

More than Hazard Analysis

Recognizing Process Safety Elements and Building your Process Safety Toolkit

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FEBRUARY 6, 2019

The Safety Meeting Challenge

If something during this presentation informs you – great!

But... if you are actually take action as a result of this presentation, please let me know what it was and what you did! Sarah.eck@corteva.com

Examples:

- Subscribe to a newsletter
- Read a publication you recently discovered
- Do something with (or change) a program in your plant or facility!



What institution
taught you about
Process Safety?

Group Participation

A solid orange horizontal bar at the bottom of the slide.

How would you define the term “Process Safety?”

Group Participation



How do I describe “Process Safety?”

- “Keep it in the pipe!”
(to prevent fires, explosions & toxic releases)

How do I describe “Process Safety?”

- “Keep it in the pipe!”
(to prevent fires, explosions & toxic releases)
- Activities that are important to prevent (or mitigate) infrequent, catastrophic chemical accidents

Process Safety (CCPS Glossary)

www.aiche.org/ccps/resources/glossary

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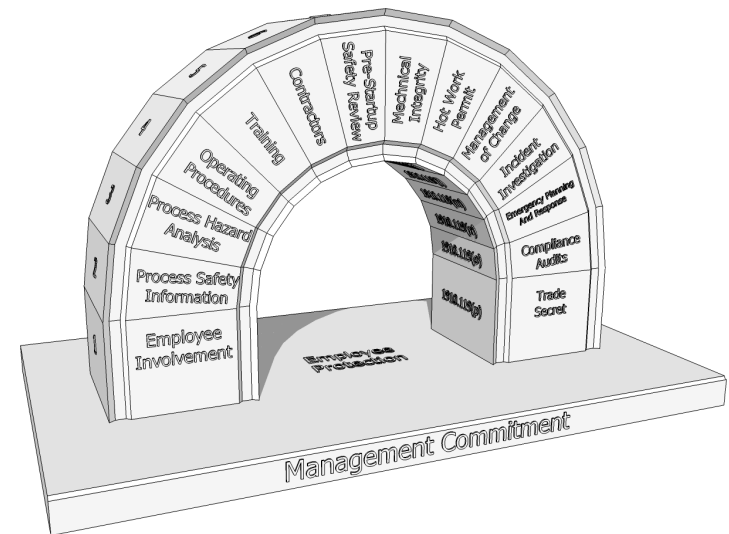
A disciplined framework for managing the integrity of operating systems and processes handling hazardous substances by applying good design principles, engineering, and operating practices. It deals with the prevention and control of incidents that have the potential to release hazardous materials or energy. Such incidents can cause toxic effects, fire, or explosion and could ultimately result in serious injuries, property damage, lost production, and environmental impact.

What is Process Safety?

(SEARCH RESULT FROM THE CENTER FOR CHEMICAL PROCESS SAFETY)

Typical Models | OSHA PSM

1. Employee Participation
2. Process Safety Information (PSI)
3. Process Hazard Analysis (PHA)
4. Operating Procedures
5. Training
6. Emergency Planning & Response
7. Hot Work (Permitting)
8. Management Of Change (MOC)
9. Pre Startup Safety Review (PSSR)
10. Contractors
11. Mechanical Integrity (MI)
12. Incident Investigation
13. Compliance Audits
14. Trade Secrets



Risk Based Process Safety (available as a free download)

Reference: <https://www.aiche.org/ccps/resources/publications/books/guidelines-risk-based-process-safetyccps/documents/overview>
And "Guidelines for Risk Based Process Safety", © 2007, CCPS

Risk Based Process Safety Overview



A summary of the risk based process safety (RBPS) management approach as detailed in *Guidelines for Risk Based Process Safety*.

[Click here to download the PDF file.](#)

Risk Based Process Safety (CCPS)

Commitment to Process Safety

1. Process Safety Culture
2. Compliance with Standards
3. Process Safety Competency
4. Workforce Involvement
5. Stakeholder Outreach

Understanding Hazards & Risks

6. Process Knowledge Management
7. Hazard Identification and Risk Assessment (HIRA)

Learn from Experience

17. Incident Investigation
18. Measurement & Metrics
19. Auditing
20. Management Review & Continuous Improvement

Manage Risk

8. Operating Procedures
9. Safe Work Practices
10. Asset Integrity and Reliability
11. Contractor Management
12. Training and Performance Assurance
13. Management of Change
14. Operational Readiness
15. Conduct of Operations
16. Emergency Management

Why is a holistic viewpoint valuable?

