R1

2027 Training Catalog

Process Improvement Institute (PII)
part of Trinity Consultants, Inc.
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www.piii.com

A sample of what some of our attendees and clients have said:

"We use PII nearly exclusively for our PHA/HAZOP needs. Since 2014, PII has led and documented the PHA/HAZOPs of our existing natural gas collection sites and our large gas process plant, and are now working on the PHA/HAZOP of our natural gas liquid separation plant. PII performed the LOPA and the more than 800 SIL Verifications on the gas processing plant. And PII performed high level risk assessments of the gas plant to help us decide between alternatives for proposed expansions. PII does very thorough work and are not afraid to take a hard stance on important issues; this has helped PlusPetrol make significant improvements to process safety. We especially appreciate the way they cover PHA/HAZOP of startup, shutdown, and online maintenance; we would not want to miss possible accident scenarios for these modes of operation. The value of using PII is quite high."

Mary Stella Corsaro
Global Safety & Operations Integrity Manager
PlusPetrol (Argentina and Peru)

"PII provides outstanding process safety and loss control training and consulting services. I have worked extensively with Bill Bridges and his colleagues from 1996 until now, 2016, and have found their expertise and standard of care to be second to none. They have customized training for CCP and have provided hands-on help with PHAs (HAZOPs), PHA revalidations, and continual improvement with PSM. One aspect of PII that we greatly appreciate is that they do not charge additional licensing fees (as others do) for use of and training with standard industry methods such as Root Cause Analysis. PII is considered part of our team at CCP. We highly recommend PII."

Mike Gromacki
President, DIXIE Chemicals
(Former Vice President of Operations/Chief Sustainability Officer)

Trinity Consultants | PROCESS IMPROVEMENT INSTITUTE Risk and Reliability Specialists

Expertise of Process Improvement Institute*

Our consultants and instructors are internationally recognized experts in risk assessments, risk management systems, PSM, and loss prevention. They are among the very best in the field because they combine complete theoretical understanding of their topic with the experience that is necessary to discriminate between something that works only in theory and something that works in practice.



Our instructors have trained over 8000 in PSM-related topics, including over 3800 investigators, 4000 PHA leaders, 3000 PSM experts and auditors, 1200 procedure writers, and many others on other topics.

Our personnel have led over 600 PHAs (qualitative risk assessments or HAZOPs; most of these were of entire units), over 150 major investigations, and over 65 major PSM audits. They have developed and implemented effective MOC programs, procedure writing protocols, and hazard review (risk assessment) methodologies. They are among the most experienced PSM experts and instructors in the world.

They have **served as chair or co-chair of 11 major international conferences on PSM** and have authored or co-authored over 50 articles/papers on PSM topics and were co-authors or primary authors of the following definitive textbooks for AIChE's Center for Chemical Process Safety (CCPS):

- **Guidelines for Initiating Events and Independent Protection Layers**, CCPS/AIChE, 2015 (Mr. Bridges was the principal author; this is an essential supplement to the original LOPA book which was co-authored by Mr. Bridges).
- **Guidelines for Conditional Modifiers and Initiating Events for LOPA**, CCPS/AIChE, 2013 (Mr. Bridges is a committee member and contributing author; this will be an essential supplement to the original LOPA book which was co-authored by Mr. Bridges).
- **Guidelines for Hazard Evaluation Procedures,** CCPS/AIChE, 2008 (3nd Edition) (this is the definitive text on performing PHAs; Mr. Bridges and Mrs. Tew were contributing authors)
- **Essential Practices for Managing Reactive Chemicals Hazards,** CCPS/AIChE, 2003 (Mr. Norsworthy was a committee member and contributing author)
- **Guidelines for Investigating Chemical Process Incidents**, 2003 (2nd Edition) (this is the definitive textbook on investigation; Mr. Bridges was a primary author)
- **Guidelines for Analyzing and Managing the Security Vulnerabilities of Fixed Chemical Sites,** CCPS/AIChE, 2002 (Mr. Norsworthy was a committee member and contributing author)
- **Layer of Protection Analysis**, CCPS/AIChE, 2001 (Mr. Bridges and Mr. Art Dowell were the inventors and primary authors; this is the definitive text on simplified quantitative risk assessment)
- **Guidelines for Hazard Evaluation Procedures,** CCPS/AIChE, 1991 (2nd Edition) (this is the definitive text on performing PHAs; Mr. Bridges was a contributing author)

They have co-authored six related standards for the US Department of Energy, as well as authoring or co-authoring the definitive papers on:

- How to address human error/factors during PHAs (and HAZOPs)
- How to analyze procedure steps for hazards/risks of performing steps incorrectly
- How to make your PHAs comply with US OSHA's PSM requirements
- What are the Costs/Benefits of PSM compliance
- How to get Near Misses Reported and Investigated
- How to write effective operating and maintenance procedures
- How to develop troubleshooting guides from HAZOP tables
- How to implement an effective LOPA program
- How to perform incident investigations and root cause analyses

A full résumé of each PII expert is available upon request; and we can provide you with a long list of references (your peers) that use us and can attest to the value of our services.

**In March 2026, Process Improvement Institute, Inc. (PII) was acquired by Trinity Consultants, Inc. PII is now part of Trinity Consultants and continues to deliver expert process safety consulting and training services. This integration enhances our capabilities and expands our team, allowing us to better support and serve our clients' needs.*

PII 2027 Public Course Calendar[R1]

Course Title	Typical Course Attendees	Fees (in USD)/ Duration	Jan. '27	Feb. '27	Mar. '27	Apr. '27	May '27	June '27	July '27	Aug. '27	Sept. '27	Oct. '27	Nov. '27	Dec. '27
Course 1 **Overview of Process Safety Management (PSM)** Reviews all elements of PSM for compliance and best practices. Excellent for workers.	• Workers – Operations, Maintenance, Lab, support staff • Engineers – Process, Safety, and Mechanical • Environmental Management and Technicians	1 day	*(only offered as a private course at client site)*											
Course 2 **Process Safety Management (PSM)** Detailed description of each PSM element and how these interrelate. Some exercises and many examples. Great starter for PSM implementers.	• Managers – Operations, Safety, Environment, and Executive • Engineers – Process, Safety, and Mechanical • PSM Implementation Team Members – Anyone involved with implementation • Compliance Auditors	$1,350 – 3 days in USA or by Distance Learning $1,995 – 3 days in Dubai (UAE)	4-6 Distance Learning					7-9 Dubai					1-3 Houston	
Course 3 **Compliance Auditing for Process Safety** Details of how to perform an audit (gather and analyzing data), using PSM elements as the focus.	• PSM Implementation Team Members • Managers – Operations, Safety, Environment, and Executive • Engineers – Process, Safety, and Mechanical • Compliance Auditors	$1,100 – 2 days in USA or by Distance Learning $1,695 – 2 days in Dubai (UAE)		4-5 Distance Learning				10-11 Dubai					4-5 Houston	
Course 4 **Incident Investigation & Root Cause Analysis Leadership** In-depth explanation and hands-on workshops for prospective investigators and analysts; course covers all aspects & all activities and uses industry best practices.	• Engineers – process, process safety, and mechanical • Operations and Maintenance Staff – senior operators, maintenance technicians, supervisors • Process reliability staff • Process quality control/assurance staff	$1,350 – 3 days in USA or by Distance Learning $1,995 – 3 days in Dubai (UAE)	**13-15 Napa**		3-5 Houston			16-18 Dubai				**6-8 Chicago**		**8-10 San Diego**
Course 4-O **Incident Investigation & Root Cause Analysis Overview** Overview for workers or management who may participate in investigations.	• Operations and Maintenance Staff, process reliability, and process quality control/assurance staff who may be team members • Managers who must ensure active participation on investigation and RCA processes	1 day	(only offered as a private course at client site)											

Atlanta=Atlanta, GA • Chicago=Chicago, IL • Charlotte=Charlotte/Gastonia, NC • Dallas=Dallas, TX • Houston=Houston, TX • Phoenix= Phoenix, AZ • San Diego=San Diego, CA • Bahrain or Dubai (UAE) • Distance Learning (Live, Online w/PII Expert Instructor) NOTE: All distance learning courses will begin at 8:00 am US Central Standard Time*

Trinity Consultants | PROCESS IMPROVEMENT INSTITUTE Risk and Reliability Specialists

PII 2027 Public Course Calendar *R1*

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Course 5 **Writing Effective Operating and Maintenance Procedures** Following the rules taught in this course will prevent human error. This course is designed for writers (operators, maintenance workers, etc.).	• Senior Operations and Maintenance Technicians are the primary targets of this course, since they should write their procedures and take ownership of them (maintenance technicians need only to attend the first day) • Engineers – Process, Safety, and Mechanical • PSM and Quality Compliance Auditors	$1,100 – 2 days in USA or by Distance Learning $1,695 – 2 days in Dubai (UAE)			9-10 Distance Learning						14-15 Phoenix		8-9 Distance Learning	
Course 6 **Mechanical Integrity** Explains how to comply with the MI requirements within PSM, as well as how to mesh MI with reliability. Many workshops.	• Designated employee responsible for designing, developing, and implementing a PSM-based MI program • Engineers – Mechanical & Plant & Reliability • Managers – Plant Manager, Maintenance, and Production • PSM Manager or Coordinators	$1,100 – 2 days in USA or by Distance Learning $1,695 – 2 days in Dubai (UAE)				12-13 Houston				3-4 Houston				
Course 7 **Management of Change and PSSR** In-depth explanation and workshops on managing changes to procedures, equipment, etc., including how to do simple hazard reviews and explains pre-startup safety reviews.	• Technical Managers and Supervisors • HSE professionals • Quality control managers and staff • Engineers • PSM coordinators • Most other staff who are involved with designing, implementing, tracking, and evaluating MOC programs	$1,100 – 2 days in USA or by Distance Learning $1,695 – 2 days in Dubai (UAE)			11-12 Distance Learning						16-17 Phoenix			
Course 8 **PHA/HAZOP Leadership** The best course on how to lead and scribe hazard evaluations; taught by experts who have led hundreds of PHAs. For people who will be leading/scribing.	• Process engineer or project engineer • Operations supervisor • PSM coordinator • EH&S Managers & Engineers	$2,500 – 5 days in USA or by Distance Learning $2,995 – 5 days in Dubai (UAE)	**18-22 Napa**					21-25 Dubai			25-29 Atlanta			**13-17 San Diego**
Course 8-O **PHA/HAZOP Overview** Review of the requirements and methods. Ideal for managers or for team members.	• Operations and Maintenance Staff, process reliability, and process quality control/ assurance staff who may be team members • Managers who must ensure active participation in PHA and hazard reviews (HAZOPs, etc.)	1 day	(only offered as a private course at client site)											

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Course 9 **PHA Revalidation** Best, proven methods for revalidating PHAs/ HAZOPs. For experienced PHA leaders.	This course is primarily for PHA leaders, but anyone with the following background will also find the course valuable: • Process engineer • PHA element coordinator/manager • PSM coordinator and auditors • EH&S Managers & Engineers	$1,100 – 2 days in USA or by Distance Learning				14-15 Distance Learning				5-6 Houston				
Course 10 **Human Error Prevention** Covers all of the reasons why humans make mistakes and why they develop habits (good and bad) and explains how to optimize each factor to control human error.	• Managers – Operations, Safety, Environment, and Executive • Production Supervisors • Training Managers • Engineers – Process, Safety, and Mechanical • PSM Coordinators and Managers • PHA (hazard review) Leaders and Incident Investigators	$1,100 – 2 days in USA or by Distance Learning $1,695 – 2 days in Dubai (UAE)			1-2 Houston			14-15 Dubai				**4-5 Chicago**		**6-7 San Diego**
Course 11 **Layer of Protection Analysis (LOPA)** Thoroughly explains how to perform LOPA to judge risk and to determine the proper SIL. Taught by one of the 3 primary authors of the industry textbook on LOPA.	This course is designed for **experienced PHA/HAZOP leaders;** however, others will benefit from learning this simpler method for estimating risk. Only individuals with a strong technical background (such as engineers and scientists) should attend. Others who may benefit from this course include: • Managers – Operations, Safety • Project Managers • Engineers – Process, Safety, and Mechanical • PSM Coordinators and Managers	$1,200 – 2 days in USA or by Distance Learning $1,795 – 2 days in Dubai (UAE)	26-27 Houston					28-29 Distance Learning					**29-30 San Diego**	

