LOSS PREVENTION IN THE PROCESS INDUSTRY



Akpofure RIM-RUKEH

DEDICATION

This book is dedicated to memory of Éleuthère Irénée du Pont de Nemours (24 June 1771 – 31 October 1834), known as Irénée du Pont, or E.I. du Pont. He was a French American chemist and industrialist who founded the gunpowder manufacturer, E.I. du Port de Nemours and Company.



Éleuthère Irénée du Pont de Nemours (24 June 1771 – 31 October 1834)

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@ Akpofure RIM-RUKEH 2014

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Akpofue RIM – RUKEH (Ph.D)
2014

PREFACE

A chemical process is that which effects chemical and mechanical transformations of matter, conducted continuously or repeatedly on a substantial scale. A process converts raw materials to products. A chemical process includes any group of vessels which are interconnected or separated and contain Highly Hazardous Chemicals (HHC's) which could be involved in a potential release.
Over the last three decades the process industries have grown very rapidly, with corresponding increases in the quantities of hazardous materials in process, storage or transport. Plants have become larger and are often situated in or close to densely populated areas. Within these periods, the process industries have experienced process failures that have resulted to loss of life and property. Many of these incidents can be foreseen and avoided, if adequate training of employees is undertaken.
Chemical process safety is seldom part of university curricula and many professionals do not have the appropriate knowledge to interpret process data in terms of risks. As a result, even though responsible for the safety of the process, they do not have easy access to the knowledge. Process safety is often considered a specialist matter, thus most large companies employ specialists in their safety departments. However, this safety knowledge is also required at the front, where processes are developed or performed, that is in process development departments and production. To achieve this objective of providing professionals with the required knowledge on the safety aspects of their processes, the methods must be made accessible to non - specialists. Such systematic and easy - to - use methods represent the backbone of this book, in which the methods used for the assessment of operational risks are presented in a logical and understandable way, with a strong link to industrial practice.

This book discusses the fundamental skills, techniques, and tools of understanding basic process safety management system. This book “Loss Prevention in the Process Industry” is designed to enhance the process of teaching and applying the fundamentals of chemical process safety. It is appropriate for an industrial reference, undergraduate course, or a graduate course in chemical process safety. It can be used by anyone interested in improving chemical process safety, including chemical and mechanical engineers and chemists. More material is presented than can be accommodated in a three-credit course, providing instructors with the opportunity to emphasize their topics of interest. This textbook can also be used as a reference for a design courses in process engineering.

The book is structured in seventeen chapters:
Chapter 1: gives a general introduction on the meaning of process safety and process safety management. Origin of process safety management and fourteen (14) elements of process safety are also presented.
Chapter 2: discusses symbols used in the process industry. Process operation identication letters are also presented.
Chapter 3: discusses fundamentals and benefits of process safety diagrams. Process safety diagrams such as; block flow diagrams (BFDs), process flow diagrams (PFDs), piping and instrumentation diagrams (PIDs) and process plant layout diagrams (PPLDs) are also discussed. Chapter 4: describes major hazards in the process industry. Concepts such as; fire, explosion, toxic releases, loss of containment, hot work, run away reactions, confined space are also prsented.
Chapter 5: focuses basic risk management in the process industry.
Chapter 6: is devoted to qualitative analysis of process hazard analysis techniques. Techniques such as; concept hazard analysis (CHA), preliminary hazard analysis (PrHA), concept safety review (CSR), cause and effects diagrams, failure modes and effects analysis, hazard and

operability (HAZOP), what -if- analysis, checklist analysis, what if/checklist, and bow tie analysis are presented.
Chapter 7: focuses on quantitative analysis of process hazard analysis techniques. Techniques such as; fault tree analysis (FTA), event tree analysis (ETA), layer of protection analysis (LOPA), cause – consequence annalyis (CCA) are also presented.
Chapter 8: discusses the importance of management of change in the process industry. The chapter discusses the meaning and types of change such as change in-kind and change not –in-kind.
Chapter 9: descibes relevance of mechanical integrity of process facilities. Six key elements of mechanical integrity program are also presented.
Chapter 10: is dedicated to accident/incident investigation in the process industry. Purpose and steps for accident/incident investigation are also discussed.
Chapter 11: is devoted to the concept of pre-startup safety review.
Chapter 12: is dedicated to operating procedures in the process industry. Case studies on the relevance of operating procedures are presented.
Chapter 13: introduces the reader to concept of emergency management in the process industry. Phases of emergency management such as; mitigation, emergency preparedness, emergency response and emergency recovery are discussed.
Chapter 14: is devoted to process plant siting and layout.
Chapter 15: introduces the reader to applicable codes, standards, reggulations, laws and policies in the process industry.
Chapter 16: is devoted to case histories of process plant failures. The Bhopal disaster of 1984, Philips petroleum chemical plant explosion and fire in 1989, Nypro factory Flixborough United kingdom in 1974, the Piper Aipha Disaster of 1988 and others are discussed.
Chapter 17: reminds the reader on basic safety terms in the industry. Concepts such as; unsafe acts, unsafe conditions, HSE communication, personnal protective equipment (PPE), occupational health, work at height, behavioural safety, ergonomics etc are discussed.

I hope that this textbook helps prevent chemical plant process accidents and contributes to a much safer future.

Akpofure Rim – Rukeh (Ph.D)