RADIATION

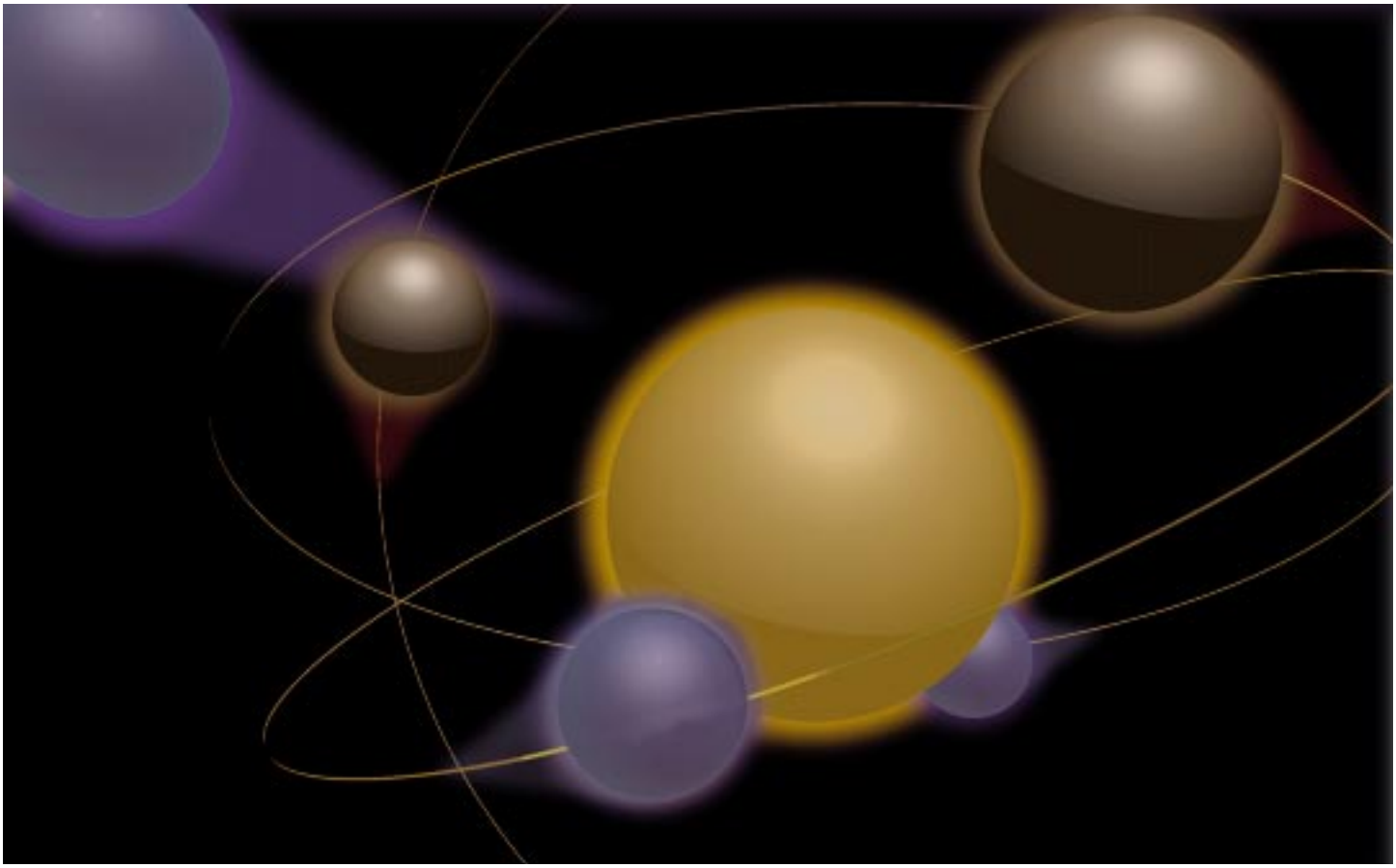
Radiation is a natural phenomenon like gravity and magnetism. In a broad sense, radiation means simply energy that is radiated, and it includes light and radio waves. The term can also refer to ionizing radiation — radiant energy that changes the physical state of atoms that it strikes by causing them to become electrically charged or ionized.

