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PetroSkills.com

2026 DOWNSTREAM & MIDSTREAM

Instructor Led Training
and Development Guide



Worldwide Energy Training

Industry Driven. Industry Approved.

With a complete spectrum of solutions, courses and learning tools, PetroSkills is developing competent petroleum professionals in all technical processes, spanning the industry's entire value chain, worldwide. PetroSkills' services and solutions connect learning to the workplace, allowing employers to manage and assure the competence of workers at every level.

eLearning Solutions

For Engineers and Professionals

The Competency Alliance's eLearning solutions combine industry knowledge, expertise, content, and technology to develop workforce competency. Online learning accelerates time to competency while eliminating travel expenses.

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For Operations and Maintenance

Comprehensive eLearning courses in Health, Safety, and Environment (HSE) and technical skills. Our expertly designed programs ensure your team is well-equipped to meet stringent compliance standards. Invest in knowledge and build a resilient, informed workforce.

petroskills.com/solutions/epilot-elearning-libraries



In-Person Solutions

In-House Training

In-house courses are private, on-site classes taught wherever, whenever and however you want. Offering a cost-effective solution by bringing our courses to your site or to any convenient location you choose.

petroskills.com/solutions/in-house-training



Public Courses

We conduct more than 1,000 public course sessions each year, in every oil and gas producing region. Wherever you are located, PetroSkills courses are available frequently and conveniently to lower total cost.

petroskills.com/training?vf-mode=sessions

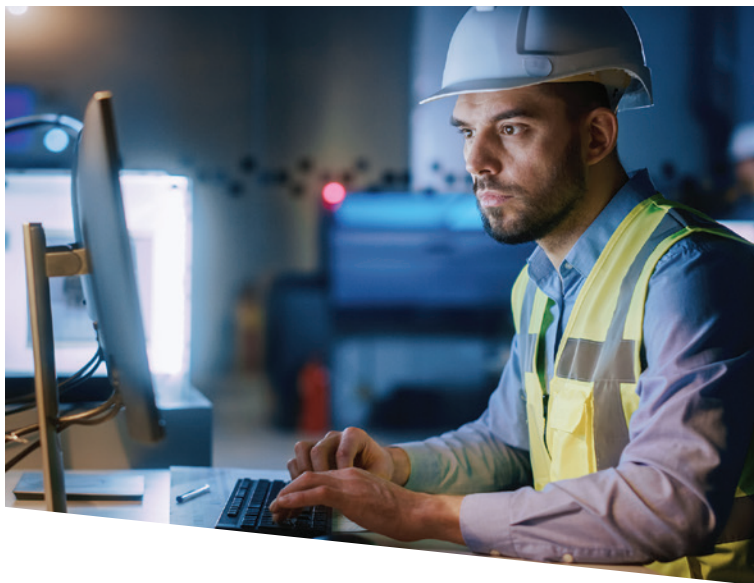


Console Operator Simulator Training

From Simulation Solutions, Inc.

Our Hands On Training System contains a broad range of high fidelity process models and realistic DCS system emulations which have been integrated into a network based, fully automated training system that includes detailed training exercises, comprehensive on-line help, self and graded evaluations, and the recording of test scores and results.

petroskills.com/solutions/console-operator-training



PetroSkills Ability™

Learning Management to drive competency and move your business forward.

To be effective, Learning and Development must not only manage employee capabilities—but must also do so in a way that supports key business goals. Ability™ is designed to make these L&D challenges easier. It is a tool we created by combining a powerful learning and compliance management engine with a competency development and assurance engine. Our experience with compliance and competency is broad. We have more than 30 years' history of innovating L&D technologies, and we have been delivering learning and compliance solutions worldwide to the most heavily-regulated industries for over 50 years.

petroskills.com/solutions/ability



Performance Consulting

Combining business, technical, and learning expertise to improve operations.

PetroSkills Performance Consulting Services can help you understand how to achieve sustainable competency management. We use a proven four-phase methodology to guide a Performance Consulting project, relying on the knowledge and assets developed through the PetroSkills Alliance for guidance. To support better business results PetroSkills Performance Consulting Services combines proven resources, including:

- Petroleum industry business experts
- Highly experienced technical experts
- Comprehensive learning resources

petroskills.com/solutions/performance-consulting



PetroSkills
part of **RelyOn**

We help individuals and companies in the oil and gas industry identify skill and knowledge gaps, give them the tools they need to fill those gaps, and equip them to do their jobs safely, efficiently, and profitably.

To learn more visit petroskills.com

Industry-leading competency-based training available online & in-classroom.

Downstream Training for the Energy Industry

Downstream organizations must build organizational strength with a focus on workforce development and talent management to assure a sufficient supply of qualified recruits to meet the growing requirements and a commitment to building management and technical capabilities by combining conceptual training with on-the-job learning.

Midstream Training for the Energy Industry

For over 50 years, PetroSkills has been a trusted advisor to the industry. By integrating our facilities expertise and content with our e-learning capabilities and competency methodologies, PetroSkills is uniquely able to develop a comprehensive plan to improve workplace performance.

Our Workforce Development approach enables companies to meet business challenges, enhance effectiveness, achieve compliance goals, mitigate risk, and improve operations.





The courses listed within this catalog are arranged by Discipline and then Level.
The Disciplines have been color coded for ease of locating.
For more information on Courses, please contact us or visit PetroSkills.com.

Downstream Courses



Operations & Maintenance

4	Basic	Applied Maintenance Management - OM-21
4	Basic	Oil and Gas Processing Facilities for Operations and Maintenance - OT-1
4	Foundation	Basic Refinery & Petrochemical Operations - SIM-BRP
4	Foundation	Crude Oil Pipeline Operations - OT-50
5	Foundation	LNG Facilities for Operations and Maintenance - OT-43
5	Foundation	Maintenance Planning and Work Control - OM-41
5	Foundation	Pumps and Compressors - SIM-PAC
5	Intermediate	Fractional Distillation Crude Oil - OT-44
6	Intermediate	Process Plant Reliability and Maintenance Strategies - REL-5
6	Intermediate	Turnaround, Shutdown and Outage Management - TSOM



Refining

6	Foundation	Decision Analysis (DA) Training for Downstream and Chemical Installations - DAD
6	Foundation	Refining and Petrochemical Process Troubleshooting Course - DTC

Midstream Courses



Gas Processing

7	Basic	LNG Short Course: Technology and the LNG Chain - G-29
7	Basic	Overview of Gas Processing - G-2
7	Foundation	Gas Conditioning and Processing - G-4
7	Foundation	Gas Conditioning and Processing - LNG Emphasis - G-4 LNG
8	Intermediate	Debottlenecking Gas Processing Facilities - G-33
8	Intermediate	Gas Treating and Sulfur Recovery - G-6
8	Intermediate	LNG Commercial Operations - G-51
8	Intermediate	LNG Shipping Economics and Freight Calculations - G-52
9	Intermediate	LNG Value Chain and Economics - G-53
9	Intermediate	Troubleshooting Gas Processing Facilities - PF-49G



Instrumentation, Controls & Electrical

9	Basic	Instrumentation, Controls and Electrical Systems Overview for Non-Electrical Engineers - ICE-21
9	Foundation	Electrical Area Classification Workshop for Petroleum Facilities per API RP 500 / 505 - E-32
10	Foundation	Electrical Engineering Fundamentals for Facilities Engineers - E-3
10	Foundation	Electrical Engineering I - M124V (for Shell employees only)
10	Foundation	Instrumentation and Controls Fundamentals for Facilities Engineers - IC-3
10	Foundation	National Electrical Code (NEC) Workshop for Industrial Applications - E-31
11	Foundation	Power System Design Fundamentals for Electrical Engineers - E-41
11	Intermediate	Flow and Level Custody Measurement - IC-73
11	Intermediate	Practical PID Control and Loop Tuning - IC-74



Mechanical Engineering

11	Basic	Overview of Offshore Systems - OS-21
12	Basic	Overview of Subsea Systems- SS-2
12	Foundation	Corrosion Management in Production/Processing Operations - PF-22
12	Foundation	Fundamentals of Offshore Systems Design and Construction - OS-4
12	Foundation	Fundamentals of Pump and Compressor Systems - ME-44
13	Intermediate	Mechanical Specification of Pressure Vessels and Heat Exchangers - ME-43
13	Intermediate	Piping Systems - Mechanical Design and Specification - ME-41
13	Intermediate	Pumps and Pumping Systems - ME-21
13	Specialized	Compressor Systems - Mechanical Design and Specification - ME-46



Pipeline Operations and Maintenance

14	Foundation	Offshore Pipeline Design and Construction - PL-43
14	Foundation	Onshore Pipeline Facilities - Design, Construction and Operations - PL-42
14	Foundation	Terminals and Storage Facilities - PL-44



Process Facilities

14	Basic	Choosing the Right Facilities Equipment for the Reservoir - PF-3
15	Basic	Introduction to Oil and Gas Production Facilities - PF-2
15	Basic	Oil Well Pad Facilities (for non-Facilities Engineers) - OWPF-nFE
15	Foundation	Applied Water Technology in Oil and Gas Production - PF-21
15	Foundation	Fundamental and Practical Aspects of Produced Water Treating - PF-23
16	Foundation	Fundamentals of Process Safety - PS-2
16	Foundation	Oil Production and Processing Facilities - PF-4
16	Foundation	Oil Well Pad Facilities (for Facilities Engineers) - OWPF-FE
16	Foundation	Process Safety Engineering - PS-4
17	Foundation	Risk Based Process Safety Management - HS45
17	Intermediate	Heat Transfer Equipment - PF-43
17	Intermediate	Onshore Gas Gathering Systems: Design and Operations - PF-45
17	Intermediate	Relief and Flare Systems - PF-44
18	Intermediate	Separation Equipment - Selection and Sizing - PF-42
18	Intermediate	Troubleshooting Oil and Gas Processing Facilities - PF-49
18	Intermediate	Troubleshooting Oil Processing Facilities - PF-49O
18	Specialized	CO2 Surface Facilities - PF-81





Applied Maintenance Management

BASIC: 5 DAYS

OM-21

No matter the price of oil, safe, efficient operations require well managed, integrated asset management. Effective, well organized maintenance management is the key. In this course, participants will receive a sound, integrated, basic knowledge of the maintenance function and how to progress towards world-class performance. Individual action plans will carry course learning into the work environment. A pre and post seminar self-assessment will be given to indicate delegates' competency improvements. The assessment is taken from the PetroSkills industry standard competency map for Maintenance Management.

COURSE CONTENT:

- World class standards
- Maintenance strategies
- Planning and scheduling
- Optimizing preventative and predictive maintenance
- Identifying critical equipment
- Developing organizational competence
- Presenting your action plan

TARGET AUDIENCE:

Maintenance supervisors, team leaders, or managers needing to improve their maintenance programs. This course is a broad survey of essential aspects of maintaining a safe, efficient, and reliable facility asset.

Oil and Gas Processing Facilities for Operations and Maintenance

BASIC: 5 DAYS

OT-1

The public course content is governed by the common production / processing facilities in the regions where the course is being held. There is gas / LNG content focus, gas / expander plant, or oil / water / gas focused courses. Note that the North Sea content has produced water treating included as well. The course is customizable to meet client needs at no additional cost. Marcellus / Bakken Gas Processing Modules Overview of gas processing Industry terminology Process drawings Units of measurement Hydrocarbons physical properties Phase behavior fundamentals Water / hydrocarbon behavior Basic principles of fluid flow Amine gas sweetening Mole sieve dehydration Mechanical Refrigeration GSP (T/E) Process Operations NGL stabilization and fractionation Process troubleshooting Permian / Eagle Ford / North Sea Oil and Gas Production and Processing Modules Overview of oil and gas processing Industry terminology Process drawings Units of measurement Hydrocarbons physical properties Phase behavior fundamentals Basic principles of fluid flow Gas lift systems Production separators Crude oil dehydration Crude oil desalting Crude oil, condensate, and NGL stabilization Crude oil storage and vapor recovery systems Crude oil pipeline systems Produced water treating Process troubleshooting Australia Gas Processing Modules. Overview of gas processing Industry terminology Process drawings Units of measurement Hydrocarbons physical properties Phase behavior fundamentals Water / hydrocarbon behavior Basic principles of fluid flow Amine gas sweetening (not in Brisbane) Mole sieve dehydration Mechanical refrigeration Cascade refrigeration Mixed refrigerants NGL stabilization and fractionation LNG facilities Process troubleshooting

COURSE CONTENT:

- Basic chemistry and physical principles related to hydrocarbons
- Quick overview of gas processing
- Phase behavior fundamentals
- Mass transfer operations
- Amine gas sweetening
- Water-hydrocarbon behavior, including hydrate formation
- TEG gas dehydration
- Solid bed adsorbers
- Mechanical refrigeration
- Gas expansion NGL recovery (turbo expanders and Joule-Thompson effect)
- NGL stabilization and fractionation
- Claus sulfur recovery

TARGET AUDIENCE:

Facility operators who require a working knowledge of the various processes used in production fluid conditioning and processing, including the common operational difficulties that may arise and operational tactics used to resolve them. Also suitable for maintenance technicians, supervisors, and managers, as well as other non-engineering personnel who would benefit in an understanding of gas processing techniques that can be applied to their daily work activities.

