

North Carolina State University

Pregnant Employee's Guide to Radiation Safety



Questions? Please call or come by
The Radiation Safety Office
515-2894

Pregnant Employee's Guide to Radiation

This document attempts to explain the risks associated with radiation and pregnancy and compares these risks with other risks to the unborn child. This will assist the pregnant, occupationally exposed employee in assessing the potential risk to the unborn child during the course of employment. Also discussed are methods of minimizing the radiation dose and the risk to the unborn child and maintaining the radiation doses as low as reasonably achievable.

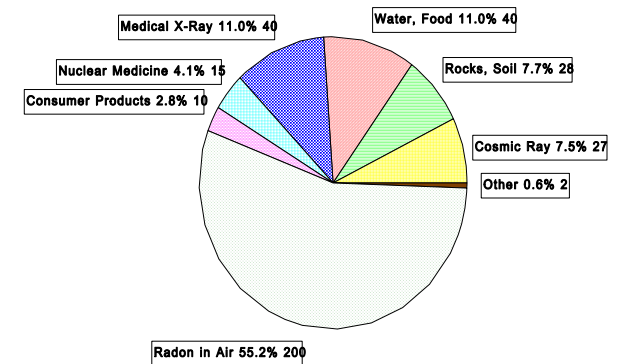
There are things in our surroundings and in our lifestyles that can affect an unborn child. It is especially important that individuals who work with sources of radiation understand the risks of radiation to the unborn child.

Everyone is exposed daily to various kinds of radiation: heat, light, ultraviolet, microwave, ionizing, and so on. All human activities involve exposure to radiation. People are exposed to different amounts of background ionizing radiation depending on where they live, what they eat and drink, and how they live. Background radiation comes from many sources: radon, soil, rocks, cosmic rays, water, air, consumer products, etc. The average person is exposed to approximately 360 mRem per year from these background sources of ionizing radiation.

References:

- Cunningham, Gary F. et al. *Williams Obstetrics*, 19th Edition; Appleton and Lange: Norwalk, CT, 1993.
- National Council on Radiation Protection and Measurements. Exposure of the population in the United States and Canada from natural background radiation. NCRP Report No. 94, 1987.
- National Council on Radiation Protection and Measurement. Radiation Exposure to the U.S. Population from consumer products and miscellaneous sources. NCRP Report No. 95, 1987.
- U.S. Nuclear Regulator Commission. Instruction concerning prenatal radiation exposure. Regulator Guide 8.13, 1987.

Sources of Radiation Exposure



Effects on the Embryo/Fetus of Exposure to Radiation and Other Environmental Hazards

To understand the potential effects of different levels of radiation on an embryo/fetus, it is helpful to compare them to the naturally occurring effects and the environmentally produced risks such as smoking and drinking. This will allow someone to contrast these risks with those produced by exposure to ionizing radiation.

The natural risks for birth defects are as follows: 3-5% of all births have some type of abnormality detectable at birth and 3-5% of all births have some type of condition or disease that develops later in life (not detectable at birth). The risk of a known pregnancy ending in a miscarriage or stillbirth is 20-30%.

The following table compares the radiation risks (childhood cancer, abnormalities) and non-radiation risks (stillbirth or spontaneous abortion due to high-risk occupations such as the lead industry, fetal alcohol syndrome and perinatal death due to alcohol or smoking) with their natural occurrence as birth defects.

Natural Occurrence of Birth Defects v. Excess Defects Due to Types of Risk

Effect	# Occurring From Natural Causes	Type of Risk	Excess Occurrence Due to Risk
NATURAL RISK Per 1000		RADIATION RISK Per 1000	
Childhood Cancer			
Cancer death	1.4	Radiation dose of 1 rem received before birth	0.6
Abnormalities		Radiation dose of 1 rem received during specific periods after conception	
Small head size	40	4–7 weeks	6
		8–11 weeks	9
Mental retardation	4	8–15 weeks	4
NATURAL RISK Per 1000		NON-RADIATION RISK Per 1000	
Occupation		Occupational Risk	
Stillbirth or spontaneous abortion	200	Work in high-risk occupations	90
Alcohol Consumption		Alcohol Risk	
Fetal alcohol syndrome	1-2	2-4 drinks per day	100
		>4 drinks per day	200
		Chronic alcoholic (>10 drinks per day)	350
Perinatal infant death (around time of birth)	23	Chronic alcoholic (>10 drinks per day)	170
Smoking		Smoking Risk	
Perinatal infant death	23	<1 pack per day	5
		1 pack per day	10

Nuclear Regulatory Commission and the North Carolina Division of Radiation Protection

Regulations and guidance are based on the conservative assumption that any amount of radiation, no matter how small, can have a harmful effect on an adult, child, or unborn child. Because it is known that the unborn child is more sensitive to radiation than adults, particularly during certain stages of development, a special dose limit for protection of the unborn child has been established. Such a limit could result in job discrimination for women of child-bearing age, and perhaps an invasion of privacy (if pregnancy tests were required).

Therefore, the regulatory agencies have taken the position that special protection of the unborn child should be voluntary and should be based on decisions made by workers and by employers who are well informed about the risks involved. It is important that the employee understand the risk to the unborn child from radiation received as a result of the occupational exposure of the mother.

Radiation Dose Limits

Because of the sensitivity of the unborn child, the *North Carolina Regulations For Protection Against Radiation* and the *Code of Federal Regulations* Part 20 has recommended that the dose equivalent to the unborn child from occupational exposure of the expectant mother be limited to 500 mrem for the entire pregnancy.

This radiation exposure limit can only be enforced if the pregnancy is declared by the mother. A declared pregnancy is one in which a woman voluntarily informs her employer, in writing, of her pregnancy and gives the estimated date of conception. An employee can declare her pregnancy by filling out a Pregnancy Declaration form available in the Radiation Safety Office.

Advice for Employee and Employer

Although the risks to the unborn child are small under normal working conditions, it is a regulatory requirement to limit the radiation dose from occupational exposure to not more than 500 mrem for the total pregnancy and to not more than 50 mrem in any month. Employee and employer should work together to decide the best method for accomplishing this goal. Some methods that might be used include: reducing the time spent in radiation areas, wearing some shielding over the abdominal area, and keeping an extra distance from radiation sources when possible. The Radiation Safety Officer will be able to estimate the probable dose to the unborn child during the normal nine-month pregnancy period based on the exposure history. If the predicted dose approaches the limit, the employee and employer should work out schedules or procedures to confine the dose to less than the 500 mrem required limit.

Internal Hazards

Workers should be aware that radiation exposure to the fetus could be from internal sources as well as from external sources. In workplaces such as nuclear medicine clinics and research laboratories where unsealed radioactive materials are routinely used, there is a greater risk of radioactive material entering the body. Pertinent standard radiation precautions include the following:

1. *Never smoke, eat, drink, or apply cosmetics where radioactive materials are used.*
2. *Never pipette by mouth.*
3. *Use disposable gloves while handling radioactive materials.*
4. *Wash hands and monitor for radioactive contamination frequently.*
5. *Wear lab coats or other protective clothing around loose radioactive material.*
6. *Use certified ventilation hoods when handling volatile or potentially volatile radionuclides.*