Advanced Process Safety Management in Chemical Pharma Training Course

Professional Development Training Course Outline

Category	Biotechnology and Pharmaceutical Development	**Duration**	10 Days
Base Fee	$4,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

The chemical and pharmaceutical sectors operate high-hazard processes where the consequence of failure is catastrophic. Traditional Occupational Safety and Health focuses on personnel, but modern Process Safety Management is a sophisticated, systemic discipline designed to prevent major incidents like fires, explosions, and toxic releases. This advanced course moves beyond basic compliance with OSHA 29 CFR 1910.119 and international standards like CCPS Risk-Based Process Safety. It champions a proactive, predictive safety culture and is crucial for maintaining operational excellence and business continuity. We focus on quantitative risk assessment, Inherently Safer Design, and integrating digital safety technologies to manage complex, dynamic industrial risks effectively.

Advanced Process Safety Management in Chemical Pharma Training Course provides participants with mastery over advanced hazard analysis techniques and the critical systems that form a robust Layer of Protection (LOP). The curriculum delves into topics often neglected in foundational training, such as Human Factors Engineering, Asset Integrity and Reliability programs utilizing Risk-Based Mechanical Integrity, and the intricate management of Reactive Chemical Hazards. By emphasizing real-world case studies from both the chemical and pharmaceutical industries including lessons learned from incidents like Gramercy and Delaware City we equip professionals to implement sustainable process safety protocols and leverage process simulation and modeling tools to drive risk reduction and safeguard both personnel and multi-billion-dollar assets.

Programme Curriculum

Advanced Process Safety Management in Chemical Pharma Training Course

Introduction

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Course Duration

10 days

Course Objectives

Upon completion, participants will be able to:

1. Master the application of Layers of Protection Analysis (LOPA) to quantify risk and design robust Independent Protection Layers (IPLs).
2. Conduct comprehensive Quantitative Risk Assessments (QRA) to model consequence and frequency for informed, data-driven decision-making.
3. Implement the CCPS Risk-Based Process Safety (RBPS) framework, moving beyond the 14-element compliance model.
4. Incorporate principles of Inherently Safer Design (ISD) and Process Intensification into the design lifecycle of new and modified processes.
5. Develop and audit a world-class Asset Integrity & Reliability (AI&R) program, focusing on Safety Critical Elements (SCEs).
6. Analyze and mitigate complex Reactive Chemical Hazards using advanced calorimetry and thermal screening data.
7. Integrate Human Factors Engineering principles to reduce human error and optimize control room operations and procedures.
8. Lead advanced Root Cause Analysis (RCA) for major incidents and near-misses using methodologies like TapRooT or Bowtie Analysis.
9. Establish a demonstrable Process Safety Culture that emphasizes workforce involvement and safety leadership.
10. Design and manage robust Management of Change (MOC) and Pre-Startup Safety Review (PSSR) protocols for capital projects and temporary changes.
11. Utilize Process Safety Metrics for performance monitoring and continuous improvement.

12. Apply Facility Siting methodologies to manage personnel exposure risk from explosion and toxic release events.
13. Assure compliance with international and regional standards, including Seveso III / COMAH and global Good Manufacturing Practices (GMP) where PSM intersects.

Target Audience

1. Process Safety Engineers & Managers
2. Health, Safety, Environment Directors and Specialists
3. Process and Chemical Engineers
4. Operations and Plant Managers
5. Mechanical/Reliability Engineers
6. Compliance and Regulatory Affairs Officers
7. R&D Scientists/Chemists
8. Contractor Management & Maintenance Supervisors

Course Modules

Module 1: Foundations of Advanced PSM & RBPS

- The evolution from compliance PSM to Risk-Based Process Safety
- Understanding and applying the four pillars of RBPS.
- Defining Process Safety Performance Indicators.
- Developing and maintaining the Process Safety Knowledge Management system.
- Implementing Process Safety Competency assurance programs for all levels.
- Case Study: Bhopal Disaster - The paramount failure of Process Safety Culture, competency, and basic systems.

