Reactor Safety and Thermal Runaway Prevention Training Course

Professional Development Training Course Outline

Category	General Training	**Duration**	5 Days
Base Fee	$1,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Reactor Safety and Thermal Runaway Prevention Training Course is designed to equip professionals with advanced knowledge and practical skills to identify, assess, and mitigate risks associated with chemical reactor operations, process safety management, thermal hazard analysis, and runaway reaction prevention. As industries increasingly adopt Industry 4.0 technologies, digital process monitoring, and predictive safety analytics, the need for robust reactor safety programs has become critical. This course provides a comprehensive understanding of reactor design principles, thermal stability assessment, process risk evaluation, emergency response strategies, and regulatory compliance to ensure safe and sustainable operations.

Participants will gain hands-on exposure to hazard and operability studies (HAZOP), Layer of Protection Analysis (LOPA), quantitative risk assessment (QRA), safety instrumented systems (SIS), and real-time process monitoring technologies. Through industry case studies and practical exercises, learners will explore the root causes of thermal runaway incidents, analyze safety failures, and implement best practices for process optimization, incident prevention, operational excellence, and organizational resilience in high-risk industrial environments.

Programme Curriculum

Reactor Safety and Thermal Runaway Prevention Training Course

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Course Duration

5 days

Course Objectives

Upon completion of this training, participants will be able to:

1. Understand advanced principles of reactor safety management.
2. Identify causes and warning signs of thermal runaway reactions.
3. Apply process hazard analysis (PHA) methodologies effectively.
4. Conduct comprehensive thermal risk assessments.
5. Implement HAZOP and LOPA studies for reactor systems.
6. Evaluate safety instrumented systems (SIS) performance requirements.
7. Utilize predictive maintenance and digital safety monitoring tools.
8. Analyze reaction kinetics and thermal stability data.
9. Develop robust emergency shutdown strategies.
10. Strengthen process safety culture and operational excellence.
11. Ensure compliance with OSHA PSM, IEC 61511, and international standards.
12. Investigate reactor incidents using root cause analysis (RCA) techniques.
13. Design proactive thermal runaway prevention frameworks for modern process industries.

Target Audience

1. Chemical Process Engineers
2. Plant Managers and Operations Managers
3. Process Safety Engineers
4. Production Supervisors
5. HSE (Health, Safety & Environment) Professionals
6. Maintenance and Reliability Engineers
7. Risk Assessment Specialists
8. Technical Consultants and Regulatory Compliance Officers

Course Modules

Module 1: Fundamentals of Reactor Safety

- Reactor types and operational principles
- Chemical reaction kinetics fundamentals
- Heat generation and heat removal mechanisms

- Reactor design safety considerations
- Process safety lifecycle overview
- **Case Study:** Analysis of a batch reactor overheating incident caused by inadequate cooling capacity.

Module 2: Thermal Runaway Mechanisms and Hazard Identification

- Understanding exothermic reactions
- Thermal instability indicators
- Runaway reaction triggering mechanisms
- Hazard identification methodologies
- Critical process parameters monitoring
- **Case Study:** Investigation of a pharmaceutical reactor thermal runaway event.

Module 3: Process Hazard Analysis (PHA), HAZOP and LOPA

- Hazard identification techniques
- HAZOP methodology application
- LOPA implementation strategies
- Risk ranking and prioritization
- Safeguard effectiveness evaluation
- **Case Study:** HAZOP review of a specialty chemical production reactor.

Module 4: Thermal Risk Assessment and Calorimetry

- Thermal hazard screening methods
- Reaction calorimetry fundamentals
- Adiabatic calorimetry techniques
- Determining safe operating limits
- Thermal decomposition analysis
- **Case Study:** Assessment of unstable reaction mixtures using calorimetric testing.

Module 5: Safety Instrumented Systems and Process Control

- SIS architecture and functionality
- Safety Integrity Level (SIL) concepts
- Advanced process control systems
- Automated shutdown and interlocks
- Digital monitoring technologies
- **Case Study:** Implementation of SIS upgrades following a near-miss reactor incident.

Module 6: Emergency Response and Incident Management

- Emergency preparedness planning
- Reactor upset condition management
- Emergency venting systems
- Crisis communication protocols
- Incident command structures
- **Case Study:** Emergency response evaluation following a chemical plant reactor excursion.

Module 7: Incident Investigation and Root Cause Analysis

- Incident investigation methodologies

- Root Cause Analysis (RCA)
- Human factors and organizational failures
- Lessons learned management
- Corrective and preventive actions (CAPA)
- **Case Study:** Detailed review of a major industrial thermal runaway accident and lessons learned.

Module 8: Advanced Prevention Strategies and Future Technologies

- Predictive analytics for process safety
- Artificial Intelligence in reactor monitoring
- Digital twins and smart manufacturing
- Industry 4.0 safety integration
- Continuous improvement frameworks
- **Case Study:** Application of AI-driven predictive safety systems in modern chemical processing facilities.

Training Methodology

This course employs a participatory and hands-on approach to ensure practical learning, including:

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

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	27 Nov 2026	Online	$1,000
23 Nov 2026	27 Nov 2026	Physical	$1,500
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$4,500
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$6,000

Ready to enroll or request a customized program? Book online or contact us:

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