using x-rays or radioactive materials.
• The density and composition of subsurface soil and rock can be assessed using gauges and sensors lowered into test wells and mines to find deposits of oil, coal, metal ores or other minerals.
• Some welding rods contain thorium, which produce easier starting, greater arc stability and less metal contamination.
• To control dust, static can be eliminated using radioactive sources in a variety of production processes, including the manufacture of photographic film, and audio and video tapes. Static elimination is also important in the paper and publishing industries.
• Self-luminous lights and instrument dial faces contain radioactive materials.

Scientific Research

• Electron microscopes, using beams of energetic electrons, are used to image cells and other small objects, even down to the atomic level.
• Some remote weather monitoring stations use small radioactive batteries.
• Some satellites and deep space probes use plutonium or other radioactive electric generators to power their sensors and communications systems and keep operating systems warm. The Sojourner rover on the Mars Pathfinder mission carried several small radioactive "heaters."

• Radioactive elements are used to study nutrition, biological processes and development in agricultural, medical and biological studies. This includes research that leads to the development of new drugs and treatment procedures.
• Radioactive materials are used in devices to detect and analyze environmental pollutants.
• Physicists use giant particle accelerators, like the one at Fermi National Accelerator Laboratory near Batavia, to unlock the secrets of the behavior of matter at the atomic and subatomic levels.
• Devices containing radioactive elements are used to determine the composition and density of soil and rocks, either on the surface or deep underground.

IEMA-Division of Nuclear Safety: Regulating the Use of Radiation and Radioactive Materials

The IEMA-Division of Nuclear Safety is the state agency charged with protecting the citizens of Illinois and their environment from the potential hazards of radiation, while ensuring that radiation is used safely for beneficial purposes.

To this end, all individuals and organizations in the state that own and use radiation producing devices, such as x-ray machines and particle accelerators, must register with the IEMA-Division of Nuclear Safety and allow periodic inspections by IEMA-Division of Nuclear Safety staff.

Most individuals and organizations in the state that own and use radioactive materials in industry, commerce, research, or medical practice, must be licensed by the IEMA-Division of Nuclear Safety and are subject to periodic inspections as well.

Individuals other than physicians who use radiation-producing devices or radioactive materials in the medical professions must be accredited by the IEMA-Division of Nuclear Safety to perform those activities. Industrial radiographers must also be certified by the IEMA-Division of Nuclear Safety.

IEMA-Division of Nuclear Safety also actively pursues safety at nuclear power stations in Illinois, by operating a remote monitoring system to track safety-related conditions at each station, and by placing a resident inspector at each station to conduct independent safety-related inspections. IEMA-Division of Nuclear Safety also certifies boiler, steam and pressure vessels at the nuclear power stations.

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INFO: Everyday Uses of Radiation & Radioacitve Materials

Radiation is an integral part of our lives...

It is simply amazing how far humans have come in the use of radiation and radioactive materials since they were discovered just over a century ago. Without radiation and radioactive materials, many of our modern technological advancements simply would not be possible. Society gains many benefits from the use of radiation and radioactive materials—in health care, consumer goods and services, electric power generation, agriculture and food production, industry, mining and construction, and scientific research.

A recent study reported that, in 1991 in the United States, the production and use of radioactive materials created about 3.7 million jobs, accounted for $257 billion in sales, and $45 billion in local, state and federal taxes. In Illinois, the report stated, the numbers were about 35,500 jobs, $2.5 billion in sales and $410 million in taxes.

The study only considered strictly economic benefits attributable to radioactive materials. It did not include the impact of machines, such as medical x-ray machines, that generate radiation. Nor did the study attempt to measure the less-tangible but no less important impacts of improved efficiency, higher quality, safer products and processes, and saved and improved lives that come from the careful use of radiation and radioactive materials.

While radiation and radioactive materials are widely used in our society, there are very few uses in which radioactive objects are available to the general public. In many of these cases, the radiation present comes from naturally occuring radioactive materials, or when the amount of radioactive material added is very slight. In almost no cases do objects or materials exposed to radiation or radioactive materials become radioactive themselves.

Only in a few, very limited uses do the target materials or objects become radioactive. These are primarily in medical diagnosis and treatment, when radioactive materials must be injected or ingested into the body. For example, former President George Bush and his wife Barbara both underwent treatment for Graves Disease, an illness that affects the thyroid gland. Each was administered a dose of radioactive iodine, which made their bodies temporarily radioactive.

Health Care

Americans make about 310 million outpatient visits to hospitals each year, and about 33 million people are admitted. In addition, there are hundreds of millions of visits to doctors at their offices and clinics, and to dentists, podiatrists, chiropractors and other health care providers (including the veterinarians who care for family pets). Many of these visits require diagnostic tests, and radiation plays a big part in many diagnoses and treatments. More than 200 million medical examinations using x-rays are made each year in the U.S. Diagnostic nuclear medicine procedures involving radioactive materials are performed more than 8 million times each year. In addition, about 15 million cancer therapy treatments occur each year.

