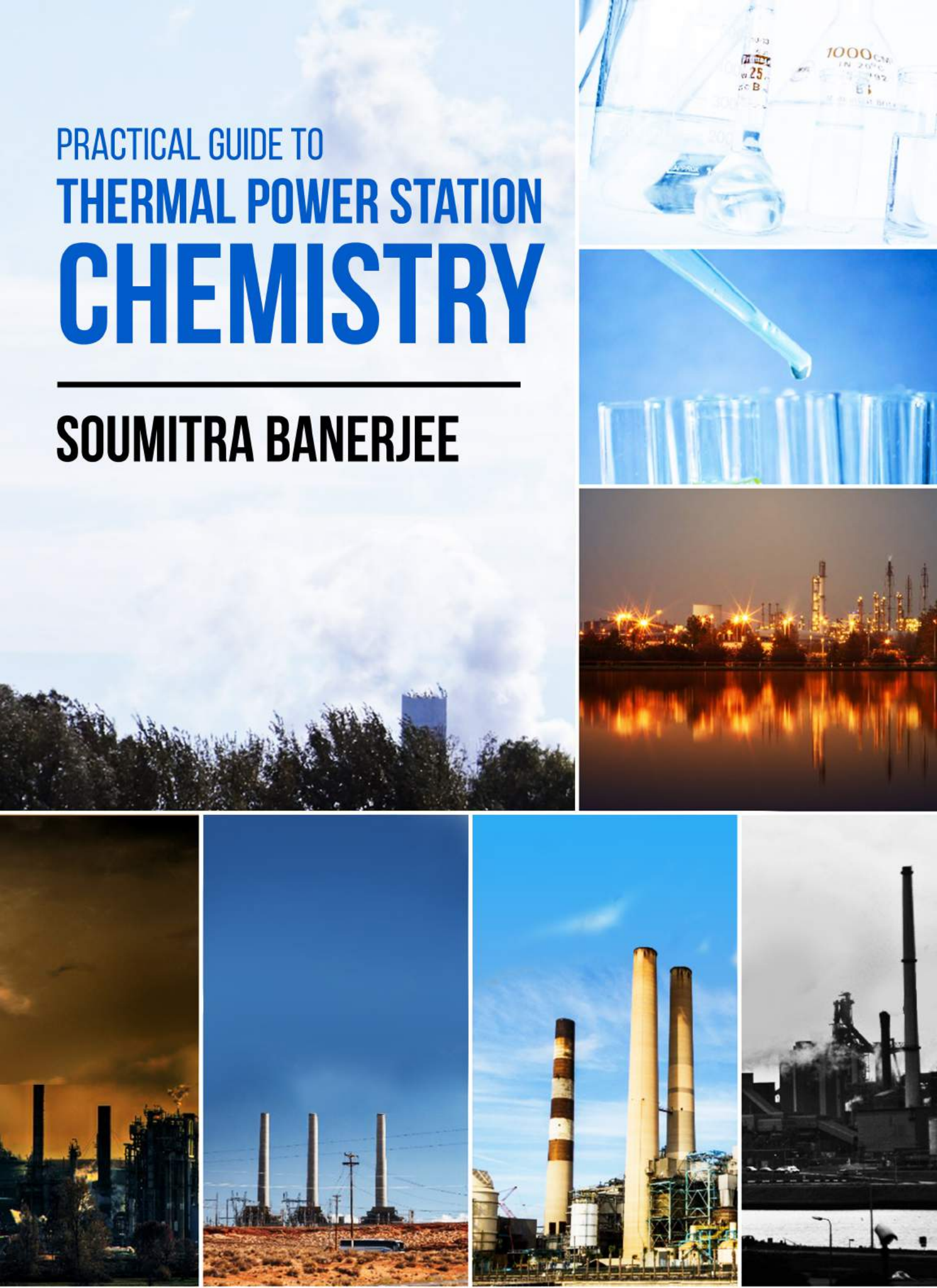
PRACTICAL GUIDE TO

THERMAL POWER STATION CHEMISTRY

SOUMITRA BANERJEE



Practical Guide To Thermal Power Station Chemistry

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Practical Guide To Thermal Power Station Chemistry

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Dedication

This book is dedicated to my parents Shri. Pradeep Banerjee, Smt. Kalpana Banerjee and my family who are the personification of compassion and who always stood for sublime human values.

This book is also dedicated to the nations Thermal Power Stations, big or small, who need to get the power station chemistry stronger than before.

Soumitra Banerjee

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Soumitra Banerjee

Foreword

In India approximately 64% of total electricity generating capacity comes from Thermal Power stations which are highly capital intensive, 24X7 operating asset. To get reliable and efficient output from these costly assets is the responsibility of all of us, the power professionals.

My long experience of managing large thermal stations have taught me that understanding the quality and behavior of two most important inputs, Water/Steam and Coal, is the key to achieve safe, reliable generation with optimum cost. Water in a power station is like blood in the human body. It is everywhere and a good maintenance of its parameter avoids many unwanted happenings. Our friend, Soumitra Banerjee, a consultant in power plant chemistry, with long hands-on experience in multiple big private power stations, have written a book "Practical Guide to Thermal Power Station Chemistry".

This book deals with the entire gamut of work which chemistry department of a power plant does. The book covers water chemistry, steam-water cycle chemistry, cooling water cycle chemistry, condensate polishing, stator water conditioning, coal analysis, water analysis procedures in great details. It is for all kinds of intake water and all types of boilers like Drum/Once-through for subcritical and supercritical technologies in different operating conditions including layup. It has also covered nuances of different cycle chemistry treatments like All Volatile / Oxygenated.

