

Extended Process Safety Fundamentals for Design, Maintenance/Inspection and Operations

Introduction

In our industry, the root causes for Process Safety Events (leaks, fires,...) lie in 3 categories:

1. Design & Construction
2. Technical Integrity
3. Operations.

In TotalEnergies, the contribution to the category “Operations” represents about 50 percent of all Process Safety Events whereas Technical Integrity and Design & Construction represent about 40 percent and 10 percent respectively. The same observations can be made in other oil & gas companies according to benchmarks of IOGP, GBG and EPSC. To address issues related to Design & Construction, Technical Integrity and Operations, a set of **Process Safety Fundamentals** were developed for installations with major accident potential. These Process Safety Fundamentals (PSFs) have been introduced to reduce and ultimately eliminate process safety events with potential catastrophic or disastrous consequences by putting **the focus on a limited number of key principles**. Designed to support those working at **all levels in operations, maintenance and engineering**, the PSFs are designed to draw attention to situations or conditions that are most likely to lead to process safety events. The Process Safety Fundamentals can be subdivided in 3 categories:

1. Safe Design Principles
2. Safe Maintenance & Inspection Principles
3. Safe Operating Principles

As the strict application of the Golden Rules or Life Saving Rules would avoid most of the occupational safety incidents, the **strict application of the Process Safety Fundamentals could avoid most of our Process Safety Events** with potentially catastrophic or disastrous consequences. A **Company wide awareness, promotion and use of Process Safety Fundamentals could further improve our process safety performance**.

1. Safe Design Principles

Examples of contributing factors to potentially catastrophic or disastrous Process Safety Events related to design and construction include:

- o Lack of compliance with general mandatory design specifications
- o Accident scenarios that were not identified or adequately addressed in risk analysis
- o Wrong material specification for equipment or piping
- o Lack of compliance with project specifications
- o New hazards and risks introduced via inadequate Management of Change

To address Process Safety Events related to the design and construction of our facilities, a set of **6 guiding principles were developed to raise awareness of employees in charge of the development of new projects and modification of existing assets**. These principles include:

1. Application of Design Standards
2. Derogations to Design Standards
3. Identification of Process Hazards & Risks
4. Process Risk Analysis
5. Management of Change
6. Identification of Critical Safety Barriers



2. Safe Maintenance & Inspection Principles

Examples of contributing factors to potentially catastrophic or disastrous Process Safety Events related to maintenance and inspection include:

- o Vibration, fatigue
- o Non-detected corrosion
- o Non reported degraded critical barriers
- o Reliability issues
- o Important backlog in inspection or maintenance activities

To address Process Safety Events related to the maintenance and inspection of our facilities, a set of **4 guiding principles applicable to critical barriers were developed to raise awareness of employees in charge of maintenance and inspection activities**. These principles include:

1. Development of Performance Standards for Critical Barrier and Critical Barrier Elements
2. Development, Planning and Execution of Inspection & Maintenance
3. Management of Non-Conformities (incl. backlog)
4. Monitoring of Performance

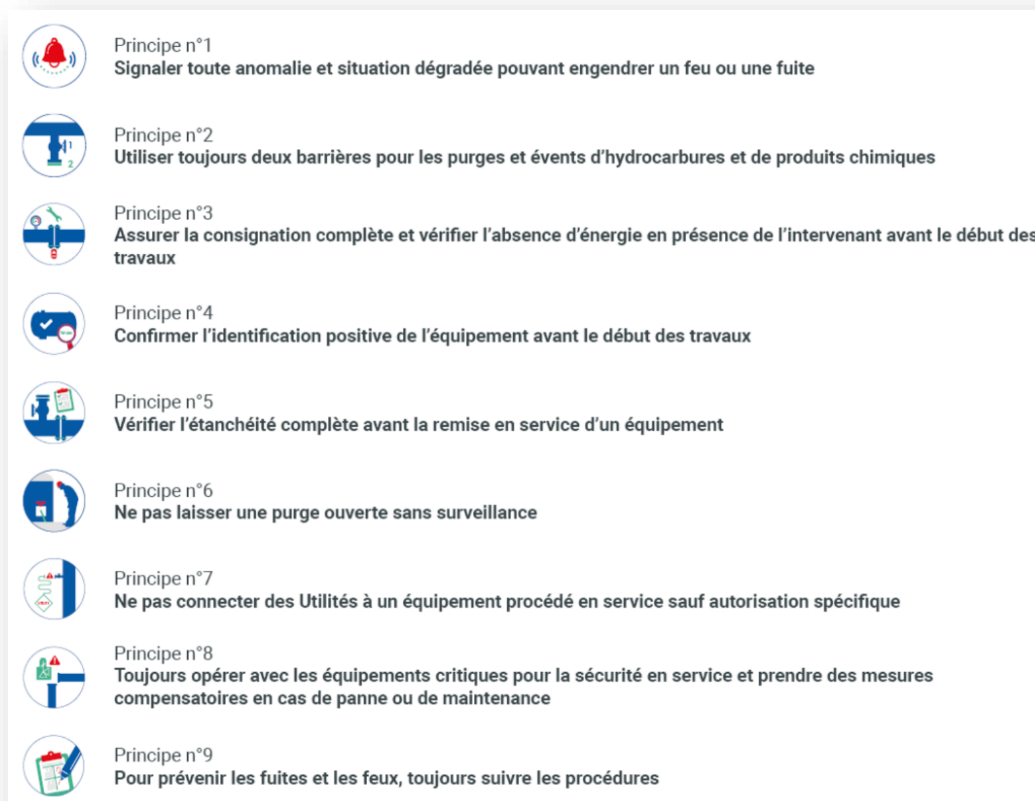


3. Safe Operating Principles

Examples of contributing factors to potentially catastrophic or disastrous Process Safety Events related to operations include:

- o Drain or vent left open
- o Safe isolation of equipment before starting works
- o Wrong execution of operating procedure
- o Operation out of safe operating window
- o Bypassing of a safety barrier

Since the introduction by Shell in 2016, the Safe Operating Principles concept was adopted by many companies in industry and professional organizations (IOGP, EPSC,...). In TotalEnergies, the Safe Operating Principles (see graph below) were introduced in the RC Branch in 2020. Today, MS is considering introducing the Safe Operating Principles in their sites.



4. Application of Process Safety Fundamentals

The objective would be to put the focus on these different principles in order to improve commitment to process safety through the whole organization. Addressing Design, Maintenance & Inspection and Operational issues would allow us to target most of our employees and contractors.

Each of the principles could be illustrated by one (or two) major accidents that occurred in the oil & chemical industry (see next page) due to a non-rigorous application of one of the principles. People will be asked to discuss the event and to retrieve within their own site an example of process event illustrating also the impact of a non-strict application of the same principle. Depending on their role within the Company, people could focus their discussions on the most relevant principles of their activity. Such a theme is consistent with the message that **safety critical barriers** need to be properly designed, maintained, inspected and operated.

Landmark Historical Major Accidents

