



# Facts about Food Irradiation

## Q:

## A:

**1** Have there been major accidents at industrial irradiation facilities?

**1** Yes. Over the past 25 years, there have been a few major accidents at industrial irradiation facilities that caused injury or death to workers because of accidental exposure to a lethal dose of radiation. All of the accidents happened because safety systems had been deliberately bypassed and proper control procedures had not been followed. None of these accidents endangered public health and environmental safety.

### *Safety of Irradiation Facilities*

In most cases, reports of "accidents" have actually turned out to be operational incidents. Such incidents have caused the irradiator to be shut down but they did not harm anyone or pose a risk to the environment. The distinction between accidents and incidents is used by authorities responsible for safety in all industries. This is the case for many other food technologies, such as canning, fumigation and the agro-chemical industry, which are also potentially hazardous to workers. As at irradiation facilities, controls and formal protocols are required to prevent accidents.

The radiation processing industry is considered to have a very good safety record. Today there are about 160 industrial gamma irradiation facilities operating worldwide, a number of which process food in addition to other types of products. Most irradiation facilities are used for sterilizing disposable medical and pharmaceutical supplies, and for processing other non-food items. ■

**INTERNATIONAL CONSULTATIVE GROUP ON FOOD IRRADIATION (ICGFI)**

*Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture  
Wagramerstrasse 5, P.O. Box 100  
A-1400 Vienna, Austria*

ICGFI is an international group of experts designated by Governments to evaluate and advise on global activities of food irradiation. It was established under the aegis of the Food and Agriculture Organization of the United Nations, World Health Organization, and International Atomic Energy Agency.



**2** Do workers at irradiation facilities face dangers from long-term or accidental exposure to radiation?

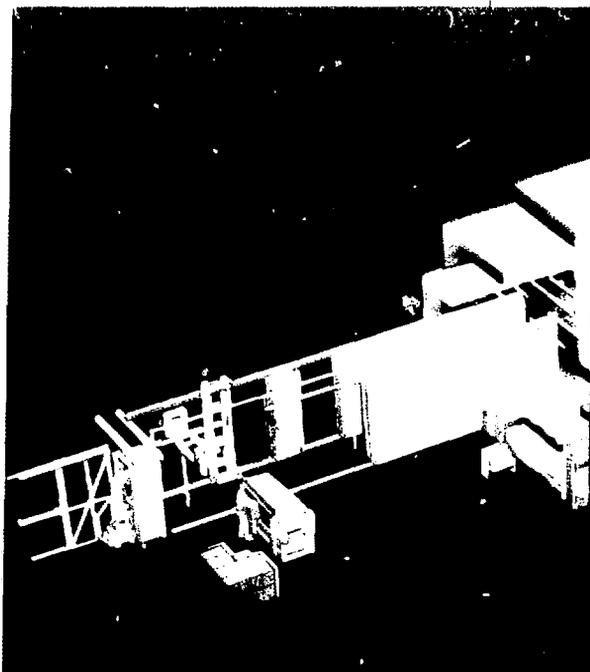
**2** Any industrial activity includes certain risks to human beings and the environment. One of the risks at irradiation facilities is associated with the potential hazard of accidental exposure to ionizing radiation. Under normal operating conditions, all exposures of workers to radiation are prevented because the radiation source is shielded. Irradiators are designed with several levels of redundant protection to detect equipment malfunction and to protect personnel from accidental radiation exposure. Potentially hazardous areas are monitored and a system of interlocks prevents unauthorized entry into the radiation cell when the source is exposed. Worker safety further rests upon strict operating procedures and proper training. All radiation plants must be licensed. In most countries, regulations require periodic inspection of facilities to ensure compliance with the terms of operating licenses. In the United Kingdom, the Health and Safety Executive has reported to a parliamentary committee that personnel working in the country's 10 irradiation facilities face no

**CONVEYOR SYSTEM**

Packaged or bulk products move in and out of the irradiation chamber automatically via a fixed conveyor system. Products pass through the radiation field inside the chamber at a precisely controlled rate to absorb the correct amount of energy for processing. The levels of energy are too low to induce radioactivity in the products or other materials. After processing, they can be unloaded and shipped immediately.

**CONTROL CONSOLE**

Trained operators electronically control and monitor the radiation source and processing of products from a console outside the irradiation chamber.



