

# PetroSkills®

2010 Facilities Training Guide

Training That Delivers . . . Real Skills, Real Knowledge, Real Return on Investment

## NEW for 2010:

- New course in Procurement/Supply Chain
- Collaboration with Curtin University to offer a Master's Degree in Petroleum Technology
- Sponsored and in-house courses available

**OGCI®**

John M.  
**Campbell & Co.**

Exclusive provider of **PetroSkills®** facilities training.



***Line Managers need skilled staff...and we help deliver those skills.***

The excitement continues in this great business: new developments, new staff, another major swing in the price of petroleum, worldwide turmoil in the financial markets...and great technical achievements.

In the Gulf of Mexico we see a new depth record with the Perdido platform which aims to produce from over 8,000 ft (2.6 km) of water. At that depth there are certainly no divers; there isn't even daylight. In Norway, both the Melkoya LNG plant at latitude 71 N and the Ormen Lange offshore gas field provide yet more examples of innovation. Ormen Lange can supply up to 20% of Britain's gas. There is no platform at Ormen Lange; all the facilities are sub-sea.

Of course, hydrate prevention and superior facilities engineering are just as important in Wyoming gas plants, Middle East LNG complexes, Australian pipelines or a Siberian oil field. Training by John M. Campbell & Co (JMC), exclusive provider of PetroSkills Facilities training, touches on all these areas.

Skilled staff are always needed. For PetroSkills Alliance members, an individual's required competencies are defined by the network and accessible to that person on-line. Course content comes from line-managers, oil company subject-matter experts and our own JMC instructors. Each PetroSkills course receives regular reviews, updating and approval through the Alliance network.

For some years we have seen proven results from our in-house blended-learning and distance-learning programs. Delivered via the internet, these are becoming more sophisticated and accepted. This course delivery method includes instruction, exercises, group syndicates and exams.

Most of our business is through word-of-mouth referrals so JMC carefully watches quality. Every course participant completes an evaluation form on every instructor on every course, no exceptions. The evaluation summaries are seen by senior JMC management and addressed regularly to maintain quality.

JMC organizes a yearly instructor gathering for technical exchanges, to learn new teaching methods and improve instructional design. We also share lessons from consulting work, conferences, industry committees, etc. This combination of technical fundamentals and practical application supports the long-term growth we experience.

We are proud of our staff and instructors, and proud to be a member of the PetroSkills Alliance. We are especially proud to be part of the exciting oil and gas industry by training and developing the talent for tomorrow.

Thank you for the business we receive and for the continued role we are able to have in the industry.

A handwritten signature in black ink that reads "D. John Morgan". The signature is written in a cursive, slightly slanted style.

D. John Morgan  
Chairman of the Board

**Our Mission**

To build proficient energy professionals that serve the energy needs of the global community.

**Delivering Knowledge. Developing Competence.**

## Industry Benchmark

The power behind PetroSkills is the alliance itself. Member company technical experts direct and continuously update detailed competency maps for each petroleum discipline. These maps are used to guide the learning objectives of each program. This gives all PetroSkills programs an operator's 'shared viewpoint' of the skills required to perform at different levels within each technical discipline. We work together to develop and deliver PetroSkills training courses and work experiences that build the competencies outlined in the competency maps. We continually improve and renew both the maps and programs to stay current with industry trends, technology, and demands. The size and scope of the PetroSkills alliance further enables us to make our program available at a wide variety of locations and dates around the world and throughout each year.

## What is PetroSkills?

### COMPETENCY-BASED.

PetroSkills is a unique competency-based training program – not just a collection of courses. Course content is based on detailed skill and competency maps developed with our member companies. The alliance members work together to clearly define the skills that are needed in each discipline for a range of skill levels. Companies that use the competency maps know that their technical professionals will have the specific skills that they need to perform their jobs; and individuals know how they can build the skills that they will need to be on the right track for advancement. Another feature of the competency maps is that they are available to individuals and companies via a web-based Competency Analysis Tool (CAT). CAT allows professionals to track their development, determine what skills they need, and create a customized plan to fill any learning gaps.

### PRACTICAL. REAL-WORLD. BUSINESS-RELEVANT.

Practicality sets us apart. This competency-focused learning delivers the individual skills and technology needs of operating companies and industry professionals. Our goal is that after attending a PetroSkills course, professionals will return to their workplace and immediately be able to apply the skills they have learned to create value.

### QUALITY COURSES. QUALITY INSTRUCTORS.

PetroSkills coursework is reviewed and strengthened by each of its partner companies. The member curriculum advisors and the PetroSkills Board must approve each course, and continually ensure that the programs deliver practical, up-to-date, relevant training. The same is true for the instructors that teach the courses – they must be approved by the PetroSkills Board and member curriculum advisors.

### CONVENIENT AND FREQUENT.

Convenient and frequent delivery is a key part of the PetroSkills philosophy. By presenting courses near to the client on a shared basis, we keep travel and other costs as low as possible. In addition to teaching hundreds of public sessions in dozens of cities each year, PetroSkills will bring any of its courses to you on an in-house basis anywhere in the world.

For more information, contact: [training@petroskills.com](mailto:training@petroskills.com)

800.821.5933 (In the US and Canada)

+1.918.828.2500 (worldwide)



HALLIBURTON



ConocoPhillips



WOODSIDE



BG GROUP

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TTG Systems

John M. Campbell & Co.



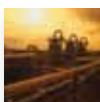
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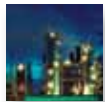
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# ABOUT JMC

## Training That Delivers

John M. Campbell & Co. trains midstream and downstream oil and gas industry professionals and engineers from super global companies to independent contractors all over the world. Campbell instructors are well known in the oil and gas industry before they teach for us and their recognition continues to grow while in front of our classrooms. In addition to publishing our own course material and textbooks, the research of Campbell instructors is routinely published in peer-review journals and presented at industry conferences. In short, Campbell works hard to have a positive impact on the oil and gas industry through our experience, knowledge, training, consulting, and publications.

### But how did we begin?

It all started with one man and 54 articles published over 50 years ago.

John M. Campbell & Co. was officially incorporated in 1968 by Dr. John M. Campbell, Sr. yet our history starts before then when Dr. Campbell published a 54 part series in the *Oil & Gas Journal* on surface production facilities between 1954 and 1958. These articles became the basis for Volumes 1 and 2 of the *Gas Conditioning and Processing* textbooks which are still used today throughout the industry and in our courses.

Within 10 years after the series published, Dr. Campbell formed John M. Campbell & Co. and was offering the “Campbell Gas Course™” internationally using his original articles as the course’s foundation. John M. Campbell & Co. is proud to say that we are still teaching this course today with regular updates to stay industry current. The “Campbell Gas Course™” has become G-4 Gas Conditioning and Processing and is still the industry standard. (see pages 14-15 for more information)

The two original Campbell books were just a start for a publishing company that has now produced nearly 20 industry publications including *Effective Communication for the Technical Man*, *Petroleum Flow Systems*, and Volumes 3 and 4 of *Gas Conditioning and Processing*.

From that significant course we have grown into the premier training company for gas processing offering over 50 courses in 10 major disciplines.

### From Individual to Alliance

While the company was founded by an individual, we have formed partnerships to expand our services and to respond to requests from the industry. Early in 2003, John M. Campbell & Co. joined the PetroSkills Alliance as the exclusive provider of facilities training. Our membership in the PetroSkills Alliance further ensures the delivery of competency-based training directed by industry technical experts. We currently offer courses in the following disciplines: Electrical, Instrumentation and Controls; Mechanical; Offshore; Operations Management; Procurement/Supply Chain Management; Water Treatment and Corrosion; Production Facilities; Reliability Engineering; Health, Safety and Environment; Pipeline; Refining; and Operator Training.

We continue to grow every year as more companies join the PetroSkills Alliance and as the “New Crew” change increases the need for comprehensive training services.

## Recent Publications

**Young, Clyde**, "The Threat from Within," *Hydrocarbon Engineering*, November 2008.

Walter, F. Brian, **Snow-McGregor, Kindra**, "Flammability of Gas Mixtures", 85th Annual Gas Processors Association Convention, March 2006.

**Snow-McGregor, Kindra**, Johnson, Johnny, "Acid Gas Water Dewpoint, Hydrate and Physical Property Predictions", 83rd Annual Gas Processors Association Convention, March 2004.

**Snow-McGregor, Kindra**, Friedman, Barry, "Recent Regulatory Activity, and Review of Flare Destruction Efficiency", 83rd Annual Gas Processors Association Convention, March 2004.

**Moshfeghian, M., Bothamley, M.E., Lilly, L.L.**, "Feed gas molecular weight affects centrifugal compressor performance," *Oil & Gas Journal*, May 10, 2008.

**Moshfeghian, M.**, and Taraf, R., "New method yields MEG injection rate," *Oil & Gas Journal*, September 1, 2008.

**Moshfeghian, M., Bourdon, J.B., Maddox, R.N.**, "Study tests accuracy of methods that estimates hydrate formation," *Oil & Gas Journal*, January 8, 2007.

**Moshfeghian, M., Jarrett, F.** and Qabazard, H., "Study finds optimum compressor interstage pressure," *Oil & Gas Journal*, March 13, 2006.

**Moshfeghian, M., Bothamley, M.E.**, "Study evaluates two amine options for gas sweetening," *Oil & Gas Journal*, August 8, 2006.

**Moshfeghian, M., Maddox, R.N., and A.H. Johannes**, "Application of Exponential Decay Distribution of C6+ Cut for Lean Natural Gas Phase Envelope," *J. of Chem. Engr. Japan*, Vol 39, No 4, pp.375-382, 2006.

**Moshfeghian, M., Lilly, L.L., Maddox, R.N., and Nasrifar, Kh.**, "Study Compares C6+ Characterization Methods for Natural Gas Phase Envelope," *Oil & Gas Journal*, Nov. 21, 2005.

**Bothamley, M.**, "Offshore Processing Options for Oil Platforms", SPE Paper 90325, Sept. 2004.

**Moshfeghian, M., Maddox, R.N., and A.H. Johannes**, "Simple Predictive Procedure Calculates Heptane K-value", *Oil & Gas Journal*, April 7, 2003.

Al-Sayegh, A., **Moshfeghian, M.**, M. R. Abbaszadeh, A. H. Johannes, and R. N. Maddox "Computer Simulation Accurately Determines Volatile Sulfur Compounds," *Oil & Gas Journal*, October 21, 2002.

## Dedication to Industry

But we have not strayed too far from our beginnings. Like Dr. Campbell Sr., today's Campbell instructor has a strong and proven record in the industry, with a minimum of 10-15 years experience, before ever beginning their teaching career with us. Many Campbell instructors hold advanced degrees. Many have held leadership positions in renowned technical societies and have been recognized by the industry for their achievements. Within our instructional staff you will find past Gas Processing Association Presidents, Hanlon Award Recipients, Society of Petroleum Engineering Distinguished Lecturers and Gas Processing Supplier's Association Editorial Review Board Members.

Many Campbell instructors were published before joining Campbell and have continued to publish. Industry publications, including *Hydrocarbon Engineering*, *Journal of Hydrocarbon Processing* and of course *Oil & Gas Journal* have recently printed articles authored by Campbell instructors as individual authors as well as in collaboration.

Campbell instructors often present papers at technical conferences. In 2008 and 2009, our instructors presented papers at the Annual Gas Processors Association Convention, Tobago Gas Technology Conference, SMI Conference, SPE Gas Hydrate Challenges in the Oil and Gas Industry, Mary K. O'Connor Process Safety Center International Symposium, and the GPA Europe Annual Conference.

Our instructors commitment to the industry is evident. And their dedication to delivering knowledge is endless.

## Global Presence

Dr. Campbell's initial series of articles published in the *Oil and Gas Journal* reached the global energy community through a far reaching journal. Campbell training continues to occur where the highest concentrations of oil and gas engineers and operators work and live. Our public courses are in cities well-known to be hubs of oil and gas activity.

Our in-house courses demonstrate our flexibility and understanding of the training needs and budgets by sending our instructors anywhere a client needs. By expanding on Dr. Campbell's solid series of articles on surface production facilities, John M. Campbell & Co. has built training services that continue to be competency based, industry relevant and available where you need them.

We are where you are.

### Full Service

John M Campbell & Co. was formed in 1968 to provide professional services to the oil and gas industry. To date, we have provided training and consulting to virtually every major oil company worldwide. But we are more than just a training company.

#### Public Courses

Our most popular format, courses are held throughout the year around the world. Public Courses provide opportunities to learn and interact with peers from other companies.

#### Instant Public

Courses requested from customers in a specific location that are added to our current public schedule after a contracted commitment.

#### Sponsored Courses

Courses in which a specific company sends employees that is also open to public enrollments.

#### In-house Courses

In-house courses are held at your location and can be customized to fit your training needs. Courses and even company specific training programs can be developed to serve you best.

#### Operator Training

Fully customizable operator training courses are designed to enhance operator and troubleshooting skills. Campbell Operator Training courses have been called “engineering courses for operators.”

#### Consulting

John M. Campbell Consulting provides a wide array of consulting services in engineering, operations, problem solving, construction/startup, and process safety. For more information, see pages 41-44.

#### On-site Mentoring

JMC provides on-site mentoring programs for specialized local topics. This service is useful for international locations with local new hires who need specific training. Often a more effective and economical method of workforce development. Customized programs involve the selection of topics with the client, then a rotation of JMC instructor/consultants to cover the topics; this rotation may be concentrated or spread out depending on the amount of On-the-Job training desired.

#### Tip of the Month

Campbell instructors share their knowledge to address current issues in the oil and gas industry, currently available in English and Spanish. An example Tip of the Month can be found on pages 45-48. Or subscribe at [www.jmccampbell.com](http://www.jmccampbell.com).

#### Campbell Forums

The Campbell Forums allow you to expand your network of resources by participating with your peers. To view or join, go to <http://campbellforums.com>.

#### Twitter

Stay in contact by following us on Twitter. In addition to helping you stay current with Campbell news, we also provide links to interesting industry information. Follow us at [twitter.com/johnmccampbell](https://twitter.com/johnmccampbell).

#### Books and Software

Developed by our talented instructors, and considered by many to be the industry standard, Campbell software and textbooks are used in many of our courses. Pages 49-50 show available books and software from Campbell and PetroSkills instructors.

## What is Public/Instant Public/Sponsored/In-House?

	Public	Instant Public	Sponsored	In-House
<b>Minimum Registrations</b>	1	Varies	12	15
<b>Who Attends</b>	Open Registration	Open Registration	Open Registration	Selected by Client
<b>Location</b>	Worldwide at JMC's Discretion	Worldwide based on Consultation with Clients	Worldwide hosted by Client	Worldwide hosted by Client
<b>Teambuilding with Coworkers</b>		Yes	Yes	Yes
<b>Networking with Industry Peers</b>	Yes	Yes	Yes	
<b>Course Materials</b>	Standard	Standard	Standard	Customizable

### Public Courses

Public courses allow industry peers to gain equivalent, non-proprietary knowledge and provide an excellent opportunity to network. Companies can send as few or as many employees as needed. John M. Campbell & Co. selects the course location and processes all registrations. Public courses are held predominately in industry hubs to reduce travel expenses as much as possible while still providing frequent and convenient sessions.

Visit our website at [www.jmccampbell.com/public-courses](http://www.jmccampbell.com/public-courses) for our current public course schedule.

### Instant Public

Instant public courses can be a solution when the training needs of multiple clients exceeds the public course schedule and individual clients do not have enough participants for a sponsored or in-house course. JMC will add courses to the public course schedule after a contracted commitment from a client(s) to send a minimum number of attendees. The course is then opened to public registrations.

Contact us at [jmcsupport@jmccampbell.com](mailto:jmcsupport@jmccampbell.com) to schedule an Instant Public Course.

### Sponsored Courses

Sponsored courses are courses held for a specific client who is not asking for customization and would like their employees to have the opportunity to network with industry peers. Course logistics are arranged with the sponsoring client. John M. Campbell & Co. then opens up registration to the public.

Contact us at [jmcsupport@jmccampbell.com](mailto:jmcsupport@jmccampbell.com) to schedule a Sponsored Course.

### In House Courses

In-house courses are an excellent solution to training needs when travel budgets are reduced. All course attendees are limited to your internal employees and can be held anywhere you need training. Our instructor travels to your location. It is possible to customize JMC's standard course materials to best fit your needs. We can also work with you to develop courses or a training program for your specific to your company.

Contact us at [jmcsupport@jmccampbell.com](mailto:jmcsupport@jmccampbell.com) to schedule an In-House Course.

**For more information about our public, instant public, sponsored or in-house courses visit our website at [www.jmccampbell.com](http://www.jmccampbell.com) or email us at [jmcsupport@jmccampbell.com](mailto:jmcsupport@jmccampbell.com).**

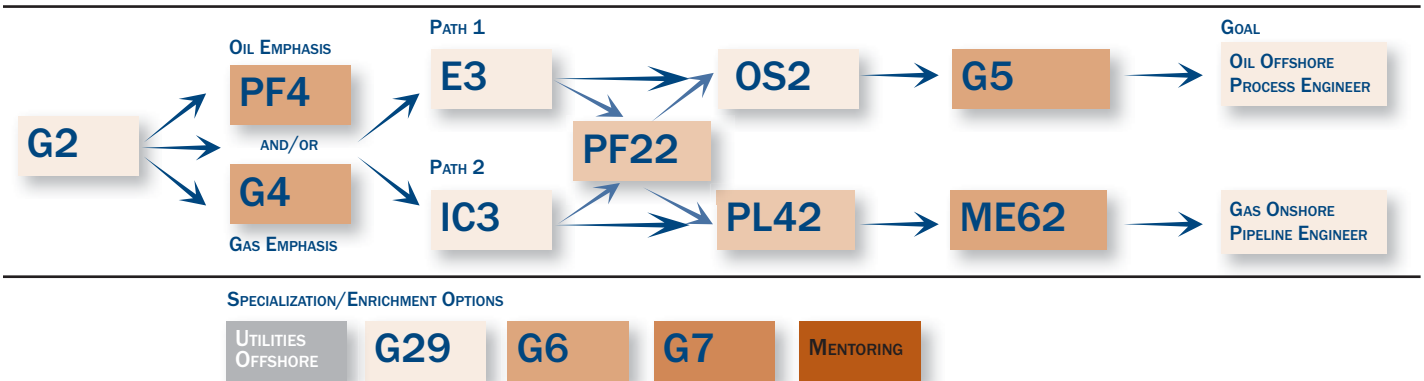
## PetroSkills Facilities Training Courses. Find Your Skill Gaps. Map Your Future.

You know what your career goals are but have you figured out the best way to get there? The easiest way to reach a destination is by using a map.

Everyone has goals that require individualized planning and strategic training. This example diagram shows two of many possible directions a Facilities Engineer can take. In this example, the engineer is starting in an onshore facilities technical role. The engineer would want to start in a Basic course such as the G2 - Overview of Gas Processing. From

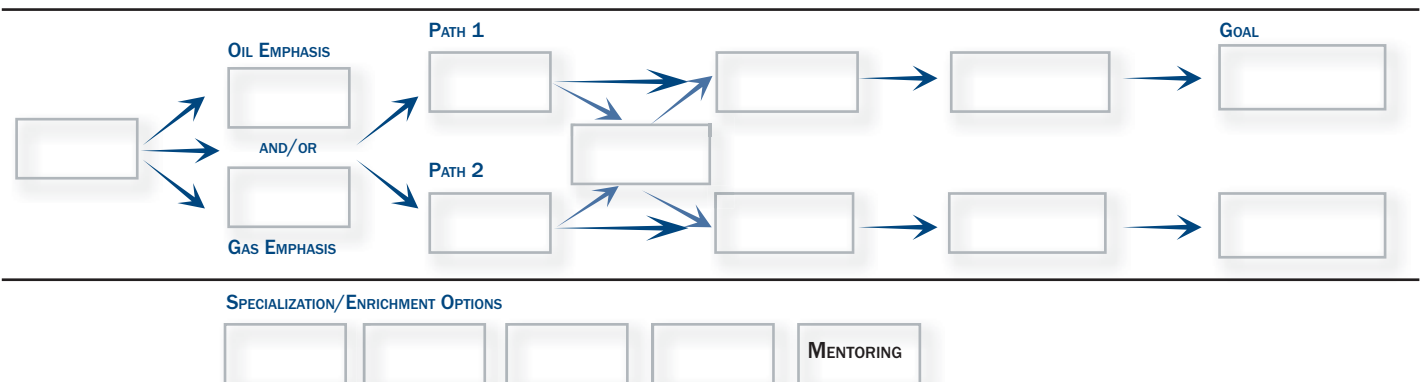
there an in-depth Intermediate level course, the PF4 - Oil Production and Processing Facilities and/or the G4 - Gas Conditioning and Processing, depending on career direction. As the engineer progresses a course in water corrosion, PF22 - Corrosion Management in Production/ Processing Operations, might be needed regardless of the career path chosen. An engineer with the goal of Oil Offshore Process Engineer would follow Path 1, a Gas Onshore Pipeline Engineer would follow Path 2. Additional courses and Mentoring opportunities such as the G-29 - LNG Short Course offer Specialization and Enrichment Options.

### Example Career Path: Facilities Engineer



Comprehensive self-assessment can highlight areas in which you may need training. Talk to any of our Campbell Instructors, a supervisor, or a mentor about the right courses to progress toward your career goals. Use the diagram below and Campbell course descriptions to map your road to success. Additional information can be found at [www.jmcampbell.com](http://www.jmcampbell.com) and/or [www.petroskills.com](http://www.petroskills.com).

### Your Career Path



# E, I & C

## Electrical Engineering Fundamentals for Facilities Engineers (E-3)

COURSE LEVEL Basic

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

Facilities Engineers as well as new Electrical, Instrumentation or Controls Engineers who need to improve their basic understanding of electrical systems within oil and gas facilities

### YOU WILL LEARN

- About electricity including physics of matter, conductors, semiconductors, insulators, electrostatics, magnetics, energy, DC voltage systems, and AC voltage systems
- The various components of facilities electric power distribution which include circuit arrangements, wiring, cabling, terminations, conduit, low voltage boards, low and medium voltage switchgear, and single phase and three phase schemes
- About the operation, components, electromotive forces, turns and voltage ratios, losses, efficiency, rating, and connections of transformers
- The difference between direct current motors, alternating current motors, enclosures and how to select motors
- About protection including fuses, direct tripping, relaying, and coordination
- About emergency power to include power requirements, generator sets, direct current systems, batteries, and an overview of uninterruptible power supplies (UPS)
- About power generation which includes an overview of emergency, prime, base, peak and co-generation, quality, sizing, operation, control, and power factor correction
- The advantages of variable speed drives as well as AC drives and DC drives
- The advantages, operations, applications, functionality, and architecture of programmable electronic systems
- About electrical safety including the dangers of electricity, causes, prevention, work practices, static, and OSHA
- About grounding and bonding with an overview of systems, equipment, ignition sources, separately derived systems, performance, and substation grounding
- About the efficiency, color, life, lumens, types, and design of lighting as well as lamp rating characteristics
- About hazardous areas with general information on classifications, NEC, IEC, equipment protection, certification, and definitions

### ABOUT THE COURSE

This course applies fundamental electrical engineering principles to oil and gas facilities design and operation. The course is designed for Facilities Engineers with or without a background in electrical engineering and can accelerate the development of new Facilities Electrical Engineers. Through the use of individual and group problem solving, attendees will learn about transformers, motors, generators, one-line diagram interpretation, protection and coordination of electrical equipment, emergency power, direct current systems, uninterruptible power supplies, site and standby generation, adjustable speed drives, programmable electronic systems, electrical safety, grounding and bonding, lighting, and hazardous areas. Participants will gain a better understanding of electrical components and systems and will develop a greater appreciation for electrical engineering.

### COURSE CONTENT

- Fundamentals of electricity
- Direct current
- Basic AC theory
- Transformers
- Motors
- Power distribution
- System protection and coordination
- Emergency power generators, direct current systems and uninterruptible power systems
- Power generation
- Adjustable speed drives
- Programmable electronic systems
- Electrical safety
- Grounding and bonding
- Lighting
- Hazardous areas

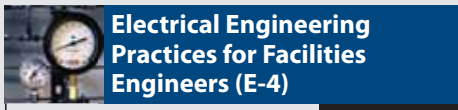
Campbell Training delivers competencies to enhance Electrical, Instrumentation & Controls (EI&C) skills for the design, construction and operation of oil and gas facilities.

We provide EI&C awareness courses that help professionals understand EI&C systems. We also offer advanced courses that provide fundamental skills to enable engineers and technicians to apply EI&C principles and practices in their daily work routines.

Our EI&C courses are designed and presented as individual topic modules. An in-house course client may choose specific modules to make up a customize in-house course which meets the needs of the organization or in development of key disciplines. Whether you chose a customized in-house course or a standard public course, you can feel confident that participants will make progress in their chosen career path.

**Instructors:** Darrell Carver, Mick Crabtree, Dennis Perry, Chip Stansbury

COURSE MATRIX						
	E, I & C	Gas Processing	Operations Management	Procurement / Supply Chain	Production Facilities	Reliability
SPECIALIZED		G7 Process Simulation in Gas Conditioning and Processing			PF81 CO <sub>2</sub> Surface Facilities	
		G6 Gas Treating and Sulfur Recovery				
		G5 Gas Conditioning and Processing - Special				
INTERMEDIATE		G4 Gas Conditioning and Processing			PF42 Separation Equipment - Selection & Sizing	REL62 Principles of Reliability Engineering
		G4 LNG Gas Conditioning and Processing LNG Emphasis		SC61 Inside Procurement in Oil & Gas	PF4 Oil Production and Processing Facilities	REL61 Optimizing Equipment Availability
FOUNDATION	IC4 Instrumentation and Controls Engineering Practices for Facilities Engineers		OM43 Effective Maintenance Shutdowns	SC42 Effective Materials Management	PF 43 Heat Transfer Equipment	
	E4 Electrical Engineering Practices for Facilities Engineers	G40 Process/Facility Fundamentals	OM41 Maintenance Planning and Work Control	SC41 Contracts and Tenders Fundamentals	PF22 Corrosion Management in Production/Processing Operations	REL44 Reliability Centered Maintenance
						REL50 Introduction to Reliability Statistics
BASIC						REL46 Introduction to Reliability Engineering
		G29 LNG Short Course - Technology and the LNG Chain	OM23 Essential Leadership Skills			REL45 Introduction to Life Cycle Costing
	IC3 Instrumentation and Controls Fundamentals for Facilities Engineers	G2 Overview of Gas Processing Technical	OM22 Project Management for Engineering and Construction			REL25 Root Cause Analysis
	E3 Electrical Engineering Fundamentals for Facilities Engineers	G1 Overview of Gas Processing Non-Technical	OM21 Applied Maintenance Management		PF21 Applied Water Technology in Oil and Gas Production	REL24 Introduction to Condition Monitoring



## Electrical Engineering Practices for Facilities Engineers (E-4)

PETROSKILLS

COURSE LEVEL Foundation

DURATION 5 Days

### DESIGNED FOR

Facilities Engineers with two or more years of experience; Electrical, Instrumentation or Controls Engineers with two or more years of experience, or those who have completed the E-3 course and need to further develop their understanding of electrical systems within oil and gas facilities

### YOU WILL LEARN

- Some basic principles in project management for electrical projects including basics, front end loading, scope definition, brown field vs. green field, engineering deliverables, roles and responsibilities, project planning, risk analysis and management, cost estimating, and procurement, construction, contractor and supplier management
- Standards and recommended practices through an introduction to ANSI, API, CSA, CFR, IEC, IEEE, IES, ISA, NEMA, NFPA, AND UL
- About electrical distribution systems including background, planning, voltage selection, and system protection
- How to select, maintain and control DC and AC motors
- The characteristics, properties, insulation, shielding, jacketing, short circuit capabilities, and references of wires and cables
- About transformers which include operation, models, types, components, turns and voltage ratios, connections, losses, efficiency, ratings, application, selection, and safety
- About medium and low voltage switchgear and motor control centers including specifications, maintenance, and distribution
- Topics in faults and circuit protection including sensing devices, fuses, direct tripping devices, protective relaying, relaying schemes, major equipment protection, and system relay coordination
- About the distribution, construction, fuses, circuit breakers, disconnects, grounding, types, and ratings of switchboards and panels
- The systems and requirements of uninterruptible power supply (UPS) and emergency power in addition to an overview of generator set, ATSS, and batteries
- About fault protection, system grounding philosophy, ungrounded systems, grounded systems, bonding, ignition sources, bonding techniques, separately derived systems, performance, and substation grounding
- About North American and non-North American classifications of hazardous area in addition to NEC and IEC comparisons, extension of zones, equipment certification, and equipment protection methods

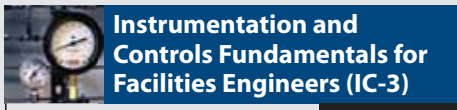
### ABOUT THE COURSE

This course applies Electrical Engineering principles to oil and gas facilities design and operation and requires some prior experience. Electrical Engineering principles are reinforced through the use of individual and team problem solving exercises, one-line diagram coordination, interpretation, and class discussions of interfaces between facilities engineers, contractors and maintenance personnel. Participants gain additional understanding of electrical equipment requirements for facilities and what is important to the Electrical discipline.

### COURSE CONTENT

- Electrical project management
- Standards and recommended practices
- Distribution systems
- Motors
- Wire and cable
- Transformers
- Switchgear
- Motor control centers
- Switchboards and panels
- Electrical faults (short circuits) and circuit protection
- UPS and emergency power
- Electrical system ground and bonding
- Hazardous area classification

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*



## Instrumentation and Controls Fundamentals for Facilities Engineers (IC-3)

PETROSKILLS

COURSE LEVEL Basic

DURATION 5 Days

### DESIGNED FOR

Facilities Engineers as well as newly graduated Electrical, Controls and Instrument Engineers who need to improve their basic understanding of instrumentation and control systems within oil and gas facilities

### YOU WILL LEARN

- About field measurement devices including level, pressure, temperature and flow
- About final elements and actuators including control loops, control valves, shutdown valves, actuators, transducers
- About pressure relief and pressure regulation
- How to document instrumentation including tag numbers, P&IDs, loop and logic diagrams
- Process control basics with emphasis on control loops, types, strategies, and loop tuning
- How programmable logic controllers operate as well as their advantages, application, functionality, architecture, and programming
- About Supervisory Control and Data Acquisition (SCADA) Systems to include telemetry, RTUs, internet and web based
- About Distributed Control Systems (DCS) including Fieldbus and Profibus
- About risk mitigation, technologies, and architecture of Safety Instrumented Systems (SIS)
- The best practices for hazardous areas and equipment selection which will include area classification, NEC, IEC, equipment protection, selection, certification, location, and ingress

### ABOUT THE COURSE

This course applies fundamental instrumentation and control engineering principles to oil and gas facilities design and operation and is designed for Facilities Engineers with or without a background in instrumentation or control engineering. The course is also 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, final elements and actuators, pressure relief and regulation, documentation, programmable logic controllers, power supplies, SCADA, DCS, SIS, hazardous areas, and installation methods. Participants will gain a better understanding of instrumentation and control components and systems and will gain a greater appreciation for instrumentation and control engineering.

### COURSE CONTENT

- Fundamentals
- Field measurement devices
- Final elements and actuators
- Pressure relief and pressure regulation
- Instrumentation documentation
- Control system basics
- Programmable logic controllers
- Supervisory control and data acquisition (SCADA) systems
- Distributed control systems (DCS)
- Safety instrumented system (SIS)
- Hazardous areas and equipment selection



## Instrumentation and Controls Engineering Practices for Facilities Engineers (IC-4)

CAMPBELL

COURSE LEVEL Foundation

DURATION 5 Days

### DESIGNED FOR

Oil and gas Facilities, Electrical or Instrumentation and Controls Engineers with two or more years of field experience who want to further improve their practical understanding of Instrumentation/Controls systems within oil and gas facilities. Attendees should have taken the IC-3 course or have good working knowledge of instrumentation and control fundamentals.

