

11/1/76

CENTER FOR HUMAN RADIOBIOLOGY

Fact Sheet on

Diagnostic X-Ray Dosimetry

The medical examination in the Center for Human Radiobiology includes a complete diagnostic x-ray survey of the skeleton. Although diagnostic exposures generally are well below those known to produce health effects in adults, there is concern that effects may nevertheless occur and that exposure levels may not always be as low as practicable. In order to improve our knowledge of CHR patient doses we are making measurements in an anthropomorphic female phantom. At present, our efforts are devoted to dose measurements in the active marrow, the ovaries and the breasts. The thyroid and lungs may be added in the future. No dose measurements using a male phantom are planned since 85% of the examinations made are of females.

Dosimeters are placed at the locations of the organs and the phantom is radiographed by the technicians who make the patient exposures. Technical factors are established for the phantom in the same manner as for the patients. The limbs are missing so only head and torso exposures are made. Only a small underestimate of dose results since the active marrow, ovaries, and breasts are outside the useful beam for the deleted projections. Examinations are made in Boston, under the direction of the MIT Radioactivity Center, and at ANL, so dose measurements have been made in both facilities.

Active marrow dose

The tables below present our best estimates to date of the doses currently given at the two facilities. The measurements were repeated three times and the results for each replication (A, B, C) are given. The total active marrow weight is assumed to be 1000 g.

CHR-ANL examination

<u>Anatomical region</u>	<u>Dose, g rad</u>			<u>Average ± S.D.</u>
	<u>A</u>	<u>B</u>	<u>C</u>	
Head and neck	27	27	35	30 ± 5
Chest	30	32	36	33 ± 3
Abdomen and pelvis	104	98	118	107 ± 10
Totals	160	157	189	169 ± 18

CHR-MIT examination

<u>Anatomical region</u>	<u>Dose, g rad</u>			<u>Average ± S.D.</u>
	<u>A</u>	<u>B</u>	<u>C</u>	
Head and neck	82	99	92	91 ± 9
Chest	138	161	159	153 ± 13
Abdomen and pelvis	191	229	231	217 ± 23
Totals	411	489	482	461 ± 44

Prepared by R. A. Schlenker

REPOSITORY Organics CHR
 COLLECTION Records Relating to Industrial/Medical
 BOX No. Exposure to Radium, Box 121 ASH
 FOLDER Folder # 33 - CHR Fact Sheets
Review Committees
History of CHR from ANL Reports

The abdomen and pelvis make a greater contribution to the total dose than do either of the other regions. This results from a combination of two factors: more than half of the marrow is contained there and more radiation is required to produce an adequate film exposure than in the other regions because of its great thickness.

Ovary and breast dose

The best estimates of ovary and breast doses are given in the table below. The values quoted are the averages for both ovaries or for both breasts. The doses to the individual breasts differ by a factor of about 2 for MIT and the ovary doses differ by about 20% for MIT and 40% for ANL. This asymmetry is produced by lateral projections, in which the right side is always nearer the x-ray tube.

<u>Facility</u>	<u>Dose, mrad</u>	
	<u>Ovary</u>	<u>Breast</u>
CHR-ANL	197 ± 26	100 [*]
CHR-MIT	491 ± 31	265 ± 63

^{*} Not a measured value; scaled from MIT data.

Comparison with national averages for x-ray exposure

Entrance exposure doses for several standard projections are known to vary widely throughout the country. This is apparently due to a failure to optimize the dose for the diagnostic information desired. Surveys of 4 patients indicate entrance doses in the ranges 1.9—4.5 mR for the PA chest and 69—150 mR for the AP lumbar spine projections made at ANL. Doses at MIT would be about 2-1/2 times higher. These compare with national averages of 27 mR and 620 mR, respectively, determined in the 1970 Public Health Service x-ray exposure study. By this standard of comparison our patients are receiving less radiation dose than would be given at other facilities that conform to accepted medical practice.