



IONIZING RADIATION AND NON-IONIZING RADIATION – FREQUENTLY ASKED QUESTIONS

A RESOURCE FOR VETERANS, SERVICE MEMBERS, AND THEIR FAMILIES

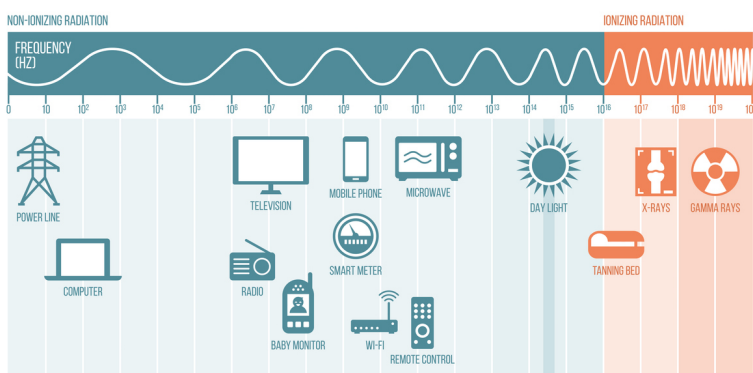
To best respond to the concerns of Veterans and health care providers, we’ve compiled a list of frequently asked questions.

WHAT IS RADIATION?

- Radiation is all around us. Everyone is routinely exposed to a baseline level of radiation that comes from natural sources like the sun, the ground, and outer space as well as from man-made sources like cell phones and microwaves. The average annual radiation dose is 620 millirem.
- Radiation exists across a spectrum from very low-energy (low-frequency) radiation to very high-energy (high frequency) radiation. This is called the electromagnetic spectrum with non-ionizing radiation (i.e., radio waves, cell phones, radar) representing lower frequency waves and ionizing radiation (i.e., x-rays, radioactive materials) representing high frequency waves (Figure 1).

- Non-ionizing radiation has enough energy to move around atoms in a molecule or cause them to vibrate, but unlike ionizing radiation, it does not have enough energy to remove electrons. Examples of non-ionizing radiation include
 - o Radio waves for radio broadcasting
 - o Microwave radiation for telecommunications and heating food
 - o Cell Phones
 - o Radiofrequency signals used by radar systems to detect the presence, direction or range of aircraft, ships or other objects
- Ionizing Radiation refers to high frequency, “ionizing” sources such as x rays and gamma rays. Ionizing radiation differs from non-ionizing radiation because ionizing radiation has enough energy to break chemical bonds in molecules or remove tightly bound electrons from atoms, creating charged molecules or atoms (ions).

THE ELECTROMAGNETIC SPECTRUM



WHAT HEALTH EFFECTS ARE LINKED TO RADIATION?

The type of radiation you are exposed to influences your health risks.

- **Non-Ionizing Radiation:** Non-ionizing radiation does not have sufficient energy to remove electrons from atoms and is less harmful than ionizing radiation. In many instances, short-duration, low frequency sources of non-ionizing radiation are not thought to cause health problems. Higher frequency, non-ionizing radiation (for example, infrared exposure from airborne forward looking infrared (FLIR) scanners, guidance heads for missiles, and night vision goggles) may cause burns and tissue damage with overexposure. Exposure to significant amounts of non-ionizing radiation may result in tissue damage due to heat. People may notice excessive non-ionizing radiation exposure through heat sensation and pain.

HOW DO NON-IONIZING RADIATION AND IONIZING RADIATION DIFFER?

- Non-ionizing radiation is low frequency radiation and moderately higher frequency radiation, including radio waves, microwaves, infrared radiation and visible light.





- **Ionizing Radiation:** Health risks for ionizing radiation are different because ionizing radiation may damage DNA in the genes. The amount of damage depends on many factors including the type of ionizing radiation, the exposure pathway, and the total amount of radiation absorbed. Because damage is at the cellular level, the effect from small or even moderate ionizing radiation exposure may not be noticeable. Most cellular damage from ionizing radiation is repaired. However, some cells may not recover well and could become damaged or cancerous. Ionizing radiation also can kill cells. Children are more sensitive to ionizing radiation than adults because children are still in the process of growing. People who are exposed to high doses of ionizing radiation may develop Acute Radiation Syndrome (ARS) (sometimes known as radiation toxicity or radiation sickness). ARS is an acute illness caused by irradiation of the entire body (or most of the body) by a high dose of radiation in a very short period of time (usually a matter of minutes). Examples of people who developed ARS were people near the atomic bomb detonations in Hiroshima and Nagasaki, Japan at the end of World War II.