Basic Refinery & Petrochemical Operations

FOUNDATION: 2 DAYS

SIM-BRP

Operator Troubleshooting for PTEC Operators, Supervisors, and Early Career Engineers This interactive 2-day course combines elements of high fidelity, generic process simulators as well as a student-driven learning model centered around the INSTO™ Methodology. The course teaches operators how to build a mental model of various processes and stress critical thinking skills for operators that can be brought back to the control room. In this course each trainee will have access to their own generic simulators including a Heat Exchanger, Flash Drum, and Distillation simulator. Trainees will have an opportunity to startup each piece of equipment as well as spend time troubleshooting common malfunctions relating to exchanger and separating units. Tower operations that promote both safety as well as optimization are stressed throughout the course. The material of the course is applicable to refineries, petrochemical sites, chemical plants, and any other facilities that operate distillation columns.

COURSE CONTENT:

- A complete startup procedure for a heat exchanger and distillation column
- Operating an outlet temperature to hot side flow cascade loop including manually engaging these controls
- Simulating the effects of varying flow characteristics (flow rate, temperature, density) within a shell and tube heat exchanger
- Simulating changes to flow rates, operating temperature, and operating pressure of a flash drum and the resultant effects to product yields and purities
- Operating a binary distillation column with equipment including a reboiler, overhead condenser, hot vapor bypass pressure system and feed preheaters
- Troubleshooting scenarios for a distillation column including loss of preheat, reboiler fouling, loss of air to controllers, tower flooding, and incorrect instrumentation readings
- HAZOP analysis on loss of cooling to a distillation column and simulating the corresponding shutdown procedure
- Change in feed composition to a distillation column (more lights in feed) with objectives to maintain product purities by adjusting key operating variables
- Integrated dynamic profitability analysis within the simulator to determine profitability based on energy efficiency and minimum product specifications

TARGET AUDIENCE:

Console Operators, Outside Operators, Console Supervisors, and Young Engineers that work with separations

Crude Oil Pipeline Operations

FOUNDATION: 5 DAYS

OT-50

This course utilizes case studies and industry best practices for operating and maintaining onshore crude oil and liquid pipeline systems that maximize life cycle reliability; employee, public, and environmental safety; and operational cost effectiveness. It focuses on open discussions and troubleshooting techniques that may be applied to crude, HVL (High Volatility Liquids) and refined product pipelines and their associated infrastructure. The course aims to improve the operation profitability and communication with management and engineering staff.

COURSE CONTENT:

- Overview of crude oil transportation systems
- Industry codes and regulations, scope and applicability
- Crude oils, waxes and DRA, fluid properties and behavior
- Overview of hydraulic analysis of pipelines and hydraulic gradients
- Pipeline pumps - components, operation, seal systems and seal leak detection
- Pipeline surge and overpressure protection systems
- Pipeline facilities - filtration, pressure controls, pigging equipment
- Terminal facilities - tanks, truck/rail loading, metering, sampling and proving
- Pigging goals, processes and activities
- Pipeline repairs and maintenance
- Corrosion overview and prevention
- Leak detection methods
- CFR 49, Part 195 review of documentation requirements and terminology
- Emergency response planning, spills and loss of containment response

TARGET AUDIENCE:

Pipeline operations personnel who require a working knowledge of onshore liquid pipeline and terminal systems, including the common operational difficulties that may arise and operational tactics used to resolve them. Also suitable for maintenance personnel, metering technicians, lead supervisors, and area managers, as well as field engineering personnel who would benefit in an understanding of pipeline systems that can be applied in their daily work activities.



LNG Facilities for Operations and Maintenance

FOUNDATION: 5 DAYS OT-43

This 5-day, LNG facilities course provides an overview of field operations, and an in-depth review of the in-plant equipment and processes. The course includes the two most common types of LNG liquefaction processes, the AP-C3MR and ConocoPhillips Optimized Cascade Process. Class exercises/problems focus on the application of theory to operational trends, so operators can understand their processes and become more proficient at identifying issues and troubleshooting problems before production suffers. Course content is customizable to client needs at no additional cost.

COURSE CONTENT:

- Overview of oil and gas processing
- Separation equipment
- LNG feed quality requirements
- LNG pre-treatment systems (AGRU / molecular sieve / Hg removal)
- Fundamentals of centrifugal compression
- Refrigeration principles (propane, cascade and mixed refrigerant)
- NGL stabilization and fractionation (regional)
- LNG COP Cascade Process Overview
- LNG APCI C3MR Process Overview
- LNG storage operations and considerations
- LNG shiploading operations and considerations
- Boil-off gas management methods
- Gas turbine fundamentals
- Hydrocarbon physical properties
- Phase behavior fundamentals
- Water / hydrocarbon behavior

TARGET AUDIENCE:

LNG facility operators who require a working knowledge of the various processes used in LNG facilities, including the common operational difficulties that may arise and operational tactics used to resolve them. Also suitable for maintenance technicians, supervisors, and managers, as well as other non-engineering personnel who would benefit from an understanding of gas processing techniques that can be applied in their daily work activities.

Maintenance Planning and Work Control

FOUNDATION: 5 DAYS OM-41

No matter what the price of oil is, safe facilities operations require effective maintenance work control. ISO 55000 (PAS 55) is the asset management standard everyone is moving towards. This course is designed to build competency in Work Control as a primary skill set required to achieve these new standards. It will focus on the six phases of work management: work identification, planning, prioritization, scheduling, execution, and history capture. These essential skills are the key components of integrity management, safety, efficient resource utilization, and reliable operation. A pre and post self-assessment will be used to measure competency improvement. In order to improve facility asset management, each participant will develop an action plan to help their organizations in the long-term effort to become more efficient and safe.

COURSE CONTENT:

- Work identification
- Planning prioritization
- Scheduling execution
- History records
- Optimizing preventive maintenance
- Predictive maintenance planning
- Critical equipment focus
- Emergency response

TARGET AUDIENCE:

Maintenance managers, superintendents, supervisors, team leaders, and planners engaged in work management, planning, and scheduling.

Pumps and Compressors

FOUNDATION: 2 DAYS SIM-PAC

This interactive 2-day course combines elements of high fidelity, generic process simulators as well as a student-driven learning model centered around the INSTO (TM) Methodology. PetroSkills Simulation Solutions 2-Day Courses teach operators how to build a mental model of various processes and stress critical thinking skills for operators that can be brought back to the control room. In this course each trainee will have access to their own generic simulators including Centrifugal Pumps, Centrifugal Compressor (Fundamental) and Centrifugal Compressor w/ Utilities (Intermediate). Trainees will have an opportunity to startup each piece of equipment as well as spend time troubleshooting common pump and compressor malfunctions. Operations that promote both safety as well as optimization are stressed throughout the course. The material of the course is applicable to refineries, petrochemical sites, chemical plants, and any other facilities that operate pumps and compressors.

COURSE CONTENT:

Startup, troubleshooting, safety operations, optimization operations through simulators for:

- Centrifugal Pumps
- Centrifugal Compressor
- Centrifugal Compressor with Utilities

TARGET AUDIENCE:

Console Operators, Outside Operators, Console Supervisors, and Young Engineers that work with pumps and compressors

Fractional Distillation Crude Oil

INTERMEDIATE: 5 DAYS OT-44

This foundational course shows how crude oil is converted by fractional distillation to premium quality gasoline, diesel, kerosene, jet fuel, lubes, and subsequent chemical / refinery unit feedstocks. The course is excellent for experienced operators who want to understand the "why" as much of the "how" of separation, fractional distillation, and splitting processes. The course introduces operators to basic troubleshooting techniques for the process, equipment, and critical controls.

COURSE CONTENT:

- Overview of refinery processes
- Crude stabilization
- Fractional distillation
- Produced hydrocarbon fluids and their properties
- Physical principles
- Oil and condensate processing
- Practical thermodynamics: mass and energy balances
- Mass transfer operations
- Introduction to hydrotreating and hydrocracking
- Systems and equipment

TARGET AUDIENCE:

Refinery, process unit operations and maintenance technicians, supervisors and managers, as well as other non-engineering personnel requiring a fundamental focus on refinery processing facilities.



Process Plant Reliability and Maintenance Strategies

INTERMEDIATE: 5 DAYS REL-5

This course is designed to teach reliability engineering skills as they apply to improving process system reliability and developing maintenance strategies. You will use modern software and analysis methods to perform statistical analysis of failures and model system performance, plus develop maintenance and reengineering strategies to improve overall performance.

COURSE CONTENT:

- Criticality analysis
- Availability simulation and modeling
- Statistical analysis of failures using Weibull
- Maintenance strategy development; condition monitoring; reliability-centered maintenance; and essential care
- Process reliability analysis
- Root cause analysis
- Failure reporting, analysis, and corrective action systems
- Key performance indicators
- Reliability definitions

TARGET AUDIENCE:

Maintenance, engineering, and operations personnel involved in improving reliability, availability, condition monitoring, and maintainability of process equipment and systems. Participants should have foundation skills in statistical analysis and reliability techniques for equipment.

Turnaround, Shutdown and Outage Management

INTERMEDIATE: 3 DAYS TSOM

Scheduled turnarounds are difficult to manage. Managing a surprise shutdown or outage is like firefighting. Firefighters succeed because they know what strategies work and are highly trained to handle complex, risky situations. Uncertainty and complexity abound when a plant is down. Extra work can appear when equipment is opened and inspected. Integrating project work increases the challenge. Experienced instructors show you how to control scope uncertainty, tackle the complexity of integrating project work, and get the facility restarted. The course addresses in detail the structure and process that is used to effectively manage all of the potential scope items that Operations, Maintenance, and project staff want to do during the TSO. The overall staged process and management oversight methodology is discussed in detail. This course counts toward PMI Project Development Units (PDUs) through continuing education. Completion Certificates may be submitted to PMI as required to document third-party training.

COURSE CONTENT:

- Metrics that illustrate why certain activities are required for a TSO to meet its key performance indicators
- The correlation between scope growth and TSO failure and how to effectively manage scope
- A detailed discussion of all of the activities that should be done starting one year prior to the start of the TSO
- How to establish clear TSO objectives that align with the needs of all stakeholders
- The TSO objectives will be used to develop Work Scope Qualification Criteria: what is mandatory and what is optional scope. Early on we'll discuss the importance of this criteria to the success of the TSO.
- Discussion will also center around the role of the Work Scope Qualification Team and how it interacts with the TSO Manager, TSO Team, and Steering Team.
- The importance of the TSO Steering Team, in guiding the entire TSO Team, as well as their role in supporting rigorous scope control
- The key role that the TSO Premises Document (similar to a Basis of Design) in planning a successful TSO
- How to use the three major categories of TSO scope to support a successful TSO
- How to develop a TSO management plan (similar to a Project Execution Plan) to align the TSO Team and the Steering Team and use it to plan and deliver a successful TSO
- How to develop a Work Order Package and how in many ways it is very similar to the highly successful Advance Work Packaging methodology that is used to drive down labor costs and improved field productivity
- How to effectively manage planning and execution of both capital project scope and TSO maintenance scope
- How to develop an effective contract breakdown structure for all of the contractors that will work on the TSO
- The use of Earned Value or the Value of Work Done to track TSO work completion, field productivity, and labor costs
- Items to expect from a subcontractor working on the TSO to effectively manage labor and costs for reimbursable work
- Key components of an overall TSO logistics plan including material storage, traffic management, loading/unloading, etc.
- Develop effective plans for procurement, HSE, and quality management
- How to handle emerging work scope
- Tools that a TSO Manager uses during the shutdown to manage activities including the Daily Work List, Execution Progress Meeting, Shift Work Logs, VOWD curves, etc. In essence the course discusses, a day in the life of a TSO Manager.

TARGET AUDIENCE:

TSO Managers, project managers, supervisors, engineers, schedulers in maintenance, operations, reliability, HSE, procurement and projects should attend. This course also helps business, commercial, finance and other non-technical personnel who want to know more about turnaround, shutdown and outage best practices. Suitable for Upstream, Pipelines, Refineries, and Petrochemical Plants.



Decision Analysis (DA) Training for Downstream and Chemical Installations

FOUNDATION: 3 DAYS DAD

Decision Analysis (DA) Training for Downstream and Chemicals provides an interactive three-day workshop designed for groups evaluating major financial investments, alternative business strategies, key projects or complex decisions aimed at creating business value in the refining and chemicals industries. The workshop is designed to introduce industry best practices in decision-making, with attention to resolving cross-functional ambiguities and dealing directly with the major uncertainties and risks that occur in this industry. The course will provide you with the hands-on training needed to create a common language and a working understanding of the process toward enabling superior business decisions. This course is based on book "Introduction to Decision Analysis" by David C. Skinner and can be delivered either face to face or virtual.

