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Edited by Preben Hempel Lindøe, Michael Baram and Ortwin Renn

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## Introduction: In Search of Robustness

*Michael Baram, Preben Hempel Lindøe, and Ortwin Renn*

### 1.1. OFFSHORE SAFETY

Offshore oil and gas resources are an important part of the global energy system and an asset of high value to many developed and developing nations. Technological advances have enabled the exploration and production of these resources initially in shallow coastal areas and now far offshore in the much deeper waters of the outer continental shelf regions that extend from Europe, North and South America, Africa, and Asia. As a result, vast reservoirs of oil and gas in previously inaccessible seabed regions are being discovered, extracted, processed, and distributed to meet the ever-increasing demand for fuel and energy.

Exploration and production are complex and costly operations that require the coordinated performance of drilling-rig owners and operators with many contractors and service firms. Their success provides significant benefits to the countries that have jurisdiction over such activities, and to the participating companies and investors. However, many aspects of these operations are intrinsically hazardous and thereby pose risks to health, safety, and the environment, as well as to other societal and commercial interests. In addition, there is synergistic risk potential because of extreme weather conditions and other natural hazards that can interfere with operations and emergency response at many drilling sites. Thus, ensuring that operations are safely conducted is a major concern of the governments and industrial organizations involved, and of many others who as stakeholders enjoy the benefits but fear the risks.

Of most concern are major accidents. The history of offshore operations is marred by the sporadic occurrence of blowouts, explosions, and fires at drilling rigs and other incidents that caused multiple injuries and deaths among the workforce, destroyed company assets and other property, and caused major spills that contaminated vast offshore and coastal areas, killed wildlife, and disrupted fishing, transport, recreation, and other activities.

Among the most notorious accidents are the capsizing of the Alexander Kielland flotel (1980), which caused the deaths of 123 of the workers it housed, and the fire

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that destroyed the Piper Alpha rig (1988) and killed 167 workers, in the Norwegian and British sectors of the North Sea; the Montara blowout and oil spill (2009) that continued unabated for 74 days in the Timor Sea off the Australian coast; and the blowout and fire on the Deepwater Horizon drilling rig (2010) in the U.S. sector of the Gulf of Mexico, which killed 11 workers, caused the worst of all recorded spills, which could not be stopped for 86 days, and contaminated a vast region of the Gulf and its shoreline.

Other accidents on a smaller scale occur more frequently and also take their toll, such as the Frade well leak and oil spill (2012) in the south Atlantic off the Brazilian coast, and the gas well blowout in the Scottish Elgin Field sector of the North Sea (2012), which created a hazardous zone and necessitated suspension of neighboring activities. In addition, numerous near-miss incidents also occur and command attention because they may be precursors to an accident or indicate a systemic or industrywide safety problem that may lead to multiple accidents.

These incidents, safety performance data, and particularly major accidents, prompt the countries that authorize offshore operations to undertake reforms in the ways by which they govern the risks of such operations. Risk governance may encompass several forms of institutional control over a hazardous industry (e.g., civil liability law, criminal prosecution, insurance requirements, etc.), but a regulatory regime is the primary means of ensuring offshore safety because of its capacity to fully investigate and address specific problems, and thereby improve performance and *prevent* accidents by mandating or promoting improvements in the design, equipment, and maintenance of operations and the safety management systems and practices of the firms involved.

When improvements in governance are sought, a critical assessment of the existing regulatory regime and industrial performance is undertaken. The assessment may then lead to incremental change in the existing regime and its implementation in the form of a specific recommendation or rule calling, for example, for more stringent testing of well control equipment by offshore operators or for improvements in inspection, maintenance, and training. But when triggered by a major accident, the reform is more likely to involve reconsideration of the premises, design, and implementation of the existing regime and the enactment of a new regulatory regime. In either case, what takes place is a *quest for robust regulation*, for a regime that will be more effective at drawing on industrial expertise and improving the safety performance of offshore operators.

## 1.2. THE QUEST FOR ROBUST REGULATION

The main purpose of this book is to illuminate the issues involved in conceptualizing, designing, and implementing a robust regulatory regime for preventing

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major accidents and improving the safety performance of industrial operators during offshore exploration and production of oil and gas resources. Because quests for robust regulation are also undertaken in other technological sectors that experience or have the potential to cause major accidents, and which encounter similar issues, the book is also intended to contribute to the global body of knowledge about improving safety regulation and industrial safety management of highly hazardous technologies.

