

Preface

The aim of this book is to summarize probabilistic safety assessment (PSA) of nuclear power plants with WWER440 reactors, and demonstrate that the plants are safe enough for producing energy even in the light of the Fukushima accident. The book examines level 1 and 2 full power, low power, and shutdown PSA, and summarizes the author's experience gained during the last 35 years in this area. It provides useful examples taken from PSA training courses the author has lectured and organized by the International Atomic Energy Agency. Such training courses were organized in Argonne National Laboratory (Chicago, IL, USA), Abdus Salaam International Centre for Theoretical Physics (Trieste, Italy), Malaysia, Vietnam, and Jordan to support experts from developing countries.

The role of PSA for the plants is an estimation of the risks in absolute terms and in comparison with other risks of the technical and the natural world. Plant-specific PSAs are being prepared for the plants and being applied for detection of weaknesses, design improvement and backfitting, incident analysis, accident management, emergency preparedness, prioritization of research and development, and to support the regulatory activities.

There are three levels of PSA, being performed for full power and low power operation and shutdown operating modes of the plants: level 1, 2, and 3 PSA. The nuclear regulatory authorities do not require the level 3 PSA for the WWER440 plants nor other plants in the member countries of the European Union. So, only limited number of plants has available the level 3 PSA in Europe. However, in the light of the Fukushima accident, the performance of such analyses is strongly recommended in the future.

This book is intended for professionals working in the nuclear industry, researchers, and students interested in safety of operational plants. The reader is presumed to have completed the methods of reliability engineering. The book is focused exclusively on safety and risk assessment of the WWER440 plants, therefore, it should not be considered as a substitute for a broader course in reliability engineering.

In organizing the book, the author has attempted to provide examples for illustration of the presented material and better understanding of the text. The book is divided into six chapters.

Chapter 1 presents a short history of PSA including the WWER440 reactors. Chapter 2 describes the WWER440 plants, its safety and operational systems. Both types of WWER440 reactors (V230 and V213) are described to show the gradual steps important in prediction, quantification, and management of the risk for these plants. Chapter 3 describes the main steps of full power level 1 PSA. Each step is illustrated by several examples. Chapter 4 focuses on low power and shutdown level 1 PSA. Chapter 5 is devoted to level 2 full power and shutdown PSA. Chapter 6 presents the PSA applications.

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Bratislava, Slovakia

Zoltan Kovacs

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KOVACS, Z.

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