COURSE CONTENT:

- Review Traditional Decision processes
- Conduct Investor Exercise to demonstrate Decision Analysis principles
- Review the Situation Analysis and Options Development Phases for a Refinery Case Study
- Review the options to conduct the evaluation, driven by the level of complexity and uncertainty
- Review the tools for the Full Stochastic evaluation approach
- Review the Full Stochastic methodology to the Refinery Case Study
- Review DA Scalability approach and apply tools for a small project example
- Apply the DA process and tools to a Cogeneration Capital Project Case Study
- Review the financial modeling techniques and tools used in the Evaluation Phase
- Review the Framing techniques and tools used in the Situation Analysis and Options Development Phases

TARGET AUDIENCE:

This training is designed for individuals and teams desiring a working knowledge and understanding of this best practice approach to decision situations. This will include project team participants, key knowledge resource experts and decision makers who regularly review project decisions. The goal is to have knowledgeable participants to be able to work much more effectively with experienced process facilitators, thus enabling a focus on content and creativity in the process. The recommended audience for this workshop includes: Members of Decision Teams analyzing investments, projects, or strategic alternatives Project Managers Business Managers Planning & Economics Engineers Portfolio Managers of strategy areas Technical experts who will provide input for the analysis uncertainties Marketing personnel who will provide commercial input for the decision

Refining and Petrochemical Process Troubleshooting Course

FOUNDATION: 3 DAYS DTC

The Process Plant Troubleshooting Course interactive workshop is designed for groups involved in troubleshooting manufacturing facilities in the process industry and for introducing industry best practices in process plant troubleshooting. The course focus on resolving process facilities issues such as unit capacity, quality, and reliability. The course, ideally suited for engineers in the operations support roles as well as for the lead operators, provides hands-on training to create a common language and a working knowledge of effective process plant troubleshooting techniques. The course emphasizes the principles of effective process plant troubleshooting: Defining the sequence of events Formulating a theoretically correct working hypothesis Providing a means to test the hypothesis Providing a foolproof means to eliminate the problem

COURSE CONTENT:

- Introduction
- Limitations of unstructured approaches
- Successful Plant Problem Solving
- Case Studies
- Hypothesis Development
- Verification of data
- Plant test
- Unsteady state
- Pumps and Compressors
- Team Exercise
- Fractionation and Computation
- Heat exchangers and kinetically limited process

TARGET AUDIENCE:

These workshops are designed for individuals and teams desiring a working knowledge and understanding of this best practice approach to process plant troubleshooting. The goal is to have trained participants to be able to work much more effectively with experienced operations support engineers and operators, thus enabling a focus on quality and creativity in the process. Recommended audience includes: Fresh Engineers Engineers moving to operations support positions Operations support engineer Applications Engineers Lead Operators First line operations supervisors Operations Manager



LNG Short Course: Technology and the LNG Chain

BASIC: 5 DAYS **G-29**

This LNG Short Course is designed for participants requiring moderate technical coverage, coupled with information on LNG commerce and all parts of the LNG Value Chain. Over 5-days, the course covers technical LNG basics and facility operation topics, plus technical, design, and commercial issues. Selected exercises and syndicates are used to reinforce the main topics of LNG trade and technology. In-house versions are available with either increased technical and operational emphasis or increased project and development emphasis. More in-depth coverage for technical, production, and processing personnel is available in our 10-day course, G-4 LNG, Gas Conditioning and Processing - LNG emphasis.

COURSE CONTENT:

- What LNG is and where it comes from
- Physical properties of LNG
- Vapor-liquid equilibrium behavior of LNG and refrigerants
- Gas pre-treatment
- Heat exchangers
- Refrigeration
- Rotating machinery
- Liquefaction processes
- LNG storage
- LNG shipping
- LNG importing

TARGET AUDIENCE:

Commercial and managerial staff looking for a concise overview; engineers new to the LNG industry; operations supervision staff and senior plant personnel; specialists looking to broaden their general knowledge of LNG; and staff involved in LNG commerce and interested in LNG technical fundamentals.

Overview of Gas Processing

BASIC: 3 DAYS **G-2**

G-2 is a versatile overview of the gas conditioning and processing industry. This course is designed for a broad audience and is engaging and interactive, utilizing basic technical exercises and terminology to communicate key learning points. This course does not cover the technology and engineering principles in depth, and is only recommended for those needing an overview of the industry and common processes and equipment used.

COURSE CONTENT:

- Natural gas and world energy trends
- Hydrocarbon components and physical properties
- The role of gas processing in the natural gas value chain
- Heat transfer equipment
- Pumps and compressors
- Acid gas removal
- Gas conditioning (dew point control) and NGL extraction
- Stabilization and fractionation concepts and facilities
- Gas processing key equipment and support systems (heat transfer, compression, pipelines and gathering systems, and measurement)
- Specialty processes in gas processing (LNG, nitrogen rejection and helium recovery, sulfur recovery, and acid gas reinjection)

TARGET AUDIENCE:

As a wide ranging overview, it is suitable for interested parties, such as geologists, reservoir engineers, procurement professionals, and sales or business development staff; related specialists like environmental staff, operational staff, and shift foremen; those new to the industry, such as entry-level (1-2 year) engineers; or anyone interested in a general, technically-oriented overview of the gas processing industry.

Gas Conditioning and Processing

FOUNDATION: 10 DAYS **G-4**

The Campbell Gas Course has been the standard of the industry for more than 52 years. Tens of thousands of engineers have attended our G-4 program, considered by many to be the most practical and comprehensive course in the oil and gas industry. The Campbell Gas Course textbooks, Volumes 1 and 2, are routinely updated to reflect evolving technologies in this broad industry. Both hand-methods and computer-aided analysis are used to examine sensitivities of technical decisions. To enhance the learning process, about 30 problems will be assigned, reviewed, and discussed throughout the course. Problems will be solved individually and in teams.

COURSE CONTENT:

- Gas processing systems
- Physical properties of hydrocarbons
- Terminology and nomenclature
- Qualitative phase behavior
- Vapor-liquid equilibrium
- Water-hydrocarbon phase behavior, hydrates, etc.
- Basic thermodynamics and application of energy balances
- Process control and instrumentation
- Relief and flare systems
- Fluid hydraulics; two-phase flow
- Separation equipment
- Heat transfer equipment
- Pumps
- Compressors and drivers
- Refrigeration in gas conditioning and NGL extraction facilities
- Fractionation
- Glycol dehydration; TEG
- Adsorption dehydration and hydrocarbon removal
- Gas treating and sulfur recovery
- Overview and summary

TARGET AUDIENCE:

Production and processing personnel involved with natural gas and associated liquids, to acquaint or reacquaint themselves with gas conditioning and processing unit operations. This course is for facilities engineers, process engineers, senior operations personnel, field supervisors, and engineers who select, design, install, evaluate, or operate gas processing plants and related facilities. A broad approach is taken with the topics.

Gas Conditioning and Processing - LNG Emphasis

FOUNDATION: 10 DAYS **G-4 LNG**

This is the LNG-industry version of our popular G-4 course, with expanded coverage of refrigeration and LNG technologies. The course includes in-depth information on basic natural gas conditioning and processing. This is mainly the core G-4 Campbell Gas Course curriculum in an LNG context with the expanded refrigeration coverage.

The course covers relevant details of both the mixed refrigerant (APCI) and cascade (ConocoPhillips) processes in LNG liquefaction. Reference is made to other liquefaction processes including Mixed Fluid Cascade Process, Dual Mixed Refrigerant Process, and Nitrogen (single or dual) Cycles being developed for FLNG projects. This is followed by higher level coverage of the LNG value chain consisting of a gas liquefaction section; LNG run-down to LNG storage; loading berth for LNG export; LNG shipping; and LNG receiving and regasification terminals.

Versions of this course have been taught in many of the world's base-load and peak-shaving LNG plants, such as Australia, Indonesia, Malaysia, Norway, Qatar, UK, and West Indies.

COURSE CONTENT:

- Basic gas technology principles
- Terminology and nomenclature
- Physical properties of hydrocarbons
- Qualitative phase behavior
- Vapor-liquid equilibrium
- Water-hydrocarbon system behavior, hydrates, etc.
- Thermodynamics of LNG processes
- Separation equipment
- Gas treatment, CO₂, and H₂S removal
- Dehydration of natural gas (TEG and Molecular Sieve)
- Heat transfer and exchangers
- Pumps and compressors
- Refrigeration systems
- LNG liquefaction technologies
- Fractionation
- Other facilities topics relevant to LNG
- Course summary and overview

TARGET AUDIENCE:

Personnel involved with natural gas processing and LNG production, as well as anyone interested in a solid technical understanding of the principles of an LNG plant.



Debottlenecking Gas Processing Facilities

INTERMEDIATE: 5 DAYS G-33

This course will cover how to establish a methodology for performing a debottlenecking study of a gas processing facility, as well as how to identify and evaluate debottlenecking options for specific equipment types and process systems. The course will be primarily structured in a workshop format. The first part of the course (~1 day) will focus on defining the scope and establishing a logical methodology for performing a debottlenecking study. The remainder of the course (~4 days) will be spent determining the current capacities of an existing facility's major equipment and processing units, followed by identification and evaluation of the relevant debottlenecking options. A hypothetical 200 MMSCFD gas processing plant will be used as the basis for the study work. The plant is a mechanical refrigeration (propane) plant featuring inlet fluids reception facilities, condensate stabilization, inlet compression, amine gas sweetening, cooldown/NGL recovery including a de-ethanizer and propane refrigeration system, glycol injection and regeneration, and sales gas compression. Major process support/utility systems will be covered at a high level. Debottlenecking cases of 230 MMSCFD and 260 MMSCFD will be evaluated. Three different scenarios will be considered for the expansion cases: The expansion gas is the same as the original design "medium" feed composition. The expansion gas is leaner than the original design feed gas. The expansion gas is richer than the original design feed gas. The duration of the course will not allow for coverage of all possible gas processing configurations but "modules" for major process/equipment types that are not part of the case study plant, eg. TEG dehydration, will be provided as part of the course materials and covered during the week. Much of the course content will be applicable to both onshore and offshore facilities, with the offshore facilities generally being somewhat less complicated. The general approach to debottlenecking and most of the equipment-specific module content will also be relevant to smaller field gas processing facilities as well as the gas-handling parts of an oil processing facility. An actual debottlenecking study could take several months to complete. This 5-day course will cover the main elements of a debottlenecking study without getting too deep into the details. It is assumed that course participants have a solid understanding of how gas production and processing facilities work, including the commonly used processes and equipment involved.

COURSE CONTENT:

- Review of the "Base Case" plant configuration and debottlenecking scenarios.
- Debottlenecking study methodology
- Establishing a baseline starting point
- Equipment/process module format:
 - Brief review of fundamentals
 - Main capacity limits and how to quantify them
 - Typical debottlenecking options and how to quantify them
 - Debottlenecking option selection considerations
 - Group time to work the selected case
- Modules covered:
 - Separation equipment
 - Reciprocating and centrifugal compressors
 - Amine sweetening units and their components
 - Columns, eg. fractionation and absorption
 - Heat exchangers (mostly shell & tube and air-cooled)
 - Glycol injection and regeneration systems
 - Centrifugal pumps
 - Fractionation facilities, separation requirements, condensers, reboilers
 - Plant piping
 - Glycol dehydration systems
 - Relief and flare systems
 - Main utility systems

TARGET AUDIENCE:

Process/Facilities engineers with 5–15 years of experience, Facilities Engineering team leaders/supervisors, and Senior Facilities operational personnel.

Gas Treating and Sulfur Recovery

INTERMEDIATE: 5 DAYS G-6

This course emphasizes process selection, practical operating issues, technical fundamentals, and integration of the sweetening facilities into the overall scheme of gas processing. Sulfur recovery and tail gas processes are also covered, including standard Claus configurations, SuperClaus, EuroClaus, SCOT, etc. Special design and operation topics, such as trace sulfur compound handling and the importance of H₂S:CO₂ ratio, are covered as well. Related topics reviewed during the course include liquid product treating, corrosion, materials selection, and NACE requirements.

COURSE CONTENT:

- Fundamentals of sour gas processing, sweetening, etc.
- Overview of gas treating and sulfur recovery, terminology
- Gas specifications and process selection criteria
- Generic and specialty amine treating
- Common operating and technical problems
- Proprietary amine solvents, such as Sulfinol and Flexsorb
- Carbonate processes
- Physical absorption processes, e.g. Selexol
- Metallurgical issues (corrosion)
- Other technologies and new developments
- Selective treating, acid gas enrichment
- Solid bed and non-regenerable treating; scavengers
- Liquid product treating
- Sulfur recovery processes (including degassing)
- Tail gas clean-up (SCOT-type, CBA, and others)
- Acid gas injection
- Membranes
- Emerging and new technologies
- Course workshop and summary

TARGET AUDIENCE:

Production and processing personnel involved with natural gas treating and sulfur recovery, requiring an understanding of the principles of these process operations. This course is for facilities engineers, process engineers, operations personnel, and field supervisors, as well as others who select, design, install, evaluate, or operate gas sweetening and sulfur recovery facilities.

LNG Commercial Operations

INTERMEDIATE: 5 DAYS G-51

Liquefied Natural Gas (LNG) has provided international mobility to natural gas, which now provides around 25% of the world's primary energy. Being the cleanest fossil fuel natural gas consumption is forecasted to grow in all future scenarios. With the entry of various actors, including Trading companies, the LNG value chain is becoming increasingly complex, and solid understanding and management of the interfaces have become crucial to identify and realise additional margin opportunities. This course gives a concise introduction to the LNG business. Thereafter, the elements of the LNG value chain are described and analysed. A Business Activity Model along the value chain will be developed and discussed in depth, covering the following key processes: Buy Gas -> Transport Gas -> Liquefy Gas -> Sell LNG/Products -> Ship LNG -> Regasify LNG Contracts defining the Commercial aspects for each of these activities will be examined and the associated Commercial operations, will be described. Gas Supply Agreements (GSA), Sale & Purchase Agreements (SPA), Ship Chartering (VOY), and Terminal Use Agreements (TUA) s are included. Good practice for developing and executing Annual Gas Supply and Annual Product Delivery (ADP) plans and Specific Delivery Schedules (SDS) will be shown within the framework of a so-called Integrated Activity Planning & Scheduling. Roles and responsibilities of relevant positions, requiring a multi-functional approach, will be examined. Most of these critical positions are located at the interfaces of Operational, Shipping, Commercial functions and their seamless cooperation under expert guidance is essential for optimizing the value chain for the any company having an interest in the LNG value chain. Real life experience based hands-on exercises will facilitate deeper understanding. These include: Gas/LNG property and price parity calculations Custody Transfer issues, performance Contract Management – Annual Delivery Programme design and execution strategies LNG property (Heating Value/Wobbe Index) adjustment (Nitrogen injection-UK, LPG injection-JP) LNG Shipping freight calculations, diversion opportunity generation and negotiations Excel based tools/models will be provided to the participants for these exercises.

