



**Center for Process Safety Training**

*Taking You Further With Safety >>>>*

# Process Safety Training Course Catalog



**A GLOBAL PROVIDER OF  
INTEGRATED HSSE  
SOLUTIONS AND SERVICE**



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# 1. Introduction

## About PSRG

PSRG (*aka, Process Safety & Reliability Group*) is a premier, global Health, Safety, Security and Environmental (HSSE) consulting and training firm that specializes in Process Safety, Risk Management, and Process Plant Reliability services and solutions. With more than 100 highly experienced professionals averaging 29+ years of experience in industry best practices and lessons learned, we provide value-added services and solutions to a wide variety of industries, both onshore and offshore. Established in 1997, we have worked on thousands of engagements with hundreds of Clients in more than 101 countries.

## Mission

Our mission is to provide our Customers with the best quality, most responsive, and cost effective HSSE services in the industry today, and to enhance the safety, productivity, and reliability of Customer facilities through innovative and optimum solutions while not presuming to know their needs and concerns better than they do.

## Vision

We strive to become your preferred global HSSE services provider, helping industry to build a safe, reliable, and sustainable future.

## Core Values

- Safety
- People
- Diversity
- Integrity
- Commitment
- Trust
- Alignment with Client Goals
- Social Responsibility

## 2. PSRG e-Training

PSRG provides many training options including on-demand e-Training, on-site Instructor-Led Training, virtual Instructor-Led training, hybrid e-Training (on-demand e-Training and live Instructor-Led Training), and numerous process safety management training topics available in several locations throughout APAC, EMEA, LATAM and NA.

The objectives of our training courses are:

- To explain the business case for process safety (why one should implement a process safety management program and the case for improved overall business performance and competitiveness);
- To provide an appreciation of lessons learned from real-life accident case histories;
- To point out internationally Recognized and Generally Accepted Good Engineering Practices (RAGAGEP) and best practices related to safety and environmental risk management principles and practices;
- To provide a thorough understanding of the essential elements in identifying hazards and mitigating the risks associated with chemical, hydrocarbon and manufacturing process facilities;
- To provide an in-depth application of proven HSSE quality management principles and techniques;
- To provide hands-on experience in planning, designing and implementing an effective process safety and risk management system;
- To explain how a process safety management system can be integrated with other HSSE elements; and,
- To identify other internationally accepted HSSE tools and techniques that can enhance overall business performance, competitiveness, and public image.

## Benefits of Onsite PSRG Training

- **Customization:** Course content and training methods are tailored to the individual needs and requirements of your organization and facilities, utilizing personnel time more efficiently, and your resources more effectively.
- **Cost Savings:** By bringing our experts to you, you realize a significant saving in travel expenses.
- **Minimal Impact to Schedule:** Your personnel are trained at your facility, thereby minimizing their time away from work.
- **Availability On-Demand:** PSRG training courses can be scheduled to the convenience of our Customers.
- **Expert Training:** Receive training from experts who have worked in industry, have taught hundreds of safety and risk management professionals, and who are noted for their world-class training effectiveness.
- **Hands-On:** Obtain hands-on experience through interactive workshops and practical examples.
- **Lessons Learned:** Learn from real-world case studies as shared by our course instructors based on their experience in government and industry. Our instructors can provide a practical and complete perspective to your training session to enable learned knowledge to be readily applied after successful completion of the training.

## 2. PSRG e-Training

- **Local Languages:** PSRG can provide LIVE training with our multilingual instructors in 17 different languages, such as English, German, French, Korean, Hindi, Cantonese, Mandarin, Portuguese, Spanish, Turkish, Vietnamese, and more.
- **Accreditation:** Participants who successfully complete training receive certified Professional Development Hours (PDHs) and a Certificate.

## Benefits of PSRG e-Training

- **For our On-Demand Self-paced e-Training:**
  1. Access immediately upon payment
  2. Modular based training (On-Demand)
  3. Attend anywhere, self-paced
  4. Certificate of attendance
  5. Includes Professional Development Hours (PDH)
  6. Access to course materials up to six months
  7. *Optional 1 hour with trainer for Q&A/Discussion session*
- **For our Hybrid e-Training (On-Demand Self-paced + Live Instructor):**
  1. Modular based training (On-Demand Self-paced)
  2. Attend anywhere, self-paced
  3. Quizzes
  4. Interactive course exercises with personal feedback
  5. Certificate of attendance
  6. Includes Professional Development Hours (PDH)
  7. Live trainer during workshop and Q&A sessions
  8. Require completing modules prior to scheduling with live trainer
- **For our Live Instructor e-Training:**
  1. Reduce travel; Attend from a location convenient for you
  2. Live instructor-led training sessions
  3. Quizzes/Live polling
  4. Interactive course exercises with personal feedback
  5. Downloadable digital copies of course lessons and other supporting materials
  6. Certificate of attendance, Includes awarding of Professional Development Hours (PDH)
  7. *Available in any time zone or language*

## Registration

Register by contacting PSRG to obtain a registration form or complete one online using the following link:  
<http://www.psrqgroup.com/training/>

Tel: 1-800-250-8511 (in U.S.); +1-713-532-8800 (outside U.S.)  
Fax: +1-713-532-8850  
Email: [training@psrq.com](mailto:training@psrq.com)

For any questions regarding training, please contact our Training Department at [training@psrq.com](mailto:training@psrq.com)

### 3. Process Safety Courses

RBPS 101:	Principles of Risk Based Process Safety (RBPS)
LOPA 104:	Layer of Protection Analysis (LOPA)
PHA 102:	Principles of Process Hazards Analysis for Team Members
PHA 203:	PHA Team Leader Training
DHA 204:	Dust Hazard Analysis
PSM 101:	Developing an Effective Process Safety Management System
PSM 105:	Auditing for Process Safety Management
PSM 106:	Mechanical Integrity and RAGAGEPs for Process Safety Management
PSM 107:	Management of Change for Process Safety
PSM 108:	Incident Investigation
PSM 110:	Risk Analysis and Decision Making
PSM 113:	Human Error Analysis and Human Factors
PSM 118:	Hazardous Area Classification
PSM 216:	Quantitative Risk Assessment
PSM 217:	Safety and Operability Studies on Electrical Power Systems (SAFOPs)
PSM 219:	Developing Effective Standard Operating Procedures
PSM 220:	Overpressure Relief and Flare Analysis
PSM 309:	Facility Siting
PSM 311:	BowTie Analysis
PSM 312:	Failure Modes Effect Analysis
PSM 313:	Hydrogen Process Safety
PSM 315:	Inherently Safer Design

## **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

This course introduces the elements of Risk Based Process Safety (RBPS) Management as recommended by the Center for Chemical Process Safety (CCPS) of American Institute of Chemical Engineers (AIChE). This introductory course will cover the basic knowledge of the elements of a safety management system and their application. Implementation tools, industry best practices and lessons learned will be shared. With the help of this course, you should be able to develop a risk-based safety management system at your company and receive tools to implement and maintain it. Throughout this course, examples will be provided on the concepts discussed, to reinforce your knowledge of each element.

## **Course Benefits**

- Learn about the pillars of RBPS
  - Commit to process safety
  - Understand hazards and risks
  - Manage risks
  - Learn from experience
- Learn the principles behind each element and develop understanding to communicate and explain to others in your company who need to understand the issues
- Learn how to develop, review, update and implement effective RBPS elements that meet industry best practices
- Learn about the interrelationship between elements

## **Who Should Attend**

- Process safety engineers, safety specialists and process safety managers
- Operations and plant managers
- Engineers and supervisors

## **Prerequisites**

- None

*Continued on next page.*

## **Course Content and Agenda**

### **Day 1**

- What is Process Safety?
- History of Accidents and Loss of Prevention Lessons Learned (e.g., Flixborough, Seveso, Bhopal, Mexico City, Pasadena, Texas City)
- Business Case for Process Safety
- Overview of Risk Based Process Safety
  - Commitment to Process Safety
  - Hazard Identification and Risk Assessment
  - Risk Management
  - Continuous Learning
- Commitment to Process Safety
  - Process Safety Culture
  - Compliance with Standards
  - Process Safety Competency
  - Workforce Involvement
  - Stakeholder Engagement
- Understanding Hazards and Risks
  - Hazard Identification and Risk Analysis
    - Preventing Loss of Containment through Assessment of Hazards, Consequences, and Risks
- Process Knowledge Management

### **Day 2**

- Managing Risks
  - Operating Procedures
  - Conduct of Operations
  - Safe Work Practices
  - Asset Integrity & Reliability
  - Contractor Management & Control of Visitors
  - Training & Performance Assurance
  - Management of Change
  - Operational Readiness & Pre-Startup Safety Review
  - Emergency Planning and Response
- Learning from Experience
  - Incident Investigation
  - Measurement & Metrics
  - Auditing
  - Management Review & Continuous Improvement
- Implementation and Sustenance
- Summary of Roles and Responsibilities
- Course Learning Assessment
- Course Evaluation



## **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

In this course, the participant will learn about Layer of Protection Analysis (LOPA) which is a semi-quantitative risk assessment method that lies between a qualitative Process Hazard Analysis (PHA) and a traditional Quantitative Risk Assessment (QRA). This technique also helps in determining the Safety Integrity Level (SIL) necessary for a safety instrumented system to comply with instrument standards, such as ISA S84 and IEC 61511. This course will cover the LOPA methodology in detail, through practical examples and teaching of the fundamental rules of how to develop LOPA scenarios, estimate their consequences and severity, identify initiating events and frequency, and finally calculate risk and make decisions. In this course, the participants will learn about the Independent Layers of Protection (IPLs) and estimating their failure on demand. This course will also demonstrate practical examples to explain each concept and the development of a LOPA worksheet from a PHA worksheet.

