PET Cyclotron Q and A

What is a cyclotron?

A cyclotron is a machine that produces radioisotopes (radioactive atoms). This technology is used in medicine for medical imaging, therapy, and research and is vital to cancer care and treatment. The radioisotopes produced are of great value to Alberta patients, doctors, and researchers.

Is a cyclotron safe?

Yes. Cyclotrons have been built and operated worldwide since the 1930s and are considered to be a clean nuclear technology that produces very little radioactive waste.

The work AHS conducts with nuclear substances has a tremendous benefit to health care and research in Alberta. We operate a safe facility and have extensive operating and emergency measures in place to ensure the safety of patients, staff and the public at all times.

As part of the governance of nuclear technology, an operating license must be granted by the Canadian Nuclear Safety Commission (CNSC). The CNSC has extensive experience licensing cyclotrons from facilities across Canada and it takes worker safety, public safety, and environmental safety very seriously.

Regular monitoring, annual reports, and license renewals are a necessity to ensure compliance with CNSC regulations. All radiation levels to staff working both inside and outside the AHS facility, as well as to guests at the Cross Cancer Institute, are well below the CNSC allowable limits.

How does it work?

The cyclotron takes particles and accelerates them in a circular motion at a very high speed. The beam of particles is then directed towards a target where a reaction takes place and forms radioisotopes. The radioisotopes are then extracted and used to form clinically useful drugs called radiopharmaceuticals.

The radiopharmaceuticals are then delivered to specific medical clinics where they are used for medical imaging procedures such as positron emission tomography (PET) scans, an imaging technology used daily in Alberta for cancer diagnosis and treatment. PET is the most advanced medical diagnostic imaging technology available today for:

(i) early and accurate detection of cancer,
(ii) detecting certain diseases of the heart and brain.

Radiopharmaceuticals used in PET scans have a short lifespan, lasting between two and 110 minutes. In order for Albertans to utilize this advanced imaging technique, radiopharmaceuticals must be generated in close proximity to the PET scanner, which requires our province to have at least one cyclotron.

How are radiation levels measured?

Radiation doses are calculated in units called Sieverts. Typical dose levels are measured in the range of microSieverts (uSv) or milliSieverts (mSv), which are one millionth and one thousandth of a Sievert, respectively. Staff who work in radiation therapy wear personal dosimeters, which measure radiation levels, to ensure doses are kept to a minimum and well below the allowable limit. We are all subjected to radiation everyday from the environment and the food we eat.

Learn more from this radiation chart which puts doses in perspective: Chart

What is the difference between a cyclotron and nuclear reactor?

A nuclear reactor (such as the National Research Universal reactor in Chalk River) utilizes uranium to generate fission products and neutrons, which creates short-lived and long-lived radioisotopes. These radioisotopes are used in medicine, industry, and research. Relatively speaking, larger quantities of radioactive waste are created in a reactor as compared to a cyclotron. However, some isotopes can't be produced in a cyclotron nor can cyclotrons produce a sufficient quantity for worldwide distribution, so nuclear reactors are needed. The cyclotron at AHS is a safe and appropriate option for the production of a variety of isotopes on a regional scale, and most importantly, helps provide care for our patients in Alberta.

For more information:

- Questions? cyclotron.info@albertahealthservices.ca
- AHS PET Cyclotron Public Disclosure http://www.albertahealthservices.ca/11104.asp
- Health Canada: www.hc-sc.gc.ca
- Canadian Nuclear Safety Commission: www.CNSC.gc.ca