

NUCLEAR *facts*

Commercial applications of nuclear technology

MANY PEOPLE ARE NOT AWARE OF THE PRESENCE OF NUCLEAR TECHNOLOGY AND ITS MANY APPLICATIONS IN OUR DAY-TO-DAY LIVES.

Besides its use in energy production and in health care, nuclear technology also has many commercial, industrial, food processing and agricultural applications, and is also used in the space and aeronautical sector.

Consumer products

Radiation or radioactive materials are used in the manufacturing and operations of many consumer items. For example, cosmetics, hair products, and contact lens solutions are sterilized with radiation to remove irritants and allergens. Photocopiers use small amounts of radioactive material to eliminate static and prevent paper from sticking together and jamming the machine.

Ionization smoke detectors also rely on a tiny radioactive source to detect smoke from a fire. See CNA fact sheet "How is nuclear technology used in smoke detectors" for more on this.



Radioactive materials are used in many common consumer products such as smoke detectors.

Industry

Many industries use radioactive materials to take measurements without direct physical contact with the substance being measured, such as the thickness and density of paper on a paper-making machine or the height of fluid in a tank.

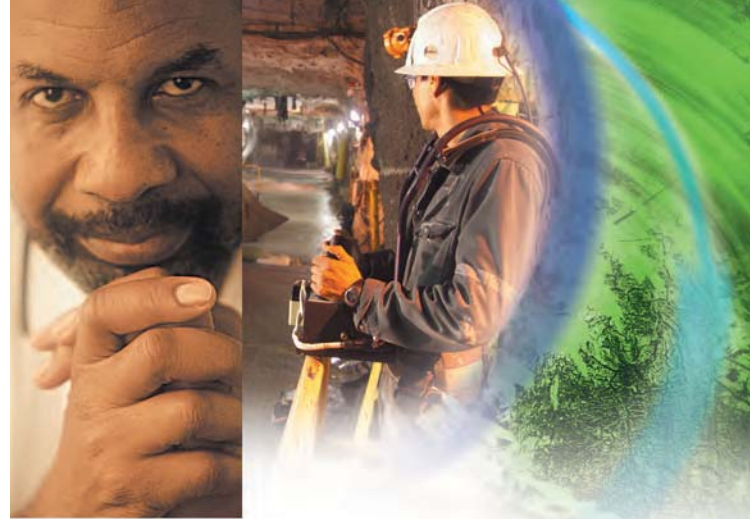
Radiography using a radioactive source is used to inspect finished goods for weaknesses and flaws.

Other applications using radioactive materials include:

- Studying groundwater origin, age, distribution, and quality;
- On-line determination of sulphur and nitrogen in coal;
- Sterilization of medical supplies such as surgical dressings, bandages, and sutures;
- Looking for defects in the welds in oil and gas pipelines



Canada is a leader in food irradiation, which prolongs shelf life and prevents food-borne illness.



Food irradiation

Canada is a leader in the development of the technology used to safely treat fruits, vegetables, and meats with radiation to prolong their shelf lives and prevent the risk of food-borne illness.

See the CNA fact sheet "What is food irradiation?" for more information.

Desalination

As much as one-fifth of the world's population does not have access to safe drinking water. This is a major global issue. There are several technologies being used in the world today to remove salt from sea water: reverse osmosis, multi-stage flash distillation, multi-effect distillation, and vapour compression. All of the processes are energy intensive, requiring anywhere from five to 200 kilowatt-hours of electricity to remove the salt from a cubic metre of water. Nuclear energy is also used for desalination, chiefly in India, Japan and Kazakhstan and has the potential for much greater use. Nuclear desalination is generally very cost-competitive with using fossil fuels.

Agriculture

To improve agricultural production, harmful insects can be eliminated by using radiation to sterilize the males of the species. In this process, male insects are placed in a shielded container containing a gamma ray emitting a radioactive isotope of either cobalt-60 or cesium-137. While in the chamber, low doses of gamma radiation sexually sterilize the insects. The sterilized insects produce no offspring, effectively controlling the population.

This technology has proven to be effective, safe and environmentally friendly because it releases no chemical, biological or nuclear agents into the environment. Used widely around the world, this method replaces the use of chemical pesticides. Canada played a leading role in developing this technique.

Significant improvements in agricultural production have also been realized by using irradiation to develop new strains of plants. This has been particularly useful in developing grains that are virus resistant and have better growth and yield patterns in different locations around the world.

In agricultural research, nuclear technology is also used to measure the efficiency of fertilizer used by crops and for monitoring moisture content. Radioisotopes are used to determine plant uptake of nutrients and water from the soil, enabling farmers to limit the use of fertilizers. This preserves water supplies, saves energy costs from pumping, and prevents run-off of potential contaminants into streams and rivers.

Space and aeronautical applications

Nuclear technology has been used in space since the beginning of the space program. For example, astronauts have dined on irradiated food for years and food irradiation has now been endorsed by every major food and health organization.

Radioisotope thermo-electric generator

Another nuclear technology used in space is the radioisotope thermo-electric generator (RTG) – an electricity generator which converts the heat generated by the decay of plutonium-238, a radioactive isotope, into electricity through the use of thermocouples. Thermocouples convert heat energy directly into electricity which can be used to power electrical systems. To date, NASA has launched over 25 missions equipped with RTGs into space and the former Soviet Union has launched over 40 satellites and probes using similar technologies.

RTGs are used in spacecraft because they are rather simple to construct and very reliable, often providing electricity for years, and in some cases decades, after launch. They are able to provide power for deep space missions to the outer planets and beyond the solar system where there is not enough sunlight to power solar panels; and can provide much more electrical energy than is possible with solar panels, with the result that more equipment and experiments can be powered. In the future, RTGs will play an even larger role in space exploration.



A number of nuclear technologies are used in space and aeronautical applications.

Nuclear Rockets

The use of nuclear rockets is once again under consideration. Many experts agree that nuclear rockets may be the only way to carry large payloads to Mars and the outer planets, because they are much lighter than chemically-fuelled rockets. This technology would allow spacecraft to travel greater distances at greater speeds, carry more, and also allow spacecraft to be more manoeuvrable.

Updated: October 2009