## **Course Benefits**

- Learn how and when to use LOPA
- Learn how to determine the independence and uniqueness of an IPL
- Learn how to lead a LOPA study
- Learn industry best practices for LOPA

## **Who Should Attend**

- Experienced PHA/HAZOP Leaders and PSM Coordinators and Managers
- Operations, Safety and Project Managers; Process, Safety and Mechanical Engineers

## **Prerequisites**

- PSM or PHA training

*Continued on next page.*

## **Course Content and Agenda**

### **Day 1**

- Process Safety Concepts
- Introduction to LOPA
  - Overview of LOPA Methodology
  - When is LOPA Used?
  - Uses and Limitations of LOPA
- Risk and Risk Tolerance Criteria
  - Examples of Common Risk Matrixes
- Development of LOPA Scenarios
  - Selection of Hazard Scenarios using Hazard Evaluation
  - Selection of Hazard Scenarios using Previous Incidents
  - Selection of Hazard Scenarios from Design Evaluation
- Estimation of Consequences and Severity of Scenarios
  - Consequence Categories
  - Defining Severity for the Consequences

### **Day 2**

- Identification of Initiating Events
  - Understanding Initiating Events
  - Initiating Event Frequency Estimation
  - Enabling Conditions and Conditional Modifiers
- Identification of Independent Protection Layers (IPL)
  - Types of IPL
  - IPL Assessment
  - Estimating Probability of Failure on Demand of IPLs
- Calculating the Risk
  - Use of LOPA Worksheet
  - Calculation of Risk for Scenarios
- Making Risk Decisions
  - ALARP and its Typical Application
- Performing PHA to Facilitate LOPA
- Example Workshop

## **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

This course is designed to help the participants understand the process and regulatory requirements of a Process Hazard Analysis (PHA). It provides an overview of the various methodologies of conducting PHA studies, including HAZOP, What-If, Checklist and other techniques. Guidance is provided on selecting the proper PHA technique and participating in a PHA. PHA techniques are described with real-life examples. Attendees will participate in demonstration PHAs led by the course instructor. After completing this course, participants will be prepared to serve as members of PHA teams.

## **Course Benefits**

- Learn how to satisfy the commonly practiced and governed PHA requirements

## **Who Should Attend**

- Process Safety Managers, HSE Personnel, Plant Management, Engineers, O&M staff
- Individuals leading or participating in process hazard analysis studies, scribes

## **Prerequisites**

- None

## **Course Content and Agenda**

### **Day 1**

- Overview of PHAs for Engineers and Managers
  - Definitions
  - Uses
  - Benefits
  - Limitations
- PHA Regulatory Requirements [U.S. OSHA 1910.119(e), U.S. EPA 40 CFR 68]
- Guidelines and Roles of PHA Participants
- Fault Tree Analysis (FTA)
- Failure Modes & Effects Analysis (FMEA)
- Other Methods
- Mock-Team PHA Exercise

### **Day 2**

- Introduction to PHA Methods
  - 'What-If' Studies
  - 'What-If'/Checklist Studies
  - HAZOP Studies

## PHA 203: PHA Team Leader Training

### **Course Description**

**Accreditation:** 28 PDHs

**Duration:** 4 Days

This course teaches Process Hazard Analysis (PHA) techniques and prepares each participant to lead teams and effectively perform and document PHA and other hazard/risk management studies. The participants will learn to organize and lead PHA studies using the HAZOP, What-If and other techniques. Participants will discover the tactics and success factors that help ensure a successful study. They will also learn about, and use, software available for documenting PHA studies. In addition, this course provides a better understanding of the importance of certain aspects of PHA facilitation and the best practices that should be used during a PHA study. Using these best practices techniques will reduce time, confusion and increase the quality of the PHA. This course will also highlight the 'dos and don'ts' in a PHA study. The content of the course will be demonstrated practically by the participants forming a study team with other participants and taking turns leading a PHA using practical exercises based on actual plant examples. These exercises will be supervised by an instructor who will give feedback on the team's performance.

### **Course Benefits**

- Learn to organize, effectively and efficiently lead, and document PHA studies in accordance with local regulatory and industry best practices using the HAZOP, What-If, Checklist and other methodologies
- Learn the techniques that help ensure a successful PHA study
- Learn about, and use, software available for documenting PHA studies
- Obtain useful tools, checklists, and other aids for reference in future PHA studies

### **Who Should Attend**

- PSM Coordinators/Managers, HSE personnel, Plant Management, O&M personnel
- Engineers, Operations and Maintenance Staff
- Others responsible for leading PHA studies

### **Prerequisites**

- None

*Continued on next page.*

## Course Content and Agenda

### Day 1

- Overview of Process Safety Management and Risk Management
- Introduction to Process Hazard Analysis (PHA) for Engineers and Managers (Definitions, Uses, Benefits, and Limitations)
- PHA Regulatory Requirements [OSHA, EPA]
- Hazard Identification
- Design Intent, Guidewords Parameters and Deviations
- PHA Methods (Including workshop)
  - 'What-If' Studies
  - 'What-If'/Checklist Studies
  - Hazard & Operability Studies (HAZOP)
  - Fault Tree Analysis (FTA)

### Day 2

- PHA Methods (Including Workshop)
  - Failure Modes and Effects Analysis (FMEA)
  - Bow-tie Analysis
  - Quantitative Risk Assessment (QRA)
  - Other Methods
- Preparing and Organizing PHA Studies
- Noding the P&IDs
- PHA Recording/Worksheets
- Facilitator/Chairman Skill Requirements
- Team Member Composition/Roles
- Management of PHA Studies/Quality Control in PHA Studies

### Day 3

- Human Factors in PHAs
- Facility Siting in PHAs
- Procedural HAZOP
- HAZOP Batch Process
- MOC HAZOP
- HAZOP for Different Modes of Operation such as Start-up and Shutdown
- Risk Ranking
- PHA Report Preparation

### Day 4

- Managing the Follow-Up of PHA Results
- New PHAs vs. PHA Revalidations
- PHA Software
- Sample PHA Report/Worksheets
- Introduction Layer of Protection Analysis (LOPA)
- Mock Facilitation
- Examination

## DHA 204: Dust Hazard Analysis

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### **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

The course provides a detailed procedure to conduct either a risk-based dust hazard analysis or prescriptive dust hazard analysis. A brief background introduction is covered along with knowing combustible dust physical and chemical properties, combustible dust hazards, and applicable regulations/codes/standards for controlling dust hazards. Combustible hazards protection is another section provided in this course based on process design, equipment selection, building construction, ignition source control, and dust hazards management. Participants will learn to utilize engineering controls to prevent and mitigate combustible dust hazards.

### **Course Benefits**

- Learn to understand dust properties and different types of dust hazards
- Learn to know OSHA issued combustible dust regulations and combustible dust standard (e.g., NFPA)
- Learn to conduct a risk-based dust hazard analysis or prescriptive dust hazard analysis
- Learn to use engineering controls to prevent and mitigate combustible dust hazards

### **Who Should Attend**

- Plant process safety manager and coordinator
- Process engineers and safety engineers with dust-involved tasks
- Professionals interested in learning dust hazard analysis

### **Prerequisites**

- Having background of PHA approaches, e.g., HAZOP, What-If

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## DHA 204: Dust Hazard Analysis

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### **Course Content and Agenda**

#### **Day 1**

- Introduction to combustible dust hazards
- Regulations and standards on dust hazards control
- Combustible dust hazard parameters and testing
- Know dust fire and explosion severity
- Ignition sources for dust fire/explosion
- Introduction to dust hazard analysis
- Prescriptive dust hazard analysis (DHA)
- Risk-based dust hazard analysis (DHA)

#### **Day 2**

- Dust explosion protection
- Dust-involved equipment design and protection
- Dust-involved building design and protection
- Classification of locations
- Dust fire/explosion Ignition source control
- Housekeeping
- Personal Protection Equipment for dust hazard protection
- Dust hazards management system

## **Course Description**

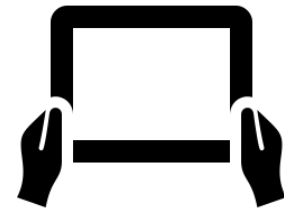
**Accreditation: 14 PDHs**

**Duration: 2 Days**

This course provides an overview of the elements of Process Safety Management (PSM) covered under the U.S. Occupational & Safety Administration (OSHA) PSM Standard, 29 CFR1910.119, and the U.S. Environmental Protection Agency (EPA) Risk Management Program (RMP) Rule, 40 CFR 68, SS 651, etc., which have been established to reduce chemical accidents and manage the release of highly hazardous flammable and toxic chemicals. This course will demonstrate how to interpret these 'performance-based' regulations and develop and implement a PSM program for a covered process required by the OSHA PSM regulation and the EPA RMP rule. Participants will be provided with information on how to ensure your PSM program is designed to meet regulatory requirements and implemented through an effective management system to improve business performance. This course will go beyond the regulatory requirements and cover concepts on developing a culture of safety, metrics for continual improvement, and principles of inherent safety. Industry "best practices" and "lessons learned" will be shared.