Where Does Radiation Come From?

Radiation has been present since the beginning of time, and all life on earth has been exposed to low levels of ionizing radiation throughout the ages. This background radiation comes from three main sources:

- Cosmic rays come from the sun and outer space. Earth's atmosphere acts as a shield to reduce cosmic radiation reaching the surface.
- Environmental sources such as rocks and soils may contain varying amounts of radioactive material. Granite formations contain uranium and thorium, naturally radioactive elements. Also, soils emit varying amounts of naturally occurring radon gas, which is a radioactive decay product of uranium and thorium.

Radiation might seem exotic because much of it is invisible. However, radiation is a natural phenomenon like gravity and magnetism. The world as we know it could not exist without radiation. At the INEEL radiation is studied, harnessed to produce new processes and products, and treated with the appropriate respect, caution, and radiological controls.



- Our own bodies contain small amounts of radioactive materials absorbed from things we eat and drink. Foods rich in potassium, such as bananas and potatoes, are sources of a naturally occurring radioactive isotope of potassium.

In addition to background radiation levels, some radiation that we encounter in everyday life comes from man-made sources:

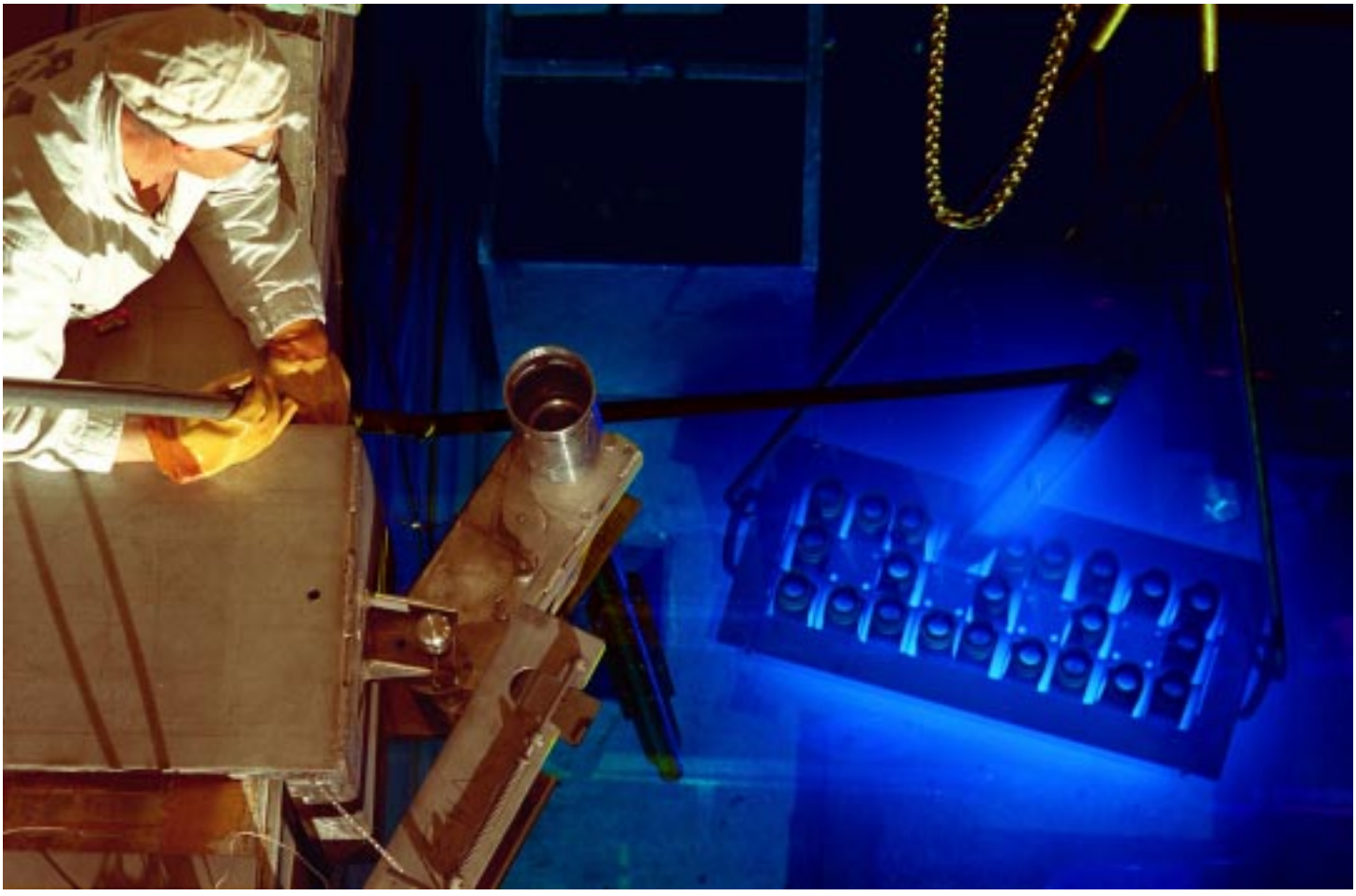
- X-rays for medical and dental procedures.
- Nuclear medicine for diagnostic testing.
- Consumer products such as televisions, lantern mantles, smoke detectors and tobacco.