COURSE CONTENT:

Review of Natural Gas & LNG Business

- Hydrocarbons for Energy
- Natural Gas Business
- Natural Gas Value Chain
- Markets
- Pricing
- Exercise - Heating Value/Wobbe Calculations
- LNG Value Chain

LNG Assets / Commercial Operations

- LNG Liquefaction Process
- LNG Shipping
- Exercise - Freight Calculations; Routing - Panama vs other options
- LNG Regasification/Terminals
- LNG Project/Business Structures

Commercial Operations

- Product Quality & Specification
- Exercise - LNG Wobbe Adjustment in a Regasification terminal
- Buying Gas
- Producing LNG

Commercial Operations Planning & Execution

- Custody transfer
- Exercise - Custody Transfer Calculations
- Selling LNG & Products
- Planning & Scheduling & Daily Operations Coordination

Commercial Operations Strategy

- Exercise - Diversion Calculations / Negotiation
- Strategy and Planning
- Business Planning Process
- Management Information systems
- Business Performance Monitoring and Appraisal
- Benchmarking, Target (KPI) setting
- Back office/ Support
- Hydrocarbon Accounting
- Documentation, BOL, COQ, cargo docs...
- Customer Information & Relationship Reporting
- Professional Competence Management
- Resources

TARGET AUDIENCE:

Technical, Operational, Shipping and Commercial professionals already active in Commercial Operations area and in particular Planners and Schedulers, Liquefaction technologists, Contract administrators, Traders, Ship Charterers, Cargo Operators, Loading Masters will directly benefit in seeing how their contributions fit in to the integrated optimisation effort and identifying potential improvements to maximise integrated margins. Managers (Technical, Financial, Legal and Governance) less familiar with Commercial Operational activities will also benefit from this course, as they will get the required background to be able set sharper targets, suitable performance indicators, and governance and performance assessment guidelines for such operational units.

LNG Shipping Economics and Freight Calculations

INTERMEDIATE: 4 DAYS G-52

Liquefied Natural Gas (LNG) has provided international mobility to natural gas, which now provides around 25% of the world's primary energy. Being the cleanest fossil fuel, natural gas/LNG consumption is forecasted to grow in all future scenarios. In the LNG value chain, LNG Shipping is a key element to manage the Supply and Demand sustainably and profitably. Understanding the dynamics of the LNG Shipping Industry in terms of its Economics and Chartering practice is vital to manage the shipping availability and costs in order to optimise the overall trading margin in the value chain. Recent market disturbances caused by natural gas price instabilities and political challenges (Ukraine/Russia) make a deep understanding of LNG Shipping/Freight issues even more essential to ensure the security of energy supplies for all the actors – producer/sellers, traders, portfolio operators, shippers, and the buyers as well as the Regulators (Energy and Port Regulators) who oversee the commercial activities. This course starts with a concise review of the LNG business. Thereafter, the elements of the LNG Shipping Industry (who are the owners, operators, how is the financing, chartering practices and agreements etc) are described and their individual economics analysed. Types of LNG ships, the relevant industry trends in terms of Containment and Propulsion systems are discussed in depth, and the interplay between ship characteristics (size, type of propulsion, containment and insulation impacting the LNG and fuel balances) and shipping/charter costs and rates are analysed in depth. An excel spreadsheet model will be built to capture these elements to calculate the overall costs. Leveraging on model hands-on exercises and case studies, this course will equip the participants with the opportunity to develop their skill in this area by tackling real-life cases. Excel model will be provided to the participants for their private use. Finally, the relevant management systems will be discussed (to see how to track shipping performance and compare with competitors through benchmarking). The course will end with an LNG and Shipping Outlook, discussing the future trends and challenges.

COURSE CONTENT:

LNG & LNG Shipping Review

- LNG Basics
- LNG Value Chain
- Exercise: Routes/Distances
- LNG Shipping
- What determines Shipping Costs?

LNG Economics & Freight Costing

- Freight Cost Elements & Modelling
- Ship capital cost recovery (DCF)
- Operating Costs Elements: Fixed & Variable costs
- How Charter fees develop
- Shipping Fuels
- Freight Cost Modelling & Exercise
- Optimisation
- Business Models

Hands-on Exercises/Workshop

- Exercises
- Special Operations / Costs - Workshop
- Exercise: Group Discussion
- Charter Party / Contracts

Tools & Management Systems, Outlook

- Case Study
- Group Exercise
- Scheduling & Optimisation
- Develop LNG Annual Delivery Plan & Integrate with Shipping Plan
- LNG Storage vs Shipping Capacity optimisation
- Performance Management Systems
- Operational Performance Management
- Risk management, Disputes
- Benchmarking
- Outlook
- Course Review, Feedback

TARGET AUDIENCE:

Technical, Operational, Shipping, Commercial, Project and Governance professionals already active in a specific section of the LNG Value Chain will directly benefit in developing a wider and deeper perspective on how the LNG Shipping Business operates and can be managed to optimise the overall LNG margins in the value chain. Managers (Shipping, Technical, Financial, Legal and Governance) less familiar with the specifics of the LNG Shipping Industry will also benefit from this course, as they will get the required background to be able to set sharper targets, suitable performance indicators, and governance and performance assessment guidelines for units engaged in the chain.



LNG Value Chain and Economics

INTERMEDIATE: 5 DAYS G-53

Liquefied Natural Gas (LNG) has provided international mobility to natural gas, which now provides around 25% of the world primary energy. Being the cleanest fossil fuel natural gas/LNG consumption is forecasted to grow in all future scenarios. With the entry of various actors, including Trading companies, the LNG value chain is becoming increasingly complex, and solid understanding of its economics and management of its interfaces have become crucial to identify and assess investment opportunities and risks. Recent market disturbances make a deep understanding of LNG Value Chain Logistics and Economics even more essential to ensure security of energy supplies sustainably and profitably. This course starts with a concise introduction to the LNG business. Thereafter, the elements of the LNG value chain are described, and their individual economics analysed. A Business Activity Model along the value chain will be developed and discussed in depth, covering the following key processes: Buy Gas -> Transport Gas -> Liquefy Gas -> Sell LNG/Products -> Ship LNG -> Regasify LNG. The integrated chain economics will then be developed and quantified. A hands-on group workshop/exercise developing the economic case of a full-size Liquefaction project will be carried out, considering the forecasted cash flows throughout the project life, the location of the plant, its markets, project sensitivities and profitability assessment. Excel based tools/models (LNG Liquefaction project development NPV analyses, Shipping Freight Calculations and Economics) will be provided to the participants for these exercises and their future personal use.

COURSE CONTENT:

Overview of Natural Gas & LNG Industries

- Introduction and course overview
- Hydrocarbons for energy - foundation
- Natural gas & LNG business
- Deep dive into the elements of the LNG Value Chain

LNG Value Chain Economic Concepts/Elements

- Economics of the LNG Value Chain
- Liquefaction projects
- LNG project shipping
- Exercises:
- Freight Calculations
- Hands-on DCF Calculations

Project Calculations

- DCF/NPV Modelling
- Integrated Project Economics Workshop

Quantification & Optimization of Value Chain Economics

- Integrated value chain economics
- Shipping cost calculations
- Freight optimization exercise
- Optimizing the value chain
- LNG bunkering, trucking

Planning, Managing Value Chain Performance

- Risk identification, assessment, management
- Business/project performance management
- LNG outlook and Energy Transition

TARGET AUDIENCE:

Technical, Operational, Shipping, Commercial, Project and Governance professionals already active in a specific section of the LNG Value Chain will directly benefit in developing a wider and deeper perspective on how the LNG VALUE CHAIN operates and can be optimised. Managers (Projects, Technical, Financial, Legal and Governance) less familiar with the specifics of the LNG Industry will also benefit from this course, as they will get the required background to be able set sharper targets, suitable performance indicators, and governance and performance assessment guidelines for units engaged in the chain.

Troubleshooting Gas Processing Facilities

INTERMEDIATE: 5 DAYS PF-49G

This course will cover how to establish and apply a general troubleshooting methodology as well as how to conduct process/equipment specific troubleshooting related to gas production and processing facilities. Definitions of good/normal performance will be discussed for each process/equipment type covered. Data gathering, validation and utilization procedures will be discussed. Criteria to use when evaluating possible problem solutions will also be covered. Real-world exercises will be utilized throughout the class to reinforce the learning objectives. Both onshore and offshore facilities will be discussed. It is assumed that course participants have a solid understanding of how typical gas production and processing facilities work, including the commonly used processes and equipment involved. This course will not provide in-depth coverage of fundamentals.

COURSE CONTENT:

- Understanding the similarities and differences between troubleshooting vs optimization vs debottlenecking
- Types of gas production and processing facilities
- System trouble vs component/equipment-specific trouble
- Defining good/normal operation
- Quantifying the cost of the trouble
- Gathering, validating, and utilization of data (types of data, sources of data, data quality and validation, using the data)
- Developing a step-by-step troubleshooting methodology/flowchart
- Identifying the best solution (criteria for defining best)
- Processing and major equipment modules covered include separation equipment, amine gas sweetening, glycol dehydration, molecular sieve dehydration, shell and tube heat exchangers, NGL recovery processes, reciprocating compressors, and centrifugal compressors

TARGET AUDIENCE:

Process/Facilities engineers with 5-10 years of experience, facilities engineering team leaders/ supervisors, and senior facilities operational personnel.

Instrumentation, Controls and Electrical Systems Overview for Non-Electrical Engineers

BASIC: 5 DAYS ICE-21

This course provides an introduction and overview of electrical systems, instrumentation, process control, and control/safety systems typically encountered in oil and gas facilities. The focus is to understand terminology, concepts, typical equipment configurations, and common pitfalls in order to improve communication with electrical and I&C professionals. This course covers similar content to our E3 and IC3 courses, but at a more conceptual level. Although not required, a computer with Excel is recommended for in-class exercises.

COURSE CONTENT:

- Fundamentals of electricity
- Power distribution and motor control systems for oil and gas applications
- Emergency power systems
- Hazardous area classification for oil and gas applications
- Electrical safety in industrial facilities
- Control system fundamentals
- Field measurement and control devices
- Programmable electronic systems (PLC, DCS, SIS, SCADA)
- Control system networking
- Drawings and documentation for IE&C projects

TARGET AUDIENCE:

Process, chemical, and mechanical engineers, (i.e. non-instrumentation and non-electrical disciplines), as well as other technical and non-technical professionals with little or no background in IC&E systems. Electrical and Instrumentation Engineers should consider E3 and IC3 for more in-depth coverage.

Electrical Area Classification Workshop for Petroleum Facilities per API RP 500 / 505

FOUNDATION: 3 DAYS E-32

This 2.5 day workshop style course is intended to provide a working knowledge of Electrical Area Classification of petroleum facilities which include hazardous (explosive) atmospheres due to the presence of flammable vapors and liquids. The course includes a Workbook for the participants to actively explore the API RP 500 standard, and apply requirements to an actual mock project based on process information and a plot plan. The first section of the course covers important information about the purpose of Hazardous Area Classification, the terms and standards used, OSHA requirements, documentation examples, and typical work flows. The second portion examines fluid properties that impact area classification based on the nature of the substances handled (Classes) and the process conditions under which they are handled. Next, the likelihood of release is examined (Divisions/Zones) based on equipment type, operating and maintenance considerations. While this course focuses on flammable vapors, gasses and liquids (Class I), a brief introduction to combustible dusts (Class II) is also included as they are often present in refining operations. The main section of the course includes the methods of performing area classification based on API RP 500 and includes a mock project where process conditions and a plot plan are presented, and the participants perform area classification and produce a hand drawn plot plan with their results. For applications involving heavier-than-air components the Alternate Method (Annex D) using the point sources method is addressed and the results compared to using other portions of the standard. The fugitive emission method (Annex B) and battery room applications (Hydrogen) are also covered. Lastly, an overview of Hazardous Location Rated equipment is provided, including certification and testing, labeling, equipment selection, installation practices per the US National Electrical Code (NEC, NFPA 70), and comparison of Zone and Division rated equipment.

Note: The course uses refining applications as a basis of the exercises, but upon request, upstream production or midstream gas processing facility applications can be provided for in-house deliveries. Contact a PetroSkills representative for more information about tailoring the content to your needs.

Important note: A copy of the 4th edition of API RP 500, June 2024 is required for this course, and not included in the registration fee. The 3rd edition of API RP 500 or 2nd edition of API RP 505 (Zone method) will suffice, but some references may have changed between editions. If you need a copy of the API RP 500 or 505 Standard, a genuine copy can be purchased through the API website, API.org or other resellers such as GlobalSpec (IHS Markit), TechStreet or obtained through a company subscription to one of these services.

