



# The PSM Auditing

## Issue

Methods,  
Tools, and  
Resources

## Minimizing Audit Findings by Increasing Operational Discipline and Process Safety Culture

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Many major accidents have taken place in the chemical and petrochemical industry over the past 40 years (e.g. Bhopal (India, 1984), Texas City (USA, 2005)), which have been key driving forces for issuing new regulations (governments), publishing standards (industry groups), developing policies (companies), and ultimately for improving Loss Prevention strategies and Process Safety Management (PSM). On this context, a key standard is the OSHA PSM (29 CFR 1910.119), a process-based program aiming at preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals.

The present paper focuses on the results from several PSM audits performed between 2010 and 2016, at several different Chemical Process Industry (CPI)

facilities. On the one hand, we have evaluated how well these facilities complied with the requirements of the OSHA PSM Standard. On the other hand, the data from the audit findings has been compiled and statistically processed in order to compare the main common findings with the results of those analyzed by OSHA's Refinery and Chemical National Emphasis Programs (NEP) in 2012.

Key audit findings from the CPI are a valued source of information for understanding current safety weaknesses. The lessons learned from this study help us to identify operational discipline and process safety leadership and culture benefits towards minimizing or avoiding audit findings, and therefore, to contributing to an optimized and sustainable Process Safety management system.

## 1. Introduction

Many major accidents have taken place in the chemical and petrochemical industry over the past 40 years (Table 1), which have been key driving forces for issuing new regulations (governments), publishing standards (industry groups), developing policies (companies), and ultimately for improving Loss Prevention strategies and Process Safety Management (PSM). On this context, a key standard is the OSHA PSM (29 CFR 1910.119), a process-based program aiming at preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals.

## Process Safety tv® Video PSM Frequently Asked Questions

Does your facility need a PSM program? Is your PSM program effectively implemented? If your facility uses, stores, manufactures, handles, or moves flammable or highly hazardous chemicals on site above the Threshold Quantity (TQ), OSHA does require PSM implementation. Learn the facts about process safety management.

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The United States (US) Occupational Safety and Health Administration (OSHA) process safety management (PSM) standard 29CFR 1910.119 is a performance-based management system regulation intended to prevent catastrophic releases of highly hazardous chemicals (HHC). This standard contains requirements for the safe management of hazards associated with processes using, storing, manufacturing, handling, or moving highly hazardous chemicals onsite. It emphasizes the management of hazards through an established

*Table 1: Examples of major accidents in the chemical and petrochemical industry*

Location	Date	Company	Process	Major Incident	Fatalities (F)/Injuries (I)
Flixborough (UK)	6/1/74	Nypro (UK) Ltd	Production of caprolactam	Explosion in oxidation of cyclohexane process	F: 28 workers I: 36 on-site, 53 off-site
Seveso (Italy)	7/10/76	Industrie Chimiche Meda Societa Azionara (ICMSA)	Batch production of 2,4,5-trichlorophenol (TCP)	Toxic release of TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin)	F: 0 I: 477 people reported skin injuries (burns & chloracne)
Bhopal (India)	12/3/84	Union Carbide India Ltd	Production of Sevin	Toxic release of methyl isocyanate (MIC)	F: 3,787+ workers and near-by residents
Piper Alpha (UK)	7/6/88	Occidental Petroleum	Offshore oil and gas processing	Oil platform explosion and fire	F: 167 workers



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comprehensive program that integrates technologies, procedures, and management practices. The OSHA PSM 1910.119 standard consists of 14 elements and compliance audits is one of them. It requires compliance audits of all covered facilities every three years; these audits are the ongoing quality assurance process for the process safety management systems.

This study presents a case study that compiles and analyses management system audit findings and related data from a sample of sixteen (16) process facilities. The analysis identifies the most frequently cited elements and compares them with the results obtained by OSHA refinery and chemical National Emphasis Program (NEP) inspections:

- 2007 – Petroleum Refinery Process Safety Management NEP
- 2009 – PSM Covered Chemical Facilities NEP
- 2011 – PSM Covered Chemical Facilities NEP

NEP are the most significant PSM enforcement actions since the OSHA standard was promulgated in 1992.

## 2. Methodology for Performing PSM Audits

The 14 OSHA PSM elements were included in the scope of the audits, as all PSM elements work together to provide multiple layers of protection

(Aziz et. al., 2017). Moreover, the scope of the audit also encompassed an assessment of the applicability of the standard based on the chemicals handled on each specific site.

The audits were conducted by a person knowledgeable in audit techniques and who was impartial towards the facility or area being audited. All 14 OSHA PSM Elements were distributed among the several members of the Audit Team. Likewise, the compliance audit was conducted by at least one person knowledgeable in the process.

Prior to arriving on site, a pre-audit questionnaire was requested to be completed and forwarded to the audit team to help them prepare for the audit. This pre-audit questionnaire had information regarding how the PSM regulation is implemented at the specific facility. Once on site, a kick off meeting was conducted to introduce the audit team, to identify the element champions, to review the plan and approach for conducting the audit, and to establish an agenda according to the team's availability. The audit was based on the following:

- Physical inspections of the facility;
- Examination of selected process safety administrative and operating records;

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# Industry News



## Chemical Safety Board Report on the Massive Refinery Explosion and Fire in Philadelphia, PA

Asset integrity programs do matter. Read the CSB report and be reminded why consequence modeling, facility siting, and emergency planning are vital to reduce and manage risk.

The Chemical Safety Board released a factual update into the explosion and fire at the Philadelphia Energy Solutions (PES) Refinery. The factual update notes that a pipe elbow, which had corroded to about half the thickness of a credit card, appears to have ruptured in the refinery's alkylation unit, releasing process fluid that included over 5,000 pounds of hydrofluoric acid. (Chemical Safety Board, 2019)

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Chemical Safety Board. (2019, October 16). Chemical Safety Board Releases Factual Update and New Animation Detailing the Events of the Massive Explosion and Fire at the PES Refinery in Philadelphia, PA - General News - News. Retrieved from <https://www.csb.gov/chemical-safety-board-releases-factual-update-and-new-animation-detailing-the-events-of-the-massive-explosion-and-fire-at-the-pes-refinery-in-philadelphia-pa/>

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