Development of Automation and Remotisation Systems for Fabrication of (Th- U^{233})O_2 MOX fuel for AHWR

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To meet the ever increasing power requirement of India, country is planning to utilize its large thorium reserves for the third stage of nuclear power program based on Thorium- Uranium^{233} fuel in A.H.W.R. Although there are many advantages of (Th- U^{233})O_2 fuel cycle, presence of radiological hazards due to the presence of 1000-2000 ppm level of U^{232} in the U^{233} fuel and inertness of ThO_2 makes handling and fabrication of fuel difficult. The associated high alpha and gamma activity demands high level of automation and remote handling in alpha tight hot cells. To demonstrate automation and remotisation in (Th- U^{233})O_2 fuel fabrication , a mock up facility is being set up at BARC. This facility shall develop automation systems required for remote fuel fabrication in a simulated hot cell environment. There are many innovative schemes and systems being developed like integrated powder pellet system, remote viewing system for hot cell application etc. Low visibility inside the hot cell has always been a problem for the operator. To overcome this problem a remote viewing system has been developed by which entire hot cell area can be scanned with the use of a joystick and the display can be seen on a LCD monitor. The viewing system is made up of radiation resistant optics which can work even in high gamma fields. It consists of objective end assembly which is used to scan the hot cell area with the help of prism doublets and drive mechanism for capturing full 360^0 solid angle view. There is a Galilean telescope and focusing system used for focusing images of distant objects. Drive mechanism can be controlled by the joystick available to the operator. System has a high resolution CCD display and camera which gives a clear display of objects lying inside the hot cell area.

Integrated powder pellet system is being developed for fabrication of MOX pellets from feed powder. This will be automated system which will take input in the form of MOX powder and convert it into sintered pellets performing various operations like weighing, mixing and milling, compaction and finally sintering. In the system various operations are integrated to reduce the overall size and improve the performance of the system.

Similarly efforts are carried out to develop systems for various pin handling operations required in fuel fabrication process. These operations will be performed in simulated hot cells remotely with the provision of master slave manipulators for maintenance and troubleshooting. After gaining experience from this mock up facility, actual (Th- U^{233})O_2 fuel will be fabricated on laboratory basis in another facility with the heavy shielding in place.

Hence a large thrust is being given to demonstrate the front end of AHWR thorium fuel cycle facility which will help in success of the Indian third stage nuclear program.

Keywords: U^{233}, AHWR, Automation, Remotisation