## **Course Benefits**

- Learn how to determine if your facility is covered by applicable PSM regulations (e.g., OSHA 29CFR1910.119 PSM, EPA 40CFR68 RMP, SS651, etc.) regulations.
- Learn how to develop, review, update and implement effective PSM/RMP programs that meet regulatory requirements.
- Learn the principles behind each element and develop understanding to communicate and explain PSM requirements to others in your company who need to understand the issues.



**NOTE: A 4-hour On Demand Self-Paced course available on PSRG's LMS.**

## **Who Should Attend**

- Managers, Supervisors
- PSM Managers and Coordinators, Process Safety Engineers
- Anyone who is involved and responsible for satisfying OSHA PSM regulatory requirements

## **Prerequisites**

- None



## **Course Content and Agenda**

### **Day 1**

- Introduction to PSM
- What is Process Safety?
- Personnel Safety vs. Process Safety
- History of Accidents (e.g., Flixborough, Seveso, Bhopal, Mexico City, Phillips, Pasadena, BP, Texas City)
- Performance Based and Prescriptive Regulations
- Business Case for Process Safety
- Covered Processes and Applicability of PSM and RMP
- Elements of PSM
  - Employee Participation
  - Process Safety Information
  - Process Hazard Analysis
  - Operating Procedures
  - Training
  - Contractors

### **Day 2**

- Elements of PSM
  - Pre-Startup Safety Review
  - Mechanical Integrity
  - Hot Work Permit
  - Management of Change
  - Incident Investigation
  - Emergency Planning and Response
  - Compliance Audits
  - Trade Secrets
- Applying PSM to Non-Regulated Processes and Operations
- Management Systems for Implementation of Prevention Programs
- Building a Culture of Safety
- Development of Effective Process Safety Metrics
- Leading and Lagging Indicators (e.g., API RP 754)
- Introduction to Inherent Safety Principles
- Summary of Roles and Responsibilities
- Sample Process Safety Management Manual

## PSM 105: Auditing for Process Safety Management

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### **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

This course provides an understanding of compliance audits, a key element of Process Safety Management under the U.S. Occupational & Safety Administration (OSHA) Process Safety Management (PSM) Standard, 29 CFR1910.119, and the U.S. Environmental Protection Agency (EPA) Risk Management Program (RMP) Rule, 40 CFR 68. In this course, the participants will learn how to develop their own audit programs. They will also learn how to prepare for and conduct a compliance audit, document the findings, develop reports and track the findings for follow-up and closure. Participants also learn how to use PSRG Maturity Model™ to assess the health of your PSM program.

### **Course Benefits**

- Learn how to develop and establish a PSM/RMP Audit Protocol to meet regulatory requirements
- Learn from experts about the methods of conducting accurate and objective audits, sampling techniques, reporting, etc.
- Use the tools learned from the course to perform efficient and effective auditing against regulatory requirements, NEP citation patterns, and enforcement statistics
- Assess your PSM/RMP program relative to the PSRG 'MaturityModel™'

### **Who Should Attend**

- PSM Managers and Coordinators
- Process, Safety and Mechanical Engineers
- Anyone who needs to develop an audit program or for improving their existing program

### **Prerequisites**

- Understanding of PSM/RMP Principles

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## **Course Content and Agenda**

### **Day 1**

- Introduction to Auditing
  - Scope of the Audit
  - Audit Criteria and Protocol
  - Auditor Qualifications or Requirements
  - Frequency of Audits
- Regulatory Requirements for PSM/RMP Auditing
- Developing an Audit Program

### **Day 2**

- Roles and Responsibilities
- Preparation for the Audit
- Conducting and Evaluating Compliance Audit of the PSM/RMP Programs, their Processes and Products
- Sampling Methods
- Interviews
- Writing Quality Recommendations
- Audit Recording and Reporting
- Audit Follow-up, Closure and Tracking
- Quality Assurance of Audits
- PSRG Maturity Model™

## PSM 106: Mechanical Integrity and RAGAGEPs for Process Safety

### **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

This course describes the way to develop and implement an effective program for plants to maintain the integrity of safety critical process equipment. This is important to improve the reliability of the equipment, reduce breakdowns and business interruptions costs, and comply with regulations. This course covers codes and standards to meet Recognized and Generally Accepted Good Engineering Practices (RAGAGEPs). The participants will learn how to identify safety critical equipment (SCE), perform preventative maintenance, assign tasks, train personnel, develop procedures, manage deficiencies, and maintain written documentation. This course will also provide tools on how to identify and alleviate equipment deficiencies and assure the quality and material of equipment fabricated and installed meet the codes and standards.

### **Course Benefits**

- Learn how to interpret the 'performance-based' regulations to identify safety critical equipment and to comply with Mechanical Integrity (MI) regulatory requirements
- Learn how to develop and implement a new MI program or improve an existing MI program in your company
- Learn the meaning of RAGAGEPs and how to best follow them
- Learn how to maintain equipment inspector, testing, and repair records

### **Who Should Attend**

- PSM Managers and Coordinators
- Process, Safety and Mechanical/Maintenance Engineers
- Anyone who needs to develop a MI program or for improving their existing program

### **Prerequisites**

- A background in engineering, operations, and/or maintenance

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## **Course Content and Agenda**

### **Day 1**

- Mechanical Integrity Overview
  - Meaning and Importance of MI
  - Relationship with other PSM Elements
- Regulatory Requirements for MI
  - RAGAGEPs
  - Interpretations of PSM MI Requirements
- Designing a MI Program
- Safety Critical Equipment Selection Criteria
- Codes, Standards and Best Practices for Covered Safety Critical Equipment:
  - Pressure Vessels and Storage Tanks
  - Piping Systems (Including Piping Components such as Valves)
  - Relief and Vent Systems and Devices
  - Emergency Shutdown Systems
  - Controls (Including Monitoring Devices and Sensors, Alarms, and Interlocks)
  - Rotating Equipment and Pumps
  - Electrical Systems

### **Day 2**

- Inspection, Testing, Preventative Maintenance
  - Tasks
  - Techniques
  - Frequencies
  - Documentation
- Risk Based Inspection (API 580, 581)
- Fitness for Service
- Training and Qualification of Personnel
- Corrosion and Non-Destructive Testing Tools and Methods
- Identifying and Mitigating Equipment Deficiencies
- Quality Assurance/Quality Control
- Spare Parts
- Computerized Maintenance Management Systems
- Reliability Centered Maintenance
- Sample M.I. Program

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## **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

This course provides an understanding of a key element of Process Safety Management (PSM), Management of Change (MOC), covered under the U.S. Occupational & Safety Administration (OSHA) PSM Standard, 29 CFR1910.119, and the U.S. Environmental Protection Agency (EPA) Risk Management Program (RMP) Rule, 40 CFR 68. MOC is performed to ensure that any changes made to a process are reviewed and the hazards introduced by the change are identified, analyzed, and controlled before resuming the operation in a chemical processing facility.

MOC is required for:

1. Changes in technology
2. Changes to equipment
3. Changes to procedures
4. Changes to organization

In this course, the participants will learn, with case studies and practical examples, how to recognize, initiate, review, and implement a change. They will also learn about the roles and responsibilities and the forms used for the MOC process. Further, the course will give an overview of the Pre-Startup Safety Review (PSSR) process and guidelines to establish and manage successfully the MOC/PSSR program.

## **Course Benefits**

- Learn how even simple changes could lead to incidents through case studies
- Learn how to establish and manage a PSM compliant MOC/PSSR program
- Learn how to develop a new MOC program or review and audit an existing one

## **Who Should Attend**

- PSM Managers and Coordinators
- Process, Safety and Mechanical Engineers
- Any other personnel who participate in decisions on process changes

## **Prerequisites**

- None

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## **Course Content and Agenda**

### **Day 1**

- Introduction
- Regulatory Requirements for MOC and PSSR
- Recognizing Changes
- Types of Changes (Replacement-in-Kind, Non-Like Changes)
- Reviewing Hazards
- Implementing a Change
- Roles and Responsibilities
- PSSR
- Examples of MOC Process and PSSR

### **Day 2**

- Management Systems for Managing Change
- Designing and Developing a MOC Program
- Auditing MOC Program
- Personnel Roles and Responsibilities
- Temporary MOCs
- Emergency MOCs
- Interface with Other Facility Programs
- Elements of a MOC Program
- Implementation Guidelines
- Sample MOC Checklists/Flowchart

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## **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

Many incidents in chemical facilities have led to loss of life and property. This course provides the participants an understanding of which incidents to investigate and how to investigate the incidents in order to determine the underlying causes to avoid similar incidents in the future. Incident Investigations will not only help a company to learn from its incidents, but also when shared across the board can help similar industries to avoid incidents. Investigations should be performed not only for incidents, but also for positive outcomes to identify what sets the stage for positive outcomes of certain outcomes. This course provides a systematic process with practical examples and case studies where participants will be a team member for an investigation.

