LDI Training

A 5 Day Course On Topic

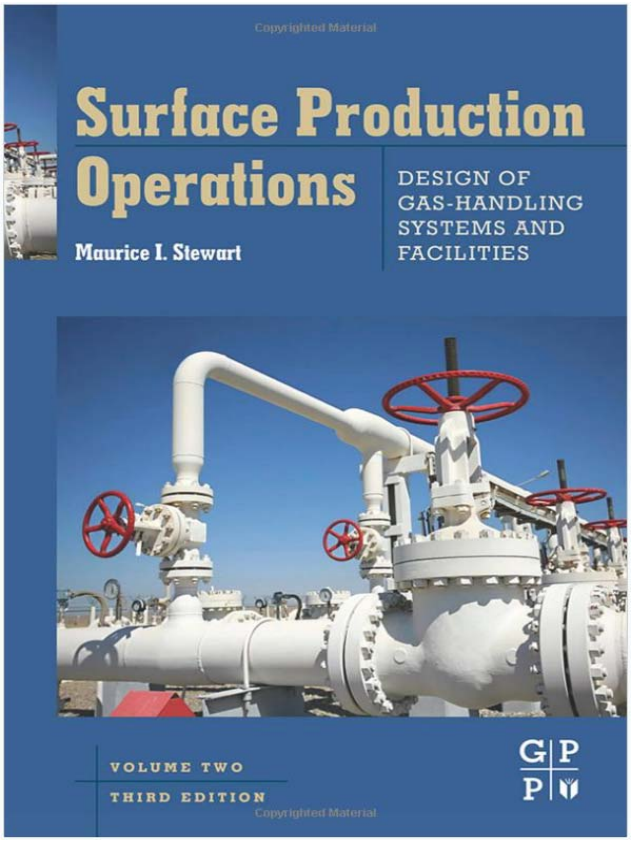
GAS HANDLING, CONDITIONING and PROCESSING FACILITIES

Learn how to design, select, specify, install, test and trouble-shoot

by

Dr. Maurice Stewart, PE., CSP

"Worldwide Petroleum Training"



What You Will Learn

- Develop a "feel" for the important parameters in designing, selecting, installing, operating and trouble-shooting gas handling, conditioning and processing facilities

- Understand the uncertainties and assumptions inherent in designing and operating the equipment in these systems and the limitations, advantages and disadvantages associated with their use
- How to size, select, specify, operate, maintain, test and trouble-shoot surface equipment used with the handling, conditioning and processing of natural gas and associated liquids such as separators, heat exchangers, absorption and fractionation systems, dehydration systems, refrigeration, low temperature separation units, JT plants and compression systems
- How to evaluate and choose the correct process for a given situation

NOTE: The course maintains a **balance** between **lecture and in-class exercises**, and between **theory and application**. In-class exercise sessions are evenly dispersed throughout the course to emphasize the principles covered.

Dr. Stewart has a **storehouse of knowledge and experience that he passes along to help the participants get a unique multidiscipline approach** to combine electrical, mechanical, civil and petroleum methods **in solving problems** associated with the **handling, conditioning or processing** of natural gas and associated liquids.

Course Content

Basic Principles
• Units of Measurement
• Fluid Properties
• Terminology
  ◦ Associated Gas vs. Non-Associated
  ◦ Wet Gas vs. Dry Gas
  ◦ Gross Vs Net Heating Value
• Basic Gas Laws
	• Characterization of the Flow Stream
	• Fundamentals of Gas Reservoirs
	• Phase Behavior
	• Vapor-Liquid Equilibrium
	• Flash Calculations
	• Characterization of Natural Gas and its Components

Wellhead Configuration
• Gas well Christmas-tree configuration
  ◦ Master, Crown, Wing Valves and Chokes
  ◦ Surface-controlled-subsurface-safety valve requirements (SCSSV's)
  ◦ Wellhead/Flowline Safety Device Requirements
	• Surface safety system (SSS) considerations
	• Emergency support system (ESS) considerations

Process Selection and Planning • Basic Production Processing System • Flowsheets • System Constraints	• Gas Processing System • Contract Considerations • Project Planning

Water-Hydrocarbon Phase Behavior • Water-hydrocarbon behavior • Determination of Water content of gas • Gas hydrates Formation	 • Temperature drop determination • Hydrate prevention • Hydrate inhibition
Heat Transfer and Heat Exchangers • Basic heat transfer theory • Process heat duty • Heat exchanger configurations	 • Fin-fan cooling considerations • Equipment selection and sizing

Gas-Liquid Separation
 	
• Factors affecting separation
• Separator/scrubber construction
• Types of separators/scrubbers
• Filter (coalescing) separators
• Gas-liquid separation
• Liquid-liquid separation
• Vessel internals
• Operating problems and practical solutions
• Two-phase separator sizing
• Three-phase sizing
	