### YOU WILL LEARN

- How to work through a project with a brief introduction to a three-phase (oil, gas, water) inlet separator, its design, operation, components, and controls
- Basic principles of project management for instrumentation and control projects to include front-end loading, scope definition, brown field vs. green field projects, engineering deliverables, roles and responsibilities, project planning, risk analysis and management, cost estimating, procurement management, construction management, contractors and suppliers management
- Front end engineering design (FEED) to include pre-feed, flow diagrams, P&IDs, material take off, indices, plot plan, control system philosophy, I&C block diagrams, safety instrumented system (SIS) logic, specifications, cost estimates, and design approval
- Final design activities that includes authorization for expenditure (AFE), indices, specifications, SIS design, distributed control system (DCSs), plot plans, power systems, installation details, wiring and connection diagrams, schematics, logic diagrams, cable and conduit schedules, electronic systems i/o indices, loop diagrams, bill of materials (BOM), and panel arrangements
- The various requirements of construction and commission to include procurement requirements, construction requirements, QA and QC requirements, factory acceptance test (FAT), commissioning and startup requirements
- Basic design criteria for selection of control valves (CVs), sizing of control valves, selection of flow measurement devices, sizing of orifice plates, selection of relief valves, selection of temperature devices, selection of level devices, selection of pressure measurement, selection of alarm and shutdown switches, instrument tag numbering, loop diagrams preparation, P&IDs, and SIS logic matrices

### ABOUT THE COURSE

An exercise is developed throughout the session to illustrate the process of instrumentation selection and specification for a pressure vessel. The required documentation is identified and developed for incorporation in a BPCS (basic process control system). The exercise does not require formal instrument engineering training but prior field experience is very helpful. Through the use of individual and team problem solving you will learn about instrumentation on a vessel, developing required documentation, reviewing end devices, control valves, process control basics and discussing the various interfaces between facilities engineers, contractors and maintenance personnel. Participants will gain a better understanding of the instrumentation process and what is important to this discipline.

### COURSE CONTENT

- Introduction
- Basic project management
- Front end engineering design (FEED)
- Final design activities
- Construct and commission
- Weekly project design actives

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*

# GAS PROCESSING

GAS PROCESSING

## Instructors

Frank Ashford	Frank Jarrett
Mark Bothamley	Larry Lilly
John Bourdon	Harvey Malino
James Breau	D. John Morgan
Ajey Chandra	Mahmood Moshfeghian
Pierre Crevier	Ralph Neumann
Arthur Delargy	John Newman
Rafil Elyas	Peter Reeves
Robert Fanning	John Sheffield
Bob Hložek	Michael Sheilan
Bob Hubbard	Kindra Snow-McGregor
	Peter Williams
	Wes Wright

The Gas Processing discipline covers equipment and processes primarily focused on the handling of natural gas and its associated liquids. The wellhead is the starting point, ending with delivery of the processed gas, meeting the required specifications, into a sales gas or reinjection pipeline. Recovered natural gas liquids (NGL), again meeting the required specifications, are delivered to an export point – either a pipeline or storage facility. The NGL may be fractionated into individual specification products or sold as a mix for fractionation elsewhere. Waste byproducts are disposed of in accordance with the applicable regulatory requirements.

Main topics covered include: fundamentals, natural gas characterization, phase behavior, vapor – liquid equilibrium, basic thermodynamics, and water – hydrocarbon behavior.

Campbell Training delivers competency based training in these and other areas, at progressive levels to provide the skills necessary to successfully support the operation of oil and gas production processes.

COURSE MATRIX										
	E, I & C	Gas Processing	Mechanical	Offshore	Operations Management	Pipeline	Procurement / Supply Chain	Production Facilities	Refining	Reliability
SPECIALIZED		G7 Process Simulation in Gas Conditioning and Processing						PF81 CO <sub>2</sub> Surface Facilities		
		G6 Gas Treating and Sulfur Recovery								
INTERMEDIATE		G5 Gas Conditioning and Processing - Special								
		G4 Gas Conditioning and Processing						PF42 Separation Equipment - Selection & Sizing		REL62 Principles of Reliability Engineering
FOUNDATION		G4 LNG Gas Conditioning and Processing LNG Emphasis	ME62 Turbomachinery Monitoring and Problem Analysis			PL61 Flow Assurance for Pipeline Systems	SC61 Inside Procurement in Oil & Gas	PF4 Oil Production and Processing Facilities	RF61 Refinery, Gas Treating, Sour Water, Sulfur and Tail Gas	REL61 Optimizing Equipment Availability
			ME46 Compressor Systems - Mechanical Design and Specification							
		IC4 Instrumentation and Controls Engineering Practices for Facilities Engineers	ME44 Overview of Pumps and Compressors in Oil and Gas Facilities		OM43 Effective Maintenance Shutdowns	PL42 Onshore Pipeline Facilities - Design, Construction and Operations	SC42 Effective Materials Management	PF43 Heat Transfer Equipment		
		E4 Electrical Engineering Practices for Facilities Engineers	G40 Process/Facility Fundamentals	ME41 Piping Systems - Mechanical Design and Specification	OS4 Fundamentals of Offshore Design and Construction	OM41 Maintenance Planning and Work Control	PL4 Fundamentals of Onshore and Offshore Pipeline Systems	SC41 Contracts and Tenders Fundamentals	PF22 Corrosion Management in Production/Processing Operations	
BASIC										REL50 Introduction to Reliability Statistics
										REL46 Introduction to Reliability Engineering
		G29 LNG Short Course - Technology and the LNG Chain		SS2 Overview of Subsea Systems	OM23 Essential Leadership Skills					REL45 Introduction to Life Cycle Costing
		IC3 Instrumentation and Controls Fundamentals for Facilities Engineers	G2 Overview of Gas Processing Technical	OS2 Overview of Offshore Oil and Gas Facilities	OM22 Project Management for Engineering and Construction					REL25 Root Cause Analysis
	E3 Electrical Engineering Fundamentals for Facilities Engineers	G1 Overview of Gas Processing Non-Technical	OS21 Introduction to Offshore Systems for Business Professionals	OM21 Applied Maintenance Management			PF21 Applied Water Technology in Oil and Gas Production	RF31 Refining Technology Overview	REL24 Introduction to Condition Monitoring	



## Overview of Gas Processing - Non-Technical (G-1)

COURSE LEVEL Basic

PETROSKILLS

DURATION 2 Days

### DESIGNED FOR

General administration, supervisory, non-technical management personnel or anyone that could benefit from a broad overview of important aspects of the gas processing industry

### YOU WILL LEARN

- Oil and gas facilities terminology
- Fundamentals of commercial and contract issues
- Key areas in oil and gas production surface facilities
- How gas is transported and sold
- Non-technical fundamentals of technology and processes
- Why various treatment processes and technologies are selected for differing gas compositions and processing applications
- Markets and uses for natural gas liquids

### ABOUT THE COURSE

This course is designed for a broad non-technical audience. While the course is intended to be interactive and participatory, most technical calculations are eliminated and use of technical terminology is minimized.

### COURSE CONTENT

- Basic concepts & fundamentals of natural gas
- Industry overview
- Natural gas composition and specifications
- Production facilities
- Gas properties and behavior
- Gas flow fundamentals
- Natural gas treating
- Overview of sulfur recovery and disposal
- Gas dehydration
- Conditioning and processing of natural gas
- Liquid product fractionation and treating
- Gas compression
- Transportation systems



## Overview of Gas Processing - Technical (G-2)

COURSE LEVEL Basic

PETROSKILLS

DURATION 3 Days

### DESIGNED FOR

Geologists, reservoir engineers, line managers, operational staff, shift foremen, those new to the industry such as entry-level engineers or anyone interested in a general, technically oriented overview of the gas processing industry

### YOU WILL LEARN

- Oil and gas facilities terminology
- How gas processing fits into the value chain for hydrocarbon products
- About key commercial and contract issues
- How gas is transported and sold
- The difference between various gas conditioning and processing technologies
- Why various treatment processes and technology are selected for differing gas compositions and processing applications
- Principles of gas measurement and common measurement devices
- Markets and uses for NGL, LPG, ethane, propane and butane
- Key pieces of equipment used in natural gas production and processing facilities

### ABOUT THE COURSE

This course is designed for a broad technical audience. It is participative and interactive, and utilizes fundamental technical exercises and terminology to communicate key learning points.

### COURSE CONTENT

- Industry overview
- Gas processing fundamentals
- Terminology
- Chemistry of oil and gas
- Markets, gas contracts and specifications
- Technical fundamentals, e.g. physical properties and phase behavior
- Oil and gas production facilities
- Hydrates, hydrate inhibition
- Gas dehydration
- Gas sweetening and sulfur recovery
- Acid gas reinjection
- Natural gas liquids and dew point control
- Nitrogen rejection and helium recovery
- Fractionation and stabilization
- Heat exchange and compression
- Gas transportation options
- Emerging technology

## Testimonials

*"I feel it [G-2 course] gives you an excellent grounding for chemical engineering; great recap and everything ties up very well. The links between subjects help keep it clear and easy to understand. The course presentation was good and when we looked confused points were clarified without us having to ask."*

R.K. Atwal  
G2 Participant



*"The books given were excellent. The discussions were very informative. The best thing about the course was I could relate to the instructors. They helped a lot and imparted their vast experiences to us. It helped solve some problematic issues."*

M Riaz  
G4 Participant



*"It [the course] has given me a broad-brush understanding which was what I wanted - excellent course."*

Kenny S.  
G2 Participant

*“This course was by far the best course I have attended in my career so far. John Morgan’s delivery of the course was excellent & I would rate him as one of the best lecturers I’ve ever had (which is taking into account school, university and other occupational training courses).”*

*Chris L.  
G4 Participant*



*“I loved the key learning points sessions! I loved the close follow-up and familiarity with the text book. I really liked the exercises and the frequent breaks to keep fresh and alert. And of course the instructor’s positive and highly encouraging attitude.”*

*Mirna S.  
G4 Participant*

## Share Your Experience

John M Campbell & Co, exclusive provider of PetroSkills facilities training, asks previous participants to share their experience with industry peers.

Please tell us about your experience at

[www.jmcampbell.com/testimonials](http://www.jmcampbell.com/testimonials)

or read what others have said.



## LNG Short Course: Technology and the LNG Chain (G-29)

PETROSKILLS

**COURSE LEVEL Basic**

**DURATION 5 Days**

### DESIGNED FOR

Technical and senior operations staff or commercial and management staff who require a technical overview of the LNG industry

### YOU WILL LEARN

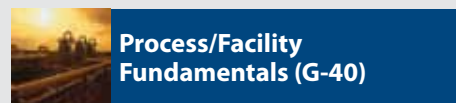
- How to survey commercial and contractual issues
- About project costs, feasibility and development
- Some fundamentals of gas technology
- To apply knowledge of LNG gas pretreatment, drying and refrigeration
- To describe liquefaction technologies and appreciate the differences
- The types of compressor drivers, gas turbines and electric motors
- About LNG storage, shipping and terminals

### ABOUT THE COURSE

Technical LNG basics are covered in this intensive short course. It provides an overview of the technology in the LNG chain. The course covers facility operation topics, technical and design issues. Key commercial issues are also discussed. Selected exercises and syndicates are used throughout the course. In-house versions are available with either increased technical and operational emphasis or increased project and development emphasis.

### COURSE CONTENT

- Introduction to LNG
- Commercial issues
- Technical fundamentals
- Gas processing basics
- Major equipment
- Refrigeration and LNG liquefaction
- Shipping
- LNG storage
- Regasification terminals and energy recovery
- Future trends in LNG



## Process/Facility Fundamentals (G-40)

PETROSKILLS

**COURSE LEVEL Foundational**

**DURATION 5 Days**

### DESIGNED FOR

Oil and gas process and facility personnel in need of understanding gas processing fundamentals and their applications to solve practical problems

### YOU WILL LEARN

- Technical fundamentals, property correlations, phase behavior and applied thermodynamics
- How to apply physical and thermodynamic property calculations with emphasis on limitations and applications to facility / equipment design
- How to apply phase behavior principles and phase diagrams to design and operating problems
- How to apply thermodynamic laws and principles to equipment design and operation

### ABOUT THE COURSE

This course is designed for those who desire a brief but intensive overview of gas process engineering principles. Course emphasis is on the application of engineering principles to solve operating and design issues common in gas processing facilities. Process simulation will be used throughout the course. The course is based on portions of Volume 1 of Campbell's Gas Conditioning and Processing.

### COURSE CONTENT

- Hydrocarbon phase behavior
- Vapor liquid equilibrium
- Physical properties of hydrocarbons
- Applied thermodynamics

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*



Photos of articles 1-3 of original 1954 O&G Series

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*"If separators are properly sized and operated, the loss of oil and rich vapors will be held to a minimum. More oil and higher gravity mean more money for the producer. The series that starts with this article is intended to show the operator how to choose and operate his separators and other field-processing equipment for maximum profit. The next few articles will show the effect of pressures and temperature on separation, application of stage separation and how to get top efficiency from other operations."*

*Introduction from Part 1 - Elements of Field Processing by Dr. John M. Campbell, Sr.*

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## The Campbell Gas Course™ and the Gas Conditioning and Processing Series

A comprehensive course that has evolved over the last 40 years, the Campbell Gas Course™ has the right mixture of subject matter at the right level for a range of engineering experience.

Like all Campbell courses, the Gas Conditioning and Processing course (G4), constantly changes and advances with demands of the industry. In 10 days, course attendees learn skills that can be immediately applied in the workplace. Problem assignments are completed throughout the course that reinforce learning and build confidence, attendees can apply that knowledge to real world applications improving individual and facility performance.

Attendees of the Campbell Gas Course™ learn the fundamentals with a proven blend of quality materials and instructor expertise. The G4 textbooks are considered to be among the most valuable references available to engineers around the world. Beginning in 1954 as a 54-part series of articles published in the *Oil and Gas Journal*, they are comprehensive, easy to read, and relevant. Published under John M. Campbell and Co. in 1968, Volume 1 of *Gas Conditioning and Processing* is now in its 8th edition.

Building on the fundamental skills presented in the Campbell Gas Course, the Gas Conditioning and Processing series includes the G4, G4-LNG and the G5. The G4-LNG focuses on the characteristics of the LNG industry with emphasis on refrigeration technologies and deeper coverage of acid gas removal. The popular G5 course applies the fundamentals of the G4 through a deeper analysis of gas processing technologies and practical industry problems using widely available computer simulator programs.

Companion software has been developed for Volumes 1 and 2 of *Gas Conditioning and Processing*. GCAP® was developed 18 years ago based on the equations and correlations found in the textbooks. A trial version of this software is included in the three courses of the Gas Conditioning and Processing series, G4, G4 LNG and G5.

Quality is extremely important. In order to make the classroom experience the best it can be, John M. Campbell & Co. expects the highest level of quality from our instructors. Campbell Instructors are required to attend annual meetings where they learn advanced instruction methods, exchange information on new technical developments and share lessons from current consulting work. Campbell instructors' wealth of practical experience incorporated into each session amplifies the learning experience.

We have invested heavily in our instructor development process to insure the highest level of quality instruction. So that, when the classroom work is done, you walk out - performance ready.

In order to maintain the same level of quality in our materials, every course uses a uniform evaluation form that is seen by the President of the Company and the Technical Training team. Meeting and exceeding the demands of the industry is our goal in keeping the quality of our materials and our instructors at the highest level. John M. Campbell & Co. believes that our success depends on maintaining the reputation of excellence we have in both the instructional material and the instructors.

We work hard to keep that reputation and hope you agree.

**See page 49 for the current editions of the Gas Conditioning and Processing series and the companion GCAP® software.**



## Gas Conditioning and Processing (G-4)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 10 Days

### DESIGNED FOR

Production and processing personnel involved with natural gas and associated liquids who wish to acquaint or reacquaint themselves with gas conditioning and processing unit operations. This course is also for facilities engineers, process engineers, operations personnel, field supervisors and others that select, design, install, evaluate or operate gas processing facilities.

### YOU WILL LEARN

- About the selection and evaluation processes used to dehydrate natural gas, meet hydrocarbon dew point specifications and extract NGLs
- How to apply physical/thermodynamic property correlations and principles to the design and evaluation of gas processing facilities
- Equipment sizing methods for major process equipment
- To recognize and develop solutions to operating problems and control issues in gas processing facilities

### ABOUT THE COURSE

The "Campbell Gas Course™" has been the standard of the industry for forty years. Over 30,000 engineers have attended our G-4 program, considered by many to be the most practical and comprehensive course in the oil and gas industry. Both hand-methods and computer-aided analysis is used to examine sensitivities of technical decisions. To enhance the learning process, about 30 problems will be assigned, reviewed and discussed throughout the course.

### COURSE CONTENT

- Gas processing systems
- Physical properties of hydrocarbons
- Qualitative phase behavior
- Vapor-liquid equilibrium
- Water-hydrocarbon phase behavior
- Basic thermodynamic concepts
- General system energy changes and rate processes
- Process control fundamentals
- Fluid hydraulics
- Separation equipment
- Heat transfer
- Pumps
- Compressors
- Refrigeration
- Fractionation / distillation
- Glycol dehydration
- Adsorption systems

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*



## Gas Conditioning and Processing - LNG Emphasis (G-4 LNG)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 10 Days

### DESIGNED FOR

Personnel directly or indirectly involved with natural gas processing and LNG production; also for anyone interested in a solid understanding of the principles of an LNG plant

### YOU WILL LEARN

- The basics of LNG gas conditioning and processing
- To select and evaluate processes used to dehydrate natural gas, remove heavy components and other contaminants, and to extract NGLs for LNG plants
- Physical/thermodynamic property correlations and principles, including heating values, etc. as applied to gas processing facilities and LNG plants
- Fundamentals of propane and propane pre-cooled, mixed refrigerant systems used in LNG plants
- Key points in other LNG liquefaction technologies
- How to perform and review equipment sizing for major process equipment
- Solutions to operating problems and control issues in LNG and gas processing facilities

### ABOUT THE COURSE

This is the LNG-industry version of our popular G-4 course with expanded coverage on refrigeration. The course includes in-depth information on basic LNG gas conditioning and processing. Instructors will explain the acid gas removal processes (various amines, hot carbonate, Sulfinol®, etc.) employed in LNG processes. Relevant details of both the mixed refrigerant and cascade processes in LNG liquefaction are described. Versions of this course have been taught in many of the world's base-load and peak-shaving LNG plants.

### COURSE CONTENT

- Basic gas technology principles
- Water-hydrocarbon system behavior
- Hydrates
- Thermodynamics of LNG processes
- Separation equipment
- Gas treatment, CO<sub>2</sub> and H<sub>2</sub>S removal
- Dehydration of natural gas
- Heat transfer and exchangers
- Pumps and compressors
- Refrigeration systems
- LNG liquefaction technologies
- Fractionation and adsorption
- Course summary and overview



## Gas Conditioning and Processing - Special (G-5)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

Engineers who desire an intensive training in natural gas processing and associated liquids recovery processes with emphasis on the use and benefits of a simulation package

### YOU WILL LEARN

- To determine the water content and hydrate formation conditions for gas streams using both a commercial process simulator and hand calculation methods
- Techniques to inhibit hydrate formation including injection of equilibrium inhibitors such as methanol and MEG
- Simulation of TEG dehydration processes and evaluation of the simulator results by using quick hand calculations
- Design of processes used to control the hydrocarbon dew point of sales gas streams by removing NGL's using mechanical refrigeration processes
- Various techniques to optimize mechanical refrigeration systems
- How to use the process simulator to evaluate the impact that pressure and temperature changes have on the sizing of process equipment
- How to use short-cut distillation calculations to provide input to rigorous distillation simulations in order to obtain consistent convergence
- Which thermodynamic property correlations are the best applications for various gas processing systems
- Limitations associated with commercial simulation packages and how the simulation results can be quickly checked for relative accuracy

### ABOUT THE COURSE

The course has been designed to cover topics from the 10 day G-4 course in an accelerated 5-day format using a commercial simulator to perform calculations. A basic working knowledge of the commercial process simulation package being used will provide the best opportunity to achieve the learning objectives of this course. Volumes 1 and 2 of the John M. Campbell text books, Gas Conditioning and Processing, are used as the basis for the material presented in this course. A comprehensive course exercise based on a typical gas processing facility which can be applied to either onshore or offshore facilities is used for this course. The problem is developed in stages, as the material is covered, using a commercial simulator package (typically HYSYS®). At the completion of the course the participant will have developed a process simulation model that includes a dew point control process, a mechanical refrigeration process with economizers, hydrate inhibition using MEG, gas dehydration using TEG, and liquid product stabilization with recycle.

### COURSE CONTENT

- Gas processing systems
- Physical properties of hydrocarbons
- Qualitative phase behavior
- Vapor-liquid equilibrium
- Water-hydrocarbon equilibrium
- Basic thermodynamic concepts
- Separation equipment
- Heat transfer
- Pumps
- Compressors
- Refrigeration
- Fractionation/distillation
- Glycol dehydration
- Adsorption systems

## Gas Treating and Sulfur Recovery (G-6)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

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 also for facilities engineers, process engineers, operations personnel, field supervisors and others who select, design, install, evaluate or operate gas sweetening and sulfur recovery facilities.

### YOU WILL LEARN

- About the evaluation and selection of processes to remove acid gases (H<sub>2</sub>S, CO<sub>2</sub>, COS, CS<sub>2</sub>, mercaptans, etc) from gas and NGLs
- The advantages and disadvantages of available gas treating technology and processes
- How to estimate solvent circulation rates, energy requirements and equipment sizes
- To recognize and evaluate solutions to common problems
- About sulfur recovery technologies, including an overview of the Claus Sulfur process
- How to select the proper sulfur recovery process given differing process conditions

### ABOUT THE COURSE

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 optimization of H<sub>2</sub>S:CO<sub>2</sub> ratio is covered. Related topics such as liquid product treating, corrosion, materials selection and NACE requirements will also be reviewed.

### COURSE CONTENT

- Gas specifications and process selection criteria
- Generic and specialty amine treating
- 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
- Solid bed and non-regenerable treating; scavengers
- Liquid product treating
- Sulfur recovery processes
- Tail gas clean-up: SCOT-type, CBA and others
- Course workshop and summary

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*

## Process Simulation in Gas Conditioning and Processing (G-7)

COURSE LEVEL Specialized

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

Engineers involved in simulation modeling of natural gas and liquids processing facilities who have completed our Gas Conditioning and Processing course (G-4) or comparable training

### YOU WILL LEARN

- To recognize and appreciate the capabilities and limits of process simulators in the design and evaluation of production/processing facilities
- How to develop models to solve several real problems using commercial simulation packages
- To work independently to apply process simulations to profitably design new facilities or evaluate existing facilities

### ABOUT THE COURSE

This extension of the Gas Conditioning and Processing (G-4) and Process/Facility Fundamentals (G-40) courses provides practical knowledge about using computers to solve operating problems more effectively and efficiently. Detailed discussions cover strengths, limitations and pitfalls of the calculation procedures used for the specification, design and operation of production processing facilities. Since most calculations are now made on a computer, this should be considered a required course in the normal training program for technical personnel. This course is presented using commercial simulator packages. The primary objective is to teach the participant how to work more effectively as an engineer by using a commercial simulator package as a tool. Familiarity with the simulation package used in the course is a prerequisite. The course is normally taught using HYSYS®, but arrangements can be made with the instructor to use other packages as well.

### COURSE CONTENT

- Overview of computer simulation as a tool in the management of engineering as it relates to the design, selection and operation of oil and gas production
- Equations of state and their application
- Calculation of thermodynamic properties
- Gas compression
- Preparation of a compressor train flow sheet
- Preparation of production train flow sheet with recycles and equipment sizing
- NGL recovery processing
- Preparation of offshore dew point control flow sheet
- Characterization of the C6+ fraction
- Preparation of offshore dew point control flow sheet with emphasis on the potential risk of improper feed characterization
- Fractionation / distillation
- Modeling a fractionation train for multiple product specifications
- Fluid hydraulics
- Modeling a piping system with both pumps and compressors



## Under Development

It is our mission to build proficient energy professionals that serve the energy needs of the global community.

With that goal in mind, John M Campbell & Co. is constantly developing new courses to help close your skills gaps.

Check our website often for announcements.

Or choose our email opt-in to stay up-to-date with Campbell news and course offerings.

[www.jmcampbell.com](http://www.jmcampbell.com)

# MECHANICAL

## Piping Systems - Mechanical Design and Specification (ME-41)

COURSE LEVEL Foundation

CAMPBELL

DURATION 5 Days

### DESIGNED 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

### YOU WILL LEARN

- To apply piping system codes and standards
- About line sizing and layout of piping systems in various types of facilities
- How to specify proper components for process and utility applications
- To compare alternative materials of construction
- The process of steelmaking, pipe manufacturing and material specifications
- Joining methods and inspection techniques
- Key considerations for flare and vent systems, including PSV sizing

### ABOUT THE COURSE

This five-day foundation 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

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*

MECHANICAL

## COURSE MATRIX

	Gas Processing	Mechanical	Offshore	Operations Management	Production Facilities	Reliability
SPECIALIZED	G7 Process Simulation in Gas Conditioning and Processing				PF81 CO <sub>2</sub> Surface Facilities	
	G6 Gas Treating and Sulfur Recovery					
INTERMEDIATE	G5 Gas Conditioning and Processing - Special					
	G4 Gas Conditioning and Processing				PF42 Separation Equipment - Selection & Sizing	REL62 Principles of Reliability Engineering
	G4 LNG Gas Conditioning and Processing LNG Emphasis	ME62 Turbomachinery Monitoring and Problem Analysis			PF4 Oil Production and Processing Facilities	REL61 Optimizing Equipment Availability
FOUNDATION		ME46 Compressor Systems - Mechanical Design and Specification				
		ME44 Overview of Pumps and Compressors in Oil and Gas Facilities		OM43 Effective Maintenance Shutdowns	PF43 Heat Transfer Equipment	
	G40 Process/Facility Fundamentals	ME41 Piping Systems - Mechanical Design and Specification	OS4 Fundamentals of Offshore Design and Construction	OM41 Maintenance Planning and Work Control	PF22 Corrosion Management in Production/Processing Operations	REL44 Reliability Centered Maintenance
						REL50 Introduction to Reliability Statistics
BASIC						REL46 Introduction to Reliability Engineering
	G29 LNG Short Course - Technology and the LNG Chain		SS2 Overview of Subsea Systems	OM23 Essential Leadership Skills		REL45 Introduction to Life Cycle Costing
	G2 Overview of Gas Processing Technical		OS2 Overview of Offshore Oil and Gas Facilities	OM22 Project Management for Engineering and Construction		REL25 Root Cause Analysis
	G1 Overview of Gas Processing Non-Technical		OS21 Introduction to Offshore Systems for Business Professionals	OM21 Applied Maintenance Management	PF21 Applied Water Technology in Oil and Gas Production	REL24 Introduction to Condition Monitoring



## Overview of Pumps and Compressors in Oil and Gas Facilities (ME-44)

COURSE LEVEL Foundation

CAMPBELL

DURATION 5 Days

### DESIGNED FOR

Mechanical, process, facilities, plant, or pipeline engineers, technicians, and operators who desire a general knowledge of pumps and compressors in oil and gas facilities

### YOU WILL LEARN

- About API and ISO codes
- How to select, size and specify common pump and compressor equipment used in the oil and gas industry
- About integrating pump and compressor equipment with piping and other process systems
- About identifying physical principles and forces that occur in rotating equipment; focusing on pumps and compressors
- About using operating and troubleshooting techniques for pumps and compressors
- About pump and system hydraulics and compressor thermodynamics


### ABOUT THE COURSE

This is an intensive, five-day foundation level course that provides a comprehensive review of pump and compressor equipment used in the upstream and midstream sectors of the oil and gas industry. Emphasis is on applications, design, selection, installation, operation, and maintenance of such equipment.

### COURSE CONTENT

- Major components of pumps and compressors and their function
- Types and applications of pumps and compressors including equipment limitations
- Centrifugal pumps
- Reciprocating pumps
- Rotating pumps
- Pump selection, application and performance evaluation
- Thermodynamics of compression
- Centrifugal compressors
- Reciprocating compressors
- Rotary screw compressors
- Pump and compressor operating/control methods
- Pump installation, operation, troubleshooting and maintenance considerations
- Compressor installation, operation troubleshooting and maintenance considerations
- Auxiliary systems – lube oil, seal flush, and monitoring instruments

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*



## Compressor Systems - Mechanical Design and Specification (ME-46)

COURSE LEVEL Foundation

CAMPBELL

DURATION 5 Days

### DESIGNED FOR

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

### YOU WILL LEARN


- How to apply thermodynamics to compressor performance and operating characteristics
- How to size, specify, and select compressors
- About compressor auxiliary systems
- About series and parallel application of compressors
- How to integrate compressor systems into process facilities used in the oil and gas industry
- How to use state-of-the-art monitor and control devices in the operation, maintenance, and troubleshooting of compression systems
- How to apply maintenance practices to improve compressor reliability
- About shop and field performance testing
- Compressor economics including OPEX vs. CAPEX considerations

### ABOUT THE COURSE

This five-day foundation 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



## Turbomachinery Monitoring and Problem Analysis (ME-62)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

Experienced mechanical or facilities engineers and senior technicians who require an in-depth understanding of monitoring and troubleshooting turbomachinery

### YOU WILL LEARN

- How to evaluate turbine performance during startup and operation
- How to identify turbomachinery system components
- How to define and use appropriate monitoring techniques and tools
- How to utilize effective operation and shutdown procedures
- How to analyze common turbomachinery problems, such as vibration, temp/pressure operation and surge
- How to solve instrumentation and control problems
- To understand the inter-relationships of drivers, couplings, gearboxes, and driven equipment
- About installation techniques, equipment failures and different maintenance practices
- About economic considerations

### ABOUT THE COURSE

This five-day course is an intensive, intermediate level program for experienced mechanical equipment engineers to develop and expand their capabilities in monitoring and problem analysis of turbomachinery. This course focuses on defining the systems and subsystems that form the turbomachinery, the potential problems with these systems and subsystems, monitoring techniques for early detection of problems, and methods to analyze the monitored variables to detect potential problems or reconstruct reasons for failures. Case studies are used throughout the course.

### COURSE CONTENT

- Gas turbine machinery - general description
- Operating principles of gas turbines
- Key performance variables and means to monitor
- Major components of axial flow compressors: rotors, blades, shafts, combustion chambers, nozzles, etc
- Auxiliary systems: lube oil, seal oil, fuel, start up, etc
- Evaluation of turbine performance parameters during start up and normal operation
- Troubleshooting control systems for gas turbines: start up, speed and temperature controls, vibration
- Principles of operation and general components of compressors: rotors, seals, diaphragms, etc
- Operating characteristics curves
- Surging phenomenon
- Choking phenomenon
- Compressor instrumentation: various control loops; anti-surge control loops
- Compressor safety interlock and trip systems
- Gas turbine and compressor systems start up procedures
- Normal operation - monitoring of parameters
- Shutdown procedures
- Logging of monitoring checks
- Vibration monitoring
- Troubleshooting

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*

# OFFSHORE

## Instructors

Gary Blackburn  
 Ralph Dartez  
 Kris Digre  
 Andrea Mangiavacchi  
 Gordon Sterling

Campbell Training's Offshore Discipline Team provides technical training and consulting for the complete lifecycle of offshore oil and gas systems; from exploration and development to decommissioning. The discipline curriculum includes courses that provide the students the knowledge to understand and participate in evaluating the major offshore development alternatives: fixed structures, floating systems and subsea systems. Other key elements stressed in all offshore courses include life cycle costs, constructability, operability and interface management.