Module 2: Advanced Hazard Identification and Analysis

- HAZOP revalidation requirements and advanced techniques for complex systems
- Conducting What-If/Checklist Analysis for non-routine operations
- Mastering the application of Failure Mode and Effects Analysis for critical equipment.
- Introduction to Fault Tree Analysis and Event Tree Analysis for scenario modeling.
- Developing and managing the Process Hazard Analysis action item tracking system.
- Case Study: BP Texas City Refinery Explosion (2005) - Systemic failures in PHA, MOC, and Human Factors during startup procedures.

Module 3: Layers of Protection Analysis (LOPA)

- Defining Independent Protection Layers and avoiding common LOPA pitfalls.
- Calculating Probability of Failure on Demand (PFD) for protection layers.
- Application of Conditional Modifiers to refine risk estimates.
- LOPA workshops focusing on determining required Safety Integrity Level (SIL) for Safety Instrumented Systems (SIS).
- Integrating LOPA results into the decision-making process for Risk Tolerability.
- Case Study: Longford Gas Plant Explosion (1998) - Failure of an independent protection layer leading to catastrophic equipment damage.

Module 4: Quantitative Risk Assessment (QRA)

- Consequence modeling, frequency analysis, and societal risk evaluation.

- Understanding and interpreting Risk Contours, F-N Curves, and Risk Matrices.
- Using QRA to justify major capital safety investments and facility changes.
- Modeling toxic dispersion and flammable vapor cloud explosion (VCE) scenarios.
- Communicating complex QRA results to non-technical stakeholders and senior management.
- Case Study: Flixborough Disaster (1974) - A failure in temporary piping modification requiring advanced consequence modeling after the fact.

Module 5: Inherently Safer Design (ISD) & Process Intensification

- The four ISD strategies.
- Applying ISD principles at the Conceptual Design stage to eliminate hazards.
- Reviewing design specifications for Process Intensification and continuous flow manufacturing.
- Incorporating Design for Safety Reviews (DSR) throughout the project lifecycle.
- Pharmaceutical focus: Minimizing the use of hazardous solvents and materials in synthesis.
- Case Study: Gramercy Works Plant Explosion (1999) - A failure in basic design highlighting the need for simpler, more robust systems.

Module 6: Advanced Reactive Chemical Hazards Management

- Introduction to Reaction Calorimetry data and thermal screening techniques
- Defining and managing the Maximum Adiabatic Temperature Rise and Time to Maximum Rate
- Designing robust Emergency Pressure Relief Systems using DIERS methodologies.
- Managing hazards of highly energetic materials and intermediates in pharma scale-up.
- Developing protocols for safe storage, mixing, and transfer of reactive chemicals.
- Case Study: T2 Laboratories Explosion (2007) - A runaway exothermic reaction due to inadequate understanding of reactive chemistry and lack of a relief system.

Module 7: Safety Instrumented Systems (SIS) & Functional Safety

- Detailed review of the IEC 61511 standard for functional safety.
- The Safety Life Cycle.
- Specifying and proving the required Safety Integrity Level (SIL) for each SIS loop.
- Understanding the role of the Basic Process Control System (BPCS) versus the SIS.
- Managing SIS maintenance, bypassing, and proof-testing procedures.
- Case Study: Stanlow Refinery Incident (2011) - A complex failure involving the SIS due to inadequate proof testing and maintenance protocols.

Module 8: Asset Integrity and Reliability (AI&R)

- Developing a Risk-Based Mechanical Integrity (RBMI) inspection plan.
- Defining and managing Safety Critical Equipment (SCE) and their Performance Standards.
- Inspection, testing, and preventive maintenance (ITPM) for pressure vessels, piping, and relief devices.
- Managing Corrosion Under Insulation (CUI) and other common damage mechanisms.
- Utilizing Maximo/SAP and other digital tools for MI data management and scheduling.
- Case Study: Delaware City Refinery Incident (2001) - Catastrophic tank collapse due to severe corrosion and a failure to act on repeated inspection recommendations.

Module 9: Management of Change (MOC) & PSSR

- Designing an effective, auditable MOC lifecycle for all technical and organizational changes.
- Managing Temporary Changes and ensuring timely restoration to original design.

