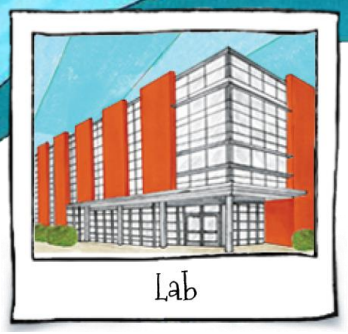

RadTown USA

Particle Accelerators

Particle accelerators are special machines that speed up charged particles and smash them into atoms, breaking the atoms into even smaller pieces.

- Scientists use particle accelerators to study the smallest building blocks of our world.
- Accelerators can produce ionizing radiation in the form of x-rays, neutrons and charged particle beams as well as radioisotopes for use in research and technology.
- Particle accelerators are built and operated with safety in mind.

About Particle Accelerators

Have you ever heard of atom smashers? This is a fun name for particle accelerators, which "smash" particles into atoms. Particle accelerators are special machines that speed up charged particles: electrons, protons and positrons. The accelerator uses electricity to "push" the charged particles along a path. It pushes them over and over to make them go faster and faster. The accelerator uses magnets to steer the particles. Sometimes particles go almost as fast as the speed of light. The magnets then steer the particles at top speed into a metal target. When these fast-moving particles hit the target, the atoms in the target split apart. Then scientists can study the pieces to learn what makes up an atom and what holds atoms together. These scientists are studying the smallest building blocks of our world.

Fermilab, located 40 miles west of Chicago, is home to the Tevatron. The Tevatron was the second most powerful particle accelerator in the world before it was shut down in 2011.

According to the International Atomic Energy Agency (IAEA), more than 15,000 accelerators are in use around the world. There are many different designs, some small and some very big. The largest particle accelerator in world, the Large Hadron Collider at the European Center for Nuclear Research (CERN) in Switzerland, consists of more than 16 miles of tube.

Some accelerators produce ionizing radiation in the form of x-rays. Other accelerators are used to create radioactive material by breaking apart atoms and making them unstable. Almost all particle accelerators are either used in medicine to treat diseases or by industry to make products like ceramics and plastics. They can also be used for research, like the Large Hadron Collider. IAEA lists several types of and uses for particle accelerators:

- Diagnosing and treating cancer--Some accelerators produce radioactive materials that are used during Positron Emission Computed Tomography (PET) scans. Other types of radiation therapy can use linear particle accelerators to target and destroy tumors.
- Finding oil and minerals in the earth--Companies use small accelerators that produce neutrons for this use.

- Processing computer chips with charged particle beams.
- Sterilizing medical equipment and food.
- Making products like ceramics and plastics.

Particle accelerators are built and operated with safety in mind. Particle accelerators use a lot of energy to speed up particles and they emit ionizing radiation while they are operating. They are often used to produce radioactive material and, in some cases, can produce radioactive waste from running the machine.

Rules and Guidance

THE STATES

In many cases, states have agreements with the U.S. Nuclear Regulatory Commission (NRC) and the Department of Labor's (DOL) Occupational Safety and Health Administration (OSHA) to run particle accelerators, ensure the safety of the operators and facility employees, and regulate radioactive material produced from particle accelerators.

U.S. DEPARTMENT OF LABOR (DOL), OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

OSHA sets rules for worker safety for operating particle accelerators and in the handling of radioactive materials produced as a result of running a particle accelerator.

U.S. NUCLEAR REGULATORY COMMISSION (NRC)

NRC is in charge of regulating nuclear material, including material made radioactive by using a particle accelerator.

U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES (HHS), U.S. FOOD AND DRUG ADMINISTRATION (FDA)

FDA makes rules about the manufacture and use of electronic products that emit radiation, including particle accelerators. Accelerators used for cancer treatment also must meet FDA rules for medical equipment.

What you can do

In the unlikely event that you are near a particle accelerator, obey all safety rules.

Where to learn more

You can learn more about particle accelerators by visiting the resources available on the following webpage: http://www3.epa.gov/radtown/particle-accelerators.html#learn-more.