What Are the Types of Radiation?

Different kinds of ionizing radiation have different characteristics:

- Alpha particles are heavy, positively charged particles consisting of two protons and two neutrons. They are emitted by certain radioactive substances such as uranium. Alpha radiation can be stopped by a sheet of paper, but, if taken internally, can cause damage to the body over time.
- Beta particles are electrons or positrons and are more penetrating than alpha

An INEEL worker uses a long tool to handle radioactive materials deep underwater. The water acts as a shield, protecting the worker from radiation. The blue glow caused by radiation is a natural effect, commonly seen with radioactive materials handled underwater.



radiation. Materials such as aluminum can stop them.

- Gamma rays are small bits of energy traveling in wave form away from the source. Gamma rays are penetrating and can pass through the human body, but sufficient concrete, lead or water can stop them. X-rays are very much like gamma rays, but they do not have as much energy.
- Neutrons are uncharged, heavy particles contained in the nuclei of all atoms heavier than hydrogen. They are released during the fission of uranium atoms in the fuel of nuclear power plants, and they can be very penetrating. Water or other materials containing large amounts of hydrogen can provide shielding against neutron radiation.

How Does Radiation Affect the Body?

Just as our bodies can absorb the energy from sunlight, our bodies also can absorb the energy of ionizing radiation. Large amounts of radiation can cause tissue damage, either by killing living cells or by damaging the genetic material contained in cells. Small amounts of radiation are less harmful than large amounts. A scientific debate is occurring over the question of very small amounts of radiation actually being good for the body rather than harmful. Since radioactivity was discovered about 100 years ago, scientists have studied it extensively to determine the exact biological effects of different kinds and amounts.

To quantify the effects of ionizing radiation on human tissue, scientists use the rem. Background radiation exposure is typically measured in millirem (one thousandth of a rem), and in the United States it averages about 360 millirem per year – almost all of it from natural sources.

How Does Radiation Benefit Us?

The benefits of the use of radiation and radioactive materials, under controlled conditions, greatly outweigh the risks. Our growing understanding of the atom has enabled us to use radiation in many positive ways:

- In diagnosing and treating illnesses, including cancer.
- In power generation for electricity and for space exploration.
- In sterilizing foods, medical supplies and consumer products.
- In keeping airline engines safe.
- In smoke detectors.
- In measuring products and processes in industry.
- In medical research.

Putting Radiation into Perspective

More is known today about the risks of radiation exposure than about practically any other physical or chemical agent in our environment.

We are exposed everyday to low-level, background radiation from natural and man-made sources.

The health effects of exposure to radiation are not unique. A number of other agents are known also, which cause the same effects attributed to low-level radiation. The risks of exposure to low-level radiation should not be disregarded, but it must be recognized that other agents pose much greater risks.

Media Contact:

John Walsh

Idaho National Engineering and Environmental Laboratory

(208) 526-8646

jhw@inel.gov