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Partitioning of High Level Liquid Waste for value recovery –a step toward advance fuel cycle

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India has adopted a 'closed fuel cycle' considering spent fuel a material of resource. This has enabled not only optimally utilising the scarce resource of Uranium but also helped in efficient management of radioactive-waste and opening the possibilities for tapping the energy of various useful radio-isotopes present in waste for societal benefits which otherwise are not available in nature. Reprocessing of spent fuel enables in recovering of fuel and recycling them to future reactor for utilising as fuel. Such recovery and recycling of fuel material in reactor to generate power not only helps in ensuring the energy security of the country but also helps in reducing the rad-waste volume meant for geological disposal to a great extent. Spent fuel reprocessing results in recovery of more than 95% of material and hence generates a very small amount of high level liquid waste (HLLW) which is significantly lower than the direct disposal of spent fuel in case of 'open fuel cycle'. The HLLW, characterised by high concentration of radioactivity in combination with presence of long lived minor actinides, poses the challenge for its safe management. The HLLW is vitrified in suitable glass matrix and interim stored for removal of decay heat. The advantage of vitrification of HLLW into vitreous matrix is to immobilise the radioactivity in chemically durable form ascertaining containment and isolation of radioactivity from the human environment for extended period of time.

HLLW contains many valuable radio-nuclides such as Cs-137, Sr-90, Ru-106 etc which have various societal applications in the field of industry and healthcare. India has put a step forward in implementation of advance fuel cycle by recovering the valuable radionuclides from HLW and deploying them for various societal applications. Separation science has played a key role in selective recovery of these radio-nuclides in pure form from HLLW. Recovery of Cs from HLLW using solvent extraction based system enabled use of Cs in non-dispersible glass form for irradiation purpose. Recovery of Sr-90 from HLLW was also demonstrated to milk out the radio-pharmaceutical grade Y-90 for radiopharmaceutical applications. Recently, Ru-106 has been recovered from HLLW to produce Ru plaque for eye cancer treatment.

Reprocessing of spent fuel for recovery of heavy metals followed by extraction of useful radioisotopes reduces the waste volume immensely prior to isolation and their eventual disposal. The paper outline, the practices being adopted in India for management of high level radioactive waste. A brief description covering the important aspects of waste management like the sources of HLW, composition details along with management strategy is given.

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Country or International Organization

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