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Course 12 **Safety Instrumented Systems (SIS & SIL)** Details how to determine when a SIF is needed, determine the proper SIL, specify and design and SIS, verify the SIL, and install and maintain and validate the SIF/SIL. Taught by one of the developers of SIL verification standards.	This course is designed for those needing to learn what are SIS, and especially those wanting to learn how to verify SIL design and install and validate SIS/SIL. The course workshops focus primarily on SIL verification and design. The coverage of SIL determination is minimal since Course 8 and Course 11 cover this topic in topic in detail. Consider taking this course in conjunction with Course 11, LOPA. Those who may benefit from this course include: • Managers – Operations, Safety • Project, Engineering, and Technical Managers • Engineers – Instrumentation, Electrical, Process, Safety, and Mechanical • Technicians/Specialist – instrumentation • PSM Coordinators and Managers	$1,200 – 2 days in USA or by Distance Learning $1,795 – 2 days in Dubai (UAE)	28-29 Houston					30-July 1 Distance Learning						**1-2 San Diego**
Course 13 **Job Safety Analysis (JSA)** Detailed procedures and workshops to teach workers and supervisors how to perform JSAs.	• This course is for anyone involved in operations and maintenance that needs to know how to perform JSAs of new or existing tasks. Ideal for all operators and maintenance workers • In addition, full-time safety practitioners, safety committee members, safety coordinators, safety specialists, safety managers, loss control managers, and operations managers can benefit from this course	3.5 hours (2 sessions offered each day)	(only offered as a private course at client site)											
Course 14 **Human Error Prevention - for Workers** A customizable course to explain human errors to workers, with options to provide tools for controlling errors (such as JSA, STAR, etc.).	• This course is for anyone involved in operations, maintenance, lab, utilities, and other support areas to a process, with direct hands-on responsibilities. Ideal for all operators and maintenance workers • In addition, full-time safety practitioners, safety committee members, safety coordinators, safety specialists, safety managers, loss control managers, and operations managers can benefit from this course	1-3 days, depending on needs	(only offered as a private course at client site)											

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Course 15 **Safety Task Action Reporting (STAR)** Workshops to teach workers how to control bad habits in the workplace.	• This course is for anyone involved in operations, maintenance, lab, utilities, and other support areas to a process, with direct hands-on responsibilities. Ideal for all operators and maintenance workers • In addition, full-time safety practitioners, safety committee members, safety coordinators, safety specialists, human resources, safety managers, loss control managers, and operations managers can benefit from this course	1 day - worker course 1-day - managers course	(only offered as a private course at client site)											
Course 16 **Behavior-Based Management for Safety and Reliability (Behavior-Based Error Reduction)** Best practices from lessons learned in the past 20 years of implementing effective methods for controlling habits. Can include a module on implementing STAR.	• This course is for anyone involved in operations, maintenance, lab, utilities, and other support areas to a process, with direct hands-on responsibilities. Ideal for all operators and maintenance workers • In addition, full-time safety practitioners, safety committee members, safety coordinators, safety specialists, human resources, safety managers, loss control managers, and operations managers can benefit from this course.	2 days	(only offered as a private course at client site)											

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Course 1: Process Safety Management (1-Day)

Recommended prerequisites: None. However, either this course or Course 2 is a recommended before attending Courses 4 through 9 (on various PSM elements). ***For a more in-depth study, you should plan to attend Course 2.***

This course introduces the PSM architecture (written programs, roles and responsibilities, implementation including training, record keeping, and auditing). The course explores all 14 key elements (parts) of a comprehensive PSM program and how the overall architecture applies to each. Links between elements and integration with existing and sometimes overlapping current company policies (such as quality and reliability programs) are also discussed.

Typical Course Candidates:

- Managers – Operations, Safety and Executive
- Engineers – Process, Safety and Mechanical
- PSM Implementation Team Members – Anyone involved with implementation including operators, maintenance personnel, and purchasing agents
- Compliance Auditors
- Environmental Management and Technicians

What You Will Learn:

- Basic performance-based requirements of PSM standards
- Jargon for communicating PSM requirements to others throughout the organization
- Specific guidelines for developing written programs tailored for each PSM element
- How to avoid costly implementation mistakes
- For each element
  - How to begin implementation at your company
  - Additional training necessary for implementation of specific elements

Take Home:

- Comprehensive course notebook containing
  - Sources of PSM information
  - Comprehensive list of key PSM performance indicators
- Certificate of Completion
- 0.8 CEUs & 0.8 COCs

1-Day PSM, Course Outline (1-day, 8:00 a.m. to 3:30 p.m.)

Introduction to PSM

- Overview of PSM standards and regulations, summary, definitions, origins, goals

Elements of PSM:

- Employee Participation
- Process Safety Information
- Operating Procedures

- Hot Work Permit/Safe Work Practices
- Training
- Contractors
- Process Hazard Analysis
- Management of Change
- Mechanical Integrity
- Pre-Startup Safety Review
- Emergency Planning and Response
- Incident Investigation
- Compliance Auditing
- Trade Secrets
- Management Commitment and Accountability

PSM programs – Developing, Implementing and Planning

Overview of Key Performance Indicators (KPIs) for PSM elements

More Information

This course is only offered as a private offering at a client's site. Please contact PII for details about having our training provided at your site.

Course 2: Process Safety Management (3-Day)

Recommended prerequisites: None. However, this course is a recommended before attending Course 3: PSM Auditing.

This course provides an in-depth study of each PSM element. The course introduces each PSM element and the specific guidelines for integrating PSM element requirements into other corporate programs and evaluating program compliance throughout the implementation phase.

Case Studies – Case studies and exercises are used throughout the course to illustrate interpretations of the requirements and demonstrate ways to develop an effective PSM program, including several video based case studies.

Typical Course Candidates:

- Managers – Operations, Safety, and Executive
- Engineers – Process, Safety, and Mechanical
- PSM Implementation Team Members – Anyone involved with implementation, including operators and maintenance personnel
- Compliance Auditors
- Environmental Management and Technicians

What You Will Learn:

- To interpret the performance-based requirements of the U.S. OSHA PSM and EPA risk management standards, as well as learn about related industry standards
- The elements of process safety that are missing from typical PSM systems, including Human Factors elements (communication, human system interface, work environment, staffing, and fitness for duty), Facility Siting element, Project Risk Management, Senior Leadership & Accountability. The Risk-Based Process Safety (RBPS) guide (2007) from CCPS/AIChE is reviewed so you can understand how to close critical gaps
- Multiple options for implementing an effective need-specific program
- Specific guidelines for developing cost effective written programs tailored for each PSM element, whether for a single facility or a corporation
- How to avoid costly implementation mistakes
- Jargon for communicating PSM requirements to others throughout the organization
- For each element
  - How to develop written programs to meet PSM requirements
  - How to incorporate and integrate the PSM element requirements into other corporate programs (other corporate management systems)
  - Key performance indicators
  - How to evaluate program compliance throughout implementation
  - How to begin implementation at your company
  - Additional training necessary for implementation of specific elements
- The course uses actual and generic case studies, including several video-based case studies
  - To illustrate interpretations of PSM requirements
  - To demonstrate developing an effective PSM program that can be adapted for your facility

Take Home:

- Comprehensive course notebook containing
  - Sources of PSM information, including examples of working PSM systems
  - Clarifications and interpretations of OSHA PSM standards
  - Comprehensive list of key PSM performance indicators and how to use them
- Certificate of Completion
- 2.1 CEUs & 2.1 COCs

3-Day PSM, Course Outline

Day 1 (8:00 a.m. - 5:00 p.m.)

- Introduction to PSM and its origins and goals
- Overview of PSM standards and regulations world-wide, definitions, compliance interpretations
- Elements of PSM:
  - Human error basics
  - Elements missing from most PSM systems, including specific human factor aspects, management commitment & accountability, and project risk management
  - Employee participation
  - Trade secrets
  - Process safety information
  - Operating procedures

Day 2 (8:00 a.m. to 5:00 p.m.)

- Elements of PSM (continued):
  - Hot work permit/safe work
  - Training
  - Contractors
  - Process hazard analysis
  - Management of change
  - Mechanical integrity
  - Pre-startup safety review

Day 3 (8:00 a.m. to 3:00 p.m.)

- Elements of PSM (continued):
  - Emergency planning and response
  - Incident investigation
  - Compliance auditing
- Key Performance Indicators, Leading Indicators, and Tracking
- Summary of roles and responsibilities
- Developing PSM programs, implementation planning
- *Course examination (optional)*

Course 2 Pricing for Public Offerings (per student):
$1,350.00 USD in USA
$1,995.00 USD in Bahrain and Dubai [UAE]

Course 3: Auditing for Process Safety/Risk Management (2-Day)

Recommended prerequisites: A thorough understanding of the PSM and RMP regulations; for a refresher course on PSM, see Course 1. Others should take Course 2 and apply PSM for at least one year before becoming a PSM/RMP auditor.

This course covers every aspect of auditing from gathering data via records and interviews, keeping notes, report writing, and making recommendations. Using all rules and methods taught in class, the second day is a workshop to audit actual PSM practices in a real-time setting.

Typical Course Candidates:

- PSM Implementation Team Members – Anyone involved with implementation, including
  - Managers – Operations, Safety, and Executive
  - Engineers – Process, Safety, and Mechanical
  - Environmental Management
- Compliance Auditors

What You Will Learn:

- Auditing fundamentals to help you structure effective PSM/RMP audits
- How to apply PSM and RMP compliance auditing to your system
- How to design audits that have dual purposes: verifying compliance with regulations and identifying weaknesses in the design and implementation of PSM/RMP programs
- How to properly document audit results for compliance and for internal purposes
- Extensive exercises and workshops are used to illustrate how to effectively perform each phase of a PSM audit
- Gain hands-on experience in:
  - Reviewing PSM/RMP programs in an audit team environment with real-time constraints and the need for team member consensus
  - Writing specific, concise audit findings and observations
  - Auditing techniques, including interviewing skills

Take Home:

- Comprehensive course notebook containing auditing tools and resources
- Electronic copies of audit tools, allowing audit checklist/protocol customizations
- Certificate of Completion
- 1.3 CEUs & 1.3 COCs

Auditing for Process Safety/Risk Management, Course Outline

Day 1 (8:00 a.m. to 5:00 p.m.)

- Scope of the audit
- Audit techniques
- Gathering data from people – interviewing
- Keeping notes/records
- **Workshop: Interviewing**
- Gathering data from records – reviewing documentation

- Gathering data from field observations
- **Workshop: Gathering, cataloging, and judging data**
- The audit report
- The audit process – planning the audit
- Audit follow-up and tracking

Day 2 (8:00 a.m. to 4:00 p.m.)

