hydrogenation, cracking
- Reaction Mechanism
- Normalisation

Catalysts

- Composition
- Hydrogenation function
- Acidity
- Amorphous Silica-Alumina
- Zeolites
- Properties of catalysts (e.g. SA, PV,

MPD, strength etc)

Catalyst manufacture

- Support
- Zeolite
- Extrusion
- Calcination
- Impregnation
- Quality control & Analyses

Commercially available hydrocracking catalysts

- Topsoe
- ART
- Axens
- Criterion / Shell

Day 2

Feedstocks

- Type
- Contaminants

Catalyst handling

- Reactor loading
- Presulphiding procedures
- Unloading

Catalyst testing

- Best Practices pretest
- WABT

- Temperature profile
- WHSV
- Recycle cutpoint
- Pressure
- Gas to oil ratio
- Critical Measurements

Calculations

- Conversion
- Hydrogen consumption
- Normalizations of WABT's

Day 3

Corrosion

- High-temperature
- Aqueous
- Wash-water injection to prevent corrosion

Safety aspects

- Catalysts
- H₂S
- Polycyclic Aromatics

- NH₃
- Sulphiding Compounds
- Ni(CO)₄

Troubleshooting

- Reasons for malperformance in
- How to identify/rectify malperformance
- Invitation to tender/Technical offer preparation
- How to prepare a technical forecast based on pilot plant data

Thermal Cracking Process

Lecturer: Jari Marci

Learning objectives

The Petrogenium. Thermal Cracking Course is an awareness skills course aimed at professionals that deal with Visbreaker or Thermal Conversion units at a Refinery.

Who should attend

Unit technologists, process engineers and experienced operations staff who are working on or exposed to visbreaking technology or its products (fuel oil blending operations). Further the course will be valuable to anybody that wants to gain better perspective on how the Thermal Cracking Units fits into the refining scheme.

What will you learn

This course provides a general introduction to thermal conversion processes such as visbreaking, distillate cracking and Thermal Gasoil Units. The basis and theory behind the process will be addressed including properties of feed residue and products as well as stability theory. Further elements are main process equipments including their constraints, unit operation as well as unit decokes. The course will further address fuel oil blending as well as process economics. The last day of the course is an interactive clinic workshop during which current challenges and issues of the unit at hand will be discussed and analysed.

Course Programme

Day 1

- Basics of Thermal Conversion
- Line-ups of Thermal Conversion units
- Yields and Properties of TC-products
- Exercise: Yield and property modelling
- Marine fuel oil: specification and application aspects

Day 2

- Fuel oil blending exercise
- Thermal conversion furnaces
- Equipment of TCU's
- Economics of Thermal Conversion
- Start-up, shut-down decoke and emergency procedures
- Monitoring of TCUs

Day 3

- Thermal conversion case study - where every aspect discussed in the program will be discussed.

Energy and Utility Systems

Lecturer: Jan Zander

Learning objective

The Petrogenium. Utility and Energy course has the key objective to provide understanding and guidance to staff, with the purpose to improve the reliability, efficiency and effectiveness of utilities generation and distribution at your refinery, petrochemical complex or LNG facility.

Over many years the Petrogenium. experts gathered deep technical expertise in the operation, optimization and troubleshooting of all Utility complex aspects and its associated equipment. This knowledge and resulting best practices were collected and built the foundation for the course.

Who should attend?

The course is designed for (new) engineers and senior operational staff whereas based on the attendee profile a more theoretical or practical course approach can be followed. If desired the 5-day can be structured with side specific support activities and exercises during various sessions

Course Programme

Day 1

- Introduction
- Basic water chemistry
- Water sources & surge
- Sedimentation & clarification
- Filtration
- Ion exchange / demin plant

Day 2

- Deaeration & oxygen scavenging
- BFW pumps & NPSH
- Boilers & combustion basics
- Boiler water treatment
- Condensate treatment
- Steam distribution, control & dynamics

Day 3

- Steam turbines
- Condensers
- Cooling towers performance
- Cooling water treatment
- CT water & chlorination
- Cooling water & legionella

Day 4

- Water integrity protection
- Process safety in utilities
- Pump curves
- Condensate trapping
- Fuel gas
- Instrument air
- Nitrogen
- Reliability philosophy
- Power dynamics

Amine treating and Sour Water Stripping

Lecturer: Egbert van Hoorn

Learning objectives

Key objective of the course is to provide understanding, raise awareness and guidance to refinery staff in the field of amine treating and sour water stripping. The content of this course will enable staff to optimize unit operation, troubleshoot upsets as well as to provide them with design awareness.