- Aligns with collective industry knowledge and experience.
- Helps foster leadership and worker engagement.
- Helps solve problems more efficiently. (Use the right “tool” for the job!)



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Has a holistic approach to Process Safety been valuable to you?

Audience Check Point



DO YOU HAVE ANY
QUESTIONS?



DO YOU HAVE ANY KEY
THOUGHTS SO FAR?

Why “go outside” [the company] for information?



**You are not the first person
to solve this problem!**

(Are you sure you understand
what problem you’re trying
to solve?)



**Leverage collaborative teams
with different perspectives!**

(Watch out for your
bias & blind spots!)



**You may find something your
company doesn’t offer!**

(So... take it back with you!)

Resources

- Center for Chemical Process Safety (CCPS)
- Chemical Safety Board (CSB)
- Occupational Safety & Health Administration (OSHA)
- National Fire Protection Association (NFPA)



Safety Beacon

<https://www.aiche.org/ccps/resources/process-safety-beacon>



Guidelines books



Tools & Projects (e.g. databases, metrics surveys, culture resources, and more)



Information about the CCPSC
(Process Safety Professional Certification)

Center for Chemical Process Safety (CCPS)

Resources

Please Subscribe! (monthly publication)

Process Safety Beacon

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Process Safety Messages for Manufacturing Personnel

[What is the Beacon »](#)

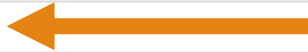
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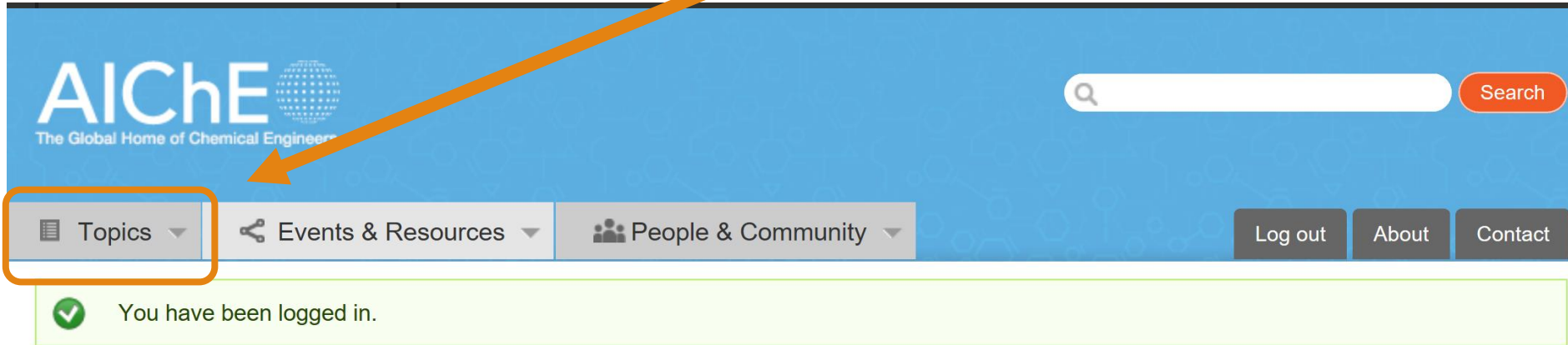
[Accessing Archived Beacons »](#)



The image shows the cover of the Process Safety Beacon magazine. At the top left is the CCPS logo. In the center is the Beacon logo with the tagline 'Process Safety Messages for Manufacturing Personnel'. At the top right is the iomosaic logo with the text 'This issue sponsored by'. Below the logos is the title 'Critical safeguards must be kept functional!' and the date 'February 2019'. The main article text describes a 1999 incident at a plant where a partial power outage led to an overpressure in several vessels, causing a rupture and explosion. It lists three key findings: 1. The pressure control system was in manual mode. 2. The high pressure interlock was bypassed. 3. The pressure relief valves had been disabled. A photograph shows the aftermath of the explosion. Below the text are two columns: 'Did you know?' with safety tips and 'What can you do?' with action items. At the bottom is the slogan 'Your safety is built in layers. Make sure they are working!' and a copyright notice for AIChE 2018.

www.aiche.org

Log in.
Open “Topics” → “Process Safety”



The screenshot shows the top section of the AICHE website. The header is blue with the AICHE logo on the left, which includes the text "The Global Home of Chemical Engineers". On the right side of the header is a search bar with a magnifying glass icon and a red "Search" button. Below the header is a navigation menu with three main items: "Topics", "Events & Resources", and "People & Community", each with a dropdown arrow. The "Topics" item is highlighted with an orange box, and an orange arrow points from the text above to it. To the right of the navigation menu are three buttons: "Log out", "About", and "Contact". Below the navigation menu is a green notification bar with a checkmark icon and the text "You have been logged in."

