

operate at higher temperatures and more moderate pressures. An additional (and unexpected) bonus is the fact that the organic coolant deposits minimal amounts of radio-active corrosion products on piping surfaces, so that most of the primary heat-transport circuit is readily accessible for maintenance. In the case of the WR-1 reactor, activity fields around the primary circuit are trivial, even when the reactor is operating at full power.

Power reactor development. The year 1972 saw the proving of the CANDU-PHW concept as a reliable and economically attractive energy source. All major technical questions affecting their viability, e.g., heavy-water losses, on-power fuelling and fuelling costs, have been satisfactorily answered. Equally important is the fact that Canadian industry has been proved capable of bringing such a complex project to fruition ahead of schedule. The reliability of the Pickering reactors in a non-routine situation was also convincingly demonstrated in 1972 when, after a lengthy shut-down due to a strike by Ontario Hydro employees, the three reactors were re-started and brought to full power without incident and with remarkable rapidity.

Pickering generation station is, however, merely the starting point for Ontario Hydro's nuclear-intensive energy program. Bruce, a four-unit, 3,000-MW PHW installation is scheduled for completion by 1979. Subsequent nuclear generating stations will continue to use the PHW system, probably until the late 1980s. A similar pattern, although starting later, is expected with Hydro-Quebec whose operating experience with the AECL-owned Gentilly BLW reactor is to be augmented by the construction of a 600-MW PHW installation on the same site.

With this in mind, it is apparent that a large part of AECL's power reactor development activities will be oriented to the support and enhancement of the PHW reactor. Evidence of this development will be seen in the Bruce generating station, whose design incorporates many evolutionary, rather than revolutionary, design changes. These are especially aimed at increasing the reliability of the conventional (as opposed to nuclear) components, such as pumps, seals and valves. Improvement in the thermal efficiency of the PHW will be realized by operating the heavy-water coolant in the near-nucleate boiling mode. In the period 1969-71 the Nuclear Power Demonstration reactor at Rolphton, Ont. was operated in this manner to provide data on hydrodynamic stability, reactor control, and corrosion effects of the boiling heavy-water coolant. This experimental work provides a good example of how AECL's research and development work is aimed "at a moving target" since results from the NPD investigations had particular relevance to the CANDU-BLW Gentilly project.

The major thrust in AECL's power reactor development is toward realizing capital cost reductions without compromising the basic CANDU concept of neutron economy. The BLW reactor, with its reduced heavy-water inventory, single-stage cooling and reduced construction time, represents a move in this direction. Further exploration of this concept could include use of plutonium-enriched fuel which, in a BLW, would enable considerably more power to be extracted per core unit volume. Not only would this offer substantial cost savings but it would provide an opportunity to utilize the plutonium contained in spent PHW fuel, thus effectively "stretching" Canadian uranium resources. A longer-term possibility is the employment of the thorium fuel cycle in conjunction with an organic coolant, and plutonium enrichment, or possibly a supply of neutrons from an external source.

Fuel development work at AECL is now aimed at first improving the existing uranium dioxide fuel to further increase its ability to withstand sudden reactor power fluctuations, and then at developing new, higher density fuels such as uranium silicide and alloys.

Heavy-water production remains, in many ways, the keystone to the growth of Canada's nuclear power program. The shut-down of the Douglas Point reactor in the summer of 1972, for decontamination and other maintenance work, together with the shut-down of NRU, one of three high-power experimental reactors, for a vessel change released sufficient heavy water to allow Pickering III to start up. This is indicative of the present short supply of this material. With the rehabilitation of Glace Bay (a 400-ton-per-year plant), the maturation of the Port Hawkesbury plant (400 tons per year) and the coming into service of the 800-ton-per-year Bruce plant (supplied with steam from the Douglas Point generating station) in 1973, the short-term heavy-water-supply problem should be relieved. If the hoped-for expansion of nuclear power in Canada (especially in Ontario) is to be realized, then further heavy-water production facilities should be committed in the near future. AECL regards heavy-water