

<p><b>KLM Technology Group</b></p> <p>Practical Engineering Guidelines for Processing Plant Solutions</p>	<table border="1"><tr><td><b>KLM</b></td><td><b>Technology Group</b></td></tr></table> <p><b>Engineering Solutions Consulting, Guidelines, and Training</b></p> <p><a href="http://www.klmtechgroup.com">www.klmtechgroup.com</a></p>	<b>KLM</b>	<b>Technology Group</b>	<p>Page 1 of 10</p> <p>Rev 1.0</p>
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## **Optimizing Ethylene Plant Unit Operations Training Course**

### **Introduction**

The success of every company depends of 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 process unit operations 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 greatly 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.



## **Course Objective**

This course will guide the participants to develop key concepts and techniques for optimizing Ethylene unit operations. These key concepts can be utilized to make operating decisions that can improve your unit's performance.

Many aspects of Ethylene Plant operations management can be improved including, product recoveries, purities and 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 Ethylene Plant 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.

There are many aspects of operational optimization. Partial list may include;

1. Safety
2. Reliability – Continuity of Operations
3. Quality
4. Cost
5. People Development

1. Safety

Safety is the number one concern. No project or operation can be classified as optimized or best unless it is done safely. Many Studies show a strong culture of safety awareness also has economic benefits as well as the social and humane benefits

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## 2. Reliability - Continuity of Operations

A stable reliable plant is the largest revenue source. A reliable plant that has high cost will make generate more revenue than a low cost plant that has multiple outages. The on stream factor is a benchmark of reliability. Industry average is 97%, but the top quartile approaches 100%. This three percent increased production is a significant difference in revenue.

## 3. Quality

Quality has two aspects. The first is the external aspect. To develop and maintain the reputation of producing quality products will allow you to charge a premium during the economic up turns and be able to maintain your key customers in a downturn.

The second is the internal aspect. There is an added cost of non-quality production. Sometime the product can be reprocessed, with an added energy debit. If the product cannot be reprocessed it will need to be sold with a cost debit.

## 4. Cost

Cost control is an especially important aspect of operational optimization. The two largest costs are feedstock and energy. An exceedingly small feedstock reduction can lead to an exceptionally large profit improvement. The industry averages three percent energy improvement per year. The top quartile will improve more than 3%.

## 5. People Development

Most people might rate this higher than fifth. It is an especially important aspect of operational excellent, but talent can be acquired for a price. The best plan is to hire talented people, train them well, pay them well, and retain them, but few companies seem to be capable of accomplishing this task. People Development will ensure that items one through four are optimized.

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## Outline

### 1. Introduction

- Overview of the Chemical Processing Industry
- Safety for the Chemical Processing Industry

### 2. Fundamentals of Petroleum Chemistry

- Description of a Hydrocarbon Molecule
- Types of Hydrocarbon Molecules
- Definition and Function of a Catalyst

### 3. Introduction to Petrochemical Key Concepts

- Unit Operations
- Process Flow Diagrams
- Mass Balance

### 4. Introduction to Troubleshooting

- Typical Equipment Problems
- Integration of Process, Equipment and People
- Troubleshooting Techniques
- Troubleshooting Tools
- Troubleshooting concepts and techniques
- Typical Problems
- Interaction of Process and Equipment
- Tower Scan Case Study
- Tower Inspection Case Study

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## 5. Introduction to Ethylene Plant Equipment

- Distillation
- Absorption
- Heat Exchange
- Reactors
- Pumps
- Compressors
- Furnaces

## 6. Ethylene Overview

- Typical Ethylene Flowsheets
- Comparison of Flow Schemes
- Ethane Flowsheet
- E/P Flowsheets
- Naphtha Flowsheets
- Furnace Overview
- Quench Systems Design and Operation
- Compression Overview
- Separation
- Refrigeration
- Hydrogenation Acetylene Reactor Catalyst Review
- Molecular Sieve
- Flare Safety Review
- Ethylene Process Variables
- Ethylene Economics

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## 7. Ethylene Furnaces

- Overview of Ethylene Furnace
  - Historical Development
  - Design Constraints
    - Residence time
    - Partial Pressure
    - Low Pressure
  - Comparison of Current Designs
    - One pass coil
    - Two pass U coil
    - W coil
    - Hybrid coil
  - Furnace Run lengths
    - Design and normal run lengths of current designs
    - Factors affecting run lengths
  - Anti-Coking
    - Comparison of technologies
  - Future Opportunities
    - Catalytic
    - Latest patents
- Safe Commissioning of a Process Furnace
- Design of Furnaces
  - A. Pyrolysis
  - B. Radiant Coil
  - C. Coking
  - D. De Coking
  - E. Burners
  - G Convection
  - H. Control
  - I. Revamps
- Burner Management Systems
- Economics – Excess Air Control, Flame Pattern

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- Trouble Shooting
  - Convection Bowing
  - Insulation
  - External transition designs
- Case Study
- Maintenance Guidelines
- Safety

## 8. Ethylene Distillation

- Overview of Distillation Equipment
- Safe Commissioning of Distillation Equipment
- Design of Distillation Equipment
  - Designing Towers for Fouling Service
  - Designing Towers for Quench Service
  - DSG Design
  - Caustic Tower
  - C2 Splitter
  - C3 Splitter
  - DeMethanizer
  - DePropanizer
  - DeEthanizer
  - DeButanizer
- Economics – Reflux Optimization, Reboiler Optimization, Tray Efficiency
- Trouble Shooting
  - Troubleshooting Guidelines
- Case Studies
  - BTX Case Study
  - Gamma Scan on Vacuum Tower
  - BTX Installation Case Study
  - Saturator Revamp Case Study
  - DSG Case Study
- Maintenance Guidelines – Tray verses Packing
- Safety
  - Texas City Case Study

## 9. Plant Reliability

- Introduction to Plant Reliability
- Equipment Design for improved Reliability

## 10. Quality

- Introduction to Quality
- Overview of Statistical Process Control

## 11. Cost Control

- Introduction to Cost Control
- Feedstock
- Energy
- Develop Key Performance Indicators
- Managing Projects

## 12. People Development

- People Development
- Team Building
- Training



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### **Who Should Attend:**

- People who are making day to day decisions regarding operation, design, and economics of processing plants;
  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
- Ideal for veterans and those with only a few years of experience who want to review or broaden their understanding in Processing Plant Operations.
- Other professionals who desire a better understanding of subject matter

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

- A detailed overview of Ethylene Unit operations, processes, and economics
- Gain an understanding of the equipment of an Ethylene Unit
- Gain an understanding of the Ethylene Unit flow sheets
- Gain an understanding of chemistry and catalyst
- Gain an understating of process unit margins
- Troubleshooting Techniques
- Gain an insight to optimization strategies