DOES RADIATION CAUSE CANCER?

Non-ionizing Radiation: Low frequency, short duration, non-ionizing radiation is not thought to cause cancer.

We do not know if exposure to non-ionizing radiation from higher frequencies with longer durations may cause cancer. The International Agency for Research on Cancer (IARC) has classified radio radiation as a "possible human carcinogen." (A carcinogen is an agent that causes cancer.) Several other expert organizations like the US Food and Drug Administration (in a report issued in 2020) concluded that there is insufficient evidence to support a link between non-ionizing sources of radiation like radiofrequency radiation and cancer. Research is ongoing to learn how radiofrequency non-ionizing radiation may impact health.

Ionizing Radiation: The risk of cancer from ionizing radiation is different because ionizing radiation, unlike non-ionizing radiation, can break down cells and cause damage that results in cancer. Much of

our knowledge about the cancer risks for ionizing radiation are based on studies of survivors of the atomic bombs in Hiroshima and Nagasaki, Japan at the end of World War II. Studies of radiation industry workers and people receiving large doses of medical radiation are also important sources.

The chance of developing cancer may increase as the radiation dose increases. As with other types of toxins, "the dose makes the poison". Full body radiation exposure is often more harmful than radiation to one part of the body.

HOW ARE VETERANS EXPOSED TO RADIATION IN THE MILITARY?

- Veterans who served in these specific "radiation risk" activities may have been exposed to ionizing radiation:
 - o Military Service at one of the following gaseous diffusion plants for at least 250 days before Feb. 1, 1992: Paducah, Kentucky; Portsmouth, Ohio; or K25 in Oak Ridge, Tennessee.
 - o Radiological cleanup of Enewetak Atoll from January 1, 1977, through December 31, 1980.
 - o U.S. Air Force plutonium cleanup mission near Palomares, Spain (1966).
 - o U.S. Air Force plutonium cleanup mission at Thule, Greenland (1968).
 - o Participated in underground nuclear weapons testing at: 1) Amchitka Island, Alaska before Jan. 1, 1974; or 2) Nevada Test Site for at least 250 days from January 1, 1963, through December 31, 1992.
 - o Participated in atmospheric nuclear weapons tests conducted primarily in Nevada and the Pacific Ocean between 1945 and 1962.
 - o Participated in the occupation of Hiroshima and Nagasaki, Japan between Aug. 6, 1945, and July 1, 1946, or Prisoners of war in Japan near Hiroshima and Nagasaki during World War II.
- Military occupations such as nuclear weapons technicians, x-ray technicians, and dental technicians may have ionizing radiation exposure but typically these





jobs are monitored through occupational health surveillance programs and have safety protocols in place like shielding, protective equipment, and safety monitoring.

- Veterans with embedded pieces of depleted uranium from a tank armor explosive event or munition injury may have internal radiation exposure. Radiation risk from depleted uranium is less than natural uranium since depleted uranium is “depleted” of about 40% of its radioactivity. Depleted uranium is a heavy metal and can be harmful to the kidneys and other internal organs.
- Other groups of Veterans who may have radiation exposures are: 1) U.S. Coast Guard Veterans who worked at LORAN (Long Range Navigation) stations from 1942 to 2010 (x-ray radiation from high voltage vacuum tubes); 2) U.S. Navy Veterans who worked at McMurdo Station Antarctica from 1964 to 1973 where a leak was discovered at the nuclear plant; and 3) Veterans who received nasopharyngeal (nose and throat) radium irradiation treatments from 1940 to mid-1960s. These groups include potentially exposed pilots, submariners, and divers.
- Service members may have been exposed to low levels of ionizing radiation in Japan from March 12, 2011, to May 11, 2011, following the Fukushima nuclear accident on March 11, 2011. It is not thought that this exposure will cause long term health effects, and Service members/ Veterans potentially exposed to radiation during this event have been included in the Department of Defense Operation Tomodachi Registry.
- Veterans who receive radiation therapy to treat diseases like cancer are exposed to ionizing radiation.

ARE THERE VA PRESUMPTIVE CONDITIONS FOR MILITARY RADIATION EXPOSURE?

