

An Introduction to Process Safety

HOW TO GET STARTED WITH PROCESS SAFETY VOLUME 1

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About Energy Safety Canada

Energy Safety Canada is the oil and gas industry's advocate and leading resource for the continuous improvement of safety performance. Our mission is to help companies achieve their safety goals by providing practices, assessment, training, support, metrics and communication.

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This document as well as future revisions and additions, is available from:

Energy Safety Canada

150 - 2 Smed Lane SE, Calgary, Alberta T2C 4T5

Phone: 403 516 8000

Toll Free: 1 800 667 5557

Fax: 403 516 8166

EnergySafetyCanada.com

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Preface

PURPOSE

The purpose of the How to Get Started with Process Safety library of documents is to provide practical steps for companies in the oil and gas industry managing process safety risks (as “process safety” risks). While managing risks that are process safety risks is not new to the industry, for some companies managing these risks under the banner of process safety is new. This library is designed to help companies rapidly understand what is meant by process safety and assist them in identifying their most significant process safety risk as well as their existing management components and operational practices that fall under process safety management.

This volume, *An Introduction to Process Safety*, provides a definition and overview of process safety, as well as introducing the key premises that are foundational to this How to Get Started library.

HOW TO USE THIS GUIDELINE

The intended audience for this document is senior management or senior operational managers who have risk management responsibilities. This would also include, but not be limited to, those specifically assigned senior roles in either process safety or, more likely, assigned health, safety, and environmental (HSE) roles. It should also be of interest to anyone assigned the task of developing and/or implementing process safety for an organization in the oil and gas industry.

LIMITATIONS

This document does not represent an industry standard on process safety. Process safety as a discipline and process safety management practices are established in a number of well-known standards. This document and the *How to Get Started* library are limiting themselves to offering advice on the practical demands of process safety implementation.

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What is Process Safety?

A Technical Definition:

Process safety is a disciplined framework for managing the integrity of operating systems and processes handling hazardous substances. It is achieved by applying good design principles, engineering, and operating and maintenance practices. It deals with the prevention and control of events that have the potential to release hazardous materials and energy. Such incidents can result in toxic exposures, fires or explosions, and could ultimately result in serious incidents including fatalities, injuries, property damage, lost production or environmental damage.

(Process safety - recommended practice on key performance indicators, OGP Report No. 456 [November 2011], 1)

An Oversimplified Definition:

Process safety will often be described by showing how it is distinct from personal or occupational safety.

Using this approach, process safety can be quickly explained as follows.

If you are in charge of “safety” and you start with the worker and think of hazards like this, you are doing *personal safety*.

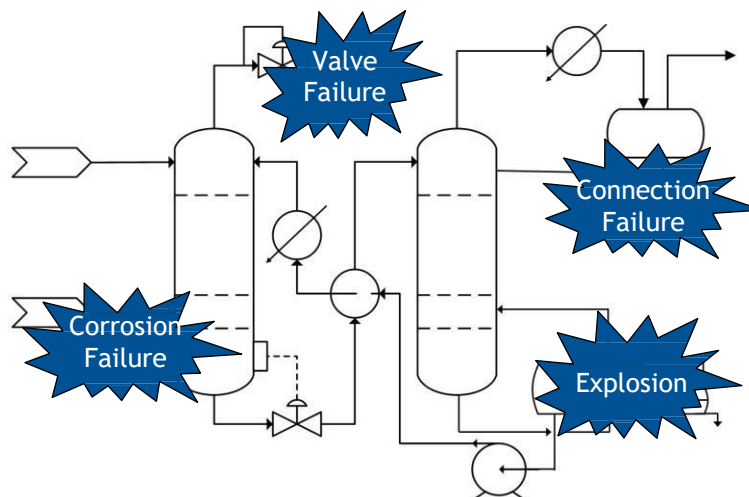


Figure 2: Process Safety

Related Concepts

The term “process safety” is a bit problematic because many of the industries and operations that can benefit from process safety management are not accustomed to thinking of their operations in “process” terms.

For the oil and gas industry, it is useful to introduce two overlapping concepts-asset integrity and major incident/accident.

