

Radiation

Jack E. Hauck, M.D.

Over the past eighteen months, there has been much reported and written about radiation events such as the Three Mile Island accident and the ocean dumping of low-level radiation waste have been widely reported. Thanks to sophisticated communication systems today, we learn about such events in a matter of minutes. However, we must often rely on interpretations of people who may be remote from the event or who may not understand precisely what they are reporting.

Although the term radiation is broad, it is often used to mean *ionizing radiation*, which is radiation that can go before things the moment that it strikes. This type of radiation can be either beneficial or harmful, depending on its use and control. There are many types of ionizing radiation. Perhaps the three most widely known are alpha, beta and gamma. *Alpha radiation* is positive-charged particles from uranium, radium, and various man-made elements. Alpha radiation will just penetrate the surface of the skin but can be stopped with a sheet of paper. *Beta radiation* particles can penetrate one to two centimeters of water or human flesh but can be stopped by a sheet of aluminum a few millimeters thick. *Gamma radiation*, or X-rays, can penetrate through the human body and can be very drastically reduced or almost completely absorbed by about three feet of concrete. Dense materials such as concrete and lead are often used as shields.

Radiation received is calculated in dose form using the term REM (Roentgen Equivalent Man) and millirem (1/1000 of a REM). These calculations are utilized to take into account the different biological effects of different types of ionizing radiation on people.

We are continuously subjected to natural ionizing radiation. We are exposed to it from outer space, from rocks and the soil we walk on, from building materials, from the air we breathe and the food we eat. In addition, we receive radiation from man-made sources such as X-rays, medical diagnoses, and treatments.

The average individual receives about 100 millirem each year from natural sources. This number depends on local conditions, occupation, etc.

Catawba

Catawba Nuclear
Station
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How Much
Radiation
Do You
Receive?

For example, a person living in Denver would receive about 63 millirem. More than one living in California, chiefly because of altitude and the naturally occurring radiation in the granite formation of the Rocky Mountains. A male will receive five millirem more than a female, chiefly because of the intake of food and the fact that he has more flesh.

On the average, an individual picks up another 100 millirem per year from various man-made sources. For example, watching color TV will add one millirem per year, one chest X-ray will give a person about 50 millirem. A person who flies regularly will pick up an additional millirem for every hour at an altitude of 29,000 feet. Living within one mile of a new nuclear power plant will add one millirem.

The effects of radiation are probably better known than those of all other agents. The regulations and monitoring measurements which protect us against these effects are more advanced and more sophisticated.

The use of radiation has brought tremendous benefits to mankind. Radioisotopes and controlled radiation are used to sterilize medical supplies, to aid in the study of the environment and of environmental pollution, in agriculture, in industrial procedures, and in the production of electricity. Radiation is used in medicine as a major tool in the treatment of cancer. Radioisotopes are used in medical procedures to detect and treat cancerous body organs.

From my perspective, the benefits of radiation and radioactive materials clearly outweigh the risks.

—Orange County Medical Association Bulletin
November 1980

*Depending on X-ray technique.

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PROPERTY NUMBER
FRED. B. STELL, FAC.

50-413/414 OL

I-EP-11 5/3/84

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USNRC

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NUCLEAR REGULATORY COMMISSION

Sub

Docket No. *D-413 x 4/402* Official Exh. No. *EP-11*

In the matter of *Catalomb*

Staff	IDENTIFIED	<i>-</i>
Applicant	RECEIVED	<i>✓</i>
Intervenor	REJECTED	<i>✓</i>

Cont's Off's

Contractor

Other

DATE *5/3/84*

Witness *Cat. 1+7 Panel*

Reporter *ky*

HOW MUCH RADIATION DO YOU RECEIVE?

We live in a radioactive world. Radiation is all around us and is part of our natural environment. By filling out this form, you will get an idea of the amount you are exposed to every year. The average American is exposed to a total of 180 units.

Factors	Common Sources of Radiation	Your Annual Dose (mrem)									
WHERE YOU LIVE	Cosmic radiation at sea level.....	26									
	For your elevation (in feet)—add this number of mrem.....	_____									
	Elevation—mrem	<table style="display: inline-table; border: none;"> <tr> <td style="padding-right: 10px;">1000-2</td> <td style="padding-right: 10px;">4000-15</td> <td style="padding-right: 10px;">7000-40</td> </tr> <tr> <td style="padding-right: 10px;">2000-5</td> <td style="padding-right: 10px;">5000-21</td> <td style="padding-right: 10px;">8000-53</td> </tr> <tr> <td style="padding-right: 10px;">3000-9</td> <td style="padding-right: 10px;">6000-29</td> <td style="padding-right: 10px;">9000-70</td> </tr> </table>	1000-2	4000-15	7000-40	2000-5	5000-21	8000-53	3000-9	6000-29	9000-70
	1000-2	4000-15	7000-40								
2000-5	5000-21	8000-53									
3000-9	6000-29	9000-70									
Elevation of some U.S. cities (in feet): Charlotte 700, Atlanta 1050, Chicago 600, Denver 5500. (Coastal cities are assumed to be zero, or at sea level.)											
	Ground: U.S. average.....	26									
	House Construction: For stone, concrete or brick building..... add 7	_____									
WHAT YOU EAT, DRINK, AND BREATHE	Food Water U.S. average..... Air	24									
	Weapons test fallout.....	4									
HOW YOU LIVE	Medical										
	Number of chest X-rays..... x 10	_____									
	Number of lower gastrointestinal tract X-rays..... x 500	_____									
	Number of radiopharmaceutical examinations (brain uptakes) scans, thyroid..... x 300	_____									
	Number of extremity (arms, legs) X-rays..... x 20	_____									
	(Average dose to total U.S. population = 92 mrem)										
	Dental										
	Number of bitewing series..... x 40	_____									
	Number of panorex X-rays..... x 500	_____									
	Jet plane travel: For each 2500 miles..... add 1	_____									
Luminous clocks..... x 9	_____										
Luminous wristwatch..... add 2	_____										
TV viewing: For each hour per day..... x 0.15	_____										
Smoke detectors..... x 0.02	_____										
Sleep with another person..... add 0.1	_____										
HOW CLOSE YOU LIVE TO A NUCLEAR PLANT	At site boundary: Average number of hours per day..... x 0.2	_____									
	One mile away: Average number of hours per day..... x 0.02	_____									
	Five miles away: Average number of hours per day..... x 0.002	_____									
	More than 5 miles away..... None	_____									
	<i>NOTE: Maximum allowable dose determined by "as low as reasonably achievable" (ALARA) criteria established by the U.S. Nuclear Regulatory Commission. Experience shows that your actual dose is substantially less than these limits.</i>										
	TOTAL	_____									

Primary Source:

Revised from earlier editions based on the "BEIR Report-III" — National Academy of Sciences, Committee on Biological Effects of Ionizing Radiation, "The Effects on Population of Exposure to Low-Level Radiation," National Academy of Sciences Washington, DC, 1980