• The most familiar procedure is the x-ray, which most commonly is used to make images of the bones and tissue of the chest, head, arms and legs.
• There are more complex procedures involving x-rays that use special dyes to highlight particular organs.
• More specialized imaging systems are Computerized Axial Tomography (CAT or CT) scans, which use x-rays to make detailed examinations of the body.
• Radioactive materials are also injected into the body as tracers, which concentrate in certain tissues and are then read using sensitive detectors called gamma cameras. One such system is called Positron Emission Tomography, or PET. These diagnostic procedures can identify injuries, the movement of materials through tissues and organs, or the development of illnesses such as cancer or organ failure.
• Radiation is also used in numerous laboratory analyses, where it is used to identify chemical compounds in tissue samples.
• Radioactive compounds, called radiopharmaceuticals, and beams of radiation from x-ray machines, particle accelerators or radioactive materials are used to treat cancer and other diseases.
• Radioactive materials were once used in batteries for some internal heart pacemakers, but are no longer used.
• Many medical supplies, such as gowns, gloves, dressings, catheters, syringes and sutures are sterilized by exposure to gamma or electron radiation.
• Many tissues used in grafts and transplants are sterilized using gamma radiation to reduce infection.

Consumer Goods and Services

Radiation and radioactive materials are often used in the manufacturing of consumer goods, especially to ensure the proper thickness of materials and other quality control measures. Other consumer goods contain minuscule amounts of radioactive materials.

• The average American house has at least two particle accelerators. They are called television sets, which throw beams of electrons at a phosphorus-coated screen. TV sets (and computer monitors as well) are constructed of materials that shield viewers from electrons and x-rays within the machines.
• Most smoke detectors use radioactive materials to detect the presence of smoke in the air.
• Many photocopiers use a strip of radioactive material to reduce static electricity and keep paper from sticking as each sheet is removed from the stack. Similar devices are used on printing presses.
• Audio, video, and computer data storage tapes and disks can be cured of "memory loss" by exposing them to high-energy radiation.
• Many health and beauty items, such as facial cosmetics, artificial eyelashes, mascara, hair creams, and contact lens solutions may be treated with radiation to neutralize irritants that could trigger allergies.
• Non-stick frying pans are often treated with gamma radiation to help the plastic coating stick to the metal.
• Self-luminous emergency exit signs use radioactive materials to excite atoms and cause the signs to glow.
• Some "glow-in-the-dark" watch and clock faces and instrument dials contain small amounts of radioactive elements to make them glow.
• Radioactive materials have been used to create vivid colors in jewelry, colored glassware and ceramics.
• Gemstones are sometimes exposed to radiation to create vivid, unique colors.
• Some building materials, such as granite, contain naturally occurring radioactive materials.
• Security systems at airports use x-ray machines to inspect carry-on luggage. Other devices are used at larger airports to detect explosives.
• Static elimination devices are used in the manufacturing of many consumer goods.
• Dental fixtures, such as crowns and dentures, contain small amounts of uranium to provide a natural color and brightness.
• Fluorescent lights contain small amounts of thorium, which help extend bulb life.
• Some electric blanket thermostats contain a radioactive element.
• Indicator lights on some appliances, such as washers, dryers, stereos and coffemakers, contain radioactive krypton gas.

Electric Power Generation

Perhaps the best-known use of radiation and radioactive materials is the generation of electric power at nuclear reactors. About one-sixth of the world's electricity is generated at more than 435 nuclear power reactors. The U.S. is the top generator, with 104 operating reactors generating about 22 percent of the nation's electricity.

There are eleven operating nuclear power reactors at six nuclear power stations in Illinois: Braidwood, Byron, Clinton, Dresden, La Salle, and Quad Cities. Three other reactors have operated in Illinois, but are now closed. In northern Illinois, before the closure of the Zion station in 1997, about 80 percent of the electricity came from nuclear power. For the whole state, the figure was about 55 percent.

Agriculture and Food Production

Radiation and radioactive materials are used in agricultural research and in the production and treatment of food.

• Nuclear tracers are used to study the development of plants and animals and the uptake of nutrients from food, the air, and the soil.
• Crop seeds are sometimes exposed to radiation to kill grain-eating insect pests, or reduce the rate of germination or spoilage.
• Parasitic flies and other insect pests that infest cattle, other livestock, and a wide variety of fruit and vegetable crops, can be controlled by releasing insects sterilized by radiation to breed with normal insects.
• Radiation is used to check that the correct amount of food or liquid is canned or bottled.

• Irradiation of food has been approved by the U.S. Food and Drug Administration for killing bacteria in poultry, beef, pork and seafood. Irradiation is commonly used throughout the world to reduce bacterial contamination and extend the shelf life of spices, fruit, vegetables, milk and other products.
• In many crop species, radiation has been used to accelerate the mutation rate, allowing the development of new traits.
• Moisture gauges are used to control irrigation, reducing the need for water while improving crop production.

Industry, Mining and Drilling, and Construction

Many industries use radiation and radioactive materials. Frequently, these uses come during the research and development stage. Other devices and materials are used in quality control or to enhance a production process.

• Gauges containing radioactive materials are used to check the thickness of materials, such as tin, aluminum, steel, rubber, plastics, textiles and paper, during the manufacturing process. Similar gauges are used to determine the possible corrosion or erosion in pipes and tanks.
• Other gauges can be used to test the volume, velocity, mixing, or consistency of materials stored in tanks or flowing through pipes.

• Manufacturers can test the quality of metals used in the construction of buildings, cars, airplanes, ships and other structures and vehicles.
• Aircraft manufacturers and airlines use radiation to detect metal fatigue in aircraft bodies, engines and other mechanical parts. Ships, trains and other vessels and structures are also subject to inspections for metal fatigue and stress fracturing.
• Engineers and construction crews can check the density and composition of soil, rock, concrete, asphalt and other materials to ensure proper construction.
• The strength and quality of welds in manufacturing and construction can be assessed