Canadian Nuclear Laboratories' Thoria Road Map Project

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The use of thorium as a fuel in current water-cooled power reactors has been assessed in numerous studies for decades. Thorium dioxide could be deployed as a fertile fuel matrix in current reactors, for consuming plutonium or transmuting nuclides. Thoria-based fuels for LWRs and HWRs show potential for improved in-core fuel performance in terms of reduced fission product release and reduced erosion, if defected. Test programmes (out-reactor and in-reactor) of thoria fuels have been carried out in the past, are currently ongoing, or are planned to determine key properties, performance, and behaviour of thorium dioxide fuels. These efforts have been essential to consider extensive use of thoria in existing reactors. Nevertheless, thorium-based fuels require further characterization and their behaviour must be well understood to ensure their safe performance under normal operating conditions and accident scenarios; processes must be further developed for manufacturing and reprocessing thorium-based fuels on an industrial scale. Computer codes for design, safety analyses and core following must be developed and validated; and challenges in radiation protection, waste management and safeguards must be addressed. The Canadian Nuclear Laboratories Thoria Road Map Project looks at eleven technological areas and defines gaps to be addressed. Specific examples of current experimental and modelling work to address these gaps will be discussed.

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Dr. Bhaskar Sur is the Director of the Nuclear Science Division at Canadian Nuclear Laboratories in Chalk River, Ontario. Sur, as he is commonly known, obtained a Master's in Physics from the Indian Institute of Technology in Kanpur, and a Ph.D. in Physics from the Ohio State University in Columbus, Ohio. Following post-doctoral work at Lawrence Berkeley Laboratories in Berkeley, California and at Queen's University in Kingston Ontario, he joined Chalk River Laboratories in 1992. Sur has broad research interests in nuclear science, particularly in nuclear instrumentation and in neutronics and neutron-beam experiments.