- Case Studies: Auditing the PSM/RMP system and its processes and products
  - Small teams will:
    - » Determine data needs
    - » Gather data (interview role-players, get data from company files, etc.)
    - » Use techniques taught in class to determine compliance with each element of PSM
    - » Judge compliance with your PSM standard
    - » Draft effective recommendations
  - Team presentations to class
- *Course examination (optional)*

Course 3 Pricing for Public Offerings (per student):
$1,100.00 USD in USA
$1,695.00 USD in Bahrain and Dubai [UAE]

Course 4: Incident Investigator/Root Cause Analyst Training (3-Day)

Recommended prerequisites: Participants should have practical, technical experience in design, operation, or maintenance of complex systems. Individuals with good logic skills do best in this course. Course 10 is especially helpful, but not required.

This training teaches how to lead investigations and root cause analyses using various techniques such as Causal Factor Charting, Fault Tree Analysis and Root Cause Charts. This is a "How To" course designed to teach skills. An optional part of the course can include 1 to 2 hours of software instruction.

Typical Course Candidates:

- Engineers – process, process safety, and mechanical
- Operations and Maintenance Staff
- Process reliability staff and process quality control/assurance staff

You Will Learn:

- How to meet regulatory requirements for incident investigations
- How to develop and implement a structured program
  - Designed for learning from incidents
  - Why and how to define misses
  - How to train others to recognize and report incidents
  - Includes planning for trending of data
- How to initiate and conduct an investigation
  - Establishing an effective team quickly and methods for collecting different types of data, including effective interviewing skills
- How and when to apply causal factor and root cause analysis for investigating process and non-process incidents
  - Includes event and condition charting (causal factor charting)
  - Filling data gaps using fault tree logic
  - "5-Whys" technique for finding root causes
  - PII's Root Cause Chart™ for categorizing root causes
- How to develop appropriate recommendations to address root causes at various levels and how to structure reports
- Via actual industry examples and workshops, learn key points and practice your new skills

Take Home:

- Comprehensive course notebook containing
  - Root Cause Chart™ , industry examples and solutions, and a 65-page Root Cause Analysis Guide on the use of the Root Cause Chart™
- Electronic (PDF) copy of course notebook, including the Toolkit , Root Cause Chart™, and Free Excel worksheet for documenting causal factor charts and fault trees
- Certificate of Completion and 2.0 CEUs & 2.0 COCs

3-Day Incident Investigator/Root Cause Analyst, Course Outline

Day 1 (8:00 a.m. to 5:00 p.m.)

- Basics of incidents and investigations
- **Workshop: Identifying near misses (near hits)**
- Initiating the investigation
- Gathering data
  - Basics
  - Gathering data from people
  - Gathering data from documentation, parts, and chemicals
- **Workshop: Identifying key data needs**
- Analyzing data for ALL causal factors
- **Workshop: Causal factor charting**

Day 2 (8:00 a.m. to 5:00 p.m.)

- Bridging gaps in data
- **Workshop: Using fault tree analysis to find all possible scenarios and determine the most likely one**
- Determining ALL root causes of each causal factor
- **Workshop: Identifying root causes using the "Root Cause Chart" technique**
- Developing conclusions and recommendations
- **Workshop: Conclusions and recommendations based on facts**
- Overview of results trending
- Preparing for the Case Study

Day 3 (8:00 a.m. to 3:30 p.m.)

- Case Study: Using all rules and methods taught in class to investigate actual incident in real-time setting. Small teams will:
  - Determine data needs
  - Gather data (interview role-players, get data from computer control systems, etc.)
  - Use causal factor charting and fault trees to analyze data and determine ALL causal factors
  - Use PII's Root Cause Chart ™ to determine the multiple root causes of each causal factor
  - Draft effective recommendations and make presentation to class
- *Course examination (optional)*

Course 4 Pricing for Public Offerings (per student):
$1,350.00 USD in USA
$1,995.00 USD in Bahrain and Dubai [UAE]

Course 4-O: Incident Investigator/Root Cause Analysis Overview (1-Day)

Recommended prerequisites: None

This training provides a general background in how investigations and root cause analysis (RCA) are performed. It explains the importance of near miss reporting and investigation as a proactive tool to control risk before losses/harm occur. This course is for anyone who needs a general understanding of investigations, including reporting of near misses and how to interview.

Typical Course Candidates:

- Operations and Maintenance Staff, process reliability, and process quality control/assurance staff who may be team members
- Managers who must ensure active participation on investigation and RCA processes

You Will Learn:

- How to meet regulatory requirements for incident investigations
- How and why to report near misses
- How to help a team gather data, especially interviewing of peers
- Overview of cause determination methods and overview of effective root cause determination methods
- How to develop appropriate recommendations to address root causes

Take Home:

- Comprehensive course notebook containing Root Cause Chart™
- Certificate of Completion and 0.7 CEUs & 0.7 COCs

1-Day Incident Investigator/Root Cause Analysis Overview, Course Outline

Day 1 (8:00 a.m. to 4:00 p.m.)

- Basics of incidents and investigations
- **Workshop: Identifying near misses (near hits)**
- Gathering data
  - Gathering data from people
- **Workshop: Identifying key data needs**
- Analyzing data for ALL causal factors
- Determining ALL root causes of each causal factor
- **Workshop: Identifying root causes using the "Root Cause Chart" technique**
- Developing conclusions and recommendations More Information

More Information

This course is only offered as a private offering at a client's site. Please contact PII for details about having our training provided at your site.

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Course 5: Writing Effective Operating and Maintenance Procedures (2-Day)

Recommended prerequisites: Participants should have practical, technical experience in design, operation, or maintenance of complex systems.

This course teaches how to write effective step-by-step operating procedures and how to develop troubleshooting guides from PHA documentation. This is very much a "How To" course, designed to teach skills. The first day of the course is for both operations and maintenance personnel; the second day is mainly for operators (since they typically must write more in-depth troubleshooting guides).

Typical Course Candidates:

- Senior Operations and Maintenance Technicians are the primary targets of this course, since they should write their procedures and take ownership of them (maintenance technicians need only to attend the first day)
- Engineers – Process, Safety, and Mechanical
- PSM and Quality Compliance Auditors

What You Will Learn:

- How to comply with regulatory requirements and quality control requirements for procedures
- How to perform detailed task analysis and writing step-by–step instructions
- How to assess current procedures for addressing best practice rules
  - This will be done in class, so bring procedures for review
- How to address operating limits and process deviations
- How to develop troubleshooting guides
- How to avoid common procedural errors that can reduce safety and quality levels, leading to incidents
- How to choose the best page layout/format for the goal of each procedure
- Learn 22 rules to help you write every step-by-step procedures effectively
- Learn where/when written procedures are required

Take Home:

- Comprehensive course notebook containing
  - Examples of acceptable procedural formats
  - Checklists for identifying missing procedures, gathering procedure information, formatting procedures, and writing step-by-step instructions
  - Completed workshops from class exercises, including typical solutions for each
- Electronic (PDF) copy of course notebook
- Certificate of Completion
- 1.3 CEUs & 1.3 COCs

Writing Effective Operating and Maintenance Procedures, Course Outline

Day 1 (8:00 a.m. to 5:00 p.m.)

- What is an effective procedure?
  - Goals, general concepts, definitions
  - Overview of process for developing procedures
  - Procedure requirements: industry standards for quality & safety regulations
  - Introductory Workshop: Writing effective instructions for a simple task (shows ahead of time why effective procedure writing rules are critical)
- Formatting the procedures
  - Step-by-step formats; Use of white space; Step numbering
  - Document control features — headers and footers
  - Introductory items — procedure titles, sections, and section titles
  - Use of graphics/figures
  - Review of Formatting rules and why each is important
- Writing step-by-step instructions
  - Rules for writing the most effective instructions: Using commands; keeping it simple; being consistent; being precise; use of references
  - **Workshop: Improving a poor step-by-step procedure**
- Addressing Operating limits and deviations
  - Defining "operating limits," "deviations," and more
  - Identifying deviations that may occur, including errors of omission and errors of commission (for step-by-step procedures)
  - Defining procedural boundaries using conditional statements, warnings, and cautions (for step-by-step procedures)

Day 2 (8:00 a.m. to 3:30 p.m.)

- Addressing Operating limits and deviations (for continuous mode of operation)
  - Listing the triggers for process parameters where action is required
  - Identifying the worst case and more likely consequences
  - Developing troubleshooting steps (diagnosis steps, steps to prevent excursions, steps to correct excursions)
  - **Workshop: Developing a troubleshooting guide for continuous operating mode**
- Deciding what procedures are needed
- Gathering information for a procedure
  - When/why the procedure will be performed
  - Main steps, sub steps, details, hazards, precautions
  - **Workshop: Creating a procedure from basic information**
- Verifying, validating, and certifying procedures
- Overview of managing changes to procedures
- Overview of risk review of procedures
- *Optional Exam*

Course 5 Pricing for Public Offerings (per student):
$1,100.00 USD in USA
$1,695.00 USD in Bahrain and Dubai [UAE]

Course 6: Mechanical Integrity (2-Day)

Recommended prerequisites: Participants should have practical, technical experience in maintenance of complex systems.

This course prepares you to evaluate your existing practices versus recognized codes and standards and then to efficiently improve or develop and implement your mechanical integrity (MI) program. Topics also include how to merge your MI program with a reliability program. To enhance the value of your training investment, plan to attend Course 6's companion course on writing effective maintenance procedures (Course 5).

Typical Course Candidates:

- Designated employee responsible for designing, developing, and implementing a PSM based MI program
- Engineers – Mechanical & Plant
- Managers – Plant Manager, Maintenance, and Production
- PSM Manager or Coordinators

What You Will Learn:

- Up-to-date MI strategies and techniques for effectively building and implementing a comprehensive MI program that addresses process safety management requirements and/or reliability and other concerns as defined through company, industry, and regulatory requirements
- Through lectures and case-study-based workshops, you will learn how to develop, implement, and maintain an efficient MI program. The experienced instructor guides you through building your own MI program regardless of the age, size, or complexity of the facility
- How to expand this program to encompass reliability and quality goals
- How to define and assign roles and responsibilities
- How to integrate your new or revised MI program with existing MI activities
- Develop an inspection and testing plan using your own equipment list or generic examples
- Quality assurance methods for identifying & resolving equipment deficiencies
- How to develop maintenance procedures and training programs for maintenance personnel
- How to develop a maintenance procedures list for your plant site

Take Home:

- An easily adaptable written MI program
- A comprehensive notebook covering all course topics
- Electronic (PDF) copy of course notebook
- A Certificate of Completion
- 1.3 CEUs or 1.3 COCs

Mechanical Integrity, Course Outline

Day 1 (8:00 a.m. to 5:00 p.m.)

- Introduction
  - Learning objectives, goals, and motivations for mechanical integrity (MI)
    - » Regulations, standards, and interpretations
    - » Relationship to Reliability programs
- Designing a mechanical integrity program
  - Minimal MI only for compliance or a fully integrated reliability program?
  - Something in-between?
  - **Workshop: Deciding in detail what you need your MI program to address (this sets the basis for later workshops and discussion)**
- Developing a mechanical integrity program
  - ***Equipment identification and related issues***
    - » List of critical equipment
    - » Types of MI activities (reactive, proactive, preventive, predictive)
    - » Choosing the right task type and choosing the specific task
    - » Determining the right frequency for the task (condition or time dependent)
    - » **Workshop: Starting the development of an inspection, test, and preventive maintenance (ITPM) plan**
  - ***Personnel focus***
    - » Procedures & Training
    - » **Workshop: Completing the development of an IPTM plan by identifying written procedures and training needs for your mechanical integrity program**

Day 2 (8:00 a.m. to 3:30 p.m.)

