Introduction to Unit Operations Fundamentals and Troubleshooting 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 unit operations. This is the difference between being in the best quartile of operational excellence 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 safety principles is the most effective way to obtain the desired results. Training and learning should be an ongoing continuous lifelong goal.

Course Objective

Today's processing plants are under increasing pressure to increase safety, reliability, reduce costs and improve profits. Engineers and production professionals need practical training to assist their companies to accomplish these goals. Generally, universities teach fundamental concepts, and then the professional will need to learn to apply these concepts to their field.

This training course will use practical technical know-how to guide participates in these key concepts with Case Studies. These key concepts may be utilized right away in their operations to increase profits. Our Senior Technical Processional will share his 25+ years of engineering experience with the students to show them how to optimize the unit operations at their facility. Many time process improvements require only small amount of capital with exceptionally large return on investment (ROI)

Key Unit Operations

Mass Transfer (Separation)
Momentum Transfer (Fluid Flow)
Heat Transfer
Reaction

Course Duration and Delivery

Typical course duration is 3 to 5 days based on the background of the participates. One of our Senior Technical Professional with over 25 years of experience would lead the class. Instruction can be in house or in an online webinar.

This course is an introductory course for these topics – for an advanced course consider attending our Advanced Unit Operations Course.

Course Syllabus

Introduction to the Processing Industry

Safety for the Processing Industry

Mass Transfer

Distillation

1. Introduction to distillation
2. Liquid level basics
3. Trays
   A. Tray efficiency review
   B. Downcomers
   C. Seal trays, special trays, etc.
   D. Feed trays
4. Random and Structured Packing
   A. Distributors
5. When to utilize trays and packing
6. Reboiler return piping configurations
7. Gamma scans/studies
8. Design Guidelines for Fouling Services
9. Design Guidelines for Vacuum Distillation
10. Design Guidelines for Extractive Distillation

Troubleshooting Distillation

1. Troubleshooting Techniques
2. Drawings vs. field measurements
3. Instruments and their limitations
4. Design sensitivity
5. Distillation Case Study
6. Vacuum Tower Case Study

Momentum Transfer - Fluid Dynamics Fundamentals

1. Review of the fluid flow basics
    A. Laminar and Turbulent Flow
    B. Reynolds Number
    C. Two Phase Flow
    D. Liquid Hammer
    E. Friction
2. Guidelines for Velocity and Pressure Drop
3. Review of Pipe Specifications
4. Fluid Flow Measurement

Fluid Dynamics Troubleshooting

1. Fluid Dynamics Troubleshooting and Case Study

Pump Fundamentals

1. Introduction to Pumps
2. Pump Efficiencies
3. Positive displacement pumps
4. Centrifugal pumps
    A. Pump impellers
    B. Suction specific speed, Nss
    C. pump curve considerations
    D. Hydraulic requirements
    E. NPSH
    F. Cavitation

Pump Troubleshooting

1. Pump Troubleshooting and Case Study

Compressor Fundamentals

1. Introduction to Compressors
2. Positive displacement compressors
3. Centrifugal compressors
4. Surge and Stonewall
5. Operating Point
6. Compressor Efficiencies

Compressor Troubleshooting

1. Compressor Troubleshooting and Case Study

Heat Transfer Fundamentals

Introduction to Heat Transfer

1. Radiation
2. Conduction
3. Convection

Furnaces and Boilers

Introduction to Furnaces and Boilers

1. Fire Box
2. Convection
3. Stack
4. Burners
5. Fluid Flow
6. Heat Transfer
7. Fuels
8. Design Guidelines

Improve the Efficiency of Fired Heaters and Boilers

1. Excess Air
2. Burner Types
3. Flame types

Introduction to Fired Heater Control / Burner Management Systems

Troubleshooting Furnaces and Boilers

1. Furnace and Boiler Troubleshooting
2. Furnace Damage Case Study
3. Boiler Damage Case Study
4. Boiler Video

Heat Exchangers

Introduction to Heat Exchangers

1. Shell and Tube
2. Fin Fan
3. Spiral
4. Plate Heat Exchanger
5. High Heat Flux

Applications / Design Considerations

1. Single-phase
2. Boiling/evaporating
3. Condensation

Practical heat exchanger performance review

1. Pressure Drop
2. Fouling
3. Cooling water
4. Vibration

5. Venting and draining
6. Temperature pinch

Troubleshooting Heat Exchangers

1. Heat Exchanger Troubleshooting
2. Heat Exchanger Case Study
3. Heat Exchanger Safety Video

Reaction

1. Introduction to Reactors

   A. Batch Reactors
   B. Continuous Stirred Tank Reactor (CSTR)
   C. Plug Flow Reactor (PFR)
   D. Packed Bed Reactor (PBR)
   E. Fluidized Reactors
   F. Single Phase vs. Multiphase
   G. Endothermic vs. Exothermic

2. Catalyst

   A. Catalyst properties and classification
   B. Steps in catalysis preparation
   C. Adsorption isotherm
   D. Catalyst Deactivation

3. Reactor Flow Types

   A. Radial Flow
   B. Down flow
   C. Continuous regeneration
   D. Fluidized Flow

Troubleshooting Reactors

1. Reactor Troubleshooting
2. Reactor Case Study

Who Should Attend

- People who are making day to day decisions regarding operation, design, and economics of processing plants;

    1. 1st Line Operations personnel,
    2. Operation Supervisors,
    3. 1st Line Maintenance personnel,
    4. Maintenance Supervisors,
    5. Senior Plant Supervisors,
    6. Operations Engineers
    7. Process Support Engineers,
    8. Design Engineers,
    9. Cost Engineers

- People who are making day to day decisions regarding operation, design, maintenance, and economics of process industry plants.

- Ideal for veterans and those with only a few years of experience who want to review or broaden their understanding of process safety.

- Other professionals who desire a better understanding of the subject matter.

What You Can Expect to Gain

- A detailed understanding of unit operations
- An understanding of process parameters that affect unit operations
- Design guidelines for unit operations
- Troubleshooing Stragaties and Case Studies
- Gain an insight to optimization strategies