

PREFACE

The field of radio-activity has garnered a considerable interest since its discovery by Henri Becquerel in 1896. This landmark discovery paved the way for several other equally important events such as the discovery of radium by Marie Curie and Pierre Curie in 1898, neutrons by James Chadwick in 1932 and artificial radioactivity by Irène Curie and F. Joliot in 1934. These milestones eventually culminated in the discovery of nuclear fission by Otto Hahn, Fritz Strassmann, Lise Meitner in 1939, which led to the birth of “nuclear-era”. Over the decades, the field of radioactivity and radiation has evolved from fundamental interests to technological arena. In the beginning, it was envisaged that nuclear technology will be confined to only power production. However, this perception started to change by the discovery of several non-power applications, such as $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$ radio-nuclide generator at Brookhaven National Lab in 1960, which turned out to be a work-horse of early cancer diagnosis. The application of C-14 dating for age determination fetched Nobel Prize to W. F. Libby in 1960. Smoke detectors using radioactive materials became commercially available in early 1960s. These initial discoveries led to the rapid expansion of non-power applications of nuclear technologies.

The present book is intended to give a broad overview of non-power applications of nuclear technologies, developed by BARC, in the field of health, agriculture, water resources, environment and industry. Nuclear waste is a rich source of unique and valuable wealth. Protocols for the recovery of valuable radio-isotopes from radioactive waste and their utilization have been adequately discussed. There are dedicated chapters on radiopharmaceuticals, radiation processing technology for healthcare sector, radiation technology for genetic enhancement of crop plants and improvement of crop productivity, radiation in food processing, radiation assisted hygienisation of municipal sewage sludge, radiotracer applications in industry, sealed radioisotope sources, nucleonic gauges in industry, isotope techniques in water resources, non-nuclear applications of deuterium/heavy water, radiation processing of polymers and use of radioisotopes in assessment of potential ecological risk due to sedimentation. There are specialized chapters on neutron scattering and neutron activation analysis which will be useful to those working in these areas of research. The concept of nuclear battery has also been elaborated.

We would like to express our sincere gratitude to Shri K. N. Vyas, Chairman, Atomic Energy Commission and Secretary to the Government of India, Department of Atomic Energy for his keen interest in this book. We are thankful to all the authors for their contributions. Dr. G. Ravi Kumar, Head, Scientific Information Resources Division, BARC, and his colleagues Shri Manoj Singh, Smt. Leena A. Kanal, Shri Bhushan S. Chavan, Shri Dinesh J. Vaidya and Shri Sanjay Kumar Singh are thanked for taking efforts for publication of the book.

Although due care has been taken to make the book as error-free as possible, some oversight may have crept in as unnoticed. We shall be thankful to the readers for bringing such unintentional errors to our notice. We have made attempts to strike a balance in the contents of the book to make it appealing to a wide spectrum of readers comprising of science professionals and non-professionals.

A. K. Tyagi
A. K. Mohanty