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# Waste WEALTH

During the last decade, a quantum leap has been achieved in the technological advancement in back-end of nuclear fuel cycle, especially in the field of spent fuel reprocessing and radioactive waste management. Right from the inception of BARC, Nuclear Recycle Group is contributing towards the expansion of Indian Nuclear Power Programme (INPP) envisioned by Dr Homi J. Bhabha. The journey started from 1965 when India's first reprocessing plant, i.e., Plutonium Plant at Trombay was commissioned for reprocessing of Spent Nuclear Fuel (SNF) of research reactor origin. Since then, efforts were continued for development of advanced technologies for reprocessing of SNF from each stage of power programme as well as ensuring safe and efficient management of radioactive waste including extracting valuable radionuclides from waste for societal applications to realise the concept of 'Wealth from Waste'.

India follows 'closed fuel cycle' and spent fuel reprocessing acts as a bridge to integrate various stages of INPP adapted for enabling optimum use of available nuclear fuel resources in our country. This will catalyse transition towards thorium-based technology to provide self-sustained solution for country's long term energy needs. Over the past decades, progressive advancement has been made in reprocessing flow sheet to continuously enhance the overall product purity and separation efficiency. The head-end systems of reprocessing plants were mechanised & automated for increased throughput with reduced radiation exposure to plant personnel while operating and maintaining the systems.

As a result, technological maturity has been achieved by reprocessing of spent fuel from thermal neutron based research reactor and power reactors. R&D was also focussed to achieve the goal of tapping power from Thorium for nuclear energy security. As a part of this, irradiated Thoria fuel bundles in CIRUS and PHWRs were reprocessed in UTSF and PRTRF respectively, to demonstrate the engineering

capabilities of Thoria-based fuel reprocessing flow sheet on industrial scale. This has helped in establishing a steadfast scientific and technological foundation.

Management of radioactive waste has always been the thrust area for developing scientific concepts and translating the same into innovative technologies. Emphasis has been towards environment friendly green solutions and diverting recovered radionuclides for healthcare applications. There has been distinctly visible improvements in its treatment, conditioning, transport and disposal technologies. An efficient and safe waste management practices in congruence with evolving global approaches has been given vital priority in INPP. The same has been recognised as a very important component of National Policy on Radioactive Waste Management (RWM). India has made a phenomenal progress in technological advances towards development of novel extractants and separation technologies for recovery of valuable radioisotopes from high level radioactive liquid waste and their utilisation for societal benefit like medicine and cancer treatment. This has altered the public perception in the otherwise complicated issues pertaining to waste management. The radioactive wastes are gradually turning into the material of resource thereby, establishing 'Waste to Wealth' philosophy.

It is felt necessary to bring out a gamut of scientific and technological aspect about advanced fuel cycle so that effective and state-of-the-art technologies can be implemented at various stages especially in view of the sense of fear in general public associated with radioactive wastes and their long-term radiological characteristics.

This issue features twelve articles on industrial experience of reprocessing and radioactive waste management and four articles on technological advancements towards healthcare applications. Nine articles are pertaining to R&D activities involving process and matrix development along with spinoff applications. Finally, News Corner and Synopsis sections are also included to highlight the outcome of diversified scientific and academia efforts towards technological development for spent fuel reprocessing and radioactive waste management.

The front cover of this issue carries an iconic picture of Plutonium Plant, first milestone to India's progressive journey of back-end fuel cycle, glimpses of back-end activities and view of future melter technology. The back cover of the issue is highlighted with Waste Immobilisation Plant at Trombay presently under operation for management of HLW and equipped with associated systems to demonstrate the concept of 'Wealth from Waste'.

I take this opportunity to congratulate all the authors for their precious contributions to enhance the elegance of scientific and technological contents published in this issue. Finally, I acknowledge the untiring efforts and sincere hard work of Editorial Team members for their time-bound compilation of all the articles to bring out the special issue of BARC Newsletter on activities pertaining to back-end of nuclear fuel cycle.