## **Course Benefits**

- Learn the steps to assure a good investigation
- Learn to conduct trend analysis
- Learn how to set up a formal investigation, secure the scene, conduct interviews, and review documents
- Learn how the incident evolves and to develop a timeline for the incident
- Learn to perform basic and root cause analysis
- Learn to formulate recommendations and develop a formal report
- Learn how to manage incident investigations
- Learn to identify latent causes

## **Who Should Attend**

- PSM Managers and Coordinators
- Process, Safety and Mechanical Engineers
- Any technical personnel who could lead or participate in incident investigations

## **Prerequisites**

- None

*Continued on next page.*



## **Course Content and Agenda**

### **Day 1**

- Introduction
- Incident vs Accident
- Understanding Near-miss Incidents
- Regulatory Requirements
- Incident/Accident Investigation Goals
- Human Factors and Error
  - Exercise: Interviews
- Incident Reporting (Internal and Regulatory)
- Accident/Incident Investigation Kit
- Steps in an Investigation
- Initiating an Investigation
  - What to Investigate
  - What Method(s) to Use
  - When to Do What
- Gathering and Preserving Data
  - People
    - Brainstorming
    - Interviewing
    - Facilitating Meetings
  - Physical Data
  - Paper/Electronic Data
  - Exercise: Documentation
- Developing the Timeline of the Incident
- The Investigation Team

### **Day 2**

- Enhanced Five Why Method with Excel
  - Focal Point
  - Causal Charting Without Graphics
- Exercise: Five Why Method
- Causal Charting
  - Validating Causes
  - Terminating Causal Chains
- Exercise: Causal Charting
- IncidentXP and Exercise
- Writing Recommendations
- Reporting
- Communicating Results
  - Management
  - Staff
- Exercise: Process Safety Incident
- Learning from Incidents
- Management of Incident Investigations

## **Course Description**

**Accreditation:** 7 PDHs

**Duration:** 1 Day

This course is designed to provide an overview of risk analysis techniques from qualitative to quantitative. This course also explains how risk tolerance and acceptance criteria are developed and used to make risk-based decisions from incident frequencies and consequence analysis.

## **Course Benefits**

- Learn how to differentiate between hazard and risk
- Learn different types of risk analysis methods
- Learn the meaning of As Low As Reasonably Practical (ALARP)

## **Who Should Attend**

- PSM Managers and Coordinators
- Process Safety Engineers

## **Prerequisites**

- None

## **Course Content and Agenda**

- Overview of Concepts of Hazard and Risk
  - Definitions of Hazard and Risk
  - Frequency and its Relationship to Risk
  - Risk Analysis
  - Risk Perception
  - Risk Communication
- Qualitative and Quantitative Methods of Risk Assessment
  - Risk Matrix
  - Index Based Methods
  - LOPA
  - QRA
    - Consequence Analysis
    - Frequency Assessment
- Risk Measures
  - Indices
  - Individual Risk and Societal Risk
  - Aggregate Risk
- Risk Presentation and Calculation
  - Frequency Determination
  - Point Estimates and Uncertainty
  - Risk Contours
- F-N Curves
- Risk in Decision Making
  - Risk Tolerance Criteria
  - Risk Acceptance Criteria
  - ALARP
- Risk Reduction Alternatives

## **Course Description**

**Accreditation:** 7 PDHs

**Duration:** 1 Day

Human error is determined as one of the main causes for most incidents in chemical, aviation, maritime, and other industries. Human error is a very broad term which can be further categorized into different factors affecting human performance such as the environment, the complexity of the task, organizational factors and operator characteristics. In this course, the participants will learn about these human performances impacting factors and various human performance reliability models. This course will further describe the practical ways of performing human error analysis such as checklists, guideword methods, and task analysis methods, and talk about prevention and mitigation techniques.

## **Course Benefits**

- Learn the practical techniques to perform human error analysis
- Learn about the role of culture in preventing human error

## **Who Should Attend**

- Managers, Process Safety Coordinators, and others responsible for addressing human factors

## **Prerequisites**

- None

## **Course Content and Agenda**

- Introduction to Human Error
- Systems Approach to Human Error
- Regulatory Requirements
- Case Studies
- Approaches to Human Error
  - Traditional Approach
  - Human Factors Engineering
  - Cognitive Engineering Perspective
  - Socio-technical Perspective
- Factors Influencing Human Performance
  - Environment and Task Characteristics
  - Operator Characteristics
  - Organizational and Social Factors
- Human Reliability Analysis Models
  - James Reason's Model
  - Human Factors Analysis and Classification
    - HFACS Model
  - HFACS Case Study
- Human Error Analysis Techniques
  - Checklist and Guideword Methods
  - Task Analysis Methods
- Implementing a Human Factors Integrated PSM System

## PSM 118: Hazardous Area Classification

### **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

In this course, the attendees will learn how to assess and determine hazardous (electrical) area classification based on the characteristics of flammable or combustible materials, and types of equipment. Hazardous conditions can exist during normal plant operations as a result of the continuous or intermittent release of flammable materials into the atmosphere. Releases can occur due to leaks at valves and pipe flanges, from routine maintenance where a seal is being replaced, or where a process results in the regular venting of gases. Hazardous area classification is used to identify potentially hazardous zones and ignition sources in the workplace, and identify the equipment needed to prevent fires and explosions. The attendees will learn about the various classification systems for hazardous areas, including flammable gases, dusts, mists and vapors.

### **Course Benefits**

- Learn about the different systems to classify hazardous areas
- Learn about the area classification assessment for flammable gases, mists, dusts and vapors
- Learn about the engineering best practices in hazardous area classification
- Learn about the limitations of hazardous area classification
- Learn how to develop hazardous area classification drawing

### **Who Should Attend**

- Fire Safety Managers, Workplace Safety and Health Professionals, Facility Managers, Workplace Managers or anyone who manages hazardous area classification.

### **Prerequisites**

- None

*Continued on next page.*

## Course Content and Agenda

### Day 1

- Explosion Basic Requirement
  - Flammable Substance Classification
  - Ignition
  - Oxidizer
- Design Regulations for Explosion Proof Electrical Equipment
  - Industry Codes and Standards
  - Approval Agencies
- Overview of Hazardous Area Classification (HAC)
- HAC Definition and Division System
- Zone System
  - Gas Zone
  - Dust Zone
  - Electrical Equipment Group
- Protection Techniques and Methods
- Class and Zone Comparison
- Reading Marking Equipment
- Equipment Protection Level (EPL)
- ATEX Directive
- Marking
  - Gas Marking
  - Dust Marking
  - Zone Marking

### Day 2

- Risk Assessment Methodology Development
- Area Classification Assessment
- Area Classification Assessment for Zone System
  - Source of Release
  - Ventilation
- Plant and Area Design
- Ignition Sources Control
- Classification of Areas Containing Liquids, Vapors and Gases
- Classification of Areas Containing Dust
  - Combustible Dust
  - Identify Zones of Risk for Combustible Dust
- Engineering Best Practices
  - Material Properties
  - Dust Layer Hazard
  - Gas and Oil-Fired Systems
  - Audit and Review
- HAC Limitations

## PSM 216: Quantitative Risk Assessment

### **Course Description**

**Accreditation:** 21 PDHs

**Duration:** 3 Days

This training course provides in-depth knowledge on how to perform and understand a Quantitative Risk Assessment (QRA) with the help of worked examples. In this course the participant will learn about the key components of a QRA, the expected outcomes, and how to effectively perform and audit QRA studies. The course will also cover industry best practices and lessons learned. Upon successful conclusion of the training course, participants should be prepared with the tools and skills to efficiently and effectively perform and evaluate a QRA.

