

When I Look Back My Career at BARC...



Manjit Singh

I joined BARC in the year 1972 after my graduation from Punjabi University, Patiala, Punjab. After one year orientation course at BARC Training School, I joined Reactor Control Division of BARC in the year 1973. I have been lucky to have worked under the guidance of a great man (late) Shri S. N. Seshadri during the period from 1973 till 1986, when he suddenly expired at the age of about 56 years. Shri Seshadri could motivate a large number of persons like me to take up challenges and deliver at any cost. I have also been lucky to have a team of very competent engineers reporting to me.

During early days, PHWRs were built with the provision of dumping the Heavy Water moderator for reactor shutdown. Subsequently, it was decided to introduce solid absorber elements into the reactor core using remotely operated reactivity control mechanisms. Indian research reactor 'DHRUVA' and power reactor at Narora were designed with mechanical shutdown system. Being safety critical system, design of shutdown mechanism is challenging in itself. At the time of reactor start-up, the absorber elements are withdrawn one-by-one and for shutdown, rod falls freely into the reactor core in a given time period, also ensuring minimum terminal velocity at the end of its travel. Moreover, depending upon reactor layout and number of such mechanisms to be provided on the top of the reactor, space available for the mechanism is limited, which makes it a custom-built design. Design of the mechanism is also dictated by the weight of the absorber element, its travel, withdrawal time and its rod drop characteristics. Shutdown mechanism is built with modular construction giving ease of maintenance, fail-safe and free fall for the required length of travel giving consistent rod drop performance. This assignment was first-of-its-kind for Indian research and power reactors. Being safety critical system of the reactor, design is qualified through prototyping and subjecting it to life-cycle testing to demonstrate its reliability and repeatability in its performance. Design of shutdown mechanism adopted in the research reactor DHRUVA and power reactor at Narora is considered to be 'Benchmark design' for subsequent reactors.

The next challenge on which my team worked was design and development of BARC Coolant Channel Inspection System (BARCIS) for in-service inspection (ISI) of coolant channel of 220MWe and 540MWe PHWRs. The assignment was given by Dr. Anil Kakodkar, our Ex-Chairman, AEC in 1991. The system was successfully developed in a record time of less than a

year. A number of BARCIS units are in regular use at various Nuclear Power Plant Sites. I feel proud that our team could contribute significantly towards Nuclear Power Programme of the Department. BARCIS has been in regular use at all our PHWRs for ISI activity and thus forming an important tool in the coolant channel health assessment programme of PHWRs.

Based on the successful deliveries mentioned above, Dr. Kakodkar entrusted the development of robust remote handling and robotic products for use in radioactive environment to my team in the year 2000. We could deliver rugged duty mechanical master-slave manipulator and servo-manipulator to various users. We also developed mobile robots for remote survey and inspection of radioactive areas. We took the challenge of building a mobile robot with on-board manipulator and remove Anti-Tank Mine Fuzes remotely at Ordnance Factory Khamaria, Jabalpur, in the year 2007. On another front, we developed an automated Guided Vehicle (AGV) based Materials Transfer System for use in the manufacturing environment in the year 2010.

The most satisfactory experience has been the design and development of indigenous low-cost Teletherapy Machine for the treatment of cancer. Cancer is a major public health concern in our country, and due to various reasons the incidence of cancer is expected to increase substantially in coming years. Considering the growing need of such machines in the country, we have developed a state-of-the-art machine Bhabhatron incorporating the latest concepts in safety, control and user interface in the year 2005. This low cost machine has a number of features superior to any other machine in the category. More than 30 machines are operating at various cancer hospitals and treating large number of patients on regular basis. These include rural and semi-urban areas where our machine has unique advantage of running even on battery/ small generator during power-cuts. We could also deliver a robust Radiotherapy Simulator to localize the treatment volume to be subjected to radiation during radiotherapy treatment, in the year 2011. Currently we are working for the development of an indigenous low-cost robotic system for minimally invasive surgery which is a special type of servo-manipulator. The imported systems are prohibitively expensive. Based on our experience in servo-manipulator technology, we are confident of meeting this challenge in reasonable time.

The experience of working at BARC has been satisfying and I will cherish this forever. I consider the motivation from our leaders and team-work have resulted in success in all our endeavors.