The Deepwater Horizon disaster and other major accidents offshore have intensified the quest in producing countries, just as major accidents incurred by other types of industrial activities have done in their host countries. Among such events are the lethal explosions at petroleum facilities in Texas City and Toulouse, the accidental release of toxic materials at chemical facilities in Bhopal and Seveso, the radioactive contaminations caused by cooling system failures at nuclear reactors in Chernobyl, Three Mile Island, and Fukushima, and accidents arising from malfunctions in the operation of pipelines, waste disposal facilities, high-speed rail, passenger aircraft, and the *Challenger* and *Columbia* spacecraft.

The quest for robust regulation that follows such an event usually involves two levels of analysis: investigation to determine *how* the accident occurred, which produces specific findings about contributing factors such as defects in design, equipment, operation, human performance, safety management, and contingency plans; and more far-reaching and speculative analysis to discern the institutional, cultural, economic, behavioral, and other contextual factors which may explain *why* it occurred. This leads to consideration of the lively global discourse about competing concepts of regulation, inspection, and enforcement, issues raised by increasing reliance on industrial self-governance, and accommodation of emerging norms for information disclosure and stakeholder participation.

In order to take a coherent approach to the many issues raised by the quest, this book addresses four main themes. The first is risk governance and the process by which it leads to the design of a robust regulatory regime. This theme is discussed at a generic level applicable to hazardous industrial activities and then in more detail as it applies to offshore operations. The second theme is the critical importance of issues that arise at the interface between government and industry, the “sphere” wherein the regime encounters the private domain of offshore industry and its self-regulatory practices. The third theme is the value of comparing different regimes that have highly developed approaches to offshore safety in order to discern their respective strengths and weaknesses. Finally, the fourth theme is learning from experience, which involves consideration of governmental and industrial processes for gaining and applying knowledge from major accidents, near-misses, and safety performance data.

### 1.3. THIS BOOK

Part I of the book illustrates the need for generic and systemic approaches to technical safety. Given the dimensions of potential accidents, the strategy of trial and error is not acceptable from a safety perspective. It needs to be replaced by anticipatory risk analysis and simulation. Projecting trial and error in the virtual space places, however, many demands on risk modeling and accident prevention and necessitates reliable concepts for robust risk management and regulation. One of these concepts is the risk governance framework of the International Risk Governance Council (IRGC), which has been used as a reference model in this book. This framework is the main topic of Chapter 1. Based on this theoretical insight, Chapter 2 investigates the various patterns of safety regimes and highlights the importance of co-regulatory models. Those models underlie the need for inclusive governance, providing room for stakeholders to be an integral part of the regulatory process. Chapter 3 widens the perspective from governance to the role of safety and risk culture in regulatory practice. The chapter emphasizes the relevance of norms, values and beliefs that govern institutional and individual responses to risk and crisis management. The last chapter in Part I deals with the current literature on public and private regulatory regimes and demonstrates the need for public and private actors to cooperate.

Part II describes and evaluates four notable regulatory regimes governing oil and gas operations offshore. The chapters also consider the cultural, legal, and other contextual factors that have influenced the design and implementation of the regimes, and their reliance on industrial expertise and standards. Of these, the U.S. regime, which has remained essentially unchanged over decades, requires and enforces operator compliance with detailed government-developed prescriptive rules and numerous industrial standards. The U.K. regime, inspired by the Cullen report on the Piper Alpha disaster, requires company analyses of hazards and risks and preparation of a “safety case” for each operation, in order to determine and ensure company awareness and preparedness for addressing the risks. The Australian regime, which is patterned after the UK regime, reflects an engineering approach to safety and is called upon to incorporate knowledge from the social and behavioral sciences. The fourth and most innovative is the Norwegian regime, which calls for each company to develop an internal safety management system, self-determine how it will fulfill essential safety functions, and self-audit its performance, all pursuant to governmental oversight. Part II concludes with a chapter on the role and value of safety performance indicators for a regime, current usage, and the difficulties in garnering comparable data for comparative analyses of different regimes.

