

What Radiation Levels are Considered Safe?

Radiation Exposure and Health Effects

Public awareness has increased concerning the potential risks of such exposure due to the growing number of medical tests and procedures that use radiation. First, what exactly *is* ionizing radiation? It is radiation that is powerful enough to increase chemical activity inside cells, causing them to change. It is known that very high doses of radiation can cause damage to tissue that may occur within days after exposure. However, much less is known about the effects of low-dose radiation. We hope that this information sheet will provide you with a better understanding of the true risks of radiation exposure from medical imaging tests and procedures.

What Radiation Levels are Considered Safe?

Humans are exposed to radiation from **both natural and man-made sources**. To determine safe levels, an important first step is estimating your annual exposure to radiation that occurs **naturally**. The amount of radiation dose or exposure is usually described in a unit called a **millirem**, abbreviated as “**mrem**.”



Natural Radiation Sources

Radon – This is a radioactive gas that you cannot see, taste, or smell and that comes in small concentrations from the soil. Radiation dose from inhaled radon is estimated around 230 mrem a year.

Cosmic Radiation - This is radiation from outer space, from the sun and other stars. Exposure varies, depending on altitude. Levels may range from around 30 mrem per year at sea level, to around 100 mrem per year at an altitude of 2 miles. This explains why you receive a small radiation dose when you take an airplane flight.



Terrestrial Radiation - This is due to radiation such as uranium, thorium, and other radioactive materials naturally found in the soil. An average dose is around 20 mrem a year, although this varies depending on where you live.

Radiation from the Inside of our Body

Foods and water naturally contain radioactive substances such as radioactive potassium, uranium, thorium and carbon. They collect in our body tissues leading to an average dose of 25 mrem a year. So we are actually exposed to slight doses simply by being alive.

Total Radiation Exposure from the Natural Environment – On average, in the United States, our total natural radiation exposure is 310 mrem per year. It is reasonable to consider this a safe level of radiation.

Industrial Sources and Consumer Products

Industrial sources, which include nuclear power, coal-burning power, and other industrial plants, produce very little radiation: less than 2 mrem per year. Trace amounts of radiation can be found in some consumer products, including cigarettes, building materials, smoke detectors, and household products. Radiation produced by such consumer products amounts to 10 mrem/year.

Medical Tests

Generally speaking, diagnostic medical tests using ionizing radiation like CT, radiography, and nuclear medicine carry very low radiation risk. Most of the X-ray exams are associated with the lowest radiation dose, whereas CT exams and long fluoroscopy procedures usually result in a higher dose.



Following is a listing of typical dose levels, per the American Nuclear Society:

- **Arm or leg X-ray:** 1 mrem
- **Dental X-ray:** 1 mrem
- **Chest X-ray:** 10 mrem
- **Nuclear Medicine** (thyroid scan): 14 mrem
- **Neck/Skull X-ray:** 20 mrem
- **Pelvis/Hip X-ray:** 65 mrem
- **Head CT (computed tomography) Scan:** 200 mrem
- **Upper GI X-ray:** 245 mrem
- **Barium Enema:** 405 mrem

What is the Cancer Risk?

Small amounts of radiation result in an extremely low cancer risk. For example, a person who has 5 CT head scans has 1 in 1000 chance of developing cancer. In comparison, 420 people out of a 1000 have a chance of developing cancer unrelated to radiation during their lifetimes.

Who is Most at Risk?

A younger person is more at risk because their cells are growing and dividing more rapidly. The developing fetus, infant, and very young child are at the greatest risk, which can be several times higher than that of a middle-aged adult. Elderly individuals are at the lowest risk. In Radiology, we take all possible measures to identify women who are pregnant. In addition, when possible, we will perform imaging studies without ionizing radiation. When such studies are needed, we take measures to shield other areas of the body and to reduce radiation dose as much as possible.

Medical Treatment

There are a number of medical procedures where radiation is used in much higher doses to treat cancer (called **radiation oncology**). Such radiation is carefully targeted and applied locally to protect surrounding healthy tissue. Radiation therapy may be recommended as part of a cancer patient's treatment, based on careful assessment determining that the medical benefits greatly outweigh the risks.

Weighing Radiation Risk versus Medical Benefits

All medical procedures, including those that involve radiation, carry some level of risk. And as we know, that is also the case with all activities in our lives. As with any decision, we need to carefully consider the benefits and the possible risks of receiving a specific medical test or of undergoing radiation treatment. In

addition, patients and their referring physicians should discuss both the risks of receiving the medical test or therapy as well as the risks of **not** doing so.

The American College of Radiology (ACR) advises that no imaging exam should be performed unless there is a clear medical benefit that outweighs any associated risk. At Danbury Hospital, our practice is to use the **lowest** level of radiation during imaging tests needed to achieve the necessary result. An imaging test provides an important benefit that outweighs its theoretical radiation risks by confirming or helping to rule out the presence of disease or injury

Reducing Dose from CT Imaging

At Danbury Hospital, a main concern is reducing radiation doses, and our staff is trained accordingly. Our CT scanners are programmed to ensure the most effective dose based on the specific area of the body being imaged as well as certain patient factors. All of our scanners are accredited by the ACR and meet the ACR's strict dose control requirements. We conduct regular performance and dose checks for safety measures. Our CT technologists are trained to take all possible steps to reduce patient dose, including:

- limiting the length of the scan to the absolute minimum
- adjusting and correcting the patient's positioning, and
- applying external shielding to protect neighboring tissue.

At Danbury Hospital, our staff pays special attention to young patients. We follow the principles of the ACR's "**Image Lightly**" campaign, using special CT procedures that take into account the young patient's age and weight.



The Danbury Hospital Radiology Department also is dedicated to reducing radiation dose by limiting the number of necessary imaging studies. This **may** include a single-phase study rather than CT scanning with and without contrast or an imaging study that does not use radiation, such as an MRI or ultrasound.

If you have questions regarding an imaging test and the possible risks versus benefits, it is important that you speak with your referring physician and/or your radiologist regarding your particular case.

Source:
EPA. (2010). Sources of radiation exposure. Retrieved from www.epa.gov/rpdweb00/sources/index.html

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For more information, or to learn about the specialized services and programs available at Danbury Hospital, please visit www.DanburyHospital.org