Who should attend ?

The course is designed for operational staff and process engineers who are involved in operation, supervision or maintenance of Amine and Sour Water Stripping units.

You will learn

- To understand the process principles in Amine Treating and Sour Water Stripping
- The purpose of the process units in the refinery
- To understand the Unit Equipment, Column Internals, Unit operation and Monitoring
- To interpret Amine analysis
- The process control steering of the unit
- How to handle the degradation of Amine solvents and Heat stable salts
- Troubleshooting

Course Programme

Day 1:

- | | |
|---|--|
| • Introductions, Course Objectives and Expectations | • Equipment Review |
| • Process Principles | • Design Parameters and Operating Conditions |
| • Amine Chemistry and Selection | • Amine Analysis |

Day 2:

- | | |
|--------------------------------------|---|
| • Process Control | • Degradation of Amine Solvents and Heat Stable Salts |
| • Loss Reduction and Foaming Control | • Review of the Actual Refinery Operation |
| • Corrosion Control and Case Studies | • Sour Water Stripping |
| • Filtration | |

Sulphur Recovery and Tail-Gas Treating

Lecturer: Frank Öhlschläger

Learning objectives

The Petrogenium. Sulphur Recovery and Tail-Gas Treating training provides unique insight into the design and operation of Sulphur Recovery and Tail gas treating units. Over many years the Petrogenium. experts have gathered deep technical expertise in design, commissioning, start-up, operation, optimization and troubleshooting of SRUs, Tail-Gas Treating units and associated equipment. This knowledge and resulting best practices built the foundation for the course.

Who should attend ?

The course was designed for engineers as well as operational staff. Pending attending audience, the training can receive a theoretical profile or focus more on practical aspects.

What You will learn

In the more technology and design focused 3-day course, a wide overview of commercially available and proven technology is provided highlighting pros and cons of each option including their specific limitations. Especially engineers and project developers will find this concept useful.

For operators a training program of 2-days, focussing on the actual technology at site, best practices and other operational aspects is available.

The operator training is to focus on the process technology installed at the particular site. For this option DCS screenshots of the particular site are included into the course program to allow more site-specific discussion about operating parameters and unit line-ups.

Course Programme

Day 1, SRU fundamentals:

- Introduction and environmental impact
- Sulphur Recovery fundamentals
 - o Claus reaction
 - o Modified Claus process
 - o Side reactions
 - o Sour water stripper gas processing
 - o Oxygen enrichment of process air
 - o Design variations
- Sulphur Recovery Unit equipment
 - o General design conditions
 - o Air blower
 - o Air and acid gas preheater
 - o Main combustion chamber
 - o Waste heat boiler
 - o Sulphur condenser
- o Sulphur lock and sulphur piping
- o Process gas reheating (direct and indirect)
- o Reactor
- o Catalyst
- o Sulphur coalescer
- Tail gas incineration
 - o Thermal incineration
 - o Catalytic incineration
- Sulphur degassing
 - o Shell sulphur degassing process
 - o D'GAASS process
 - o Catalytic enhanced degassing processes

Day 2, SRU Operations:

- Sulphur Recovery Unit instrumentation and control
- SRU commissioning and start-up
- SRU normal operation
- SRU operation monitoring
- SRU shutdown
- SRU hot and cold standby
- SRU trouble shooting
- SRU performance testing and analytical
- SRU process safety

Day 3, Tail Gas Treating and Sulphur processes & storage

For the following processes:

- SCOT process
- Superclaus® and Euroclaus® process
- Sub-dewpoint processes
- Cansolv®
- WSA process®
- Thiopaq®
 - o Process Basics
 - o Process Description
 - o Equipment
 - o Operational Aspects
 - o Advantages/Disadvantages
 - o Alternative Line-Ups
- Sulphur storage

Petrogenium. – “Because Experience Matters”

Our expert lecturer's

All Petrogenium. lecturers are seasoned industry professionals with many years of process technology, design and operational experience. Their passion is dealing with challenging process, technical, design and operational problems where they have provided countless practical solutions for improving process unit availability, reliability and design. The combined years of accumulated hands-on industry and technology experience set our courses and work shops apart from any of the competition.

Our experts enjoy lecturing and openly share their know-how with both the current and next generation of operators, engineers and non-technical staff in the downstream refining and midstream industry.

Bert van der Linde

Bert is a world class professional with more than 35 years' work experience in Hydrocracking Processes, Catalyst selection, Gasoil Hydroprocessing for Low Sulphur Diesel production and Catalytic Dewaxing. He also has extensive experience in Residue Hydroprocessing, Residue Thermal Conversion processes and Bitumen Manufacturing.

Prior to joining Petrogenium, Bert was working as an independent industry expert and has worked for Shell Global Solutions, Shell International and the Technical University of Delft, the Netherlands. Bert uses a pragmatic approach when helping technical and operations staff to translate complicated problems into practical solutions. He did so for Shell and many other IOCs/NOCs in Europe, USA, Canada, the Far East and South Africa.

Bob Scheffer

Bob is an accomplished chemical engineer with more than 30 years of international experience in Refinery Catalyst Technology and Hydroprocessing.

His comprehensive areas of expertise include: Hydrocracking, Resid Hydroprocessing, Refinery

Operations, Catalyst R&D, Catalyst Manufacturing, Catalyst Analysis, Catalyst Technology Training, Gas-to-Liquids, Gas-to-Chemicals, and Research Management.

Recognized as an international expert in Catalyst Technology, Bob is co-editor of the book 'Catalyst Deactivation', is a speaker at major conferences, a guest lecturer at Delft University of Technology and a member of the Board of the Netherlands Catalysis Society.

Charu Ehrenreich

Charu is a passionate chemical engineer with 20 years' international experience. Her specific areas of expertise are in: Hydroprocessing and Hydrotreating Technologies, techno-economical refinery, chemical and bio process evaluations, biochemical and biofuel R&D design and implementation. Charu also enjoys coaching junior engineers in dedicated workshops and delivering training in the hydroprocessing domain.

Colin Schaverien

Following his PhD in Chemistry in Bristol and postdoctoral fellowships at MIT and UC Berkeley, Colin spent 30 years in various R&D and Innovation leadership roles at Shell. Colin drives Petrogenium's

renewables resource section and supports Clients, particularly in the areas of biofuels, biorefining and green chemicals, where Biorefining means the processing or coprocessing in standard refinery units.

He also shares his know-how in customized workshops providing hands-on experience with dedicated hydrotreated vegetable oils (HVO) using 100 % vegetable oils, fats, tallow and other lipid-like feeds, as well as their coprocessing in both hydrotreaters and FCC units.

Ed Ouwerkerk

Ed graduated Cum Laude in Experimental Physics at the University of Leiden and has a Ph.D. in Molecular Physics from the University of Amsterdam. His expertise is to support refinery HydroTreating units to achieve & maintain the highest level of unit upgrading. His experience in refinery/unit optimisation and troubleshooting, debottlenecking and design of HydroTreating facilities, is extensive.

He ran many improvement projects where a boost in catalyst & reactor internals technologies made it possible to revamp many old units up to the new specifications.

Edwin Voeten

Edwin spent over 25 years in the field of combustion and heat transfer technologies. He has worked in research and development, oil refineries, chemical plants, central technical support organizations and Shell's International consultancy organization. Edwin acquired deep knowledge in burner and furnace development, design and engineering, in burner, boiler and furnace commissioning, start-up, control & safeguarding, operations and trouble-shooting. Further expertise in handling and operation of fuel and flue gas systems, reviewing and auditing of the efficiency, reliability, economics and environmental aspects of combustion systems in oil refineries, gas and chemical plants complement his deep technical knowledge basis.

