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Hans J. Pasman, *Risk Analysis and Control for Industrial Processes - Gas, Oil and Chemicals: A System Perspective for Assessing and Avoiding Low-Probability, High-Consequence Events*, Butterworth-Heinemann Press, 2015, 458 pp. \$133 Hardcover

By Genserik RENIERS [†]

Abstract. This book discusses high-impact low-probability risks (so-called HILP risks) in the gas & oil sector and the chemicals using industries. The text is written in an agreeable style, yet at the same time also suitable for technical experts in risk management and process safety. The book is inclusive, in the sense that a triple perspective is used and the history, the present, as well as the state-of-the-art of dealing with HILP risks is discussed. Both technical and non-technical aspects are thoroughly elaborated, and, wherever possible and useful, linked with hazardous materials data and accident scenario information. The book might be interesting for process safety specialists, but it may also be employed as a handbook or reference work in academia.

Keywords. *Process safety, Oil and gas industry, Hazardous materials, HILP risks.*

JEL. D81, L60, O30.

Book Review

This book offers a very interesting and original perspective on dealing with high-impact low-probability risks resulting from handling, storing and processing hazardous materials. This kind of risks, being typical for the oil and gas sector and other related industries, are also called HILP risks or major accident risks, and the risks are usually treated by a discipline called ‘process safety’. Books on process safety written by experts in academia and from the industry, usually focus on certain major accident scenarios and how to deal with these scenarios from a technical viewpoint, that is, consequence and probability calculations, -estimations, and -assessments, and they very often have only one or a few minor chapters dealing with non-technical aspects of process safety. In this book, a large number of separate fields of research related to process safety are discussed, such as reliability engineering, QRA, risk management, safety management, safety culture, domino effects, economic issues, systemic risks, risk communication, etc.

In chapter 1, the reader is made curious about the rest of the book by the discussion of well-known and much-used products and their hazards. The second chapter deals with US-legislation and European legislation on high-impact low-probability risks. Chapter 3 continues with theories, models and tools developed

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for risk management in the process industries. Chapter 4 analyzes current trends in society as well as two recent industrial disasters. The next chapter treats the larger, systemic, perspective of safety, that is, sociotechnical systems, system safety and the alike. The sixth chapter provides information on soft factors such as safety culture and human factors. The state-of-the-art in research based on scientific literature is expounded extensively in chapters 7 (technical viewpoint) and 8 (non-technical viewpoint). Chapter 9 is a chapter on economic issues related to safety. The chapters 10, 11, and 12 are all short chapters and mainly have the purpose to provide common-sense recommendations to the reader about soft issues such as the legislation approach, knowledge and learning, risk communication, risk perception, risk acceptance, risk governance. Chapter 13 concludes the book.

This book fills an existing gap in process safety literature, since the author successfully manages to treat technical aspects as well as non-technical factors, such as organizational aspects and human factors, both extensively, and this in a very legible way. The first chapter immediately invites the reader to continue reading by using widely known and extensively employed hazardous materials such as gasoline, liquefied petroleum gas, natural gas, ammonium nitrate, and other substances, to treat their characteristics and link these to process safety information. Furthermore, some major industrial accidents that have happened, both recent and old, are also linked with the substances and provide practical insights.

The book is no technical reference work, but provides the reader detail into the fascinating world of contemporary process safety research and practice. The book in fact contains the essence of everything one should know about dealing with HILP risks in the chemicals using industries. The author regularly refers to current researchers, mentioning their names, which are playing a key role in a certain state-of-the-art subjects related to process safety, and by doing so, the book sometimes reads more like a novel than like a scientific work, although it certainly is the latter. Complex phenomena are explained in an easy manner and a lot of good, common-sense, useful advice is given throughout the book. Sometimes, examples are worked out in depth to provide better understanding into a certain problem. Otherwise, rules of thumb are given to provide the reader with a quick way to answer certain questions he/she might have concerning HILP risks.

An interesting aspect of the book, is that both European and US history and legislation are discussed. This provides profound insights into two fundamentally different approaches. For instance, the US approach treats all risks in the same legislation and has specific issues with respect to 'stationary source siting' (US term), whereas the European approach differentiates between occupational risks and major hazard risks and has its own view on 'Land-Use Planning' (European term), transparency, and communication to the public, amongst others. The author clearly and objectively explains the pros and cons of both models and indicates how these different viewpoints lead to different guidelines, industrial practices and regulations. Experts from both sides of the Atlantic Ocean may indeed learn a lot from each other and the understanding of how legislation is conceptualized and implemented, may lead to further improvements due to cross-American-European thinking and learning.

The book is written for both experts and laymen interested in HILP risks. In some chapters, a lot of technical information is given for the experts, whereas in other parts of the book, the text is written in a very accessible way so that non-experts may follow the whole text. As an example of information given for the experts, the use of probit functions, equations and coefficients are discussed, the technique of QRA is extensively explained, STAMP is explained, the accidents of Deepwater Horizon and Fukushima are analyzed in depth, etc. In brief, the

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domains of technology, procedures and human factors related to HILP risks are treated, they are put in an historic perspective, and discussed in relation to existing European and US legislation, socio-economic factors, and from a safety-scientific viewpoint. New pathways of research such as systemic risks and the STAMP methodology, game-theoretical applications for safety, Bayesian networks that may be used for HILP risks, developments in control theory, decision-making under deep uncertainty, and other very timely, extremely promising, topics to further advance our understanding of high impact low probability risks in the chemicals using industries, are treated.

The book might be seen by some readers as an academic handbook, or a reference book. It can indeed be used to help academics or to teach students, especially process safety scholars but also safety science students, about the essentials of how is dealt with high-impact low-probability risks in the chemical and process industries. Due to the original structure used in the book, and in view of the state-of-the-art of part of the contents, it is however obvious that the author has tried to make the book more than a student course. Opinions and recommendations made by the author are always accompanied by scientific evidence and/or common sense arguments.

For those readers wishing to learn more about one or several of the various topics discussed, a very extensive overview of references is provided, containing academic literature as well as professional publications. Nonetheless, it should be stressed that mostly scientific journal articles are used, especially in discussing the state-of-the-art. Other publications such as books, book chapters, conference papers, and others, mainly serve the narrative and the historical context.

In summary, without being too detailed, since huge progress has been made the past 30 years in the research field of process safety and HILP risks, and also in practicing it, and since an exponential number of documents have been published on the topic (also books), this particular book provides an excellent and legible state-of-the-art overview about high-impact low-probability risks in the chemicals- and oil sectors, for everyone having a desire to learn more. The downside of the attempt of the author to take the very broad and inclusive standpoint for treating such HILP risks, is that the book contains almost 500 pages, making it a work not suitable for a quick-read-through, or for persons with time restrictions, and safety experts generally seem to belong to this kind of people.



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