

Process Safety Pocket Guide

Published and Distributed by
GENIUM PUBLISHING CORPORATION
One Genium Plaza
Schenectady, NY 12304-4690 USA
(518) 377-8854

Author
Donald Pierce
REM, CHMM, WSO-CSM

Technical Editor
Dr. Catherine Franklin

Co-editors
Christine E. Gorman
Erik M. Roy

Copyright © 1993, 1995
by Genium Publishing Corporation
All Rights Reserved
ISBN 0-931690-56-0
Printed in the United States of America

NOTICE: Every effort has been made to ensure the accuracy and completeness of the information in this guide. However, Genium Publishing Corporation, the author, and the editors assume no liability for any loss or damage resulting from inaccuracy or incompleteness. All persons named are fictional. Any similarity to real persons is coincidental.

**The *Process Safety Pocket Guide* is
available with your organization's name
imprinted on the cover.**

TABLE OF CONTENTS

Introduction	3
I. Overview of the Standard	7
Process Safety Management	7
II. Normal Process Operation	13
Process Safety Information	13
Process Hazard Analysis	18
Operating Procedures	24
Mechanical Integrity	26
III. Nonroutine Activities	32
Pre-Startup Safety Review	32
Management of Change	33
Incident Investigation	36
Emergency Planning and Response	39
IV. Other Important Topics Covered by the Standard	42
Contractors	42
Compliance Audits	43
Trade Secret Information	45
Hot Work and Nonroutine Work	46
Interaction with Other Safety Standards	47
V. Training	49
Operating Procedures Training	51
Maintenance Training	52
Process Safety Information Training	52
Emergency Planning and Response Training	53
Pre-Startup Training	53
Training Verification	54
Glossary	57
Appendix - Highly Hazardous Chemicals Listing	82

INTRODUCTION

Ben received the check and repair slip for reduced flow in a piping section at 3:30 p.m. from the plumbing foreman. Upon inspection, he quickly discovered that somehow the valve had partially closed. Despite several hours of his best efforts, it remained nearly closed and flow obstructed. It was well after 6:00 p.m., and Ben knew that he shouldn't be working alone on the piping, especially in such a tight space, and after normal business hours. He also knew that if he didn't get this troublesome valve fixed tonight, he would have to come back tomorrow, completely shut down the system, and replace the entire valve assembly. The ocean fishing trip he'd been planning for months would have to be postponed if he couldn't repair this stubborn valve NOW.

Ben was in a heavy sweat, due to a combination of the confined space and his frustration at the unyielding valve. He removed his hard hat, placing it on the pipes adjacent to the problem valve. Mopping his brow, he decided that more drastic action was needed.

Lighting a propane torch, Ben began to apply concentrated heat to the valve. A few minutes of this ought to take care of the problem, he thought. Suddenly, Ben heard a strange crackling sound, like thousands of eggshells being crushed at once. Then, with a terrible WHOOSH, an explosion threw him against the wall, and into unconsciousness.

When he opened his eyes several minutes later, there was a strange green vapor streaming from the piping and filling the room.

"Ibena! Ibena!" he heard a voice calling. He recognized it instantly.

"Bob?" he said aloud. **"Bob Ratchet, is that you?"**

"Yes, Ibena, it's me, Bob Ratchet, your old buddy and partner."

Ben couldn't believe his ears. Bob Ratchet had been one of his closest friends as well as his mentor, and the only one aside from his parents to call him by his childhood nickname. For obvious reasons, Ben rarely used his complete name, Ignatius Benedict Aloysius Phool, which, long ago, some neighborhood kids had shortened to I. Ben A. Phool. And now, to hear Bob's voice again, almost ten years after his untimely death in an industrial accident, was very unsettling. Ben gasped.



“What are you doing here, Bob? You’re dead! Does this mean that I’m . . .”

“No, Ibena, no. You’re not dead, although you might wish you were when that nasty bump on your head starts to ache.”

“I don’t understand. If I’m not dead, but you are, then how and why are we talking?”

“Well, you see, Ibena . . .”

