

# Preface

Technology comprises much more than the products and systems that shape our environment. Today our living, working, transportation, and communication are based on large coupled networks. The functioning of our society is completely dependent on these networks or critical infrastructures, such as electricity supply, water supply, oil and gas production, transportation, banking and finance, and information and communication technologies (ICT). Risk and vulnerability analyses are needed to grasp the impact of threats and hazards. However, these become quite complex, as there are strong interdependencies both within and between the infrastructure systems. The interdependencies can cause redundant systems to fail simultaneously due to common cause failures; one system can fail due to failure of another system and thereby increased load; and finally, if the service of one infrastructure is depending on another (say electricity) there can be a direct cascading effect of a failure.

This book provides a theoretical basis and a practical guideline for analyzing interdependencies and risks in critical infrastructures. Examples and case studies for several infrastructures are included for illustrating the areas of application. Various risk and vulnerability analysis techniques are adapted to different infrastructures. The book describes the identification of hazards that are threatening infrastructures, and enhances the understanding of how these threats can propagate throughout the system and affect other infrastructures. It is mainly aimed at users with limited experience in risk analysis of critical infrastructures, to enable use of the methods in real world problems. The methods are presented describing the inputs needed for the analysis, the type expertise to draw upon, and expected results from doing these kinds of analyses.

The book provides essential reading for municipalities and infrastructure owners who need knowledge about the risks and vulnerabilities of their critical infrastructures, to avoid hazardous events and plan for emergency preparedness. It should also be a valuable reading for consultants and researchers in the area, and could serve as a supplementary curriculum and reading for master students in risk analysis.

The book starts out with a couple of introductory chapters. [Chapter 1](#) gives an overview of some methods and approaches for investigating interdependencies in critical infrastructures, and some literature is briefly reviewed. Main concepts—like risk, vulnerability, critical infrastructure, and different types of interdependencies—are further elaborated in [Chap. 2](#). [Chapter 3](#) outlines a generic “risk and vulnerability analysis” that could serve as a basis for investigating the hazards and risks of an infrastructure system. This analysis should conclude with suggesting risk reducing measures and identification of needs for more detailed analysis through the use of more advanced methods.

[Chapter 4](#) presents a generic method for identifying and analyzing interdependencies, and provides an example applied to railway, electricity supply, and ICT (based on an actual event at the Central station (railway/bus) of Oslo, Norway). The modeling of interdependencies is also the topic of [Chaps. 5](#) and [6](#). A modeling framework for interdependent technical infrastructures and types of vulnerability analyses, distinguishing between global vulnerability analysis, critical component analysis, and geographic vulnerability analysis, is described in [Chap. 5](#). [Chapter 6](#) utilizes the framework and types of analyses from [Chap. 5](#) and presents two case studies on an interdependent electric distribution and water distribution system in a city and on an interdependent railway system in southern Sweden.

[Chapters 7](#) and [8](#) treat risk analyses of electricity supply systems. [Chapter 7](#) describes an analytical approach for the analysis of electricity supply, investigating the consequences of supply interruptions, and [Chap. 8](#) presents three case studies using results of previous chapters in the book. The topic of [Chap. 9](#) is the integrated urban water supply. Challenges faced by the water utilities to provide safe, secure, and reliable service are discussed, and risk analysis models are presented.

The analysis of ICT is treated in [Chap. 10](#). In particular, the dependencies between ICT and other critical infrastructures are addressed. Further, main threats toward ICT systems are explained, and various risk analysis techniques are presented. [Chapter 11](#) discusses risk in maritime transport systems and interdependencies within the transport system, as well as to other infrastructure systems. An example on LNG (liquefied natural gas) transport is presented in [Chap. 12](#).

The last two chapters treat challenges for management. [Chapter 13](#) presents human reliability management and the importance of infrastructure resilience, illustrated by an empirical study of joint stressful conditions for control room operators in electricity supply and water supply systems in California. [Chapter 14](#) concludes the book by discussing organizational challenges regarding risk management in critical infrastructures.

Several chapters of the book are to a large extent based on results from the research project DECRIS (Risk and Decision Systems for Critical Infrastructures), which was funded by the Norwegian Research Council and carried out in close cooperation with the municipality of Oslo.

Risk and Interdependencies in Critical Infrastructures

A Guideline for Analysis

Hokstad, P.; Utne, I.B.; Vatn, J. (Eds.)

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