How to Interpret Radiation Exposures

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The following chart on interpreting radiation exposures was developed to help people understand the meaning of different levels of exposures. For many people the fact that radiation is detectable means that it is bad, however, there are three facts which might help to interpret radiation exposures.

1. There is NO ZERO radiation. We live in a radioactive world and we are surrounded with radiation all the time. All of the food we eat and the air we breathe are radioactive. Thus our bodies contain a large amount of radioactive material normally. On the average our bodies are also bombarded with several hundred thousand gamma rays every minute from outer space and from the ground.
2. Our bodies are actually very resistant to harm by radiation. Medical doctors know this from the enormous amounts of radiation required to kill cancer cells (which are more sensitive to damage by radiation than normal cells).
3. We can measure radiation in very small amounts, even at the level of individual atoms.

Units of millirem (mrem) or millisieverts (mSv) are measures of the dose or quantity of radiation energy that could be deposited in our bodies. To help with conversions from international to United States measures: mSv/10 = rem and µSv/10 = mrem.

Radiation Dose mrem	Radiation Dose mSv	Interpretation
1	0.01	The average radiation dose received in one day by people in the US from naturally occurring radiation.
2	0.02	Allowable dose for an hour of exposure to the public from regulated sources of radiation
3 – 5	0.03 – 0.05	Radiation dose a person receives from flying for 10 hours
8 – 10	0.08 – 0.1	Dose that may be received from a chest x-ray
10 – 12	0.1 – 0.12	Average annual dose from exposure to consumer products in the US (such as smoking, radioactive glassware, light salt, smoke alarms, etc)
20	0.2	Average annual dose in the US due to radiation from the ground
30	0.3	Average annual dose in the US due to radiation from outer space
30	0.3	Average annual dose from radioactive material in our bodies
100	1	Allowable dose for a year of exposure to the public from regulated sources of radiation
100 – 150	1 – 1.5	Average annual radiation dose received by US nuclear power plant workers
230	2.3	Average annual radiation dose from radioactive radon gas in US homes
310	3.1	Average annual dose in the US from all natural sources combined
500	5	Allowable dose (nine months) for protection of the embryo / fetus of a declared pregnant radiation worker

Radiation Dose mrem	Radiation Dose mSv	Interpretation
620	6.2	Average annual radiation dose received in the US from combined natural radiation and man-made radiation (primarily from medical procedures)
600 – 800	6 – 8	Average annual dose from natural radiation in Yangjiang, China
1,000 – 2,500	10 – 25	Radiation dose a person may receive from computed tomography (a CT scan)
1,500 – 2,500	15 – 25	Average annual dose from natural radiation in Kerala, India
5,000	50	Allowable annual dose limit for trained radiation workers
6,000 – 8,000	60 – 80	Average annual dose from natural radiation in Guarapari, Brazil
10,000 – 26,000	100 – 260	Average annual dose from natural radiation in Ramsar, Iran
25,000	250	Recommended limit for persons engaged in life saving during a radiation emergency (such as in Japan). No observable effects are expected at this dose level.
100,000	1,000	If this dose is received to the whole body in a short time (within one day), some people may begin to feel mild nausea and effects may be seen on blood cells under a microscope.
200,000	2,000	When the whole body is exposed to this dose in a short time, many people will show the effects of acute radiation. They will have nausea, upset stomach, diarrhea, and possibly fever within a few days. Over days and weeks, they may have loss of hair and loss of weight. These are the same effects seen in cancer patients undergoing radiation therapy. Complete recovery is expected.
500,000	5,000	When this dose is received in a short time, a person will experience severe effects of acute radiation. This includes damage to blood forming organs and the digestive system. With good medical care most people will survive this dose.
1,000,000	10,000	A short term dose to the whole body at this level would produce very severe damage and even with the best medical care the person may not survive
2,000,000	20,000	No one has survived a single dose at this level
5,000,000 – 8, 000,000	50,000 – 80,000	Required dose directed at a tumor for radiation therapy to kill cancer cells.

Note: When radiation doses are spread out over many years, such as doses that could be received by radiation workers at 5,000 mrem a year, there would not be observable effects for a total dose of 200,000 mrem or more. When radiation doses are spread out over time, the body has time to adapt and repair any damage. However, a person receiving such doses over a lifetime will have a small additional risk of cancer later in life. The current chances of getting cancer in the US are normally about 50% for men and about 33% for women without any extra radiation.

The materials in this chart are derived from publications of the National Council on Radiation Protection and Measurements (NCRP), the National Academy of Sciences (NAS), the Nuclear Regulatory Commission (NRC), and the Journal of the Health Physics Society (HPS).