- Developing a mechanical integrity program (continued)
  - ***Management systems required and related issues***
    - » Quality assurance; Equipment deficiency resolution; root cause analysis; management of change
    - » **Workshop: Identifying gaps in your quality assurance plan and identifying additional needs for procedures and training**
- Implementing/Maintaining a mechanical integrity program
  - Review of detailed checklist for implementing an MI/reliability system
  - Documenting and managing data/results, computer systems and other equipment files
  - **Workshop: Customizing the detailed implementation checklist to your specific needs (optional)**
- Roles and Responsibilities for MI
- **Workshop: Identifying roles and responsibilities for your MI program**
- Key performance indicators for MI and continual improvement of a mechanical integrity program
- *Optional Exam*

Course 6 Pricing for Public Offerings (per student):
$1,100.00 USD in USA
$1,695.00 USD in Bahrain and Dubai [UAE]

Course 7: Management of Change & Pre-Startup Safety Review (2-Day)

Recommended prerequisites: Participants should have practical, technical experience in design, operation, or maintenance of complex systems.

MOC is the element for which all other "foundation" elements of PSM are implemented. It is the PSM element that controls introduction of new risk. Recognizing change, analyzing the risk of each change, and handling small changes efficiently are just some of the barriers that managers face with MOC implementation. This 2-day course explores proven strategies for implementing a workable MOC system and customized approaches to fit your company's culture. It also shows how to implement physical and instrumentation changes through the proper use of pre-startup safety review (PSSR) systems, sometimes called operational readiness reviews (ORRs). Written examples of programs for addressing simple and complex changes are included in the course notebook.

Typical Course Candidates:

- PSM coordinators and HSE professionals
- Engineers, Technical Managers, and Supervisors
- Quality control managers and staff
- Most other operation, maintenance, reliability, and quality staff who are involved with designing, implementing, and evaluating MOC programs

What You Will Learn:

- Requirements of a complete MOC System
- What PSSR is and how it works and how it can be combined with MOC and mechanical integrity systems
- How to realistically control both small and large changes, minimizing employees' needs to bypass the system
- Simple frameworks for identifying and analyzing risks associated with a recommended change to help ensure the minimum losses to your company (this is the heart of any MOC system)
- Training needs and requirements for all levels of your organization necessary to make managing change a functional system.
- How to integrate all company systems for managing specific functional changes into one MOC system to handle PSM, HSE, quality control, reliability, and productivity changes; and learn why this integration is so important

Take Home:

- Training tools for teaching your employees to recognize the difference between a replacement-in-kind and a change (take home copies included)
- Copies of real MOC and PSSR written programs, forms, and checklists of risk review & PSSR questions
- Electronic (PDF) copy of course notebook
- A Certificate of Completion
- 1.3 CEUs or 1.3 COCs

Day 1 (8:00 a.m. to 5:00 p.m.)

- Introduction
  - Learning objectives and overview of PSM
  - Overview of PSM
  - Overview of MOC and PSSR
  - **Workshop: Identifying which MOC failures led to a catastrophe**
- Recognizing or proposing changes
  - Review of basic definitions of replacement-in-kind (RIK) and not-replacement-in-kind (NRIK)
  - **Workshop: RIK vs NRIK Quiz**
  - **Workshop: Developing RIK and NRIK examples for your company**
- Initiating the change request
  - Who does what?
  - Initiating the change request form
  - Example of change request forms
- Reviewing the proposed change
  - Technical reviews and Risk reviews
  - **Workshop: Choosing the appropriate risk review method for a minor mechanical change**
  - **Workshop: Performing a risk review of a minor mechanical change**

Day 2 (8:00 a.m. to 3:30 p.m.)

- Reviewing the proposed change (continued)
  - **Workshop: Performing a risk review of a minor procedure change**
- Approving and implementing the change
  - Roles, responsibilities, and authorities
  - Tracking the change request through closure
- Pre-Startup Safety Reviews
  - Definitions and Style of PSSRs
  - Combining PSSR with other PSM or Reliability systems
  - **Workshop: PSSR Quiz**
  - **Workshop: Performing a PSSR for a minor mechanical change**
- Overall Roles and Responsibilities
- Managing the MOC/PSSR program(s)
  - MOC/PSSR scope decisions
  - Review of typical MOC Program in notebook
  - Review of typical PSSR Program in notebook
- Key Performance Indicators
- **Workshop: Implementation planning**
- *Optional Exam*

Course 7 Pricing for Public Offerings (per student):
$1,100.00 USD in USA
$1,695.00 USD in Bahrain and Dubai [UAE]

Course 8: PHA Leadership Training (5-Day)

Recommended prerequisites: Course 1 or Course 2 is recommended unless student has equivalent experience. Course graduates will be capable of organizing, leading, and documenting PHAs of processes or for changes to processes (MOC risk review). Only those who will be leading and/or scribing PHAs or administering the PHA (risk review) program should attend. Courses 9, 10, and 11 are highly recommended after this course.

The risk review techniques most popular for initial PHAs of entire units or of large projects, MOC reviews, and PHA revalidations are hazard and operability (HAZOP) analysis and what-if/checklist. Both of these techniques facilitate systematic, imaginative searches for process hazards and potential operational difficulties. In this course, you will also learn how to use the failure mode and effects analysis (FMEA) method and you will learn how to use checklists of hazards to supplement your brainstorming analyses. You will learn the best situations and circumstances to use each technique. **This course is mostly workshops: You will lead and participate in several analyses to familiarize yourself with each technique.**

Typical Course Candidates:

- Process engineer or project engineer
- Operations supervisor
- PSM coordinator
- E, H, & S Managers & Engineers

What You Will Learn:

- How to perform a PHA to meet PSM requirements for initial PHAs and management of change analyses including these critical elements:
  - How to prepare for the PHA; Scope the PHA; Collect information; Select the team; Lead a meeting; Document results
- **How to analyze operating procedures for critical accident scenarios**
- How and when to apply HAZOP, FMEA, and/or what-if/checklist analyses methods to any process system in any industry

Take Home:

- A CD containing hazard evaluation software and manual (license not included; demo works for 15 days; a license can be obtained separately)
- Blank PHA analysis forms, generic PHA report, and a spreadsheet for estimating the labor and time requirements for doing a PHA
- Electronic (PDF) copy of course notebook
- A copy of the course notes and problem solutions
- A Certificate of Completion
- 3.1 CEUs and 3.1 COCs

PHA Leadership, Course Outline

Day 1 (8:00 a.m. to 5:00 p.m.)

- Introduction: Learning objectives; Overview of process safety management; Risk assessment concepts; Overview of PHA requirements
- Overview of risk review methods
  - Methods and their usefulness over the life cycle of a process; Making risk judgments; Human factors concepts and how to address human factors during hazard evaluations
- Preparing for the hazard evaluation (risk review or PHA)
  - Scoping the analysis; Choosing technique and level of detail and sections; Choosing the team members
  - Logistics and procedures for pre-meeting, meeting, and post-meeting tasks
- What-if/checklist technique
  - **Workshop: What-if/checklist review of continuous process (instructor-led)**

Day 2 (8:00 a.m. to 5:00 p.m.)

  - **Workshop: What-if/checklist review of a continuous process (student-led)**
- HAZOP technique
  - **Workshop: HAZOP review of a continuous process**
- Analysis documentation, results, and follow-up
  - **Workshop: HAZOP review of a continuous process (continued)**

Day 3 (8:00 a.m. to 5:00 p.m.)

  - **Workshop: HAZOP review of a continuous process (continued)**
- HAZOP/what-if techniques for analyzing procedures and batch processes
  - **Workshop: HAZOP/what-if reviews of batch processes & procedures**

Day 4 (8:00 a.m. to 5:00 p.m.)

  - **Workshop: HAZOP/what-if reviews of batch processes & procedures**
- Failure Mode Effect Analysis (FMEA)
  - **Workshop: FMEA of a critical auxiliary system**

Day 5 (8:00 a.m. to 2:00 p.m.)

- Checklist analysis as supplements to brainstorming methods
  - **Workshop: Using Checklists after brainstorming methods**
- **Workshop: Estimating the schedule & labor required to perform a PHA**
- **As time allows, additional workshop: more HAZOP/what-if reviews**
- Software Training – Does NOT include a license to the software
- **Workshop: How to use software to prepare for and document hazard evaluations/risk reviews**
- *Certification exam (optional)*

Course 8 Pricing for Public Offerings (per student):
$2,500.00 USD in USA
$2,995.00 USD in Bahrain and Dubai [UAE]

Course 8-O: PHA Overview Training (1 Day)

Recommended prerequisites: None

This training provides general background in how process hazard analyses (PHAs) are performed. It explains the importance of PHAs for existing plants and PHAs/hazard reviews for changes to processes. This course is for anyone who needs a general understanding of PHAs.

Typical Course Candidates:

- Operations and Maintenance Staff, process reliability, and process quality control/assurance staff who may be team members
- Managers who must ensure active participation in PHA and hazard reviews

You Will Learn:

- How to meet regulatory requirements for PHAs
- Overview of team meetings and team member responsibilities
- Overview of hazard review methods
- Overview of making risk judgments in team settings
- Overview of how to develop effective recommendations and how to effectively resolve recommendations

Take Home:

- Comprehensive course notebook
- Certificate of Completion and 0.7 CEUs & 0.7 COCs

1-Day PHA Overview, Course Outline

Day 1 (8:00 a.m. to 4:00 p.m.)

- Basics of PHAs and other related hazard reviews required over the life of a process
- Overview of team meetings and team member responsibilities
- Video: Typical team meeting
- Overview of risk review methods
- Workshop: What-if analysis of a simple system
- Overview of making risk judgments in team settings
- Overview of how to develop effective recommendations and how to effectively resolve recommendations

More Information

Schedule:
This course is only offered as a private offering at a client's site. Please contact PII for details about having our training provided at your site.

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Course 9: Updating and Revalidating Process Hazard Analyses (2-Day)

Recommended prerequisites: Previous training in leading PHAs, such as completion of Course 8, as well as experience in leading PHAs of entire units.

This course prepares you to execute a PHA revalidation that complies with PSM regulations and industry standards. PHAs usually must be updated and revalidated every 5 years. Several factors determine the extent of the revalidation analysis, including the quality of your previous PHAs and its documentation, process and facility changes, incidents during the past 5 years, and new interpretations of codes and standards. In some cases a complete "redo" may be required if the previous PHA quality and documentation did not meet your standards or regulatory requirements.

Typical Course Candidates:

- Anyone who wants to understand how to decide on an appropriate approach for PHA revalidations and/or lead PHA revalidations should consider attending. Though this course is primarily for PHA leaders, anyone with the following background will also find the coursed valuable:
  - Process engineer
  - PHA element coordinator/manager/owner
  - PSM coordinator and auditors
  - E, H, & S Managers & Engineers

What You Will Learn:

- Options and requirements for leading a team through a revalidation process that satisfies PSM requirements and utilizes the best approach for your company
- Resource requirements for performing a revalidation
- Preparation, execution, and documentation steps to meet company's goals, streamline future analyses and to produce a functional report useful to many
- Experience in leading and documenting PHA revalidations through workshops
- Factors to determine the appropriate revalidation approach
- How to address previous PHA deficiencies
- How to identify improvements in operating procedures, training, and preventive maintenance through the revalidation process

Take Home:

- A revalidation decision tree (flowchart) to assist you in choosing the right revalidation approach for your facility
- A copy of the course notebook
- A Certificate of Completion
- 1.3 CEUs and 1.3 COCs

Updating and Revalidating Process Hazard Analyses, Course Outline

Day 1 (8:00 a.m. to 5:00 p.m.)