Egbert van Hoorn

Egbert has spent almost his entire 35 year career of in the technical support and troubleshooting of Amine units, Sour Water Strippers, Sulphur Recovery Units and Claus Tailgas Treating Units for a variety of companies serving customers worldwide. He developed very successful training seminars for Amine and SWS as well as for SRU and has presented them more than 100 times.

Egbert has expert knowledge on the presence of trace contaminants causing foaming, corrosion or solvent degradation in the various sour streams.

In the Oil and Gas industry Egbert is considered a world-class Amine, SWS and SRU expert who is very passionate about creating value for the customer and is willing to share his know-how in an open way.

Eugen Hofmann

Eugen is a very passionate technical leader and world-class process engineer with more than 40 years' international hands-on experience in Refinery Process Technologies and Refinery Operations. In the world of refining he is particularly recognized as a world-class expert in Distillation Technologies.

Eugen held a number of leading positions in Refineries and at Shell's Technical head office in the areas of Distillation and Thermal Conversion Technology as well as Technical and Operational Management.

He is an expert user of various Distillation Process Simulation & Pinch Analysis and Process Integration tools.

Frank Öhlschläger

Frank is a world-class expert with very broad experience in gas and liquid treating aspects such as Amine and Caustic Treatment, Sour Water Stripping, Sulphur Recovery, Tail Gas Treatment and Adsorption processes.

Frank's experience covers all relevant aspects from modelling and design (new units, revamp, debottlenecking), treating concept development, operation, troubleshooting, (pre-) commissioning, start-up, training seminars and coaching. Prior to joining Petrogenium, he worked for Shell for 28 years in various refining technology, leadership, project organization and technology consulting positions.

Frans van den Berg

Frans is a passionate leader, researcher and world-class expert with more than 35 years' international experience in Syngas Technologies, Catalysis, Residue

Hydroconversion, Gas treating, Crude Oil, Heavy Fuel, Jet Fuel Product Qualities and Emerging Technologies in the Heavy Oil field. Frans held a variety of technology and managerial positions in Shell and was, for many years, on the forefront of Shell's innovation strategy of the 'bottom-of-the-barrel' commercial products and upgrading technologies.

He authored and co-authored some 30 publications and presentations at international conferences and has twelve patents in his name.

Fredrik Sandelin

Fredrik has an extensive background in refining with a broad range of experience gathered in operations, technical support, process design and research & development. For almost 30 years he specialized in gasoline production processes and technology.

Besides his experience in Fluid Catalytic Cracking, his passion lies with Catalytic Reforming, Isomerisation and process modelling. He has successfully supported many clients around the world in Unit Monitoring, Optimisation, Troubleshooting and Technologist Training programs.

Han Gesink

Han is an experienced manager with broad experience in Operations Excellence and Production Performance improvement in Upstream & Downstream Oil and Gas Business. He worked for more than 38 years at Shell and subsequently as a consultant delivering various consultancy programmes and training. He achieved significant results in the delivery of Operations, Asset Management business improvement

programs including Commissioning and Start-up, Flawless start-up, Operations Readiness and Change Management, Human Resources planning and Organization. Furthermore, he has extensive experience in Upstream, Midstream (Gas), Downstream Refining and Chemicals projects, development of customer strategy, workshop facilitation, seminars and training courses.

Henk Helle

Henk studied Chemical Technology and Materials Science at Delft University, graduating with an MSc., A PhD Material Science from Delft University the Netherlands. Henk has worked some 40 years in the field of material science, integrity management and corrosion, firstly in the metals industry and later in the oil industry. Over the last 20+ years Henk established himself as a recognized technical expert in corrosion and integrity management in the Oil and Gas industry. He publishes at conferences and in the leading corrosion journals and wrote two monographs: "Corrosion Control in Crude Units" and "Integrity Management in HF-Alkylation Units".