### **Course Benefits**

- To introduce attendees to fundamentals of QRA technique to be used when conducting and performing QRAs
- To introduce attendees to QRA documentation techniques
- To provide an appreciation for lessons learned based on real-life incident case histories
- To point out internationally Recognized and Generally Accepted Good Engineering Practices (RAGAGEP) and best practices related to safety and environmental risk management principles and practices (i.e., CCPS Guidelines for Quantitative Safety Risk Criteria, API RP 752, and API RP 753)
- To provide an understanding of the essential elements for equipment spacing, siting and layout in hydrocarbon and chemical process facilities
- To provide an understanding of proven consequence analysis and frequency estimation techniques

### **Who Should Attend**

- PSM Managers and Coordinators
- Process, Safety and Mechanical Engineers
- Professionals with a background in science and engineering

### **Prerequisites**

- None

*Continued on next page.*

## **Course Content and Agenda**

### **Day 1**

- Introduction to QRA
- Origins
- Anatomy of a QRA
  - Hazard Selection
  - Consequence Assessment
  - Frequency Estimation; Risk Output
- Risk Criteria
  - Origins
  - ALARP
  - Individual Risk (IR) & Societal Risk (SR)
- Hazard Identification
  - Hazard Types
  - Historical Major Accidents
  - Deterministic Approach
  - Probabilistic Approach
- Consequence Assessment
- Fires
  - Calculate Fire Radiation Distances
  - Pool Fires and VCE
  - BLEVEs and Fireballs

### **Day 2**

- Fires
  - Effect of Fire on People and Equipment
- Explosions
- Calculate Explosion Distances
  - TNT and TNO Multi-Energy
  - Baker-Strehlow
- Effect of Explosions on People and Equipment
- Toxics
- Gas Dispersion Principles
- Calculating Dispersion
  - Source Models
  - Pool Vaporization
  - Dense Gas Dispersion
  - Momentum Jet Dispersion
- Effect of Toxics on People
- Probability of Injury/Death
  - Effect Tables and Probits
- PHAST/SAFETI, Part 1
  - Models, Assumptions and Limitations

### **Day 3**

- Frequency Assessment
  - Frequency Data Sources & Data Limitations
  - Fault Tree & Event Tree Analysis
- Risk
  - Calculating IR, SR and IRPA
  - Models and Tools
- Assessing QRAs
- QRA Results Reporting
  - Iso-Risk Contours & F-N curves
- Uncertainty Analysis
- QRA for Layout and Spacing

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## **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

This course will introduce principles of Safety and Operability Studies for high voltage Electrical Power Systems (SAFOP) to the attendees. It will describe the purpose and objectives of different SAFOP study techniques, including Safety Analysis (SAFAN), Security and Operability Analysis (SYSOP) and Operator Task Analysis (OPTAN). In the course, the participants will learn about team composition, preparatory, documenting, and reporting requirements. This course will provide the participants with a better understanding of SAFOPs so as to contribute to future studies more effectively at their workplace.

## **Course Benefits**

- Learn the SAFOP terminology, tools and techniques
- Gain sufficient information to conduct efficient and effective SAFOPs
- Learn team leader qualities and characteristics to effectively lead SAFOP studies

## **Who Should Attend**

- PSM Managers and Coordinators
- Process, Safety, Electrical and Mechanical Engineers
- Professionals with a background in science and engineering

## **Prerequisites**

- None

*Continued on next page.*



## **Course Content and Agenda**

### **Day 1**

- Introduction to SAFOP Studies
- SAFOP Studies
  - Purpose
  - Objectives
  - Terminology
- Introduction to Different Types of Studies
- Safety Analysis (SAFAN)
- Workshop 1
  - Worked Examples of SAFAN Study
- Security and Operability Analysis (SYSOP)
- Workshop 2
  - Worked Examples of SYSOP Study
- Operator Task Analysis (OPTAN)
- Workshop 3
  - Worked Examples of OPTAN Study

### **Day 2**

- Timing of Studies
  - Initial Studies
  - Final Studies
- SAFOP Team Composition
- SAFOP Team Leader Roles and Responsibilities
- SAFOP Team Member Roles
- Study Execution
  - Scoping and Scheduling
  - Preparatory Work
  - Documentation and Reporting
  - SAFOP Study Execution Follow-Up
- SAFOP Pitfalls
- SAFOP Critical Success Factors
- SAFOP Report Example

## PSM 219: Developing Effective Standard Operating Procedures

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### **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

In this course, the participants will learn how to develop and write effective operating and maintenance procedures in process facilities. Well-written and effective operating procedures are essential to safe operation in process industries. Most regulatory regimes, including OSHA PSM and EPA RMP, enforce the use of written standard operating procedures. In order to comply with these requirements, many companies will have the employees develop operating procedures by simply documenting their actions which can lead to ineffective procedures. In this course, the attendees will learn about the different approaches to document and format operating procedures according to established principles and best practices. The regulatory requirements for procedures will be described along with interpretations from OSHA and the EPA. Examples will be used to demonstrate well designed and developed procedures.

### **Course Benefits**

- Learn to design and develop and write effective operating and maintenance procedures
- Learn about the regulatory requirements and their interpretations for operating procedures
- Learn about different approaches and industry best practices to develop operating procedures
- Learn about safe operating limits and consequences of deviation

### **Who Should Attend**

- Operations and Maintenance Personnel
- Process Engineers
- PSM Managers and Coordinators

### **Prerequisites**

- Experience in process industry

*Continued on next page.*

## **Course Content and Agenda**

### **Day 1**

- Introduction of Standard Operating Procedure (SOP)
  - Purpose
  - Who Should Write SOPs?
- General PSM Requirement for SOPs
- Operating Procedure Considerations
- Purpose of Establishing Upper and Lower Limits
- What Limits Should be Included?
  - Challenges of Establishing Limit
  - Information Required for Safe Operation
  - Operation Issues
  - Effective Boundary Management
  - Hierarchy Structure
- Safe Operating Limits and Consequences of Deviation
- Safety and Health Systems Considerations
- Guidelines for Writing Shutdown Procedures
- Guidelines for Preparing Operating Manuals
- Safe Work Practice
- Common Audit Findings for Operating Procedures
- Six Steps in Writing Procedures

### **Day 2**

- Considerations Prior to Writing Operation Procedures
- Design and Operating Intent
- Structure of an Operating Manual
- Auditing the Procedures
- Details of Modular Structure
- Operating Instructions
- Making Operating Procedures User-Friendly
- Circumstances for which Operating Procedures must be Written
- Generic Procedures and Vendor Manuals
- Batch Operations
- Workplace Design
- Batch and Procedure Based PHAs

## PSM 220: Overpressure Relief and Flare Analysis

### **Course Description**

**Accreditation:** 21 PDHs

**Duration:** 3 Days

In this course, the participants will be provided with an overview of pressure relief system design and requirements. In the process industry, pressure vessels and other equipment are to be protected from overpressure and vacuum scenarios through the use of relief devices/venting systems to prevent conditions that may cause serious injuries to personnel, costly mechanical damage and environmental releases. This course is designed to provide specific guidelines for evaluating the relief system design. This will entail analysis of overpressure scenarios, calculation of required relief rates, and relief device capacity and size. This course also provides engineering guidance on flare header design, e.g., flare height and heat radiation, knock-out drum disengagement analysis, flame-out prevention, smokeless combustion, etc. PSM demands adequate verification and documentation of the design basis for all new and existing pressure relief and disposal systems, but it does not outline how to do this nor what constitutes 'adequate' documentation. This course will cover the best practices pertaining to what constitutes adequate documentation for relief system design.

### **Course Benefits**

- Describe the various types of relief devices and how they function
- Understand how equipment may be over-pressured
- Know how to document Pressure Relief Systems
- Know how to specify and size a relief device
- Know what relief device resources are available
- Understand how codes, standards, and regulatory agencies influence the design of relief systems (e.g., API RP 520/521)
- Know how to screen for two-phase flow
- Understand about flare headers and flares

### **Who Should Attend**

- Process Engineers
- PSM Managers and Coordinators
- Personnel who have the responsibility of maintaining and auditing the pressure relief system design basis documentation for OSHA 1910.119 compliance

### **Prerequisites**

- Experience in process industry

*Continued on next page.*

# PSM 220: Overpressure Relief and Flare Analysis

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## **Course Content and Agenda**

### **Day 1**

- Introductions, Rules and Course Objectives
- Industry Regulations, Codes and Standards for Pressure Relief and Flare Systems
- Pressure Relief Device Terminology
- ASME Code Relief Device Requirements
- Types of Relief Valves (i.e., Conventional, Balanced Bellows and Pilot Operated)
- Rupture Disks

### **Day 2**

- PRD Documentation Requirements with no gaps allowed
- Relief Scenario Analysis
- Introduction to PSV Calculations – General Theory building by going over the 25 Possible Relief Scenarios One by One (i.e., Review the API RP 520/521 rules)

### **Day 3**

- Storage Tank Relief Devices (i.e., PVRVs (Conservation/Breather Vents), Manhole cover weighted emergency reliefs, vacuum reliefs, flame arresters)
- Flare Header Design
- Flare and Flare Knockout Pots
- Vent to a Safe Place Discussion
- Two Phase Flow Comments

### **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

This course is intended as an introduction to Facility Siting for advanced PSM practitioners. The course includes modules regarding the following: Why do we do Facility siting, What is the Regulation?, How we do Facility Siting Analyses, How to Analyze Buildings, Identifying Scenarios, Types of consequences and the vulnerabilities of persons and buildings, What kinds of Software are available, Reporting a Facility Siting Study and Pitfalls of Facility Siting. The course is organized in 24 modules for online self-paced study. Each module includes a brief 2-3 question quiz at the end of the module. Following the completion of the modules by all learners, the instructor will schedule an online live question and answer session.

### **Course Benefits**

- Learn the different methods, both qualitative and quantitative, used to address facility siting concerns and their benefits and limitations
- Learn how to identify hazardous scenarios that could affect occupied buildings
- Learn how facility siting study addresses spacing of process units, spacing between equipment and employees in occupied buildings, and spacing between equipment and potential ignition sources
- Learn to analyze if your facility has vulnerable locations for control rooms or other occupied buildings, and whether a building can provide shelter-in-place

### **Who Should Attend**

- PSM Coordinators and Managers
- Anyone who conducts or approves facility siting studies.