“Bob, how many times have I asked you not to call me that.”

“Sorry, Iben . . . er, Ben. You have been chosen to receive and deliver a message.”

“What message?”

“Tell me, Ibena, er, Ben, have you heard of the Process Safety Management Standard for Highly Hazardous Chemicals, 29 CFR 1910.119?”

“You mean the PSM standard? I’ve heard of it, but it’s really no different than the Hazard Communication standard.”

No sooner had those words left his mouth than Ben felt the floor beneath him shake and crack. Plaster crumbled from the walls, and the green vapor tore through the room like a hurricane.

“NO, BEN!” *Bob’s voice bellowed.* “The HazCom standard provides only a part of the information you need to know under the PSM standard.”

Ben wasn’t frightened. He’d heard Bob bellow like that before.

I. OVERVIEW OF THE STANDARD

Process Safety Management

“Why is process safety management so important?”

“The main purpose of the Process Safety Management standard is to prevent unwanted releases of hazardous chemicals, especially into locations that could expose employees and others to serious hazards. A successful process safety management program can help minimize the risk of injuries that result not only in human suffering, but can cause a devastating economic loss as well.

In addition, process safety management also promotes better quality through the elimination of process fluctuations and process shutdowns. And preventive maintenance, an important part of process safety management, should increase efficiency and prolong equipment life.”

“How is a written standard going to do all this?”

“The PSM standard targets highly hazardous chemicals that have the potential to cause a major incident. According to OSHA, ‘The Process Safety Management standard establishes requirements which are intended to prevent or minimize the catastrophic releases of toxic, flammable, or explosive chemicals. Such releases could result in toxic, fire, or explosion hazards.’ They could also cause disaster in the workplace, and possibly in the surrounding community.

That’s really what process safety management is all about. It’s the proactive identification, evaluation and reduction or prevention of chemical releases that could occur as a result of a failure in a process, procedure, or equipment. To be effective, a process safety management program requires a systematic

II. NORMAL PROCESS OPERATION

Process Safety Information

“According to the standard, your employer starts by compiling all written process safety information. This helps the employer and employees operating the process to identify and understand the hazards of the highly hazardous chemicals used or produced by the process. It also provides information on the technology of the process, and the equipment used in the process.”

“That makes sense. It’s kind of like understanding the rules of the game before you play. But what do I need to know about the hazards of highly hazardous chemicals?”

Hazards of highly hazardous chemicals

“The information you should know and understand about the hazards of highly hazardous chemicals should include, at least:

- toxicity information;
- permissible exposure limits;
- physical data;
- reactivity data;
- corrosivity data;
- thermal and chemical stability data; and
- the hazardous effects of inadvertent mixing of different materials.

If material safety data sheets (MSDSs) are available, they can be used as a source of information about highly hazardous chemicals, but they must be supplemented with process chemistry information, including runaway reaction and overpressure hazards, if applicable.”

Process technology

“Do I have to understand the process too? I

III. NONROUTINE ACTIVITIES

“Hold on there, my fidgety friend. We’re just getting warmed up. There’s still plenty more to learn. Remember a while ago when I split the standard into four different sections? Well, we’ve still got three to go.”

“That’s right! I was only thinking about the normal process operation. I forgot that the standard addresses some things that aren’t every day concerns. But the only thing I recall you mentioning was a pre-startup review. What’s that all about?”

Pre-Startup Safety Review

“The PSM standard says that a pre-startup safety review is required for new facilities, and for modified facilities, when the modification is significant enough to require a change in the process safety information.

The review must confirm that, before the introduction of highly hazardous chemicals to a process:

- construction and equipment match design specifications;
- safety, operating, maintenance, and emergency procedures are adequate and in place;
- for new facilities, a process hazard analysis has been completed; modified facilities must meet the requirements of the PSM standard for the management of change (see page 33); and
- training has been completed for each employee involved in operating a process.