Featured



2019 Spring Meeting and 15th Global Congress on Process Safety

📅 March 31 - April 4, 2019

📍 [Hilton New Orleans Riverside](#)

The AIChE Spring Meeting is the year’s key technical conference for practicing chemical engineers. A wide range of subjects relevant to the current needs of industry is covered.



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An AIChE Technological Community

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Topics > Process Safety

Elements of Process Safety

Process Safety Technical Areas

Process Safety

“Elements” references the Risk Based Process Safety Model

Featured



Process Safety Boot Camp



Center for Chemical Process Safety (CCPS)

CCPS was established in 1985 to focus on engineering and management practices that can prevent and mitigate catastrophic accidents involving release of hazardous materials. CCPS is supported by sponsors in the chemical and hydrocarbon



2nd CCPS Global Summit on Process Safety

November 3-5, 2015
Hotel Istana, Kuala Lumpur, Malaysia

The 1st Global Summit on Process Safety held in Mumbai on December 2014 was a great success. The theme of the conference is based on Vision



Elements of Process Safety

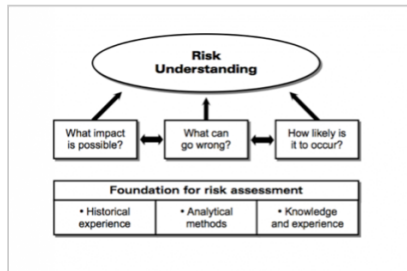
Narrow the search by choosing one of the “foundations” (categories)

The four pillars and the twenty elements of risk based process safety can be designed and implemented at varying levels of rigor to optimize process safety management, performance, efficiency, and effectiveness.

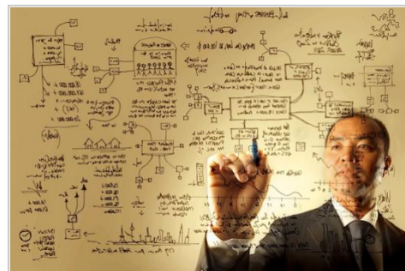
Search for titles containing the following words:

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HAZOP Studies and Other PHA Techniques for Process Safety and Risk Management
Face-to-Face Course



Advanced Concepts for Process Hazard Analysis
Face-to-Face Course
Move beyond simply

		Risk Magnitude			
Likelihood magnitude	0	+3	+4	+5	+6
	-1	+2	+3	+4	+5
	-2	+1	+2	+3	+4
	-3	0	+1	+2	+3
	-4	-1	0	+1	+2
	-5	-2	-1	0	+1
	-6	-3	-2	-1	0

HAZOP Studies/Advanced PHA Concepts Combo Course
Face-to-Face Course



Bow Ties in Risk Management: A Concept Book for Process Safety
September, 2018

Featured Resource: Culture Toolkit

<https://www.aiche.org/ccps/topics/elements-process-safety/commitment-process-safety/process-safety-culture/building-safety-culture-tool-kit>

Building Process Safety Culture Toolkit

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Tools to Enhance Process Safety Performance



Dave Jones and Anne O'Neal, Chevron Corporation, Co-chairpersons, November 1, 2005

The Primary Tools

- **Presentation: Lessons From the Columbia Disaster – Safety & Organizational Culture** »
- **Self-evaluation tool: Key Lessons From The Columbia Shuttle Disaster** » (With Adaptation To The Process Industries)

Instructions for using the package

- **Instructions for using the Presentation** »
- **Conducting An Organizational Culture Workshop** »

Background materials


- **White Paper: Safety Culture: “What Is At Stake”** »
- **Incident Summary: Columbia Case History** »
- **Incident Summary: Challenger Case History** »
- **Incident Summary: Piper Alpha Case History** »
- **Incident Summary: Flixborough Case History** »
- **Bibliography** »

Acknowledgements

CCPS wishes to thank the members of the Process Safety Culture subcommittee for their dedicated efforts in developing the Process Safety Culture toolbox. Specifically, we wish to thank co-chairs Dave Jones and Anne O'Neal of Chevron, and committee members Don Abrahamson (OxyChem), Scott Berger (CCPS), Mike Broadribb (BP), Walt Frank (ABSG Consulting), John Herber (3M), Dan Isaacson (Lubrizol), Shakeel Kadri (Air Products and Chemicals), Greg Keepports (Rohm and Haas), Jack McCavit (Celanese Chemicals (retired)), Pete Lodal (Eastman Chemical), Bill Marshal (Eli Lilly), Lisa Morrison (PPG), Mike Rogers (Syn crude Canada), and Karen Tancredi (DuPont).