Offshore instructors have extensive real world experience managing offshore development projects, well construction and servicing, asset management and producing operations. Their broad knowledge blends the unique technical and operational issues of offshore into an integrated approach to enhance understanding of the full scope of offshore facilities.

COURSE MATRIX										
	E, I & C	Gas Processing	Mechanical	Offshore	Operations Management	Pipeline	Procurement / Supply Chain	Production Facilities	Refining	Reliability
SPECIALIZED		G7 Process Simulation in Gas Conditioning and Processing						PF81 CO <sub>2</sub> Surface Facilities		
		G6 Gas Treating and Sulfur Recovery								
		G5 Gas Conditioning and Processing - Special								
INTERMEDIATE		G4 Gas Conditioning and Processing						PF42 Separation Equipment - Selection & Sizing		REL62 Principles of Reliability Engineering
		G4 LNG Gas Conditioning and Processing LNG Emphasis	ME62 Turbomachinery Monitoring and Problem Analysis			PL61 Flow Assurance for Pipeline Systems	SC61 Inside Procurement in Oil & Gas	PF4 Oil Production and Processing Facilities	RF61 Refinery and Gas Treating, Sour Water, Sulfur and Tail Gas	REL61 Optimizing Equipment Availability
FOUNDATION			ME46 Compressor Systems - Mechanical Design and Specification							
	IC4 Instrumentation and Controls Engineering Practices for Facilities Engineers		ME44 Overview of Pumps and Compressors in Oil and Gas Facilities		OM43 Effective Maintenance Shutdowns	PL42 Onshore Pipeline Facilities - Design, Construction and Operations	SC42 Effective Materials Management	PF43 Heat Transfer Equipment		
	E4 Electrical Engineering Practices for Facilities Engineers	G40 Process/Facility Fundamentals	ME41 Piping Systems - Mechanical Design and Specification	OS4 Fundamentals of Offshore Design and Construction	OM41 Maintenance Planning and Work Control	PL4 Fundamentals of Onshore and Offshore Pipeline Systems	SC41 Contracts and Tenders Fundamentals	PF22 Corrosion Management in Production/Processing Operations		REL44 Reliability Centered Maintenance
BASIC										REL50 Introduction to Reliability Statistics
										REL46 Introduction to Reliability Engineering
		G29 LNG Short Course - Technology and the LNG Chain		SS2 Overview of Subsea Systems	OM23 Essential Leadership Skills					REL45 Introduction to Life Cycle Costing
	IC3 Instrumentation and Controls Fundamentals for Facilities Engineers	G2 Overview of Gas Processing Technical		OS2 Overview of Offshore Oil and Gas Facilities	OM22 Project Management for Engineering and Construction					REL25 Root Cause Analysis
E3 Electrical Engineering Fundamentals for Facilities Engineers	G1 Overview of Gas Processing Non-Technical		OS21 Introduction to Offshore Systems for Business Professionals	OM21 Applied Maintenance Management				PF21 Applied Water Technology in Oil and Gas Production	RF31 Refining Technology Overview	REL24 Introduction to Condition Monitoring

OFFSHORE

## Overview of Offshore Oil and Gas Systems (OS-2)

COURSE LEVEL Basic

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

Technical staff that needs a basic understanding of offshore field development, production work processes and facilities systems. It is a good choice for individuals with limited experience working with offshore Oil and Gas Operations and field development or are beginning or transitioning from other areas to be directly involved with the design, construction and operation of offshore oil and gas facilities.

### YOU WILL LEARN

- To identify the key parameters for field architecture design and to define an optimum system for field development for fields in any water depth, from shallow to ultra deepwater
- To recognize the types of offshore production facilities and structures and understand the associated terminology
- To understand the impact of the ocean environment on facilities design and operations
- To identify major design and operational interfaces of offshore systems, both fixed and floating
- To understand key design, construction and installation issues associated with fixed and floating platforms
- To recognize important loads on offshore structures and how they influence their design and cost

### ABOUT THE COURSE

This five-day course will accelerate the learning and productivity of engineers and technical managers with little of 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 rigs, workover equipment, 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 are used throughout the course. A "red thread" exercise is included to develop field architecture recommendations, basic design and high level project execution plans for an offshore development. The course instructors are experienced offshore managers.

### COURSE CONTENT

- Field development planning
- Structural system options
- Oil and gas transportation system design and installation
- Well construction and servicing operations
- Drilling, processing and utilities topside facilities
- Production operations
- Life cycle considerations

## Introduction to Offshore Systems for Business Professionals (OS-21)

COURSE LEVEL Basic

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

Business professionals, technicians, analysts and other non technical staff members that are already involved, or are transitioning from other areas to be involved, with the selection, planning, design, construction and operation and decommissioning of offshore oil and gas facilities. It will provide these individuals with a basic understanding of offshore exploration and production work processes and systems in all water depths, from shallow to ultra deepwater.

### YOU WILL LEARN

- To appreciate the rich and fascinating history of the Offshore Oil and Gas business from its first advances in 1897 to the present time
- To understand how oil and gas is formed and how the explorationists determine the likelihood of hydrocarbons in a "play"
- To identify the key steps in the development of offshore Oil and Gas fields from exploration through decommissioning
- To understand how offshore oil and gas wells are drilled and completed and the associated equipment used
- To recognize the types of offshore production facilities and structures and understand the associated terminology
- To identify the common types of fixed and floating offshore structures
- To recognize many of the key technical and non-technical stakeholder issues involved in the process from explore through decommission
- To appreciate the basic processes and equipment involved in the topsides design and operation
- To be conversant with the common offshore terminology and acronyms
- To understand the pipeline and shuttle tanker methods of oil transport
- To develop an understanding of, and appreciation for the marine equipment used in the construction of wells and facilities
- To understand basic issues in life cycle and decommissioning decisions
- To appreciate the continuing advances being made in the technology of offshore, and how it might effect business decisions of the future

### ABOUT THE COURSE

This five-day course will accelerate the learning and productivity of business professionals, other non-technical staff, and general business managers involved in various aspects of the offshore oil and gas industry from shallow to ultra deepwater. Past attendees have included legal staff, public and government relation's professionals, human resource staff, HSES professionals, Field and Operations Technicians, Construction and Operations Foremen and staff, Financial Analysts, Supply Chain professionals and Administrative staff, and host country regulatory staff. The course instructors are experienced offshore managers.

### COURSE CONTENT

- Setting the stage: history and recent activities
- Five phases-explore through decommission
- Exploring in deepwater
- Drilling and completing wells
- Field development options and systems
- Marine construction equipment
- Fixed structures
- Floating production systems
- Subsea systems
- Production facilities (topside)
- Pipelines, flow lines and risers
- Life cycle and decommissioning
- Future systems

## Fundamentals of Offshore Systems Design and Construction (OS-4)

COURSE LEVEL Foundation

CAMPBELL

DURATION 10 days

### DESIGNED FOR

Individuals with a basic awareness of offshore engineering and operations and who have some experience working in onshore oil and gas projects or engineering. Technical staff, project engineers, engineering discipline leads, engineering specialists and operating staff will find this course enables them to accelerate their capability to contribute on offshore field development planning, design and construction projects and field operations.

### YOU WILL LEARN


- To identify the key facilities parameters that must be evaluated for field development
- To describe the types and capabilities of offshore well construction, pipeline, riser and production (surface and subsea) facilities needed for all water depths, from shallow to ultra deepwater
- To recognize the best applications and characteristics of each type of offshore fixed and floating structure
- To account for the affects of the ocean environment on facilities design, construction and operations
- To identify the impact space, loads and forces have on the structural design and global performance of offshore structures and how they influence their cost
- To describe the impact topside facilities (drilling, well servicing, processing and utilities) affect the structural design and how the topside design process is done
- To recognize and manage key design and operational interfaces between the major components of offshore facilities systems
- To understand and apply the key design, construction and installation issues associated with fixed and floating platforms to your work

### ABOUT THE COURSE

This 10-day course will provide a fundamental understanding of the technology and work processes used for the design and construction of all types of offshore systems asset development, surveillance and management. The content includes the full range of water depths from shallow water to ultra deepwater and will also address 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-disciplined team approach needed to manage the myriad interfaces of offshore facility design, construction and operations. Individual and group exercises are used throughout the course. A "red thread" exercise is included to develop field architecture recommendations, basic design and high level project execution plans for an offshore development. The course instructors are experienced offshore managers.

### COURSE CONTENT

- Offshore systems overview and field architecture selection
- Well construction and servicing equipment and operations
- Flow assurance
- Topside 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



**Overview of Subsea Systems (SS-2)**

**COURSE LEVEL** Basic

**PETROSKILLS**

**DURATION** 5 Days

# OPERATIONS MGMT.

**DESIGNED FOR**

Technical staff that are beginning or transitioning from other areas to be directly involved with the design, construction, and operation of subsea systems and non-technical staff working on or with a subsea development team will benefit by developing an awareness of subsea systems

**YOU WILL LEARN**

- To recognize the integrated nature of field architecture, system design, and component selection
- To identify appropriate applications for subsea systems
- To identify the main subsea components, their functions, strengths, weaknesses and interfaces from the well to the production facility
- To understand key design, construction, and installation issues
- To describe basic operating and maintenance considerations
- To understand the key steps from drilling through startup for the design, fabrication, testing, installation and operation
- To understand the importance of an integrated approach to design, flow assurance, installation, and life cycle considerations

**ABOUT THE COURSE**

An overview of subsea components and how they are integrated into field architecture is provided during this 5-day course. Individuals will develop a basic understanding of the various subsea components used in all water depths, from relatively shallow to ultra deepwater. The participants will all learn how the components are integrated into subsea field developments which will accelerate learning and productivity. Installation and working underwater 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 "red thread" exercise 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

The skills required to be successful comprise much more than "hard" engineering skills. Excellent managers and supervisors are effective leaders, knowledgeable in a broad range of disciplines, and able to develop their workforce. The Operations Management (OM) discipline provides skills development that give facility managers the knowledge required for success.

Operations Management includes skills development programs and consultation in these vital areas:

- Maintenance management, planning & work control
- Managing turnarounds
- Competency assessment
- Production operations
- Project management
- Organizational development
- Warehouse operations
- Leadership & team building

**Instructors:** Perry Lovelace, Jim Vinson

		COURSE MATRIX					
		Gas Processing	Offshore	Operations Management	Procurement/Supply Chain	Production Facilities	Reliability
SPECIALIZED	G7 Process Simulation in Gas Conditioning and Processing					PF81 CO <sub>2</sub> Surface Facilities	
	G6 Gas Treating and Sulfur Recovery						
	G5 Gas Conditioning and Processing - Special						
INTERMEDIATE	G4 Gas Conditioning and Processing					PF42 Separation Equipment - Selection & Sizing	REL62 Principles of Reliability Engineering
	G4 LNG Gas Conditioning and Processing LNG Emphasis				SC61 Inside Procurement in Oil & Gas	PF4 Oil Production and Processing Facilities	REL61 Optimizing Equipment Availability
FOUNDATION				OM43 Effective Maintenance Shutdowns	SC42 Effective Materials Management	PF43 Heat Transfer Equipment	
	G40 Process /Facility Fundamentals	OS4 Fundamentals of Offshore Design and Construction	OM41 Maintenance Planning and Work Control	SC41 Contracts and Tenders Fundamentals	PF22 Corrosion Management in Production/ Processing Operations		REL44 Reliability Centered Maintenance
							REL50 Introduction to Reliability Statistics
BASIC							REL46 Introduction to Reliability Engineering
	G29 LNG Short Course - Technology and the LNG Chain	SS2 Overview of Subsea Systems	OM23 Essential Leadership Skills				REL45 Introduction to Life Cycle Costing
	G2 Overview of Gas Processing Technical	OS2 Overview of Offshore Oil and Gas Facilities	OM22 Project Management for Engineering and Construction				REL25 Root Cause Analysis
	G1 Overview of Gas Processing Non-Technical	OS21 Introduction to Offshore Systems for Business Professionals	OM21 Applied Maintenance Management			PF21 Applied Water Technology in Oil and Gas Production	REL24 Introduction to Condition Monitoring

OPERATIONS MANAGEMENT



## Applied Maintenance Management (OM-21)

PETROSKILLS

COURSE LEVEL Basic

DURATION 5 Days

### DESIGNED FOR

All maintenance personnel who are supervisors, team leaders, or managers who would like to improve the quality of their maintenance programs. This course is a broad survey of essential aspects of maintaining a safe, efficient and reliable facility asset

### YOU WILL LEARN

- World class maintenance standards and how to apply them
- Key Performance Indicators for your dashboard
- Essential elements of work planning & scheduling
- Optimization of Preventive and Predictive maintenance
- How to focus your resources on critical equipment
- How to work with contractors more effectively
- Develop organizational competence

### ABOUT THE COURSE

This course provides essential knowledge required for achieving excellence in maintenance management. Work control, planning, and scheduling will be covered. 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. Better utilization of Computerized Maintenance Management Systems (CMMS) will be covered in this course. 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
- Utilizing your CMMS
- Supplier certification
- Developing organizational competence
- Presenting your action plan



## Project Management for Engineering and Construction (OM-22)

PETROSKILLS

COURSE LEVEL Basic

DURATION 5 days

### DESIGNED FOR

Maintenance, operations, engineering, and purchasing personnel including team leaders and managers who plan, manage, or participate on project teams

### YOU WILL LEARN

- To define project phases and execute them skillfully
- To develop control tools and progress report cards
- To use extensive checklists to make sure all project deliverables are addressed
- To apply project management skills to your current projects
- To utilize project management software as an effective tool
- How to develop sustainable, repeatable knowledge management for projects

### ABOUT THE COURSE

This course will provide a comprehensive presentation and discussion of modern project management principles and practices as they relate to design; procurement; construction activities, maintenance; and upgrade turnarounds at facilities in the oil and gas industry. The specific training received in schedule and cost management, risk management, and the proper use of scarce resources (people and materials) will help the project manager make the best decisions possible. Upon completion of this course, the participant will know what the eight project management process groups are. Participants will understand how project management process groups relate to one another, what tools are available for the project manager to use, what information will be generated, and what that information means. The course is taught using a combination of instruction, facilitated discussion, and hands-on exercises using "real-world" project examples related to facilities design, procurement, construction, and turnarounds. The exercises will include both individual and group activities that will provide each participant with a visual application of the principles and practices discussed throughout the course.

### COURSE CONTENT

- Introduction to project management framework
- Four stages of project management
- Eight project management process groups
- Initiation: scope/change, schedule/cost, quality, resource/team, communication/information, risk, subcontract/outsourcing, and integration
- Control: scope/change, schedule/cost, quality, resource/team, communication/information, risk, procurement/contracting, and integration/coordination
- Close-out: scope, subcontract/outsourcing, lessons learned, and integration



## Contact us via email in English or Spanish

*Contáctenos via correo electrónico (email) en Inglés , o Castellano*

Do you have questions about our company or any of our courses?

*Tienen algunas preguntas referente a nuestra Empresa , o algunos de los Cursos (Eventos)?*

Personnel at John M. Campbell & Co. are happy to respond to any inquiries.

*El personal de la John M. Campbell & Co. se complacen en responder a sus indagaciones.*

Feel free to contact us at any time.

*Siéntanse en completa libertad para comunicarse con nosotros en cualquier momento.*

[jmcsupport@jmcampbell.com](mailto:jmcsupport@jmcampbell.com)



## Essential Leadership Skills (OM-23)

CAMPBELL

COURSE LEVEL Basic

DURATION 5 days

### DESIGNED FOR

Supervisors, team leaders, managers, and others who aspire to become more effective in their leadership and communication skills

### YOU WILL LEARN

- To enhance your leadership, decision-making and communication styles
- About coaching and leading an empowered team
- To recognize and solve conflicts
- How to negotiate difficult situations

### ABOUT THE COURSE

This seminar will include lecture, discussion, readings, role-playing, video examples and creation of participant action plans. This course will help you unleash natural motivation in your team. You will lower your stress level by working more efficiently and effectively by tapping into the emotional intelligence of your team. Under the guidance of the seminar leaders, you will use competency maps in Leadership and Management to assess yourself in seven major skill areas before and after the seminar.

### COURSE CONTENT

- The nature of groups
- Leadership vs. Management
- Self-centering
- Listening
- Motivation
- Group dynamics
- Conflict management
- Team building
- Critical thinking and taking action



## Maintenance Planning and Work Control (OM-41)

PETROSKILLS

COURSE LEVEL Foundation

DURATION 5 Days

### DESIGNED FOR

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

### YOU WILL LEARN

- To develop world class planning and work control
- To employ business process analysis techniques in work control
- How to use a gap analysis on your work management system
- Step-by-step work control from identification through using work history
- Optimization of preventive and condition-monitoring activities
- Techniques critical equipment analysis, critical spares control and emergency response work

### ABOUT THE COURSE

This course is designed to build competency in Work Control as a primary skill set in the Competency Map for Facilities Maintenance Management. 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, resource control, and reliable operation. A pre and post self assessment will be used to measure competency improvement. Each participant will develop an action plan to help their organizations 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

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*



## Effective Maintenance Shutdowns (OM-43)

CAMPBELL

COURSE LEVEL Foundation

DURATION 5 days

### DESIGNED FOR

Maintenance, engineering, and operations personnel responsible for planning and managing effective maintenance shutdowns with foundation skills in maintenance planning and scheduling

### YOU WILL LEARN

- How to develop and control maintenance shutdown scope of work
- To control work before and during the maintenance shutdown
- To use available computerized scheduling tools
- To use Manpower planning and control methods
- How to measure progress of the maintenance shutdown
- To manage worker productivity
- How to measure maintenance shutdown performance
- How to improve performance on future maintenance shutdowns

### ABOUT THE COURSE

This course is designed to teach the skills of maintenance shutdown management as described in the Facilities Maintenance Management Competency Map. You will develop shutdown planning strategies and will develop the organizational structure necessary for managing successful shutdowns. Case studies and real world examples will be used to reinforce the techniques learned in the course. Students will be asked to bring examples from their maintenance shutdown experiences to be used as case studies during the course.

### COURSE CONTENT

- Maintenance shutdown terms and basics
- Shutdown planning strategy: establishing goals and objectives, working cooperatively across departments, developing maintenance shutdown procedures
- Management planning: components of the maintenance shutdown plan, planning for effective communications
- Developing a management strategy, organization, and roles and responsibilities
- Work scope development and strategy
- Planning and scheduling controls: participation and teamwork, the overall plan, specifying tasks, shutdown and start-up plans, work scheduling, optimizing the plan, handling emergent work, work control documents
- Computerized scheduling tools
- Manpower planning and control: using in-house resources, balancing teams and skills, managing scarce and critical resources

# MASTER OF TECHNOLOGY PETROLEUM TECHNOLOGY

- > Complete your Masters Degree online, from anywhere in the world
- > Part-time studies available, complete the MTech in 2-4 years
- > Enjoy a flexible study program aligned with job skills and competencies
- > PetroSkills courses provide partial program credits after online assessment



## What is the PetroSkills MTech?

An online, part-time and flexible Masters Degree in Petroleum Technology awarded by Curtin University of Technology, Western Australia. Online assessment of selected PetroSkills courses will provide approximately half the total credits required for the MTech. The remaining program credits are obtained through workplace-based projects monitored and assessed by Curtin University.

**Program Duration: 2-4 Yrs Part-Time – All Assessment Online**

For course entry requirements, application information and course structure information, visit the MTech website at: [www.mtechpt.curtin.edu.au](http://www.mtechpt.curtin.edu.au)

## Curtin University of Technology

Curtin is an institution with a worldwide reputation for providing programs of study that focus on the delivery of knowledge and the acquisition of practical skills designed to achieve industry and workplace standards. One of Curtin's core areas of academic strength and research expertise is in the oil and gas industry, with internationally recognised programs available in Petroleum Engineering, Chemical Engineering and Exploration Geophysics.

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[www.geophysics.curtin.edu.au](http://www.geophysics.curtin.edu.au)

[mtechpt.curtin.edu.au](http://mtechpt.curtin.edu.au)

For further information, please refer to the University Website: [www.curtin.edu.au](http://www.curtin.edu.au)

**PetroSkills®**

**Curtin**   
University of Technology

# PIPELINE

## Instructors

John Berry  
 Bill Dokianos  
 David Hairston  
 Richard Van Laere

The Campbell Training's Pipeline Discipline provides technical training and consulting for oil and gas transportation, focusing on pipeline systems as well as onshore infrastructure systems that support oil and gas operations. The discipline covers pipeline transportation systems, oil and gas terminals facilities, and the onshore infrastructure from regional considerations through design and construction of site specific systems. As with all PetroSkills/Campbell training programs, these discipline areas integrate with the other technical, operations and HSE disciplines.

The Campbell Instructors and consultants that support the Pipeline discipline have extensive real world – global experience from conceptual development through operations. Their broad knowledge blends the unique technical and operational issues of pipeline systems that transport all types of fluids – from heavy oils to refined products to high pressure injection gas and water - into integrated systems. This global experience spans the pipeline industry from initial site selection through detailed design and construction of unique facilities.

## COURSE MATRIX

	E, I & C	Gas Processing	Mechanical	Offshore	Operations Management	Pipeline	Procurement / Supply Chain	Production Facilities	Refining	Reliability	
SPECIALIZED		G7 Process Simulation in Gas Conditioning and Processing						PF81 CO <sub>2</sub> Surface Facilities			
		G6 Gas Treating and Sulfur Recovery									
INTERMEDIATE		G5 Gas Conditioning and Processing - Special									
		G4 Gas Conditioning and Processing						PF42 Separation Equipment - Selection & Sizing		REL62 Principles of Reliability Engineering	
FOUNDATION		G4 LNG Gas Conditioning and Processing LNG Emphasis	ME62 Turbomachinery Monitoring and Problem Analysis			PL61 Flow Assurance for Pipeline Systems	SC61 Inside Procurement in Oil & Gas	PF4 Oil Production and Processing Facilities	RF61 Refinery Gas Treating, Sour Water, Sulfur and Tail Gas	REL61 Optimizing Equipment Availability	
			ME46 Compressor Systems - Mechanical Design and Specification								
		IC4 Instrumentation and Controls Engineering Practices for Facilities Engineers	ME44 Overview of Pumps and Compressors in Oil and Gas Facilities		OM43 Effective Maintenance Shutdowns	PL42 Onshore Pipeline Facilities - Design, Construction and Operations	SC42 Effective Materials Management	PF43 Heat Transfer Equipment			
		E4 Electrical Engineering Practices for Facilities Engineers	G40 Process/Facility Fundamentals	ME41 Piping Systems - Mechanical Design and Specification	OS4 Fundamentals of Offshore Design and Construction	OM41 Maintenance Planning and Work Control	PL4 Fundamentals of Onshore and Offshore Pipeline Systems	SC41 Contracts and Tenders Fundamentals	PF22 Corrosion Management in Production/Processing Operations		REL44 Reliability Centered Maintenance
										REL50 Introduction to Reliability Statistics	
BASIC										REL46 Introduction to Reliability Engineering	
		G29 LNG Short Course - Technology and the LNG Chain		SS2 Overview of Subsea Systems	OM23 Essential Leadership Skills					REL45 Introduction to Life Cycle Costing	
		IC3 Instrumentation and Controls Fundamentals for Facilities Engineers	G2 Overview of Gas Processing Technical	OS2 Overview of Offshore Oil and Gas Facilities	OM22 Project Management for Engineering and Construction					REL25 Root Cause Analysis	
	E3 Electrical Engineering Fundamentals for Facilities Engineers	G1 Overview of Gas Processing Non-Technical		OS21 Introduction to Offshore Systems for Business Professionals	OM21 Applied Maintenance Management			PF21 Applied Water Technology in Oil and Gas Production	RF31 Refining Technology Overview	REL24 Introduction to Condition Monitoring	

## Fundamentals of Onshore and Offshore Pipeline Systems (PL-4)

COURSE LEVEL Foundation

CAMPBELL

DURATION 10 Days

### DESIGNED FOR

Technical professionals who are new to the pipeline business or need a broad understanding of the pipeline business including: pipeline project managers, pipeline engineers, facilities engineers, pipeline design and construction engineers, engineering and construction contractors

### YOU WILL LEARN

- How to apply mechanical and physical principles to all phases of pipeline design, construction, and operation
- To identify similarities and differences of onshore and offshore pipeline systems
- To incorporate construction methods, commissioning, pressure testing, and start up into the design of a pipeline system
- About applying safety and environmental regulations for a sound design
- Common sense methods and technical requirements to define pipeline routes and facilities locations
- The importance of fluid properties and process to pipeline systems design and construction

### ABOUT THE COURSE

This intensive, ten-day foundation level course covers the design, construction, and operation of pipeline systems. The focus is on pipeline routing, hydraulics, mechanical design, and construction for both onshore and offshore pipelines. The result of this course is cost-effective, safe and environmentally sound design, construction, inspection, operation, and maintenance of pipelines. Design problems and group projects are an integral part of this course.

### COURSE CONTENT

- Pipeline systems definition and applications
- Codes and standards related to pipelines
- Pipeline hydraulics: single phase gas and liquids, multiphase fluids and heavy/waxy crudes
- Major design considerations for strength, stability, and installation
- Pipeline survey and mapping
- Pipeline route engineering
- Pipeline materials and components
- Corrosion and cathodic protection of pipelines
- Special design aspects, covering such issues as risers, slug catchers, pigging facilities, etc
- Basic design considerations for pipeline facilities
- Pipeline construction for cross country and offshore systems focusing on welding
- Pressure testing, pre-commissioning, and commissioning
- Pipeline integrity aspects including in-line inspection
- Leak detection and emergency planning considerations
- Repairs and modification considerations
- Safety, environmental, and regulatory requirements

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*

## Onshore Pipeline Facilities - Design, Construction and Operations (PL-42)

COURSE LEVEL Foundation

CAMPBELL

DURATION 5 Days

### DESIGNED FOR

Technical professionals who are new to the onshore pipeline business or need a broad understanding of the onshore pipeline business including: pipeline project managers, pipeline engineers, facilities engineers, pipeline design and construction engineers, engineering and construction contractors

### YOU WILL LEARN

- How to apply mechanical and physical principles to pipeline design, material selection, construction, and operation
- To identify special design and construction challenges of onshore pipeline systems
- To identify the principal interfaces and potential interrelationships of pipeline facilities such as: pump stations and terminals on design and operations of onshore pipeline systems
- Safety and environmental practices and their effect on design, construction, and operation

### ABOUT THE COURSE

This intensive, five-day foundation level course covers the design, construction, and operation of onshore pipeline systems. This course will incorporate construction methods, commissioning, pressure testing, and start up into the design of a pipeline system. The course focuses on pipeline routing, mechanical design, construction methods, hydraulics, installation, and operations of onshore pipeline systems. Participants will acquire and/or consolidate the essential knowledge and skills to design, construct, and operate pipelines. Design problems are an integral part of this course.

### COURSE CONTENT

- Pipeline systems definition and applications
- Safety, environmental, and regulatory considerations; codes and standards related to pipelines
- Pipeline conceptual and mechanical design for strength, stability, and installation
- Impacts of pipeline hydraulics on pipeline design, construction, and operations
- Pipeline survey, mapping, and route selection
- Pipeline materials and components
- Corrosion and cathodic protection of pipelines
- Pipeline construction for onshore systems
- Introduction to flow assurance considerations and pipeline integrity aspects including in-line inspection, leak detection, and emergency planning considerations
- Pipeline operations, maintenance and repairs considerations

## Flow Assurance for Pipeline Systems (PL-61)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

Technical professionals in the pipeline business including: project managers, pipeline engineers, facilities engineers, design engineers, and engineering contractors

### YOU WILL LEARN

- About identifying and applying fluid characteristics and behavior in the design and operations of pipeline systems
- To assess the physical behavior of the key flow assurance and integrity challenges: corrosion, hydrate formation, transient behavior and wax deposition
- To evaluate mechanical integrity of the pipeline
- How to evaluate the effectiveness of pigging operations and leak detection systems
- To define the roles and uses of Supervisory Control And Data Acquisition Systems (SCADA) in flow assurance

### ABOUT THE COURSE

This course will provide an understanding of flow phenomena that can help the participant avoid problems such as hydrate formation, pressure (surge) waves, or high viscosity liquid flow failure. This intensive, five-day intermediate level course addresses several critical problems in achieving pipeline flow assurance. The focus of this course is on potential challenges to pipeline operations including: surge, corrosion, hydrate formation, wax deposition, multiphase fluids, and slugging. The causes for these problems, design solutions, and operational responses will be an integral part of the course.

### COURSE CONTENT

- Introduction to oil and gas fluid transport properties
- Fluid property data and phase determination
- Fluid flow analysis – single and multiphase
- Slug formation and prediction
- Surge analysis
- Corrosion – internal and external
- Hydrate formation and prevention
- Wax formation and deposition, including prevention and mediation
- Asphaltene prediction, scale precipitation and sand production
- Pigging operations
- Leak detection methods and SCADA
- Startup/shutdown issues

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*

# PROCUREMENT/SUPPLY CHAIN

PROCUREMENT/SUPPLY CHAIN

## Instructors

Dave TenHoor  
 Vinton "Bud" Vesta  
 Ronn Williamson

The Procurement/Supply Chain discipline covers skills and processes primarily focused on managing supply chains that support the wide range of facilities found in the oil and gas industry. In the past five years or more, oil companies have begun to reshape procurement, logistics and warehousing operations to be less transaction-oriented and more strategic in nature. This shift requires new training topics that prepare thousands of staff in hundreds of positions to add more value and improve every aspect of the supply chain.

Campbell Training delivers competency based training in these and other areas, at progressive levels. This provides the skills necessary to successfully support the operation of oil and gas production processes.

COURSE MATRIX										
	E, I & C	Gas Processing	Mechanical	Offshore	Operations Management	Pipeline	Procurement / Supply Chain	Production Facilities	Refining	Reliability
SPECIALIZED		G7 Process Simulation in Gas Conditioning and Processing						PF81 CO <sub>2</sub> Surface Facilities		
		G6 Gas Treating and Sulfur Recovery								
INTERMEDIATE		G5 Gas Conditioning and Processing - Special								
		G4 Gas Conditioning and Processing						PF42 Separation Equipment - Selection & Sizing		REL62 Principles of Reliability Engineering
FOUNDATION		G4 LNG Gas Conditioning and Processing LNG Emphasis	ME62 Turbomachinery Monitoring and Problem Analysis			PL61 Flow Assurance for Pipeline Systems	SC61 Inside Procurement in Oil & Gas	PF4 Oil Production and Processing Facilities	RF61 Refinery Gas Treating, Sour Water, Sulfur and Tail Gas	REL61 Optimizing Equipment Availability
			ME46 Compressor Systems - Mechanical Design and Specification							
		IC4 Instrumentation and Controls Engineering Practices for Facilities Engineers	ME44 Overview of Pumps and Compressors in Oil and Gas Facilities		OM43 Effective Maintenance Shutdowns	PL42 Onshore Pipeline Facilities - Design, Construction and Operations	SC42 Effective Materials Management	PF43 Heat Transfer Equipment		
		E4 Electrical Engineering Practices for Facilities Engineers	G40 Process/Facilities Fundamentals	ME41 Piping Systems - Mechanical Design and Specification	OS4 Fundamentals of Offshore Design and Construction	OM41 Maintenance Planning and Work Control	PL4 Fundamentals of Onshore and Offshore Pipeline Systems	SC41 Contracts and Tenders Fundamentals	PF22 Corrosion Management in Production/Processing Operations	
BASIC										REL50 Introduction to Reliability Statistics
										REL46 Introduction to Reliability Engineering
		G29 LNG Short Course - Technology and the LNG Chain		SS2 Overview of Subsea Systems	OM23 Essential Leadership Skills					REL45 Introduction to Life Cycle Costing
		IC3 Instrumentation and Controls Fundamentals for Facilities Engineers	G2 Overview of Gas Processing Technical		OS2 Overview of Offshore Oil and Gas Facilities	OM22 Project Management for Engineering and Construction				REL25 Root Cause Analysis
	E3 Electrical Engineering Fundamentals for Facilities Engineers	G1 Overview of Gas Processing Non-Technical		OS21 Introduction to Offshore Systems for Business Professionals	OM21 Applied Maintenance Management			PF21 Applied Water Technology in Oil and Gas Production	RF31 Refining Technology Overview	REL24 Introduction to Condition Monitoring

## Contracts and Tenders Fundamentals (SC-41)

COURSE LEVEL Foundation

PETROSKILLS

DURATION 5 days

### DESIGNED FOR

Individuals involved in any aspect of sourcing, tendering, selecting, forming and executing contracts with suppliers of goods and services to the oil and gas industry. This includes all contracting and procurement specialists and administrators, category managers, and logistics managers, along with technical roles such as drilling engineers, project engineers and coordinators, commissioning engineers, contracts engineers, planning engineers, facilities and asset managers, and legal trainees.

