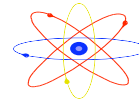
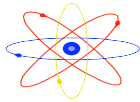


Nuclear Technology

Affects us all



Within the last week did you...

_____ **Ride in a car or bus**

The tires of a car can be treated with radiation to toughen the rubber. Radiation imaging can be used to make sure the steel belts are aligned properly and that metal components are durable. Paint can be "cured" with radiation. Vinyl and other materials can use radiation as part of the production (chemical processing) of the material.

_____ **Sit or stand next to someone for more than a few minutes**

People emit radiation from potassium-40 and carbon-14 in our bodies.

_____ **Walk or drive on a road**

Radioactive sensors can be used in the construction of roads. The sensors let the workers gauge the moisture/density of the soil prior to paving and can verify asphalt thickness.

_____ **Use electricity**

Over 20% of U.S. electricity is generated by nuclear power. (Pennsylvania is over 33%)

_____ **Use anything made with petroleum (oil)**

The exploration for oil-bearing rock (geology) can use radioactive probes.

_____ **Use a sheet of paper or aluminum foil**

In paper and aluminum factories radioactive sensors can be used to gauge the thickness of these materials.

_____ **Use cosmetics (makeup) or eye drops**

Cosmetics, ophthalmic ointment, contact lens solution, and others are sterilized with radiation (typically gamma rays).

_____ **Take any type of medication**

80% of all new medicines are developed using radioactive materials.

_____ **Use plastic wrap**

Radiation can give plastic wrap extra strength and the ability to cling.

_____ **Watch TV or computer (monitor)**

A very small amount of x-radiation is emitted by video display terminals, however, most of the radiation is blocked by the screens and cases.

_____ **Stay in room or building with a smoke detector.**

Some smoke detectors use radioactive Americium-241. The radioactive source ionizes the air - smoke particles affect the ionization process which is detected electronically - sounding the alarm.

_____ **Use a non-stick frying pan**

Non-stick frying pans can be treated with radiation (to make the coating stick).

_____ **Use any appliance or device with a computer (control)**

Semi-conductor materials are used in a lot of modern electrical and electronic devices. They function because of the presence of a small amount of impurities, which are created by bombarding the electronic components with neutrons from a research or experimental reactor improving their performance.

_____ **Use a medical bandage (Band-aid)**

Materials such as medical bandages can be sterilized by radiation (typically gamma rays).

In the last week have you consumed...

- _____ **Ice Cream**
Radioactive sensors can measure the amount of air whipped into ice cream.
- _____ **Eggs**
Eggshells can be checked with radiation to see if the shell is thick enough for transport.
- _____ **Rice**
At least 28 new species of rice were cultivated using radiation to increase the number of changes (mutations).
- _____ **Brazil Nuts**
Brazil Nuts contain a small amount of radioactive radium.
- _____ **Wheat/flour**
At least 12 new “bread flours” were cultivated using radiation to increase the number of changes (mutations).
- _____ **Apple Sauce**
The sugar content can be measured using a radioisotope gauge
- _____ **Banana**
Bananas and other foods such as spinach contain potassium-40 - a naturally occurring radioactive isotope of potassium.
- _____ **Soda**
Radioactive sensors can be used to detect the level of liquids in containers.

In the last year have you...

- _____ **Traveled across a metal bridge**
Bridge welds, etc. can be inspected with radioactive materials (industrial radiography).
- _____ **Visited a museum**
Art museums rely on radioactive materials to determine if a work of art is real or a forgery. There are many applications in this area -including radiocarbon dating and other techniques.
- _____ **Had an x-ray or CT scan taken**
X-rays are ionizing radiation used to look inside of the body. CT scans use X-rays. MRI scans are a form of Non-ionizing radiation.
- _____ **Used a photo copy machine**
Some photocopiers have radioactive alpha sources inside to eliminate static and prevent the paper from sticking together. These sources can also be used at paper mills to reduce static electricity.
- _____ **Been around someone who smokes** (NCRP Report No. 56 28 and EPA Radon risk)
Radioactive materials, such as Pb -210 and Po-210, have been detected in cigarette smoke. An average smoker will obtain an extra 8 rem a year if they smoke 1.5 packs a day.

In your lifetime have you...

Seen a white or pink poinsettia

These and many varieties of ornamental plants have been developed using radiation. Note that red poinsettia would be found in nature - different colors are due to spontaneous changes that occur - in nature this is one in one million - radiation can increase the rate of change to one in ten thousand. Most African Violets that aren't "violet" colored were cultivated - some through mutation breeding and others through other methods. Here's the data from an old source (1986) - Up through 1985 a total of 688 commercial varieties of many crops have been developed by induced mutations. Over several hundred varieties of Chrysanthemum - have been produced using induced mutations. Over 24 varieties of Alstroemaria - more than 21 varieties of Begonia, over 3 varieties of Kalanchoe, etc. The numbers are much higher now since it has been almost 2 decades since my reference paper was written. The mutagens used, during the past decades are known for 544 mutant varieties: 91.4% have been produced by means of irradiation (predominantly x-rays - we use gammas) whereas only 7.5% arose after treatment with mutagenic chemicals.