CCPS Tools & Projects

<https://www.aiche.org/ccps/resources/tools>

- LOPA Database
- Process Equipment Reliability Database
- Process Safety Metrics 
- Process Safety Moments
- RBPS Resources Web Tool
- Reactivity Worksheet 4.0
- RAST (Risk Analysis Screening Tool)

Process Safety Metrics

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Identifying and using relevant process safety metrics over the life of a process is one of four elements in the RBPS pillar of **Learning from Experience**.

Read more about What is it?, Why is it important?, Where/when is it done?, Who does it?, What is the anticipated work product? and How is it done?

Leading and Lagging Indicators for Process Safety Performance

To continuously improve upon process safety performance, it is essential that companies in the chemical and petroleum industries implement effective process safety metrics. CCPS has filled this need through a diverse, international effort leading to the publication of recommended process safety metrics. The recommended metrics can be reviewed in the documents below:

April 2018 Version (Update to the 2011 Version of "You Don't Improve What You Don't Measure" Document)

- [Process Safety Metrics: Guide for Selecting Leading and Lagging Indicators \(English\)](#) »

<https://www.aiche.org/ccps/resources/certified-process-safety-professional>



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Process Safety

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Certified Process Safety Professional Quick Links

- [Introducing Certified Process Safety Professional Certification \(CCPSC\)](#)
- [Why Get Certified?](#)
- [How Do I Get Started?](#)
- [What are the Steps in the Certification Process?](#)
- [Where Can I Find Reference Material?](#)
- [What does it Cost?](#)
- [Frequently Asked Questions - FAQs](#)
- [FAQ for Current CCPSC](#)

Chemical Safety Board

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News

The CSB is an independent federal agency that investigates industrial chemical accidents.

The CSB's mission is to "drive chemical safety change through independent investigation to protect people and the environment."



- About the CSB
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CSB Releases Factual Investigative Update

About the April 26, 2018, Explosion and Fire at the Husky Superior Refinery

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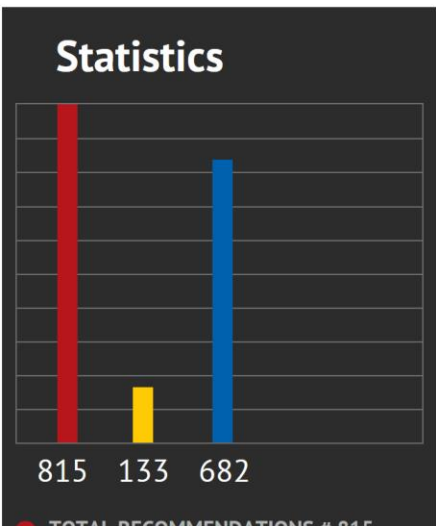
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Incident Type:

- ALL --
- Chemical Distribution - Fire and Explosion
- Chemical Manufacturing - Fire and Explosion
- Combustible Dust Explosion and Fire
- Community Impact
- Confined Space / Asphyxiation
- Explosion and Fire
- Flammable Vapor
- Hot Work - Explosion and Fire
- Oil and Refining - Fire and Explosion
- Oil and Refining - Reactive Incident
- Reactive Incident
- Release

Current Investigations

CSB Videos

Investigations & Safety Messages



Emergency Response Safety Message

Friday, Nov 02 2018

A CSB safety message that includes an interim 2D animation highlighting emergency response efforts at Husky Energy's Superior Refinery during the April 26, 2018, explosion and subsequent asphalt fire. The CSB's investigation is ongoing and a final report including findings and recommendations will be released in 2019.

Investigations:

- [Husky Energy Refinery Explosion and Fire](#)

[Download QuickTime Video](#)



Dangerously Close: Explosion in West, Texas

CSB Safety Video on the April 17, 2013, fire and explosion at the West Fertilizer Company in West, Texas, which resulted in 15 fatalities, 260 injuries, and widespread community damage.

