

For Your Information

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The Pregnant Radiation Worker

Studies have shown that the fetus is sensitive to high doses of ionizing radiation, especially during the first three months of gestation.^{12,15} A small risk of harmful effects from low doses of radiation is assumed, but not proven, to exist. That is, any radiation dose is assumed to result in an increased probability of harm to the fetus. The risks from radiation should be compared with the natural incidence of adverse effects. Value judgments on both an institutional and individual level made about the amount of acceptable additional risk versus the benefits to be gained from the occupational exposure.

The major potential effects following irradiation *in utero* at high doses are mental retardation, the induction of leukemia and other childhood cancers during the first ten years of life, and the induction of congenital anomalies.⁴ The probability that a particular effect will occur depends on several factors including dose, stage of gestation, and dose rate.

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By studying atomic-bomb survivors exposed *in utero*, researchers have found that the maximal sensitivity of the human brain occurs between 8 to 15 weeks after conception. The data suggest that a threshold for mental retardation may exist in the ranges of 20 to 40 rads.⁴ The most

sensitive period for producing congenital anomalies is during organogenesis (days 14 to 56 post conception) when the major organs are developing. The relative risk of cancer is also highest for exposure that occurs in the first trimester. While the exact amount of risk is subject to considerable controversy, experts agree that the risk is small. The best estimates of risk are 0.0005 per rem for malformations¹⁶ and 0.0002 per rem for fatal childhood cancers.^{4,17} The spontaneous incidence rate of congenital anomalies is 4 to 6 per 100 births,^{15,18} while the incidence rate of fatal childhood cancers is 3.4 per 100,000 people per year.¹⁹

Formulating Realistic Policies:

Effective, fair management of pregnant employees exposed to radiation requires the balancing of three factors: (1) the rights of the expectant mother to pursue her career without discrimination based on sex, (2) the protection of the fetus, and (3) the needs of the employer. Each healthcare organization should establish a realistic policy that addresses these three concerns, by clearly articulating the expectations of the employee. A sample pregnancy policy for radiation workers has been published in the literature.²⁰

The NCRP has recommended a total dose equivalent limit of 500 mrem for the embryo-fetus. In addition, once a pregnancy becomes known, the rate of dose accumulation is restricted to 50 mrem per month.⁶ These recommendations are designed to limit the dose to a fetus of an occupationally exposed mother and do not pertain to the expectant mother's exposure from other sources such as medical procedures.

In recent years, radiation protection measures have been devised according to the principle of ALARA (as low as reasonably achievable). Radiation exposure should be maintained at the lowest practicable level. Radiation protection practices do not change because the worker becomes pregnant. Measures that reduce the dose to the worker will also reduce the dose to the fetus. The major ways to decrease the dose further are to restrict the types of tasks performed, or to limit the number of times a particular task is performed.

When an employee first discovers she is pregnant, it is desirable to conduct, on an individual basis, a review of her exposure history and work assignments. If a radiologic technologist, for example, has averaged 30 mrem per month for the last several months, then a reasonable projection is that this individual, as well as her unborn child, will not receive more than 500 mrem during the period of gestation. This radiologic technologist could continue to work in her current capacity during her pregnancy. However, she should be encouraged to monitor her film-badge readings and report any unusual reading to the radiation safety officer.

Contrary to what is generally believed, fluoroscopy and portable x-ray procedures do not result in high exposures to the fetus. For example, in fluoroscopy attenuation by the lead apron and by overloading maternal tissues will reduce the dose to the fetus. Film-badge readings totaling 500 mrem correspond to a fetal dose of 7.5 mrem.²⁰ Consequently, radiologic technologists can continue their work assignments in stationary radiography, portable radiography, fluoroscopy, and special procedures throughout pregnancy.

Evaluating Past Policies:

In the past, many institutions have followed a more conservative, informal policy of reassigning the employee to duties involving no occupational exposure when the pregnancy becomes known. Such conservatism may represent an overreaction stemming from the fear of legal action by an employee who gives birth to a child with some defect. Such a policy is subject to criticism since it supports the following argument: a low dose received by the fetus during the second and third trimesters is potentially more harmful than a dose received early in the gestation period when the pregnancy is not known. Otherwise, if this were not the case, fertile women would be prevented from working in all areas involving radiation exposure. This concept can be stated in slightly different terms: if it is important to remove the pregnant employee as a radiation worker during the second and third trimesters when the pregnancy is known, then as a potentially pregnant employee she should not have been occupationally exposed at any time. There is a sense that the removal of a worker from the radiation environment during the latter trimesters implies an admission of being responsible for permitting an unacceptable risk to that same fetus during the first trimester.

The NCRP's fetal dose limit does not normally interfere with the employment of fertile women as radiologic technologists.

The management of the pregnant radiation worker is based on an assessment in which the risk of harm to the unborn child is comparative with the benefits gained from the expectant mother's occupational exposure. The NCRP, in evaluating the scientific data, has determined that the dose to the fetus during the gestation period should be limited to 500 mrem. This dose limit does not normally interfere with the employment of fertile women as radiologic technologists. Health risks for the unborn child from the mother's occupational exposure are considered to be low compared with the spontaneous incidents of malformations and cancers. If the view were accepted that the protection of the unborn child takes precedence over all other considerations, then any additional risks, however small, would be unacceptable. Consequently, fertile women could not be employed in a radiation work environment.¹⁶

Pregnant employees can maintain a high level of job satisfaction and performance in a radiation work environment. However, both the employer and employee must assume certain responsibilities to limit the dose to the fetus.