	• Scrubber sizing
	• Mechanical design
	  • Design considerations
	  • Safety factors
	  • ASME Code, Section VIII, Division 1 vs. Division 2
	  • Determination of shell and head wall thickness
	• Maintenance and trouble-shooting considerations

Compressors
 	
• Classification
• Application of compression theory
  • Compression processes
  • Compression ratio
  • Heat considerations and efficiency
  • Flow
  • Determination of number of stages and horsepower
  • Determination of gas discharge temperature
• Determination of inter-stage pressure loss
• Compressor selection
• Reciprocating compressors
  • High speed “separable” units
  • Low speed “integral” units
• Centrifugal Compressors
• Vapor recovery units
	
	  • Pulsation and vibration considerations
	  • Suction/discharge bottles
	  • Piping support and stress analysis
	• Compressor station design considerations
	  • Inter-stage scrubbers
	  • Inter-stage coolers
	  • Compressor enclosure considerations
	  • Gas detection system
	  • Foundation considerations
	• Safety system considerations and determining sensor set-points
	• Maintenance and trouble-shooting considerations
	  • Developing performance curves for reciprocating

• Screw compressors • Vane compressors - Piping considerations • Compressor station piping layout • Auxiliary equipment considerations • Process considerations	compressors • Preventive Vs predictive maintenance considerations • Vendor alliances in compressor maintenance • Benchmarking with "best-of-the-best" gas companies
Absorption and Adsorption Processes - Mass Transfer Fundamentals - Absorber Process	 - Adsorber Process - System Considerations
Glycol Dehydration and Regeneration System - Principle of operation • Gas and glycol systems • Reflux condenser • Glycol/glycol pre-heater • Gas/glycol/condensate separator • Sock filter/micro-fiber filters (solids control) • Charcoal (carbon) filters • Glycol/glycol heat exchangers • Still column • Reconcentrator • Stripping gas - Effect of operating variables • Glycol selection • Inlet gas temperature • Lean gas temperature • Lean glycol temperature • Glycol reboiler temperature • Temperature at top of stripping column • Contactor pressure • Reboiler pressure • Glycol concentration • Glycol circulation rate • Number of absorber trays - System design • Sizing considerations • Inlet scrubber	 • Glycol-gas contactor • Tray design • Glycol circulation rate • Lean glycol concentration • Glycol-glycol pre-heater • Glycol/glycol cooler • Glycol/glycol cooler • Glycol/glycol exchanger • Gas/glycol/ condensate separator • Reboiler • Reflux condenser • Stripping still column • Filters • Glycol pumps • Still emissions - Moisture content determination - Glycol maintenance, care and trouble-shooting • Preventive maintenance • Glycol care • Analysis and control of glycol • Trouble-shooting • Three step approach to trouble-shooting - Glycol system cleaning • General considerations • Cleaning techniques to avoid - Glycol dehydration system design
Acid Gas Sweetening	

• Acid gas considerations • Sweetening processes • Solid bed adsorption • Chemical solvent • Physical solvent Processes	• Direct conversion of Hydrogen Sulfide to Sulfur • Gas Permeation • Process selection
Gas Processing • Absorption/lean oil process • Vapor Compression System • Refrigeration Plants	• Expander Plants • J-T Plants • Fractionation
Process Control and Safety Systems • Control Objectives and Control Loops • PID Control Theory • Control Valves	• Flow Measurement and Control • Alarm and Wellhead Shutdown Systems • API RP 14C
Flow of Fluids • Pressure Drop in Piping • Choosing a Line Diameter and Wall Thickness • Pressure Ratings and Determining Pressure Breaks • Designing Loop Systems	• Single-Phase and two-phase flow • Testing and Inspection • Pigging • Flow Splitting

Course Materials

- A copy of the newly revised 3rd Edition of Volume 2 of the widely acclaimed **"Surface Production Operations: Design of Gas Handling Facilities"** written by Ken Arnold and Maurice Stewart. This textbook continues to be the standard for industry, and has been **used by thousands since its first printing over fifteen years ago.**
- A comprehensive set of lecture notes for after course reading and reference
- An extensive set of practical in-class "case study" exercises specifically developed by Dr. Stewart that emphasizes the design and "trouble-shooting" pitfalls often encountered in the industry. The suitability and applicability of the case studies is recognized as one of the best in the industry.

Who Should Attend

- New engineers, asset management team members, design and construction engineers, team leaders/coordinators, operations engineers, construction coordinators, maintenance team leaders/engineers, operations team leaders and other personnel who are or will be responsible for the designing, selecting, sizing, specifying, installing, testing, operating and maintaining gas handling facilities, gas plant facilities and gas pipelines
- Experienced professionals who want to review or broaden their understanding of gas handling, conditioning and processing facilities and gas pipeline operation and maintenance
- Professionals with little to moderate experience with the handling or processing of natural gas and associated liquids
- Other professionals who want a better understanding of the subject matter

Your Course Instructor

Dr. Maurice Stewart, PE, CSP, a Registered Professional Engineer with over 40 years international consulting experience in project management; designing, selecting, specifying, installing, operating, plant optimizing, retrofitting and trouble-shooting oil, water and gas handling, conditioning and processing facilities; leading hazards analysis reviews and risk assessments.