VA presumes that any Veteran who participated in the specific military radiation risk activities described and who develop one of these cancers listed here are eligible for VA disability:

- o Cancers of the bile ducts, bone, brain, breast, colon, esophagus, gall bladder, liver (primary site, but not if cirrhosis or hepatitis B is indicated), lung (including bronchiolo-alveolar cancer), pancreas, pharynx, ovary, salivary gland, small intestine, stomach,

thyroid, urinary tract (kidney/renal, pelvis, urinary bladder, and urethra)

- o Leukemia (except chronic lymphocytic leukemia)
- o Lymphomas (except Hodgkin’s disease)
- o Multiple myeloma (cancer of plasma cells)

VA recognizes other diseases are possibly caused by exposure to ionizing radiation during service. Eligibility for VA disability compensation for these conditions are based on radiation type, radiation dose, and timing of the onset of illness. VA decides these claims on a case- by-case basis. Health conditions that may warrant additional consideration include:

- o All cancers
- o Non-malignant thyroid nodular disease
- o Parathyroid adenoma
- o Posterior subcapsular cataracts
- o Tumors of the brain and central nervous system

WHAT STEPS CAN I TAKE TO PROTECT MYSELF FROM EXCESSIVE RADIATION EXPOSURE?

- If you work in a job with radiation, take safety precautions to protect yourself. Using protective equipment and shielding, limiting time of exposure, increasing distance from the radiation source, and engaging in safety monitoring are important.
- If you live in a community with radioactive radon, check your house for radon. Radon can get into homes or buildings through small cracks or holes and build up to higher levels. Over time, breathing in high radon levels may cause lung cancer. In these instances, safety protocols and shielding are routinely used to minimize harmful effects to parts of the body that do not need the radiation therapy.
- Talk to your doctor about avoiding unnecessary (repeat) medical procedures that use ionizing radiation (CT scans, x-rays, fluoroscopy, mammograms, nuclear medicine).
- Protect yourself from ultraviolet radiation by staying in the shade during mid-day hours and using sun-protective covers/clothing and sunscreen.
- Do not use tobacco products as tobacco may directly expose your lungs, throat, and mouth to radioactive materials through smoking or other use.





WHERE CAN I LEARN MORE ABOUT RADIATION?

- If you engaged in one of the military radiation risk activities listed, talk to your environmental health coordinator at your local VA to discuss an evaluation through the VA’s Ionizing Radiation Registry. Information about VA’s Ionizing Radiation Registry available at <https://www.publichealth.va.gov/exposures/radiation/benefits/registry-exam.asp>
- Veterans who participated in atmospheric nuclear weapons tests conducted primarily in Nevada and the Pacific Ocean between 1945 and 1962 are encouraged to review the fact sheets on the tests from the Nuclear Test Personnel Review office, available at <https://www.dtra.mil/About/Mission/Nuclear-Test-Personnel-Review/NTPR-Fact-Sheets/>
- Veterans with questions about ionizing radiation exposure while in the military may contact DoD’s Defense Threat Reduction Agency’s public outreach service at 1-800-462-3683 to get more about information about their ionizing radiation exposures.
- Veterans with questions about VA disability benefits for military radiation exposure may contact the VA Benefits Administration at 1-800-827-1000, <https://benefits.va.gov>

FACT SHEET ADAPTED FROM THESE RESOURCES:

- VA Office of Public Health: Radiation- <https://www.publichealth.va.gov/exposures/radiation/index.asp>
- Centers for Disease Control and Prevention- Radiation in your Life: <https://www.cdc.gov/nceh/radiation/sources.html>
- US Environmental Protection Agency RadTown Radiation Exposure- <https://www.epa.gov/radtown/radtown-radiation-exposure-teacher-information>
- National Institute of Health- Non-Ionizing Radiation: <https://ors.od.nih.gov/sr/dohs/safety/Pages/non-ionizing.aspx>
- Occupation and Safety Health Administration- Non-Ionizing Radiation: <https://ors.od.nih.gov/sr/dohs/safety/Pages/non-ionizing.aspx>
- Nuclear Regulatory Commission- Personal Annual Radiation Dose Calculator: <https://www.nrc.gov/about-nrc/radiation/around-us/calculator.html>
- U.S. Food and Drug Administration- Radiofrequency Radiation and Cell Phones: <https://www.fda.gov/radiation-emitting-products/cell-phones/radio-frequency-radiation-and-cell-phones#:~:text=Scientific%20consensus%20shows%20that%20non,cause%20any%20harm%20to%20people>

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