

# Combined: Layer of Protection Analysis and Safety Integrity Level

C200/210 Classroom

## Layer of Protection Analysis

### **DAY 1: 8:00 A.M. TO 5:00 P.M.**

- Fundamentals of Risk Judgment definitions
- Relationship of Regulations and Standards
  - History of LOPA
  - Relationship of qualitative and quantitative risk judgment
- Overview of LOPA
  - What is LOPA?
  - How does LOPA work?
  - Examples of industry variations on LOPA
- Scenario Development
  - Starting with hazard evaluations
  - Design evaluations
  - Incidents
- Consequences
  - Limiting definitions
  - Consequence categories
- Initiating Events
  - Enabling conditions
  - Frequency categories
- Independent Protection Layers: definitions, rules and examples
- Calculations
  - Basics of worksheet calculations
  - Workshop: Scenario evaluations

### **DAY 2: 8:00 A.M. TO 3:00 P.M.**

- Case Studies and Workshop: Pulling it all together
- Risk Tolerance Criteria
  - Examples
  - Development and implementation
  - Dealing with liability concerns
- Special Applications; facility siting and safety interlocks with workshops

# Safety Integrity Level

## **DAY 1: 8:00 A.M. TO 5:00 P.M.**

- OSHA and EPA regulations
- CCPS guideline documents
- ANSI SP 84
- Developing the System Requirements
  - How to evaluate consequences of system failure
  - Layers of protection and LOPA
  - Safety integrity levels
  - Intrinsically safer design
- Review of Principles of Reliability Analysis
  - Safety life-cycle concept
  - Availability, reliability, and dependability
  - Equipment failure modes
- Introduction to Systems Architectures
  - Redundant vs. nonredundant systems
  - Voting systems
  - Computers and programmable logic controllers

## **DAY 2: 8:00 A.M. TO 4:00 P.M.**

- Design Concerns
  - Alarm problems
  - Maintenance (test intervals, online testing)
  - Human factors (man/machine interface)
  - Plant production environment
  - Power supplies
  - UPS
  - Power surge/lighting protection
  - Power quality to unit
  - Grounding
  - Static electricity
- Good Practices
  - Single wire pulls
  - Fuses
  - Optical isolation
  - Fire fusible links
  - Spare parts
- Workshop: Preliminary Specification of an Interlock System for a Toxic Chemical Storage Area – Preview of Coming Standards (IEC 1508)