### YOU WILL LEARN

- How contracts can be used to manage cost and add value
- Standard forms of contracts and how they work
- The contracting process life cycle including strategy development; contractor solicitation; tendering and selection; contract award; post contract award; contract implementation, administration and closeout
- Key similarities and differences of the legal systems in global contracting
- How to identify the appropriate contracting strategy associated with fixed price and cost reimbursement contracts to minimize financial risks and contract costs
- The essential elements needed to manage contractor/supplier relationships and achieve better contract outcomes
- The variety of pricing models used in supplier proposals and what strategies may be used to achieve fair market pricing outcomes
- Most commonly negotiated contract terms and where more emphasis should be placed to achieve better value
- How types of progress payments for project contracts mitigate contract risk and what is commonly done in different situations
- The difference between cost and price analysis and how to use each technique to evaluate a proposal
- The key steps to anticipate, avoid or successfully manage disputes and contract performance issues
- How to more effectively use appropriate terms and conditions and some of the most common mistakes made today

### ABOUT THE COURSE

Contracts and Tenders Fundamentals can provide attendees with a more strategic approach to contracting, along with numerous tools to use throughout the contracting process. When you leave this course, you will improve job performance through: 1) better alignment of contract process steps with supply needs; 2) better contracts; 3) fewer disputes and claims; and 4) better contract outcomes. It involves many roles that must work together to achieve desired outcomes. Everyone involved in some element of contracting must understand the process, keys to success and what is required of their role.

### COURSE CONTENT

- Contracting life cycle and process steps
- Elements of a valid contract
- Common law and civil law jurisdictions
- Contracting strategy development
- Contracting team formation
- Tendering process and key documents
- Types of contracts
- Buyer and seller pricing objectives
- Economic price adjustment
- Bid evaluation and award considerations
- Key contract terms and conditions for oil and Gas Industry
- Cost/price analysis
- Progress payments and risk management
- Proper use of Incoterms in contracting
- Contract dispute avoidance
- Contract change control

## Effective Materials Management (SC-42)

COURSE LEVEL Foundation

PETROSKILLS

DURATION 3 days

### DESIGNED FOR

Professional and management personnel who have responsibility for, materials, spare parts and supplies needed to support any refinery, gas plant, onshore/offshore production or other industry operations. Buyers, procurement specialists, stock analysts, and logistics, warehouse, distribution or operations supervisors will benefit from this course by learning the techniques and principles for providing better service to their operations, reducing stock outs and surplus materials and maximizing the return on investment for inventory.

### YOU WILL LEARN

- How to establish the best methods of inventory analysis and create performance measures using min/max and order point systems
- How the decision to stock can be made more effectively to avoid surplus materials
- How to use supplier stocking programs, consigned inventory and integrated supply agreements
- How to improve warehousing efficiency, layout and space utilization for better inventory management
- How to establish improvement goals for fewer stock outs, higher inventory turnover and reduced obsolescence
- How to improve inventory record accuracy and physical control of materials to lower inventory levels and increase space utilization
- The most useful inventory classifications, stocking levels and safety stock calculations
- How inventory systems use forecasting techniques and what can be done to improve them
- How to provide better customer service for long lead or critical materials and spare parts essential to the success of any well field operation, offshore platform, refinery, gas plant or chemical processing facility
- Best practices used to manage surplus or inactive assets and increase investment recovery dollars.

### ABOUT THE COURSE

This 3-day course covers practical considerations essential to achieve major improvements in planning, buying, storing and disposing of the vast array of materials and spare parts needed in the oil and gas industry. Attendees will benefit through: 1) practice with key calculations and metrics that improve inventory performance; 2) discussion of common issues for materials management in the industry; 3) methods to deal with obstacles and constraints to effective materials management; and 4) techniques and tools that have immediate use on the job. Evolving best practices by major oil and gas companies are explored as three inter-related modules for inventory management, warehousing and investment recovery.

### COURSE CONTENT

- Setting comprehensive inventory goals and objectives
- Understanding carrying costs and economic order quantity theory
- Improving material identification and coding
- Segmenting inventory for analysis
- Using formal procedures for making the decision to stock
- Determining safety stock levels and order points
- Improving min/max systems and settings
- Understanding and using material forecasts
- Establishing a warehouse scorecard
- Creating best practices in the physical control of materials
- Measuring record accuracy and improving cycle counting systems
- Increasing the use of warehouse technologies
- Improving warehouse safety and security
- Setting up an investment recovery program
- Preventing and reducing surplus materials
- Understanding investment recovery techniques
- Using the disposition value chain for investment recovery

## Inside Procurement in Oil and Gas (SC-61)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 3 days

### DESIGNED FOR

Experienced procurement practitioners; attendees may be new to the industry or in existing industry procurement roles and need a better understanding of procurement value creation in the oil & gas industry

### YOU WILL LEARN

- How the industry is structured and the key drivers that procurement needs to support in an environment of increasing joint operations and shifting relationship models around the globe
- How the E&P Asset Management Cycle drives procurement attention to the Total Cost of Ownership (TCO) concept
- The role of industry economics in dictating procurement good practices in cost management
- The significant aspects of oil and gas law that have a bearing on procurement activities
- Industry typical compliance needs and how procurement can add value in meeting them
- How to use the value chain concept to characterize the procurement role in the industry for oil field development, productions & completions, refining & related operations and marketing & distribution
- Characteristics of supply markets to oil and gas and the emphasis on managing supply risks
- What constitutes effective procurement/supply chain metrics for performance improvement
- Procurement challenges unique to the industry including global sourcing with remote operations, managing materials & logistics onshore/offshore and driving eCommerce and eProcurement growth

### ABOUT THE COURSE

This blended learning course will challenge procurement practitioners with on-the-job implications for procurement that drive value in the Oil & Gas industry. Participants will learn what the industry segments require from procurement and be given insights to maximize value delivery and increase their contribution to any business unit of the organization. Attendees will leave better prepared to create and execute procurement strategies that meet stakeholder needs whether for project procurement or operations supply chain support. This course has been designed in collaboration with major oil companies to increase procurement competencies that are most relevant to the industry today. Participants will begin with an online questionnaire that leads into an interactive web forum requiring no more than 4-6 hours per attendee for pre-read materials and instructor interaction. The course concludes with a 3-day classroom learning experience.

### COURSE CONTENT

- Industry overview for procurement
- The E&P asset management cycle and total cost of ownership (TCO)
- Economics of oil and gas that drive procurement value creation
- Fundamentals of oil and gas law
- Corporate compliance and key government regulations pertaining to procurement
- Procurement value-added for health, environment and safety (HES) improvements
- Common practices for delegation of authority in procurement
- Procurement's role in oil and gas value chain management
- Market intelligence roles and practices for procurement
- Industry spend analysis characteristics and strategies
- Managing supply risks through supplier qualification/approval to support business unit objectives
- Typical industry category management/sector strategies
- Procurement metrics that deliver value to stakeholders
- Challenges of supply base management and global sourcing
- Key drivers of materials and logistics management
- Joint operations stakeholder impact on procurement
- Driving eCommerce and eProcurement initiatives

# PRODUCTION FACILITIES

## Instructors

Frank Ashford	Bob Hlozek
Mark Bothamley	Bob Hubbard
James Breaux	Frank Jarrett
Arthur Delargy	Larry Lilly
Robert Fanning	D. John Morgan
Alan Foster	Wes Wright


Production Facilities separate the well stream into three phases – oil, gas and water – and process these phases into marketable products or dispose of them in an environmentally acceptable manner.

While gas handling/processing facilities are a subset of Production Facilities, they are covered under Gas Processing for the purposes of this catalog. Therefore Production Facilities as used here will mainly include:

- Single – well, satellite & central tank batteries, including
  - Oil treating
  - Stabilization
  - Desalting
  - Storage
  - Separation equipment
- Produced water treating facilities
- Offshore topsides facilities
- Water injection facilities
- Corrosion management

		COURSE MATRIX									
		E, I & C	Gas Processing	Mechanical	Offshore	Operations Management	Pipeline	Procurement / Supply Chain	Production Facilities	Refining	Reliability
SPECIALIZED			G7 Process Simulation in Gas Conditioning and Processing						PF81 CO <sub>2</sub> Surface Facilities		
			G6 Gas Treating and Sulfur Recovery								
			G5 Gas Conditioning and Processing - Special								
INTERMEDIATE			G4 Gas Conditioning and Processing						PF42 Separation Equipment - Selection & Sizing		REL62 Principles of Reliability Engineering
			G4 LNG Gas Conditioning and Processing LNG Emphasis	ME62 Turbomachinery Monitoring and Problem Analysis			PL61 Flow Assurance for Pipeline Systems	SC61 Inside Procurement in Oil & Gas	PF4 Oil Production and Processing Facilities	RF61 Refinery Gas Treating, Sour Water, Sulfur and Tail Gas	REL61 Optimizing Equipment Availability
FOUNDATION				ME46 Compressor Systems - Mechanical Design and Specification							
		IC4 Instrumentation and Controls Engineering Practices for Facilities Engineers		ME44 Overview of Pumps and Compressors in Oil and Gas Facilities		OM43 Effective Maintenance Shutdowns	PL42 Onshore Pipeline Facilities - Design, Construction and Operations	SC42 Effective Materials Management	PF43 Heat Transfer Equipment		
		E4 Electrical Engineering Practices for Facilities Engineers	G40 Process/Facility Fundamentals	ME41 Piping Systems - Mechanical Design and Specification	OS4 Fundamentals of Offshore Design and Construction	OM41 Maintenance Planning and Work Control	PL4 Fundamentals of Onshore and Offshore Pipeline Systems	SC41 Contracts and Tenders Fundamentals	PF22 Corrosion Management in Production/Processing Operations		REL44 Reliability Centered Maintenance
BASIC											REL50 Introduction to Reliability Statistics
											REL46 Introduction to Reliability Engineering
			G29 LNG Short Course - Technology and the LNG Chain		SS2 Overview of Subsea Systems	OM23 Essential Leadership Skills					REL45 Introduction to Life Cycle Costing
		IC3 Instrumentation and Controls Fundamentals for Facilities Engineers	G2 Overview of Gas Processing Technical		OS2 Overview of Offshore Oil and Gas Facilities	OM22 Project Management for Engineering and Construction					REL25 Root Cause Analysis
	E3 Electrical Engineering Fundamentals for Facilities Engineers	G1 Overview of Gas Processing Non-Technical		OS21 Introduction to Offshore Systems for Business Professionals	OM21 Applied Maintenance Management			PF21 Applied Water Technology in Oil and Gas Production	RF31 Refining Technology Overview	REL24 Introduction to Condition Monitoring	

PRODUCTION FACILITIES



## Applied Water Technology in Oil and Gas Production (PF-21)

COURSE LEVEL Basic

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

Managers, engineers, chemists, and operators who need to understand water related problems in oil and gas production and their solutions

### YOU WILL LEARN


- The basics of oilfield water chemistry
- How to monitor and control corrosion, scale, and bacterial growth in produced water and water injection/disposal systems
- How to implement system surveillance programs to detect potential problems before system damage occurs
- About produced (oily) water treatment options and related treatment equipment
- How to use the knowledge gained to identify typical system problems and be able to propose solutions

### ABOUT THE COURSE

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 will be reviewed as well as water injection and disposal systems. An exercise will be given to identify typical system problems and you will be able to apply the knowledge you 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



## Corrosion Management in Production/Processing Operations (PF-22)

COURSE LEVEL Foundation

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

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

### YOU WILL LEARN

- The basics of corrosion chemistry
- The main corrosion mechanisms occurring in oil and gas production/processing systems
- The different types of damage caused by corrosion
- About materials selection for corrosion prevention
- Some methods for conducting cathodic protection (CP) surveys
- Items to consider in corrosion inhibitor selection
- Some advantages and disadvantages of the various corrosion monitoring methods
- Where the main locations of corrosion concern occur within oil production systems, gas processing facilities (including amine units), and water injection systems

### ABOUT THE COURSE

This 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 estimate the corrosivity of a given environment through analysis of the chemical and physical characteristics of the system. You will review approaches to selecting materials and coatings for corrosion resistance for different conditions and applications, including the use of NACE MR0175.

You will be introduced to CP surveys, selecting the CP system type, estimating current requirements and the design principles of simple cathodic protection systems. There will be opportunity to select and utilize corrosion inhibitors for different systems and you will learn 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. This course provides an appropriate balance of necessary theory and practical applications to solve/mitigate corrosion related problems.

### COURSE CONTENT

- Fundamentals of corrosion theory
- Major causes of corrosion (O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>S, microbiologically influenced corrosion)
- Forms of corrosion damage
- Materials selection
- Protective coatings & 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



## Oil Production and Processing Facilities (PF-4)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 10 Days

### DESIGNED FOR

Process/facilities engineers, senior operating personnel, and production chemists

### YOU WILL LEARN

- About well inflow performance and its impact on processing facilities
- About oil, gas, and water compositions and properties needed for equipment selection and sizing
- How to select and evaluate processes and equipment used to meet sales or disposal specifications
- How to apply physical and thermodynamic property correlations and principles to the design and evaluation of oil production and processing facilities
- How to perform equipment sizing calculations for major production facility separation equipment
- How to evaluate processing configurations for different applications
- How to recognize and develop solutions to operating problems in oil/water processing facilities

### ABOUT THE COURSE

The emphasis of this course is on oil production facilities – from the wellhead to the delivery of a specification crude oil product to the refinery. Both onshore and offshore facilities will be discussed. Produced water treating and water injection systems are also covered. Solution gas handling processes and equipment will be discussed as well, though at a relatively high level. In addition to the engineering aspects of oil production facilities, practical operating problems will also be covered including emulsion treatment, sand handling, dealing with wax and asphaltenes, etc. Exercises requiring calculations are utilized throughout the course. The course is intended to be complementary to the G-4 Gas Conditioning and Processing course which is focused on the gas handling side of the upstream oil and gas facilities area.

### COURSE CONTENT

- Overview of upstream oil and gas production operations
- Fluid properties and phase behavior
- Overview of artificial lift
- Processing configurations (example PFD's)
- Phase separation of gas, oil, and water
- Emulsions
- Sand, wax, and asphaltenes
- Oil treating
- Field desalting
- Crude stabilization and sweetening
- Crude oil storage and vapor recovery
- Measurement of crude oil
- Transportation of crude oil
- Produced water treating
- Water injection systems
- Overview of solution gas processing
- Compressors
- Sweetening
- Dehydration
- NGL recovery
- Relief and flare systems



## Separation Equipment - Selection & Sizing (PF-42)

PETROSKILLS

**COURSE LEVEL** Intermediate

**DURATION** 4 Days

### DESIGNED FOR

Process/Facilities engineers

### YOU WILL LEARN

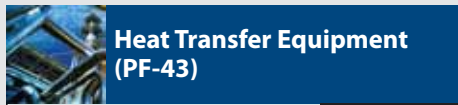
- About the different types of separation equipment utilized in the oil and gas industry and where they are used
- About the separation performance capabilities of the different types of equipment
- How to size the different types of separation equipment
- About new developments in separation equipment design
- How to troubleshoot and debottleneck separation equipment
- How to calculate the wall thickness and estimate the weight of separators
- About the instrumentation and controls used on separation equipment

### ABOUT THE COURSE

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 how the various types of separation equipment are incorporated into real production facility process flow diagrams (PFD's). Exercises requiring calculations are utilized throughout the course.

### COURSE CONTENT

- Fluid properties & phase behavior
- Phase separation processes
- Gas – liquid separation equipment
- Slug catchers
- Conventional separators (horizontal & vertical)
- Scrubbers
- Filter separators/coalescing filters
- Separator internals
- Inlet devices
- Mist extractors
- Baffles, weirs, etc
- Emulsions
- Oil – water separation equipment
- Conventional 3 – phase separators & freewater knockouts
- Wash tanks
- Oil treating & desalting equipment
- Mainly electrostatic coalescers
- Mechanical design aspects
- Pressure vessel codes
- Wall thickness & vessel weight estimation
- Material selection
- Relief requirements
- Operating problems and control



## Heat Transfer Equipment (PF-43)

PETROSKILLS

**COURSE LEVEL** Foundation

**DURATION** 5 Days

### DESIGNED FOR

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

### YOU WILL LEARN

- To select the correct heat transfer equipment for a particular application with reference to typical facility process flow diagrams (PFD's)
- To apply heat transfer principles to design and specify heat transfer equipment
- Evaluate the performance of heat transfer equipment and recommend solutions to problems
- About the typical instrumentation and control schemes used by the various types of heat transfer equipment

### ABOUT THE COURSE

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

- Typical process heating & cooling applications
- Fluid properties
- Heat transfer principles
- Shell and tube exchangers
- Compact heat exchangers
- plate – frame
- printed circuit
- welded plate
- Brazed aluminum exchangers
- Air coolers
- Fired equipment (furnace type & firetube)
- Operating problems
- Typical instrumentation control schemes

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*



## CO<sub>2</sub> Surface Facilities (PF-81)

PETROSKILLS

**COURSE LEVEL** Specialized

**DURATION** 3 Days

### DESIGNED FOR

Engineers and senior operating personnel involved with carbon dioxide / natural gas / CO<sub>2</sub>EOR systems

### YOU WILL LEARN

- To evaluate the effect of CO<sub>2</sub> on physical/thermodynamic properties
- To dehydrate high CO<sub>2</sub>-content gases
- The best practice to deal with Dense Phase pipelines, metering, flaring etc
- How to pump and compress CO<sub>2</sub>
- About using purification processes: membranes, Ryan-Holmes, amines, hot carbonate, etc

### ABOUT THE COURSE

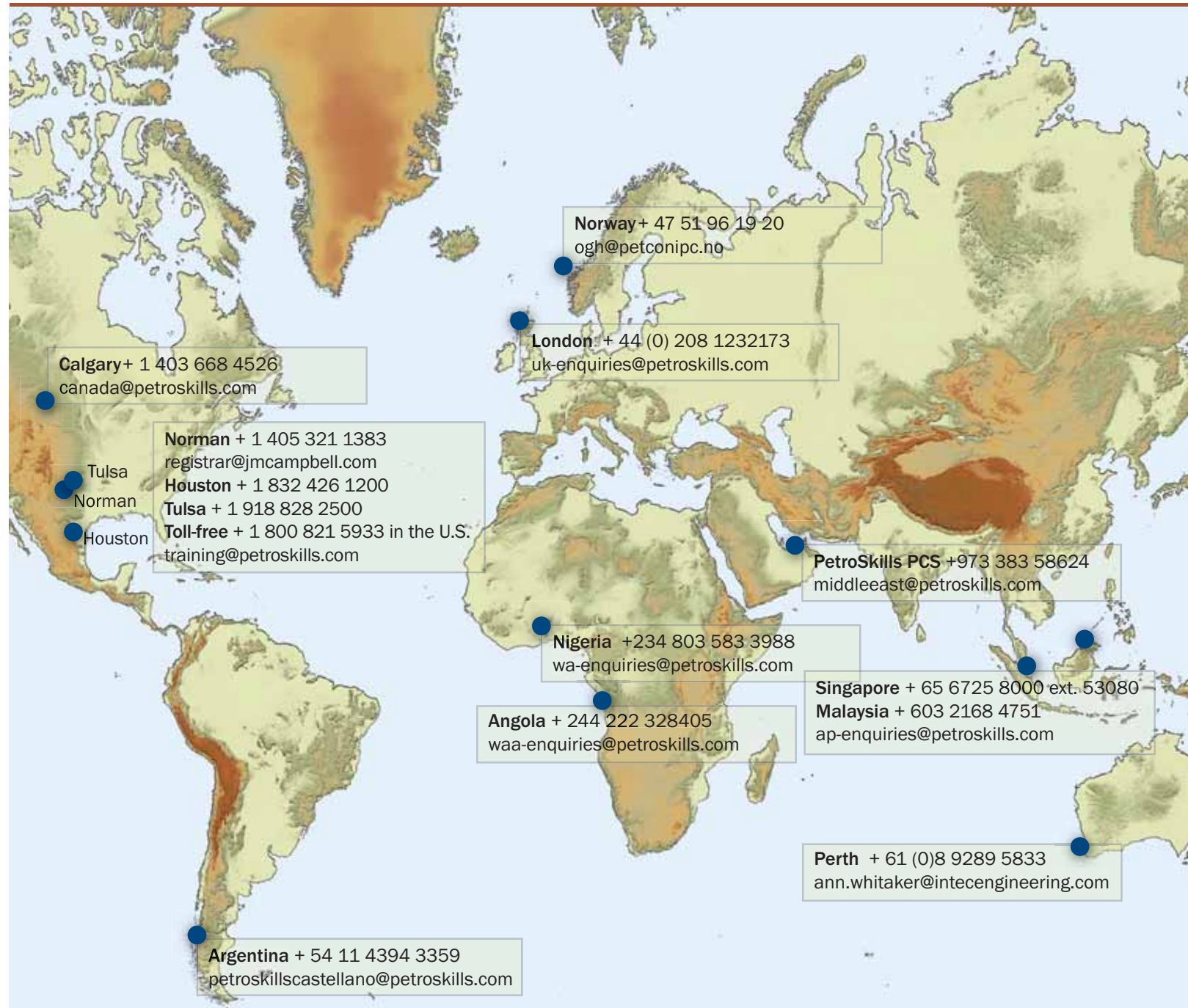
This course emphasizes the effect of carbon dioxide on the selection and operation of equipment (separators, compressors, and dehydrators), as well as sweetening process equipment. This program, first introduced in 1985, assists those working with carbon dioxide or high carbon dioxide content natural gas. This course is particularly applicable to those persons who operate and/or design enhanced oil recovery (EOR) facilities using CO<sub>2</sub> 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. The plant tour is optional.

### COURSE CONTENT

- Overview of CO<sub>2</sub> injection and process facilities
- Heavy emphasis on CO<sub>2</sub> for enhanced oil recovery
- Physical and thermodynamic properties of CO<sub>2</sub> and high CO<sub>2</sub> mixtures
- Materials selection and design consideration in CO<sub>2</sub> systems
- Process vessel specification
- Pumps and compressors
- Fluid flow
- Dehydration of CO<sub>2</sub> and CO<sub>2</sub>-rich gases
- General overview of processes to treat/recover CO<sub>2</sub>

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Exclusive provider of **PetroSkills** facilities training.

# REFINING

## Instructors

Tim Armstrong  
John Bauld  
Louis Beke

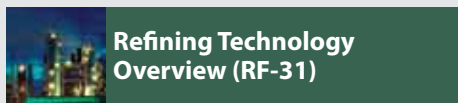
Oil refineries are exciting combinations of modern technology. Many contain state-of-the-art, high-technology processes with sophisticated catalysts and operating techniques, coupled with high pressures/temperatures. That same refinery will also operate standard long-established units with technical roots developed many decades ago.

In recent years refined product specifications have undergone dramatic change: automobile tail-pipe emissions and ultra-low sulfur fuels to mention just two. Refining margins have also been extremely tight, placing tremendous demands on refiners to cut costs and work efficiently.

Campbell Training refining courses address the overall technologies that are important in today's efficient complexes. Our courses stress safety, efficiency, limiting emissions, operating skill and technical sophistication.

COURSE MATRIX										
	E, I & C	Gas Processing	Mechanical	Offshore	Operations Management	Pipeline	Procurement / Supply Chain	Production Facilities	Refining	Reliability
SPECIALIZED		G7 Process Simulation in Gas Conditioning and Processing						PF81 CO <sub>2</sub> Surface Facilities		
		G6 Gas Treating and Sulfur Recovery								
		G5 Gas Conditioning and Processing - Special								
INTERMEDIATE		G4 Gas Conditioning and Processing						PF42 Separation Equipment - Selection & Sizing		REL62 Principles of Reliability Engineering
		G4 LNG Gas Conditioning and Processing LNG Emphasis	ME62 Turbomachinery Monitoring and Problem Analysis			PL61 Flow Assurance for Pipeline Systems	SC61 Inside Procurement in Oil & Gas	PF4 Oil Production and Processing Facilities	RF61 Refinery Gas Treating, Sour Water, Sulfur and Tail Gas	REL61 Optimizing Equipment Availability
FOUNDATION			ME46 Compressor Systems - Mechanical Design and Specification							
	IC4 Instrumentation and Controls Engineering Practices for Facilities Engineers		ME44 Overview of Pumps and Compressors in Oil and Gas Facilities		OM43 Effective Maintenance Shutdowns	PL42 Onshore Pipeline Facilities - Design, Construction and Operations	SC42 Effective Materials Management	PF43 Heat Transfer Equipment		
	E4 Electrical Engineering Practices for Facilities Engineers	G40 Process/Facility Fundamentals	ME41 Piping Systems - Mechanical Design and Specification	OS4 Fundamentals of Offshore Design and Construction	OM41 Maintenance Planning and Work Control	PL4 Fundamentals of Onshore and Offshore Pipeline Systems	SC41 Contracts and Tenders Fundamentals	PF22 Corrosion Management in Production/Processing Operations		REL44 Reliability Centered Maintenance
BASIC										REL50 Introduction to Reliability Statistics
										REL46 Introduction to Reliability Engineering
		G29 LNG Short Course - Technology and the LNG Chain		SS2 Overview of Subsea Systems	OM23 Essential Leadership Skills					REL45 Introduction to Life Cycle Costing
	IC3 Instrumentation and Controls Fundamentals for Facilities Engineers	G2 Overview of Gas Processing Technical		OS2 Overview of Offshore Oil and Gas Facilities	OM22 Project Management for Engineering and Construction					REL25 Root Cause Analysis
E3 Electrical Engineering Fundamentals for Facilities Engineers	G1 Overview of Gas Processing Non-Technical		OS21 Introduction to Offshore Systems for Business Professionals	OM21 Applied Maintenance Management			PF21 Applied Water Technology in Oil and Gas Production	RF31 Refining Technology Overview	REL24 Introduction to Condition Monitoring	

REFINING



## Refining Technology Overview (RF-31)

COURSE LEVEL Basic

CAMPBELL

DURATION 4 days

### DESIGNED FOR

Personnel in the petroleum refining business and related activities

### YOU WILL LEARN

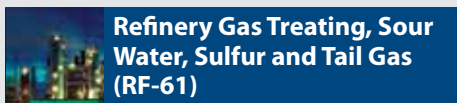
- About sources of refinery feed stocks, crude or synthetic
- About composition of the feeds, their characterization, desirable properties, and selection
- How a refinery matches crude composition to product market demand by selection of process units
- Fundamentals of individual refinery processes, engineering, materials, and construction challenges
- About operational challenges
- How to improve profitability by debottlenecking, yield improvement, and blending
- How to evaluate alternative processing schemes and what makes a regional 'Pacesetter' refinery

### ABOUT THE COURSE

This basic course shows how any crude oil is converted to products based upon the demand for premium quality gasoline, diesel, lubes, and chemical feedstock. It is useful for those new to the refining business such as new hires of any discipline, transferees from other sectors of the petroleum, upstream, mid-stream, and chemical sectors. This course is excellent for experienced operators who want to understand the 'why' as much as the 'how' of refining. Basics of refining and its technology are stressed. Details of chemistry, process conditions, and materials are described where necessary to support the basics. The backbone of the course is to develop a refinery processing scheme through a series of simple, linked student-worked problems. This will show how a processing scheme to meet product qualities and volumes is developed.

### COURSE CONTENT

- Refining climate, background and driving forces
- Crude oil distillation processes: atmospheric and vacuum
- Straight run naphtha processing, treating, isomerisation and reforming for gasoline production
- Distillate desulfurization for diesel and heating oil production
- Light-ends recovery and treating of liquefied petroleum gas (LPG) for gasoline blending and sales
- Vacuum gas oil conversion, catalytic feed hydrotreater (CFHT), fluidized catalytic cracking (FCC) and hydrocracking
- Light olefin streams recovery, treating and alkylation for gasoline
- Residue processing, residue fluidized catalytic cracking (RFCC), ARVDS, VRDS, residue hydrocracking, delayed and continuous coking
- Lube oil production
- Aromatics recovery and re-arrangement to make benzene, toluene, ethyl-benzene and xylene (BTEX)
- Product blending to make gasoline, diesel, heating oil, and fuel oil
- Refining economics



## Refinery Gas Treating, Sour Water, Sulfur and Tail Gas (RF-61)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 5 Days

### DESIGNED FOR

Personnel in the gas treating, sulfur recovery and environmental conservation areas of the petroleum refining business. Management, process engineers, and operators who work in: acid gas absorption, principally H<sub>2</sub>S, using non-selective and selective amines to keep refineries within SO<sub>2</sub> emission compliance limits; maintaining spent water within recycling or compliance limits of H<sub>2</sub>S, ammonia and other potential contaminants; the safe and reliable operation of amine and Claus plants while maximizing sulfur recovery to meet statutory requirements

### YOU WILL LEARN

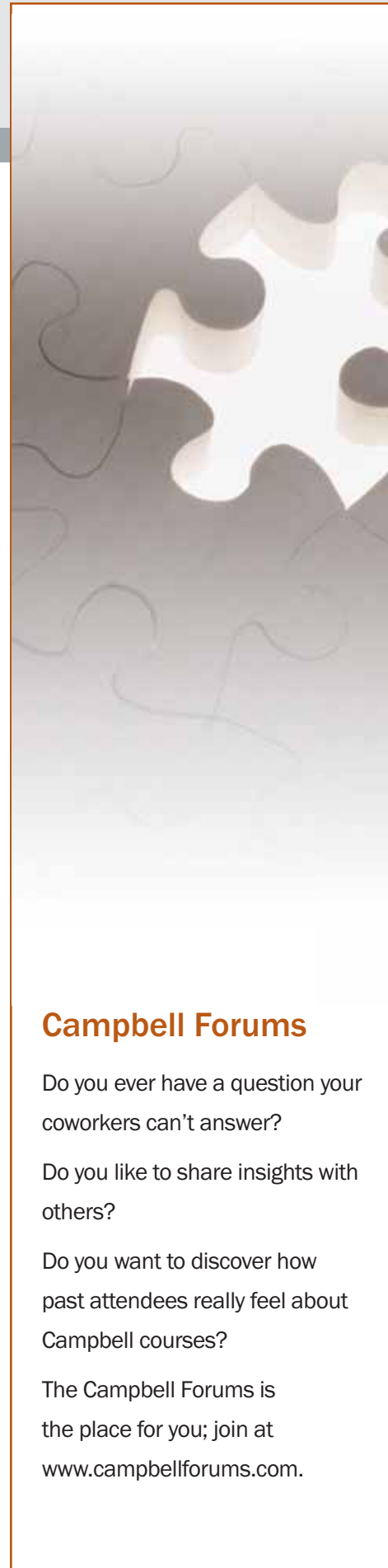
- Safety concerns with handling H<sub>2</sub>S and H<sub>2</sub>S rich streams
- Composition of typical refinery sour gas and acid gas feeds and their characterization
- The different types of amines: advantages and disadvantages
- How to select an amine from the various types available and calculate amine circulation rates required
- How to select a sour water processing scheme
- How to select sulfur recovery unit configuration
- About the economics of tail gas treatment plant selection to meet legislation
- Individual processes, engineering, materials, and construction challenges
- How to handle the operation of units, interaction and challenges encountered
- How to maximize reliability
- How to increase sulfur removal and recovery by debottlenecking, changing solvents, and sulfur plant oxygen injection

### ABOUT THE COURSE

This is an intermediate, five-day course with an established, successful format that has been delivered worldwide to refinery and natural gas process engineers and managers. Practical acid gas removal, sour water stripping, and sulfur recovery processes are stressed. Details of chemistry, process conditions and materials are described as required to assure a real understanding of the processes and their materials, construction, and operational issues. To ensure that participants return to their workplace with enhanced ability and understanding, a large portion of the course includes participant discussions and problem solving.

