

# NUCLEAR *facts*



## *What are the health benefits of nuclear medicine?*

RADIATION IS WIDELY USED TODAY FOR PREVENTING, DIAGNOSING AND TREATING DISEASE.

### **Prevention**

Hospital supplies such as sutures, masks, surgical gloves, dressings, catheters and syringes are pre-packaged and passed through an irradiator containing a large cobalt-60 source. The irradiation process virtually eliminates all bacteria, viruses and other living organisms that could threaten the sterile operating room environment without damage to the product.

Irradiation, being a cold process, permits the sterilization of heat-sensitive materials such as plastic, and is often the only method of sterilizing some pharmaceutical powders, ointments and solutions. Many of the world's industrial irradiators (more than 200 to date) have been designed and built by the Canadian company MDS Nordion. More than 40% of all single-use medical supplies such as syringes and sutures are sterilized using this technology.

This technology is also used to help make the world's food supply safer. Food irradiation has been approved for use in some 55 countries to eliminate harmful pathogens from many foods. See Nuclear Facts - "Why Food Irradiation?"

### **Diagnosis**

Since the 1950s, radiation has been increasingly used in numerous medical diagnostic applications. Minute quantities of radiation emitted by radioisotopes are easy to detect and measure. When radioisotopes are given to a patient, the distribution, rate of distribution and concentration of that radioactive material can be safely traced by detectors in special cameras. There are over 100 diagnostic applications using medical isotopes. Diagnostic tests employing radioisotopes are used to determine how well organs function;

how the body absorbs certain substances; and how to locate and delineate tumors, often eliminating the need for exploratory surgery. Millions of diagnostic procedures are carried out each year using Canadian-produced radioisotopes.

The most widely used medical radioisotope for diagnostic medical purposes is technetium-99m, largely because its short half-life of only six hours limits the radiation dose to the patient and the energy of its gamma rays is ideally suited for diagnosis. For a number of years, MDS Nordion has been the major supplier of molybdenum-99, which decays (changes) into technetium-99m. This company supplies more than half of the world's reactor-produced medical isotopes which are used in over 50,000 nuclear medicine procedures throughout the world every day with 5,000 of these being in Canada.





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## Treatment

Radiation is used to treat disease, notably cancer, in several ways. Therapy machines using the radioisotope cobalt-60 deliver an external beam of radiation to the cancer. There are some 1200 cobalt machines operating throughout the world and over 40,000 treatments a day are delivered using this Canadian technology. Cobalt-60 teletherapy was first used at the Victoria Hospital in London, Ontario in October 1951 using a machine designed by Eldorado Mining and Refining Ltd. (later to become part of Atomic Energy of Canada Ltd).

Today, cobalt-60 teletherapy units are manufactured by Best Theratronics, part of Best Medical Canada.

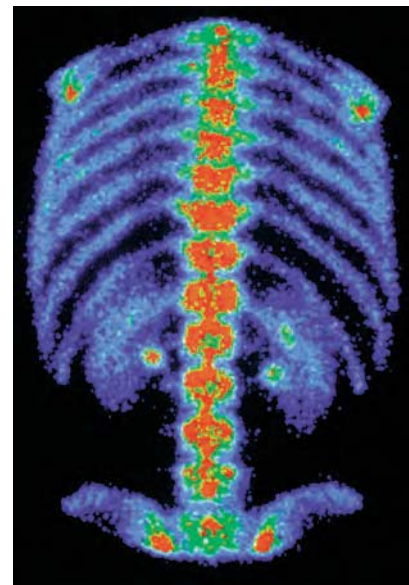
In other forms of treatments, radiation sources can be inserted directly into or beside tumours to kill cancer cells. Known as brachytherapy, this technique is more suited to certain areas of the body, such as the prostate, cervix and throat.

Exciting applications in isotope technology are making new treatments possible, such as treating liver cancer, non-Hodgkin's lymphoma and brain cancer. In this form of treatment radioisotopes are attached to antibodies or other substances that seek out cancer cells. Once

connected to the cells, they are acted upon by the radiation from the attached isotope thus delivering highly targeted radiation to the tumour from within the body.

## How does Canada's nuclear program relate to medicine?

Canada's nuclear program has made possible the production of a range of medical radioisotopes used to prevent, diagnose and treat disease.



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One such treatment option for liver cancer, TheraSphere®, manufactured by MDS Nordion, is a low toxicity therapy which consists of millions of micro glass beads containing yttrium 90. The product is injected by physicians into the main artery of the patient's liver through a catheter which allows the treatment to be delivered directly to the tumour via blood vessels.

Cobalt-60, for instance, is a deliberately manufactured, man-made isotope. It is produced by irradiating naturally occurring cobalt-59 with neutrons, either in power reactors or in the NRU reactor at the Chalk River Laboratories of Atomic Energy of Canada Limited (AECL). When cobalt-59 absorbs a neutron it becomes the radioactive cobalt-60. Canadian nuclear reactors produce up to 60% of the cobalt-60 used worldwide.

**See also:**  
[www.mds.nordion.com](http://www.mds.nordion.com);  
[www.aecl.ca](http://www.aecl.ca); and  
[www.theratronics.com](http://www.theratronics.com)

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Canadian Nuclear Association

130 Albert Street, Suite 1610  
Ottawa, Ontario K1P 5G4  
Tel. (613) 237-4262  
Fax (613) 237-0989  
[www.cna.ca](http://www.cna.ca)