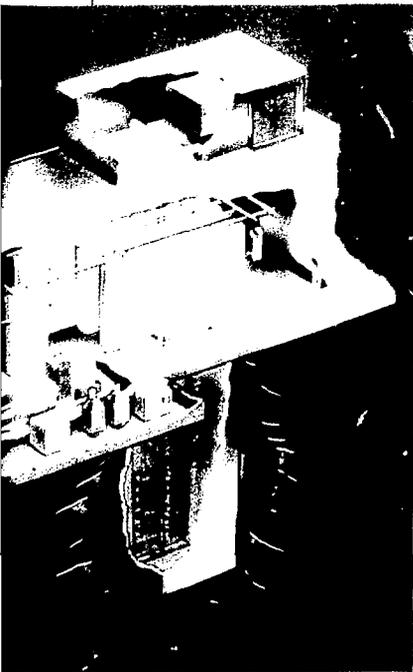
unusual dangers: "...the risk is kept under effective control by the use of sophisticated safety control systems. The plants are constructed with very heavy radiation shielding and thus the process presents no risk to the general public...We do not expect that the legalisation of foodstuffs irradiation will present any novel health and safety issues within our area of interest". ■

**3** More radioactive materials will need to be transported if more food irradiators are built. What steps have been taken to minimize the danger of radioactive spills from transport accidents?

**IRRADIATION ROOM**

Products are treated inside a central chamber with thick concrete walls and specially designed doors to prevent radiation from escaping. Interlocks and warning devices do not allow the radiation source to be raised until all doors are securely closed.

*Credit: Nordion International*



**STORAGE POOL**

A deep storage pool of water holds the radiation source when not in use. Known as one of the best shields against radiation energy, water absorbs the radiation energy and protects workers from exposure if they must enter the room.

**3** Radioactive material required for irradiators is transported in lead-shielded steel casks. These are designed to meet national and international standards modelled upon the *Regulations for Safe Transport of Radioactive Materials* of the International Atomic Energy Agency. Large quantities of radioactive material are safely shipped all over the world to supply some 160 irradiators processing a variety of goods, mainly medical products such as syringes, physician gloves, sutures, and hospital gowns. From 1955 to early 1988, for example, Canada shipped approximately 190 million curies of cobalt-60 in 870 separate shipments without any radiation hazard to the environment or release of radioactive materials. Over the same period, approximately one million shipments of radioisotopes for industrial, hospital, and research use were made in North America without radiation accidents. This excellent safety record far exceeds that of other industries shipping hazardous materials such as toxic chemicals, crude oil, or gasoline. The same procedures used so successfully and safely to transport radioactive materials to existing irradiators will of course be used for transporting radioactive materials to any additional irradiators constructed for food processing. ■

**4** Can an accident at a gamma irradiation facility lead to “meltdown” of the irradiator and release of radioactivity that would contaminate the environment and endanger people living nearby?

**5** Do gamma irradiators have radioactive waste disposal problems?

**4** No. It is impossible for a “meltdown” to occur in a gamma irradiator or for the radiation source to explode. The source of radiation energy used at irradiators cannot produce neutrons, substances which can make materials radioactive, so no nuclear “chain reaction” can occur at an irradiator. The walls of the irradiation cell through which the food passes, the machinery inside the cell, and the product being processed cannot become radioactive. No radioactivity is released into the environment. ■

**5** No. Radioactive waste does not accumulate at irradiation facilities because no radioactivity is produced. The radiation energy used at some irradiators — namely electrons or X-rays — is generated by industrial machines called accelerators. At gamma irradiators, radionuclide sources, typically cobalt-60 or more rarely caesium-137, are used as the sources of radiation energy. These elements decay over time to non-radioactive nickel and non-radioactive barium, respectively. The sources are removed from the irradiator when the radioactivity falls to a low level, usually between 6% and 12% of the initial level (this takes 16 to 21 years for cobalt-60). The elements are then returned in a shipping container to the supplier who has the option of reactivating them in a nuclear reactor or storing them. Canada has calculated that all the cobalt-60 it supplied for use in 1988 (about 100 million curies) would require a storage space of about 1.25 cubic metres, roughly equivalent to the space occupied by a small desk.

**Scientific and Technical References:**

Memorandum to the United Kingdom House of Lords Select Committee on the European Communities Irradiation of Foodstuffs by the United Kingdom Health and Safety Executive, HMSO, London (1989).

*Safety and radiation protection aspects of gamma and electron irradiation facilities, final draft*, International Atomic Energy Agency, Vienna (1990).

“Safety considerations in the design of gamma irradiation facilities and the handling of cobalt-60 sources”, by R.G. McKinnon, *Radiation Physics and Chemistry*, 31 (1988).

Basically the same procedures are followed when an irradiation plant closes down. The sources can be acquired by another user or returned to the supplier, the machinery dismantled, and the building used for other purposes. There is no radiation hazard for the new occupants or the general public. ■

Original contains  
color illustrations