

structure studies, and earlier tandem Van der Graaff made pioneer work possible by providing multiply charged ions of precisely known energy and direction. It has proved possible to produce nuclei in specific energy states by different routes and to identify and analyse the states, thereby deducing the spin and other characteristics and discovering, for example, three correlated series of rotational states in the nucleus neon-20. Not only is this important to a basic understanding of nuclear structure but it also finds application in unravelling the complex of nuclear reactions responsible for the genesis of nuclei in the interior of stars. With the new tandem Van der Graaff rated at 10,000,000 volts on the terminal replacing the former machine that attained 7,000,000 volts, it should be possible to study reactions between heavier and more complex nuclei.

Studies of neutron interactions with matter are made possible by the intense beams of neutrons available from the NRU reactor. By monitoring the neutrons in cosmic radiation, it has been possible to find correlations with the occurrence of solar flares and contribute to the recent advances of knowledge of phenomena in interplanetary space. Isotope techniques have brought about revisions in the basic theory of chemical reactions induced by radiation. This basic research may find a useful application in the technology of various coolants in nuclear power reactors.

The research facilities of the NRX and NRU reactors have continued to attract individual scientists as well as teams from universities and from other countries. More facilities for studying radiation damage and its effects under closely controlled conditions are coming into use. These include devices for measuring creep of metals under stress and fast neutron bombardment at controlled temperatures.

The growing use of lithium-drifted germanium detectors for precise measurements of gamma-ray energies has led also to more extensive electronic digital data-processing.

The first major installation at the Whiteshell Nuclear Research Establishment (WNRE) is the organic liquid-cooled heavy-water-moderated experimental reactor WR-1. The facilities of WR-1 are quite extensive and can be applied to development work also with other coolants such as boiling water and super-heated steam. Laboratory facilities at WNRE are specially suited to studies of the effects of radiation on materials and a wide program from molecular biology to radiation chemistry and reactor engineering is developing.

Atomic energy or nuclear science is spreading out into so many fields of technology and daily life that the boundaries are becoming diffuse. For the purposes of this review, the field is restricted to all those activities that are conducted only under an order from the Atomic Energy Control Board. This field includes all uses of radioisotopes including natural uranium and thorium at significant levels of activity and the operation of all machines capable of producing such isotopes and highly penetrating radiations. Radioisotopes are widely used in medical research and diagnostics including forensic studies and in biological research in universities, hospitals, research institutes and field stations. They are also used in well logging and in analyses of geological and mineral samples. The radiations from isotopes, especially Cobalt-60, are used for sterilization of packaged and sealed medical supplies, for cancer therapy and for food sterilization. Since the Cobalt-60 radiations are not capable of producing neutrons or secondary radioactivity, the products from these operations require no subsequent radiation control and therefore lie outside the atomic energy field. The irradiators themselves are controlled by the AECB. Multimillion volt particle accelerators are capable of and sometimes used for producing radioisotopes at high activity levels, so both the machines and the products come under AECB regulation. Several new accelerators have been introduced recently in university research laboratories. There are new electron linear accelerators at the universities of Saskatchewan and Toronto. The University of Montreal has taken over the Tandem accelerator from Chalk River and a similar machine has been installed at McMaster