COURSE CONTENT:

- Introduction to Hazardous Locations
- Area Classification Methods (Risk Assessment)
- Classification by Substance (Gasses and Vapors, Liquids)
- Likelihood of Ignitable Mixtures Being Present
- Combustible Dust Summary
- Methods of Classifying Areas
- Applying API RP 500
- Design Exercises
- Annex D – Alternate Method (Point Source)
- Annex B – Fugitive Emissions Method
- Hazardous Location Rated Equipment Certification
- Protection Methods
- Installation Requirements for Hazardous Locations
- Comparison to Zone Methods

TARGET AUDIENCE:

Electrical and Instrumentation designers, Electrical or Instrument engineers, Process Safety Engineers, Facilities Engineers and others involved in area classification of petroleum facilities.



Electrical Engineering Fundamentals for Facilities Engineers

FOUNDATION: 5 DAYS E-3

This course applies fundamental electrical engineering principles to oil and gas facilities. The course is designed for Facilities Engineers who interface with electrical systems, and provides practical insight and development of new Facilities Electrical Engineers. Through the use of individual and group problem solving, attendees will learn about power transformers, motors, generators, one-line diagram interpretation, protection and coordination of electrical equipment, site and standby generation, electrical safety, and hazardous areas identification. Participants will gain a better understanding of electrical power systems in oil and gas facilities.

COURSE CONTENT:

- Fundamentals of insulation and conduction
- Direct current, alternating current
- Transformers power and instrument
- Motors induction and synchronous
- Power distribution
- System protection and coordination
- Standby power systems
- Power generation
- Variable speed drive principles
- Grounding, bonding, and electrical safety
- Hazardous area identification

TARGET AUDIENCE:

Those facilities personnel who interface with facility electrical power systems, including project engineers, operation leads, instrumentation, controls personnel, and electrical engineers who are new to electrical power systems within oil and gas facilities.

Electrical Engineering I - M124V (for Shell employees only)

FOUNDATION: 10 DAYS M124V

This course is the first technical electrical course in the professional development program for Shell Electrical Engineers. It has been developed through a collaboration with Shell and PetroSkills and is focused on getting electrical engineers up to speed with the essential principles of electrical safety, system design and maintenance. Additionally, this course introduces the participants to the critical elements of relevant Shell DEPs that they will use in their daily work. The course focuses on foundational concepts rather than regional code and standard requirements, but does cover common international (IEC, EN, BS, etc.) and North American (NEC, IEEE) standards related to design and safe operation. This intensive program is held over 10 8-hour sessions in two weeks and has been designed to be delivered virtually. As such, the expectation is that participants fully engage online, ask and answer questions posed in the course and participate in meaningful discussions related to the concepts, implications, and application of the concepts. A sample project will be completed in phases throughout the course, giving the participants an opportunity to work with their peers in solving typical design challenges and applying concepts and Shell standards. Offline time will be allotted before, during, and after the course to allow participants to complete assignments at their own pace. At the end of the course, participants will complete a formal written final exam, and must pass or remediate the exam to receive credit for the course.

COURSE CONTENT:

- Electrical Safety
- Principles of Electrical Design
- Hazardous Locations
- Earthing (Grounding) and Bonding
- Initial System Design Fundamentals
- Initial Electrical System Studies (Fault, Load Flow, Voltage Dip, Voltage profile, etc.)
- Cables and Cable Sizing
- Switchgear
- Transformers
- Motors
- Variable Speed Drives
- Battery and UPS Systems
- Basic Principles of Protection (Selection, Coordination, Protective Relay Systems
- Generators and Prime Movers
- Electrical Maintenance Aspects

TARGET AUDIENCE:

This course has been designed for Electrical Engineers with a bachelor's or master's degree (or equivalent) in electrical engineering and 1-3 years' experience on the job and Senior Electrical and Instrument Technicians or Supervisor whose activities include work on electrical equipment in refineries, gas and chemical plants or oil field installations. It is assumed that participants will come to the course with academic background in the fundamentals of AC and DC electricity, 3-phase power systems, basic electrical mathematic principles (Ohm's Law, Kirchhoff's laws, etc.), phasor math, basic understanding of the role of common industrial power system equipment and components (Substations, Generators, transformers, switchgear, protective devices, cables, conduit, etc.). Basic knowledge of Shell internal systems including locating Shell and Industry standards is expected. It is beneficial if students have some practical experience working in industrial facilities so that they can understand the context of the material presented. This course will be held in English. Participants should be fluent in English with proficiency such that they can participate in technical discussions.

Instrumentation and Controls Fundamentals for Facilities Engineers

FOUNDATION: 5 DAYS IC-3

This course applies fundamental instrumentation and control engineering principles to oil and gas facilities design and operation, and is designed to accelerate the development of new Facilities Instrumentation and Control Engineers. Through the use of individual and group problem solving, attendees will learn about field measurement devices, valves and actuators, documentation, programmable logic controllers, power supplies, PLC, SCADA, DCS, SIS, hazardous areas, and installation methods. "Thanks for the great instruction in the IC-3 course. I am currently completing the installation of some fancy instruments that required me to pull fiber optic cable for the first time. Thanks to your instruction, I was able to more actively plan and oversee the installation than I have in the past. I think I surprised myself with some of the information I retained, and our instrument techs were happy to have someone in our group (all process engineers) who could at least attempt to speak their language. If I'm not careful, I'm likely to get all the instrumentation projects that come to our little research plant. Thanks!" - Process Engineer

COURSE CONTENT:

- Fundamentals of control signals and wiring
- Control system basics
- Field measurement devices
- Control and shutdown valves
- Programmable electronic systems (PLC, DCS, SIS, SCADA)
- Control system networking
- Instrumentation and control strategies for common oil and gas equipment
- Installation and infrastructure requirements
- Drawings and documentation for IE&C projects
- Hazardous area installations

TARGET AUDIENCE:

Facilities and Project Engineers as well as newly graduated Electrical, Controls and Instrument Engineers (0-5 years) with a need to improve basic understanding of instrumentation and control systems within oil and gas facilities.

National Electrical Code (NEC) Workshop for Industrial Applications

FOUNDATION: 3 DAYS E-31

This 2.5 day workshop style course is intended to provide a working knowledge of the US National Electrical Code (NEC, NFPA 70) specifically for industrial applications, including oil and gas facilities which include hazardous (explosive) atmospheres. The course includes a Workbook for the participants to actively explore the NEC Handbook, and apply requirements to an actual mock project based on a one-line diagram. The first section of the course covers important information about the scope, purpose and intent of the NEC, key definitions, how it is structured and tips and tricks for navigating the NEC Handbook. The second portion of the course uses a mock project based on a temporary power project, and walks the participant through determination of load, minimum conductor ampacity, conductor sizing, overcurrent protection selection, rounding and neutral conductor sizing, and conduit and cable tray sizing. Topics are handled by explaining underlying principles and concepts to better prepare the participants for interpreting the intent of various code sections, rather than simple "cookbook" approach which may compromise cost, efficiency, operability or safety.

In addition to a course workbook, and copies of the presentation, additional reference material related to industrial installations is provided including; an infographic relating code articles to a one-line diagram, a "code digest" of the most commonly used articles in industrial facilities and the basic rules, a cable sizing flow chart, and solutions to all exercise will be provided.

Important note: A copy of the latest edition of the NEC Handbook (Not the Codebook) is required for this course, and not included in the registration fee. Hard copies are strongly recommended over digital editions. If you need a copy of the NEC Handbook, a genuine copy can be purchased through the NFPA website, NFPA.org. Note that copies purchased through Amazon.com are often counterfeit, of poor print and binding quality, and include some printing errors. It is recommended that you purchase through NFPA directly, or a known reputable reseller.

COURSE CONTENT:

- Introduction and Overview of the NEC
- Navigating the NEC
- Key Definitions
- Working Space and Egress
- Refresher on Electrical Math and 3-Phase Power
- Wiring Methods overview
- Calculating Load and Minimum Conductor Ampacity
- Conductor and Cable Construction
- Conductor Sizing
- Overcurrent Protection
- Grounding and Bonding
- Conduit Fill
- Cable Tray Fill
- Hazardous Locations
- Temporary Installations

TARGET AUDIENCE:

Electrical designers, engineers and others involved in the design of industrial facilities. Electrical crafts personnel who may plan and execute small projects, or temporary power installations within existing installations.



Power System Design Fundamentals for Electrical Engineers

FOUNDATION: 10 DAYS E-41

This course is targeted towards early career electrical engineers in the oil and gas industry. It has been developed through a collaboration with PetroSkills Alliance member Shell Global and is focused on getting electrical engineers up to speed with the essential principles of electrical safety, power system design, studies, protection and equipment specification as well as operations support and maintenance. Additionally, this course introduces the participants to the critical elements of industry and typical company standards as well as common project execution and project assurance principles. The course focuses on foundational concepts rather than regional code and standard requirements, but does address the typical equipment, requirements and methods used in both international (IEC, EN, BS, etc.) and North American (NEC, IEEE) standards related to design and safe operation. This intensive program is typically held over 10, 8-hour sessions in two weeks, and has been designed to be delivered virtually or in-person. As such, the expectation is that participants to fully engage online, ask and answer questions posed in the course and participate in meaningful discussions related to the concepts, implications and application of the concepts. A sample project will be completed in phases throughout the course, giving the participants an opportunity to work with their peers in solving typical design challenges and applying concepts. Off-line time will be allotted prior to, during and after the course to allow participants to complete assignments at their own pace. At the end of the course the participants will complete a formal written final exam.

COURSE CONTENT:

- Electrical Safety
- Principles of Good Electrical Design
- Hazardous Locations
- Earthing (Grounding) and Bonding
- Initial System Design Fundamentals
- Initial Electrical System Studies
- Cables and Cable Sizing
- Switchgear
- Transformers
- Motors and Motor Starting
- Variable Speed Drives
- Generators and Prime Movers
- Battery and UPS Systems
- Basic Principles of Protection
- Heat Tracing Systems (Optional Content)
- Lighting Systems (Optional Content)
- Final Exam

TARGET AUDIENCE:

This course has been designed for Electrical Engineers with a bachelor's or master's degree (or equivalent) in electrical engineering and 1-3 years' experience on the job and Senior Electrical and Instrument Technicians or Supervisor whose activities include work on electrical equipment in refineries, gas and chemical plants or oil field installations. It is assumed that participants will come to the course with academic background in the fundamentals of AC and DC electricity, 3 phase power systems, basic electrical mathematic principles (Ohm's Law, Kirchhoff's laws, etc.), phasor math, basic understanding of the role of common industrial power system equipment and components (Substations, Generators, transformers, switchgear, protective devices, cables, conduit, etc.). Basic knowledge of locating Company and Industry standards is expected. It is beneficial if students have some practical experience working in industrial facilities so that they can understand the context of the material presented. This course will be held in English. Participants should be fluent in English with proficiency such that they can participate in technical discussions.

Flow and Level Custody Measurement

INTERMEDIATE: 5 DAYS IC-73

This course is designed to acquaint users with the problems and solutions for high accuracy transfer of liquid and gas petroleum products from supplier to customer. These needs have been brought about by major changes in manufacturing processes and because of several dramatic circumstantial changes such as: the increase in the cost of fuel and raw materials; the need to minimize pollution; and the increasing pressures being brought to bear to adhere to the requirements for health and safety.

COURSE CONTENT:

- Fluid mechanics
- Flowmeter classification
- Uncertainty analysis
- Flow measurement
- Turbine
- Positive displacement
- Ultrasonic flowmeters
- Coriolis mass flowmeters
- Level measurement
- Buoyancy tape systems
- Hydrostatic pressure
- Ultrasonic measurement
- Radar measurement
- Flow calibration
- Terminal custody transfer
- Tank management systems
- Lease automatic custody transfer
- Truck and rail custody transfer
- Pipeline considerations
- Fugitive emissions
- Leak detection
- Real time transient model
- Loss control systems
- Custody transfer sampling
- Monitoring and controlling production losses
- Physical leaks
- Meter prover performance
- API standards
- Measuring the suspended S&W content
- Calculating net volume
- Flowmeter selection and costs
- Initial considerations
- Meter selection
- Properties and measurement of NGL, LPG, and LNG

TARGET AUDIENCE:

This workshop is specifically tailored for any personnel who are, or will be, responsible for designing, selecting, sizing, specifying, installing, testing, operating, and maintaining instrumentation related to the field of custody level and flow transfer measurement. This could include facilities, process, chemical, electrical, instrumentation, maintenance, and mechanical engineers and technicians.

Practical PID Control and Loop Tuning

INTERMEDIATE: 5 DAYS IC-74

This workshop provides instrumentation, automation, and process engineers and technicians with the basic theoretical and practical understanding of regulatory control systems and how this can be applied to optimize process control in terms of quality, safety, flexibility, and costs. Centered on the ISA-recommended PC-Control LAB simulator, participants will learn through active participation using exercises, questionnaires, and a series of 16 practical simulation sessions covering: process reaction; tuning methods; diagnostic tools; effect of different algorithms; surge tank level control; analysis of such problems as valve hysteresis, stiction and non-linearities and the impact on controllability; and integral windup.

