RADIOISOTOPES IN EVERYDAY LIFE

Radioactive materials are used in a wide variety of applications in everyday life. Research laboratories, medical centers, industrial facilities, food irradiation plants and many consumer products all use or contain radioisotopes.

ENERGY

The most commonly known use of radioactive materials is nuclear power generation. Nuclear power plants produce 20% of the electricity used in the US, and 16% worldwide. Nuclear reactors are also used to power submarines, aircraft carriers and spacecraft.

Radioisotope thermoelectric generators (RTGs) use the energy emitted from radioisotopes to boil water and generate power for remotely located weather stations and navigational buoys. Many pacemakers are also powered by radioactive materials.

MEDICINE

Radioisotopes are used to diagnose and treat many medical conditions and diseases, including cancer and thyroid disorders. Imaging procedures such as kidney and bone scans often use radioactive materials because these materials are absorbed by particular parts of the body. Thyroid conditions are diagnosed and treated using radioactive iodine, which concentrates in the thyroid. Bone scans use radioactive phosphorous, and muscle imaging uses potassium. The workings of the digestive and cardiovascular systems can also be seen by eating or injecting special radioactive materials and using a special camera to record the paths the materials take through the body.

All of these treatments are classified as "nuclear medicine procedures." Overall, more than 11 million nuclear medicine procedures are performed in the U.S. each year. Around 100 million medical laboratory tests on body fluid and tissue samples use radioactive materials, as well.

INDUSTRY

Radioactive materials allow many industrial processes to be performed cheaper, faster, easier, and more effectively. Radioactive tracers make it possible to find blockages and leaks in pipes and to determine how quickly materials flow through them. They also allow corrosion and wear and tear on mechanical equipment to be monitored. In addition, radioactive materials are employed in external industrial imaging applications to determine metal content and quality in steel and to show cracks and faults in engines, bolts and structural assemblies.

Paper and metal sheet manufacturers use radioisotopes to monitor the sheets to ensure that the proper thickness is attained. The height of liquid in beverage containers and large tanks is tested in a similar fashion.

The mining, oil and gas industries rely on radioactive materials to find and map mineral and hydrocarbon deposits. Road surface density is also measured using radioisotopes.

AGRICULTURE

Radiation is used to kill bacteria, molds and other microorganisms in strawberries, onions, potatoes, meats, and spices, preventing the food from spoiling, and making it safer to eat.

CONSUMER PRODUCTS

Many smoke detectors contain a radioactive Americium source, while some photocopiers use radioactive Polonium to prevent static buildup. Cosmetics, baby powder and contact lens solution are sterilized by radiation.

COMMON RADIOISOTOPES AND THEIR USES

The most common radioisotopes seen in everyday life are tabulated on the following pages with their main uses, half-life, and emission types.

Isotope	Symbol	Half-Life	Emissions				Uses
			Alpha	Beta	Gamma	Other	
Americium-241	Am241	432.7 yrs	X		X		Smoke detectors, thickness gauges in rolling processes such as steel and paper production, determining where oil wells should be drilled
Cadmium-109	Cd109	462 days			X		Metal alloy analysis
Calcium-47	Ca47	4.5 days		X	X		Biomedical research
Californium-252	Cf252	2.6 yrs	X			*	Mineral content measurement in coal ash, moisture content measurement in silos
Carbon-14	C14	5715 yrs		X			Radiocarbon dating, drug research
Cesium-137	Cs137	30.1 yrs		X	X		Cancer treatment, measurement and control of flow in pipes, fill level measurement for food and drug packaging, food irradiation
Chromium-51	Cr51	27.7 days			X		Biological research
Cobalt-57	Co57	271.8 days			X		Medical diagnostic scans
Cobalt-60	Co60	5.3 yrs		X	X		Medical instrument sterilization, food irradiation (poultry, fruits, spices)
Copper-67	Cu67	2.6 days		X	X		Cancer treatment
Curium-244	Cm244	18.1 yrs	X		X		Material analysis in mining and drilling operations
Iodine-123	I123	13.2 hrs			X		Thyroid disorder diagnosis
Iodine-129	I129	16 million yrs		X	X		Biological research
Iodine-131	I131	8.0 days		X	X		Diagnosis and treatment of thyroid disorders
Iridium-192	Ir192	73.8 days		X	X		Non-destructive integrity testing of pipeline welds, boilers and aircraft parts, cancer treatment
Iron-55	Fe55	2.7 yrs				**	Electroplating analysis
Krypton-85	Kr85	4.5 hrs and 10.8 yrs		X	X		Indicator lights on appliances (clothes washers and dryers, stereos, coffeemakers), thickness gauges for thin plastics, sheet metal, rubber, textiles and paper, measurement of dust and pollutant levels
Nickel-63	Ni63	100 yrs		X			Explosives detection, voltage regulators
Phosphorus-32	P32	14.3 days		X			Molecular biology and genetics research
Plutonium-238	Pu238	87.7 yrs	X		X	*	Radiothermal power generation in remote regions and spacecraft
Polonium-210	Po210	138.4 days	X				Photocopiers
Potassium-40	K40	1.3 billion yrs		X	X		Ceramic glazes for antiques
Promethium-147	Pm147	2.6 yrs		X			Electric blanket thermostats, thickness gauging of plastics, sheet metal, textiles and paper
Radium	Ra	Varies: days to many yrs	X		X		Glow-in-the-dark instrument dials in antique clocks and watches
Selenium-75	Se75	119.8 days			X		Life science research
Sodium-24	Na24	15.0 hrs		X	X		Industrial pipeline leak detection, oil well studies
Strontium-85	Sr85	1.1 hrs and 64.8 days		X		**	Bone and metabolic studies
Strontium-90	Sr90	28.5 yrs		X			Survey meters
Technetium-99m	Tc99m	6.0 hrs			X		Medical imaging and diagnostic studies

Isotope	Symbol	Half-Life	Emissions				Uses
			Alpha	Beta	Gamma	Other	
Thallium-204	Tl204	3.8 yrs		X			Dust and pollutant level measurement, thickness gauging for plastics, sheet metal, rubber, textiles and paper
Tungsten	W	Varies: min to days			X		Electric arc welding rods for construction, aircraft, petrochemical and food processing equipment
Thorium	Th	Varies	X	X	X		Ceramic glazes for antiques
Thorium-229	Th229	7300 yrs	X		X		Fluorescent lighting
Thorium-230	Th230	75000 yrs	X		X		Colored glazes and glassware
Tritium	H3	12.3 yrs		X			Life science and drug research, self-luminous aircraft and commercial signs, dials, gauges and wristwatches, luminous paint
Uranium	U	Varies	X		X		Ceramic glazes and vaseline and canary glass in antiques
Uranium-238	U238	4.5 billion yrs	X		X		Dental fixtures (crowns and dentures), conversion to fuel for commercial nuclear power reactors and naval nuclear propulsion
Xenon-133	Xe133	5.2 days		X	X		Nuclear medicine

* Spontaneous Fission (neutrons emitted)
** Positron (similar to beta)