### COURSE CONTENT

- Source and compositions of refinery sour gas and sour water streams
- Types of sulfur compounds and ammonia and their affects on treating, stripping, and sulfur recovery
- Gas treating with amines – Acid Gas Removal Unit (ARU)
- Sour water stripping (SWS)
- Elemental sulfur recovery – Sulfur Recovery Unit (SRU)
- Tail gas treating – Tail Gas Unit / Tail Gas Clean Up (TGU /TGCU)
- Incineration



## Campbell Forums

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# RELIABILITY

## Instructors

- Bill Keeter
- Bob O'Bannon
- Andy Page
- Doug Plucknette
- Maury Torrey
- Ricky Smith

Assuring the reliability of facilities involves much more than fixing rotating equipment. Reliability Assurance involves a systematic approach to human and facility systems, gathering useful information, determining the most cost effective projects, and reviewing and improving the maintenance and operations activities.

Building competent people to design operate and maintain the facility is crucial to a successful Reliability Assurance program. Reliability Assurance is an integral part of Process Safety Management and Operational Integrity programs. Our courses will contribute to the training requirements of these programs.

Each course provides a progression of competency development that will deliver results to your bottom line. Courses can be taken as a series and build on one another or taken individually as appropriate.

		COURSE MATRIX									
		E, I & C	Gas Processing	Mechanical	Offshore	Operations Management	Pipeline	Procurement / Supply Chain	Production Facilities	Refining	Reliability
SPECIALIZED			G7 Process Simulation in Gas Conditioning and Processing						PF81 CO <sub>2</sub> Surface Facilities		
			G6 Gas Treating and Sulfur Recovery								
			G5 Gas Conditioning and Processing - Special								
INTERMEDIATE			G4 Gas Conditioning and Processing						PF42 Separation Equipment - Selection & Sizing		REL62 Principles of Reliability Engineering
			G4 LNG Gas Conditioning and Processing LNG Emphasis	ME62 Turbomachinery Monitoring and Problem Analysis			PL61 Flow Assurance for Pipeline Systems	SC61 Inside Procurement in Oil & Gas	PF4 Oil Production and Processing Facilities	RF61 Refinery Gas Treating, Sour Water, Sulfur and Tail Gas	REL61 Optimizing Equipment Availability
				ME46 Compressor Systems - Mechanical Design and Specification							
FOUNDATION		IC4 Instrumentation and Controls Engineering Practices for Facilities Engineers		ME44 Overview of Pumps and Compressors in Oil and Gas Facilities		OM43 Effective Maintenance Shutdowns	PL42 Onshore Pipeline Facilities - Design, Construction and Operations	SC42 Effective Materials Management	PF43 Heat Transfer Equipment		
		E4 Electrical Engineering Practices for Facilities Engineers	G40 Process/Facility Fundamentals	ME41 Piping Systems - Mechanical Design and Specification	OS4 Fundamentals of Offshore Design and Construction	OM41 Maintenance Planning and Work Control	PL4 Fundamentals of Onshore and Offshore Pipeline Systems	SC41 Contracts and Tenders Fundamentals	PF22 Corrosion Management in Production/Processing Operations		REL44 Reliability Centered Maintenance
											REL50 Introduction to Reliability Statistics
BASIC											REL46 Introduction to Reliability Engineering
			G29 LNG Short Course - Technology and the LNG Chain		SS2 Overview of Subsea Systems	OM23 Essential Leadership Skills					REL45 Introduction to Life Cycle Costing
		IC3 Instrumentation and Controls Fundamentals for Facilities Engineers	G2 Overview of Gas Processing Technical		OS2 Overview of Offshore Oil and Gas Facilities	OM22 Project Management for Engineering and Construction					REL25 Root Cause Analysis
	E3 Electrical Engineering Fundamentals for Facilities Engineers	G1 Overview of Gas Processing Non-Technical		OS21 Introduction to Offshore Systems for Business Professionals	OM21 Applied Maintenance Management				PF21 Applied Water Technology in Oil and Gas Production	RF31 Refining Technology Overview	REL24 Introduction to Condition Monitoring

RELIABILITY

## Introduction to Conditioning Monitoring (REL-24)

COURSE LEVEL Basic

PETROSKILLS

DURATION 3 Days

### DESIGNED FOR

Managers, engineers, planners, and supervisors who are responsible for the daily use of information that comes from a condition monitoring program

### YOU WILL LEARN

- How to strike the right balance between Preventative Maintenance (PM) and Predictive Maintenance (PdM)
- How to evaluate your PM program and eliminate unnecessary work
- The principles of PdM and the reasons why it's so powerful
- The business case and value proposition for PdM
- Where resources will come from: 3 different strategies to consider and the pros and cons of each
- How PdM reduces overtime and emergency work
- How PdM can increase the capacity of your plant without a dollar of capital investment
- How much PdM is enough and what you can learn from best practice organizations and benchmarks
- How to use LEAN tools to make your PdM program self-funding every step of the way
- How to recognize when you have achieved best practice
- How to convert to the proactive workflow model and its key advantages
- What asset health is and how to measure it
- The right way to use assessments to measure the effectiveness of your program
- How to identify mechanical, electrical, and stationary failure modes using PdM technologies
- How to identify the common traps of each technology
- How to build a comprehensive Asset Health Matrix
- Why PM is not enough and the surprising truth behind 80% of all equipment failures
- The common language of PdM with key terms and definitions
- How to balance workflow maturity with coverage
- How to apply benchmark data and asset criticality to "design the coverage" model

### ABOUT THE COURSE

The course provides skills which will allow attendees to understand the application and integration of basic predictive maintenance technologies. It is designed to teach the fundamental principles of the five predictive maintenance technologies most prevalent in industry: vibration analysis, infrared thermography, airborne and structure-borne ultrasonics, oil analysis and motor circuit analysis. Upon completion of the course, attendees will have an understanding of the capabilities of the technologies along with the common traps that may be encountered during application.

### COURSE CONTENT

- Benchmarking, business case and success stories
- Striking the balance between PM and PdM
- Defining the P-F curve, Weibull shapes, correlation models
- Explain how to perform a Preventive Maintenance Evaluation
- Define how to measure asset health
- Quantifying mechanical asset health
- Infrared thermography, oil analysis
- Airborne and structure-borne ultrasonics
- Vibration analysis, on-line motor circuit analysis
- Quantifying electrical asset health
- Infrared thermography, oil analysis
- Airborne and structure-borne ultrasonics
- Vibration analysis, off-line motor circuit analysis
- Quantifying stationary asset health
- Infrared thermography, airborne and structure-borne ultrasonics
- Pulse echo ultrasound, magnetic particle testing, penetrant testing
- Visual inspection, radiographic testing, eddy current testing
- Identifying and mapping the proactive and reactive maintenance workflow model

## Root Cause Analysis (REL-25)

COURSE LEVEL Basic

ALLIED

DURATION 3 days

### DESIGNED FOR

Industry craft workers, first line supervisors, engineers, reliability and maintenance engineers, and managers who may participate in root cause analysis investigations of chronic equipment problems, or serious incidents related to the environment or safety. Upper level managers who want to understand how rigorously applying Root Cause Analysis (RCA) techniques can bolster bottom line results should also attend.

### YOU WILL LEARN

- What are the 5 Whys technique for failure analysis
- How to get everyone at the plant engaged in doing 5 Whys
- How to find root causes that can benefit corporate goals regarding Overall Equipment Effectiveness (OEE) injuries, environmental incidents, etc
- To use Logic Trees to uncover the physical, human and latent causes of failures
- When it is appropriate to use the Logic Tree
- The primary benefits of the Logic Tree approach
- Why gathering and preserving evidence is critical to root cause analysis
- How to find the best solutions once you have determined the cause
- How to insure solutions are implemented and that they are effective
- The Causal Factor Mapping technique for failure analysis, when it is appropriate to use, and the primary benefits of this technique
- How to establish triggers to know when RCA is appropriate
- How to find the chronic failures that are creating the most losses
- How to implement an RCA process at your plant
- How to use an RCA Playbook to determine when each method is appropriate
- What circumstances trigger the use of RCA
- How driving to the root cause of failures can significantly increase OEE as well as, reduce injuries and environmental incidents

### ABOUT THE COURSE

This course is designed to teach the attendee how to use three of the most popular and useful problem solving techniques available today – 5 Whys, Logic Trees, and Causal Factor Mapping. Class lecture will be reinforced with numerous practice opportunities, so the attendee will feel comfortable going back to the job and attacking chronic plant problems and incidents right away.

### COURSE CONTENT

- Introduction to Root Cause Analysis concepts
- Finding root causes of unreliability and incidents versus fire fighting with chronic problems
- Compare RCA to FMEA and other reliability improvement techniques
- The simple 5 Whys method of failure investigation
- Finding how root causes impact business goals
- OEE
- Injuries
- Environmental incidents
- Review OEE concepts and how increasing OEE benefits business
- Examples of RCA techniques improving OEE
- Calculate OEE and revenue improvements from RCA techniques
- Causal Factor Mapping for incidents and failures
- Using an RCA playbook and spreadsheet to determine when each method is appropriate
- What circumstances trigger the use of RCA?
- How to use FMEA and Pareto to determine which problems to work on
- How to implement an RCA process
- Selling the benefits of RCA to management
- Possible approaches to RCA implementation and how to overcome resistance
- Develop an action plan resulting from RCA

## Reliability Centered Maintenance (REL-44)

LEVEL Foundation

ALLIED

DURATION 3 Days

### DESIGNED FOR

Maintenance managers, maintenance supervisors, reliability and maintenance engineers, maintenance technicians, production managers, production supervisors, operators, plant engineers or anyone who is involved in operating and maintaining of assets

### YOU WILL LEARN

- Fundamental Reliability Centered Maintenance (RCM) philosophies
- How to evaluate failure consequences
- How to select preventive maintenance tasks and intervals
- How to select predictive maintenance tasks and intervals
- How to select failure finding tasks and intervals
- What other function protective actions are available
- When run-to-failure is appropriate
- Commercial RCM standards
- Various approaches to RCM
- RCM terminology and fundamental philosophies
- How to identify and allocate resources for a RCM program
- Techniques for prioritizing systems for analysis
- How to use of Weibull and statistical analysis in RCM processes
- How to package and implement RCM analysis results
- Barriers to implementation and how to get buy-in from all levels

### ABOUT THE COURSE

This course teaches the fundamentals of Reliability-Centered Maintenance (RCM). The course is not process specific but gives the participant fundamental tools and knowledge required to participate in any RCM analysis process. The course will use life-cycle cost analysis and an understanding of equipment failure characteristics to achieve an optimal maintenance program that meets specified safety, environmental, and economic goals. The course focuses on preserving equipment functions by identifying appropriate preventive maintenance (PM) tasks, predictive maintenance (PdM) tasks, failure finding tasks, and other actions that protect against failure or mitigate the consequences of failure. Examples and exercises give participants hands on experience to help them begin to master RCM concepts.

### COURSE CONTENT

- Introduction to Reliability Centered Maintenance (RCM) concepts
- RCM analysis preparation
- Techniques for prioritizing systems for analysis
- Failure Modes and Effect Consequence Analysis for RCM
- Evaluating failure consequences
- Statistics in RCM
- Statistical principles used in RCM
- Use of Weibull analysis in RCM processes
- Selecting the right maintenance tasks for reliability
- How to select preventive maintenance (PM) tasks and intervals
- How to select predictive maintenance (PdM) tasks and intervals
- How to select failure finding tasks and intervals
- Other functional maintenance strategies
- When run-to-failure is appropriate
- Packaging and implementing RCM results
- When to use a Subject Matter Expert (SME) team

## Introduction to Life Cycle Costing (REL- 45)

COURSE LEVEL Basic

ALLIED

DURATION 3 days

### DESIGNED FOR

Plant, equipment and reliability engineers, supervisors, and managers with little or no previous financial experience

### YOU WILL LEARN

- What Life Cycle Costing (LCC) is
- The difference between standard costing and LCC
- How to determine the entire cost of ownership
- How to calculate net present value (NPV)
- How to quantify reliability engineering activity into financial terms
- How to perform real-world LCC studies
- How to present LCC data to management and the financial community
- What is the LCC philosophy
- The steps for performing a LCC analysis
- The concepts of NPV and Future Present Value (FPV)
- How to use LCC to make better asset acquisition decisions
- To communicate the results of the LCC analysis
- To recognize when a LCC analysis is warranted
- To test the assumptions and uncertainties of the LCC analysis
- Financial concepts such as net savings, savings-to-investment ratio, adjusted internal rate of return, and discounted payback
- To use LCC to evaluate the varying efficiency levels of competing designs
- How to use LCC for value engineering to buy the right solution based on long term cost rather than the least cost solution today

### ABOUT THE COURSE

This knowledge-building course covering the use of Life-Cycle Cost (LCC) analyses to communicate solutions to management and members of the financial community. LCC evaluates many alternatives to identify the solution with the least total cost of ownership. Evaluations are based on the entire cost of ownership including design, procurement, installation, maintenance, repair, and disposal costs. LCC analyses are based on the concept of Net Present Value (NPV) and can be discrete or probabilistic in nature. Participants will learn how to put reliability engineering skills into financial accounting terms. Each attendee will also learn techniques to perform real-world studies to evaluate the sensitivity of assumptions and uncertainties in the LCC model. Exercises are used to help the participants learn the concepts and the step-by-step process of a LCC analysis.

### COURSE CONTENT

- Introduction to the basics of finance in reliability
- Balance sheet
- Profit/loss statement
- Cash flow statement
- Depreciation
- Ratios
- Introduction to Time Value of Money (TVM)
- Net Present Value (NPV)
- Future Present Value (FPV)
- Return on Investment (ROI)
- Internal Rate of Return (IRR)
- Time Value Analysis – Life Cycle decision making
- Plant equipment project analysis
- Driving improvement with Life Cycle Cost

## Introduction to Reliability Engineering (REL-46)

COURSE LEVEL Basic

ALLIED

DURATION 3 days

### DESIGNED FOR

Maintenance managers, reliability and maintenance engineers, top level maintenance technicians, production managers, plant engineers or anyone who is involved in Reliability Engineering strategies or methodologies to include design engineers for capital projects

### YOU WILL LEARN

- How to apply reliability statistics to improve asset management
- What is the Life Cycle Cost philosophy
- The steps for performing a LCC analysis
- The simple 5 Why method of failure investigation
- Fundamentals of Event and Causal Factor Mapping for incidents and failures
- Fundamentals of using Logic Trees to uncover the physical, human, and latent causes of failures
- Fundamental RCM philosophies
- Failure Modes and Effects Analysis (FMEA) for RCM
- The difference between FMEA and Failure Modes and Effects and Consequence Analysis (FMECA)
- How to identify mechanical, electrical, and stationary failure modes using condition monitoring Predictive Maintenance (PdM) technologies
- How to identify the common traps of each PdM technology
- Basics in the usage of Monte Carlo simulation in RCM and availability analyses
- Components of Human Factors Engineering in reliability
- The important terms and definitions in reliability statistics
- How to apply basic statistics in the maintenance environment
- How to calculate Net Present Value (NPV)
- RCM terminology and why RCM is important
- How to evaluate failure consequences

### ABOUT THE COURSE

This course teaches the principles of improving asset management and maintenance decisions by using fundamental principles of Reliability Engineering. Attending this course will broaden one's technical ability to tackle asset reliability in a more effective manner using the many tools learned.

### COURSE CONTENT

- Reliability Engineering fundamentals
- Reliability statistics
- Life-cycle Cost analysis
- Failure Modes and Effects and Consequence Analysis (FMECA)
- Reliability Centered Maintenance (RCM)
- Root Cause Analysis (RCA)
- Weibull Analysis
- RCM with Monte Carlo Simulation
- Availability simulation
- Condition monitoring
- Human Factor Engineering
- Reliability Centered Design (RCD)
- Failure Reporting, Analysis and Corrective Action System (FRACAS)

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*

## Introduction to Reliability Statistics (REL-50)

COURSE LEVEL Basic

ALLIED

DURATION 3 Days

### DESIGNED FOR

Reliability, maintenance, industrial, chemical, process engineers, and anyone who is involved in reliability issues who has at least a basic statistical background to include maintenance managers and maintenance supervisors

### YOU WILL LEARN

- The important terms and definitions in reliability statistics
- Fundamental concepts of measuring variability
- Basic statistics and the purpose of each
- The characteristics of Normal, Weibull, and Exponential distributions
- How to apply basic statistics in the maintenance environment
- How to calculate and utilize Mean Time Between Failure (MTBF) as a reliability predictor
- How to calculate and predict system reliability
- How to use statistics for component replacement prior to wear-out failure
- How to determine conditional failure probability
- How to apply reliability statistics to improve asset management

### ABOUT THE COURSE

This knowledge-building course is designed for those who are responsible for establishing policies and processes within the asset management discipline. The course provides knowledge and skills in reliability statistics methods allowing participants to understand and calculate appropriate statistics for specific maintenance scenarios.

### COURSE CONTENT

- Introduction to reliability and variability
- Measuring variability in reliability
- Using linear regression to understand variability in reliability
- Introduction to basic statistics
- Weibull distribution
- Exercises using basic statistics
- Reliability statistics in the maintenance environment
- Calculating Mean Time Between Failure (MTBF)
- Using MTBF in reliability prediction
- Exercises using MTBF
- Utilize statistics to analyze plant equipment life
- Using statistics to replace components prior to the wear-out phase
- Calculating conditional probability of failures
- Exercises utilizing failure prediction statistics
- Statistics for minimal testing

## Optimizing Equipment Availability (REL-61)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 5 days

### DESIGNED FOR

Maintenance, engineering, and operations personnel involved in improving the performance of process equipment and systems; participants should have foundation skills in statistical analysis, reliability techniques for equipment, and maintenance planning and work control

### YOU WILL LEARN

- To recognize the three types of availability
- To establish methods for improving the three types of availability
- How to apply root cause failure analysis and problem solving
- To improve availability through maintenance, operations and engineering actions
- To analyze current availability
- How to project future levels of availability
- How to optimize availability to meet the profit, safety, operational and environmental goals of the business

### ABOUT THE COURSE

This course is designed to teach the skills of availability engineering as detailed in the Facilities Maintenance Management Competency Map. As an intermediate level course we will use root cause failure analysis, statistical analysis, and software to identify ways to optimize asset availability to meet business goals. Process equipment examples, case studies, and exercises will be used to demonstrate the techniques. Participants will be asked to prepare and present an action plan for applying the methods learned to their everyday work upon returning to their own facility.

### COURSE CONTENT

- Types of availability
- Factors that impact availability
- Availability improvement methods
- Availability prediction
- Types of availability: inherent, achievable, operational
- Factors that impact availability: equipment design, equipment installation, operating methods, maintenance methods
- Availability improvement methods
- Predicting availability: Weibull analysis, reliability block diagrams, availability modeling

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*

## Principles of Reliability Engineering (REL-62)

COURSE LEVEL Intermediate

PETROSKILLS

DURATION 5 days

### DESIGNED FOR

Reliability engineering and operations personnel involved in improving reliability, availability, safety, maintainability and profit performance in existing or proposed process systems and equipment. Participants should have foundation skills in statistical analysis and reliability techniques for equipment.

### YOU WILL LEARN

- To define, measure and predict reliability
- How to use the reliability equation to aid in improving equipment maintenance strategies
- How to analyze system design to determine if projected capacity will meet capital requirement
- How to analyze and improve system safety
- To predict life cycle costs to make buy/replace decisions and to determine which equipment or system will create the most value for the business

### ABOUT THE COURSE

As an intermediate level course, we will use statistical analysis examples and software to measure and predict equipment reliability. Actual process equipment examples and exercises will be used to demonstrate the techniques. Participants will be asked to bring specific examples from their work environment to use as case studies.

One personal computer is provided for use during the course, at additional cost, for each two participants.

### COURSE CONTENT

- Overview of reliability engineering methods
- Weibull analysis
- Root cause failure analysis
- Availability and capacity modeling
- System reliability prediction and safety analysis
- Maintenance optimization
- Life cycle cost analysis

*This course now qualifies for credit toward a Master's degree in Petroleum Technology. See page 24.*

## Visit us at these Conferences

### 2009 Brimstone Sulfur Symposium

September 14-18; Vail, Colorado

### 2009 GPA Europe Annual Conference

September 23-25; Venice, Italy

### 2009 SPE Annual Technical Conference and Exhibition (ATCE)

October 4-7; New Orleans, Louisiana

### 2009 P2 Energy Solutions User Conference

October 27, 2009; Orlando, Florida

### 2009 Mary Kay O'Connor Process Safety Center International Symposium

October 27-28 ; College Station, TX

### 2009 IPTC International Petroleum Technology Conference

December 7-9, 2009; Doha, Qatar

### 2010 LRGCC Laurance Reid Gas Conditioning Conference

February 21-24; Norman, Oklahoma

### 2010 GPA Gas Processors Association Convention

March 21-24; Austin, Texas

### 2010 GetEnergy

March 22-24; Kuala Lumpur, Malaysia

### 2010 NPRA Reliability & Maintenance Conference & Exhibition

March 25-28; San Antonio, Texas

### 2010 GPA GCC Gulf Cooperation Council Chapter Technical Conference

May 2010; Abu Dhabi

### 2010 OTC Offshore Technology Conference

May 3-6, 2010; Houston Texas

### 2010 ADIPEC Abu Dhabi International Petroleum Exhibition and Conference

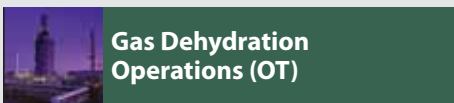
November 1-4; Abu Dhabi

### 2010 PETEX

November 2010; United Kingdom

### 2010 IPTC International Petroleum Technology Conference

December 2010



## Gas Dehydration Operations (OT)

CAMPBELL

**COURSE LEVEL** Basic

**DURATION** 2 Days

**DESIGNED FOR**

*Plant and facility operators, supervisors and technicians*

**YOU WILL LEARN**

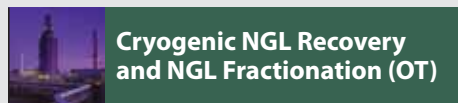
- To determine the water content of produced natural gas
- The problems and dangers of hydrate formation
- Effective methods of hydrate inhibition
- Principles and operational elements of TEG gas dehydration
- Principles and operational elements of Mole Sieve gas dehydration

**ABOUT THE COURSE**

This course will provide the basic knowledge required for understanding operating issues in natural gas dehydration units. This course is customizable to client needs.

**COURSE CONTENT**

- Types of dehydration processes: absorption, adsorption and condensation
- Water vapor content of gaseous hydrocarbons
- Hydrates and hydrate inhibition
- Dewpoint depression
- Mass transfer operations: absorption and stripping, trays vs. packing
- TEG equipment: gas scrubbers, glycol contactors, flash tank, filters, lean/rich heat exchanger, regenerator, stripping gas
- Operating procedures and problems for TEG systems: startup and shutdown, normal operations, glycol losses, corrosion, troubleshooting
- Care of the TEG solution
- Mole sieve gas dehydration
- Adsorbents and desiccants
- Mass transfer zone
- Regeneration system
- Operation and adsorbent life
- Mole Sieve operating problems and troubleshooting



## Cryogenic NGL Recovery and NGL Fractionation (OT)

CAMPBELL

**COURSE LEVEL** Basic

**DURATION** 4 Days

**DESIGNED FOR**

*Plant and facility operators, supervisors and technicians*

**YOU WILL LEARN**

- To use hydrocarbon system language
- Basic principles of gas processing
- The physical properties of natural gas and NGL components
- Practical application of the principles of hydrocarbon phase behavior
- Principles, operation, and troubleshooting of mechanical refrigeration systems
- Operating principles and issues in gas expansion NGL recovery (Turboexpander and J-T Valve) processes
- Operating principles and techniques for NGL stabilization and fractionation

**ABOUT THE COURSE**

This course will provide the basic knowledge required for understanding operating issues in cryogenic NGL (Natural Gas Liquids) extraction and stabilization/fractionation. Course content is non-mathematical and customizable to client needs.

**COURSE CONTENT**

- Hydrocarbon systems: reservoir fluids
- Hydrocarbon series: paraffins
- Physical properties of hydrocarbons
- Fluid properties: VLE, vapor pressure, boiling point, etc.
- Pressure-temperature phase diagrams (phase envelopes)
- Application of phase envelopes: hydrocarbon dewpoint control, equilibrium stage concepts, flash separators and fractionators
- Mechanical refrigeration: principles and equipment
- Tray-type towers; packed towers
- Components of turboexpander NGL recovery plants
- Turboexpander-compressor and utilities
- Principles of gas expansion NGL recovery and process variations
- Stabilizers, fractionators, and fractionation trains
- The basic fractionator and operator control techniques
- Troubleshooting

### Instructors

- Ky Alston
- Frank Ashford
- Bruce Hartman
- Joe Honeywell
- Harvey Malino
- Steve Pehnec
- Leo Wegman
- Wes Wright

## Operator Training

When it comes to training programs for plant and facility operators, one size doesn't fit all. Campbell training knows this. That's why our operator training is designed from the beginning with your company in mind. Starting with a client consultation and/or a more formal needs analysis, we customize the course material and relate it directly to your facility, incorporating PFD's, material balance tables and other materials you may supply. We deliver this training with your audience in mind; whether it's the novice or the more seasoned operator.

- Designed to enhance operating and trouble-shooting skills.
- Presented at your site.
- Customized course manual for each client.
- Lecture and demonstration-based material that is adaptable to the needs of the audience.
- Includes exercises with short-cut calculations and customized problem sets.

Campbell training has long been providing Operator Training to major oil and gas companies worldwide. Because we stress fundamentals and understanding over rote procedures, our courses have been called "engineering courses for operators." Our Operator Training courses have even been popular among both new engineers and experienced engineers making the switch from other disciplines. Our courses often fulfill statutory requirements for training and have been used to meet OSHA 1910.119 mandates.

## P-3 Production/Processing Operations (OT)

COURSE LEVEL Advanced

CAMPBELL

DURATION 10 Days

### DESIGNED FOR

Plant and facility operators, supervisors and technicians

### YOU WILL LEARN

- Advanced level physical principles, hydrocarbon properties and hydrocarbon phase-behavior
- Practical thermodynamics, including mass and energy balances
- Principles of fluid dynamics and application to pumps and compressors
- To understand process equipment, including heat exchangers, fired heaters, separators, piping and towers with trays or packing
- To understand process unit operations, including gas dehydration, NGL extraction processes and stabilization/fractionation

### ABOUT THE COURSE

This course will provide a more detailed examination of the processes found in gas production facilities, including the important theoretical aspects that must be mastered before operators can truly understand their processes and become proficient at avoiding problems and troubleshooting the technical problems that do arise. This course prepares operations personnel to communicate better and work more closely with professional engineering staff. A problem set consisting of practical calculations that will be useful to operators beyond the classroom will be administered during the course. A high-quality scientific calculator is issued to all participants of the P-3 course. It is an effective introduction to the G-4 engineering-level course. Course content is customizable to client needs.

### COURSE CONTENT

- Hydrocarbons and hydrocarbon system language
- Units of measurement
- Process drawings
- Overview of oil and gas processing
- Important properties of hydrocarbons
- Phase behavior fundamentals
- Practical thermodynamics: mass and energy balances
- Heat transfer and fired heaters
- Mechanical refrigeration
- Introduction to process control
- Basic principles of fluid flow
- Centrifugal pumps
- Centrifugal compressors
- Reciprocating compressors
- Introduction to gas turbines
- Production separators and oil dehydration
- Water treating
- Corrosion and corrosion monitoring
- Amine gas sweetening
- Sulfur recovery
- Mass transfer operations
- Water-hydrocarbon behavior
- TEG gas dehydration
- Mole sieve dehydration
- Gas expansion NGL recovery (valve & turboexpander)
- Crude oil, condensate, and NGL stabilization
- NGL fractionation
- Process troubleshooting

## Process Safety Case Study for Operations and Maintenance (OT-21)

COURSE LEVEL Basic

CAMPBELL

DURATION 2 days

### DESIGNED FOR

Operations, maintenance, supervisory and other personnel working in processing facilities

### YOU WILL LEARN

- To identify and mitigate common issues associated with catastrophic incidents in oil and gas processing facilities

### ABOUT THE COURSE

The course will focus on how failures within an organization's management system can lead to catastrophic failures and how personnel work within the system to identify and reduce the risk of incidents. Using investigation reports from the United States Chemical Safety Board (CSB) as case studies, this course will provide operators, maintenance personnel and supervisors the ability to study what happened during selected incidents to apply the lessons learned to their own area of operations. The course will consist of lecture, exercises associated with CSB investigation reports and videos, and group discussions to identify similar issues within the participant's area of operations. Techniques for analyzing and mitigating hazards will be introduced and all participants will prepare an individual action plan that will focus on applying the lessons to the workplace.

### COURSE CONTENT

- Incident overview
- Procedural deviations
- Supervisory oversight
- Operator fatigue
- Operator training
- Mechanical integrity deficiencies
- Management of change
- Organizational culture

*New course for 2010, available for public enrollment.*

## PetroSkills Operations & Maintenance

PetroSkills & SAIT Polytechnic are collaborating to deliver top quality, readily available training resources for operations and maintenance personnel.

Current O&M offerings range from instructor-led courses to online computer based content. Role specific coverage includes:

- Production Field Operators
- Gas Process Operators
- E&I Maintenance Technicians
- Mechanical Maintenance Technicians . . . and many others

Access current O&M related offerings at:

[www.petroskills.com/OM](http://www.petroskills.com/OM)

## PetroSkills®



# JMC CONSULTING

With the most sought after consultants in the world-wide energy industry, John M. Campbell Consulting provides first choice consulting services to select clients. Our clients strive to be the best in the energy industry and utilize our consulting services to provide a competitive advantage that the new energy market demands. For more information about services offered by Campbell Consulting contact us:

By phone at:

**1-800-230-9128**

By email at:

**[consulting@jmcampbell.com](mailto:consulting@jmcampbell.com)**

Or visit our web site at:

**[www.jmcampbell.com/consulting](http://www.jmcampbell.com/consulting)**

John M. Campbell (JMC) Consulting provides first choice, high-end consulting for the global energy industry. Our major emphasis is on oil and gas production and processing facilities, including both onshore and offshore operations. We routinely perform services in the LNG, LPG, NGL and sulfur industries. Our consultants are highly experienced industry professionals and include consultants who are world recognized instructors for Campbell courses.

## Our Specialty Areas

### Conceptual Design / Feasibility Studies

JMC Consulting provides front-end technical support and leadership from the earliest conceptual analyses through detailed assessments of completed designs and equipment selections. Our range of expertise includes evaluation of field development options, oil and gas processing facilities, and world scale sulfur plants. As an integral part of your team or as an objective third-party reviewer, JMC Consulting brings broad experience to design, operations, construction, and safety.

