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| <p><b>KLM<br/>Technology<br/>Group</b></p> <p>Practical Engineering<br/>Guidelines<br/>for Processing Plant<br/>Solutions</p> | <table border="1"><tr><td><b>KLM</b></td><td><b>Technology<br/>Group</b></td></tr></table> <p><b>Engineering Solutions<br/>Consulting, Guidelines, and Training</b></p> <p><b><a href="http://www.klmtechgroup.com">www.klmtechgroup.com</a></b></p> | <b>KLM</b> | <b>Technology<br/>Group</b> | <p>Page 1 of 9</p> <p>Rev 1.1</p> |
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## **Piping and Pipelines Systems, Design, Construction, Installation, Operations and Troubleshooting Training Course**

### **Introduction**

The success of every company depends on each employee's understanding of the key business components. Employee training and development will unlock the companies' profitability and reliability. When people, processes, and technology work together as a team developing practical solutions, companies can maximize profitability and assets in a sustainable manner. Training and development are an investment in future success - give yourself and your employees the keys to success.

It is strategically important that your team understands the fundamentals of Piping and Pipelines Systems, Design, Construction, Installation, Operations and Troubleshooting concepts. This is the difference between being in the best quartile of operational ability and being in the last quartile. There is vast difference in the operational ability of operating companies and most benchmarking studies have confirmed this gap in operational abilities.

Whether you have a team of new or seasoned employees, an introduction or review of these concepts are very beneficial in closing the gap if you are not in the best quartile or maintaining a leadership position. Most studies show that a continuous reinforcement of best practices in operational principles is the most effective way to obtain the desired results. Training and learning should be an ongoing continuous lifelong goal.

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## Course Objective

This course will guide the participants to develop key concepts and techniques for Piping and Pipelines Systems, Design, Construction, Installation, Operations and Troubleshooting Operations. These key concepts can be utilized to make operating decisions that can improve your unit's performance.

Many aspects of Piping and Pipelines Systems, Design, Construction, Installation, Operations and Troubleshooting management can be improved including project design, management, energy utilization, and safety. This cannot be achieved without first an understanding of basic fundamental principles of design and operation. These principles need to be understood in advance of operating and trouble shooting a process unit operation for the manager or problem solving to be effective.

This seminar focuses on the core building blocks of the Piping and Pipelines Systems, Design, Construction, Installation, Operations and Troubleshooting process systems, equipment, and economics. This program will emphasize the process unit operation fundamentals, safe utilization of these fundamentals by operations, engineering, maintenance, and support personnel.

- Appreciation of technical characteristics of piping systems, their applications in process and chemical industry
- Knowledge of methods of the hydraulic and mechanical design of piping systems according to existing standards and codes
- Procedures for the selection of best piping systems based on the optimization technique, resulting in pipe diameter and cost of material
- Use of methods of diagnosing and estimating the degree of deterioration of pipelines
- Guidelines for improving the efficiency of the overall piping system

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## Syllabus

### Introduction

- Overview of the Chemical Processing Industry

### Review of Process Incidents

- Safety for the Chemical Processing Industry

### Fundamentals of Petroleum Chemistry

- Description of a Hydrocarbon Molecule
- Types of Hydrocarbon Molecules

### Process Equipment Troubleshooting

- Troubleshooting concepts and techniques
- Typical Problems
- Interaction of Process and Equipment
- Case Study

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### Project Management Overview

- INITIATING - authorizing the project or phase of the work
- PLANNING - devising and maintaining a workable scheme to accomplish the business need for the project
- EXECUTING - coordinating people and other resources to undertake the plan
- CONTROLLING - ensuring project objectives are met by monitoring and measuring progress and taking action as needed
- CLOSING - formalizing acceptance of the project or phase of work and bringing it to an orderly end.