- Learning objectives and goals of revalidation
- Overview of PSM requirements for PHAs and Revalidations
  - Terms and definitions
  - Determining your goals (minimal compliance versus meeting the needs of procedure writers, trainers, and equipment reliability departments)
- Gathering required information
  - Previous PHA report and recommendation closure documents
  - Incident reports since previous PHA cycle
  - MOC records
  - Current P&IDs and P&IDs as existed during previous PHA cycle
  - Current SOPs and SOPs as existed during previous PHA cycle
  - **Workshop: Review of previous versus current documents to determine if MOC has worked adequately**
- Assessing the previous PHA report and other data
  - **Workshop: Compliance/Quality review of an example PHA**
- Considering "lessons learned"
- Defining the revalidation approach
- **Workshop: Choosing the revalidation approach (for an example PHA and set of gathered data)**

Day 2 (8:00 a.m. to 3:30 p.m.)

- Conducting the revalidation
- **Workshop: Revalidating a PHA (multiple examples)**
- Documenting the revalidation
- **Workshop: Revalidating a PHA (multiple examples)**
- *Certification examination (optional)*

Course 9 Pricing for Public Offerings (per student):
$1,100.00 USD in USA
$1,695.00 USD in Bahrain and Dubai [UAE]

Course 10: Preventing Human Errors (2-day version; can also be condensed to 1-day)

Recommended prerequisites: None. However, this course is an excellent supplement to several other courses, particularly Course 4: Incident Investigation/RCA Leadership and Course 8: PHA Leadership and Course 7: MOC & PSSR. All the issues covered in these three courses depend heavily on understanding how and why humans make mistakes.

Human error is widely acknowledged as the major cause of quality, production, and safety risks in many industries. This course explains the underlying reasons why humans make mistakes and how you can prevent these mistakes. Although it is unlikely that human error will ever be completely prevented, there is growing recognition that many human performance problems stem from a failure within organizations to develop an effective policy for managing human reliability.

The course will provide hands-on experience of practical error reduction techniques, using real-life case studies. You will also gain an understanding of the underlying causes of human error and how to reduce its occurrence by changing the culture of the organization and changing the design of the processes. **Workshops are used throughout the course to illustrate concepts and to demonstrate human error analysis applications.**

Typical Course Candidates:

- Managers – Operations, Safety, and Executive; and Production Supervisors
- Training Managers
- Engineers – Process, Safety, and Mechanical
- PSM Coordinators and Managers
- PHA (hazard review) Leaders and Incident Investigators

What You Will Learn:

- Why human error is a factor in all accidents
- Why humans make mistakes and proven error prevention techniques
- How to analyze and identify human errors and the conditions and situations that cause them
- How weak policies and procedures in areas of human resources, training, management, communication, and workplace design cause human errors
- How to improve and optimize procedures, workplace design, process design, and more to improve human performance

Take Home:

- Comprehensive course notebook containing
  - Checklists and worksheets for several human error analysis techniques
  - Industry examples
- Certificate of Completion
- 1.3 CEUs & 1.3 COCs (2-day version) or 0.7 CEUs & 0.7 COCs (1-day version)

Preventing Human Errors, Course Outline

(*NOTE:* Various video-based Case Studies, not shown below, *are used throughout the course to illustrate concepts and to demonstrate human error analysis applications.)*

Day 1 (8:00 a.m. to 3:00 p.m.)

Introduction to Human Error
- Learning objectives and goals of human error prevention
- What is human error and human error analysis?

Understanding Human Error:
- Errors and their relationship to loss events
- Which is most important: Management system deficiencies or personal behavior?
- Types of human error
- **Workshop: Classifying Human Errors**
- Modeling human behavior (an example of a simple model that works is used throughout the course)
- Elements associated with understanding and controlling human error
- **Workshop: Relating Human Error to Human Factor Influences**

Statistical Lower Limit of Human Error Rate and Quantitative Importance of Each Human Factors
- Error rates under various job/task design/settings
- Dependent (common cause) error rates
- Quantitative importance of each human factor
- **Workshop - Demonstrate a couple of human error probability estimates**

Common Human Error Prevention Techniques (Case Studies and Videos throughout)
- Management leadership/Culture
- Fitness for Duty
- Knowledge and Skills
- Task design versus Human Capability
- Procedures and other written reference documents (emphasis on rules for reducing human errors by content accuracy and format/presentation clarity)
- Tools and Equipment (making these fit for humans)
- Human-System Interface (introduction to error proofing)

Day 2 (8:00 a.m. to 3:00 p.m.)

Common Human Error Prevention Techniques (Case Studies and Videos throughout) - *continued*
- Task Environment
- Communication (control of errors from miscommunication; verbal and signals)
- Management systems for prediction and control
    - PHA
    - II/RCA
    - MOC
    - MoOC
- **Workshop - Split into small teams and use a human factors checklist to review various process areas and control rooms**

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Error-Proofing Methods - *NEW Course section*

- Error Recovery and Error-Proofing methods
- Application and expected values of Specific Error-Proofing methods
- Review Common Error Proofing methods (review Blue Book)

Techniques for Predicting and Analyzing Human Error

- Checklist Analysis: For situational and for management system related errors
- Guideword-based analysis (HAZOP, Job Hazard Analysis, etc.)
- Quantitative Human Reliability Analysis
- **Demonstration: Using 2 Guide-Word Analysis of procedure at IBN SINA**

Behavior/Habits

- What controls human behavior (T-H-O theory and analysis)
- Implementation strategies for controlling undesired behaviors
- **Workshops: STAR (Specific Task Action Reporting)**

Management, Leadership, and Culture

- How leadership shapes the control of human error control
- Getting Near Misses Reported
- Delegation of risk control roles

Workshop: Planning Your Path Forward

Course 10 Pricing for Public Offerings (per student):
$1,100.00 USD for 2-day version, USA
$1,695.00 USD for 2-day version, in Bahrain and Dubai [UAE]

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Course 11: Layer of Protection Analysis (LOPA)

Recommended prerequisites: Attendees should have strong technical skills and prior training in qualitative hazard evaluation techniques; prior completion of Course 8: Process Hazards Analysis Leadership or equivalent is highly recommended.

Are proposed or existing combinations of safeguards enough to prevent an accident or mitigate the consequences? Do you perceive that doing a fully quantitative risk assessment (QRA) would be over-working the problem? Then Layer of Protection Analysis (LOPA) is the new tool you need to learn. LOPA combines both qualitative and quantitative elements of hazard evaluation and risk assessment to analyze and judge the adequacy of existing or proposed safeguards against process deviations and accident scenarios. A key to the success of LOPA is its rules for judging if protection layers are truly independent. Because of these rules, LOPA helps the analysts make consistent judgments of if the risk of scenarios are "as low as reasonably practical (ALARP)". This "How To" course is taught by one of the principal authors of the AIChE/CCPS book, *Layer of Protection Analysis (2001)*. ***Workshops are used as the primary mode of teaching each aspect of LOPA. You will perform several complete LOPA before leaving class.***

Typical Course Candidates:

This course is designed for **experienced PHA/HAZOP leaders**. Other individuals with a strong technical background (such as engineers and scientists) may attend:

Managers of Operations, Safety; Project Managers; Engineers – Process, Safety, and Mechanical; PSM Coordinators and Managers

What You Will Learn:

- When and how to use LOPA and How to systematically create risk scenarios
- How to establish risk acceptance (risk tolerance) criteria for use within your company (this is also called development of ALARP criteria)
- How to calculate "as-is" risk for a cause-consequence pair:
  - Estimate the frequency of the initiating event and estimate consequence
- What is meant by "independence" and "uniqueness" with respect to IPLs
- How to use LOPA to determine the Safety Integrity Level (SIL) necessary for an instrument IPL (to comply with the requirements of IEC 61508/61511)
- How other companies worldwide use LOPA to:
  - Decide which PHA/HAZOP recommendations to reject and which to accept
  - Focus limited resources within mechanical integrity departments and operations on what is critical to manage risk to ALARP
  - Avoid wasting resources on quantifying risk using QRA methods
  - Perform specialized risk modeling for facility siting questions

Take Home:

- Comprehensive course notebook containing: Examples of risk acceptance and judgment protocols & Industry examples and solutions to all LOPA workshops
- Certificate of Completion and 1.4 CEUs & 1.4 COCs

Day 1 (8:00 a.m. to 5:00 p.m.)

Introduction to LOPA
- Learning objectives and goals of using the LOPA technique
- What is LOPA? How is LOPA applied? Definitions? When is LOPA used?

Developing LOPA Scenarios
- Selecting candidate scenarios from brainstorming hazard evaluations
- Scenarios from design questions and from incidents

Estimating the Consequence of the Scenario
- Using a look-up table of consequence; Developing a consequence look-up table for your company; Alternative methods for estimating consequences
- **Workshop 1: Estimating the consequence of a scenario (part of a continuing example)**

Estimating the Likelihood of the Selected Initiating Event
- Using a look-up table of initiating event categories and frequencies
- How to develop an initiating event look-up table for your company
- Addressing enabling conditions and time-dependent initiating events
- **Workshop 1: Estimating the frequency of an initiating event of a scenario (part of a continuing example)**

Estimating the Probability of Failure of Independent Protection Layers
- Definitions, rules, and exceptions for giving credit for an independent protection layer (IPL); Using a look-up table of IPL categories and probability of failure on demand (PFOD); How to develop an IPL look-up table
- **Workshop 1: Deciding which safeguards are valid IPLs and estimating the PFOD of the valid IPLs (part of a continuing example)**

Calculating the Risk
- Using a standardized LOPA worksheet; Rules for calculating risk for an individual scenario (LOPA); Rules for summing risk of related scenarios
- **Workshop 1: Calculating the risk of a LOPA scenario (part of a continuing example)**

Day 2 (8:00 a.m. to 3:30 p.m.)

Judging the Risk
- Examples of risk tolerance criteria from the industry
- Development and implementation of a company risk tolerance criteria
- **Workshop 1: Judging the risk of a LOPA scenario (cont. example)**

Case Studies
- **Workshop 2: Performing LOPA from beginning to end for a scenario**
- **Workshop 3: Performing several LOPA, beginning with a set to HAZOP tables and deciding which scenarios need LOPA**

Special Applications of LOPA
- Using LOPA for facility siting questions; Selecting the SIL for an interlock
- **Workshop 4: Estimating the composite risk for facility siting**

Planning your path forward with LOPA

Course 11 Pricing for Public Offerings (per student):
$1,200.00 USD in USA
$1,795.00 USD in Bahrain and Dubai, [UAE]

Trinity Consultants | PROCESS IMPROVEMENT INSTITUTE Risk and Reliability Specialists

Course 12: Safety Integrity Systems (SIS & SIF & SIL)

Recommended prerequisites: Attendees should have strong technical skills and prior training in PHA/HAZOP and LOPA for determining SIL requirements; prior completion of Course 11: Layer of Protection Analysis (LOPA) or equivalent is highly recommended. Students should also have good understand of process engineering and instrumented controls.

Are you involved in determining SIL levels or designing SIS? Do you think that too many SIS (or too high of SIL ratings) are being recommended for your site? Do you just want to understand what SIS are and where they fit in to control risk and how these are specified, designed, installed, and maintained? Do you want to know how human error dominates the ACTUAL performance in the field of installed SIS? Then this is the course for you.

This course explains SIS from the ground up and explains how these have replaced the definitions of emergency shutdowns (ESDs) and how they different from basic process control systems, such as a DCS. This course differs from others in that you ***will also learn the state of the art in SIL Verification (and Design) calculations, including how to account for systemic errors caused by human error***; these can dominate the failure rate for SIL 2 and SIL 3 systems.

