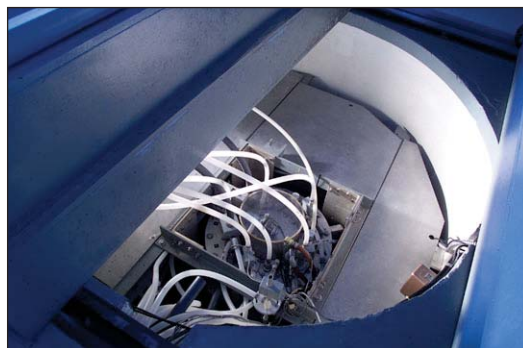


Saskatchewan's SLOWPOKE

Unknown to many, Saskatoon has been home to nuclear reactor since 1981



by Brenda Stanek

Saskatchewan has been home to a nuclear reactor for more than a quarter century. This little known fact may surprise you, but since 1981, the SLOWPOKE-2 reactor has been located at the Environmental Analytical Laboratories in Saskatoon.

The SLOWPOKE-2 is a low-power research reactor that was designed by Atomic Energy of Canada Ltd (AECL) in the 1970s. The name SLOWPOKE is derived from an experiment to determine the smallest amount of uranium that could be configured to sustain a nuclear reaction. It stands for Safe LOW POWER Kritical Experiment. (The point at which a nuclear fission reaction can be sustained is referred to as going critical). An inherent part of the design is that it is fail-safe because it does not require an active mechanical safety system. The heat produced by the reactor limits its reactivity and therefore the reactor itself cannot run into an uncontrolled power excursion. The reactor is licensed to operate for scientific purposes by the Canadian Nuclear Safety Commission.

Although fuel is used up and reactivity is lost through normal reactor operation, it is still operating with the original fuel. To maintain criticality, beryllium plates must be added to the top of the core from time to time. This has been the only servicing ever required and the SLOWPOKE-2 has operated trouble-free since its commissioning.

In the laboratory, the reactor is used as a source of neutrons for an analytical technique known as Neutron Activation Analysis (NAA). NAA allows for the analysis of many of the elements of the periodic table by producing radioactive isotopes of naturally stable elements.

The main advantages of NAA are that it requires little or no sample preparation and is non-destructive. NAA can be used for a wide variety of sample types and is especially useful if the sample is not uniform, hard to dissolve or could be contaminated using conventional techniques.

For most samples, all that is required is to weigh the sample into a plastic capsule and seal it. A pneumatic transfer system sends the sample into the reactor, where the neutrons emitted

by the reactor interact with the nuclei of the elements' atoms to generate radioisotopes. These radioisotopes decay by emitting gamma rays, which are unique in half-life and energy. The intensity of this gamma radiation can be measured using a gamma spectrometer equipped with a germanium detector. After the sample has been analyzed, any radioactive isotopes produced are allowed to decay until the activity reaches an acceptable level. At this point, the sample can be retrieved and used for other tests or returned to the client.

Uranium analysis by Delayed Neutron Counting (DNC), also referred to as Delayed Neutron Activation Analysis, is one of the main uses for the reactor. In the case of uranium, expo-

sure to neutrons in the reactor results in the emission of a beta particle, followed by emission of neutrons, which are measured. This is a sensitive and rapid technique for determining uranium concentrations from parts per million to per cent levels.

The other major test being performed using the SLOWPOKE-2 is a screening test for organic halogen compounds. These compounds can enter the environment from both natural sources and anthropogenic sources such as industrial waste streams, including those generated by the oil industry. After separation of organically bound species from inorganic using various extraction procedures, chlorine, bromine and iodine can be measured individually by NAA. There are other means of measuring organic halogen compounds but the

industry preferred method is NAA.

Clients from across Canada and around the globe are submitting samples to the laboratory. The SLOWPOKE-2 reactor as an analytical tool is a very useful complement to the wide array of more traditional chemical and instrumental techniques available for environmental testing.

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