For new processes, a process hazard analysis (PHA) helps improve the design and construction of the process. The safe operation of the new process is enhanced by making use of the PHA recommendations before final

IV. OTHER IMPORTANT TOPICS COVERED BY THE STANDARD

Contractors

“You know Bob, all this information is great for the workers at the plant. Not only do I feel better knowing that the person working next to me has learned the proper safety procedures and knows what to do in an emergency, but I think our neighbors in the community will sleep better too. However, there’s still something that you haven’t mentioned. Quite a few things have changed since we last worked together. A big difference is that we’ve got a lot of people around here who don’t work for the company, but work for outside contractors. What good will it do if company employees are all following the PSM standard, and then the contract employees come in knowing nothing about the hazardous chemicals we’re working with? For instance, last year the company hired NC Plumbing to help me recondition the underdrains in the treatment room. Those guys nearly blew us up when they decided to break the line without purging the space of explosive vapors. Must be that NC stood for No Clue!”

“You’re in luck, ol’ Benny, my boy. The PSM standard requires contractors to train their employees in the PSM standard, safe work practices, and the safety rules of the facility, including facility work practices for hazard controls during operations, such as lockout/tagout and confined space entry. Contractors must also instruct their employees in the known potential fire, explosion, or toxic release hazards related to the job functions and to the process, and in the provisions of the facility emergency action plan. Furthermore, the PSM standard requires contractors to inform the facility of hazards associated with their work, and to report any hazards found by

V. TRAINING

“I’m pretty impressed, Bob. It seems like facilities covered by the PSM standard will definitely be safer places to work. That is, if workers like me can keep all this information straight. You’ve told me so much about the PSM standard, my head is spinning. And I’m just one person! To get this standard to really work, there are millions of workers who need to learn about it and understand it. If you visit each one of them like this, you’ll never rest in peace.”

“You’re right, Iben. I certainly don’t want to visit each of the more than 2,200,000 workers affected by the standard. That’s why I’m so glad that the standard requires training. Without training, it would be very difficult for employees to understand and follow this standard.”

“But most of us have already been through all that! Isn’t the same type of training given under the OSHA HazCom standard?”

“Not entirely. The OSHA HazCom training informs employees about the chemicals they work with, and helps to familiarize them with reading and understanding MSDSs. However, additional training in operating procedures and safe work practices, emergency evacuation and response, safety procedures, routine and nonroutine work authorization activities, and other topics, is required by the PSM standard.”

“A lot of the training that I’ve received in the past has been boring. Is the PSM training more of the same?”

Bob chuckled.

“Iben, my friend, I remember very well how bored you were in some of those training sessions. You fell asleep during the demonstration on the use of hard hats and other safety gear. Your snoring drowned out

GLOSSARY

Acid. A hydrogen-containing compound that reacts with water to produce hydrogen. A fundamental category of chemicals characterized by having available reactive hydrogen and requiring an alkali to neutralize them. Acids turn litmus paper red and have pH values of 0 to 6. Acids are corrosive and may cause severe burns.

Acute Exposure. Exposure of short duration, usually to relatively high concentrations or amounts of material.

Acute Health Effect. An adverse effect on a human or animal body, generally after a single significant exposure, with severe symptoms developing rapidly and coming quickly to a crisis. See Chronic Health Effect.

Acute Toxicity. Adverse (acute) effects resulting from a single dose of, or exposure to, a substance. Ordinarily used to denote effects observed in experimental animals.

Adsorption. The condensation of gases, liquids, or dissolved substances on the surfaces of solids.

Aerosols. Liquid droplets or solid particles dispersed in air that are of fine enough particle size (0.01 to 100 microns) to remain dispersed for a period of time.

Air Pollutant. Dust, fumes, mist, smoke and other particulate matter, vapor, gas, odorous substances, or any combination thereof which is emitted into or otherwise enters the ambient air.

Alkali. A substance capable of combining with hydrogen ions. Any substance that in water solution is bitter, more or less irritating, or caustic to the skin. Strong alkalies in solution are corrosive to the skin and mucous membranes. They are also called bases, and may cause severe burns to the skin. Alkalies turn litmus paper blue and have pH values