### **Prerequisites**

- Understanding of Process Hazard Analysis techniques

*Continued on next page.*

### **Course Content and Agenda**

- Why do we do Facility Siting
- The OSHA / EPA Regulation
- Industry Standards and RAGAGEP
- Facility Siting Analyses
- Scenarios and Scenario selection
- Risk Analysis
- Probabilistic Risk Analysis
- Analyzing Builds
- Offsite Personnel
- Analyzing Hazards
- Fire hazard Analysis
- Explosion Hazard Analysis
- Explosion Hazard Analysis and Explosion Confinement
- Explosion Hazard Analysis and Explosion Vulnerability
- Toxics Hazard Analysis
- Software Selection
- Developing Risk Criteria
- Understanding Results
- Mitigating Hazards
- Pitfalls of Risk Based Analysis
- Using a QRA as a Facility Siting Study

## **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

This course provides training on the BowTie methodology of risk analysis that pictorially depicts causal relationship in high-risk scenarios. It provides a visual representation of all likely incident scenarios around a hazard and identifies the controls that a company could use to control those scenarios. The participants will learn the fundamentals of the methodology and gain hands-on experience with BowTieXP software.

## **Course Benefits**

- Learn to conduct qualitative risk assessments using this technique
- Learn to use this technique as an alternative to other practiced compliance methods
- Hands-on training on the software for BowTie with examples
- Easy representation of hazards, top events and barriers to present to management

## **Who Should Attend?**

- PSM Managers and Coordinators
- Process, Safety and Mechanical Engineers
- Professionals interested in learning about risk

## **Prerequisites**

- None

## **Course Content and Agenda**

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Risk Management</li> <li>• Overview of BowTie</li> <li>• Step One: Hazards</li> <li>• Step Two: Top Events</li> <li>• Step Three: Threats</li> <li>• Step Four: Consequences</li> <li>• Step Five-Six: Preventive Barriers, Mitigation and Recovery Barriers</li> <li>• Step Seven: Escalations Factors</li> <li>• Step Eight: Barrier Attributes</li> </ul> | <ul style="list-style-type: none"> <li>• Risk and ALARP</li> <li>• BowTie Examples</li> <li>• Final Test</li> <li>• <b>Workshop:</b> A 1/2-day workshop with hands-on examples and apply BowTie concepts.</li> <li>• Course Evaluation</li> </ul> |
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## PSM 312: Failure Modes and Effects Analysis

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### **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

Failure Modes and Effects Analysis (FMEA) is a method for systematically determining the potential failure modes of systems, subsystems and basic components and their cause mechanisms. This helps in developing actions that can be taken to eliminate the causes before it could lead to an incident. In this course, the participants will learn about the utility and benefits as well as the methodology of conducting the different types of FMEA. This course will also talk about other techniques such Fault Tree Analysis which can be used in combination with FMEA. Participants will obtain hands-on experience with instructor-led FMEA facilitation and by working on examples in a team environment. Upon conclusion of the training course, participants should be prepared with the tools, checklists, and skills in order to serve as a FMEA Facilitator efficiently and effectively.

### **Course Benefits**

- Learn to systematically determine failure modes of systems and subsystems
- Learn the best practices and how to gather an efficient team to conduct an effective FMEA
- Learn to better identify and classify risk requiring corrective actions

### **Who Should Attend**

- Managers, Process Safety Coordinators and others responsible for satisfying OSHA PSM regulatory requirements
- Non-regulated companies desiring to design and implement a process safety management program

### **Prerequisites**

- None

*Continued on next page.*

## **Course Content and Agenda**

### **Day 1**

- Introduction
  - Overview of FMEA
  - Importance and Utility of FMEA
  - Benefits of FMEA
- History and Purpose of FMEA
  - Identifying and Prioritizing Risks
  - Developing an Action Plan for Reducing Risks
- Standards and Guidelines
- Types of FMEA
  - Design FMEA
  - Process FMEA
- FMEA Methodology
  - Types of Results
  - Resource Requirements
  - Team Composition
  - Analysis Procedure

### **Day 2**

- Fault Tree Analysis (Combined with FMEA)
- Keys to Success and Efficient FMEA Development
- Worked Examples
- Practice Workshops/Breakout Sessions
- Other Tools and Techniques Used or Related to FMEA

## **Course Description**

**Accreditation:** 7 PDHs

**Duration:** 1 Day

In this course, the participants will be provided with an overview of hydrogen safety design requirements and relevant codes and standards for hydrogen safe handling. This course will discuss the general requirements for fire safety and hydrogen storage, including gaseous (GH<sub>2</sub>) and liquefied hydrogen (LH<sub>2</sub>). As the usage of hydrogen is being more widely adopted outside of chemical and refining industries, the course will also introduce some of the design requirements for gaseous and liquified hydrogen fueling facilities.

## **Course Benefits**

- Learn the basics of hydrogen safety design requirement.
- Learn how to incorporate the safety requirements from codes and standards into your facilities.
- Improve hydrogen safety awareness for your organization.

## **Who Should Attend**

- Managers, Process Safety Coordinators, Process Engineers, Design Engineers, and others responsible for operation of hydrogen facilities.
- Companies desiring to implement and improve their existing hydrogen system.

## **Prerequisites**

- None

## **Course Content and Agenda**

### **Day 1**

- Introduction
  - Importance of Hydrogen Safety
  - Physical Properties of Hydrogen
  - Incidents Lesson Learned
- Standards and Guidelines
- General Fire Safety Requirements
  - Release of GH<sub>2</sub> and LH<sub>2</sub>
  - Emergency Plan
  - Ignition Source Controls
  - Personnel Training
- General Hydrogen Requirements
  - Design and Construction
  - Storage of GH<sub>2</sub> and LH<sub>2</sub>
  - Explosion Control
  - Electrical Equipment
  - Facility Siting and Minimum Distance Requirements
- GH<sub>2</sub> and LH<sub>2</sub> Fueling Facilities
  - Design and Construction
  - Dispensing and Maintenance

### **Course Description**

**Accreditation:** 14 PDHs

**Duration:** 2 Days

This course provides an introduction to the basic principles of Inherent Safety (IS) and highlights the differences between a traditional and inherently safer design (ISD). The participants will learn about how to implement ISD principles, where it fits best in the design life cycle, and how to measure it. They will also learn about the different techniques used to conduct IS reviews in a facility. The course describes the challenges to the implementation of ISD principles and how different regulatory regimes have implemented them.

### **Course Benefits**

- Learn to use principles of IS in new and existing facilities
- Learn about the hierarchy of controls
- Learn the benefits of ISD
- Learn from practical examples on how to implement ISD at your facility
- Learn how ISD is practiced in different regulatory regimes and new changes expected in the US

### **Who Should Attend**

- PSM Managers and Coordinators
- Process, Safety and Mechanical Engineers
- Professionals with a background in science and engineering

### **Prerequisites**

- None

*Continued on next page.*

## **Course Content and Agenda**

### **Day 1**

- Introduction
- What is ISD?
- Traditional vs ISD
- Hierarchy of Controls
  - Inherent
  - Passive
  - Active
  - Procedural
- Principles of ISD
  - Minimize
  - Moderate
  - Substitute
  - Simplify
- Industry Examples of Each Principle

### **Day 2**

- IS in the Design Life Cycle
- How to Measure IS
  - ISD Indices
  - Limitations of Indices
- Implementing ISD
- IS and Security
- ISD Design Conflicts
- EPA's New Proposed Rule on Safer Technology and Alternative Analysis (STAA)
- Challenges to Application of ISD Approaches
- Case Studies

## 4. Instructors Bios



**Mr. Robert J. Weber, President/CEO and Founder/Owner of PSRG**, is a Registered Professional Engineer with more than 35 years' industry experience. In addition to managing day-to-day activities, Mr. Weber is actively engaged in ensuring PSRG's responsive, timely, and quality delivery of services providing training, quality assurance and, performing as Program Manager/Project Director and Subject Matter Expert for a variety of PSRG projects. He has experience in project management, FEED and detailed EPC, technical writing, multinational strategic planning, techno-economic analysis and feasibility studies, enterprise risk management, safety, risk, reliability, loss prevention, incident investigation, and security planning. He is knowledgeable in regulatory requirements (COMAH, DHS, DOT, EPA, and OSHA) and RAGAGEP (e.g., API, ASHRAE, ASME, IIAR, ISA/IEC, NEC, NFPA, etc.). Mr. Weber has worked on hundreds of projects in more than 90 countries worldwide. He holds an M.S. in Mechanical Engineering from University of Illinois at Urbana-Champaign and MBA from Northwestern University Kellogg Graduate School of Management.



**Mr. Lawrence Warren, Technical Manager (Asia Pacific)**, has more than 25 years' experience in the chemical, petroleum, manufacturing, aerospace, and nuclear industries. He is an expert in Process Hazard Analysis (PHA), Process Safety Management (PSM), and incident investigation. He has managed and performed hundreds of PHAs, risk analyses, and incident investigations for a wide variety of batch and continuous processes manufacturing facilities using, separating, storing, or destroying hazardous materials. Mr. Warren participated in the Baker Panel investigations following a major refinery incident in Texas City, Texas. He has taught hazard recognition, PHA, PSM, and incident investigation analysis techniques to hundreds of engineering, operating, and maintenance personnel. Mr. Warren received his engineering degree from the University of Illinois at Chicago. Prior to joining PSRG in 2011, Mr. Warren worked for several petroleum and chemical companies including BP, Henkel, BASF, Enterprise Products, Fluor Corporation and Taknia Engineering (Libya).