Seen blue Topaz

Much of the blue topaz available to jewelers is artificially enhanced with radiation to make the blue color.

Been a patient in a hospital (outpatient too)

At least 40% of all hospital patients are treated with some kind of nuclear technology

Been on an airplane

Radioactive sensors are used by airlines to check for flaws in the jet engines
X-ray machines are also used to inspect the carry-on luggage.

Seen pictures of Jupiter Mars, or Saturn

The probe is powered by RTG (radioisotope thermoelectric generators) - note that solar cells would not work that far from the sun.

Seen the Statue of Liberty or the Liberty Bell

Radiography was used to detect small cracks and in the restoration work of both of these national treasures.

Learned about Photosynthesis

Much of what we understand about the chemical/biological process of photosynthesis was through use of radioactive tracers. This includes much of the human genome research too.

Played in the dirt

Backyard soil contains an average of 30 tons of uranium and 10 grams of radium per square mile to a depth of five feet

Licked a stamp

Radioisotope gauges can be used to measure the amount of glue on a stamp.

Taken a picture (with film)

Radioactive material can be used in the manufacturing of film. Radioactive sensors can be used to measure the thickness of the chemical emulsion on the film and ensure the film's quality.

- _____ **Known anyone who has had brain surgery with the gamma knife**
Brain surgery used to take hours now it takes less than 20 minutes with the help of a “gamma knife” (A device that can aim many small beams of radiation very precisely to converge on a specific location.)
- _____ **Known anyone who has given blood or had a special blood test.**
Blood products can be treated with radiation. Tubes and bags used to collect and store blood can be sterilized using radiation. Radioimmunoassay is a technique that can detect minute amounts of hormone, etc. (blood tests for breast cancer, prostate cancer, etc.)
- _____ **Known anyone who had a stress test or heart catheterization**
Heart catheterization uses x-ray technology and many of the stress tests use radioactive material.
- _____ **Known anyone who has been treated for cancer**
Radiation therapy uses radiation produced by an accelerator for cancer treatment
- _____ **Known anyone who has been treated for a thyroid disorder**
Radioactive Iodine is used to diagnose and treat thyroid disorders

NOTE that many of the techniques mentioned can be used, but may not be the only method available. Using gamma rays to sterilize products or radiation gauges does not make the material radioactive. A nuclear reactor or an accelerator are needed to induce radioactivity (make something that wasn't radioactive to start with into something that is radioactive).

References:

Johnson, Harry, & Tutiah, Marvis, “Radiation is a part of every day life,” Nuclear Information Series. Atomic Energy of Canada Ltd.

Davison, Candace. (2003) Personal Communication. Radiation Science and Engineering Center, Penn State University.

USCEA U.S. Council for Energy Awareness. (1994)“What Do You Know About low-level Radioactive Waste?”. Washington DC.

Mouche, Carol, (1996 December) Brazil Nuts Help Explain Radioactive Risk.
<http://www.manufacturing.net/magazine/polleng/archives/1996/pol101.96/11focus.htm>.

Carmain, Emily, (1993). “The New Alchemy The Magic Of Radioisotopes.” Nuclear Energy, U.S Council For Energy Awareness: Washington, DC. (Now Nuclear Energy Institute (NEI))

Murray, Raymond, (1988) Nuclear Energy. New York, New York: Pergamon Press. ISBN 0-08-031629-8

Schmidt, Darlene, (February 1985)“Beneficial Uses/Application of Nuclear Science.” American Nuclear Society.

Penn State University, Radiation Science & Engineering Center
University Park, PA 16802

Rev. 5 - 2003 C.C. Davison, D. Hahn, K. Kohlhepp

“IAEA Activities in the Medical Applications of Radionuclides and Nuclear Radiation.” (1982)
A brochure from the International Atomic Energy Agency. Vienna, Austria.

“IAEA Activities in the Medical Applications of Radionuclides and Nuclear Radiation.” (1982)
A brochure from the International Atomic Energy Agency. Vienna, Austria.

National Council on Radiation Protection and Measurements. (1977) Radiation Exposure From Consumer products and Miscellaneous Sources. (NCRP Report No. 56) Washington DC.

Secrets of the Past: Nuclear Energy Applications in Art and Archaeology by Bernard Keisch -
Library of Congress Catalog Card Number 79-184203 (1972)

Industrial Radiography - AGFA-GEVAERT, Inc.

WEBSITES (not a complete listing - FYI - no endorsement intended):

www.ans.org

www.iaea.org/worldatom/

www.hps.org

www.snm.org

www.nrc.gov

www.doe.gov

<http://nuclear.gov/space/space-desc.html>

www.nei.org