

An LDI Training Course

GAS HANDLING, CONDITIONING and PROCESSING

by
Dr. Maurice Stewart, PE., CSP

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

<p>Basic Principles</p> <p>Units of Measurement Fluid Properties Terminology Associated Gas vs. Non-Associated Gas Wet Gas vs. Dry Gas Gross Vs Net Heating Value</p> <p>Basic Gas Laws</p>	<p>Characterization of the Flow Stream</p> <p>Fundamentals of Gas Reservoirs Phase Behavior Vapor-Liquid Equilibrium Flash Calculations Characterization of Natural Gas and its Components</p>
<p>Wellhead Configuration</p> <p>Gas well Christmas-tree configuration Master, Crown, Wing Valves and Chokes Surface-controlled-subsurface-safety valve requirements (SCSSV's) Wellhead/Flowline Safety Device Requirements</p>	<p>Surface safety system (SSS) considerations Emergency support system (ESS) considerations</p>
<p>Process Selection and Planning</p> <p>Basic Production Processing System Flowsheets System Constraints</p>	<p>Gas Processing System Contract Considerations Project Planning</p>
<p>Water-Hydrocarbon Phase Behavior</p> <p>Water-hydrocarbon behavior Determination of Water content of the gas Gas hydrates Formation</p>	<p>Temperature drop determination Hydrate prevention Hydrate inhibition</p>

<p>Heat Transfer and Heat Exchangers</p> <p>Basic heat transfer theory Process heat duty Heat exchanger configurations</p>	<p>Fin-fan cooling considerations Equipment selection and sizing</p>
<p>Gas-Liquid Separation</p> <p>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</p>	<p>Scrubber sizing Mechanical design</p> <p style="padding-left: 40px;">Design considerations Safety factors ASME Code, Section VIII, Division 1 vs. Division 2 Determination of shell and head wall thickness</p> <p>Maintenance and trouble-shooting considerations</p>

<p>Compressors</p> <p>Classification</p> <p>Application of compression theory</p> <ul style="list-style-type: none"> Compression processes Compression ratio Heat considerations and efficiency Flow Determination of the number of stages and horsepower Determination of gas discharge temperature <p>Determination of inter-stage pressure loss</p> <p>Compressor selection</p> <p>Reciprocating compressors</p> <ul style="list-style-type: none"> High speed “separable” units Low speed “integral” units <p>Centrifugal Compressors</p> <p>Vapor recovery units</p> <ul style="list-style-type: none"> Screw compressors Vane compressors <p>Piping considerations</p> <ul style="list-style-type: none"> Compressor station piping layout Auxiliary equipment considerations Process considerations 	<ul style="list-style-type: none"> Pulsation and vibration considerations Suction/discharge bottles Piping support and stress analysis <p>Compressor station design considerations</p> <ul style="list-style-type: none"> Inter-stage scrubbers Inter-stage coolers Compressor enclosure considerations Gas detection system Foundation considerations <p>Safety system considerations and determining sensor set-points</p> <p>Maintenance and trouble-shooting considerations</p> <ul style="list-style-type: none"> Developing performance curves for reciprocating compressors Preventive Vs predictive maintenance considerations Vendor alliances in compressor maintenance Benchmarking with “best-of-the-best” gas companies
<p>Absorption and Adsorption Processes</p> <p>Mass Transfer Fundamentals</p> <p>Absorber Process</p>	<p>Adsorber Process</p> <p>System Considerations</p>

<p>Glycol Dehydration and Regeneration System</p> <p>Principle of operation</p> <ul style="list-style-type: none"> 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 <p>Effect of operating variables</p> <ul style="list-style-type: none"> Glycol selection Inlet gas temperature Lean gas temperature Lean glycol temperature Glycol reboiler temperature The temperature at top of stripping column Contactor pressure Reboiler pressure Glycol concentration Glycol circulation rate Number of absorber trays <p>System design</p> <ul style="list-style-type: none"> Sizing considerations Inlet scrubber 	<ul style="list-style-type: none"> 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 <p>Moisture content determination</p> <p>Glycol maintenance, care, and trouble-shooting</p> <ul style="list-style-type: none"> Preventive maintenance Glycol care Analysis and control of glycol Trouble-shooting A three-step approach to troubleshooting <p>Glycol system cleaning</p> <ul style="list-style-type: none"> General considerations Cleaning techniques to avoid <p>Glycol dehydration system design</p>
<p>Acid Gas Sweetening</p> <p>Acid gas considerations</p> <p>Sweetening processes</p> <p>Solid bed adsorption</p> <p>Chemical solvent</p> <p>Physical solvent Processes</p>	<p>Direct conversion of Hydrogen Sulfide to Sulfur</p> <p>Gas Permeation</p> <p>Process selection</p>

<p>Gas Processing</p> <p>Absorption/lean oil process Vapor Compression System Refrigeration Plants</p>	<p>Expander Plants J-T Plants Fractionation</p>
<p>Process Control and Safety Systems</p> <p>Control Objectives and Control Loops PID Control Theory Control Valves</p>	<p>Flow Measurement and Control Alarm and Wellhead Shutdown Systems API RP 14C</p>
<p>Flow of Fluids</p> <p>Pressure Drop in Piping Choosing a Line Diameter and Wall Thickness Pressure Ratings and Determining Pressure Breaks Designing Loop Systems</p>	<p>Single-Phase and two-phase flow Testing and Inspection Pigging Flow Splitting</p>

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 the 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 troubleshooting: 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 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 received the National Society of Professional Engineers' "***Engineer-of-the-year***" award.

He is 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.

**For more information about the course please visit
lditraining.com or contact us at lditrain@indo.net.id**