**Ms. Madonna Breen, Process Improvement and Reliability Manager**, received her M.S. in Chemical Engineering from the State University of New York. She has over 25 years' experience as a Process Improvement Manager in organic peroxide manufacturing. She has worked on many projects related to process safety with PSRG including facilitating Process Hazard Analyses (PHA) and leading many PSM/RMP compliance audits. While in manufacturing, she developed Management of Change processes and procedures, led incident investigations, facilitated and participated in PHAs, developed and oversaw operator process overview training, developed and certified operating procedures, assisted with compliance, risk/behavior-based and contractor audits; and ran kinetics studies to determine reaction rates for all product lines. Most recently (2016-2020), Madonna was seconded to YCI Methanol One LLC / Koch Methanol as the SME to implement Process Safety Management systems for a new methanol production facility in St. James, Louisiana.



**Mr. Aaran E. Green, Process Safety Specialist**, has over 15 years' industry experience, including six years' safety and risk experience in refining. Mr. Green has worked on multiple process safety management projects. He has facilitated many PHA studies and has worked on multiple projects with major oil and gas refineries, including PHA/LOPA studies, PSM/RMP compliance audits, incident investigations, facility siting studies, and continuous improvement assays. Mr. Green also provides Quality Assurance/ Quality Control services, expertise in HAZOP and LOPA methodology, and functions in the role of Project and Client Manager for a number of PSRG projects. Mr. Green has taught numerous process safety courses during his time with PSRG.

## 4. Instructors Bios



**Mr. Mike Munsil, Senior Project Manager (HSE) and Director (Latin America)**, has more than 30 years' diversified experience in training, process safety, risk management, and environmental consulting in the chemical, petrochemical, petroleum, mining, and coal industries. He has conducted PSM studies and audits, PHA/LOPA studies, Bow-Tie analysis, ISO 9001 audits, EHS audits, underground storage tank investigations and remediation, soil and ground-water contamination investigations and remediation, groundwater modeling efforts, geo-physical studies, environmental risk audits, Phase I, II, and III environmental site assessments, and risk management plans for various facilities to comply with federal, state and local regulations. Mr. Munsil has

worked in Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, the Dominican Republic, the US, Mexico, Brazil, Chile, Colombia, Panama, Peru, Vietnam, and Venezuela and has represented both U.S. and Mexican clients with Mexican regulatory authorities (SEDUE, SEDESOL, CAN, SEMARNAP, SEMARNAT). He is a Certified Root Cause Analysis (RCA) Facilitator. He is fluent in both English and Spanish.



**Mr. Ryan Terry, Chief Facility Siting and Quantitative Risk Assessment**, received his BS in Chemical Engineering from Texas A&M University and his Process Safety Certification from the Mary Kay O'Conner Process Safety Center. He has more than 10 years of experience consulting in the process safety industry, serving as the lead technical specialist and principal contact for all QRA, facility siting, and consequence analysis projects. He has performed numerous facility siting and QRA projects for clients all over the world in the hydrocarbon, LNG, and chemical process industries. Additionally, he has experience in auditing all elements of Process Safety Management (PSM) and has certifications in PSM, HAZOP, Layer of Protection Analysis (LOPA), bow-tie facilitation, incident investigation, and Computational Fluid Dynamics (CFD).



**Ms. Annie Nguyen, Director for PSRG Asia Pacific Pte. Ltd**, holds a B.S. in Bio-Engineering from University of Minnesota, Twin Cities. Ms. Nguyen is responsible for managing and supporting safety services to clients in the Asia Pacific region. She has facilitated a number of PHA studies (HAZOP/HAZID, LOPA, BowTie etc.) from FEED to detailed design for clients including Fluor, GE, CB&I, KBR, and CPCHEM. She is knowledgeable of process safety management standards (US OSHA, Singapore SS 506 Part 3). Ms. Nguyen was lead auditor for numerous PSM/RMP and CCPS (20 element) compliance audits for clients including PetroVietnam Binh Son Refinery, Unilever, Lopez Foods, Noltex, Nova Molecular, Stolthaven, and numerous others. Ms. Nguyen has

conducted PHA-HAZOP Training and other PSM training courses in the Asia Pacific Region. She is fluent in English and Vietnamese.



**Mr. Tekin Kunt, Ph.D., CSPO, Director, EMEA (Europe, Middle East, and North Africa)**, received his Ph.D. in Chemical Engineering from University of Maryland at College Park. Dr. Kunt has over 25 years of experience in implementing risk-based chemical engineering modeling and optimization methodologies for oil and gas production, refining and chemical processes, pipeline operations, electricity distribution, food, pharmaceuticals, and consumer products. Over the years, he has delivered various custom workshops and public training courses in the U.S., Europe, the Middle East and Asia. Dr. Kunt is a Certified PHA Facilitator and has conducted many PHA studies using HAZOP and

LOPA methodologies. Dr. Kunt also leads and participates PSM/RMP and CCPS (20 elements) compliance audits globally. He is fluent in English, French, and Turkish.



## 4. Instructors Bios



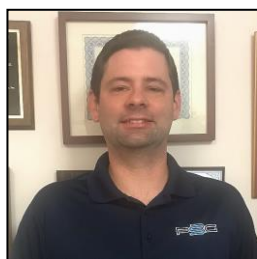
**Mr. Oscar Peña, Senior Process Safety Specialist**, has over 40 years of experience in the petrochemical and refining industry covering operations, front line management, process safety, maintenance coordination, environmental compliance and contractor management. His skills and expertise include process operations, operations management, contractor management, TAR and daily maintenance coordination, budgeting, process safety management, and program development/implementation (e.g., LOTO, environmental fugitive emissions compliance, operator training). Mr. Peña has held positions as an operator in an Olefins unit, relief shift foreman, Maintenance Coordinator, Environmental Compliance Coordinator and Senior Process Safety Specialist. He has extensive experience as a PHA/LOPA facilitator, PSM/RMP auditor, operating procedure writer and operations trainer.



**Mr. Russell ("Russ") E. Kawai, BSc. P. Eng. Is Principal Process Safety Engineer** with PSRG and has more than 30 years of international experience in natural gas, petroleum refining, olefins, ammonia/urea, methanol, mining and steel plants. He is a Licensed Professional Engineer in Ontario, Canada and holds degree in Chemical Engineering from University of Waterloo (Canada). He is based near Toronto. Russell has invaluable skills and ability to quickly understand the operation and control of any manufacturing operation through engineering and PHA facilitation experience with a diverse group of production facilities using a variety of techniques (e.g., What If, HAZOP, LOPA, FTA, FMEA). He is an innovative, detail-oriented Professional Engineer and Problem Solver with years of engineering experience and learnings in Process Safety, Risk Management, Process Engineering, Manufacturing Improvement, and Quality Management in North America, Australia, China, Korea, Saudi Arabia, Taiwan, Trinidad, and other countries. In addition to his PHA/LOPA experience, he is a Certified Root Cause Analysis (RCA) Facilitator, ISO 9001 Lead Auditor, and Six Sigma Black Belt.



**Mr. Agustín Rodríguez Ponce**, Process Safety Engineer, received his B.Sc. in Chemical Engineering from the Instituto Politécnico Nacional and became a Process Safety specialist after a 2-year training at BASF Process Safety. He has twenty eight years of combined experience as process engineer, process safety engineer, project manager and Technical Manager working in engineering design projects, start-ups and PSM responsible for the Chemical Process and Manufacturing. He currently conducts PSM/RMP and CCPS' risk-based process safety elements compliance audits, facilitates PHA studies (HAZOP, HAZID, What-If, Checklists). He is focused on projects in LATAM region.



**Mr. Brian Fagala is a Process Safety Engineer** with experience more than 10 years' experience in the upstream and downstream petroleum industries including offshore production, refining, and petrochemical manufacturing sectors. He is experienced in all elements of OSHA Process Safety Management (PSM) but specializes in multiple forms of Process Hazards Analysis (PHA), Management of Change (MOC), Facility Siting Studies (FSS), PSM Auditing, and Process Safety Information (PSI) Management. Mr. Fagala has led dozens of HAZOP and LOPA studies for numerous companies in the US and abroad in Africa, Asia, and Canada. He has also participated and/or led more than a dozen PSM audits for facilities in the US. Mr. Fagala received his chemical engineering degree from Texas A&M University at College Station.



## 4. Instructors Bios



**Mr. Roberto Ruiz, Principal Process Safety Engineer (Latin America)**, holds a B.S. in Electromechanical Engineering and a M.Sc. in Natural Gas Applications, as well as M.Sc. in Safety Engineering from Texas A&M University. He has more than 18 years of experience in the oil & gas and mining industry in positions such as analyst, supervisor, shift manager, and service head. He is experienced in mechanical integrity, facilitating process hazards analysis studies (HAZOP, LOPA, What-if, Bowtie), PSM/RMP and CCPS (20 elements) compliance audits, facility siting and consequence modeling studies (dispersion, fire and explosion). He has participated as speaker in the 9th CCPS Latin America Conference on Process Safety and 19<sup>th</sup> Global Congress on Process Safety, as well as in conferences and webinars. He is trilingual in Spanish, English, and Portuguese and supports projects in Latin America region.



