

production as the key to the commercial success of the CANDU system and is devoting considerable effort to rehabilitation of the Glace Bay plant, together with intensive development of the established generating station heavy-water production process, and then to active investigation of and experimentation with other possible extraction processes.

Fundamental research has always been, and must remain, the basis of AECL's development, and the major special tools for this research are the three high-power experimental reactors WR-1, NRU and NRX. Not only do these reactors have provision in their cores for the irradiation of materials over extended periods of time, but special isolated fuel channels, or loops, are provided for the in-reactor testing of different fuels and coolants — such testing being fundamental to prosecution of the Canadian power reactor program. Horizontal holes through the reactor shielding allow intense neutron beams to be directed to various experimental research facilities.

All three large reactors have undergone considerable change in the course of their operating history. NRX, with two calandria changes, entered its 25th year in 1972 and remains a vital research facility rather than a treasured museum-piece. At Whiteshell the organic-cooled WR-1 has undergone two major modifications. The original stainless steel fuel channels have been replaced with channels of Ozhennite-0.5, a zirconium alloy of greater neutron "transparency" which will permit a reduction in fuel enrichment and a 50% increase in neutron flux. In addition, the reactor core has been increased in size from 37 fuel sites to 54, the 17 new fuel channels being part of a third independent coolant circuit. A fourth in-reactor loop has also been installed.

It had been planned for some time to shut the NRU reactor down and carry out a vessel change, and in 1972 an opportunity to do this presented itself. By the end of the year the old reactor vessel had been successfully removed and preparations for installing the new one were well advanced. A most significant result of the NRU vessel change will be the addition of two further in-reactor loop positions.

Complementary to in-reactor experimentation, out-of-reactor loop tests can simulate the environment of a power reactor, apart from the radiation field. One of the major pieces of out-of-reactor test equipment is the freon loop, a large test rig designed specifically for investigation of the boiling water heat transfer and flow characteristics. With three full-sized test sections, the loop will provide realistic test facilities for any type of CANDU fuel configuration presently envisaged. The use of freon, with its low boiling point, as a modelling fluid to simulate water provides a considerable saving in both construction and power costs.

A further major research tool at the Chalk River Nuclear Laboratories (CRNL) in Ontario is the "MP" tandem Van de Graaff accelerator. Among its many uses are precise studies of the structure and excited states of heavy atomic nuclei. Data acquisition and analysis equipment associated with the accelerator is on-line to powerful data processing systems. In 1972 this machine was up-rated from 10 to 13 million volts and a new magnetic spectrometer was installed in one target position. These modifications will provide higher particle energies and considerably increase the machine's research potential.

AECL does not conduct an active research program on the question of fusion, but does maintain a watching brief on work being done in other laboratories. There is good reason to suppose that were a fusion reaction successfully maintained and safely contained, it might prove more profitable to use such a reaction as a neutron source for a CANDU fission system rather than as a power source on its own.

In the field of technical information the introduction of mechanized systems is progressing. The main CRNL Library, Canada's national repository of nuclear literature, has successfully introduced computer control of book circulation, periodical renewal and budgeting. Experimental operation of a computerized current awareness service has started, initially to serve AECL staff, but later to be extended on a national basis.

With the coming to maturity of the CANDU-PHW power reactor system an increasing load of development work is being handled by both CRNL and WNRE. Despite this, a high quality of active research has been maintained, as has collaboration with other laboratories in universities and research institutes in Canada and abroad.

Recently there has been growing public concern about pollution of the environment, even extrapolated to the development of nuclear power and the handling of radio-active wastes. For many years AECL has maintained an environmental research branch at the Chalk River Nuclear Laboratories and has been able to study the problems of radio-active waste