### Introduction to Natural Gas Processing

- Well Head Gas Liquid Physical Separation
  - Slug Catchers / Separators
- Dew Point Units / Dehydrations Units
  - Glycol Units
  - Mole Sieve Units
- Gas Sweetening Units
- Mercury Removal Units
- Gas Processing Units
  - Natural Gas Liquid Plants (NGL)
  - Liquified Petroleum Gas Plants (LPG)
  - Liquified Natural Gas Plants (LNG)
  - Condensate Splitters
- Gas Compression Systems

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## Overview of Piping / Pipeline Systems

- Main features of various types of piping / pipeline systems
  - Pump and compressor stations, Storage, Metering, Launchers and receivers, Valve stations, Utilities
  - Field gathering systems, field injection systems, Crude oil systems, Natural gas systems; Refined product systems, NGL products systems, distribution systems
- Classification of piping systems based on the design and application
- Standards and codes on design properties of pipes
- Main steps in the design and construction of piping systems
  - Hydrostatic test
  - Corrosion considerations
- Physical and transport properties of fluids:
  - Density, viscosity, particle contents
  - The physical properties and fluid flow characteristics of hydrocarbon gas and liquid
  - The application and importance of conservation of energy, conservation of mass, and equations of state to determining hydraulic behavior
  - Determine flow friction coefficients
  - Apply volumetric flow equations for natural gas and liquid flows
  - Calculate power required for pumping liquid and compressing natural gases
  - Basics of flow analysis in pipes - laminar and turbulent flow regimes
  - Multiphase flow characteristics
- Safety in Piping Networks

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### Calculation of Pressure and Velocity Distribution in Piping Systems

- Calculation of pressure losses and horsepower required for fluid transportation
- Selection and sizing of pipes for different applications: liquids, gases, slurries, etc.
- Calculation of minor losses in the piping system
- Basics of mechanical design: a selection of pressure class of pipe and stress ratios
- Hydrostatic testing: allowable operating pressure and hydrostatic test pressure
- Pipe construction: pipes above-ground and pipes buried

### Pumps and Compressors Used in Pipelines

- Pump interaction with the system, cavitations: work in series and parallel
- Multi-pump stations and tanks
- Pump calculation and selection
- Compressor interaction with the system, avoiding surge, stall, and choking
- Multi-compressor stations and gas holders
- Compressor calculation and selection
- Pipe networks and pipe branching: problems with transients and their control

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### Control Valves in Pipelines

- Control valves: selection, sizing and cavitation issues
- Flow measurements and monitoring instrumentation
- Pipeline system automation control
- Guidelines for pipeline installation, operation, and maintenance
- Inspection, examination, and testing of pipelines
- The vibration of pipes and pipelines and their mechanical support and anchorage

### Operation and Maintenance of Piping Systems

- Leak detection and prevention and failure risk analysis
- Pipeline protection for prevention of corrosion and erosion
- Environmental concerns: impact of above-ground and buried pipelines
- Off-shore pipelines: design and operation
- Special consideration for safety and supervision
- Liquid slugs and describe strategies to deal with slug events
  - Slug Catchers
- Importance of temperature management, uses of insulation, and the challenges of design, installation and operation of insulation / heat tracing systems
- Fluid characteristics, flow assurance issue and methods to manage for Hydrates, Wax / Paraffinic Fluids, Multiphase Flow, Scale
- Coating monitoring and inspection

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### **Who Should Attend:**

- People who are making day to day decisions regarding operation, design, and economics of piping and pipeline systems.
  1. 1<sup>st</sup> Line Operations personnel,
  2. Operation Supervisors,
  3. 1<sup>st</sup> Line Maintenance personnel,
  4. Maintenance Supervisors,
  5. Senior Plant Supervisors,
  6. Operations Engineers
  7. Process Support Engineers,
  8. Design Engineers,
  9. Cost Engineers
  10. Environmental Engineers
- Ideal for veterans and those with only a few years of experience who want to review or broaden their understanding in piping and pipeline systems.
- Other professionals who desire a better understanding of subject matter



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### **What you can expect to gain:**

- Greater knowledge of methods used to assess and calculate the main design parameters of a system for the transport of the given fluid for the given application
- Improved familiarity with all aspects of the piping systems encountered in everyday industrial practices
- A clear understanding of guidelines for selection and sizing the piping systems
- Knowledge on how to cope with modern trends in the pipeline industry regarding ever-increasing demands for larger capacities and more efficient operation
- Readiness to implement the best practices for efficient operation, improved reliability, maintenance, and problem troubleshooting
- Understand common operational problems and their troubleshooting Techniques
- Gain an insight to improve process optimization and strategies