One of the major reasons of generation loss in a thermal plant is because of boiler tube leakage. There is illustration and elucidation on this which will definitely make people more aware of the importance of adherence to strict quality parameters required for the adopted technology prescribed by well researched organization like EPRI. The other important coverage in this book is determination of quality of primary and secondary fuel which is very important to understand combustion in Boiler, apart from its commercial implication. The health analysis of Lubricants and hydraulic oil have also been adequately covered.

I am very much impressed with the detailing of each and every issue. Though Soumitra refers the book as "Practical Guide", the reader will find complete theoretical background of suggested action and the rational of monitoring each parameter. He has detailed out the process, parameters, sampling points, sample frequency & collection methods, measurement techniques, laboratory set up and record keeping very meticulously and there is adequate emphasis on trouble shooting too.

There is a nice blending of theory and practice in such a way that the reader at the end will not only learn what to do and how to do, he will also know why to do.

I hope this book will be invaluable and a primer to every power plant chemist and the station management shall find it a bankable document to ensure best chemistry practices.

S N GANGULY
EX REGIONAL ED &
ED(OS), NTPC LTD.

Foreword

Power Plants are critical infrastructure essential for the development of Industry and for general living. Even though today emphasis is being given on renewable energy to control environmental hazards but conventional power sources will continue to support the power requirements in the Country. With the emphasis being given to emissions control, the technology is being advanced to have more efficient means of power generation which will reduce emissions. Technologies such as super-critical, ultra-supercritical, Carbon Capture & Storage, etc have been developed for enhanced efficiency and lower emissions. At the base of all these technologies is the Chemistry to be adopted and maintained for efficient & reliable power generation and availability of the components. Many of these technologies have been implemented in last decade and a half or so in the Country. At the heart of Indian power stations has been an awareness of the need to sustain and improve the skills and knowledge of its technical staff. This is being achieved by formal and on-job trainings. However; still there is a void in terms of available literature which can help the power plant professionals in understanding of science & technology of Chemistry involved in efficient and reliable power generation. The present book, "**Practical Guide to Power Station Chemistry**" aims to cover the theory and practice of Power Station Chemistry.

Water and steam are the lifeblood of any steam-driven power facility, and proper chemistry control is critically important to plant operation, reliability, the bottom line, and especially personnel safety. Today's plant chemist has to be involved in various activities such as pre-treatment of water, production of high purity water for feeding as make up to boiler (high purity water using techniques like Demineralization, Membrane filteration, Electrodeionization, etc), Treatment of Condensate and equipment cooling water, maintaining steam-water cycle parameters, Low Pressure & High Pressure Dosing of Chemicals, Testing of Fuels - coal, gas, biofuels, etc, testing of oils and lubricants, treatment and management of effluents/wastes, management of environmental pollution monitoring and control equipment/systems, and many such jobs. In the last one decade, our understanding of high-pressure water/ steam chemistry has greatly advanced through direct experience in spite of research and numerous publications regarding steam generation chemistry, many in the power industry have not yet been properly informed of new developments.

It is with pleasure therefore that l introduce this "**Practical Guide to Power Station Chemistry**" which has been dedicated to Indian Power Stations primarily but may be useful to other power plant personnel. It will be invaluable to engineers and chemists across India.

Date January 27, 2020

Ashwini K Sinha
Principal Consultant,
Corrosion and Water Management Consultants
and Ex- Addl. GM, NETRA, NTPC

Preface

To the First Edition of "Practical Guide to Thermal Power Station Chemistry".

The book is intended as a reference book for all coal or fossil fuel based thermal power plants in the world. It may also be used as a text book in the power training institutes or institute of power technology for courses in Power Station Chemistry. Although meant primarily for the chemistry graduates, Chemistry post graduates and Chemical engineers, it will be equally useful for power plant operational personnel.

In our country, until now, complete power plant chemistry is not taught as such. Chemists and engineers learn them during their job in power plant and the knowledge remains partial and in silos, this is an attempt to open the complete knowledge base including procedures of best practices. This book is intended to be a practical guide on raw water treatment, pretreatment, DM plant, membrane technologies, different boiler water treatment technologies with guidelines, chemical analysis procedure of water, coal & lubricants, cooling water treatment and chemistries, heat transfer, boiler tube failure mechanism due to chemistry, coal sampling and GCV balancing across power station, stator water chemistry with many figures and tables.

While the power plant chemistry advanced with supercritical and ultra-critical technologies, with introduction of modern way of monitoring but after British Electricity International (BEI), London, Volume E, 1992, on Chemistry and Metallurgy, there was no text book written by any author on complete power plant chemistry practical aspects. No text book written by an Indian author is available on this subject. This book covers almost complete practical aspect of advanced power station chemistry. The present volume is meant to fill this gap.

Throughout the text, attempts have been made to present the subject matter in a simple, lucid and precise manner, stress has been laid in making the reader understand the figures and tables.

It is regretted, however, that despite careful scrutiny of the proofs, printing or typographical mistakes may remain in the book. If such mistakes are pointed out by readers, the same will be gratefully received.

Author has drawn heavily from the existing literatures on the subjects, for which he gratefully acknowledges. Lastly but most important, author want to than Shri. Purushottam Thakur, Head of Generation, The Tata Power Co. Ltd., who inspired him to start writing this book during author's tenure with The Tata Power Co. Ltd.

Bangalore **Soumitra Banerjee**

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