In the oil and gas industry, an asset integrity failure very often leads to a process safety incident (e.g., corroded pipeline, valve failure, or a rig collapse might all result in an uncontrolled release of hydrocarbons). Of course, it is also possible to have a catastrophic structural failure that does not result in a process safety incident (e.g., a rig collapse before a hole is drilled) or a hazardous release due to an operator opening the wrong valve. Major incidents in oil and gas may result from either or, very often, a combination of the two. In many cases, the methods and strategies for handling any one of these three categories are identical or at least very similar and typically overlap.

For further information see:

- Process safety - recommended practice on key performance indicators, OGP Report No. 456 (November 2011), page 1.
- Asset Integrity - the key to managing major incident risks, OGP Report No. 415 (December 2008).

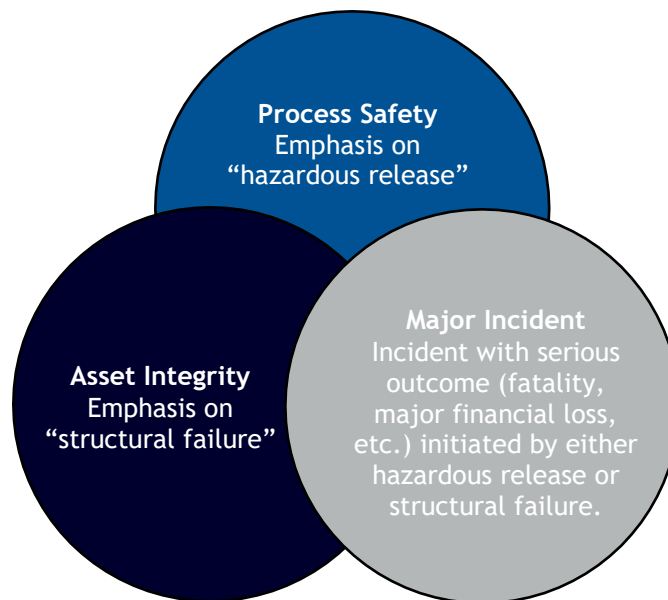


Figure 3: Related Concepts

2.0 What is a Process Safety Incident or Event?

In Simplest Terms

Any event that leads to the release of hazardous materials and/or energy from a process is a process safety incident.

In the oil and gas industry, typically hydrocarbon liquids or gas is the hazardous material that is at risk of spilling or being released (although the industry also stores and handles other highly hazardous materials). This unwanted release leads to possible environmental damage, worker exposure risks, fires, or explosions.

In formal process safety reporting the preferred term is “event” (versus “incident”) leading to the common acronym PSE (Process Safety Event).

Catastrophic Examples (often used to teach process safety lessons)

- BP Texas City Refinery Explosion (2005)
- Montara Oil Spill (Australia) (2009)
- Macondo Blowout and Explosion (2010)
- Chevron Refinery Fire (2012)
- PG&E Natural Gas Transmission Pipeline Rupture and Fire (San Bruno) (2010)
- MMA Railway Derailment and Explosion (Lac-Mégantic) (2013)

Additional Examples from Around the World

- Fatal incidents and high potential events that were also process safety events reported to IOGP between 2011-2013 (released March 2015)
- Additional reports available at <http://safetyzone.iogp.org/reports.asp>

Recent, Closer to Home Events (from Energy Safety Canada’s Safety Alert collection)

- Flammable Liquid Spill (2015)
- Service Rig Tank Flash Fire (2015)
- Snubbing Operations Gas Release (2014)
- Gas Compressor Fire and Explosion (2013)
- Gate Valve Bonnet Failures from Thermal Expansion of Fluids at High Temperatures (2013)
- Worker Burned in Methanol Tank Explosion (2012)
- Over Pressured Fracture Operation Results in Spill (2012)
- Ruptured Piston on Mud Pump leads to Pump House Fire (2011)
- Induced Hydraulic Fracture Results in Blowout (2011)
- Drilling Rig Fire Due to High AOPF, High Pressure Formation Encountered (2011)

Related Concept LOPC

When reading about process safety, you may encounter the acronym LOPC which stands for “Loss of Primary Containment”, the initial loss of containment of hazardous materials. It is frequently used as shorthand for a

measurable process safety event. In the oil and gas industry, an LOPC often has the potential to escalate into an environmental disaster, fire, or explosion.