This "How To" course is taught by one of the principal authors of the AIChE/CCPS two books, *Layer of Protection Analysis (2001)* and *Initiating Events and Independent Protection Layers (IPLs) (2011)*. The instructor is also working with the ISA TR 84.00.04 committee for developing and recommending methods for SIL Verification. The course covers all aspects of how to apply this very useful technique. ***Workshops are used as the primary mode of teaching for SIF design and SIL Verification. You will perform several complete SIL Verifications before leaving class.***

Typical Course Candidates:

This course is designed for those needing to learn what SIS are, and especially those wanting to learn how to verify SIL design and install and validate SIS/SIL. The course workshops focus mostly on SIL verification and design. The coverage of SIL determination is minimal since Course 8 and Course 11 cover this topic in topic in detail. Consider taking this course in conjunction with Course 11, LOPA. Those who may benefit from this course include:

- Managers – Operations, Safety
- Project, Engineering, and Technical Managers
- Engineers – Instrumentation, Electrical, Process, Safety, and Mechanical
- Technicians/Specialist - instrumentation

PSM Coordinators and Managers

What You Will Learn:

- History of SIS
- What is a safety instrumented function (SIF) and safety integrity level (SIL)
- How to determine if a SIF is needed or not, and especially learn if the other independent protection layers are sufficient for controlling risk to as low as reasonably practical (ALARP). ***NOTE: other courses will teach you methods that OVER SPECIFY the need for SIS; this course teaches you the unbiased way to determine the proper number of SIF and proper SIL for each.***

- Minimal requirements from international SIS standards such as ANSI/ISA 84 and IEC 61511 (and the basics of 61508). But, also learn the industry best practices behind and beyond these standards.
- How to specify and design SIS to meet the required functions and SIL.
- How to verify the SIL for a design
- Requirements for installation and validation of the SIS
- Requirements for ongoing inspection, testing, and maintenance of SIS, including ongoing proving of the SIL.

Take Home:

- Comprehensive course notebook containing industry examples and solutions to all SIL Verification and Design workshops
- Certificate of Completion
- 1.4 CEUs & 1.4 COCs

Safety Integrity Systems, Course Outline

Day 1 (8:00 a.m. to 5:00 p.m.)

Introduction to SIS

- Learning objectives and goals of using SIS
- History of SIS and basic definitions
- Where does SIS fit with other ways to control process risk?
- Relationship of SIS to ESD and basic process control systems (BPCS), such as field PLCs, relays, and DCS
- What are safety integrity levels (SILs) and what are the basic requirements for SIL 1, 2, & 3
- Lifecycle of SIS
- Overview of related international standards, ANSI/ISA 84 and IEC 61511 (and 61508)
- Overview of human factors and the impact of human error on SIS. ***Note: No other SIS course covers this all-important topic.***

Determining if a Safety Instrumented Function (SIF) is needed and if so, what SIL is needed.

- Evaluating all IPLs using qualitative (brainstorming) hazard evaluations methods (such as HAZOP), semi-quantitative methods (such as LOPA and Risk Graphs), and quantitative methods (such as fault tree analysis)
- Determining the risk reduction to allocate to the SIF (if any), which in turn specifies the SIL
- **Workshop 1: Determining the need for SIF and the related SIL from a HAZOP report**

Specifying the SIF and Designing the Related SIS.

- Determining the process requirements, such as how the process will be brought to safe state, in what order of steps, and with what delays, and also how the process will be restarted after a trip.
- Using the process requirements to develop the Safety Requirements Specification (SRS)

Designing the SIS to meet the required SIL

- Basic reliability terms (such as failure rates, MTTF, MTTR, and MART) and limitations of reliability data
- Basic reliability equations and converting between failure rates and probability of failures on demand (PFD)
- Options for improving SIL rating of a base design, including use of redundancy, changing test intervals, changing reliability of base components, and reducing chances for systemic errors (especially human errors)
- **Workshop 2: Basic SIL calculations**

Day 2 (8:00 a.m. to 3:30 p.m.)

Designing the SIS to meet the required SIL (continued)

- **Workshop 3: Using redundancy to improve SIL rating**
- **Workshop 4: Using shorter test intervals to improve SIL rating**

Estimating the PFD of a SIF to Verify the SIL.

- Definitions, rules, and exceptions for determination of SIL
- Using a look-up tables of reliability data and PFDs
- Calculations using simple equations
- **Workshop 5: Extending calculations on Workshops 3 and 4 to include systemic failure probability and Human Error Probability** ***Note: No other SIS course covers this all-important topic of the LARGE impact of human error probability on the actual PFD expected in the field***
- Calculations using other methods, such as Fault Tree and Markov analyses

SIS fabrication, installation, and startup

- Issues for fabrication and vendor qualifications
- Installation issues, especially related to maintainability and survivability and limit common cause failures
- Startup and initial validation test, leading to site acceptance test (SAT)

SIS maintenance and proof testing (validation) for the life of the SIS

- Maintenance planning and procedures
- Proof testing and record-keeping requirements for ongoing SIL Validation

Case Studies

- Industry example of SIS and issues with each
- Specialized SIS designs: HIPPS, Burner Management Systems (BMS)
- **Workshop 6: Pulling it all together from beginning to end**

Planning your path forward with SIS

Course 12 Pricing for Public Offerings (per student):
$1,200.00 USD in USA
$1,795.00 USD in Bahrain and Dubai [UAE

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Course 13: Job Safety Analysis (JSA) – 4-6 hours per Session

Recommended prerequisites: None

In this course, you will learn the basics of the performing a Job Safety Analysis (JSA), which is a proven process for controlling operating hazards and costs. You will get a step-by-step overview of the process, and define your role in making it effective.

Through lecture, demonstrations, and workshops, you'll learn how to develop and manage a JSA program in your workplace. You'll also learn how to enlist participation from line employees, supervisors, and upper management. The result: Better processes make a safer workplace - and that means improved production and higher profits.

Who should attend?

- This course is for anyone involved in operations and maintenance that needs to know how to perform JSAs of new or existing tasks.
- In addition, full-time safety practitioners, safety committee members, safety coordinators, safety specialists, human resources, safety managers, loss control managers, and operations managers can benefit from this course

There is a maximum of 15 students per 4 to 6 hour session.

Take Home:

- Comprehensive course notebook containing: Checklists of JSA and JHA issues information, Example forms; blank and filled-in
- Certificate of Completion; 0.4 to 0.7 CEUs & 0.4 to 0.7 COCs

Job Safety Analysis, Course Outline

Day 1 (4 to 6 hour per session)

- Overview of JSA:
  - Understanding JSAs and when to do them
  - JSA terminology
- Understanding JSA's relation to continuous improvement in your organization
- Identify the key requirements for a successful JSA
- Recognize the hazards inherent in task performance
- Develop appropriate solutions and hazard controls
- Example management system
- **Workshop: Complete a JSA for example at your site (or using standard examples in course) to reduce personal injuries and operating costs (repeated 2 or 3 times, as time permits)**

More Information

This course is only offered as a private offering at a client's site. Please contact PII for details about having our training provided at your site.

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This course is only offered as a private offering at a client's site. Please contact PII for details about having our training provided at your site.

Course 14: Human Error Prevention – For Workers (1 to 3 days, depending upon needs)

Recommended Prerequisites: None

In this course, the workers (hourly workers such as operators, technicians, lab personnel, etc.) learn the basics of what causes humans (them) to be more likely to make mistakes and what they can do to prevent errors. It also briefly reviews the role that management actions play in preventing human error. The student leaves with checklists and practice in identifying error-likely situations in the workplace. This course is best in 3-day format with JSA and STAR as modules comprising 1.5 of the 3 days. For the basics on human error prevention only, 1 to 1.5 days is sufficient.

Who should attend?

- This course is for anyone involved in operations, maintenance, lab, utilities, and other support areas to a process, with direct hands-on responsibilities.
- In addition, full-time safety practitioners, safety committee members, safety coordinators, safety specialists, human resources, safety managers, loss control managers, and operations managers can benefit from this course

There is a maximum of 15 students per 1 to 3 day sessions.

Take Home:

- Comprehensive course notebook containing: Checklists of Human Error causes
- Certificate of Completion; 0.7 to 2.1 CEUs & 0.7 to 2.1 COCs

Human Error Prevention – For Workers, Course Outline

1 to 1.5 Days (unless coupled with JSA and STAR, as recommended)

- Overview of Human Error and Human Error Causes
- Categories of Human Error Causes
  - Review of each cause in each category
  - Examples from actual industry settings of good and bad designs/systems
  - Examples of how to identify and reduce the causes
- Human Error Cause Prediction and Identification Methods
- **Workshops: Many hands-on workshops and exercises in determining and addressing the causes of human error (throughout the course)**

NOTE: This course is BEST offered in a 3-day setting that combines Course 13: *JSA* and Course 15: *STAR* to give the workers several tools they can use immediately to prevent human error at their worksites.

More Information

This course is only offered as a private offering at a client's site. Please contact PII for details about having our training provided at your site.

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This course is only offered as a private offering at a client's site. Please contact PII for details about having our training provided at your site.

Course 15: Specific Task Action Reporting (STAR) - (1-day Worker course). *Note: A ½-day to 1-day Manager's Course is also available upon request.*

Recommended prerequisites: None

In this course, workers learn why and how to perform observations and coaching of their peers in the workplace. The method, called "Specific [sometimes Safety is substituted for Specific] Task Action Reporting (STAR)," attacks bad habits directly, which are the most stubborn forms of human error causes to eliminate. STAR is based on the principle of reinforcing good behavior frequently and positively, while encouraging changes to poor habits in a coaching setting by peers (reducing the negative aspect of correction of bad habits). This method has a 70% success rate in reducing errors caused by bad habits.

Who should attend?

- This course is for anyone involved in operations, maintenance, lab, utilities, and other support areas to a process, with direct hands-on responsibilities.
- In addition, full-time safety practitioners, safety committee members, safety coordinators, safety specialists, human resources, safety managers, loss control managers, and operations managers can benefit from this course

There is a maximum of 15 students per 1 day session.

Take Home:

- Comprehensive course notebook containing STAR forms and workshops
- Certificate of Completion; 0.7 CEUs & 0.7 COCs

Specific Task Action Reporting (STAR) – For Workers, Course Outline

1 Day (unless coupled with JSA and Human Error Prevention, as recommended)

- Overview of Human Error and Human Error Causes
- How and Why we form Bad Habits and system for changing habits (THO analysis)
- STAR Method:
  - Developing inventory of undesired habits (behaviors)
  - Technique for observation
  - Closing the distance (coaching) to reinforce good habits & change poor habits
  - Documentation and score keeping
  - Example management system
- **Workshops: Many hands-on workshops and exercises in developing and performing and managing STAR (throughout the course)**

NOTE: This course is BEST offered in a 3-day setting that combines Course 13: *JSA* and Course 14: *Human Error Prevention* to give the workers several tools they can use immediately to prevent human error at their worksites.

More Information

This course is only offered as a private offering at a client's site. Please contact PII for details about having our training provided at your site.

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Course 16: Behavior-Based Safety - (2-day Overview Course). Note: A 1- to 2-day Worker's Course is also available upon request.

Recommended prerequisites: None

This course will provide insight into current knowledge of human error and how it can be reduced. The course focuses on human errors related to undesired behaviors (habits), what causes these, and how to effectively remedy these. This topic has been taught in various forms since its inception at Georgia Tech more than 30 years ago; you will receive the most up-to-date approaches in this course. You will learn in general what leads to negative behavior and how to prevent or correct these behaviors. You will learn specific approaches/tools you can put to use in your facilities for controlling behaviors/habits on a day-to-day basis. But to keep the topic of habits/behaviors in perspective, the course also includes a brief overview of all aspects of controlling human error, not just those related to behaviors or habits. NOTE: This course "contains" *Course 15: STAR*.

Who should attend?

- This course is for anyone involved in operations, maintenance, lab, utilities, and other support areas to a process, with direct hands-on responsibilities.
- In addition, full-time safety practitioners, safety committee members, safety coordinators, safety specialists, human resources, safety managers, loss control managers, and operations managers can benefit from this course.