**Mr. Carlos Dominguez** is a Principal Process Safety and Risk Engineer based in Madrid, Spain. He has over 20 years of extensive experience in process safety consulting, including as engineering lead in several Engineering Projects within Conceptual, Basic and Detailed Engineering phases. He has chaired more than 100 PHA studies (HAZID, HAZOP, LOPA, etc.) and QRA (Quantitative Risk Analysis), FERA (Fire and Explosion Risk Analysis) and Environmental Impact Assessments, as well as PSM Audits and implementing, and Incident Investigations. Mr. Dominguez holds a B.S. in Chemical Engineering degree and an M.S. in Project Management. He is Certified TUV Functional Safety Engineer, PHA Leader, and Risk Assessment Specialist by OSINERGIM Peru. Besides Safety Engineering duties, Mr. Dominguez led multidiscipline teams for ITT technical evaluation processes for EPC Projects (pre-selection and selection) and had conducted some workshops for establishing optimum schemes for project development based on Saaty hierarchy analysis. As a Project Manager, he had also conducted several Value Adding Studies as Value Engineering, Project Risk Analysis and Constructability analysis.



**Ms. Idil Osmanli an Experienced Chemical Engineer** with a strong background in Process Safety and over 11 years of proven leadership in various PHA methodologies, including HAZOP, What-If, FTA, and ETA. Skilled in implementing safety management systems in compliance with OSHA and CCPS guidelines, overseeing Management of Change (MOC), and managing safety-critical instruments. Adept at facilitating interdisciplinary teams, conducting PSM audits, and providing regulatory guidance. Proficient in risk assessment, incident investigation, and root cause analysis, striving to enhance operational excellence and maintain incident-free operations.



**Mr. William Giang is a Registered Professional Engineer and Process Safety Engineer** at PSRG Inc. with experience in the chemical and refinery industries. He holds a B.S. in Chemical Engineering from University of Houston. He is experienced in designing pressure relief devices sizing calculation, conducting facility siting and consequence modeling studies, and facilitating process hazards analysis studies. He is knowledgeable in OSHA PSM, EPA RMP and participated in many PSM audits for clients in America and Asia. He published a white paper at the AIChE Spring Meeting & 16th GCPS Conference on the topic of "Pressure Relief Location – A Hidden Hazard" and was a speaker at the IChemE Hazards AP 2019 Conference in Kuala Lumpur, Malaysia. He is trilingual in English, Vietnamese, and Chinese and responsible for operations in the both America and APAC region.

## 4. Instructors Bios



**Mr. Seçkin Gökçe is a Chemical Engineer (B.Sc.)** and developed his career on Process Safety Engineering in Oil & Gas Industry. He has been certified by TÜV Rheinland as FS Engineer (18650/19) and NEBOSH Process Safety Management. He took part in the establishment stages of the Process Safety Management (PSM) system at the refinery and carried out activities to increase the safety culture. He has conducted many risk assessments and solved many problems during this period. He has well understood the fundamental concepts of various risk assessments studies for different needs and experienced those couple of different demands and projects e.g., Facility Siting, Hazardous Area Classification, LOPA, QRA and Consequence Modelling. He has sound knowledge and understanding of operation standards like API, NFPA and IEC. He has a smooth communication and pleasant facilitation style that builds up

synergy among different engineering disciplines to come up with effective, efficient, safe and feasible solutions every time and in a timely manner.



**Ms. Laura Fajardo, Process Safety Engineer**, holds a bachelor's degree in chemical engineering from National University of Colombia and a Master's degree in gas processing for the University of Buenos Aires, Argentina. She has over 23 years' experience in Process Engineering, Safety Relief Engineering and Process Safety in projects for the Oil & Gas (Onshore and Offshore), Petrochemical, Manufacturing, and Food Processing industries. She has worked on different projects in U.S., Europe, Asia, and Latin America. Ms. Fajardo is fluent in English and Spanish. She has facilitated multiple PHA studies across different industry sectors. Also, she has led and participated in multiple OSHA PSM and EPA RMP compliance audits. She is also

experienced in design, revalidation and mitigation of overpressure protection systems, process configuration and simulations, PFDs and P&IDs development, hydraulics calculations and equipment design.



**Mr. Ajaykumar Kakkanattu is a Chemical Engineer** with more than 18+ years of international experience petroleum refining and petrochemicals, specialty chemical industries ranging from basic process technology development, engineering design and operations. He is experienced in all elements of OSHA Process Safety Management (PSM) and their effective implementation. He has led and supported several process safety projects for new technologies under development, greenfield and brownfield operating units including new, revamp and revalidation. He has hands on experience process hazard analysis and risk assessment (Facility Siting, QRA, FHA, HAZOP, LOPA), process simulation & design and project management for wide range of projects from conceptual to operations stage. He is experienced in commissioning and startups of

mega capital projects and responsible for process safety reviews for these projects.



**Mr. Wilson Davidson, CSP, a Principal Consultant/EHS Manager** and based in the Atlanta area. He has over 30 years of industrial experience working at manufacturing sites and corporate level, and 5 years in the EHS Consulting industry. His work is focused on Environmental, Occupational Health and Safety, Process Safety and Risk Management. He has been involved in more than 80 EHS and PSM audits in his career. Wilson is a Certified Safety Professional. Mr. Davidson has worked with multiple industries such as food and beverage, beauty, home and personal care, chemicals, aluminum extrusion, metal processing, medical devices, paints and coatings, and appliances manufacturing. This experience includes more

than 20 years of international work for multinational companies.

## 4. Instructors Bios



**Mr. Ed Lowe, Senior Safety and Reliability Engineer**, has over 40 years' experience with proven performance in the refining, petrochemical, and chemical industries in the areas of refinery management, operations, maintenance, front line management, process safety, engineering, technical support, human resources, and administration (including union and business contract negotiations). His skills and expertise include operations management, strategic planning/budgeting, engineering/maintenance management, highly hazardous material handling, process safety management, ISO 9000/product stewardship, regulatory compliance, labor/employee relations, policy and procedure development, project management, turnaround planning, and process improvement. He has held positions of PSM Manager, Plant Manager and Maintenance Manager during his career at various petrochemical companies. Mr. Lowe has taught courses on mechanical integrity and conducted numerous PSM/RMP audits. He has also facilitated many PHAs.



**Mr. John Wilhite is a highly experienced Process Safety and Occupational Safety Management Subject Matter Expert** with over 50 years of experience. At PSRG, John will be serving as a Principal Consultant and EHS Manager based in the Atlanta area. He will be responsible for providing our clients with expert advice and guidance on all aspects of process safety and occupational safety management. John will also be working to develop and implement new and innovative safety solutions.



## Contact PSRG

### **PSRG Inc. International Headquarters**

800 W. Sam Houston Parkway South Suite 107  
Houston, Texas 77042-1908 USA  
Tel: 1-800-250-8511 (in USA)  
+1 713-532-8800 (outside USA)  
Fax: +1 713-532-8850  
Email: [psrghouston@psrg.com](mailto:psrghouston@psrg.com)

### **PSRG China**

5 YongZhi Road, Building F,  
Room 728  
Qinhuai District, Nanjing City  
Jiangsu 210001, CHINA  
中国南京市秦淮区永智路5号, F座728室  
Tel: +86 25 84692926  
Fax: +86 25 52205345  
Email: [psrg-china@psrg.com](mailto:psrg-china@psrg.com)

### **PSRG Trinidad & Tobago**

c/o Diverse HSE Solutions Ltd. (DHSESL)  
7 Knaggs Street, Frederick Settlement  
Caroni, TRINIDAD  
Tel: + 868 479 6989  
Email: [psrgtt@psrg.com](mailto:psrgtt@psrg.com)

### **PSRG Middle East**

Trump Towers, Kuştepe Neighbourhood, Mecidiyeköy Yolu  
Cad.  
No:12 Tower:2 Floor:18  
Istanbul, İstanbul - Kâğıthane, 34387, Türkiye  
Email: [psrg-me@psrg.com](mailto:psrg-me@psrg.com)

### **PSRG Asia Pacific Pte. Ltd.**

Vision Exchange  
2 Venture Drive, #24-01  
SINGAPORE 608526  
Tel: +65 6914 7709  
Fax: +65 6914 9001  
Email: [psrg-asiapacific@psrg.com](mailto:psrg-asiapacific@psrg.com)

### **PSRG West Africa**

Level 3, Foreshore Towers  
2A Osborne Road, Ikoyi – PO Box 74820  
Victoria Island, Lagos, NIGERIA  
Tel: +234 1 271 3405, 470 7844  
Fax: +234 1 271 3405  
Email: [psrgnigeria@psrg.com](mailto:psrgnigeria@psrg.com)

### **PSRG Latin America LTDA.**

Calle 100 # 8A-55 Torre C Piso 10  
World Trade Center  
Bogotá, COLOMBIA  
Tel: +57 1 646 7111  
Email: [psrgcolombia@psrg.com](mailto:psrgcolombia@psrg.com)