He is **internationally respected for his teaching excellence and series of widely acclaimed textbooks** in the areas of designing, selecting, specifying, installing, operating and trouble-shooting: 1) oil and water handling facilities, 2) gas handling, conditioning and processing facilities, 3) facility piping and pipeline systems, 4) gas sweetening, 5) gas dehydration, 6) pumps, compressors and drivers, 7) instrumentation, process control and safety systems, 8) oil and gas measurement and metering systems and 9) conducting safety audits, hazards reviews and risk assessments. Dr. Stewart is one of the co-authors of the *SPE Petroleum Engineering Handbook***.** He has authored and co-authored over 90 technical papers and has contributed to numerous conferences as a keynote speaker. To date, Dr. Stewart has taught over *60,000 professionals in 90 countries***.** He has provided consultation and/or instruction in virtually every oil and gas production sector in the world, including the Middle East, UAE, Northern and Western Africa, Angola, Nigeria, North Sea, Western and Southern Europe, China, Central Asia, Democratic Republic of Congo, Indonesia, Malaysia, Myanmar, Thailand, Brunei, India, Kazakhstan, Central and South America, Australia, Canada and throughout the United States.

He has provided **consultation and/or instruction** to well **over 100 oil and gas related companies worldwide** and is currently held on retainer by a number of companies where he regularly provides consultation regarding complex oil and gas issues related to surface production facilities. A partial list of his clients include: Abu Dhabi Oil Company, Exxon USA, Esso Producing Malaysia Inc, Petronas, Petronas Carigali, Petronas Gas, Sarawak Shell, Gas Malaysia, BP, DeltaAfrik, Occidential Petroleum, Kuwait Oil Company, Saudia ARAMCO, AMOCO, ADNOC, Qatar Oil Company, Nipon Oil Company, Shell USA, Conoco Inc., Brunei Shell, DeltaAfrik, Oryax Ecuador Energy Company, Petro-Amazonas, Petro-Ecuador, British Gas, Texaco, Petro China, Petro Viet Nam,

Maxus Indonesia, Maxus Ecuador Inc., CNOOC, Cabinda Gulf Oil Company Ltd., Caltex Pacific Indonesia, Vico Indonesia, Mobil Producing Nigeria Unlimited, PTTEP, Chevron Nigeria Ltd., Chevron Overseas Producing Inc., Chevron USA, Chevron Thailand, Pertamina, UNOCAL Indonesia, UNOCAL USA, Unocal Thailand, Spirit Energy 76 ,ChevronTexaco, Medco, Migas, Total Indonesie, TotalFinaElf Myanmar, Total Fina Elf, Total E&P, Sonangol P&P, Exspan, Tengizchevoil, Exxon Mobil, Mobil USA and Royal Dutch Shell.

He also serves on numerous international committees responsible for developing or revising industry Codes, Standards and Recommended Practices for such organizations as ANSI, API, ASME, ISA, NACE and SPE. Dr. Stewart is currently serving on the following American Petroleum Institute (API) committees: *API RP 14C, RP 14E, RP 14F, RP 14G, RP 14J, RP 500 and RP 75.* Dr. Stewart has developed and taught worldwide short courses for API related to Surface Production Operations. In 1985, Dr. Stewart rived the National Society of Professional Engineers *"Engineer-of-the-year"* award.

He is very active in the Society of Petroleum Engineers (SPE). He served on the board of directors for the Delta Section for over 10 years, chairman and committee member of the professional engineering registration committee for five years and chairman of the continuing education committee for eight years. For twelve years he conducted a review course that prepared petroleum engineers for the "Principles and Practice" examination in Petroleum Engineering. He developed and has taught worldwide short courses for SPE related to Surface Production Operations. For his continuous effort in the advancement of Petroleum Engineering he was awarded the SPE Regional Service Award.

Dr. Stewart holds a BS in Mechanical Engineering from Louisiana State University and MS degrees in Mechanical, Civil (Structural Option) and Petroleum Engineering from Tulane University and a Ph.D in Petroleum Engineering from Tulane University. Dr. Stewart served as a Professor of Petroleum Engineering at Tulane University and Louisiana State University.

COURSE FEE

For Participants from Indonesia
Rp. 59.900.000,-

Course Fee
For Participants from outside Indonesia
US$ 4,500 per person

(Hotel accommodation is not included in the course fee)

ENROLLMENT INFORMATION

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