- The critical role of the Pre-Startup Safety Review (PSSR) for new and modified processes.
- Developing standardized checklists and sign-off procedures for MOC and PSSR.
- Ensuring Process Safety Information (PSI) is updated before startup
- Case Study: Esso Australia Gas Plant Explosion (1998) - Failure to manage a temporary change during a plant shutdown, resulting in a loss of containment.

Module 10: Human Factors and Human Error Reduction

- Applying Human Factors Engineering to control room and field operator interfaces.
- Addressing alarms management to prevent operator overload.
- Designing clear, simple, and error-resistant Operating Procedures and job aids.
- Analyzing common cognitive biases that lead to cognitive failures in high-stress situations.
- Implementing techniques for Human Error Reduction (HER) and performance shaping factors.
- Case Study: Three Mile Island Accident (1979) - A prime example of poor control room design and confusing HMI leading to severe operator error.

Module 11: Emergency Response and Preparedness

- Developing and testing comprehensive Emergency Action Plans for major hazards.
- Conducting Facility Siting Studies to assess building vulnerability to fire/explosion overpressure.
- Designing reliable communication and early warning systems for the workforce and the public.
- Establishing robust coordination protocols with external agencies and emergency services.
- Managing the aftermath: Post-Incident Response, Business Continuity, and Recovery Planning.
- Case Study: Chernobyl Disaster (1986) - A catastrophic failure in emergency response, containment, and communication protocols.

Module 12: Incident Investigation and Root Cause Analysis (RCA)

- Establishing a "No-Blame" Culture to encourage honest incident and near-miss reporting.
- Advanced RCA Methodologies focusing on latent conditions.
- Techniques for preserving evidence, interviewing witnesses, and collecting factual data.
- Tracking, implementing, and verifying the effectiveness of Corrective and Preventative Actions (CAPA).
- Creating high-impact Lessons Learned bulletins for company-wide dissemination.
- Case Study: Piper Alpha Platform Disaster (1988) - A series of systemic failures in permit-to-work and MOC, identified through in-depth investigation.

Module 13: PSM Auditing and Compliance Assurance

- Preparing for and conducting internal PSM Compliance Audits against OSHA and CCPS frameworks.
- Techniques for auditing Management Systems elements, not just field conditions.
- Ensuring Contractor Safety Management programs are integrated and effective.
- Developing a structure for Management Review and continuous improvement of the PSM system.
- Focusing on COMAH and other international standards for global operations.
- Case Study: Refinery Audit Failures - Analysis of various enforcement cases showing how systematic audit failures led to continued risk.

Module 14: Digital PSM and Future Trends

- Integrating Internet of Things (IoT) sensors and Predictive Analytics into process monitoring.
- Utilizing Virtual Reality (VR)/Augmented Reality (AR) for advanced PSM training simulations and field work.

- Implementing Dynamic Risk Assessment (DRA) using real-time process data.
- Leveraging Artificial Intelligence (AI) for fault detection and early warning systems.
- Cybersecurity considerations for Safety Critical Systems.
- Case Study: Stuxnet Attack - Demonstrating the vulnerability of industrial control systems and the need for Cybersecurity for Process Safety.

Module 15: PSM for the Pharmaceutical Industry

- Managing Potent Compounds and cross-contamination risks from a PSM perspective.
- Specific hazard analysis techniques for Batch Reactors and Fermentation Processes.
- PSM integration with Good Manufacturing Practices (GMP) and validation requirements.
- Handling and mitigating Dust Explosion Hazards in solid dosage manufacturing
- Applying PSM to pilot plants and R&D lab scale-up for new product introduction.
- Case Study: Pharmaceutical Pilot Plant Incident - An explosion during a scale-up reaction due to uncharacterized thermal decomposition kinetics.

Training Methodology

The course employs an intensive, highly interactive learning methodology, designed for immediate professional application:

- Conceptual Lectures
- Workshop Sessions.
- Case Study Deep Dives.
- Software Demonstrations.
- Group Audits & Action Planning.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call +254769199797

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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