### Specialist Consulting

The world-wide availability and capability of JMC Consulting provides specialists to meet your needs, whether in strategic planning, engineering, safety, or due diligence support. We have provided specialist consulting as third-party support to peer assist reviews, expert witness, owners' engineer, third party process simulation review and optimization, facility startup support, hazards analysis and remediation, and sulfur process consulting.

### Sulfur Process Expertise

JMC Consulting is an authoritative source for sulfur technology. We have experience in process development, sulfur technology training, troubleshooting, facility operations and startup, economic evaluations, process studies, and business development. Specific project types include, Claus Sulfur Recovery Units, SULFTEN Tail Gas Treating Units, SCOT (MDEA) Tail Gas Treating Units, Stretford Units, Amine Treating Units, Gas Processing, Sour Water Strippers, Gas Plant / SRU Utilities and Off-sites.

### Troubleshooting and Debottlenecking

We are frequently asked to address operating problems, bottlenecks, modifications or reliability in existing facilities. Our worldwide experience provides the insight to allow us to efficiently develop innovative and cost effective solutions.

### Facility Optimization / Facilities Engineering Services

JMC Consulting can provide facilities with the uniquely technical resources that many asset owners lack to optimize asset operations to minimize operating costs. In addition, we can provide facility engineering services in a cost effective approach through a consulting services retainer program.

### Operations Support / Start-Up Support / Performance Testing

From operator support through our facilities engineering capabilities to start-up support and facility performance planning and testing, JMC Consulting provides first-choice consulting to maintain, optimize, and/or validate your assets capabilities.

### Process Safety / PSM / HAZOP Support and Participation

JMC Consulting prides itself in its safety culture. This attitude of "safety first" permeates all our work. Our consultants routinely conduct and participate in process hazard analyses and process safety reviews, e.g. HAZOPs, LOPA, and PSM audits. The safety expertise at JMC Consulting is a natural extension of our wide ranging engineering, operations, and maintenance experience.

### Owners' Engineer

JMC Consulting can provide expert technical overview for clients at any stage of a project. Our experts will advise if project deliverables are to industry standards and provide technical guidance to our clients to ensure their projects meet their standards and expectations.

## A brief overview of projects recently executed by JMC Consulting.

### Peer Assist Reviews

JMC Consulting provided independent third party consultation during a Peer Assist Review of a deepwater topsides design. The objective was to review the process flow diagrams and the design and operating philosophies for the current development case. JMC Consulting participated with the client's Subject Matter Experts and project team to review the current design with the focus of mitigating any inherent risks in the process and to identify any possible opportunities to improve topside safety and operational reliability.

### Facility Integrity Studies

JMC Consulting has provided facility integrity studies for major oil and gas companies. The objectives of these studies are to provide a third party assessment of the clients' Integrity Management Activities.

The deliverables for these studies address the responses to the following questions:

- Are programs, processes and procedures in-place to adequately provide corrosion monitoring and equipment inspection necessary to assure the integrity of the plant?
- How are these programs implemented?
- Is documentation of the programs and of the results adequate?
- Are the programs achieving the desired results?
- What are the strengths and weaknesses of these programs?
- What recommendations can be made to enhance these programs?

Our consultants provided multiple recommendations to improve facility operations, plant and pipeline integrity and project documentation activities.

### Process Selection Studies

JMC Consulting provided a high-level evaluation of Nitrogen Rejection Unit (NRU) designs currently being used in the industry (Single-Column, Dual-Column and any other design that may be pertinent to our evaluation) with a proprietary process. The HYSYS® simulations were studied over a range of inlet nitrogen concentrations from 10 to 70 mole percent.

For each process design, the heat and material balances, compression power, heat transfer surface area, methane and nitrogen recovery,

operating costs and estimated capital costs for each option were developed. Each technology reviewed had advantages and disadvantages. The primary driver for process selection was the design inlet nitrogen concentration. The study provided the client with a clear justification for the optimum process selection for the project.

### Process Safety Reviews / PHA Support

Consultants from JMC Consulting were retained to facilitate Hazard and Operability (HAZOP) studies for a pilot oil sands extraction plant outside Vernal, Utah, USA. In addition to the HAZOPs performed, JMC Consulting developed guidance manuals for managing the organization's process safety management system and general safety program. An emergency response plan was developed and JMC consultants developed first draft operating procedures for commissioning, startup and normal operation of the plant.

JMC Consultants provided process safety support for an upgraded propane shipping facility in Texas which included additional storage bullets, state of the art metering and monitoring equipment and upgrade the pipeline pump to ship increased volumes of propane into Mexico. JMC Consulting performed PSM/RMP audits, process hazards analysis (PHA) studies, calculated worst case and alternative release scenarios and prepared the facility's Risk Management Plan submission.

### On-site and Off-site Facility Troubleshooting

#### AMINE / DEHYDRATION PROCESS

JMC Consulting provided on-site facility troubleshooting for a major oil company in Ras Laffan. The plant was experiencing severe amine foaming and carry-over. Several causes and recommendations to implement were provided to the client, including modification of the gas inlet distributor of the amine contactor, decreased reboiler operating temperature to reduce degradation of amine and improvement of the vapor/liquid separation upstream of the mole sieve dehydration beds. It was also recommended that a critical review of the current operating speed of the turbo-expander be completed.

#### HYDROCARBON DEWPOINT CONTROL

JMC Consulting was contracted by a major oil producer to solve the operating problems experienced at a hydrocarbon dewpoint facility. The gas processing facility is a low temperature, J-T hydrocarbon dewpoint plant and includes condensate stabilization. The MEG and condensate in the medium pressure separator was forming an emulsion that was causing severe MEG Regeneration operating problems and mild Condensate Stabilizer operation issues. There was also evidence that corrosion by-products were contributing to the facility operating problems.

The emulsion problems were determined to be a result of by-products from corrosion inhibitor used in the subsea pipeline. The corrosion inhibitor was changed as a result. However, to address the emulsion problems immediately, the entire MEG inventory would have needed to be replaced. JMC Consulting provided a detailed report with control set point modifications, pipeline hydrate inhibition options, pH stabilization

recommendations to prevent/minimize carbon steel corrosion through pipeline and to stabilize process operations.

#### CO<sub>2</sub> REMOVAL

Our client had a CO<sub>2</sub> Mole Sieve removal bed that was experiencing extremely poor performance, in particular with rapid breakthrough of CO<sub>2</sub> on the absorption cycle. Due to the operating conditions of the facility, it was unclear if the problem was a result of reduced bed capacity or reduced bed efficiency. JMC Consulting provided a technical review of the operating problems and provided a list of recommendations to remediate the issues, including modified operating and regenerating conditions designed to limit the amount of liquid hydrocarbons flowing in the stream to the mole Sieve bed. The recommendations were successfully implemented by the client and were proven to solve the operating problems.

JMC Consulting, with input from the client's engineering and operations personnel conducted a hazard review of the client's multiple wellsite facilities. The review was not intended to replace a HAZOP or equivalent process hazards analysis (PHA) method. This review provided an independent, experienced-based look at the facilities by an outside party, which should assist the entire safety verification effort. Along with safety related issues, several operational/design issues were identified and recorded for informational purposes.

#### Owners' Engineer

JMC Consulting provided an independent, third party assessment of recommendations provided by an engineering contractor for modifications to a sour gas treating facility / sulfur recovery process to meet state emission limits. The independent review generated many alternate recommendations that reduced the capital cost of the modifications. In addition, the focus of the study was on eliminating the source for the operating problems upstream rather than installing additional equipment and controls to deal with the problems downstream.

#### Facility Debottlenecking Studies

JMC Consulting approaches debottlenecking studies so that our recommendations can be implemented in stages, increasing plant capacity for the short term operating conditions while the long-term solutions can be implemented. One study conducted for a major facility in Egypt provided immediate operating solutions to increase capacity, provided alternate midterm strategies to further increase facility capacity, and provided the most economical facility design modifications for the permanent long term solution.

#### Sulfur Recovery Expertise

JMC Consulting has provided Schedule A packages, procurement support, support and review of detailed engineering and mechanical designs, operating manuals, and start-up services for the following Sulfur Plants which were executed in conjunction with Exterran:

- LukOil Uhta 10 MTPD Sulfur Recovery Unit and Tail Gas Treating Unit

- Bourgas 85 MTPD Sulfur Recovery Unit and Tail Gas Treating Unit
- Zhaikmunai 35 MTPD Sulfur Recovery Unit

JMC Consulting is also providing support for the mechanical design, revising the facility operating manual and providing start-up support for two Sulfur Recovery Unit revamps projects in Malaysia.

## Retainer Program

Our deeply experienced consultants who have designed and problem solved plants for major companies for 40 years are available to assist your facilities in a cost effective retainer program. It's not just theory, we've been there and done it. Now you can hire our experts at a savings of over 20% from our standard consulting rates and provide your facilities and companies the operating advantage that they need to stay competitive in today's market. JMC Consulting offers facility audits, facility optimizations and five levels of retainer programs to choose from to meet all types of clients needs. From small independent owner/operators to large international producers, we have packages that are designed to meet your company's specific needs.

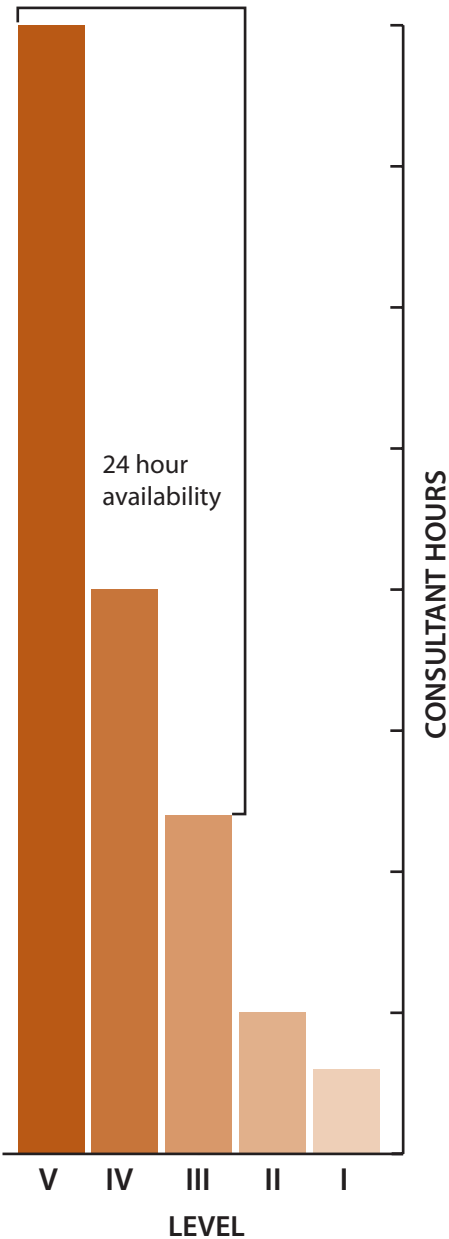
#### Facility Audits

JMC Consulting provides facility audits. The primary purpose for the facility audits is to enhance the services that we can provide in our Retainer Program. This allows your technical specialist to become intimately familiar with your plant, which results in JMC Consulting providing the best consulting services possible. Your assigned specialist will know the facility and will have met and interacted with the operations team. In addition, a report with specific recommendations will be provided to improve the operations of the facility. All travel expenses are reimbursable at cost. A proposal and cost estimate for your specific facility will be developed upon request.

#### Retainer Programs

All of our retainer programs provide access to an industry expert who is assigned to be the primary contact for your facility. Your primary consultant will have access to the entire JMC Consulting team, to allow true inter-discipline support if required. We will assist you via email, phone discussions, webmeetings and site visits as required. Your consultant will be available to support staff engineering and operations in the following areas:

- Process Troubleshooting
- Process Debottlenecking
- Equipment Replacement / Engineering Support
- Instrumentation and Controls Modifications and Support
- Process Safety Management Support
- Turn-around Planning and Support



All of our retainer programs provide access to an industry expert who is assigned to be the primary contact for your facility. Your primary consultant will have access to the entire JMC Consulting team, to allow true inter-discipline support if required. We will assist you via email, phone discussions, and webmeetings. 24-hour availability is available at some levels.

Contact us for program details.

**RETAINER LEVEL I**

This retainer is designed for small independent companies that are in need of technical resources for their plant operations and engineering staff. Throughout the month, you will have access during normal business hours to your consultant. Any additional consulting requirements or site visits throughout the month will be provided at the Retainer Program reduced rates. All associated travel fees will be billed at cost.

**RETAINER LEVEL II**

This retainer is designed for small independent companies that are in need of technical resources for their engineering staff and operating facilities. This retainer provides additional hours of consulting services over the Level I Program during normal business hours. Any additional support or site visits will be provided at the Retainer Program reduced rates.

**RETAINER LEVEL III**

This retainer is designed for mid-sized owner/operators that are in need of technical resources in the field, possibly at multiple locations. This retainer includes one site visit per month to the facility to provide on-site support to operations. Throughout the month, you will have access to your primary consultant 24 hours a day in case of facility upsets. If the site visit is not required, the retainer will provide additional hours of consulting availability. We can custom tailor this program if more than one facility requires support.

**RETAINER LEVEL IV**

This retainer is designed for mid to large sized owner operators that are in need of technical resources at multiple facilities. This retainer includes two site visits per month to the facility of your choosing to provide on-site support to operations. You will have access to two expert consultants to support your facilities, with a primary contact identified for specific facilities. Throughout the month, you will have access to your primary consultants 24 hours a day in case of facility upsets. If the site visits are not required, the retainer will provide additional hours of consulting availability for that period.

**RETAINER LEVEL V**

This is our most exclusive retainer program available. This program provides you with a world recognized leader in the oil and gas industry to provide strategic planning, business development guidance, quality assurance programs, and corporate board support and participation. This provides a high-level third-party review of critical action planning in today's volatile market. The program provides one week per month site visits at your selection to provide support in the areas that you request. In addition, your consultant will be available throughout the month and will be customized to meet your specific needs.

**FACILITY OPTIMIZATIONS**

With the current market conditions, many facilities could drastically improve their financial performance by reducing operating costs. Our facility optimization studies identify key operating parameters that improve and/or maintain performance while minimizing operating costs. Our consultants will work closely with the facility operations team in supporting the modifications required to improve performance. A detailed report with recommendations for the facility will be supplied. All travel fees are reimbursable at cost. Please contact JMC Consulting for a cost estimate for your specific facility.

**For a personalized review of your technical resource needs, contact us at 1-800-230-9128, by email at [consulting@jmcampbell.com](mailto:consulting@jmcampbell.com) or visit our web site at [www.jmcampbell.com/consulting](http://www.jmcampbell.com/consulting).**

# TIP OF THE MONTH

## SAMPLE TIP OF THE MONTH

The classroom is not the only way to learn from John M. Campbell & Co.'s expert instructors. Our instructors share their valuable, technical knowledge monthly to address current issues in the Oil and Gas industry through our Tip of the Month.

The Campbell Tip of the Month is available FREE by subscribing at [www.jmcampbell.com](http://www.jmcampbell.com).

The Campbell Tip of the Month is available in both English and Spanish.

## Two Phase Gas-Liquid Pipeline Simulation

As gas moves through a pipeline its pressure and temperature change due to the frictional loss, elevation change, acceleration, Joule-Thompson effect, and heat transfer from the surroundings. Due to pressure and temperature change, liquid and solid (hydrate) may also form in the line which in turn affects the pressure profile. Modeling and simulation of multiphase system, even under steady-state condition, is complex. There are a few tools designed specifically for modeling and analysis of complex multiphase systems such as PipePhase, PipeSim, OLGA, etc [1]. This Tip of the Month illustrates how general-purpose process simulation programs can be used to simulate wet pipelines.

In order to perform computer simulation, let's consider the gas shown in Table 1. The gas enters a pipeline with an inside diameter of 18.81 inches (47.8 cm) at rate of 180 MMSCFD equivalent to 19800 lbmole/hr (8989 kgmole/h). The pipeline length and elevation profile are shown in Figure 1. The ambient temperature is assumed to be 60 °F (15.6 °C). The gas enters the line at 1165 psia (8032 kPa) and 95 °F (35 °C). The pipeline is buried under ground; with an approximate overall heat transfer coefficient of 1 Btu/hr-ft<sup>2</sup>-°F (5.68 W/m<sup>2</sup>-°C) was assumed. Due to the high content of H<sub>2</sub>S and CO<sub>2</sub> (25.6 and 9.9 mole %, respectively) and to prevent corrosion and hydrate formation, the gas has been dehydrated before entering the pipeline.

Table 1. Gas composition and conditions

Component	Mol%
N <sub>2</sub>	0.20
H <sub>2</sub> S	25.60
CO <sub>2</sub>	9.90
CH <sub>4</sub>	62.90
C <sub>2</sub> H <sub>6</sub>	0.70
C <sub>3</sub> H <sub>8</sub>	0.20
iC <sub>4</sub> H <sub>10</sub>	0.06
nC <sub>4</sub> H <sub>10</sub>	0.09
iC <sub>5</sub> H <sub>12</sub>	0.04
nC <sub>5</sub> H <sub>12</sub>	0.05
C <sub>6+</sub> : MW=108 SG=0.7 NBP=234 F (112.2 C)	0.26
Total	100.00
Rate, lbmole/hr (kgmole/h)	19800 (8989)
T, °F (°C)	95 (35)
P, psia (kPa)	1165 (8032.4)

The calculation algorithms for computer simulation are discussed in the Gas Conditioning & Processing, Vol 3, Computer Applications for Production/Processing Facilities [2]. The pipeline was divided into 14 segments according to the number of up-hills and down-hills in the line. In addition, each segment was divided into 10 equal increments to achieve higher calculation accuracy. The pipeline was simulated by HYSYS [3], ProMax [4] and EzThermo [5] programs. For pressure drop calculation, the Beggs and Brill method with the original liquid hold up correlation was chosen in all three programs. The SRK equation of state (EOS) was chosen in the ProMax and EzThermo but PR EOS was chosen for HYSYS.

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Similar cases of fluid flow are discussed in our Fundamentals of Onshore and Offshore Pipeline Systems - PL-4; Fundamentals of Pipeline Hydraulics - PL-41; Onshore Pipeline Facilities - Design, Construction and Operations - PL-42; Flow Assurance for Pipeline Systems - PL-61; Offshore Pipeline Facilities - Design, Construction and Operations - PL-43; Process Simulation in Gas Conditioning and Processing - G-7 courses.

**SAMPLE TIP OF THE MONTH (continued)**

Figures 2 through 4 present the pressure, temperature, and liquid formation profiles along the pipeline. Figure 2 indicates that the pressure profiles predicted by the three programs follow the same pattern and ProMax and EzThermo results are very close to each other. The main difference in the calculated outlet pressure is due to the different amount of liquid formation predicted from phase behavior.

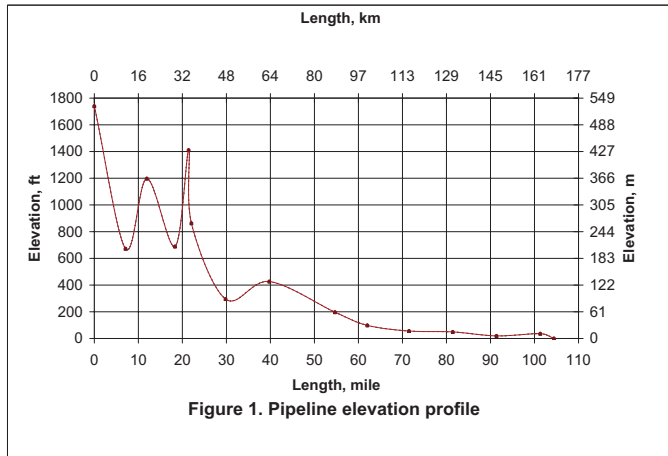


Figure 1. Pipeline elevation profile

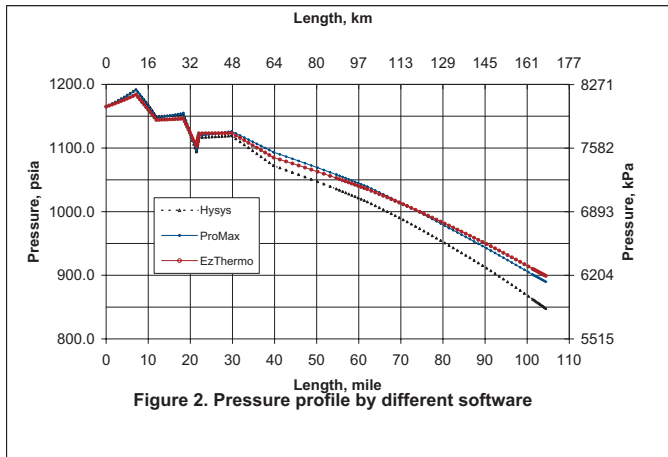


Figure 2. Pressure profile by different software

Figure 3 indicates that the temperature profiles predicted by the three programs fall on top of each other. It seems that the small amount of liquid condensation in the line has a smaller effect on the temperature profile than on the pressure profile. The liquid formation profiles predicted by the three programs are shown in Figure 4. As shown in this figure, the amount of liquid formation in the line predicted by ProMax is relatively higher than the other 2 programs. This can be explained by viewing the dew point curves predicted by these programs on Figure 5. Note that the cricondentherm predicted by ProMax is higher than the other two. As we have shown in an earlier tip of the month and publication [6], the characterization of heavy ends has a strong effect on the dew point curve and consequently on the liquid condensation in transmission lines [7]. In this study, the same normal boiling point, relative density, and molecular weight for C6+, as shown in Table 1, are used in all three programs. However, the critical properties predicted by these programs were not quite the same. In addition, the binary interaction parameters between different components and C6+ are not the same. Pipe surface roughness also play an important role for friction pressure drop in gas pipeline. It is interesting to see that the line pressure-temperature profiles by the three programs are practically the same despite the differences in the phase envelope.

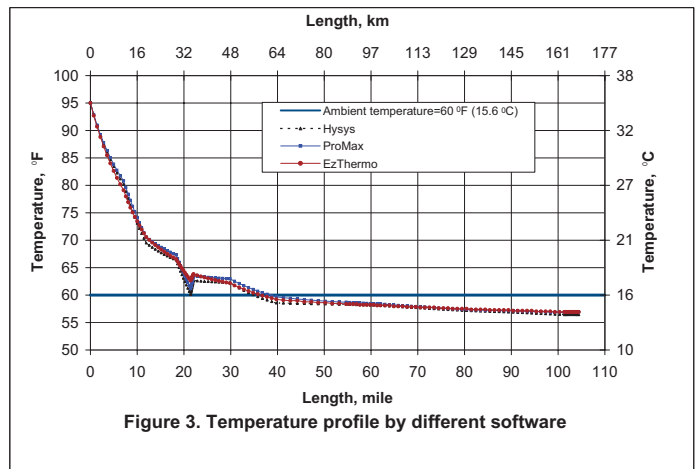
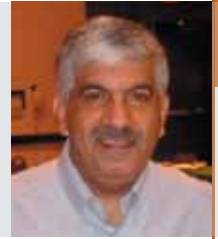


Figure 3. Temperature profile by different software

The fractional hold-up along the pipeline calculated by the three programs are shown in Figure 6. Even though all three programs demonstrate the same trends, those predicted by HYSYS and EzThermo follow each other more closely.

## Dr. Mahmood Moshfeghian



DR. MAHMOOD MOSHFEGHIAN is an instructor and consultant with John M Campbell and Company (JMC). He is the author of most of Campbell Tips of the Month and develops technical software for JMC. He has more than 30 years teaching experience in universities (Oklahoma State University, University of Shiraz, University of Sydney and University of Qatar) as well as for oil and gas industries. Dr. Moshfeghian joined JMC in 1990 as a part time consultant and then as full time instructor/consultant in 2005. Previous to joining JMC, Dr. Moshfeghian was a Senior Research Scientist at Kuwait Institute for Scientific Research and Professor of Chemical Engineering at Shiraz University. Dr. Moshfeghian is a senior member of AIChE and has published numerous technical papers on thermodynamic properties, and Process Engineering. Dr. Moshfeghian has presented invited papers in international conferences. He is a member of the editorial board for International Journal of Oil, Gas and Coal Technology (IJOGCT). He holds a B.S., an M.S. and a Ph.D. in Chemical Engineering, all from Oklahoma State University.

### RECENT JOURNAL PUBLICATIONS (2007-08):

1. Moshfeghian, M., and Taraf, R., "New method yields MEG injection rate," Oil and Gas J, Sep 1, 2008
2. Moshfeghian, M., Bothamley, M.E., Lilly, L.L. "Feed gas molecular weight affects centrifugal compressor performance," Oil and Gas J, May 10, 2008
3. Mohebi, V., Behbahani, R., Moshfeghian, M., "Method calculates lean, semi-lean streams in split-flow sweetening," Oil and Gas J, July 23, 2007
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5. Taraf, R., Behbahani, R. and M. Moshfeghian, "Direct Prediction of Cricondentherm and Cricondenbar Coordinates of Natural Gas Mixtures using Cubic Equation of State," International J. of Thermophysics, Vol 29, Issue 6, p1954, 2008
6. Javanmardi, Nasrifar, Kh., S.H. Najibi, and M. Moshfeghian, "Natural Gas Transportation: NGH or LNG?," World Review of Science, Technology and Sustainable Development, Vol 4, No 2/3, 2007

### SAMPLE TIP OF THE MONTH (continued)

In line with our earlier tip of the month and in order to see the impact of the overall heat transfer coefficient on the pipeline behavior, the overall heat transfer coefficient of 1 Btu/hr-ft<sup>2</sup>-°F (5.68 W/m<sup>2</sup>-°C) was changed to 0.25 Btu/hr-ft<sup>2</sup>-°F (1.42 W/m<sup>2</sup>-°C). The simulation results indicate that the overall heat transfer coefficient can affect the line behavior considerably. The effect of the overall heat transfer coefficient on the temperature profile predicted by the three programs is presented in Figure 7.

The work reported here clearly shows the importance of simulation tools and how general-purpose process simulation programs can be used to model and analyze the behavior of a gas transmission pipeline. However, care must be taken to utilize these programs properly. Improper use of the overall heat transfer coefficient or heavy end characterization can lead to completely erroneous conclusions about the presence or absence of liquid, even to indicate as far as a pipeline will be handling dry gas when in reality the line will be in two phase gas - liquid flow.

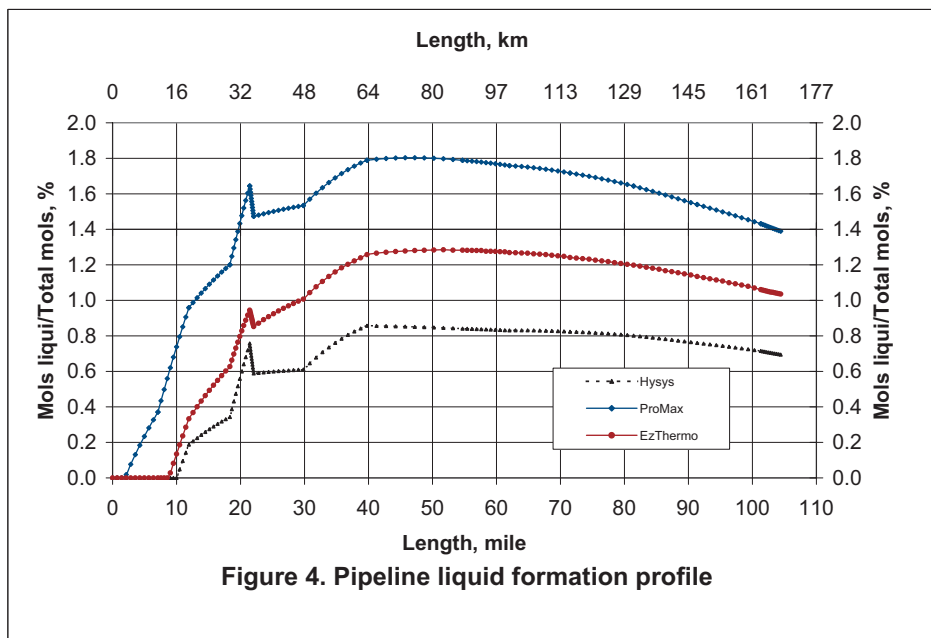
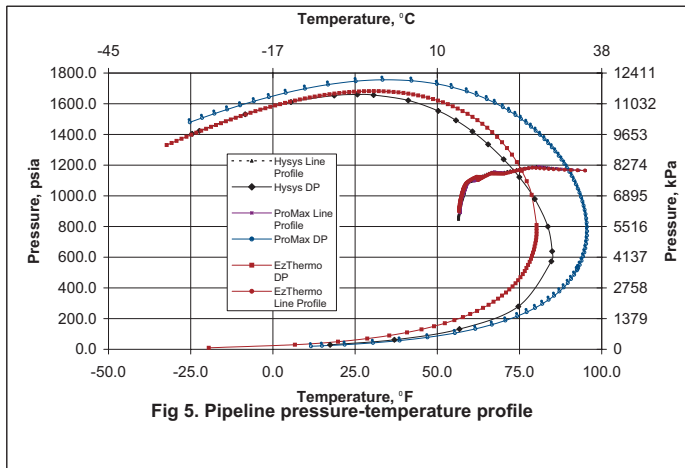


Figure 4. Pipeline liquid formation profile

Note: The Liquid-Gas ratio at the pipeline outlet in bbl/MMSCF [m<sup>3</sup>/106 std m<sup>3</sup>] are: 3.676 [20.95], 5.479 [31.23], and 7.352 [41.92] for HYSYS, EzThermo, and ProMax, respectively.

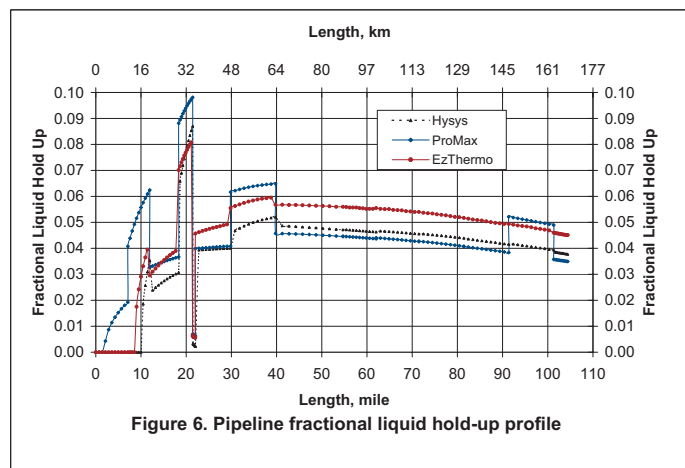
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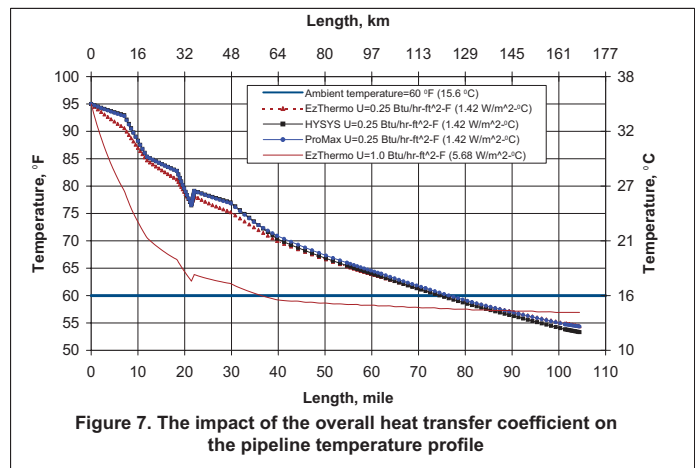
Proper use of the simulation programs combined with correct input of design parameters will lead to more accurate and reliable forecasts of gas pipeline behavior. The overall heat transfer between the line and its surroundings has an impact on liquid formation in the line and, consequently, on the line pressure profile.

