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Introduction

The art of making wise decisions is the hallmark of successful management and requires both pertinent information and good judgment. Safety-related decisions, in particular, have traditionally been based on hard-earned operating experience and intuition. As greater demand for improving the safety, security, health, environment, and economic aspects of facilities is placed on chemical companies' finite resources, the decision-making process becomes more difficult and the need for better information becomes more critical.

Company management now recognizes that simply reacting to accidents or attacks and then determining whether additional safety and/or security precautions are needed is no longer acceptable in that order – the potential effects of accidents and attacks are becoming increasingly catastrophic. Furthermore, today's technical, social and political environment also demands that decision makers take a more pro-active approach to safety- and security-related issues. Ever more thorough methods and strategies to gain an increased understanding of the significance of all kinds of (accidental and intentional) risks from the companies' operations are used.

Nowadays, a safety culture that includes a thorough understanding of the importance of safety management is common practice in the chemical industry. The safety culture describes the organization's overall attitude and commitment to safety, or as Williamson *et al.* (1997) put it, a safety culture comprises *the organizational responsibility for safety, the management attitudes towards safety, the management activity in responding to safety problems, safety training and promotion, the level of risk at the workplace, workers' involvement in safety, and the status of the safety officer and the safety committee*. Since September 11, 2001, the day the World Trade Center towers were destroyed by a terrorist attack in New York City, organizations, especially in the chemical industry, are aware of the need to shape a security culture as well, parallel to their existing company safety culture.

Organizational learning is a critical facet of an effective safety and security culture, and one that is common to a number of emerging models and approaches in the safety and security management field. However, several social and institutional barriers to effective organizational learning remain. Pidgeon and O'Leary (2000), for example, highlight two of these: informational difficulties and organizational politics. Cross-company learning through safety and security cooperation

Multi-Plant Safety and Security Management in the Chemical and Process Industries. G.L.L. Reniers

ISBN: 978-3-527-32551-1

is an example that satisfies both these factors. It is only by explicitly recognizing the obstacles to learning that arise in practice that one is able to advance the ideal of safe and secure (group-)organizational designs, and through this to counter the incubation of major failures and attacks.

Looking at the organizational safety and security trends within the chemical industry it is tempting to speculate about what the future holds. Remembering Reason's (1990) basic premise that *systems accidents have their primary origins in fallible decisions made by designers and high-level managerial decision makers*, companies start to realize that preventing major cross-plant accidents is the joint responsibility of safety management and security management decision makers in plants neighboring each other. The latter translates into a large number of individual plant safety and security cultures steadily evolving towards a limited number of multi-plant safety and security cultures within large chemical clusters.

A picture is slowly emerging of global operating companies that will set their own worldwide safety and security standards in combination with worldwide safety-management systems and security management programs. The growing complexity of processes and organizations, global companies with independent business units, corporate goal-setting policies with local implementation, outsourcing and increased involvement by the public are all trends that policy makers and captains of industry have to take into account. Since the challenge will be to develop the most effective system of harmonized codes and standards, a decision-support system that can be implemented on an inter-organizational level to adequately manage cross-company hazards would undoubtedly be a valuable tool.

In this book, such a management strategy tool has been developed as part of a multi-plant safety and security culture, combining an original meta-technical framework for optimizing cross-company cooperation management with code for a technical evaluation model for ranking chemical installation items with respect to their potential danger in a complex industrial area of chemical plants. Chapter 2 discusses chemical safety risks and security risks in general, focusing on external domino effect hazards. The expected evolvement from a plant safety and security culture to a multi-plant safety and security culture is dealt with in Chapter 3, drawing conclusions regarding anticipated future developments. In Chapter 4, the engineering of multi-plant-management procedures is presented. Chapter 5 explains how inter-company cooperation can be organized by using new frameworks, originally developed for this goal in cooperation with an expert panel. Chapter 6 drafts code to elaborate a technical method for guiding the prioritizing of installation sequences that need to be pro-actively investigated using the frameworks. Chapter 7 offers a method to assess, to evaluate and to continuously optimize operational staffing levels in industrial areas. Chapter 8 integrates the building blocks and cross-plant management instruments elaborated in Chapters 4–7. The entanglement of the approaches results in a guideline document for drafting a multi-plant safety and security culture that can be developed for achieving optimized cross-company major accident prevention within a multi-plant area being part of a (larger) chemical cluster. In Chapter 9, game-theory is employed as a mathematical technique to convince top-management of neighboring chemical plants to invest in multi-plant safety and security. Chapter 10 summarizes the work, draws overall conclusions and offers recommendations for implementation.