COURSE CONTENT:

- Basic process considerations
- Process lag, capacitance, and resistance
- Process reaction curve
- 1st and 2nd order reactions
- Instrumentation cabling
- Filtering
- Aliasing
- Reaction masking
- Sensor placement
- Correct PV
- Effect of span
- Inherent and installed valve characteristics
- Actuators
- Valve positioners
- Testing procedures and analysis
- ON/OFF control
- Proportional control
- Proportional offset
- Reset
- Integral action and windup
- Stability
- Derivative action
- PID control
- Control algorithms
- Load disturbances and offset
- Speed, stability, and robustness
- Open loop reaction curve tuning method (Ziegler-Nichols)
- Default and typical settings
- Closed loop continuous cycling tuning method (Ziegler-Nichols)
- Fine tuning
- "As found" tuning
- Surge tank level control
- Split/parallel range control
- Cascade systems
- Feed-forward and combined systems
- Ratio control
- System integration

TARGET AUDIENCE:

Instrumentation, automation, and process engineers and technicians involved in specifying, installing, testing, tuning, operating, and maintaining regulatory PID control systems.

Overview of Offshore Systems

BASIC: 5 DAYS OS-21

This five-day course will accelerate the learning and productivity of individuals with little to no experience working in the offshore oil and gas industry. The course provides an overview of field development concepts and explains how offshore structures and facilities function as integrated systems. The content includes the full range of water depths from shallow water to ultra-deepwater. All major components required for offshore developments such as fixed and floating platforms, drilling and workover rigs, pipelines, risers, process and utilities and construction equipment are discussed. The importance of life-cycle considerations during development planning is emphasized. Individual and group exercises, including a case study, are used throughout the course. The course instructors are experienced offshore managers.

COURSE CONTENT:

- Field development concepts, fixed and floating
- Subsea systems
- Wells, construction and servicing
- Topsides facilities; processing; utilities
- Oil and gas transportation systems, design and installation
- Production operations
- Offshore construction; equipment
- Fabrication; transportation; integration; installation project management
- Life-cycle considerations, including decommissioning

TARGET AUDIENCE:

Technical staff, business professionals, technicians, analysts and other non-technical staff who are involved but have limited experience, or will be involved, with offshore oil and gas facilities. The course provides a basic understanding of offshore systems in all water depths, from shallow to ultra-deepwater, including design, construction, and operations.



Overview of Subsea Systems

BASIC: 5 DAYS

SS-2

An overview of subsea components and how they are integrated into field architecture is provided during this five-day course. Individuals will develop a basic understanding of the various subsea components used in all water depths, from shallow to ultra-deep water. The participants job productivity will be accelerated by learning how the components are combined and integrated into subsea field developments. Installation and flow assurance are emphasized as key drivers in subsea design. The course emphasizes a systems approach to design. Individual and group exercises are used throughout the course, including a case study to develop field architecture recommendations, basic component selection, and high level project execution plans for a subsea development. Course instructors are experienced offshore managers.

COURSE CONTENT:

- Applications for subsea systems
- Flow assurance considerations in system design and configuration
- Field architecture considerations
- Subsea component descriptions and functions
- Fabrication, testing, installation, commissioning, and operational issues
- Production, maintenance, and repair considerations

TARGET AUDIENCE:

Technical staff who are beginning or transitioning into the design, construction, and operation of subsea systems. Non-technical staff working with a subsea development team will benefit by developing an awareness of subsea systems.

Corrosion Management in Production/Processing Operations

FOUNDATION: 5 DAYS

PF-22

This comprehensive course will cover the main causes of corrosion in upstream oil and gas operations, as well as monitoring and mitigation methods. The various corrosion mechanisms give rise to a number of different forms of corrosion damage, which will all be considered. Participants will learn about the different aspects that make fluid corrosive, what enhances corrosion rates, and how to estimate corrosion rates of a given environment through analysis of the chemical and physical characteristics of the system; review approaches to selecting materials and coatings for corrosion resistance for different conditions and applications (including the use of NACE MR0175/ISO 15156); and be introduced to cathodic protection systems and (CP) surveys, coating systems, and many other corrosion mitigation techniques. The participant will learn how to select and utilize corrosion inhibitors for different systems, and how to select and apply corrosion monitoring techniques to create an integrated monitoring program. The course content is based on a field facilities engineering point of view, as opposed to a more narrowly-specialized corrosion engineering or chemistry viewpoint. It provides an appropriate balance of necessary theory and practical applications to solve/mitigate corrosion-related problems. By the end of the course, work techniques to manage corrosion will have been presented: causes, assessment, identification, equipment integrity, and corrosion mitigation.

COURSE CONTENT:

- Fundamentals of corrosion theory
- Major causes of corrosion (O₂, CO₂, H₂S, microbologically influenced corrosion)
- Forms of corrosion damage
- Materials selection
- Protective coatings and linings
- Cathodic protection
- Corrosion inhibitors
- Corrosion monitoring and inspection
- Corrosion in gas processing facilities
- Corrosion in water injection systems
- Corrosion management strategy and life-cycle costs

TARGET AUDIENCE:

Managers, engineers, chemists, and operators who need to understand corrosion and its control management in oil and gas production and processing.

Fundamentals of Offshore Systems Design and Construction

FOUNDATION: 10 DAYS

OS-4

This 10-day course provides a fundamental understanding of the technology and work processes used for the design and construction of all types of offshore systems, including consideration of asset development, surveillance, and management. The content includes the full range of water depths from shallow water to ultra-deep water and addresses life-cycle considerations in all phases of offshore field development and operation. All major components required for offshore developments, such as fixed and floating platforms, drilling rigs, workover equipment, pipelines, risers, process, and utilities and construction equipment are discussed. Emphasis is placed on the multi-discipline team approach needed to manage the myriad of interfaces of offshore facility design, construction, and operations. Individual and group exercises are used throughout the course. A case study for an offshore project development is included.

COURSE CONTENT:

- Offshore systems overview and field architecture selection
- Well construction and servicing equipment and operation
- Flow assurance
- Topsides facilities
- Oil and gas transportation facilities
- Riser systems
- Subsea systems
- Production operations
- Infrastructure impact on design and operations
- Effects of the ocean environment
- Introduction to naval architecture
- Structural design processes and tools
- Construction plans and execution
- Project management lessons learned
- Life-cycle and decommissioning considerations

TARGET AUDIENCE:

Individuals with a basic awareness of or experience in offshore engineering and operations. Technical staff, project engineers, engineering discipline leads, engineering specialists, and operating staff find that this course accelerates their capability to contribute on offshore field development planning, design, and construction projects and field operations.

Fundamentals of Pump and Compressor Systems

FOUNDATION: 5 DAYS

ME-44

This is an intensive course providing a comprehensive overview of pumps and compressor systems. The focus is on equipment selection; type, unit, and station configuration; and integration of these units in the process scheme and control strategy in upstream and midstream oil and gas facilities. The material of the course is applicable to field production facilities, pipelines, gas plants, and offshore systems.

Disclaimer

This course requires modifications for the Greenhouse Gas Management discipline. Visit the website and click the "Request In-House Training" button for more details

COURSE CONTENT:

- Types of pumps, compressors, and drivers, and their common applications and range of operations
- Evaluation and selection of pumps and compressors, and their drivers for long-term efficient operations
- Unit and station configuration including multiple trains in series and/or parallel operations
- Integration with upstream and downstream process equipment, local and remote control systems, and facilities utilities
- Key auxiliary systems including monitoring equipment, heat exchangers, lube and seal systems, and fuel/power systems
- Major design, installation, operating, troubleshooting, and maintenance considerations

TARGET AUDIENCE:

Engineers, senior technicians, and system operators designing, operating, and maintaining pump and compressor systems in oil and gas facilities.



Mechanical Specification of Pressure Vessels and Heat Exchangers

INTERMEDIATE: 3 DAYS ME-43

This five day, intermediate level course for facility engineers and project engineers reviews the key areas associated with the mechanical design of pressure vessels for oil and gas facilities. The course is focused on vessels built in accordance to ASME VIII Div 1, considering material selection, key design calculations, and manufacturing processes. The course is not aimed at process engineers sizing equipment (PF-42 covers these elements), although a brief review of the sizing correlations is included. The course is delivered from the perspective of a vessel fabricator to better understand the dos and don'ts of ideal mechanical specification of pressurized equipment by owner/operators, in order to optimize material utilization and minimize construction costs.

COURSE CONTENT:

- Vessel codes and standards (ASME B&PV Code, TEMA, API)
- Vessel material selection, corrosion mechanisms, heat treatment, and basic metallurgy
- Essential design calculations for vessels
- Welding process overview and inspection requirements
- Constructability and operability considerations
- Vessel integrity, evaluation, and re-purposing of pressure-containing equipment according to API/ASME

TARGET AUDIENCE:

Mechanical, facilities, construction, or project engineers and plant piping/vessel designers who are involved in the specification and purchasing of pressure vessels and other pressure-containing equipment for oil and gas facilities.

Piping Systems - Mechanical Design and Specification

INTERMEDIATE: 5 DAYS ME-41

This intermediate level course for engineers and piping system designers reviews the key areas associated with the design of piping systems for oil and gas facilities. The course is focused on four areas: codes and standards, pipe materials and manufacture, piping components, and piping layout and design. Applicable piping codes for oil and gas facilities (ISO, B31.3, B31.4, B31.8, etc.), pipe sizing calculations, pipe installation, and materials selection are an integral part of the course. The emphasis is on proper material selection and specification of piping systems.

COURSE CONTENT:

- Piping codes and standards (ANSI/ASME, API, ISO)
- Pipe materials and manufacturing
- Basic pipe stress analysis methods
- Valves and actuators
- Welding and non-destructive testing
- Line sizing basics (single-phase and multiphase flow)
- Pipe and valve material selection
- Piping layout and design
- Manifolds, headers, and flare/vent systems
- Non-metallic piping systems
- Operations and maintenance considerations of facilities and pipelines

TARGET AUDIENCE:

This PetroSkills training course is ideal for mechanical, facilities, plant, or pipeline engineers and piping system designers who are involved in the design of in-plant piping systems for oil and gas facilities.

Pumps and Pumping Systems

INTERMEDIATE: 3 DAYS ME-21

This is an intensive course providing a comprehensive overview of pumps and pumping systems. The focus is on equipment selection; type, unit, and station configuration; and integration of these units in the process scheme and control strategy in upstream and midstream oil and gas facilities. The material of the course is applicable to field production facilities, pipelines, gas plants, and offshore systems.

COURSE CONTENT:

- Types of pumps, compressors, and drivers, and their common applications and range of operations
- Evaluation and selection of pumps and compressors, and their drivers for long-term efficient operations
- Unit and station configuration including multiple trains in series and/or parallel operations
- Integration with upstream and downstream process equipment, local and remote control systems, and facilities utilities
- Key auxiliary systems including monitoring equipment, heat exchangers, lube and seal systems, and fuel/power systems
- Major design, installation, operating, troubleshooting, and maintenance considerations

TARGET AUDIENCE:

Engineers, senior technicians, and system operators responsible for and involved in design, operation, and maintenance of pumping systems in oil and gas facilities.

Compressor Systems - Mechanical Design and Specification

SPECIALIZED: 5 DAYS ME-46

This 5-day, specialized level course is for facility design engineers, operations engineers, and technicians seeking an in-depth understanding of centrifugal, reciprocating, and screw compressors. This course provides basic knowledge of compressor types and associated auxiliary systems, mechanical design of equipment, operating and performance characteristics, control and monitoring systems, maintenance practices, and codes and standards.

COURSE CONTENT:

- Types and application of compressors
- Selection criteria of dynamic and positive displacement compressors
- Compressor thermodynamics and operating characteristics
- Performance curves and off-design evaluations
- Key compressor components and other auxiliary systems
- Equipment specifications
- Compressor controls and monitoring devices
- Driver and gear involvement
- Installation, operation, maintenance practices, and troubleshooting
- Economic considerations

TARGET AUDIENCE:

Mechanical, facilities, plant, or pipeline engineers and technicians needing an in-depth understanding of the different types of compressors.



Offshore Pipeline Design and Construction

FOUNDATION: 5 DAYS PL-43

This intensive 5-day foundation level course covers the principal aspects of design, construction, and operations of offshore pipeline systems. The course focuses on pipeline mechanical, strength, and stability design, and construction. Special challenges, such as shoreline crossings, foreign pipeline crossings, repair methods, flow assurance, corrosion control and cathodic protection are an integral part of this course. Participants will acquire the essential knowledge and skills to design, construct, and operate pipelines. Design problems and team projects are part of this course.

COURSE CONTENT:

- Overview of oil and gas transportation systems
- Review pipeline hydraulics, focusing on those aspects that affect design, construction, and operations
- Pipeline systems definition, survey, and route selection
- Safety, environmental, and regulatory considerations, focusing on Codes and Standards related to pipelines
- Pipeline conceptual and mechanical design for strength, stability and constructability
- Pipeline materials and components selection including line pipe, corrosion and cathodic protection, and coatings
- Specialized equipment and materials for integrating with subsea wellhead/manifold systems, side taps, insulation, and pipe-in-pipe
- Special design and construction considerations for risers and umbilicals, foreign pipeline crossings, single point moorings, and shore approaches
- Introduction to flow assurance considerations and pipeline integrity aspects including in-line inspection, leak detection and emergency planning considerations
- Pipeline operations, maintenance and repair considerations and their impact on design and material selection

TARGET AUDIENCE:

Engineers, designers and operators who are actively involved in the design, specification, construction, and operation of offshore pipeline systems.

Onshore Pipeline Facilities - Design, Construction and Operations

FOUNDATION: 5 DAYS PL-42

Successful onshore pipeline businesses require personnel competent in fully integrated approaches to evaluation, planning, design, construction, operations, and asset integrity management. This intensive, 5-day foundation level course explores best practices for developing and maintaining pipeline systems that maximize life cycle reliability; employee, public, and environmental safety; and cost effectiveness. Design and team exercises are an integral part of this course.

