Automated Powder Processing, Pelletisation and Inspection System For AHWR Type Fuel Pellets

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Development and fabrication of (Th–U\textsuperscript{233})\textsubscript{2}O\textsubscript{2} fuel inside hot cell for Advance Heavy Water Reactor is an important step in realization of India’s three stage nuclear power program. The associated high gamma activity demands high level of automation and remote handling inside hot cell to reduce man-rem. Engineering Design & Development Division and Radiometallurgy Division developed mock-up facility for automation and remotisation of (Th–U\textsuperscript{233})\textsubscript{2}O\textsubscript{2} fuel fabrication and commissioned in CIRUS, BARC. Fabrication of Nuclear fuels inside hot cell becomes very difficult. With only master slave manipulators as the handling aid, automation of all fuel fabrication processes is highly desirable. In order to gain sufficient experience in fully automated fuel fabrication, mock-up facility has been designed, installed and commissioned. Surrogate powders like Alumina and Zirconia are being used for mock-up trials.

Installation, commissioning and operation of any equipment inside hot cell must address constraints such as limitation of space, compactness of the system, ease of maintenance and operation. Many innovative schemes and systems have been incorporated, which not only address these constraints but also help in reducing process time ensure operational convenience and ease of maintaining these systems.

The facility consists of a series of interconnected cells. Some important major equipment includes (a) automated powder transfer and handling system. (b) automatic dosing system (for powder and other additives). (c) gravity discharge. (d) hydraulic presses with automated tool changing. (e) pick & place and tray indexing set-up for green pellets. (f) conveyors for transfer of trays. (g) stack preparation station. (h) loading/unloading to/from sintering furnace. (i) pellet inspection set-up. All these operations will be performed in simulated hot cells remotely.

This facility has a centralized control facility and all the operations can be controlled through single computer having SCADA software. Communication between SCADA software, different Human Machine Interfaces (HMI) and drives is through Ethernet. The system is having Auto as well as Manual mode of operation. Individual cell operations can be controlled through the respective HMI’s or the centralized PC. Each and every component can be controlled independently of others in manual as well as auto mode.