

RADIATION EXPOSURE

1. SCOPE/EFFECT: This Medical Center Policy affects the following Services: Imaging Service, Primary Care Service, Medical Service, Rehabilitation and Prosthetics Service, Geriatrics and Extended Care Service, Surgical Service, and Mental Health and Behavioral Service. There have been no major changes since the previous publication.

2. PURPOSE: To provide policy and procedural guidance and to establish responsibility for x-ray technologists and others working in and around x-ray equipment.

3. POLICY: The following is accepted as guidelines for radiation exposure.

4. PROCEDURE:

a. A number of important modifications of the Council's earlier recommendations on basic radiation protection criteria (NCRP) 1971a) have been presented. These modifications are as follows, for occupational exposures: First, the NCRP recommends discontinuance of the age probation formula of $f(N-18)$ rem where N is age in years. Second, the NCRP continues the use of the annual limit of 50 Msv (5rem) but emphasizes its boundary nature. Third, it is suggested, as guidance for radiation protection programs that cumulative exposure should not exceed the age of the individual in years $\times 10$ Msv (years $\times 1$ rem). Fourth, in the exposure of pregnant women under occupational conditions, it is recommended that the limits for the fetus (5m Msv 0.5 rem) not be received at a rate greater than 0.5 Msv (0.05 rem) per month. Fifth, it is recommended explicitly that all limits include the sum of external and internal exposures.

b. Limits of external and internal exposures:

(1) Occupational exposure (annual)

(a) Effective dose equivalent limits stochastic effects 50 Msv (5rem)

(b) dose equivalent limits for tissues and organ Nonstochastic effects

1_ Lens of eye 150 Msv (15 rem)

2_ All others (e.g., red bone bone marrow, breast, lung gonads, skin and extremities 500 Msv (50 rem)

(c) Guidance: Cumulative Exposure $10 \text{ Msv} \times \text{age}$ (1 rem age in years)

(2) Public exposures (annual)

(a) Effective dose equivalent limits, continuous or frequent exposure 1 Msv (0.1 rem)
Effect dose equivalent limit, infrequent exposure 5 Msv (0.5 rem)

(b) Remedial action recommended when:

1_ Effective dose equivalent 5 Msv ($>0.5\text{rem}$)

2_ Exposure to radon and its decay products 0.007Jhn ($>2 \text{ WLM}$)

(c) Dose equivalent limits for lens of eyes skin and extremities 50 Msv (5 rem)

(3) Education and training exposures (annual)

(a) Effective dose equivalent limit 1 Msv (0.1 rem)

(b) Dose equivalent limit for lens of eye, skin and extremities 50 Msv (5 rem)

(4) Embryo-fetus exposures

(a) Total dose equivalent limits 5 Msv (0.5 rem)

(b) Dose equivalent limit in a month 0.5 Msv (0.5 rem)

(5) Negligible Individual Risk Level (annual) 0.5 Msv (0.5 rem)

c. Certain regulations as to classification and monitoring of workers have been established. If a person normally working in a controlled area, or in performing his/her normal duties, may receive a dose exceeding one-fourth of the maximum permissible dose for radiation workers, he/she shall be classified as a radiation worker (occupationally exposed individual). As a radiation worker; he/she should wear a personal monitor.

d. Only persons required for the radiographic examination should be in the x-ray room during an exposure, and, in general, no one but the patient should be in any unshielded area when x-rays are being generated. The technologist shall be inside a shield booth or behind an adequate protective screen. Radiography with low kilovoltage radiation, as in mammography, requires similar precautions. Occasions may arise when the patient must be restrained during the exposure. Such patients may be uncooperative or incapacitated adults. Tape is often used to help position patients and many commercial immobilizers are available, but these are sometimes not adequate and it may be necessary for someone to hold or restrain the patient. No person shall be employed specifically to hold patients, nor should members of Imaging Services who

are classified as radiation workers be asked to do so. If the patient must be held during the x-ray exposures, aides, orderlies, nurses or members of the patient's family should be enlisted for this duty. Physicians ordering difficult exams should be readily available to assist technologists in performing exams. Such persons shall be provided with protective aprons and gloves, and be positioned so that the unattenuated useful beams do not strike any part of the body. A few assignments of this kind need cause to concern; efforts should be made to limit the number of times any one person is called upon to do such work. If an individual is called upon to hold patients relatively often, he/she should consult with the Radiation Safety Officer (RSO) and obtain information on radiation hazards, safety procedures and personnel monitoring.

e. These procedures may present unavoidable difficulties. A wide variety of beam directions may be required. People cannot leave the vicinity of the patient. The main precaution should be to make sure that no one is in line with the direct or useful beam. All persons should try to be at least 6 feet way from the point where the beam enters the patient, and well away from the useful beam. Those who must remain close should wear protective aprons or stand behind protective shields. There is often no structural shielding in the operative room, so that persons in adjacent areas should be considered. When there is doubt, the Radiation Safety Officer (RSO) should be asked for advice. (While masonry walls usually give adequate protection, many new construction materials provide insignificant shielding).

f. Undoubtedly, the greatest exposure to personnel involved in diagnostic radiology occurs during fluoroscopy, angiography, and other special studies. In such procedures, some person must remain in the x-ray room and close to the patient during radiation exposures. Examinations often entail fluoroscopy for extended periods and multiple radiographic exposures at high voltage requirements for surgical sterility often requires the presence of a considerable number of people. For a single study one may find aides are in the room. All persons involved need to be aware of the basic principles of radiation protection. Protective devices normally supplied with the equipment, such as lead drapes, protective pull-up panels, Bucky slot covers, etc., should be used whenever possible.

g. When a number of patients are to be examined with the same physical set-up, it may be wise to devise special shielding devices. Persons who are back as far as possible or behind the x-ray shield. Everyone in the room should be noted that with image intensified fluoroscopy the reduction in scattered radiation, and therefore one should not be lulled into a false sense of security and neglect those precautions which apply to any fluoroscopic examinations.

5. **RESPONSIBILITY:** Radiation Safety Officer works in conjunction with the radiation physician to ensure compliance.

6. **CUSTOMER SATISFACTION:** Patient/family satisfaction issues were considered in the development of this policy.

7. REFERENCES: National Council Radiation Protection Report dated 1990.
8. RESCISSION: Medical Center Policy 115-09-1356, dated February 2, 2009, same subject.
9. DISTRIBUTION: Electronic Access to All Employees