COURSE CONTENT:

- Regulations and code compliance requirements
- Pipeline survey and routing
- Mechanical and hydraulic design
- Proper system sizing and design
- Equipment selection criteria
- Facilities sites and design concern
- Construction methods and contracting approaches
- Operations and asset integrity management

TARGET AUDIENCE:

Pipeline project managers and engineers, operations and maintenance supervisors, regulatory compliance personnel, and other technical professionals with 1-3 years of experience in natural gas, crude oil, refined petroleum products, LPGs, NGL, chemical, carbon dioxide pipeline engineering, construction, operations, or maintenance. This course is intended for participants needing a broad understanding of the planning, development, construction, start-up, and operating and asset integrity management of onshore pipelines.

Terminals and Storage Facilities

FOUNDATION: 5 DAYS PL-44

This 5-day, foundation level course reviews key issues associated with development, design, construction, and operation of terminals and storage facilities for liquid hydrocarbons and NGLs. The course focuses on six areas: Terminal codes and siting constraints Terminal design and equipment layout Types of storage and selection criteria Design considerations for loading racks, fire protection, vapor recovery, blending equipment, and water treatment Detailed design of storage tanks, vessels, and caverns Operations and maintenance Safety, quality control, system reliability, availability, and regulatory compliance are integrated throughout the course. Case studies and team exercises are used to reinforce key points.

COURSE CONTENT:

- Sizing criteria and economics for storage and terminal facilities
- Various storage types (atmospheric storage tanks, pressure vessels, salt or rock caverns) and appropriate applications
- Terminal and tank farm layout constraints
- Details of industry codes and standards, plus regulatory and environmental compliance
- Selection of equipment for delivery and receipt to/from pipelines, barges and ships, trucks, and rail, including metering options, loading arms, pumps, and control systems
- Blending options and equipment, VRU/VCU, water treating, and fire protection
- Key factors affecting safety, product quality, system reliability, and profitability in design, construction, and operations
- Atmospheric storage tank design, layout, construction, corrosion prevention, and operations covering API 650 and API 653
- Overview of pressure vessel and sphere design and construction
- Design, development, and operation of underground cavern storage facilities

TARGET AUDIENCE:

Project managers, engineers, operations and maintenance supervisors, and regulatory compliance personnel with 1-3 years of experience in planning, engineering, constructing and/or operating terminals and storage facilities for hydrocarbon liquids, NGLs, and petrochemical feedstocks. This course is for participants needing a foundation level understanding of the planning, engineering, construction, operations, and maintenance of storage and terminals connected to pipelines, rail, barges/tankers and/or truck loading facilities.

Choosing the Right Facilities Equipment for the Reservoir

BASIC: 5 DAYS PF-3

This course is similar to Introduction to Oil and Gas Production Facilities (PF-2), but is presented in the context of concept selection and front-end field development planning.

Disclaimer

This course requires modifications for the Carbon Sequestration discipline. Visit the website and click the "Request In-House Training" button for more details

COURSE CONTENT:

- Reservoir types, fluid properties, and typical product specifications
- Flowlines, gathering systems, flow assurance, and production separation
- Oil dehydration and stabilization
- Produced water treating and water injection systems
- Gas handling, including compression, dehydration, and sweetening
- The effect of artificial lift systems, and secondary and tertiary recovery projects
- Midstream facilities - gas processing, pipelines, product storage, and LNG
- Other facility considerations - utility systems, process safety and asset integrity, and environmental regulations

TARGET AUDIENCE:

This course is intended for those working on field development teams, as well as those who need to better understand how surface facilities are selected and how subsurface characteristics affect facility design and specification.



Introduction to Oil and Gas Production Facilities

BASIC: 3 DAYS PF-2

This course provides a versatile overview of oil and gas production facilities. The primary focus is on the different types of production facilities, the processes utilized, and the key equipment involved. The topics cover an overview of the oil and gas industry, hydrocarbon phase behavior characteristics, and various reservoir types. It also addresses product specifications and the processes used to meet them. Additional considerations include process safety and downstream processing, which may impact the selection and operation of production facilities.

Disclaimer

This course requires modifications for the Carbon Sequestration discipline. Visit the website and click the "Request In-House Training" button for more details

COURSE CONTENT:

- Overview of the oil and gas industry
- Overview of qualitative phase behavior and reservoirs
- Important hydrocarbon properties and terminology
- Typical sales/disposal specifications
- Flowlines, piping and gathering systems
- Production separation
- Oil processing
- Water injection systems (including pumps)
- Gas handling - compression
- Gas handling - dehydration
- Measurement and storage
- Other facilities considerations - utilities, process safety
- Midstream facilities - gas processing
- Midstream facilities - pipelines
- Midstream facilities - LNG

TARGET AUDIENCE:

Those interested in an overview of production facilities, including subsurface professionals, related engineering disciplines such as IC&E and mechanical, line managers, sales or business development staff, environmental personnel, operations staff, and those new to the industry, such as entry-level (1-2 year) engineers.

Oil Well Pad Facilities (for non-Facilities Engineers)

BASIC: 3 DAYS OWPF-nFE

This course provides a comprehensive overview of onshore oil well-pad facilities as typically utilized for the development of shale/tight oil fields. The course is focused on the purpose, function, and operation of the facilities - what, why, how - not on the more detailed engineering aspects which are covered in a companion course OWPF-FE (for Facilities Engineers). A major aspect of the non-Facilities Engineers course is how the pad facilities integrate with the wells/subsurface and also the product (oil, gas, produced water) export systems. This course does not contain many calculations; instead the intent is to generate discussion and better understanding of the issues involved with design, operation, and maintenance of the pad facilities and their role in providing value to the development as a whole.

COURSE CONTENT:

- Engineering drawings
- Oil well pad process flow diagrams
- Well production characteristics
- Fluid compositions and properties
- Separation equipment
- Oil treating
- Oil stabilization
- Storage tanks and vapor recovery
- Facility piping systems
- Compressors
- Sand handling
- Produced water handling
- Flow measurement

TARGET AUDIENCE:

This course is aimed primarily at non-Facilities Engineers, e.g. production/reservoir engineers, operations personnel, environmental staff, etc., or anyone who needs a basic understanding of oil well pad facilities - what they do and how they work.

Applied Water Technology in Oil and Gas Production

FOUNDATION: 5 DAYS PF-21

This course provides an overview of the main water handling systems typically encountered in upstream (E&P) production operations, both onshore and offshore. The chemistry of the main water-related problems of mineral scales, corrosion, bacteria, and oily water will be reviewed both from the theoretical and practical aspects. Produced water treatment equipment and typical water quality specifications as well as water injection and disposal systems will be reviewed. An exercise will be given to identify typical system problems and to apply the knowledge gained to propose solutions. Emphasis will be placed on understanding and resolving operational problems in process equipment.

COURSE CONTENT:

- Water chemistry fundamentals
- Water sampling and analysis
- Water formed scales
- Corrosion control
- Water treatment microbiology
- Produced water discharge/disposal and treatment principles
- Produced water treating equipment - theory of operation, advantages and disadvantages, and the importance of oil droplet size
- Water injection and disposal systems - theory of operation, corrosion, scale, and biological control
- Case study

TARGET AUDIENCE:

Managers, engineers, chemists, and operators needing to understand water-related problems in oil and gas production and their solutions.

Fundamental and Practical Aspects of Produced Water Treating

FOUNDATION: 5 DAYS PF-23

This course covers topics related to Produced Water Treatment in upstream oil and gas operations. Produced water composition and physical properties are covered. Water quality requirements for various disposal methods are addressed, including onshore surface discharge, offshore discharge to sea, and reinjection for disposal or waterflood. Regulatory requirements and analytical methods used to monitor and ensure regulatory compliance are discussed. Treatment technology is presented along with practical considerations for selecting and operating typical water treatment equipment. Representative process flow diagrams illustrate equipment selection, design features, layout, and processes. Chemical treatment options are also considered.

COURSE CONTENT:

- Introduction to water treatment technology and issues
- Produced water chemistry and characterization
- Defining and characterizing emulsions that impact water quality and treatment
- Water quality requirements for injection or surface disposal, NPDES permits, analytical methods
- Primary water treatment technologies - separators, hydrocyclones, and CPIs
- Secondary water treatment - induced gas flotation
- Tertiary water treatment technologies - media and membrane filtration
- Chemicals and chemical treatment
- Diagnostic testing and in-field observations
- Diagnosing and resolving water treatment issues based on actual field experiences

TARGET AUDIENCE:

Managers, engineers, chemists, and senior operations personnel responsible for designing, operating, and maintaining facilities that process and manage produced water. This course will provide participants with an understanding of the technical aspects required to select, design, maintain, and troubleshoot produced water equipment.



Fundamentals of Process Safety

FOUNDATION: 5 DAYS PS-2

The course will cover the fundamentals of Process Safety for all staff levels of processing facilities in the upstream and downstream oil, gas, and petrochemical industry. To identify how different disciplines and roles can have an impact on Process Safety performance, there is a rolling case study (Project COLEX) throughout the course that involves the installation of a separator vessel. The associated Process Safety considerations and implications are explored and discussed at the various stages, from design to full operation.

COURSE CONTENT:

- Business context for Process Safety
- Risk assessment (hazard identification, hazard scenarios, consequence and likelihood analysis, and risk analysis and tools and techniques)
- Risk reduction measures (barriers)
- Management of process safety in operations (operating procedures, design and operating limits, human factors, inspection and maintenance, and emergency response)
- Management of change
- Learning from previous incidents and near misses
- Self-verification and measurement
- Process safety key performance indicators
- Management review and auditing
- Process safety leadership (governance and culture)

TARGET AUDIENCE:

The course will benefit all staff associated with the operation, maintenance, and governance in production and processing facilities. It is relevant to roles, including senior management, project and engineering support teams, HSE support, supervisors, and operator and maintenance technicians. An understanding is provided of the design basis and essentials for safe operations, without addressing the more detailed calculation aspects covered in Process Safety Engineering PS-4.

Oil Production and Processing Facilities

FOUNDATION: 10 DAYS PF-4

This course delves into the upstream and downstream aspects of oil production and transportation. It covers various reservoir types, product characterization, wellhead and artificial lift operations, gathering systems, crude oil treating facilities to meet product specifications, and transportation to refineries where refined products are manufactured. It discusses both onshore and offshore facilities, including produced water treating and water injection systems. Solution gas handling processes and equipment are covered at a high level. In addition to the engineering aspects, the course addresses practical operating problems such as emulsion treatment, sand handling, and dealing with wax and asphaltenes. Exercises requiring calculations are included throughout. This course is intended to complement the G-4 Gas Conditioning and Processing course, which focuses on the gas handling side of upstream oil and gas facilities.

COURSE CONTENT:

- Overview of Reservoir Engineering for Facilities Operations
- Gas, Oil, and Water Composition and Properties
- Oil Gathering Systems
- Gas-liquid Separation
- Oil-Water Separation
- Oil Treating and Desalting
- Oil Stabilization, Sweetening, Storage, and VRU Crude
- Flow Assurance for Surface Facilities
- Transportation of Crude Oil
- Produced Water Treatment
- Water Injection Systems
- Overview of Solution Gas Handling

TARGET AUDIENCE:

Process/facilities engineers and senior operating personnel involved with the design and operation of oil and produced water processing facilities.

Oil Well Pad Facilities (for Facilities Engineers)

FOUNDATION: 5 DAYS OWPF-FE

This course is focused on onshore well-pad facilities that are typically used for the development of shale/tight oil fields. The course starts with the review of typical well-pad facility process flow diagrams (PFDs) and the considerations involved in selecting a suitable PFD for the given conditions. Variations on the different PFDs are evaluated and their applications, pros and cons discussed. The main equipment types utilized are reviewed with focus on selection and sizing. A key aspect of this course is understanding the interfaces between the producing wells, the well-pad facility, and the gas, oil, and produced water export systems. Numerous exercises and calculations will be utilized throughout the course to develop solid understanding and competence level in the areas covered. This course differs from the OWPF-NFE (Non-Facilities Engineers) course in that it is longer, goes into more detail in the subject areas, and is focused on facilities engineering aspects and calculations. ** This course has some overlap of content with PF-4 Oil Production & Processing Facilities which is a 10-day Intermediate level course. PF-4 is broader in scope, covers onshore and offshore facilities and goes into more detail in certain areas. OWPF-FE is more narrowly focused on onshore oil well-pad facilities.**

COURSE CONTENT:

- Oil well-pad process flow diagrams
- Well production characteristics
- Fluid compositions and properties
- Separation equipment
- Oil treating
- Oil stabilization
- Storage tanks and vapor recovery
- Facility piping systems
- Relief and flare systems
- Compressors
- Sand handling
- Produced water handling
- Flow measurement

TARGET AUDIENCE:

This course is aimed primarily at Facilities Engineers but would also be suitable for senior operations personnel involved with design and operation of onshore oil well-pad facilities. It is not an engineering discipline-specific course but instead covers multiple aspects of pad facilities. OWPF could also be used for cross-training of more specialized discipline engineers to provide them with a better understanding of how the various pad facilities components integrate and act together.