Investigations:

- [West Fertilizer Explosion and Fire](#)

[Download QuickTime Video](#)

Process Safety Management for Petroleum Refineries

Lessons Learned from the Petroleum
Refinery Process Safety Management
National Emphasis Program

Purpose

This document highlights areas of the Process Safety Management standard (PSM) where OSHA issued the most citations during the Petroleum Refinery Process Safety Management National Emphasis Program (NEP). These areas include:

- Process Safety Information (PSI)
- Process Hazards Analysis (PHA)
- Operating Procedures
- Mechanical Integrity (MI)
- Management of Change (MOC)

Leading Metrics

Preventive Maintenance • Management of Change
Process Hazard Analysis • Training

"The Road Ahead"



OSHA[®] FactSheet

The Use of Metrics in Process Safety Management (PSM) Facilities

Metrics are measures that are used to evaluate and track the performance of a facility's process safety management program. For facilities that handle highly hazardous chemicals, metrics can be used to quantify how a process has performed historically, how it might perform in the future, and where improvements can be made to keep workers safe.

FactSheet OSHA[®] EPA

The Importance of Root Cause Analysis During Incident Investigation

The Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) urge employers (owners and operators) to conduct a root cause analysis following an incident or near miss at a facility.¹ A root cause is a fundamental, underlying, system-related reason why an incident occurred that identifies one or more correctable system failures.² By conducting a root cause analysis and addressing root causes, an employer may be able to substantially or completely prevent the same or a similar incident from recurring.

Root Cause Analysis Tools

Below is a list of tools that may be used by employers to conduct a root cause analysis. The tools are not meant to be used exclusively. Ideally, a combination of tools will be used.

- Brainstorming
- Checklists
- Logic/Event Trees
- Timelines
- Sequence Diagrams
- Causal Factor Determination

OSHA | Process Safety Publications

<https://www.osha.gov/pls/publications/publication.athruz?pType=Industry&pID=166>

National Fire Protection Association

The National Fire Protection Association (NFPA) is a global self-funded nonprofit organization, devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards.

www.nfpa.org



NFPA 30 – Flammable & Combustible Liquids



NFPA 652 – Fundamentals of Combustible Dust



NFPA 51B – Fire Prevention during [...] Hot Work



NFPA 2 – Hydrogen Technologies Code



NFPA 70E – Electrical Safety



NFPA 497 – Classification of flammable [materials] and of hazardous (classified) locations for electrical installations



NFPA 499 – Classification of combustible dusts and of hazardous (classified) locations for electrical installations

www.nfpa.org

Log in.
Search/type the desired NFPA #

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Errata

Document	Issued Date	Format/Size	
Errata 30-18-1, Reference: Figures 16.4.1(a) and 16.4.1(b)	February 27, 2018	119.17 KB	VIEW DOWNLOAD

Frequently Asked Questions

Document	
View 2012 edition FAQs	VIEW DOWNLOAD

Additional Information

Document	
Certified Fire Protection Specialist (CFPS) Two-day Classroom Training & Certification Exam	VIEW DOWNLOAD

The Viewer is accessible if you login. (Anyone can create an account.)

The image is a screenshot of a web browser displaying the NFPA website. The address bar shows the URL: <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=30>. The page features a large central graphic for the NFPA 30 code book. The graphic includes the NFPA logo, the number '30' in a large font, the title 'Flammable and Combustible Liquids Code', and the year '2018'. Below the title is the NFPA logo and the text 'See ALERT'. The background of the graphic is a grayscale image of an industrial facility with a large cylindrical tank and a staircase. To the left of the main graphic, there are two smaller book covers: 'NFPA 30' and 'NFPA 30 & 30A Handbook'. The top navigation bar includes 'NFPA 30' and 'Free Access to: 2018 edition of NFPA 30'. The bottom navigation bar includes 'About NFPA', 'Overview', and 'Leadership'.

Summary

- A robust Process Safety Management program contains several management systems working together to be effective.
- The OSHA and CCPS Risk Based Process Safety models are typical industry accepted approaches towards describing Process Safety.
- There is a wealth of information available to leverage that can help you understand and solve problems – take the effort to discover it!

THANK YOU!

QUESTIONS & OPEN DISCUSSION

Other Resources

CAMEO Software Suite (for emergency responders)

<https://www.epa.gov/cameo/what-cameo-software-suite>

- CAMEO Datasheets & Reactivity Prediction Tool
- ALOHA (dispersion modeling program)
- MARPLOT (mapping application)

European Process Safety Center (EPSC) <https://epsc.be/>