Process Upsets, Troubleshooting and Optimization

Course Duration : 5 Days

Type of Participant : This course is designed for process engineers, production engineers, plant engineers, and planning engineers. However, anyone involved in process upsets, troubleshooting and optimization such as managers, leaders, section heads, superintendents and supervisors can highly benefit from this training too.

Summary:

This course offers participants a comprehensive and current understanding of Process Upsets, Troubleshooting, and Optimization. It addresses the types, common causes, and examples of process upsets across various industries, as well as their impacts on safety, the environment, and the economy. Participants will learn systematic problem-solving approaches, effective data collection, and data analysis techniques. The course covers common issues with pumps, compressors, and heat exchangers, along with diagnostic tools and techniques, control loops, instrumentation, and diagnosing control system issues.

Moreover, the course delves into common problems in chemical reactions and separation processes, diagnosing chemical process issues, root cause analysis (RCA), and fault tree analysis (FTA). It also explores the impact of human error on process upsets and strategies to mitigate these errors. Topics include process optimization, cost-benefit analysis, economic optimization, and techniques for optimizing energy use in processes, as well as the application of Six Sigma methodology and Lean principles to process optimization.

Participants will also learn about statistical process control (SPC), design of experiments (DOE), and optimization of chemical reactions. The course covers heat integration, energy recovery and reuse, process intensification, and sustainability in process optimization. It teaches how to develop an integrated troubleshooting and optimization plan, identify and manage risks, and create contingency plans for

process upsets. Strategies for successful implementation, monitoring, and measuring improvements, maintaining process gains, the importance of teamwork in troubleshooting and optimization, and effective communication strategies are also discussed.

Objective:

Upon the successful completion of this course, participants will be able to:

- Apply and gain an in-depth knowledge of process upsets, troubleshooting, and optimization.
- Identify the types, common causes, and examples of process upsets across various industries.
- Discuss the safety implications, environmental impact, and economic consequences of process upsets.
- Implement a systematic approach to problem-solving, effective data collection, and data analysis.
- Identify common issues with pumps, compressors, and heat exchangers, and utilize diagnostic techniques and tools.
- Discuss control loops and instrumentation, diagnose control system issues, and recognize common issues in chemical reactions and separation processes.
- Diagnose chemical process issues and apply root cause analysis (RCA) and fault tree analysis (FTA).
- Discuss the impact of human error on process upsets and various strategies to mitigate human error.
- Apply process optimization, cost-benefit analysis, economic optimization, and techniques for optimizing energy use in processes.
- Explain Six Sigma methodology and Lean principles and their application to process optimization.
- Recognize statistical process control (SPC), design of experiments (DOE), and optimization of chemical reactions.
- Apply heat integration, energy recovery and reuse, process intensification, and sustainability in process optimization.
- Develop an integrated troubleshooting and optimization plan, identify and

manage risks, and create contingency plans for process upsets.
- Employ strategies for successful implementation, monitor and measure improvements, and utilize tools and techniques for maintaining process gains.
- Discuss the importance of teamwork in troubleshooting and optimization and apply effective communication strategies.

Daily Program:

Day 1

- Introduction to Process Upsets & Troubleshooting
- Fundamentals of Process Upsets
  - Definition & Types of Process Upsets
  - Common Causes & Examples of Process Upsets in Various Industries
- Impact of Process Upsets
  - Safety Implications
  - Environmental Impact
  - Economic Consequences
- Troubleshooting
  - Basic Principles of Troubleshooting
  - Systematic Approach to Problem-Solving
- Data Collection & Analysis
  - Importance of Data in Troubleshooting
  - Techniques for Effective Data Collection
  - Tools for Data Analysis (e.g., Statistical Methods, Root Cause Analysis)
- Case Studies: Real-World Examples of Process Upsets
  - Analysis of Past Incidents
  - Lessons Learned & Best Practices
- Troubleshooting Process Equipment
  - Identifying Common Issues with Pumps, Compressors, & Heat Exchangers
  - Diagnostic Techniques & Tools

Day 2

- Troubleshooting Process Control Systems

- Understanding Control Loops & Instrumentation
- Techniques for Diagnosing Control System Issues

- Troubleshooting Chemical Processes
  - Common Issues in Chemical Reactions & Separation Processes
  - Techniques for Diagnosing Chemical Process Issues
- Root Cause Analysis (RCA)
  - Introduction to RCA Methodologies (e.g., Fishbone Diagram, 5 Whys)
  - Practical Application of RCA
- Fault Tree Analysis (FTA)
  - Understanding FTA & Its Applications
  - Building & Analyzing Fault Trees
- Human Factors in Troubleshooting
  - Impact of Human Error on Process Upsets
  - Strategies to Mitigate Human Error

Day 3

- Process Optimization
  - Definition & Objectives of Process Optimization
  - Key Concepts & Principles
- Economic Optimization
  - Understanding Cost-Benefit Analysis
  - Techniques for Economic Optimization (e.g., Break-Even Analysis, Marginal Cost Analysis)
- Energy Optimization
  - Importance of Energy Efficiency
  - Techniques for Optimizing Energy Use in Processes
- Six Sigma & Lean Principles
  - Overview of Six Sigma Methodology
  - Lean Principles & their Application to Process Optimization
- Case Studies: Successful Process Optimization Projects
  - Review of Real-World Optimization Projects
  - Analysis of Strategies & Outcomes
- Statistical Process Control (SPC)

- Introduction to SPC & Control Charts
- Application of SPC in Process Optimization

Day 4

- Design of Experiments (DOE)
  - Understanding DOE Methodology
  - Application of DOE for Process Optimization
- Optimization of Chemical Reactions
  - Techniques for Optimizing Reaction Conditions
  - Catalysts & their Role in Process Optimization
- Heat Integration & Energy Recovery
  - Principles of Heat Integration
  - Techniques for Energy Recovery & Reuse
- Process Intensification
  - Introduction to Process Intensification
  - Techniques & Technologies for Intensifying Processes
- Sustainability & Green Chemistry
  - Principles of Sustainability in Process Optimization
  - Application of Green Chemistry Principles

Day 5

- Developing an Integrated Troubleshooting & Optimization Plan
  - Combining Troubleshooting & Optimization Techniques
  - Steps to Develop a Comprehensive Plan
- Risk Management & Contingency Planning
  - Identifying & Managing Risks
  - Developing Contingency Plans for Process Upsets
- Implementing Process Improvements
  - Strategies for Successful Implementation
  - Monitoring & Measuring Improvements
- Continuous Improvement
  - Principles of Continuous Improvement

- Tools & Techniques for Maintaining Process Gains

- Team Collaboration & Communication
  - Importance of Teamwork in Troubleshooting & Optimization
  - Effective Communication Strategies