Process Safety Engineering

FOUNDATION: 5 DAYS PS-4

PS-4 is a one week, competency driven, fundamental (more than awareness, less than skilled practice) course covering the broad scope of process safety engineering. Other topics relevant to process safety are introduced, showing how process safety engineering fits into the broader context of risk management and process safety management, but the emphasis is on the technical content. While many of the examples are drawn from upstream and midstream oil and gas facilities, the principles are applicable across the hydrocarbon processing industries. Topics covered include risk analysis, inherently safer design, process hazards analysis, layers of protection analysis, historical incident databases, leakage and dispersion, combustion behavior, sources of ignition, specific systems and equipment ("bad actors"), layout and spacing, relief and flare, corrosion and materials selection, monitoring and control, safety instrumented systems, and fire and explosion principles. Several of these topics, suitable for one week fundamental courses in themselves, are discussed as they relate to process safety. PS-4 introduces these topics in sufficient depth such that participants will be able to go deeper into any aspect of process safety engineering as and when they need to do so. The course is designed to accelerate the participants process safety learning curve. Serious process safety incidents occur somewhere in the industry nearly every week, and few if any are new; essentially the same ways of going wrong are found repeatedly, in different operating contexts. One of the main objectives of PS-4 is to develop knowledge of the more common ways of going wrong, and one of the ways of doing that is discussion of major incidents, including some of those that have affected our regulatory environment. PS-4 graduates should be able to see their facilities and projects with a new perspective, a new sense of not only how things work, but also of how things fail. They will also have an appreciation of the reasons for some of our process safety practices and regulations, which will contribute to more consistent and better reasoned application of them. Jesse Ducommon wrote in the late 1960s that we need to learn from the experiences of others rather than learning the hard way. We are still learning the hard way, and the human, financial, and environmental cost of doing so is both exorbitant and largely unnecessary. PS-4 is a very useful contribution to reducing those costs.

COURSE CONTENT:

- Historical incidents and problem areas
- Risk analysis basics
- Process hazards analysis techniques - overview
- Layers of protection
- Inherently safer design
- Hazards associated with process fluids
- Leakage and dispersion of hydrocarbon releases
- Combustion behavior of hydrocarbons
- Sources of ignition
- Hazards associated with specific plant systems
- Plant layout and equipment spacing
- Pressure relief and disposal systems

TARGET AUDIENCE:

Anyone who needs to work with process safety engineers; this would include facilities engineers, operations and maintenance supervisors, project engineers and managers, entry level process safety engineers, experienced professionals new to oil and gas, and anyone who needs a general understanding of the breadth of the process safety engineering discipline. Technical staff from insurance companies and regulatory agencies have found the course useful. Those requiring a less technical course may be interested in PS-2, Fundamentals of Process Safety; and risk-based process safety management is the subject of HS45.



Risk Based Process Safety Management

FOUNDATION: 5 DAYS HS45

This course introduces process safety management in the oil and gas industry, the elements and benefits of process safety management systems, and tools for implementing and managing a system. In this course the participant will learn to use tools and techniques for managing process safety. The Center for Chemical Process Safety's (CCPS) book titled "Guidelines for Risk Based Process Safety" or "RBPS Guidelines" will be the text for this course. Participant-centered exercises and selected case studies will be used to build on the concepts that CCPS advocates for risk based process safety. Throughout the course, participants will be challenged to think how their process safety management system can be enhanced and modified to meet the concepts of risk-based decision making. An individual action plan will be developed to apply the information from the course to the workplace.

COURSE CONTENT:

- Process safety culture and competency
- Compliance with standards
- Understand hazards and risk
- Operating procedures and safe work practices
- Asset integrity and reliability
- Management of change
- Conduct of operations
- Incident investigation (associated with plant failures)
- Measurement and metrics
- Management review and continuous improvement

TARGET AUDIENCE:

HSE professionals, operations and maintenance technicians, engineers, supervisors and project managers requiring a basic foundation in developing and managing process safety. The more technical aspects of process safety engineering are covered in PS-4, Process Safety Engineering.

Heat Transfer Equipment

INTERMEDIATE: 5 DAYS PF-43

This course reviews the selection, basic design, and operation of heat transfer equipment commonly used in the oil and gas industry, with focus on E&P production facilities. Heat transfer equipment discussed will include shell and tube exchangers, compact heat exchangers, brazed aluminum exchangers, air coolers, and fired equipment (fire-tube and direct-fired).

COURSE CONTENT:

- Heat exchanger types and applications
- Heat transfer fundamentals
- Heat exchanger basics
- Shell and tube heat exchangers
- Air cooled heat exchangers
- Compact heat exchangers (focus on plate-type)
- Brazed aluminum (plate-fin) heat exchangers
- Reboilers and condensers
- Fouling
- Fired heaters
- Fire-tube heaters
- Typical operating problems
- Typical instrumentation/control schemes

TARGET AUDIENCE:

Engineers and senior operating personnel involved in the design, specification, or operation of heat transfer equipment.

Onshore Gas Gathering Systems: Design and Operations

INTERMEDIATE: 5 DAYS PF-45

This course deals with the design, operation, and optimization of onshore gas gathering systems and their associated field facilities, from the wellhead to the central gas processing facility. From a design perspective, the main variables that impact the flexibility and operational characteristics of an onshore gas gathering system will be discussed. Typical operating problems are covered including hydrates, multiphase flow issues, corrosion, declining well deliverability, etc. Exercises will be utilized throughout the course to emphasize the key learning points.

COURSE CONTENT:

- Gas well inflow performance and deliverability
- Overview of gas well deliquification methods for low-rate, low pressure gas wells
- Effect of gathering system/abandonment pressure on reserves recovery
- Impact of produced fluids composition
- Sweet/sour
- CO2 content
- Rich/lean
- Produced water
- Hydrates and hydrate prevention
- Dehydration
- Heating
- Chemical inhibition
- Multiphase flow basics
- Corrosion/materials selection
- Gathering system layout
- Wellsite/field facilities options
- Provisions for future compression

TARGET AUDIENCE:

Production and facilities department engineers/senior operating personnel responsible for the design, operation and optimization of onshore gas gathering systems and their associated field facilities.

Relief and Flare Systems

INTERMEDIATE: 5 DAYS PF-44

This intensive course provides a comprehensive overview of relief and flare systems for oil and gas processing facilities. The course begins with the need for pressure control/overpressure protection, continues with the key engineering and design aspects including code considerations, and concludes with selecting and sizing the components of a relief and flare system. The material of the course is applicable to onshore field production facilities, pipelines, gas plants, terminals, refineries, and offshore production facilities. The use of dynamic simulations for relief load determination is discussed and demonstrated.

Disclaimer

This course requires modifications for the Carbon Sequestration discipline. Visit the website and click the "Request In-House Training" button for more details

COURSE CONTENT:

- Overview of typical relief and flare systems and key components
- Codes and standards as well as good practices typical in oil and gas facilities
- Safety implications and causes of overpressure
- Overpressure protection philosophy including source isolation and relief
- Determination of relief requirements and defining set point pressures
- Types, applications, and sizing of common relief devices
- Blowdown/depressurizing - purpose and design/operational considerations
- Design and specification considerations for relief valves and header systems, including fluid characteristics, services conditions, material selection, and header sizing
- Environmental considerations
- Radiation calculations and the impact of flare tip design
- Selection and sizing of key components: knockout and seal drums, vent/flare stack, vent/flare tips, and flare ignition systems
- Defining need and quantity of purge gas
- Flare gas recovery, smokeless flaring, and purge gas conservation
- Operational and troubleshooting tips
- The use of dynamic simulations to determine relief loads

TARGET AUDIENCE:

Engineers responsible for designing, operating, and maintaining relief and flare systems in oil and gas facilities.



Separation Equipment - Selection and Sizing

INTERMEDIATE: 5 DAYS PF-42

This course covers the different types of separation equipment typically encountered in oil and gas production facilities. Fractionation equipment and produced water treating equipment are not covered in this course. You will learn where the different types of separation equipment are used based on operating conditions and separation performance requirements. Frequent references will be made to real production facility process flow diagrams (PFDs). Typical operational problems and their solutions will also be discussed. Exercises requiring calculations are utilized throughout the course as well. Please be aware that due to overlap in content, it is not necessary to take the PF-42 course if you have already taken the PF-4 Oil Production and Processing Facilities course.

COURSE CONTENT:

- Fluid properties and phase behavior
- Phase separation processes
- Gas-liquid separation equipment: slug catchers, conventional separators (horizontal and vertical), scrubbers, compact separators, filter separators/ coalescing filters
- Separator internals: inlet devices, mist extractors, baffles, weirs, etc.
- Emulsions
- Oil-water separation equipment: conventional 3-phase separators and freewater knockouts, wash tanks
- Oil treating and desalting equipment: mainly electrostatic coalescers
- Liquid-liquid coalescing filters
- Mechanical design aspects: pressure vessel codes, wall thickness and vessel weight estimation, material selection, relief requirements
- Operational problems

TARGET AUDIENCE:

Process/Facilities engineers who need skills for design and troubleshooting of separators.

Troubleshooting Oil and Gas Processing Facilities

INTERMEDIATE: 5 DAYS PF-49

This course will cover how to establish and apply a general troubleshooting methodology as well as how to conduct process/equipment specific troubleshooting. Definitions of good/normal performance will be discussed for each process/equipment type covered. Data gathering, validation and utilization procedures will be discussed. Criteria to use when evaluating possible problem solutions will also be covered. Real-world exercises will be utilized throughout the class to reinforce the learning objectives. Both onshore and offshore facilities will be discussed. It is assumed that course participants have a solid understanding of how typical oil and gas production and processing facilities work, including the commonly used processes and equipment involved. For public delivery, we have broken this course down to better address either oil or gas: Troubleshooting Gas Processing Facilities - PF49G Troubleshooting Oil Processing Facilities - PF49O

COURSE CONTENT:

- Troubleshooting methodology fundamentals and data reconciliation
- Gas - Liquid separators
- Reciprocating compressors
- Amine gas sweetening
- Glycol dehydration units
- 3-phase separators
- Centrifugal pumps
- Oil treating
- Produce

TARGET AUDIENCE:

Process/Facilities engineers with 5-10 years of experience, facilities engineering team leaders/supervisors, and senior facilities operational personnel.

Troubleshooting Oil Processing Facilities

INTERMEDIATE: 5 DAYS PF-49O

This course will cover how to establish and apply a general troubleshooting methodology as well as how to conduct process/equipment specific troubleshooting related to oil production and processing facilities. Definitions of good/normal performance will be discussed for each process/ equipment type covered. Data gathering, validation and utilization procedures will be discussed. Criteria to use when evaluating possible problem solutions will also be covered. Real-world exercises will be utilized throughout the class to reinforce the learning objectives. Both onshore and offshore facilities will be discussed. It is assumed that course participants have a solid understanding of how typical oil production and processing facilities work, including the commonly used processes and equipment involved. This course will not provide in-depth coverage of fundamentals.

COURSE CONTENT:

- Understanding the similarities and differences between troubleshooting vs optimization vs debottlenecking
- Types of oil production and processing facilities
- System trouble vs component/equipment-specific trouble
- Defining good/normal operation
- Quantifying the cost of the trouble
- Gathering, validating, and utilization of data (types of data, sources of data, data quality and validation, using the data)
- Fundamentals of root cause analysis and methodology
- Developing a step-by-step troubleshooting methodology/flowchart
- Identifying the best solution (criteria for defining best)
- Processing and major equipment modules covered include separation equipment, oil treating and desalting, oil stabilization and sweetening, oil storage and vapor recovery, produced water treating, centrifugal pumps, and water injection

TARGET AUDIENCE:

Process/Facilities engineers with 5-10 years of experience, facilities engineering team leaders/ supervisors, and senior facilities operational personnel.

CO2 Surface Facilities

SPECIALIZED: 3 DAYS PF-81

This course emphasizes the effect of carbon dioxide on the selection and operation of equipment (separators, compressors, and dehydrators), as well as sweetening process equipment. This program, first introduced in 1985, assists those working with carbon dioxide or high carbon dioxide content natural gas. This course is particularly applicable to those persons who operate and/or design enhanced oil recovery (EOR) facilities using CO2 as a miscible agent. Physical and thermodynamic property data for carbon dioxide/natural gas mixtures are discussed. Calculations are performed to illustrate principles and techniques. An extra day will be added to this course if a plant tour is available (Midland public course sessions, or in-house sessions only).

COURSE CONTENT:

- Overview of CO2 injection and process facilities
- Heavy emphasis on CO2 for enhanced oil recovery
- Physical and thermodynamic properties of CO2 and high CO2 mixtures
- Materials selection and design consideration in CO2 systems
- Process vessel specification
- Pumps and compressors
- Fluid flow and special pipeline design considerations such as the control of ductile fractures
- Dehydration of CO2 and CO2-rich gases
- General overview of processes to treat/ recover CO2

TARGET AUDIENCE:

Engineers and senior operating personnel involved with carbon dioxide/natural gas/CO2 EOR systems.

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Industry-driven, industry-approved
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The PetroSkills Alliance is focused on meeting the challenges of workforce development and a rapidly changing hydrocarbon resource base.



The PetroSkills Alliance was founded in 2001 by Shell, BP and OGCI, to provide “important but not unique” competency based training. Since then it has evolved into an industry-driven, industry-approved program that spans the industry. Today, with dozens of members representing all facets of the global oil and gas industry, the PetroSkills Alliance is focused on meeting the challenges of workforce development and a rapidly changing hydrocarbon resource base. As the oil and gas Industry’s partner, our mission is to deliver consistent, high quality, learning and development training and programs to build competent petroleum professionals.

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PetroSkills longevity and relevance is a direct result of the member company input. Subject matter experts contributed by Alliance member-companies ensure that our courses address current industry needs through our technical discipline networks.

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