

Preface

Each year billions of dollars are spent in the area of power generation to design, construct/manufacture, operate, and maintain various types of power systems around the globe. Many times such systems fail due to human error. For example, during the period 1990–1994 about 27 % of commercial nuclear power plants outages in the United States resulted from human error.

Needless to say, human reliability, error, and human factors in the area of power generation have been receiving increasing attention over the years. Although over the years a large number of journal and conference proceedings articles related to human reliability, error, and human factors in power generation have appeared, but to the best of the author's knowledge, there is no specific book on the topic. This causes a great deal of difficulty to information seekers because they have to consult many different and diverse sources.

Thus, the main objective of this book is to combine these topics into a single volume and eliminate the need to consult many diverse sources to obtain desired information. The sources of most of the material presented are listed in the reference section at the end of each chapter. These will be useful to readers if they desire to delve more deeply into a specific area or topic of interest.

The book contains a chapter on mathematical concepts and another chapter on introductory human factors, human reliability, and human error concepts considered useful to understand contents of subsequent chapters.

The topics covered in the book are treated in such a manner that the reader will require no previous knowledge to understand the contents. At appropriate places, the book contains examples along with their solutions, and at the end of each chapter there are numerous problems to test the reader's comprehension. An extensive list of publications dating from 1971 to 2012, directly or indirectly on human reliability, error, and human factors in power generation, is provided at the end of this book to give readers a view of intensity of developments in the area.

The book is composed of 11 chapters. [Chapter 1](#) presents various introductory aspects, directly or indirectly related to human reliability, error, and human factors in power generation including facts, figures, and examples; terms and definitions; and sources for obtaining useful information on human reliability, error, and human factors in power generation.

[Chapter 2](#) reviews mathematical concepts considered useful to understanding subsequent chapters. Some of the topics covered in the chapter are sets, Boolean

algebra laws, probability properties, useful definitions, and probability distributions. [Chapter 3](#) presents various introductory human factors, reliability, and error concepts. [Chapter 4](#) presents six general methods considered useful to perform human reliability and error analysis in power generation. These methods are error-cause removal program, man-machine systems analysis, failure modes and effect analysis, probability tree method, Markov method, and fault tree analysis.

[Chapter 5](#) is devoted to specific human reliability analysis methods for nuclear power plants. The methods presented in the chapter are a technique for human event analysis (ATHEANA), cognitive reliability and error analysis method (CREAM), technique for human error rate prediction (THERP), success likelihood index method-multiattribute utility decomposition (SLIM-MAUD), accident sequence evaluation program (ASEP), human cognitive reliability model (HCR), standardized plant analysis risk-human reliability analysis (SPAR-H), and human error assessment and reduction technique (HEART).

[Chapters 6 and 7](#) present various important aspects of human factors and human error in power generation, respectively. [Chapter 8](#) is devoted to human factors in control systems. It covers topics such as control room deficiencies that can lead to human error, common problems associated with controls and displays and their corrective measures, human factors guidelines for digital control system displays, and human engineering discrepancies in control room visual displays.

[Chapter 9](#) covers various important aspects of human factors in power plant maintenance, including power plant systems' human factors engineering maintenance-related shortcomings, advantages of human factors engineering applications in power plants, and human factors methods to assess and improve power plant maintainability. [Chapter 10](#) is devoted to human error in power plant maintenance. Some of the topics covered in the chapter are facts and figures, maintenance tasks most susceptible to human error in power generation, useful guidelines to reduce and prevent human errors in power plant maintenance, and methods for performing human error analysis in power plant maintenance.

Finally, [Chap. 11](#) presents a total of six mathematical models for performing human reliability and error analysis in power generation.

The book will be useful to many individuals, including engineering professionals working in the area of power generation, power generation administrators, engineering undergraduate and graduate students, power system engineering researchers and instructors; reliability, safety, human factors, and psychology professionals; and design engineers and associated professionals.

The author is deeply indebted to many individuals, including family members, friends, colleagues, and students for their invisible input. The unseen contributions of my children also are appreciated. Last but not least, I thank my wife, Rosy, my other half and friend, for typing this entire book and timely help in proofreading.

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