ICRP 103 System

Learning Objectives

- Identify the differences between the ICRP 103 system and previous systems
- Identify possible regulatory changes if this system is adopted by the NRC

ICRP 103 (2007)

- A new set of tissue weighting factors
- Changes to radiation weighting factors for neutrons (continuous function of energy) and protons (> 2 MeV)
- Update of radiation detriment per Sv
- Maintained ICRP 60 dose limits
- An approach to demonstrate radiological protection of the environment
- Optimization of RP in planned, emergency, and existing exposure situations
- Effective dose gender-averaged for mathematical male and female phantoms

DOSE LIMIT COMPARISON CHART

Exposure Limits	ICRP 26[1]	ICRP 60	ICRP 103	Part 20
Occupational	50 mSv (5rem)/yr (108)[2]	20 mSv (2 rem)/yr, avged 5 yr 50 mSv (5 rem) in any year 100 mSv (10 rem) (total) in 5 yrs (166)	20mSv (2 rem)/yr, avged 5 yr 50 mSv (5 rem) in any year 100 mSv (10 rem)(total) in 5 yrs (183)	50 mSv (5 rem)/yr (§20.1201(a)(1)(i))
Public	5 mSv (0.5 mrem)/yr (119)	1mSv (0.1 rem)/yr Special circumstances of higher value, 5 yr average 1mSv (0.1 mrem) (192)	1 mSv (0.1 rem)/yr Special circumstances of higher value, 5 yr average 1mSv (0.1 rem) (191)	1 mSv (0.1 rem)/yr Up to 5 mSv (500 mrem)/yr with prior NRC authorization (§20.1301(a)&(d))
Fetal (Declared pregnant occupational workers)	≤ 15 mSv (1.5 rem) Working condition B (116)	2 mSv (200 mrem) to surface of abdomen for remainder of pregnancy, limit intakes 1/20 ALI (178)	1mSv (100 mrem) to the embryo/fetus (186)	5 mSv (0.5 rem) (§20.1208(a))

[1] ICRP-2 was mentioned in the body of the Commission paper but not included in this comparison because it was fundamentally different than the other reports. The external limit for occupational workers was 5(N-18) rem, where N=the worker's age. The internal dose was driven by the organ dose, which gave values of maximum permissible concentration based on organ dose rather than the effective dose. ICRP-2 did not contain any tissue or radiation weighting factors.

[2] Paragraph number from the ICRP report cited as a reference source

Enclosure

	ICRP 26	ICRP 60	ICRP 103	Part 20
Exposure Limits (continued)				
Medical Caregivers	---	Medical exposure, no limit, constraints considered, no value suggested (139 & S35)	5 mSv (500 mrem) per episode 20 mSv (2 rem)/yr max. constraint (322)	5mSv (0.5 rem) (§20.1301(c)(1))

	ICRP 26	ICRP 60	ICRP 103	Part 20
Organ Limits				
Worker	500 mSv (50 rem) organ dose 300 mSv (30 rem) lens (103)	---[3] 150 mSv (15 rem) lens (172) 500 mSv (50 rem) skin over 1 cm^2 (173) 500 mSv (50 rem) hands & feet (Table 6)	---[4] 150 mSv (15 rem) lens 500 mSv (50 rem) skin over 1 cm^2 500 mSv (50 rem) hands & feet (Table 6)	500 mSv (50 rem) organ dose 150 mSv (15 rem) lens 500 mSv (50 rem) skin over 10 cm^2 (§20.1201(a)(1)& (2))
Public	50 mSv (5 rem) organ dose (126)	--- rem hands and feet 50 mSv (5 rem) skin over 1 cm^2 150 mSv (1.5 rem) lens (194 and Table 6)	--- rem hands and feet 50 mSv (5 rem) skin over 1 cm^2 150 mSv (1.5 rem) lens (Table 6)	---[5]

[3] Restrictions of intakes to the annual limit on intake will ensure that the lifetime equivalent dose in any single organ, except lens of the eye and skin, will not be such as to result in deterministic effects (175).

[4] Control of stochastic effects will avoid the occurrence of most, and probably all, tissue reactions (95).

[5] Organs with weighting factors are limited by the public dose requirement that their Total Effective Dose Equivalent (TEDE; from internal and external exposure) is not to exceed 1 mSv (0.1 rem)

Issue	ICRP 26	ICRP 60	ICRP 103	Part 20
Tissue Weighting Factors, w_T				
Gonads	0.25	0.20	0.08	0.25
Breast	0.15	0.05	0.12	0.15
Red bone marrow	0.12	0.12	0.12	0.12
Lung	0.12	0.12	0.12	0.12
Thyroid	0.03	0.05	0.04	0.03
Bone surfaces	0.03	0.01	0.01	0.03
Colon	-	0.12	0.12	-
Stomach	-	0.12	0.12	-
Bladder	-	0.05	0.04	-
Oesophagus	-	0.05	0.04	-
Liver	-	0.05	0.04	-
Brain	-	-	0.01	-
Kidney	-	-	-	-
Salivary Glands	-	-	0.01	-
Skin	-	0.01	0.01	-
Remainder	0.30[6] (105)	0.05[7] (Table 2 and S-2)	0.12[8] (Table B.2 and B.3.5)	0.30[9] (§20.1003)

[6] The remainder is composed in part of the following additional tissues and organs: stomach, salivary glands, lower large intestine, and liver. When the gastrointestinal tract is irradiated, the stomach, small intestine, lower large intestine and upper large intestine are treated as four separate organs and be included in the remainder tissues.

[7] The remainder is composed of the following additional tissues and organs: adrenals, brain, upper large intestine, small intestine, kidney, muscle, pancreas, spleen, thymus, and uterus.

[8] The remainder is composed of the following additional tissues and organs: adipose tissue, adrenals, connective tissue, extrathoracic airways, gall bladder, heart wall, kidney, lymphatic nodes, muscle, pancreas, prostate, small intestine wall, spleen, thymus, and uterus/cervix.

[9] 0.30 results from 0.06 for each of the 5 "remainder" organs (excluding the skin and lens of the eye) that receive the highest dose.

Issue	ICRP 26	ICRP 60	ICRP 103	Part 20
Radiation Weighting Factors, w_R				
Photons, all energies	1	1	1	1
Electrons and muons, all energies	1	1	1	1
Neutrons, all (unknown) energies	10	Step function	continuous function	10
< 10 keV		5	2.5	2 to 2.5
10 - 100 keV		10	2.5 to 10	2.5 to 7.5
100 - 2 MeV		20	10 to 20	7.5 to 11
2 to 20 MeV		10	7 to 17.5	8 to 9
> 20 MeV		5	5 to 7	3.5 to 8
Protons, energy > 2 MeV	10	5	2	10
Alpha particles, fission fragments heavy nuclei	20 (20)	20 (Table 1 and S-1)	20 (Table 2)	20 (Tables 1004(b) 1 & 2)