Part III presents six case studies based on empirical research of the Norwegian regime and its paradigm shift from prescriptive regulation towards a system of government supervised self-regulation with risk assessment. The robustness and

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resilience of the regime are tested by looking at its capacity to keep pace with new technologies and emerging risks, encourage industrial safety culture, maintain the involvement and vested rights of labor, respond to near miss incidents, and ensure performance of inspection and self-audit functions. The tripartite model for cooperation and the responsibilities and accountability of the players with shifting patterns of adversarial and cooperative modes of industrial relations and social partnerships are characterized as “boxing and dancing.” The chapters discuss how purpose and principles-based regulation may evaporate, dissolve, or become irrelevant, unless industrial realities, management practices, and regulatory expectations are considered. Technological transformations and cost efficiency programs have created premises for the present regime with some of its current vulnerabilities. Finally, inspections, audits and enforcement measures are compared with the hard law approach of the U.S. offshore regime.

The concluding chapter provides a synthesis and summation of the major themes of the book, lessons learned from the case studies and analyses, and a succinct comparison of the major features of the Norwegian, UK and U.S. regimes. It also presents a clarification of the term “Robust Regulation” and considers future application of our insights by the regimes.

Throughout the book, the authors suggest functional features and attributes of a robust regulatory regime that will enable the regime to meet the diverse safety challenges that arise in offshore exploration and production, and to do so in a manner consistent with enlightened principles of democratic risk governance. Among the attributes discussed in detail from several disciplinary perspectives are the capacity of the regime to foster learning from operating experience and external sources of expertise, address the uncertainties and risks of technological change and the conduct of hazardous activities in new offshore locales, ensure effective collaboration between government regulators and industry, and between management and labor, promote improvements in industrial self-regulation and cooperation for the continuous reduction of residual risks, evaluate safety performance and ensure industrial accountability, apply knowledge from the behavioral and social sciences, and meet the transparency and stakeholder participation norms of democratic regulatory processes.

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## PART I

## Regulatory Frameworks and Concepts

## INTRODUCTION TO PART I

The emphasis on robust regulation in a comparative review of different regulatory regimes requires a general framework for the analysis of commonalities, differences, and peculiarities of each regime. Andrew Hale defines robustness in Chapter 16 as a regime “that has survived for a considerable period with its principles intact, but with adaptation in its detail to changing situations and priorities” (Chapter 16). Based on this definition, the three introductory chapters develop a common perspective on risk governance and robustness. Ortwin Renn in Chapter 1 sets the stage for the entire book: he explores the applicability of the risk governance framework of the International Risk Governance Council (IRGC) to the analysis of technical performance and safety and explains its use as a reference model for the oil and gas exploration industry. The stages of risk governance – pre-estimation, interdisciplinary risk estimation, risk characterization, risk evaluation, risk management, monitoring and control, and, embracing all these phases, communication/participation – constitute benchmarks for characterizing different regulatory regimes but also for judging “good governance.”

Chapter 2 picks up this analytic as well as normative aspect. Michael Baram and Preben Hempel Lindøe investigate the various patterns of safety regimes and highlight the importance of co-regulatory models. Those models underlie the need for inclusive governance, providing room for stakeholders to be an integral part of the regulatory process. The chapter also explores how these different regulatory principles and practices manifest themselves in different countries, most notably Norway, the United Kingdom, and the United States.

Chapter 3, by Kathryn Mearns, widens the perspective from governance to the role of safety and risk culture in regulatory practice. Her emphasis is on the norms, values, and beliefs that govern institutional and individual responses to risk and crisis management. In accordance with the two preceding chapters, she advocates

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a structured dialogue between regulators and a wider public, including experts, stakeholders, and affected communities. This request for inclusiveness and adaptive management needs to be efficiently organized, however.

This is the topic of the fourth and final chapter of Part I: Emre Usenmez reviews the current literature on public and private regulatory regimes and demonstrates the need for public and private actors to cooperate. Managing such complex interactions requires, however, new decision-making and communication tools. The chapter discusses the effectiveness and efficiency of several such tools such as nominal group technique and Delphi surveys. None of these tools are perfect but they are capable of facilitating group input and multi-actor involvement.

The four chapters illustrate the need for generic and systemic approaches to technical safety. Given the dimensions of potential accidents, the strategy of trial and error needs to be replaced by anticipatory risk analysis and simulation. Projecting trial and error in the virtual space, however, places many demands on risk modeling and accident prevention and necessitates an excellent monitoring system that provides fast and valid feedback to the modeler and risk managers as to what seems to work well and what not (before it is too late). Parts II and III provide ample illustrations, empirical data, and case studies on the success and failure of safety regimes before Andrew Hale in Chapter 16 draws general conclusions about the basic lessons learned from the conceptual and empirical investigations.