Jan Zander

Jan has spent his entire 30 year career at Shell in technology and operations functions in the utilities / power plants / energy systems of oil refineries, a Gas to Liquids plant and in central technical support organisations. He has a broad background in the operation, economics and energy optimisation of refineries and petrochemical units. Although he has managed large teams, his passion is dealing with energy saving initiatives, technical issues, to lead tailored on-site training sessions and to maintain the highest

possible reliability of utilities supply. Jan has extensive experience with troubleshooting the widest variation of utilities units and is a passionate trainer. Several energy projects and initiatives are still yielding significant benefits to Shell and other clients.

Jari Marci

Jari is a passionate process engineer. Jari is a passionate process engineer with many years' experience in Refinery and Mid-Stream Process Technology design, licensing, start-up, operation, research & development and customer unit support. His specific areas of expertise cover residue processing technologies with an emphasis on Visbreaking and Thermal Cracking. Jari has successfully designed and revamped numerous thermal conversion units including novel design concepts and energy integration schemes as well as extensive shutdown and start-up experience. Besides his core competency and admiration for the black-side of Refining, he has a proven expert track record in Gas Treating, general Gas Processing and Distillation.

Klaas Wieringa

Klaas is an all-round refinery professional, combining a broad technology base with extensive experience in performance optimisation. He developed his world class expertise during his 34 years in various positions at Shell and work assignments at multiple refineries worldwide (Shell, JV and non-Shell). Klaas knows what makes a refinery successful and applied this knowledge during many margin improvement programmes, investment masterplans, and strategic studies.

Klaas is recognized industry-wide as a world-class professional who drives margin improvement, business value enhancement and sustainability to support our downstream oil and petrochemicals clients. He is very passionate about sustainability in our industry and the energy transition of the world.

Louk Kuijten

Louk is a passionate technical professional with more than 37 years of applied operational and technical experience. He gained his vast experience whilst working for Shell, Shell Joint Ventures and many external clients in Downstream Oil Refineries, Upstream gas processing and the Midstream. Louk is an industry recognized expert in the field of process safety in design, operations and general technical process safety topics. Throughout his entire career Louk developed a passion for Process and Technical Safety that he was able to strengthen substantially during his various technical leadership roles. He knows how to design and facilitate effective staff training and coaching programs. On behalf of Shell Global Solutions he designed many process and technical safety courses and delivered them to internal and external clients around the world.

Peter Bitter

Peter is a technical professional with 30+ years of experience in the Oil, Gas and Chemical industry, both International as well as National in the broader areas of Reliability Management, Problem Solving and Maintenance management. He has worked as the responsible Manager leading multidiscipline teams as well as Consultant coaching and persuading individuals

and Leadership teams to adapt and adopt Best Practices and then implement and sustain these. His passion lies in analysing Organisations, Management processes or Technical processes or incidents. Using this analysis to determine the Gaps and then coach, drive and facilitate people in the implementation of jointly developed fit for purpose improvements and solutions. Also lecturing courses on his subjects and coaching individuals helps transferring his knowledge.

Ronald Holleboom

Ronald is a chemical engineer by profession and has almost 40 years of operational and technical experience in Downstream Oil Refineries, LNG facilities, process design, process control and technical process safety. His main strength and passions are technical process safety, operations, start-up, shutdown of refinery and LNG process facilities. These are supported by an extensive knowledge of processes, process safety, process control both in Oil Refining and LNG operations. Ronald has a pragmatic and structured approach in dealing with problems and opportunities for customers and enjoys providing training sessions for both operational and technical staff.

Ruud Keller

Ruud has worked for more than 35 years in the area of analytical services in Oil Refineries, Chemical plants and LNG facilities. For more than 25 years he was responsible for laboratory operations in different countries and of varying scale. Ruud is a world-class professional in Oil Refinery, Chemicals and LNG Analytical services. He has extensive experience in Laboratory analytical techniques, methods,

technical and operational support, laboratory benchmarking, correlation schemes and laboratory pacesetting standards. Ruud's passion is to work with customers and to deal with technical and operational issues in the area of Laboratory Analytical techniques and methods.

