

## Book Review

**Risk-Informed, Performance-Based Industrial Fire Protection – An Alternative to Prescriptive Codes**, First Edition, by Thomas F. Barry, TFBarry Publications, 704 pages, Publisher: Tennessee Valley Publishing, Knoxville, Tennessee, USA, 2002. ISBN 1-882194-09-8. Available from: <http://www.fireriskforum.com>.

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Books that focus on performance-based fire safety designs are scarce, especially one that employs a risk-based approach. This volume by Thomas Barry serves as a useful reference for fire safety practitioners as well as regulatory authorities on an alternative angle to looking at fire safety designs and methods. The most conspicuous feature of this manuscript is that there are generous number of examples to help explain and illustrate the concepts that the book attempts to convey.

Chapter 1, Program Objectives, sets the scene for risk-informed performance-based designs. It introduces the fundamentals of the risk concept and the associated terminologies, provides an outline of a framework for risk management and a step-by-step approach in conducting risk assessments, discusses project management issues, and finally touches on risk communication which is a topic that has received inadequate coverage to date.

Chapter 2, Risk Tolerance Criteria, describes a methodology for establishing risk tolerance criteria. The risk tolerance development process is presented step by step, with practical examples provided. What differs from some other risk assessment textbooks is that a financial component is introduced in the risk estimation process instead of merely concentrating on the technical portion of the risk. The inclusion in this chapter of data, such as annual fatality rate data for natural and accidental causes, and risk criteria adopted by various government authorities or private enterprises, is valuable to the readers for comparing the typical level of fire risk with other types of risk.

Chapter 3, Loss Scenario Development, presents the usage of event tree techniques and a time-based approach to identify scenarios for risk analysis with plenty of examples. A significant portion of the chapter has been devoted to the discussion of scenario screening and grouping – a technique commonly used to reduce the number of scenarios to simplify the quantitative risk analysis.

The next three chapters alone, i.e. chapters 4 to 6, with 374 pages in total, occupy over half of the book. Chapter 4 discusses in details how the frequency or probability of a defined initiating fire event scenario can be estimated through fault tree analyses together with a wealth of examples and sources of failure rate data. What differs in this chapter from most text books on the same topic is that the chapter introduces the concept of integrating management issues into the estimation of failure frequency. There is however a small omission in the text on the validity of the relationship between

the failure rate  $\lambda$  and the Mean Time Between Failure (MTBF) being expressed as  $\lambda = 1/\text{MTBF}$ ; such relationship only holds if the failure rate can be assumed to be a constant value, and does not apply to the burn-in phase and the wear-out phase in a typical reliability bathtub curve.

Chapter 5 presents a comprehensive overview of various models for estimating the consequences from a fire or an explosion and their effect on specific targets, including humans, buildings, equipment, stock, business continuity, and the environment, most of which should be familiar to fire safety practitioners. The chapter is not meant to reproduce parts of the SFPE Handbook of Fire Protection Engineering but serves to highlight various techniques that risk analysts may have to employ to complete their task.

Chapter 6 portrays a framework for estimating quantitatively the performance of fire protection systems in terms of three parameters, i.e. System Availability (Is the system available at the time of emergency, i.e. not under repair/isolation etc.), Operational Reliability (Will the system perform as required during emergency?), and Response Effectiveness (Will the system respond and function during the entire period of emergency?). The chapter would have been clearer to readers had the terms functional failure, functional reliability and operational reliability been explained in more details.

Chapter 7, Risk Estimation and Comparison, details the process of combining the results of estimation in Chapters 4, 5 and 6 in order to calculate potential risk levels and to provide a comparison with the risk tolerance criteria established in Chapter 2. About a third of Chapter 7 has been devoted to discuss how a commercial spreadsheet can be utilised to develop event trees for conducting what-if sensitivity analyses and Monte Carlo simulations; a useful technique for simpler analyses.

Chapter 8 discusses the final step that most risk analysts will do in the risk assessment process, i.e. a cost/benefit analysis. The chapter provides methods to evaluate the effectiveness of various risk reduction measures, including ignition likelihood reduction, fire protection system performance improvement, and alternative fire safety strategies to modify consequences. Examples of how the risk assessment results (technical and financial) can be presented to the management in conjunction with the risk monitoring process are given.

The final chapter of the book, Chapter 9, is dedicated to the ways of moving forward, in which the author summarises how fire protection designs were based in the past and how they can be carried out in the future, and highlights the benefits of decision making based on risk-informed performance-based assessments. The chapter also introduces the Fire Risk Forum, an online Internet resource that provides an educational platform and informational tools on risk-informed performance-based fire safety and risk-based decision making.

*Risk-Informed, Performance-Based Industrial Fire Protection – An Alternative to Prescriptive Codes* could be a useful reference document for developing an undergraduate course on performance-based probabilistic fire safety design as well as fire risk assessment and management. Whilst novice fire safety practitioners may find the book a helpful introduction to the concept of risk-informed performance-based design, experienced fire safety professionals may benefit from the text by being directed to various sources of fire-risk data that are a rarity in the fire safety engineering field. Although the book was written with industrial fire protection in mind, a lot of information, concepts, data, and models therein can also be used outside the industrial environment such as the building construction industry.

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*The preceding review corresponds to the opinion of the author and does not necessarily represent the views of Ove Arup & Partners Hong Kong Limited.*