

**Human Research Protection Office**

Barnes Jewish Hospital  
St. Louis Children's Hospital  
Washington University

**FACTS CONCERNING RADIATION**

The Human Research Protection Office (HRPO), the Radioactive Drug Research Committee, and the Radiation Safety Committee of Washington University have prepared this fact sheet to help you decide if you wish to participate in a research study that involves radiation exposure. Often people believe the risks of radiation are greater than they actually are. The purpose of this information sheet is to provide real information about the risks associated with radiation exposure. It's important to remember, your participation in a research study is voluntary.

When assessing the risks of radiation it is important to know:

- We are all exposed to small amounts of radiation from natural sources (like the Sun) throughout our lives. In the United States, the average annual radiation exposure to each person from these natural sources is about 300 millirem. (The rem is the unit used to measure radiation exposure; 1 rem = 1,000 millirem.)
- The effects of radiation have been extensively studied. Although physicians and scientists do not understand everything about the effects of radiation, we know more about radiation than we do about many other hazards, such as chemical pollutants.
- The potential harmful effects of radiation are dependent on the amount and type of radiation to which you are exposed. Large amounts of radiation in a short period of time (exposures of greater than 20,000 millirem over a few seconds) can have measurable long-term damaging effects. Small amounts of radiation exposure (less than 10,000 millirem) have not been clearly shown to have harmful effects.

It is generally assumed that the effects of radiation are related to the amount of radiation to which you are exposed. In other words, a large amount of radiation has a large chance of producing a harmful effect and a small amount of radiation will have a small chance of producing a harmful effect.

If we accept that the effects of radiation increase in response to the amount of radiation we are exposed to, we can estimate how likely it is that you will have a harmful effect from being exposed to small amounts of radiation.

One way to better understand the radiation risk in research is to compare the amount of radiation from the research procedures to other sources of radiation. For example, naturally occurring radiation exposes each of us to 300 millirems of radiation in each year. In an average lifetime (75 years), each person will be exposed to a total of 22,500 millirem of radiation from natural sources alone. X-ray procedures can expose patients to radiation in amounts ranging from as little as 10 millirem to 10,000 millirem or more. Radiation workers (for example, x-ray technologists) are allowed a maximum yearly exposure of 5,000 millirem, which translates to 200,000 millirem over a 40-year working lifetime. Although these levels of radiation are assumed to cause an increased risk of cancer, follow-up studies in radiation workers have rarely shown any measurable increase in the risk of cancer.

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In the United States, the overall lifetime risk of fatal cancer is about 28%. Therefore, in a group of one million people, there will be 280,000 fatal cancers from natural causes. We know that large amounts of radiation increase your risk of developing cancer. The risk is 2 to 3 times greater for a younger adult exposed to large amounts of radiation over a short time than an older adult exposed to the same large amount of radiation. Since radiation-induced cancers do not occur until many years after the radiation exposure, it is difficult to determine if a particular cancer is due to radiation and even more difficult to measure this slight increase (from 280,000 to 280,400 cases in 1,000,000 people) in the cancer risk. It is important to realize that if a cancer does develop in an individual after he or she was exposed to radiation, it is much more likely that the cancer occurred naturally than that it was due to the radiation exposure.

Genetic effects have been observed in animals exposed to radiation. This means that radiation exposure has impacted an animal's abilities to reproduce or has impacted fetal development during pregnancy. While radiation exposure likely has genetic effects in humans, the effect has been too small to measure directly. For example, the children of the 85,000 survivors of the atomic bombings at Hiroshima and Nagasaki were followed to monitor for genetic effects or genetic abnormalities in pregnancy. No increase in genetic abnormalities has been observed.

During their lifetimes, some people have many diagnostic tests (like X-rays, CT scans or nuclear medicine scans) involving radiation exposure or may participate in multiple research studies that result in additional radiation exposure. When you need a test like an X-ray or another imaging scan that exposes you to radiation, the benefit from having the tests (obtaining a better understanding of your disease) likely outweighs the risks from the radiation exposure.

When you participate in a research study, you may receive no benefit from your participation. However, the research may help society by answering a scientific question. When you receive no benefit from the radiation exposure, you generally should limit your radiation exposure to less than 5,000 millirem in a year. 5,000 millirem is the maximum amount of annual radiation exposure that radiation workers (for example, X-ray technologists) are allowed each year. For this reason, you should let the investigator know if you are participating in other research projects involving radiation. When a research study is likely to provide some direct benefit to the participants, radiation doses of greater than 5,000 millirem may be permitted.

We hope that the information provided in this brochure has been helpful. If you have additional questions regarding the effects of radiation, you should ask the investigator or you may contact the Human Research Protection Office at 1-(800)-438-0445, or email at [hrpo@wustl.edu](mailto:hrpo@wustl.edu).