There is a maximum of 15 students per course.

What You Will Learn:

- Why human error is a factor in all accidents
- Why humans make mistakes and an overview of proven prevention techniques
- The basics of how others analyze and identify human errors and the conditions and situations that cause them
- How weak and deficient policies and procedures in areas of human resources, training, management, communication and workplace design can lead to human errors
- The basic so of how to improve and optimize procedures, workplace design, process design and more to improve human performance
- The most useful theories for understanding why humans develop habits
- The basics of how to improve habits and correct bad habits
- Tools/activities for improving habits/behaviors
- Management systems for improving and maintaining habits/behaviors

Take Home:

- Comprehensive course notebook containing
  - Checklists and worksheets for several human error analysis techniques
  - Industry examples
  - STAR forms and workshops
- Certificate of Completion; 1.4 CEUs & 1.4 COCs

Behavior-Based Safety, Course Outline

Timing – 8:00 a.m. to 5:00 p.m.; for 2 days

Introduction to Human Error

- Learning objectives of course; Goals of human error prevention

Understanding Human Error:

- Errors and their relationship to loss events
- Which is most important: Management system deficiencies or personal behavior?
- Types of human error
- Modeling human behavior (an example of a simple model that works is used throughout the course)
- Elements associated with understanding and controlling human error

Behavior Science and Improving Human Behavior: (70% of the class-time will be allocated to this topic in the public course; the time can be allocated differently in a private course)

- What controls human behavior (T-H-O theory and analysis)
- Identifying an inventory of key undesirable behaviors
- Applying T-H-O to undesired behaviors to identify how to correct bad habits
- Implementation strategies for controlling undesired behaviors
- **Case Studies**
- **Workshops:** STAR (Specific Task Action Reporting)

Common Human Error Prevention Techniques

- Information Presentation Rules (procedures, trainers, communication, signs, etc.)
- Process/Operation/Workplace Design Rules
- Information Presentation Rules (procedures, trainers, communication, signs, etc.)
- Process/Operation/Workplace Design Rules
- Other General Rules
- **Selected Exercises**
- Overview of Techniques for Predicting and Analyzing Human Error

NOTE: This course is BEST offered in a 3-day setting that combines Course 12: *JSA* and Course 13: *Human Error Prevention* to give the workers several tools they can use immediately to prevent human error at their worksites.

More Information

This course is only offered as a private offering at a client's site. Please contact PII for details about having our training provided at your site.

Private Training

Private training is a very popular option among our clients. In fact, we teach more of our customized, private courses than public courses. A private course offers many advantages:

1. **Savings**
   If you need to train more than 6 of your staff, then the overall training cost is substantially lower for a private course, especially when the travel cost of students is taken into account (courses are priced per day instead of per student, with recommended maximums per class). The course can be tailored to your schedule, provided at one or more of your locations, and combined with other topics. Multiple course discounts are also available.

2. **Larger Class Size**
   For company-specific courses, it is usually easier to communicate the course subject to a larger group of people at the same time. Managers and others can observe (attend) key instructional portions of a course without hindering the learning process of the students. *Many companies see this bonus training as a pivotal factor in choosing a private offering of a course.*

3. **Custom Training Plan**
   We will customize the training plan for a private course to meet your staff's needs. Typical customizations include:
   - Adding materials specific to your company's internal programs, including adding sections that you want someone in your company to present
   - Adjusting the overall course length and relative emphasis on each topic
   - Skipping sections in our standard course that you do not feel are relevant

   Because of our wide selection of pre-planned options for each standard course, there is usually no extra charge for customization. Highly customized or completely new courses can also be developed for a negotiable fee.

4. **Specific Workshops**
   The most common customization option in private courses is to use your processes and procedures in the workshops, examples, and exercises. To accomplish this usually takes a few extra weeks of planning and coordination, but usually is no extra cost. In several cases, we have worked with a client for a few months to develop a company-specific exercise (such as a large case study for incident investigation training); but most clients find our generic examples, exercises, and case studies to be fine for their training needs.

5. **Confidentiality**
   Since the attendees in your private course will only be from your company, they can freely discuss your company's unique problems. This results in more interaction on issues important to your company, compared to attending public courses.

6. **Follow-on Hands-on Training**
   Another good reason to have private training is to keep our instructor around for a few additional days or a couple of more weeks to coach your students through their first implementation in "real time" of what they have learned. We all know that classroom training has limitations; the on-the-job that our instructors can provide overcomes these limitations.

Types of Private Courses

Onsite Training: If you want a course customized for your needs or if you have a number of individuals who need the same training, **let us provide a course for you at your site**. This option focuses all the discussion and example problems specifically on the issues faced by a specific facility, maximizing the benefits to your workers.

Regional Training: If you have a number of facilities in one region of the country and want to save on travel costs, **let us provide a course in a central location**. You get all of the advantages of a private course (material customized to your company) and substantial cost savings through reduced travel costs and lower course costs.

Helping You Decide if Private Courses are Right for Your Specific Needs

If you're undecided on what training options will best meet your needs, or if you have specific questions about our training courses or customized training, please call us at 1-865-675-3458. You can also e-mail PII's William Bridges at wbridges@piii.com or William.Bridges@trinityconsultants.com to have him review your needs.

Each year, PII provides 40 to 60 private courses to more than a dozen organizations world-wide. Private courses are contracted by trade associations, corporations, and individual facilities. Industry sources suggest checking references before selecting a training provider. We suggest that you check 3 or more references. PII can provide a substantial list of confidential references for specific course topics, upon request.

The best way to decide if PII's training is the best option for your company is for you to send one or more "scouts" to a course open to the public (such as those described on page 2 of this catalog) offered in the USA or in Bahrain, Dubai [UAE], or elsewhere. This is a very low risk option since you can then apply one registration fee towards the purchase of a private course of the same type and duration, when it is later offered specifically for your company.

PII Instructors Have Provided Customized Courses and Services for:

AECOM
Aerojet
Air Products
AMCDE (Saudi Arabia)
American Electric Power (AEP), USA
Apollo Group
ARAMCO
ASSE-MEC
AVANTOR
BAPCO (Bahrain)
BANAGAS (Bahrain)
Boeing
Bostik
BP USA
Bristol-Myers-Squibb
BUTEMAC (Syria)
China Light & Power, Hong Kong
ConocoPhillips
Cook Composites and Polymers
Danieli (Italy)
Delek Refining
Dixie Chemicals
DuPont
EarthTech
ECOLABS
Egypt Basic Industry Corporation
Elementis
Emirates National Oil Company
Engro Corporation Limited (Pakistan)
Enogex
Equate (Kuwait)
EVONIK
Fluor-Kayan
General Electric
Georgia-Pacific
GTI, Tampico, Mexico
Gulf Petrochemicals Industry Corporation (GPIC; Bahrain)
HADEED (Saudi Arabia)
Heritage-WTI
Hunt LNG (Peru)
Ineos
IPSL (Trinidad)
Irving Oil
J. Ray McDermott, Dubai, UAE
Johns Manville
Johnson & Johnson
Kennecott – Rio Tinto
KordSA
Kureha
LANL (US DOE site)

Marafiq (Saudi Arabia)
MOL Pakistan
Nalco
NOVA Chemical
NEXEN (Yemen)
NGC – Trinidad
NuStar
OGE
Parker USA
Pan-American Energy (Argentina)
PETRONAS
PETRORABIGH (Saudi Arabia)
Pfizer
Phoenix Park Liquefied Gas Ltd. (TT)
Pictsweet USA
Plug Power
PlusPetrol (Peru and Argentina)
Qatar Fertilizer (QAFCO)
Qatar Fuel Additives Co., Ltd (QAFAC)
ROCHE
S.W.I.F.T. USA
SABIC (nearly all affiliates; Saudi Arabia)
SAHARA (Saudi Arabia)
Saudi Ethylene & Polyethylene Co. (TASNEE)
SINOPEC-SABIC (SS-TPC; China)
SIPCHEM (Saudi Arabia)
Selmet
Shaw Group
State Lands Commission
California
SUMCO
Sun Chemical
Suncor (Canada)
Superior Wells Services
Swiss Re, Zurich, Switzerland
Titan (Malaysia)
Tennessee Valley Authority (TVA)
TORAY Plastics
US Department of Energy (DOE)
US DOE (LLNL)
US DOD
US NASA
Voescht-Alpine (Austria)
Washington Savannah River Comp (US DOE Site)

… and many others – please request our references.

Additional Comments on Selecting PII for Training Assistance

Please consider the following when evaluating the value of our public and private training services:

1. The PII-team consists of world-renowned experts in PSM consulting and related training; our courses reflect the very latest in best practices for controlling the various aspects of process safety and system reliability.
2. These course topics have been taught in various forms by the staff at PII for over 10 years (on average). Since PII was formed, all of the course topics have been newly authored using unique materials to reflect not only the best practices in the industry, but also to provide the attendees with the most comprehensive text on each topic (saving you expense related to purchasing of additional textbooks on each topic).
3. PII continually updates and improves its courses to stay current with best practices; your company will benefit from this at no extra charge.
4. PII courses are developed and taught by experts who continually help companies effectively implement PSM; we know what works in practice.
5. Our instructors teach all of these courses for many companies around the world; you will greatly benefit from this accumulated knowledge.
6. During the teaching and development of a course, we can and will comment on related management systems at your company and offer suggestions in writing for improvements. This is an enormous value-added feature of our training for organizations such as yours and could save your company many thousands of dollars in consulting fees if this service were purchased separately. We will only charge extra for such services if our instructor is not able to develop such improvements during preparation and/or delivery of a contracted training service; any extra charges will be pre-approved by you.
7. In most cases, PII can incorporate examples from your company into the courses as exercises and workshops for no extra fee, thereby minimizing development cost.

For information on having PII provide a custom course at your site(s), please call us at 1-865-675-3458.

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PII's Instructors

Process Improvement Institute's (PII's) instructors have trained more than 7000 technical and management staff in how to effectively implement PSM, safety management systems, and reliability programs. If you do not already know us, come to one of our many courses offered publicly to check us out first-hand.

William G. Bridges (Bill)



Mr. Bridges brings more than 45 years of industrial experience spanning process engineering, operations management, quality control and assurance, and safety evaluation. His distinguished career includes founding Process Improvement Institute (PII), where he served for over two decades as President, Principal Engineer, and Senior Instructor. He also served as plant manager of a chemical-based electronics fabrication facility, as well as extensive work in polymer product and process development, chemical process development, automation and control systems, and pilot plant management.

He received foundational training in process safety engineering and management, health, safety, and environment (HSE), and Process Hazard Analysis (PHA) leadership in 1981, along with formal training in Statistical Process Control (SPC), Statistical Quality Control (SQC), and Total Quality Management (TQM). Since 1986, Mr. Bridges has delivered training programs across a wide range of disciplines, including process safety management, PHA/HAZOP, incident investigation, HSE, TQM, SPC, SQC, and statistical design of experiments.

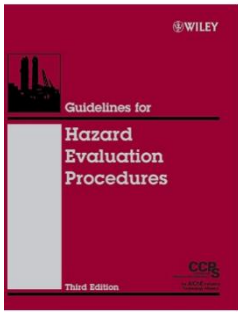
A recognized expert in human factors, his primary professional focus is on understanding, evaluating, and reducing human error in industrial environments. He continues to develop and refine methodologies for analyzing human performance and improving system reliability.

Mr. Bridges has trained more than 9,000 professionals in PSM-related topics, including over 3,700 PHA/HAZOP leaders, more than 2,800 incident investigators, and over 1,000 individuals in process safety management. He has also trained hundreds of practitioners in areas such as human factors, job safety analysis (JSA), procedure writing, and Layers of Protection Analysis (LOPA).