It is worth noting that LOPC is a more meaningful term in oil and gas industry segments that have been doing process safety much longer, e.g., refineries, petro-chemical manufacturing, storage, etc. Here there are often engineered controls to prevent an initial loss of containment from becoming a significant, uncontrolled spill or disaster (e.g., berms, pallets, or trays as secondary containment). LOPC as an expression may not resonate in segments of the industry that historically do not speak in terms of primary and secondary containment.

3.0 Are We Already Doing Process Safety

The Most Likely Answer

If you represent a company operating in the Canadian oil and gas industry with some degree of success, the answer is “Yes”.

If you define process safety as a systematic approach to preventing the release of hazardous materials, fires, and explosions, companies will be able to demonstrate through their existing practices and track record that they are addressing process safety risks. Meeting regulatory compliance in the oil and gas industry in Canada demands certain practices that are within the scope of process safety (see the Process Safety Management Regulatory Scan Report from CAPP).

For oil and gas companies with operations such as refineries or upgrading, process safety management and engaging process safety experts in the design and operation of these plants is standard. In other sectors, such as pipelines, many process safety elements will be executed through an integrity program of some sort. In the upstream segment, operators and contractors will capture many of the key elements of process safety management within their operational excellence or quality assurance programs.

A More Nuanced Answer

Given oil and gas companies already address process safety risk, the better question for an oil and gas company to ask is whether what they are doing is sufficient and, if not, where should they focus their efforts.

And to answer that question, a company would need to first answer some of these questions:

- Are we clear on our process safety risks, and in particular, on what could go catastrophically wrong?
- What are we doing across the company and within our operations to prevent these incidents?
- Is everyone responsible for operations - from project or program management, through to frontline supervisors and workers - aware of how exercising their role has an impact on whether we succeed or fail at managing process safety risks?
- Have we exercised due diligence to explore if we are actually doing everything reasonably practicable to minimize our process safety risks?
- Do we have a means of measuring our process safety management success and our process safety performance, so we can work towards continuous improvement?

Different companies are at different stages in process safety maturity. Health and safety management systems as applied to traditional personal safety risks are now standard practice across the spectrum of companies in the Canadian oil and gas industries. Equivalent, multi-faceted management systems to address process safety risks are less visible. *But this does not mean companies are, in fact, starting from scratch.*

The Premises Behind the *How to Get Started with Process Safety Library*

This How to Get Started with Process Safety library starts with the premise that Canadian oil and gas companies already:

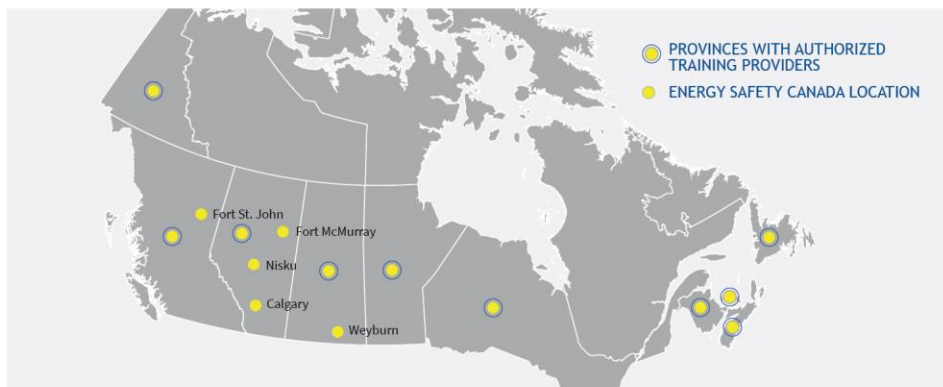
- Have individuals in their organizations with a good knowledge of critical process safety risks and their corresponding controls.
- Already encourage and engage in systematic practices that mitigate their process safety risks.
- Have management systems or elements of systems that can be coordinated and aligned to address process safety risks.
- The next premise is that these companies can benefit from:
 - Raising the awareness of process safety and process safety risk to that same level as that typically given to standard health and safety or commercial risks.
 - Systematically documenting and communicating their existing knowledge of process safety risks and their controls.
 - Transforming this knowledge into effective implementation and monitoring of process safety risk controls.
 - Coordinating efforts across business units and management systems to ensure a collaborative, effective, efficient, and measurable management of process safety risks.

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Phone:
1 800 667 5557



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