Selwyn Maduro

Selwyn is a seasoned, well-qualified, dedicated, results-driven, proactive and dynamic Refinery Downstream professional with more than 30 years of comprehensive experience. He is known as an innovative self-motivator with a proven ability to create strategies, implement changes and set up sustainable management structures with the goal of implementing continuous improvements. Selwyn is able to multitask and to manage a high-performance workforce. He is recognised as a superior communicator and for his ability to work well under pressure and interact effectively with people at all levels within an organisation. Selwyn possesses high personal standards and consistently leads teams to achieve objectives by applying a working attitude with a strong emphasis on professional relationships based on trust and respect.

Tammo Beishuizen

Tammo worked his entire career in the oil industry in technical, supply, advisory and business development roles. He worked in technical and supply planning roles at Rotterdam based BP and Shell refineries and in business development and performance improvement advisory roles at Jacobs Engineering and Shell Global Solutions. Besides being the founder of Petrogenium he enjoys lecturing on themes such

as master planning, refinery margin improvement and benchmarking.

Wim Bosch

Wim has worked at Shell for 35 years in training, technology and operations functions in both oil refineries and central office technical support organizations. Hence, he has a broad background in the technology, operation, economics and organization of oil refineries. In the period between 1999-2009, Wim was course director of Learning and Development, responsible for developing and delivering training courses on Hydroprocessing, thermal cracking, Reforming, and HF Alkylation. Wim has lectured all over the world (Europe, North America, Latin America, the Middle East, Asian Pacific, and Africa) delivering numerous courses for both Shell and non-Shell personnel.

Booking and enquiring

Please send your enquiries about our tailor-made on-site training and general trainings courses to: training@petrogenium.com

As well as the courses outlined in this booklet, we provide training and workshops in:

- Product Quality
- Crude Oil Quality
- Fired Equipment
- Introduction to Maintenance
- Waste Water Treatment
- Heat Integration
- Bitumen Manufacturing
- Catalytic Cracking
- Aromatic Extraction Technologies
- Base Chemicals
- Biofuels

And other subjects related to the Down-stream refining and Gasprocessing industry.



"Because Experience Matters"

Registration form

Petrogenium.

Please make a reservation for the following course and delegate:

Course Title:

Course Date:

Delegate details

Mr. Ms Mrs Dr

Name of delegate:

Name of company:

Job Title:

Department:

Address:

Postal code:

City:

Telephone:

Email:

Early bird discount: To qualify for early bird discount for the Introduction to Oil refining course in Amsterdam, payment must be received no later than 45 days before the course date.

Invoice: If an invoice is required to make payment by bank transfer please e-mail your request to training@petrogenium.com and an invoice will be e-mailed by return.

Cancellations, Substitutes & Programme Changes: If for any reason you are unable to attend a course, you can make a substitution at any time. All requests for substitution and name changes must be received in writing either by mail or e-mail.

For cancellations received in writing – 21 days before the start of the course, 75% of the fees will be refunded. For cancellations received after this date, course material will be sent but no refund will be applicable.

Disclaimer: The course content may be subject to changes due to unforeseen circumstances, and Petrogenium reserves the right to change the venue and/or lecturers. Petrogenium accepts no responsibility for any loss or damage to property belonging to, nor for any personal injury incurred by, attendees at our training courses, whether within the training course venue or otherwise.

Please send a scan or picture of the completed registration form to training@petrogenium.com or visit www.petrogenium.com/training for electronic registration.

If you wish to speak with us directly, please call and we will be happy to help. **+31 (0)235 83 08 91**

Mainly our Introduction to Oil Refining course is given at our headquarters close to Amsterdam, the Netherlands in Spring and Autumn.

As we have outstanding facilities for in-house, please contact us for the facilitation of other courses. Typically our courses are given on-site with about 15 to 25 course participants.

Petrogenium.

"Because Experience Matters"