By: Dr. Mahmood Moshfeghian



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2. Maddox, R. N. and L. L. Lilly, *Gas Conditioning and Processing, Vol. 3 (2nd Edition), Campbell Petroleum Series, Norman, Oklahoma, 1990.*
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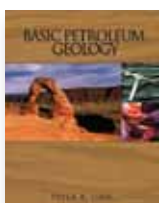
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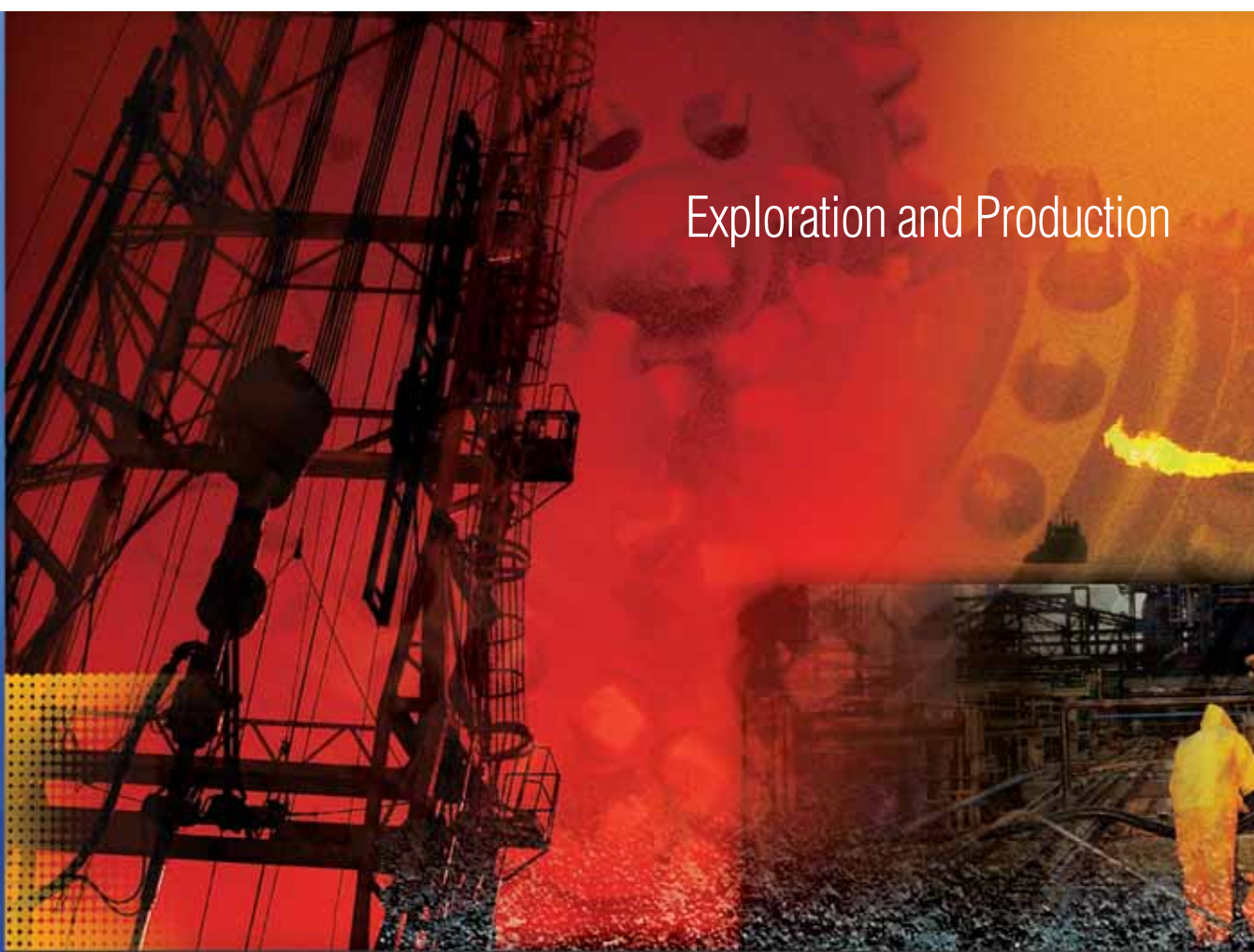
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# INSTRUCTORS

## KY ALSTON

MR. KY ALSTON comes from an extensive background in gas processing. He is currently a contract instructor / consultant for John M. Campbell & Company. Mr. Alston worked in maintenance, operations, and engineering disciplines for Amoco Production Co. in several locations throughout Wyoming during his 24 tenure. He worked his way up through the operations ranks training newer operators and debugging new projects. He then shifted his focus to the engineering group where he became heavily involved in the process simulation effort for process optimization and troubleshooting at several area facilities. He has also been involved in all stages of project management of all sizes. His primary responsibilities for JMC are Operator Training, Consulting and Process Simulation. When he is not teaching or consulting, he enjoys biking, hunting, fishing, and golf with his family.

## TIM ARMSTRONG

MR. TIM ARMSTRONG has 39 years experience in Refining and Gas Treating/Sulfur Recovery and is currently an Instructor/Consultant for John M Campbell & Co. Previously Mr. Armstrong has worked in plant operations and design engineering as well as licensing and technology development. Mr. Armstrong graduated in 1968 with a BSChE from Rose-Hulman Institute of Technology. He is currently a Registered Professional Engineer in Texas and Oklahoma and is a member of AIChE. Mr. Armstrong is an expert in the area of sulfur recovery, tail gas treating and sour water stripping and presented papers at NPRA, North Texas Regional GPA, and AIChE meetings as well as published articles in Hydrocarbon Processing and Today's Refinery.

## FRANK ASHFORD

DR. FRANK ASHFORD has 40 years experience in oil and gas producing facilities and has been with John M. Campbell & Company since 1988. He provides instruction fluently in either Spanish or English. Previous to joining John M. Campbell & Company, Dr. Ashford was a Professor at Central University of Venezuela, Caracas, Venezuela, where he taught various courses in Natural Gas Engineering Technology. He has authored technical articles published in World Oil, JPT, SPE, Intevap Pub., PDVSA, Pacific Oil World, AAPG, SPELAC, and GPA. He holds a B.S., a M.S. and a PhD in Petroleum Engineering from the University of Oklahoma.

## JOHN BAULD

MR. JOHN BAULD has more than 35 years experience in hydrocarbon processing specializing in Hydroprocessing and Gas Treating/Sulfur recovery for the petroleum refining industry. Mr. Bauld has a BSc in Chemical Engineering from Strathclyde University, Scotland. He has been involved in many sulfur related projects, establishing design requirements and licensor/ contractor selection. In on-going operations, he has been instrumental in greatly improving plant reliability and sulfur

recovery through innovation and training. He has extensive experience with Mobil/Exxon & Licensees and KBC including extensive start up and troubleshooting activities. He is a Chartered Engineer and a Fellow of the Institution of Chemical Engineers (UK) and consults for international clients. He has wide personal interests including playing classical guitar and church bell ringing.

## LOU BEKE

MR. LOU BEKE is an instructor and consultant with JMC. He is working as a consultant in process design in general and as a consultant and advisor in the technology areas of gas treating and sulfur recovery and caustic-based product treating in particular. Mr. Beke retired from Mobil Technology Company after a 31-year career that included research, capital projects, technical service and troubleshooting, startup assistance for new and revamped units, and turnaround planning/support. He was lead technologist for gas treating, sulfur recovery and tail gas clean up, sour water stripping and light product treating for Mobil's worldwide downstream (refining) business when he retired. Mr. Beke has been a speaker at symposia, authored several papers and represented Mobil as a member of the Amine Best Practices Group. He earned a BS in Chemical Engineering at Drexel University.

## JOHN BERRY

MR. JOHN BERRY has worked in the industry over 30 years as project engineer, engineering manager, and project manager. He has experience in the design and construction of natural gas and liquid pipelines, dehydration systems, compressor installations, and various surface facilities. Mr. Berry was named American Hero by Newsweek for work on behalf of peoples with disabilities and is the chair of RARC Board serving adults with disabilities. He is also a member of the Pipeliner's Club of Tulsa. Mr. Berry received a B.S. in Industrial Engineering from the University of Oklahoma and well as an MBA.

## GARY BLACKBURN

MR. GARY BLACKBURN has over 35 years of experience in engineering and management of oil and gas developments. During his 27 years working for Shell Oil Company, he led well construction and field production teams in the Gulf of Mexico, Texas, Oklahoma, Kansas and Alaska. While working in ABB's Floating Production System's Division, Mr. Blackburn led engineering teams designing deepwater systems, naval architecture, structural, topside facilities, drilling systems, and floating system hulls. After an assignment as the ABB's Project Manager for ExxonMobil's Kizomba A TLP, he was assigned as ABB's Vice President - Project Execution. In this role, he was responsible for oversight of ongoing projects and development of new processes for EPC project execution. Currently, Mr. Blackburn is providing consulting services for drilling systems

as part of field architecture design with operators of deepwater fields in the Gulf of Mexico. He is also an instructor for our Offshore Discipline.

## MARK BOTHAMLEY

MR. MARK BOTHAMLEY is the Technical Director and Chief Engineer for John M. Campbell Training and is an active consultant with John M. Campbell Consulting. His experience covers the areas of design, operation, troubleshooting and optimization of offshore and onshore oil and gas production and treating facilities. Prior to joining JMC he was with BP/Amoco for 24 years, in several locations around the world. Mr. Bothamley is a past chairman of the SPE Facilities Subcommittee and a former member of the GPSA Data Book Editorial Review Board. He holds a B.S. in Chemical Engineering from Lakehead University in Thunder Bay, Ontario, Canada, and a Diploma in Natural Gas and Petroleum Technology from the British Columbia Institute of Technology in Vancouver, B.C. Canada.

## JOHN C. BOURDON

MR. JOHN C. BOURDON is the serving President of John M. Campbell Consulting. He has more than twenty-nine years experience in hydrocarbon processing, with a focus on sulfur recovery processes. Mr. Bourdon has been involved in the development of several sulfur-related technologies and mechanical innovations and has authored several papers and made presentations worldwide. He spends a significant amount of his time consulting clients around the globe and is recognized as a world-renowned expert in sulfur recovery. He is a registered professional engineer and member of Chi Epsilon Sigma Honor Society. Mr. Bourdon is fluent in English and Spanish. Mr. Bourdon has a B.S. in Chemical Engineering from the Georgia Institute of Technology and advanced degrees in other fields.

## JAMES N. BREAUX

MR. JAMES N BREAUX has more than 38 years experience in the oil and gas industry and is currently working as Topsides Lead Engineer for a large floating oil and gas host in the ultra deep West Africa. He is responsible for Process, Mechanical, Instrumentation, and Rotating Equipment Engineering deliverables. He is also is the Topsides Lead Engineer for design and installation of a 45 MMscfd Gas Lift Compressor and for a Waterflood Expansion project on a Gulf of Mexico TLP. This project includes the application of prototype high pressure high volume pumps and novel oxygen removal systems. His previous responsibilities include Topsides Manager for the Auger TLP in the Gulf of Mexico which included design and construction management and commissioning of a large oil and gas processing facility and a full permanent drilling rig. He was also lead project engineer on numerous other Gulf of Mexico shallow water and deepwater production facilities. He is a past chairman of the API RP 14G Committee 1991-1993 and chaired a rewrite team for this Offshore

Firefighting Standard. Mr. Breaux was a member of the Operations Leadership team for a major Oil and gas company and started up surveillance operations for these facilities. He received a B. S. in Physics from Loyola University of New Orleans and a M. S. in Electrical Engineering from Tulane University. He is a Registered Professional Engineer in the State of Louisiana and a member of SPE. Mr. Breaux has authored and presented papers on dynamic process simulation and loss of containment incident analysis at Gas Processors Association conferences in Europe and the United States. He also presented papers on project management at the Offshore Technology Conference.

### DARRELL G. CARVER

MR. DARRELL G. CARVER is a registered engineer in Texas with international and domestic experience who has worked on facilities in domestic and international locations and both on and offshore. He retired from ConocoPhillips Petroleum Company in 2002 and has been instructing and developing training materials for JMC since 2003. He has more than 32 years of uniquely diverse electronics, instrumentation, and electrical upstream experience, holding senior operational and technical positions on oil and gas projects worldwide. As Principal Controls System Engineer for Phillips Petroleum he was recognized as a company expert for automation and electrical control systems. While with Phillips Petroleum, he served on numerous committees and task forces for the company representing both electrical and instrumentation disciplines. Mr. Carver has authored and co-authored several technical papers and he has been the instructor for numerous in-house courses. In addition, he has participated on numerous process enhancement teams for upstream facilities as the electrical and instrument representative. Mr. Carver received his B.S. in Electrical Engineering from the University of Arkansas.

### AJEY CHANDRA

MR. AJEY CHANDRA, P.E. has over 24 years of broad experience in the oil and gas industry for both operating companies and consulting firms. He has worked on a number of diverse projects, including field production facilities, gas processing plants, and pipeline projects. Mr. Chandra has had senior operations roles, including being the plant manager of a 2.4 BCFD gas plant, managing pipeline operations, and managing multiple gas processing plants for an operating company. Most of Mr. Chandra's career has focused the midstream components of the industry, including gas processing plants and pipelines, economics of processing, facilities acquisitions, and market analysis/project feasibility. As a consultant, Mr. Chandra has been involved in feasibility studies, acquisitions and mergers, market analysis, legal proceedings, price forecasting, and benchmarking. He holds a B.S. degree in Chemical Engineering from Texas A&M University and an M.B.A from the University of Houston. Mr. Chandra is also active in the Gas Processors Association, having served as the Program

Chairman for the 2009 Convention.

### MICK CRABTREE

MR. MICK CRABTREE trained over 4,000 engineers, technicians and scientists before joining John M. Campbell & Co. as an instructor and consultant. Formerly trained in aircraft instrumentation and guided missiles in the Royal Air Force, he completed his service career seconded to the Ministry of Defense and was responsible for ensuring the reliability, maintainability and functional usefulness of specific equipment entering the RAF. Mr. Crabtree has spent the last eight years running industrial workshops throughout the world in the fields of: Process Control and Instrumentation; Data Communications; Fieldbus; Emergency Shut-down Systems; Project Management; On-Line Analysis; and Technical Writing and Communications. He is the former editor and managing editor of Pulse magazine, South Africa's leading monthly journal dedicated to the general electronic and process control instrumentation industries. He has written and published six technical handbooks on industrial process control. Mr. Crabtree completed an HNC in Electrical Engineering (with distinctions) which is generally regarded as a B.Sc. equivalent.

### PIERRE CREVIER

MR. PIERRE P. CREVIER M.Sc., P. Eng earned B.Sc and M.Sc degrees in Chemical Engineering from the University of Waterloo in 1980 and 1987 respectively. He worked in operations, design and business development functions across Canada prior to joining Saudi Aramco in 1992. As a member of the Upstream Process Engineering Division in Dhahran he provides process consultancy to the company's gas plants and refineries. Over the last 15 years he has led the company's efforts in addressing chronic Claus catalyst deactivation caused by aromatic contaminants.

### RALPH DARTEZ

MR. RALPH DARTEZ has over 30 years of engineering and management experience. He has led engineering, construction, operating and field development and management teams in the Gulf of Mexico, Alaska Cook Inlet and UK North Sea for Marathon Oil Company. Mr. Dartez was Marathon Oil Company's Gulf of Mexico Region Manager during the mid 1990s at the time a number of deepwater fields were discovered and developed including Troika (2700' water depth), Oyster (1000' wd), Arnold (1700' wd), Petronius (1800' wd) and Camden Hills (7100' wd). He has experience with drilling and completions, design, construction and reservoir management of deepwater and particularly sub-sea developments.

### ARTHUR DELARGY

MR. ARTHUR DELARGY has over 15 years experience in Process Design/Consultancy, Field Development Planning and Process Systems engineering. Technologies he has worked with include Nitrogen Rejection, CO/H<sub>2</sub> Coldbox

technology, LNG, Gas Processing including dehydration/dewpointing, sweetening and NGL/LPG extraction, ammonia, heavy oil and various oil refining processes, as well as both on and offshore oil and gas experience. The scope of his project work has ranged from proposal preparation and field development planning to engineering design and HAZOP studies to troubleshooting on an operating plant. He holds a Masters degree in Chemical Engineering (Honors.)

### KRIS DIGRE

MR. KRIS A. DIGRE is an instructor in the Offshore discipline for John M. Campbell & Co. He has over 36 years working in locations around the world. He has designed or been involved with the design of offshore structures located off the coast of West Africa, Alaska, Australia, Brazil, Borneo, California, China, Egypt, the Gulf of Mexico and the North Sea. He has been involved in the technical specification development and/or installation of all of deepwater Tension Leg Platforms (TLP) and a Floating Production System (FPS) in the Gulf of Mexico and an FPSO offshore Nigeria. Mr. Digre remains active in retirement providing advice to E&P project groups on various Nigeria FPSO projects. Mr. Digre is a graduate (BSCE) of Illinois Institute of Technology and a Licensed Professional Engineer in New Jersey, Louisiana, Texas and California.

### BILL DOKIANOS

MR. BILL DOKIANOS has over 35 years experience in Electrical Engineering. His experience includes analyzing and solving poor platform up time at GB 128. Activities included process control changes due to stacked separator vessels, revising safe charts, operating settings and reconfiguration of pipeline export pumps. He managed a subsea tieback project in which the platform modifications included high pressure vessel redesign, dehydrator expansion, adding a second vapor recovery unit, restaging high pressure and intermediate gas compressors and modifying bulk oil process design. He has been responsible for DOT compliance activities and reporting. This included development and implementation of federal risk programs and smart pigging. Mr. Dokianos holds a Bachelor of Science in Electrical Engineering, Wayne State University, Detroit, MI. He is a Professional Engineer in Louisiana and New Mexico and holds a General and Commercial Contractor License in New Mexico.

### RAFIL ELYAS

MR. RAFIL ELYAS is an instructor of John M. Campbell & Company. He has approximately 17 years experience in gas conditioning and processing. Mr. Elyas has authored several papers and made presentations worldwide. He has experience with several simulation software programs including HYSYS. He is a registered professional engineer with the Board of Engineers, Malaysia. Mr. Elyas is fluent in English and Bahasa: Malaysia and Indonesia. Mr. Elyas received a Bachelor's Degree in Chemical Engineering from Syracuse University, LC Smith

School of Engineering in Syracuse, New York. He enjoys listening to and playing music, reading and recreational programming in his free time.

#### ROBERT FANNING

MR. ROBERT FANNING is a training consultant with John M Campbell and Company. He held various Process Engineering and Management positions in his 26 years with Mobil. Mr. Fanning's background includes general oilfield facilities, water flood facilities, CO<sub>2</sub> flood facilities, NGL recovery, and LNG. Mr. Fanning was on the Board of the Permian Basin Chapter of the GPA for several years and is a past President of the chapter. He received his B.S. in Chemical Engineering from the University of Wyoming and is a Registered Professional Engineer in the state of Texas.

#### JOHN FARRAH

MR. JOHN FARRAH is an instructor and consultant for John M Campbell & Company. He has more than 40 years of chemical production, power production, gas processing and process engineering experience. He works as a Gas Processing and Chemical Production Safety Consultant, who has proven strengths in the areas of planning, problem solving and team building, combined with attention to detail. He also has extensive knowledge in the field of safety. Mr. Farrah is a Fellow Member of the American Institute of Chemical Engineers, a Registered Professional Engineer in Texas, and served as Chairman for the Coastal Bend Section of AIChE. He has acted as Team Leader to update and publish the Gas Processor's Association Gas "Plant Safety Checklist" and served as Safety representative for Marathon on the GPA Safety Committee for 10 years. Mr. Farrah published and presented a paper on "Conversion of Boilers to Oil Firing" to the Mexican Chemical Engineering Society (IMIQ) in Mexico City. He received his B.S. in Chemical Engineering from the University of Colorado.

#### ALAN FOSTER

MR. ALAN FOSTER is a training consultant with John M. Campbell & Company and is based in the UK. Mr. Foster spent 25 years with Petrolite Corporation and Baker Petrolite involved in oilfield and refinery operational problems and their resolution by chemical treatment programs. Mr. Foster has developed and taught courses on oilfield water treatment and oilfield corrosion control since 1978. Other courses included oil demulsification, paraffin and asphaltenes, oilfield microbiology (and MIC) and refinery technology. He was also qualified by the original training company in its field to teach their project management course. He is a Chartered Chemist, Member of the Royal Society of Chemistry and a Fellow of the Chartered Institute of Personnel and Development. Mr. Foster received his B.S. in Applied Chemistry from Portsmouth Polytechnic (UK) and his MBA from Leeds University.

#### DAVID HAIRSTON

MR. DAVID HAIRSTON is a consultant and instructor with John M. Campbell & Company. Mr. Hairston is a Registered Professional Engineer in several U.S. states and has over 35 years of experience in project management, engineering and design, material logistics, and construction management for oil and gas facilities. Project experience includes pipeline transportation and production facilities, both onshore and offshore. Worldwide project and construction management experience at all levels includes grass-roots gathering, processing, and pipeline systems with a capital cost of over USD\$ 2.5 billions. Specialized technical expertise includes river and special obstacle crossings using open-cut, bridging and directional drilling methods; offshore construction and logistics planning. Mr. Hairston has been published in ASCE Magazine, Proceedings of Marine Technology, Proceedings of several industry Pipeline Conferences, and the Oil and Gas Journal. He holds a B.S. in Aerospace Engineering from Texas A&M University and an M.S. in Civil Engineering for the University of Houston.

#### BRUCE HARTMAN

MR. BRUCE HARTMAN has formal training in incident investigations, PSM auditing, audit team leader training, HAZOP facilitation, and engineering design for process safety and has been involved in more than 40 incident investigations either as consultant or as team leader including any litigation that has resulted. He has also facilitated or participated in 15 Process Safety Management audits of refineries and chemical plants and upstream facilities. Mr. Hartman has managed a team of experienced fire protection and process safety engineers split between Richmond, CA, Houston, TX, Perth, Australia and Aberdeen, Scotland. He has participated in design reviews of many major capital projects, primarily in refineries, chemical plants and upstream facilities including guidance in areas of plant/equipment layout, area classification, drainage, fireproofing and fire suppression. He initiated and managed the annual process to review major incidents and near misses throughout his career. Mr. Hartman is a past member of API Safety and Fire Protection subcommittee and chairman of the API Fire Protection Subcommittee.

#### BOB HLOZEK

MR. BOB HLOZEK is an instructor for John M. Campbell & Co. with over 40 years of technical experience in the Oil & Gas, Refining, Petrochemicals, and Specialty Chemicals industries. Mr. Hlozek has a varied work background that includes process engineering, design and equipment sizing, research, product development, plant startups, economic evaluations, technical management, operations, sales and marketing support, and business development. He holds a Bachelor of Science in Chemical Engineering from Texas A&M and completed some graduate studies toward

MBA at University of Delaware. Mr. Hlozek as authored 10 technical articles, is a member of AIChE, Houston Chapter AIChE, Houston GPA, Texas Professional Engineering Society, Texas A&M Clubs and has served as Chairman and Officer for several local technical and university chapters.

#### KEITH HODGES

MR. KEITH J. HODGES is a learning advisor and Instructor Development consultant. Mr. Hodges lives in the UK and is a qualified Project Manager who has managed multimillion pound building projects. In 2003 he had a paper relating to project management, published in the Public Service Review: Central Government and an article published within the Public FM in 2006. Since being associated with Campbell he has project managed protracted training program. For a number of years he worked within National Police Training, where he designed, directed and evaluated courses at a National level, including management courses. He has been involved in Computer Supported Collaborative E-Learning since 1996 and has directed Coach/Mentor and Management courses in this medium. Mr. Hodges has a Masters Degree in Education (M.Ed.), Training and Evaluation, gained from the University of Hull in 1995, also a Post Graduate Certificate in Education from the University of the West of England in 1998.

#### JOE HONEYWELL

MR. JOE HONEYWELL is a graduate of University of Tulsa with a Bachelor of Science in Aerospace Engineering and a Masters of Science in Mechanical Engineering. Mr. Honeywell began his career with an engineering consulting company named Crest Engineering. He worked in the mechanical department for thirteen years, specializing in rotating equipment, pressure vessels and piping systems. Mr. Honeywell advanced to project engineer and later project manager, where he was involved in many offshore and onshore projects for oil and gas producers, both domestic and international. He joined another consulting company, Crown Tech, Inc. where he worked for 19 years and became a principle in the company. At CTI, Mr. Honeywell provided engineering services to many oil and gas producers, pipeline companies, power producers and equipment manufacturers. His responsibilities included project management, design, manufacturer, construction management, start-up and operation of power plants, pipelines and production facilities. Mr. Honeywell's background includes extensive experience with mechanical systems and rotating machinery. Mr. Honeywell has been a trainer for John M. Campbell Company for four years and is a Registered Professional Engineer. Mr. Honeywell is a member of ASME and holds a U.S.A. patent.

#### ROBERT HUBBARD

MR. ROBERT A. HUBBARD is a principal consultant with John M. Campbell Consulting. He is based in Norman, Oklahoma with over 37 years

experience in oil and gas facilities. Mr. Hubbard joined John M. Campbell & Company in 1980 and has held the positions of Vice President, Chief Operating Officer, President, Chief Financial Officer and Chairman of the Board. He now focuses on consulting services worldwide. Prior to joining John M. Campbell & Company he held various engineering and management positions at Texaco Inc. from 1972 to 1980. Since retiring from JMC in 2003, Mr. Hubbard has directed a master's program in Natural Gas Engineering and Management at the University of Oklahoma. He is a member of SPE and GPSA, has chaired the SPE Facility Engineering Committee and is currently an officer of the Oklahoma City SPE section. He is a registered professional engineer in the state of Louisiana, holds a B.S. in Chemical Engineering from Kansas State University and an MBA from Tulane University. Mr. Hubbard has published and presented numerous papers at GPA and SPE meetings worldwide, directed the update of the Gas Dehydration section of the GPSA Engineering Data Book and co-authored and edited the most recent edition of Gas Conditioning and Processing Vols. 1 and 2.

### FRANK JARRETT

MR. FRANK JARRETT is an instructor and senior consultant for John M. Campbell & Company. He has over 34 years of experience in the natural gas processing industry. His background covers design and optimization of natural gas liquids recovery, LNG processing, nitrogen rejection and recovery of helium from natural gas, acid gas removal, product distillation, dehydration, relief system design and evaluation, and plant utilities systems. He specializes in process modeling using HYSYS. He is a registered professional Engineer in the state of Colorado and has served on the Board of Directors of the Rocky Mountain Chapter of the Gas Processors Association. Mr. Jarrett received a B.S. in Chemical and Petroleum Refining Engineering from the Colorado School of Mines.

### JOHN KANENGEITER

MR. JOHN KANENGEITER is a principal of the Kanengeiter Consulting Group LLC, a private organizational consulting firm which specializes in executive coaching and working with teams in challenging work systems. His work with leaders in a consulting and executive coaching relationship is augmented by his expertise gained from 20 years in the field of experiential education and leadership development. His practice includes clients as individuals, teams, and large organizations. Mr. Kanengeiter is a principle trainer contracted by NASA to work with Space Shuttle Crews in the dynamics of teamwork and leadership on extended space expeditions and worked closely with the Columbia Shuttle Crew. He also works on leadership development with the U.S. Naval Academy, the Wharton School of Business and Wildland Forest Fire Crews. He holds a Masters Degree in Applied Behavioral Science with an emphasis in Executive Coaching and Consulting in Organizations from the Leadership Institute of Seattle, Bastyr University.

### BILL KEETER

MR. BILL KEETER joined Allied Reliability in 2006 after serving as President of BK Reliability Engineers, Inc. where he provided training and facilitation services to help facilities improve asset performance using Weibull Analysis, Reliability Centered Maintenance, Availability Simulation, and Life Cycle Cost Analysis. Mr. Keeter has over 25 years of experience in Maintenance Engineering and Management. He has successfully implemented maintenance improvement programs in a variety of manufacturing and production facilities. His experience includes maintenance leadership positions in the US Military, the nuclear industry, chemicals, paper converting, and plastic film manufacturing. He has provided training and reliability consulting services to petroleum, process, mining, and defense industries in the United States, Mid-East, and Europe. He has developed competency maps for Reliability, Availability, and Maintainability Engineering for the PetroSkills® program. Mr. Keeter has published articles in a variety of internationally recognized maintenance publications and has presented papers on the practical application of Weibull Analysis at several internationally attended Maintenance and Reliability Conferences. He is a Certified Maintenance and Reliability Professional with the Society for Maintenance and Reliability Professionals Certifying Organization. He also holds degrees in Business Administration and Electrical Engineering.

### DALE KRAUS

MR. DALE KRAUS is an instructor and a consultant for John M. Campbell & Co. He has twenty-eight years of progressive responsibility from staff to management positions within the Upstream Oil and Gas Industry. Mr. Kraus has obtained sound basis in Facility/Processing Engineering and Field Operations in Oil and Gas Production. He is also the president of D. Kraus Oil & Gas Consulting Corp. Mr. Kraus is a member of A.P.P.E.G.A and the Canadian Gas Processors Association. He holds a Bachelor's degree in Chemical Engineering from the University of Saskatchewan.

### LARRY L. LILLY

DR. LARRY L. LILLY is the President of John M. Campbell Consulting Board of Directors. He has over 30 years experience with Engineering & Consulting companies including design, commissioning and startup. Dr. Lilly provides consulting services worldwide including process simulation applications, facilities operations and detailed project development. He is a member of AIChE, GPSA, GPA Europe and numerous local technical societies. He has published extensively on gas and liquid properties, world energy economics and process calculations. Dr. Lilly has presented invited papers for international conferences and has co-authored numerous operating manuals and equipment selection manuals used by major oil companies. He has also co-authored three books on Gas Conditioning and Processing and Computer Applications for

Production/Processing. He holds a B.S., an M.S. and a PhD in Chemical Engineering from Oklahoma State University.

### PERRY LOVELACE

MR. PERRY LOVELACE, CMRP specializes in Maintenance Management and Competency-based Training Programs and has over 25 years experience in industrial training and consulting. His work in competency-based workforce development is known worldwide. In addition to M&O, his participative leadership seminars have provided team-building skills to supervisors and team leaders. He has dedicated his career to providing high quality learning experiences, keeping in tune with the changing economic and technological environment, especially as applied to long-term facilities and equipment management. Mr. Lovelace has assisted many organizations through on-site consultation and training. Clients include industrial and utility organizations of different types and sizes in the United States, Kingdom of Saudi Arabia, United Arab Emirates, Qatar, Canada, New Zealand, Australia, Thailand, Malaysia, Singapore, Trinidad/Tobago, UK and Mexico. An engaging and popular speaker/facilitator, Mr. Lovelace continually receives high marks from participants. A certified Maintenance and Reliability Professional (CMRP) by the Society for Maintenance and Reliability Professionals and a member of the Society of Petroleum Engineers, Mr. Lovelace also holds a B.S. in Science Education and an M.S. in Botany from the University of Oklahoma, with pre-doctoral studies in Plant Ecology at the University of California.

### HARVEY MALINO

MR. HARVEY MALINO has more than 35 years of experience in the Chemical and Hydrocarbon Processing Industries. During his 28 years with Union Carbide Corporation/UOP, he held both technical and commercial positions. These included: Molecular Sieve Technical Manager-Design and Field Service; Licensing Manager for the Ethylene Oxide business; Area Sales and Marketing Manager for Southeast Asia; Business Manager for the Gas Processing Business Group; and World Wide Sales Manager for the Gas Processing Business Group. Mr. Malino has lived and worked in New Hampshire, Maine, New York, Singapore and Chicago. He is currently based in Sullivans Island, South Carolina where he is President of his own consulting business. Mr. Malino is a registered Professional Engineer in the State of New Hampshire. He is a Senior Member of the Advisory Board of the Laurance Reid Gas Conditioning Conference in Norman, OK. Mr. Malino earned a B.S. in Chemical Engineering from the City College of New York; and an M.B.A from Pace University in New York.

