

This basic training curriculum, held virtually, is designed to fit a sixteen (16) hour timeline with emphasis on relief system design and the *iPRSM*® software. It is not intended for engineers/professionals new to relief system audit/design as it assumes students understand fundamental concepts, terminology, and basic relief device sizing experience (see Page 4 for recommended pre-requisites).

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| • Quick Refresher of Basic PRD Terms | 1 Hour |
| • iPRSM® Navigation and Usage | 3 Hours |
| • Typical System & Scenario Development | 4 Hours |
| • Sample Problems & Solutions | 6 Hours |
| • Revision Control & Reporting | 2 Hours |

RECOMMENDED PREREQUISITIES

- ✓ Understand relief device terminology, functions, and basic types of hardware
- ✓ Review ASME & API Codes and Standards applicable to relief system design

COURSE LEARNING OBJECTIVES

- Gain working knowledge of iPRSM software application to design and audit PRD systems
- Evaluate OVP scenarios and model piping hydraulics with iPRSM
- Understand **Revision Control** to maintain engineering integrity and traceability through evergreening procedures.
- Educate on industry best practices for the sizing and selection of relief devices to adequately protect the application and its contents from overpressure.

Quick Refresher of Basic Terms – 1 Hour

- **Quick Overview of Common Relief Valve Terms**
 - Relief valve terminology and basics
 - Overpressure and Accumulation
 - API Sizing Methodologies

iPRSM Navigation and Usage – 3 Hours

- **General Use and Navigation**
 - **Introduction to iPRSM**
 - iPRSM User Interface Structure
 - iPRSM Structure Map
 - **How to Use iPRSM**
 - Product Demonstration
 - Page Components and Types

- iPRSM Handbook
 - User Interface Tips
 - Common Commands and Controls
 - Multi-tasking
 - Navigation
- **Designing a Protected System with iPRSM**
- **Equipment**
 - About equipment types
 - Relief Equipment
 - Protected Equipment
 - Overpressure sources
 - Ancillary Equipment
 - Managing Equipment
 - **Protected Systems**
 - About Protected Systems
 - Protected Systems View
 - Stream Flashes
 - Contingency Scenarios
 - Piping Losses
 - Demonstration: Protected Systems
 - Creating a Protected System
 - Linking Pieces of Equipment to the System
 - Generating physical properties
 - Adding Streams and Flashes
 - Adding Contingency Scenarios
 - Calculating Piping Losses

Typical Scenario Development – 4 Hours

- **Contingency Analysis (Overpressure Sources)**
- Understanding and Identifying Relief System Envelop
 - System Components and Overpressure Sources
 - Understanding Relief Contingency Analysis
 - *Blocked Outlet*
 - *Automatic Control Failure*
 - Vapor/Liquid relief standard calculations
 - Vapor Blowthrough and how to handle
 - *Fire Scenario*
 - Gas Expansion (Unwetted)
 - Vapor Generation (Wetted)

Sample Problems & Solutions – 6 Hours

This portion of the training will focus on evaluating overpressures scenarios using the iPRSM Software, rather than educating on the fundamental principles of overpressure sizing. Solution systems will be available for student review.

➤ **Relief Systems Evaluations – Review Sample Problems**

A training template/tutorial plant will be uploaded into iPRSM where the participants can work through the sample problem as a self-study exercise. Common relief systems are listed below:

- Compressor Discharge – Blocked Flow Example
 - Evaluate and fill out PSV information from uploaded documentation
 - Insert Piping and Fittings
 - Evaluate Vessel Equipment
 - Create Streams and associated flashes
 - Generate the following overpressure scenarios:
 - Blocked Outlet
 - Fire – Gas Expansion
 - Fire – Vapor Generation
- Protected Pipe – Fuel Gas Supply Run Example
 - Demonstrate creation of control valve as Ancillary Equipment
 - Effects of Normal Upstream Pressure vs. Maximum Upstream Pressure
 - Obtain size and flow characteristics from Mfg. Catalog
 - Evaluation of Control Valve Failure

Advanced Training: Discuss and Evaluate Control Valves in Series
- Separator Vessel and Heat Exchanger – Example
 - Complete PSV and Inlet/Outlet Piping
 - Link PSV to Discharge Header
 - Fill Out Vessel Information and Wetted Area
 - Stream and Flash creation
 - Liquid and Vapor Control Valve Failure Analysis
 - Latent Heat Discussion on Mutli-component Liquid
 - DE Header Zones
- Slug Catcher Example
 - Demonstrate cloning of Protected Equipment and link to Protected Relief System
 - Calculate Fire Gas Expansion relief requirement

Advanced Training: Discuss outside Relief Model for Supercritical Fluids evaluated in iPRSM.
- Protected Pipe – Instrument Air Header Example
 - Develop Bypass Piping Segment for hydraulic flow calculation
 - Discuss multiple Control Valve failure Scenario and identify worst-case
 - Demonstrate System Cloning for Mitigation
 - Perform Mitigation of Inadequate Relief System by installing a Restriction Orifice
- Tube Rupture Example
 - Review all scenarios affecting system
 - Discuss evaluation of Tube Rupture Scenario

- Fire Vaporizing Fluid Cases and Thermal Expansion Example
 - Liquid full Vessel
 - Fire Overpressure Scenarios
 - Latent Heat Flash for multi-component fluid at 5% vaporization
 - Vapor-driven Liquid analysis due to inadequate vapor/liquid boundary separation upon relief.

Revision Control/Deficiencies/Cloning/Reports – 2 Hours

- **Additional Other Functions**
 - Working with Documents
 - Update Worksheets
 - Cloning Systems/Equipment/Scenarios
- **Checking and Signing Off**
 - What is *Check System*
 - Signing off the Protected System
 - Logging Out
- **Revision Control**
 - Discuss various stages for system workflow
 - Discuss revision report package and new system revisions
 - Unlocked and Locked calculations
- **Findings and Deficiencies**
- **Cloning (for Mitigation)**
- **Generating Reports**
- **Evergreening**

Optional Topics open for group discussion:

- **Multiple Relief Devices (16% OVP)**
- **Rupture Disk Sizing**
- **Two-phase Flow Sizing**
- **Acoustic-induced Vibrations (AIV)**
- **Gas Dispersion Screening**
- **Reaction Forces/Noise**
- **Remote-sensing Capacity Deration for Pilot Valves**
- **Latent Heat Function**
- **OVP, Accumulation, and Set Pressure Staggering**
- **Low-Pressure Tanks** (*advanced training course*)
- **Discharge Headers** (*advanced training course*)
- **Distillation Unbalanced Vaporization** (*advanced training course*)

*Pre-requisite course offered by FES include:

- Relief System Design & Documentation (RSD&D), duration 16 hours

Courses priced separately on request. Course content is instructor facilitated lectures and presentation material with Q&A session. No limit on number of attendees. Printed Training Materials prices separately, digital training materials subject to software license agreement.