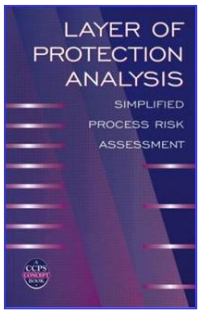
In practice, he has led more than 210 large-scale (unit-wide) PHAs/HAZOPs and over 100 smaller PHAs. His experience also includes leading more than two dozen process safety and combined HSE/PSM audits, more than 50 investigations of major and moderate incidents, and over 100 additional root cause analyses.

Mr. Bridges is a widely published author and ***industry thought leader***. He is one of the originators of Layers of Protection Analysis (LOPA) and a primary author of the three foundational textbooks on the subject. He has also served as a primary author of CCPS/AIChE textbooks on process hazard analysis and incident investigation, and as a contributing author to Safety Instrumented Systems (SIS) publications. His body of work includes approximately 80 technical papers, leadership roles in more than a dozen conferences and technical sessions, and 10 patents. Below is listing of the core textbooks for AIChE/CCPS that were authored or co-authored by Mr. Bridges:

Guidelines for Hazard Evaluation Procedures, CCPS/AIChE, 2008 (3rd Edition) (this is the definitive text on performing PHAs, using HAZOP, FMEA, What-If, and other methods; Mr. Bridges and Mrs. Tew were co-authors)



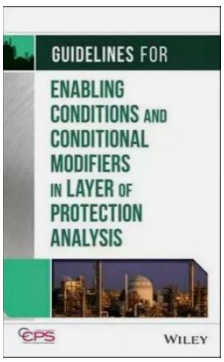
Layer of Protection Analysis (LOPA), CCPS/AIChE, 2001 (this is the original and still the definitive text on performing LOPA; Mr. Bridges and Mr. Art Dowell, III were the primary authors)



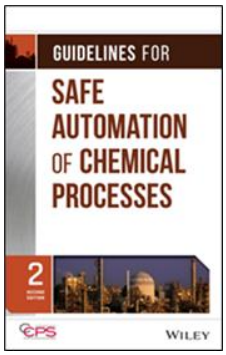
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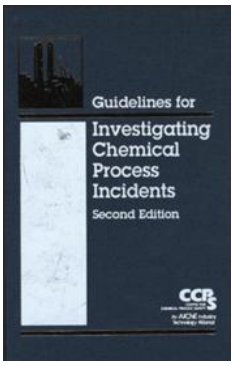
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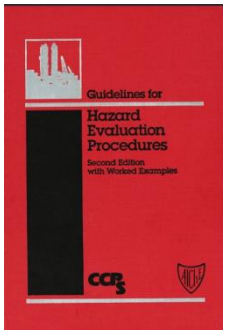
Guidelines for Safe Automation of Chemical Processes, CCPS/AIChE, (2nd Edition) 2017 (Mr. Bridges and Hal Thomas were committee members; this is an essential update to the definitive textbook from AIChE on BPCS and SIS design and installations)



Guidelines for Investigating Chemical Process Incidents, 2003 (2nd Edition) (this is the definitive textbook on investigation; Mr. Bridges was a primary author and Mr. Dowell participated on the first edition of this textbook)



Guidelines for Hazard Evaluation Procedures, CCPS/AIChE, 1991 (2nd Edition) (this is the definitive text on performing PHAs, using HAZOP, FMEA, What-If, and other methods; Mr. Bridges and Mrs. Tew were co-authors)



Trinity Consultants
PROCESS IMPROVEMENT INSTITUTE
Risk and Reliability Specialists

Adel Dakheel



Mr. Dakheel is an accomplished EHS and Process Safety Specialist with about 30 years of experience in the chemical process industry. He brings extensive expertise in petrochemical EHS management and process safety management (PSM), including Permit to Work systems, incident investigation, capital project safety, environmental management, fire protection, and Process Hazard Analysis (PHA).

He has a strong track record in loss prevention, occupational health and safety, environmental protection, fire protection engineering, and process engineering across world-scale petrochemical and fertilizer complexes. Mr. Dakheel has successfully overseen the safe design, construction, commissioning, startup, and operation of multiple multi-billion-dollar facilities, working in collaboration with leading engineering contractors such as Fluor, Stone & Webster, Parsons, Daelim, Samsung, Snamprogetti, Chiyoda, Toyo, Linde, KBR, and CTCI.

His core competencies include risk mitigation and both qualitative (including leading and scribing all PHA methodologies like HAZOP, What-If, and FMEA) and quantitative risk assessments (including deep experience in performing LOPA and consequence analysis) across all project phases. He is widely recognized for his expertise in process safety, operational reliability, and human performance improvement, and regularly contributes as an instructor for various process safety training programs such as PHA/HAZOP Leadership, Writing effective Operating and Maintenance Procedures, Management of Change (MOC) and PSSR, PSM, and PSM auditing. He has trained more than 1400 staff in these skills. He has a BS in Biological Systems Engineering

Mr. Dakheel spent more than 15 years implementing and advancing PSM systems within SABIC before transitioning into consulting, where he has supported multiple organizations in PSM implementation over the past eight years. Since earning his PHA leadership certification in 2003, he has led approximately 20 full-scale unit PHAs and over 100 Management of Change (MOC) PHAs, conducted more than 50 audits, and participated in over 20 major incident investigations, including assignments for SABIC affiliates.

Arthur (Art) M. Dowell, III, P.E.



Mr. Dowell brings more than 55 years of industrial experience in process engineering, design and startup, research, technology management, and safety evaluation. His extensive background includes providing process engineering support for operations at large, multi-process chemical sites, as well as leading the design and startup of major chemical processes. He has also held significant responsibilities in technology management, overseeing large segments of corporate manufacturing technology and facilitating integration across research, operations, optimization, and engineering functions.

Mr. Dowell began his formal training in process hazard analysis (PHA) and fault tree analysis (FTA) in 1978, and later in statistical process control (SPC), statistical quality control (SQC), and total quality management (TQM) in 1981. Since 1979, he has delivered training in process safety management (PSM), PHA, incident investigation, human factors, HAZOP, and FTA. Beginning in 1989, he dedicated his full-time efforts to process safety, leading PHAs, conducting fault tree and consequence analyses, assessing risk, investigating incidents, designing process safety systems, and mentoring emerging process safety professionals.

A recognized pioneer in the field, Mr. Dowell was an early leader in the development and application of Layer of Protection Analysis (LOPA) in the early 1990s. At Rohm and Haas Company, he spearheaded its implementation, contributed to its advancement through publications in industry symposia and journals, and trained engineers in its practical application.

He has authored numerous technical papers and articles on process safety and is the recipient of several prestigious industry awards, including:

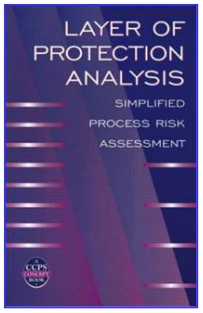
- The AIChE Bill Doyle Award (1991) for the best Loss Prevention Symposium paper
- The ISA Albert F. Sperry Founders Award (2002) in recognition of his contributions to the development of LOPA
- The Mary Kay O'Connor Process Safety Center Merit Award (2011) for significant contributions to advancing process safety education, research, and practice

Mr. Dowell has contributed extensively to industry standards and professional organizations. He served on the ISA S84 Standards Committee and the U.S. Technical Advisory Group to the IEC 61511 committee and was a primary author of Technical Report TR84.0.02 addressing the performance of Safety Instrumented Functions (SIFs).

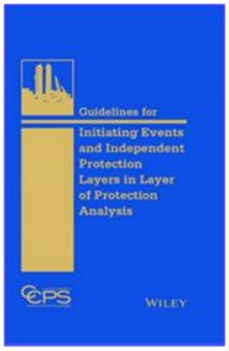
He is a Fellow of the American Institute of Chemical Engineers (AIChE) and a member of ISA. His professional service includes roles on the South Texas Section of AIChE Executive Committee, as well as secretary and treasurer. He also works on the CCPS SAChE (Safety and Chemical Engineering Education) Committee. Mr. Dowell is a licensed Professional Engineer in Chemical Engineering in both Pennsylvania and Texas.

Mr. Dowell has also served as a peer reviewer for multiple CCPS publications and for *Process Safety Progress*. Additionally, he has made significant contributions to Center for Chemical Process Safety (CCPS) publications, including:

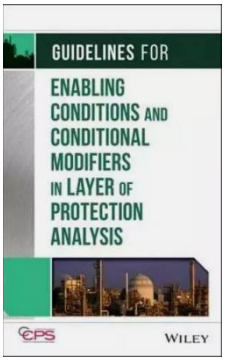
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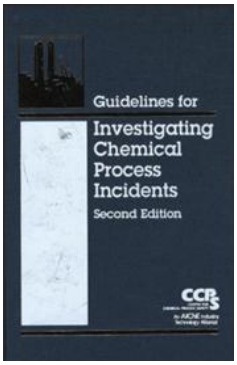
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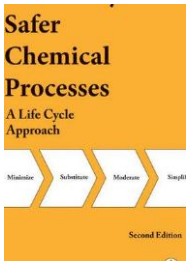


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Inherently Safer Chemical Processes, CCPS/AIChE, (Art Dowell committee co-chair and a co-author of the first edition of this definit textbook in 1996, and was also a co-author of the 2nd edition of this published in 2008)



Stella Manning



Ms. Manning is a chemical engineer from Seattle, Washington with over 14 years of total industry experience, specializing in Process Safety Management (PSM) and regulatory compliance. Prior to joining Trinity Consultants, she spent 13 years working as a Process Engineer and a Process Safety Manager at a variety of facilities in the petrochemicals industry. Ms. Manning holds a Bachelor of Science degree in Chemical and Biomolecular Engineering from the Georgia Institute of Technology.

Ms. Manning has extensive hands-on experience leading and facilitating Process Hazard Analyses (PHAs) using methodologies such as HAZOP, What-If, and Layer of Protection Analysis (LOPA). She has completed several hundred Management of Change (MOC) risk reviews and has supported successful MOC execution for a number of large facility turnarounds and capital projects. In addition, she has conducted numerous PSM and EPA Risk Management Plan (RMP) compliance audits and has developed and delivered a variety of customized PSM and RMP training programs and webinars focused on the petrochemical, refinining, and specialty chemicals industries.

Throughout her career, Ms. Manning has contributed to critical initiatives including global PSM standard and policy development, leading and participating in incident investigations, and performing calculation and classification of process safety events following API RP 754 guidance. Since joining Trinity Consultants, Ms. Manning has partnered with clients across a diverse range of industries to successfully implement and strengthen PSM and RMP programs, performed a number of PSM and RMP applicability analyses, as well as develop U.S. EPA Risk Management Plans that meet regulatory expectations.

Matías A. Massello



Mr. Massello is a chemical and functional safety engineer from Argentina with a strong foundation in process safety engineering with more than 15 years of experience. Mr. Massello has led, organized, participated in, and documented more than 100 Process Hazard Analyses (PHAs), conducted over a thousand Layer of Protection Analyses (LOPAs), completed numerous Management of Change (MOC) risk reviews, and performed more than 10 Quantitative Risk Analyses (QRAs).

Matias has been involved on numerous PSM audits and helped on PSM applicability reviews. In addition to his project work, Mr. Massello has developed customized training materials for oil, gas, and petrochemical companies, with a focus on PHA, QRA, and Safety Instrumented Systems (SIS).

Matias has performed more than 1000 SIL verifications and helped developed *SIL Solver Lite* (an app for PII/Trinity Consultants). He has also contributed to the development of Process Safety Management (PSM) guidelines, supporting organizations in strengthening their safety frameworks and practices.

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