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## 1

## A Generic Model for Risk Governance

*Concept and Application to Technological Installations*

Ortwin Renn

## 1.1. INTRODUCTION

Risk governance refers to a complex of coordinating, steering, and regulatory processes conducted for collective decision making involving uncertainty (Rosa et al. 2013). Risk sets this collection of processes in motion whenever the risk impacts multiples of people, collectivities, or institutions. Governance comprises both the institutional structure (formal and informal) and the policy process that guide and restrain collective activities of individuals, groups, and societies. Its aim is to avoid, regulate, reduce, or control risk problems.

The general process of making and implementing collective decisions – governance – is as old as the human species itself. It encompasses the traditions and institutions that are the vehicle and outcome of these decisions and has a long past.<sup>1</sup> Until very recently, the broad charge embedded in the idea of governance devolved into a much narrower idea, one referring to the administrative functions of government bodies and formal organizations.

Recent events have changed all that. Entirely new forms of coordination and regulation have emerged in response to rapidly changing societal conditions, such as globalization. Boundaries between the public and private spheres, between formal governmental bodies and informal political actors, especially nongovernmental organizations (NGOs), and between markets and business interests and the regulatory needs of society are all blurred. At the same time, as a result of the growing recognition of the increased scale of collective problems, the domains of sovereignty shifted upward to supranational bodies. Owing to these and other changes, the idea of governance has been re-elevated to its original – broad – scope (Rosa et al. 2013).

<sup>1</sup> The etymology of the term dates back to the Ancient Greek times (Halachmi 2005; Kjaer 2004). Plato used the term “kuberman” as a reference to leadership, which assimilated in Latin to “gubernare.” This notion is evaluated along various trajectories. In addition to its meaning in English, it is part of, among others, the French, Spanish, and Portuguese vocabularies.

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A number of key events are responsible for that elevation. Among them is a general rejection of the word “government” in favor of “governance” in postmodern thought on political and economic institutions. Others include the adoption of governance in the official parlance of the European Union. Still more specific actions include the prominent place (including its own title) the term holds in the prestigious independent organization in Geneva, Switzerland: the International Risk Governance Council (IRGC 2005; 2007).

This governance framework established by the IRGC provides guidance for the development of comprehensive assessment and management strategies to cope with risk. The framework integrates scientific, economic, social, and cultural aspects and includes the engagement of stakeholders. The concept of risk governance comprises a broad picture of risk: not only does it include what has been termed risk management or risk analysis; it also looks at how risk-related decision making unfolds when a range of actors are involved, requiring coordination and possibly reconciliation between a profusion of roles, perspectives, goals, and activities (Renn 2008, p. 366).

The shift from government to governance signals a crucial change in the process of how collectively binding decisions are being made: from traditional state-centric approaches, with hierarchically organized governmental agencies as the dominant locus of power, to multilevel governance systems, where the political authority for handling risk problems is distributed among separately constituted public bodies (cf. Lidskog et al. 2011). These bodies are characterized by overlapping jurisdictions that do not match the traditional hierarchical order of state-centric systems (cf. Skelcher 2005). They consist of multi-actor alliances that include traditional actors such as the executive, legislative, and judicial branches of government, but also socially relevant actors from civil society. Prominent among those actors are industry, science, and nongovernmental organizations (NGOs). The result of the governance shift is an increasingly multilayered and diversified sociopolitical landscape. It is a landscape populated by a multitude of actors whose perceptions and evaluations draw on a diversity of knowledge and evidence claims, value commitments, and political interests (Rosa et al. 2013). Their goal, of course, is to influence processes of risk analysis, decision making, and risk management. This is also evident in industrial safety. For a long time, safety was an exclusive topic for corporate management and public regulators (Rasmussen 1997). Not so any more!

In recent times, this dual relationship has emerged into a multi-player arena involving corporate safety managers, representatives of unions and labor, various governmental agencies, and NGOs. How these players interact and how their exchange is organized have been subsumed under the term “regulatory regime” (see Chapter 2 and Chapter 14 in this volume). Andrew Hale defines it as a regime “that has survived for a considerable period with its principles intact, but with adaptation