### ANDREA MANGIAVACCHI

DR. ANDREA MANGIAVACCHI is an instructor/consultant in the Offshore Discipline. A freelance independent consultant since 2001, Dr. Mangiavacchi is currently involved in

international deep-water offshore projects on behalf of several major oil and gas operators. As technical liaison member between API and ISO committees, he is also actively involved in the development of US and international standards for offshore structures. After an early academic career with the University of Rome, Italy and with Rice University in Houston, Dr. Mangiavacchi joined Brown & Root (today KBR) where over the next 25 years he was involved in a number of major international offshore oil and gas projects (Gulf of Mexico, North Sea, South America, West Africa, Asia-Pacific). He also held a number of corporate positions in the area of deep water technology, fixed and floating offshore structures, and engineering systems. Dr. Mangiavacchi has extensive experience in structural analysis and design, hydrodynamics, naval architecture, Computer Aided Engineering and Design. Dr. Mangiavacchi holds a M.Sc. in Nuclear Engineering and a Ph.D. in Aerospace Engineering, both from the University of Rome. He has authored or co-authored over 30 technical papers and holds two patents.

#### JOHN MORGAN

MR. D. JOHN MORGAN is based in Denver, Colorado, and is Vice President of John M. Campbell & Company with over 40 years experience in the design, startup and troubleshooting of oil and gas facilities. He has published extensively on sour gas treating, sulfur recovery, CO<sub>2</sub> treating, materials of construction, LNG training, and cryogenic gas processing. He consults for both North American and international clients in the gas processing industry. He performs training in LNG facilities, oil and gas production facilities, and gas plants around the world. Mr. Morgan has served as an SPE Distinguished Lecturer in 2005/06 and 2008/09. He is very active in industry activities including membership of the Editorial Review Board of the Gas Processors Supplier's Association, the Program Advisory Committee of the Laurance Reid Gas Conditioning Conference, and had served as Adjunct Professor of Petroleum Engineering at Colorado School of Mines. Mr. Morgan has many years of experience training non-native English speakers. He holds a B.Sc. (Honors) in Chemical Engineering from London University; and an M.E. in Chemical & Refinery Engineering from Colorado School of Mines, USA.

#### MAHMOOD MOSHFEGHIAN

DR. MAHMOOD MOSHFEGHIAN is an instructor and consultant with John M. Campbell & Co. and is the author of most of Campbell Tips of the Month as well as developing technical software for JMC. He has 30 years teaching experience in universities (Oklahoma State University, University of Shiraz, University of Sydney and University of Qatar) as well as for oil and gas industries. Dr. Moshfeghian joined JMC in 1990 as a part time consultant and then as full time instructor/consultant in 2005. Previous to joining JMC, Dr. Moshfeghian was a Senior Research Scientist at Kuwait Institute for

Scientific Research and Professor of Chemical Engineering at Shiraz University. Dr. Moshfeghian is a senior member of AIChE and has published numerous technical papers on thermodynamic properties, and Process Engineering. Dr. Moshfeghian has presented invited papers in international conferences. He holds a B.S., an M.S. and a Ph.D. in Chemical Engineering, all from Oklahoma State University.

#### RALPH NEUMANN

MR. RALPH NEUMANN serves as the Discipline Manager for John M Campbell & Company's Gas Processing courses. Throughout his extensive career, Mr. Neumann has gained experience in Oil and Gas Production, Natural Gas Processing, Specialty Fractionation, and Pipelines and Gathering Systems. Responsibilities have included the development of conceptual and detailed designs, multi-discipline project supervision, economic feasibility studies, consulting, and a variety of field services including pre-commissioning, startup, training, and troubleshooting. He has also been responsible for project development, management of engineering (including safety and environmental), and management of field operations for a large midstream natural gas processing company. He has authored and presented technical papers to AIChE (dynamic simulation) and Gas Processors Association (nitrogen rejection facilities, gas plant operations management, and gas and NGL treating). Mr. Neumann received his baccalaureate and master's degrees in Chemical Engineering from Rice University in Houston, Texas.

#### JOHN NEWMAN

MR. JOHN R. NEWMAN is an instructor and consultant for John M. Campbell & Company. He is currently performing competency based engineering training, competency development and skills assessment processes. His background includes more than 30 years of international and domestic design, construction and operations of natural gas and oil production, gathering and processing facilities, including Liquefied Natural Gas (LNG) plant design, start-up and operations. His specialties include oil and gas treating and processing operations, as well as process facility trouble-shooting, operating problem assessments, facility de-bottlenecking and plant efficiency improvement evaluations. Mr. Newman has a B. S. degree in Chemical & Petroleum Refining Engineering from Colorado School of Mines. He is a member of ASME and a Registered Professional Engineer in the State of Texas.

#### BOB O'BANNON

MR. BOB O'BANNON is a Senior Training Instructor for Allied Reliability with responsibilities that include facilitating learning for the Best Practices PM/PdM Series and delivering and developing additional training materials. Mr. O'Bannon has been in the maintenance and reliability field for over 20 years. He began with

the Tennessee Valley Authority's corporate vibration and diagnostic group, where he worked with a team of other engineers to solve power plant operating and maintenance issues. Both simple and complex, and even multi-channel data acquisition systems were employed to measure vibration and plant operational characteristics. Results from the data analysis were used to drive operational, maintenance, and design changes. He then transferred to a nuclear power plant site and implemented a Predictive Maintenance program to ensure equipment health and improve asset management. The PdM program included vibration analysis, ultrasonics, oil analysis, infrared thermography, and motor circuit analysis. After that, Mr. O'Bannon joined CSI as a Senior Training Instructor where he developed and delivered all types of condition based monitoring and corrective maintenance courses, at both domestic and international sites. Additionally, he practiced trouble shooting and corrective techniques in the field and mentored customers for improvement. Bob has a Mechanical Engineering degree from Mississippi State University.

#### ANDY PAGE

MR. ANDY PAGE is currently a Vice President with Allied Reliability. He directs the training group specializing in training clients in reliability engineering topics from root cause analysis, Reliability-Centered Maintenance and integrated condition monitoring programs. Mr. Page has 15 years in the maintenance and reliability field where he has played several different roles. First, he was a Maintenance Engineer for Noranda Aluminum where he was responsible for implementing a comprehensive PdM program and continuous improvements of the planning and scheduling function. Next, he held the role of Regional Services Manager for CSI where he provided technical services to new customers and for the sales staff. After that he worked for Martin Marietta Aggregates as the Asset Reliability Manager responsible for PdM and maintenance improvement process effort across 23 plants in Ohio, Indiana and Michigan. Next he served as the Vice President - Operations for a small consulting firm called Reliability Solutions, Inc. in central Ohio providing PdM services primarily to the mining industry. Mr. Page is well grounded in reliability and maintenance topics with particular emphasis on PdM technologies to include advanced experience in vibration analysis and ultrasonics and Level 2 certifications in infrared thermography and oil analysis. He has an engineering degree from Tennessee Technological University and is a Certified Maintenance and Reliability Professional (CMRP) through the Society for Maintenance and Reliability Professionals (SMRP) and is a Six Sigma Black Belt.

#### STEPHEN PEHNEC

MR. STEPHEN T. PEHNEC has been JMC's Manager of Operator Training since joining the company in early 1990. He is responsible for the design, development and delivery of

operator training programs, worldwide. Mr. Pehne has more than 37 years of experience in oil & gas exploration, production and processing operations, including technical, supervisory and management positions. He has delivered pre-startup training for a number of large projects, such as Qatar Petroleum's North Field Project (Um Said, 1991) and Sable Offshore Energy's Goldboro and Point Tupper plants (Nova Scotia, 1999). Mr. Pehne holds a BA degree (Physics) from the California University of Pennsylvania (1971), and an MBA degree (Operations Management) from Waynesburg College (1989). He has earned instructor certificates from the Petroleum Industry Training Service (PITS, 1984) and Abacus Learning Systems (2002), and he has completed a number of JMC's engineering-level courses. Mr. Pehne was JMC's Instructor of the Year for 2008.

### DENNIS PERRY

MR. DENNIS PERRY is a training consultant with John M. Campbell & Company and teaches in the Electrical and Instrumentation discipline. Mr. Perry has been working in the automation, electrical and instrumentation design business for many years. His work experience includes working in the aerospace industry as an analog circuit designer, working in the electronic instrument manufacturing business as production engineering manager, and working for a major oil and gas company as a division automation supervisor and later as a staff engineer in the central, Upstream Technology group. He has also worked for an instrument manufacturer as service manager and for an engineering construction company as an instrument/electrical engineer. Mr. Perry published a paper on Multiphase measurement fall 1998 SPE, co-authored a paper for ASME/ETCE 2000 on value of well test accuracy, presented at the Acadiana Flow measurement workshop, and co-authored a paper on heavy oil multiphase measurement with Intevep of Venezuela. Mr. Perry graduated from Louisiana Tech with a BS degree in Electrical Engineering.

### DOUG PLUCKNETTE

MR. DOUG PLUCKNETTE worked 19 years for Eastman Kodak Company, including six years as a Reliability Applications Engineer and world-wide RCM Trainer/Facilitator before joining Allied Reliability. He began his career in the field by providing training, facilitation and consulting services in Reliability Centered Maintenance, Manufacturing Reliability Measures, and Failure Reporting and Corrective Action Systems as President of Reliability Solutions Inc. While CEO of Reliability Solutions Inc., Mr. Plucknette provided reliability training and services to numerous companies around the world, large and small including such Fortune 500 companies as Cargill, Invista, Bosch, Whirlpool, Honda, Coors Brewing, Energizer, Corning, and Newmont Mining. He has been a featured speaker at several national conferences on manufacturing reliability and is noted for having developed the RCM BlitzTM method. Mr. Plucknette has made key

contributions to standard reliability measures for manufacturing, and reliability training programs for engineers, managers, technicians, and skilled trades. He has trained numerous client RCM Facilitators and performed RCM analyses in hundreds of pieces of manufacturing equipment.

### PETER REEVES

MR. PETER REEVES is an instructor and consultant for John M. Campbell & Company. He has over 18 years experience, 13 years of which is in Oil and Gas Processing and LNG. Particular areas of expertise include: gas processing; LPG / condensate recovery from gas; NGL fractionation and storage; process optimization; LNG; heavy oil processing; field development planning, including high level cost estimating and scheduling; steady state and dynamic process simulation; and plant operations. Mr. Reeves is a member of several professional societies. These memberships include MIChemE, CEng, and Gas Processors Association. Mr. Reeves has experience both as a Contractor/Consultant and in an Operating Company environment. His design experience ranges from field development/ concept screening studies to front end engineering, dynamic simulation studies and detailed design. Operations experience includes plant troubleshooting, performance monitoring, process optimization, energy efficiency improvements and process development / improvement. Mr. Reeves received his B.S. in Chemical Engineering from the University of Birmingham.

### FRED RUSSELL

MR. FRED RUSSELL is a training consultant with John M Campbell & Company. Mr. Russell has enjoyed a 45 year career in chemical engineering in the hydrocarbon processing business. Mr. Russell started his career as a gas reservoir engineer and concluded as Vice President and General Manager of a manufacturing company serving the oil and gas industry. He has extensive experience in domestic as well as international projects in designing and building such facilities as expander plants, oil absorption units, refrigeration systems, and compressor stations. He was given the Hanlon Award in 1999 by the GPSA and was named Outstanding Engineering Alumnus by the Rice Engineering Alumni Association in 2000. Mr. Russell received a B.S. in Chemical Engineering from Rice University.

### JOHN SHEFFIELD

MR. JOHN A. SHEFFIELD was a Senior Manager with M W Kellogg Ltd. a major UK E&C Company for more than 18 years during which time he managed the Process Engineering Department, Project Manager for development of LNG projects for export and import terminals and Commercial Vice President with responsibilities for key clients and projects. He helped develop projects for LNG facilities in the UK, China, Norway, Egypt, Germany and Australia and the development of LNG offshore technology for the Azure Project an EU funded project. With John M Campbell & Co. Mr. Sheffield is an Instructor/Consultant

presenting short courses on the LNG business and technologies around the world. He also practices as a consultant, assisting companies with development of both LNG export and reception terminals and is currently active on several LNG projects in Europe and Far East Asia. Mr. Sheffield graduated from UC London with a degree in Chemical Engineering. He has served on the Management Committee of the European GPA for more than 16 years and chairs the GPA Europe LNG working party. He has presented papers at GasTech, GPA Europe and at the SMI LNG conferences dealing with LNG terminals, floating LNG developments and small scale LNG facilities.

### MIKE SHEILAN

MR. MIKE SHEILAN serves as an instructor and consultant for John M. Campbell & Company. Mr. Sheilan is President of Gas Conditioning Solutions Inc., Senior Consultant for Amine Experts, Inc. and is the principle author and editor of their new textbook, *The Fundamentals of Amine Treating*. Mr. Sheilan has been involved in all aspects of the Natural Gas Processing Industry, primarily in relation to the chemicals used to treat gas and the processes that use these chemicals during his 28 year career. His recent focus has been on plant troubleshooting and plant optimization for the sour gas and oil refining industries. He is a member of the Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA) and National Association of Corrosion Engineers (NACE). He is also a senior member of the Advisory Board for the Laurance Reid Gas Conditioning Conference (LRGCC) at the University of Oklahoma. He has been published in the *Oil and Gas Journal* and *Hydrocarbon Processing* and has presented papers at various conferences including the LRGCC, NACE, CanEnergy and the Canadian GPA. Mr. Sheilan received a B.S. in Chemical Engineering from the University of Calgary.

### RICKY SMITH

MR. RICKY SMITH CMRP, CPMM has over 30 years experience in maintenance as a maintenance manager, maintenance supervisor, maintenance engineer, maintenance training specialist, maintenance consultant and is a well known published author. Mr. Smith has worked with maintenance organizations in hundreds of facilities, industrial plants, etc, world wide in developing reliability, maintenance and technical training strategies. Mr. Smith has worked as a professional maintenance employee for Exxon Company USA, Alumax, Kendall Company, and Hercules Chemical providing the foundation for his reliability and maintenance experience. He is currently the Vice Chairman of the Society for Maintenance and Reliability Professionals Oil and Gas Special Interest Group and the Reliability Engineering Discipline Manager for PetroSkills. Mr. Smith co-authored "Rules of Thumb for Maintenance and Reliability Engineers", "Lean Maintenance" and "Industrial Repair, Best Maintenance Repair Practices", "Planning and Scheduling Made Simple," as well as writing

for different magazines during the past 20 years on technical, reliability and maintenance subjects. Mr. Smith holds certification as Certified Maintenance and Reliability Professional from the Society for Maintenance and Reliability Professionals as well as a Certified Plant Maintenance Manager from the Association of Facilities Engineering.

#### **KINDRA SNOW-MCGREGOR**

MRS. KINDRA SNOW-MCGREGOR is the Engineering Manager for John M. Campbell Consulting. Her experience includes design, troubleshooting, and optimizing gas treating, gas conditioning, and sulfur recovery facilities. With over 12 year sof experience, her specific responsibilities have included process department management, lead process engineer on significant onshore design build projects, feasibility studies; conceptual and detailed process simulation and design; flow sheet development; detailed engineering; plant troubleshooting; process hazards analysis (PHA) facilitation; and facility performance testing. She is a registered Professional Engineer in the state of Colorado, with a B.S. and a M.S. in Chemical Engineering from Colorado School of Mines. She has published multiple technical papers at international conferences. She is a committee member on the Gas Processors Association Research Committee, Sub-Group 2 and participates on the scholarship committee for the Rocky Mountain Gas Processors Association.

#### **CHIP STANSBURY**

MR. MERLIN C. STANSBURY, P.E. serves as the EI&C Discipline Manager and as an instructor for John M. Campbell & Co. He come to JMC with over thirty-seven (37) years of progressive and diverse experience in electric power generation, transmission and distribution; in utilities, industrial and commercial facilities; in domestic and international markets. He holds a Bachelor of Science Degree in Electrical Engineering and a Master of Science Degree in Nuclear Engineering from Louisiana State University. He is a registered professional engineer in the states of Texas and Louisiana. Mr. Stansbury's professional affiliations include memberships in Phi Kappa Phi, Tau Beta Pi, Eta Kappa Nu and senior membership in IEEE. He has experience in Competencies Development, Organization Development, Personnel Development, Project Management, Contract Management, Project Engineering, Engineering Management, Quality Management, and Design Engineering. He has published and presented papers in his field.

#### **GORDON STERLING**

MR. GORDON STERLING is based in The Woodlands, Texas. In a 35-year career with Shell E&P, USA, he was involved in many deepwater developments. He was the design supervisor for the Cognac Platform, in 1978, which set the "deepwater" record at 1024 feet of water; the project manager for the Bullwinkle Platform, which set a new water depth record of 1354

feet in 1988, and the Construction Planning Manager for the Auger Tension Leg Platform (TLP) in 2850 feet. He was the Manager of Major Projects for Shell's Deepwater Division in New Orleans during the mid and late 90's when the Mars, Ram Powell and Ursa TLP's were designed, built and installed, (Ursa in 3950 feet of water) and when the Mensa sub sea development in 5400 feet of water was designed, built and brought on production. From 1991 through 1999 Mr. Sterling was on the Board of Directors of the Offshore Technology Conference, the largest technical conference related to offshore oil and gas in the world, annually host to 45,000 or so visitors in Houston Texas. He was Chairman of the conference in 1998 and 1999. With this background he brings a broad knowledge of the early development planning steps and a detailed knowledge of the development and production system options. In association with two colleagues he has written a book titled *Deepwater-Petroleum Exploration and Production-A non-technical guide*, which was recently published by PennWell.

#### **DAVID TENHOOR**

MR. DAVID A. TENHOOR, CPIM is an instructor in the field of Supply Chain Management for PetroSkills/John M. Campbell & Company. He has been consulting and teaching APICS (The Association for Operations Management) CPIM certification courses since 2005. He has taught in many different industries from chemical processing to discrete manufacturing. Companies include BASF, National Oilwell Varco, Halliburton, ExxonMobil Chemical and Cameron. Mr. Tenhoor brings a well-rounded package of industry experience to PetroSkills/JMC. He has held positions in Inventory Control, Manufacturing Management, Strategic Sourcing and Transportation/Distribution Management. He also has experience in Finance and Product Development. Mr. Tenhoor received his undergraduate degree in Geology from Hope College in Holland, Michigan and an MBA in Supply Chain Management from Michigan State University. He is a member of the Houston Chapter of APICS and served two terms on the Board of Directors as Treasurer.

#### **MAURY TORREY**

MR. MAURY TORREY has over 25 years of experience in the Maintenance and Reliability industry. Mr. Torrey began his Maintenance and Reliability career with 3 years in the United States Airforce and 2 years in the US Reserves. He then spent 37 years with Eastman Kodak in a variety of roles including: Maintenance Supervisor, Maintenance Manager, Reliability Engineer and World Wide Manager for Reliability Centered Maintenance and Maintenance Excellence. Mr. Torrey co-authored the Kodak RCM process along with Doug Plucknette, the owner and President of Reliability Solutions, Inc. Mr. Torrey also developed Eastman Kodak's Equipment Ranking process and has trained several facilitators. While at Kodak, he worked part-time with Reliability Solutions. After retiring from Eastman Kodak in

2004, he joined Reliability Solutions full-time adding to a total of 5 years with Reliability Solutions as a Senior Consult travelling the globe teaching the RCMBLitz™ Process and Equipment Ranking courses, performing RCM Analyses, Equipment Ranking and Maintenance Manangement training along with Criticality Based Asset Management and Maintenance Effectiveness Evaluations. His ability to bring real life examples from the workplace into the classroom turns theory into reality. Since 2007, he has been contracting with Allied Reliability to fulfill the RCMBLitz™ deliverables as needed. Today, Mr. Torrey serves as a Reliability Professional with the Reliability Engineering Services Division of Allied Reliability and will primarily be responsible for our RCMBLitz™ deliverable as well as other opportunities where his extensive knowledge of Maintenance Management, OEE and Reliability Centered Maintenance can best serve our clients. He is a Six Sigma Green belt and also a Six Sigma Management Black Belt.

#### **ADRIAN TUCK**

MR. ADRIAN TUCK has over 35 years of experience with LNG. Currently designing and delivering LNG specific technical training at three European LNG importation facilities having designed and delivered training for every aspect of the operation of and LNG facility at all of the UK peakshavers for the last ten years. Mr. Tuck has condemned one LNG facility cold box as unfit for duty and launched an LNG refurbishment project. Working with a team of 2, he scoped the project, led the team that analysed the bids and selected the MWC. Mr. Tuck directed a team of engineers to undertake the conceptual design of an LNG road truck loading facility for UK peakshave LNG facilities. He scoped the work and selected the MWC, managed project delivery and commissioning. He has designed training and delivery for all UK LNG road truck drivers.

#### **RICHARD VAN LAERE**

MR. RICHARD J. VAN LAERE is the Discipline Manager for John M. Campbell and Company's Mechanical and Pipeline courses. His career began in 1969 with positions of increasing responsibility and is currently the Regional Operations Manager for the Gulf of Mexico Region. Mr. Van Laere is on the Board of Directors of the Gulf South Minority Supplier Diversity Council and the Louisiana Pipeliners' Association. Other memberships include Texas Board of Engineers, Louisiana State Bar Association, New Orleans Museum of Art, City Energy Club and the Louisiana Mississippi Oil and Gas Association. He also sits on the Environmental Advisory Committee for the Department of Energy Strategic Petroleum Reserve as the pipeline expert. He was selected Executive of the Year in 2001 by Equiva Services for his contributions to supplier diversity. Mr. Van Laere graduated with a BSME in from the University of Tulsa and with a Juris Doctor degree in civil law in from Loyola Law School in New Orleans. He is a registered professional engineer in Texas and an attorney

licensed to practice law in the state of Louisiana.

### VINTON (BUD) VESTA

MR. BUD VESTA is currently the International Operations Manager for Mid-Western manufacturer of both power equipment and irrigation products for consumer, commercial and agricultural customers. Previously, he served with Mobil Oil Corporation (now ExxonMobil) for over 20 years in a variety of operations management positions including over 3 years as General Manager and Director of Logistics for Mobil Oil Japan. He also served with the U.S. Army as a logistics officer for nearly five years. During his working career he has had foreign assignments for nearly 11 years. Mr. Vesta is also specialized in a number of operations research models and has conducted numerous logistics optimization studies and has conducted training in related areas. He is an accomplished project manager and has successfully lead large scale international teams engaged in ERP/ MRP implementations. Mr. Vesta holds an MA in Political Science from Northern Illinois University and an MBA in Finance and Management from George Mason University. He conducts frequent volunteer training in various forums including an annual guest lecturer at Bethel University in St. Paul, MN.

### JIM VINSON

MR. JIM VINSON is a project manager and instructor with over 30 years experience in the areas of industrial technical sales and services, project management, and technical management. He has lived and worked in worldwide locations, specifically, Holland, Saudi Arabia, Bahrain, Qatar, United Arab Emirates, and South America. Mr. Vinson has held several management positions in the energy and power industry which include heavy equipment commissioning, pre-commissioning, routine maintenance services, and specialty chemical cleaning. His responsibilities included liaison and consulting work between clients, owners, operators, and engineering-construction companies on numerous large heavy industrial projects: electric power plants, de-salination plants, refineries, petrochemical plants, fertilizer and methanol plants, as well as GOSP, GTL, and NGL plants. Mr. Vinson received baccalaureate degrees in Chemistry from Cameron University and the University of Oklahoma, followed by advanced degrees at OU and OSU.

### LEONARD WEGMAN

Mr. Leonard Wegman is a training consultant with John M Campbell and Company. Mr. Wegman has over 25 years experience in operations and maintenance of production and processing facilities in Wyoming with Amoco Production Company and Burlington Resources. This includes operating procedure development, and participating in plant PHA's. In his spare time Mr. Wegman enjoys hunting and camping. Mr. Wegman holds a Bachelors of Business Administration degree from Washburn University

in Topeka, Kansas.

### MARTIN WELCH

MR. MARTIN C. WELCH is a Fire Protection and Process Safety Specialist with over 32 years experience in the petrochemical industry, including 17 years refinery operations experience and 15 years in fire protection engineering and process safety consulting. Mr. Welch retired from Chevron in 2006 with over 30 years service. Mr. Welch has experience developing, supporting and auditing petrochemical process safety-related programs. He has taught numerous courses on hazard evaluation and root cause analysis techniques. He also has experience conducting fire loss prevention and insurance surveys and capital project fire protection design and human factors reviews. As a member of various industry trade organization working committees, he has participated in the development of several technical publications in the areas of human factors and hazard analysis revalidation. Mr. Welch holds a BA degree in Management from St. Mary's College, Moraga, California.

### PETER WILLIAMS

MR. PETER WILLIAMS is an instructor/consultant with over 35 years of industrial experience, most of which were in oil and gas processing. His experience includes plant process engineering, operations supervision, project development and business case definition, project technical support, plant engineering management, and internal consulting, primarily with Saudi Aramco. Canadian experience includes plant engineering in phosphorus production, heavy water, and bitumen upgrading, and project engineering. He also has experience with benchmarking, implementation of a safety management system, and the application of lean Six Sigma methods to engineering management. He has Masters' degrees in Chemical Engineering and in Economics, is a Professional Engineer in Alberta and is a certified Six Sigma Black Belt.

### RONN WILLIAMSON

MR. RONN E. WILLIAMSON, C.P.M., CFPIM is a discipline manager, course director and instructor for PetroSkills/John M. Campbell & Company. He has been consulting and instructing in the field of supply chain management for more than fifteen years. During this time, he has delivered significant value to more than fifty, cross-industry organizations around the world. He has provided education programs internationally to hundreds of people in procurement, logistics and materials management. In 2005, he joined the PetroSkills/John M. Campbell team to develop a competency-based training tool with linked industry course offerings for Procurement/Supply Chain Management (PSCM) professionals in the oil and gas industry. Mr. Williamson gained his supply management expertise during twenty-three years of operational and management roles for a major equipment OEM company. For five years, he had executive responsibility for purchasing and transportation at Thermo King Corporation,

a subsidiary of Westinghouse Electric and a billion-dollar global business. He received an undergraduate degree (BME) in engineering and a master of business administration degree (MBA) from the University of Minnesota. Mr. Williamson has been a member and past chapter president, of the American Production and Inventory Control Society (APICS), is a member of and frequent presenter for the Institute for Supply Management (ISM), and is a member of the International Association for Commercial Contract Management (IACCM). He is also certified at the Fellow Level by APICS and has a lifetime certification from ISM.

### WES WRIGHT

MR. WES WRIGHT has 25 years experience in oil and gas producing facilities and is currently a consultant and instructor. Mr. Wright began teaching with John M Campbell in 2004 where he has been delivering courses in CO<sub>2</sub> Surface Facilities, Oil and Gas Processing and Operator Training world-wide. Prior to joining John M Campbell, Mr. Wright was the lead on-site engineer at the Weyburn CO<sub>2</sub> Miscible flood where he was closely involved in the development, design, construction, start-up and operations. Through the 1980's, Mr. Wright performed contract research at the University of Calgary in Enhanced Oil Recovery and was a consultant on a wide range of sweet and sour oil and gas projects throughout Western Canada. Mr. Wright graduated in 1983 with a BSc in Engineering from the University of Calgary. He is a Professional Engineer in Saskatchewan and Alberta, Canada and is a member of the SPE. He has been published in the ASME-OMAE, the CSCE and the IAHR.

### CLYDE YOUNG

MR. CLYDE YOUNG is a very active consultant with John M. Campbell Consulting. Mr. Young has over thirty years of diverse experience in operations and maintenance of production and processing facilities. This includes significant experience in operations and development of management systems for gas processing and water/wastewater treatment facilities. This includes operating procedure development, training program development, compliance auditing, vulnerability assessment, emergency planning and mechanical integrity program development. Mr. Young provides many of our clients with PHA services, compliance audits and Hazards Reviews. Mr. Young has presented at the Mary K. O'Connor Process Safety Symposium and written several papers that have been published in various industry publications. Mr. Young holds a B.S. in Social Sciences from the University of Wyoming-Laramie Wyoming.

# REGISTRATION POLICIES

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## REGISTRATION AND PAYMENT

In a worldwide teaching operation, sufficient lead time is needed for course logistics. For this reason, PetroSkills/John M. Campbell & Co. would appreciate receiving registrations at least one month before the course. However, we accept paid registrations for a viable session through the day before the course begins. Registrations can be made online at [www.petroskills.com](http://www.petroskills.com) or [www.jmcampbell.com](http://www.jmcampbell.com) or by contacting [customerservice@petroskills.com](mailto:customerservice@petroskills.com) or [registrar@jmcampbell.com](mailto:registrar@jmcampbell.com) for a Registration Form.

Registrations are confirmed upon receipt of payment. In the meantime, an Acknowledgment of Reservations will be issued via email. Once payment is received, an email will be issued confirming the registrant's seat in the course. Please note we do not arrange hotel accommodations for participants. When possible, we reserve a block of rooms at the suggested hotel(s). Participants should contact the suggested hotel directly for room rates and availability at least three weeks before the course begins. Remember to mention that you are attending a PetroSkills or John M. Campbell & Co. course to receive a discounted rate, if applicable. Please note if a course venue changes for whatever reason, the participant or their representative will be contacted via email.

## TUITION FEES

Tuition fees are due and payable in US dollars upon receiving the corresponding invoice. Again, a registration will not be confirmed until payment has been received.

Tuition fees do not include living costs, but do include tuition, purchase price of course materials, daily refreshments, and a \$100.00(USD) non-refundable registration fee, per five days of training or less. Tuition must be paid prior to the first day of the course. If payment has not been made prior to the course start date, the registrant or their representative should contact the appropriate Customer Service Department to make payment arrangements.

Note: Where applicable due to government regulations, Goods and Services Tax (GST) or Value Added Tax (VAT) will be added to the total tuition fees.

## TRANSFERS, SUBSTITUTIONS, CANCELLATIONS AND REFUNDS

Transfers may be accepted if received 30 days or more before the course begins. There is not a transfer fee but tuition will be due based on the registered course. PetroSkills/John M. Campbell & Co. may allow a registrant to transfer to a subsequent course after the 30-day cut off period **providing** the tuition fees have been paid and the requested course is open for enrollment. If a transfer is made and the subsequent course is not attended, no money will be refunded. Only one transfer per initial registration is allowed.

Substitutions may be made at any time without penalty.

If it is necessary to cancel an enrollment, full paid tuition, less the non-refundable registration fee of \$100.00(USD) per five days of training or less, will be refunded providing the cancellation is received in our office 30 days or more prior to the course start date. If tuition is not paid at the time of the cancellation, the \$100.00(USD) registration fee per five days of training or less is due, providing the 30 day notice was received. For cancellations received less than 30 days prior to the course, the full tuition fee is due. Please contact the appropriate Customer Service Department if you wish to cancel or transfer your enrollment. *Enrollments are not automatically cancelled if tuition payment is not received by the start of the course.*

Transfers and cancellations will not be honored and tuition is forfeited and non-transferable for courses that have reached maximum participation regardless of the amount of notice given.

We reserve the right to cancel any course session at any time. This decision is usually made approximately two weeks before the course begins. If we cancel a course enrollees will be given the opportunity to transfer to another course or receive a full refund, provided the enrollment was not transferred into the cancelled course late. Keep our cancellation policy in mind when making travel arrangements (airline tickets, hotel reservations, etc.), as we cannot be responsible for any fees charged for canceling or changing your travel arrangements. We reserve the right to substitute course instructors as necessary.

## CERTIFICATES

A Certificate of Completion is awarded to each participant who satisfactorily completes the course and will be awarded by the instructor(s) on the final day.

John M.  
**Campbell & Co.**

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Exclusive provider of **PetroSkills**® facilities training.