International Commission on Radiological Protection (ICRP)

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Early history of Radiation protection

- **Wolfram Fuchs** (1896) gave what is generally recognised as the first protection advice

1. make the exposure as short as possible
2. do not stand within 12 inches (30 cm) of the X-ray tube
3. coat the skin with Vaseline (a petroleum jelly) and leave an extra layer on the most exposed area.

Early history of Radiation protection

- In the early 1920s, radiation protection regulations were prepared in several countries
- In 1925 during the first International Congress of Radiology (ICR) considered establishing international protection standards.
- 1925 *ICRU* was established by the first ICR

ICRP Establishment

- In 1928 International Congress of Radiology established “International X-Ray and Radium Protection Committee (IXRPC)” now known as ICRP
- IXRPC was Renamed as “International Commission on Radiological Protection (ICRP)” by Second International Congress of Radiology in 1950

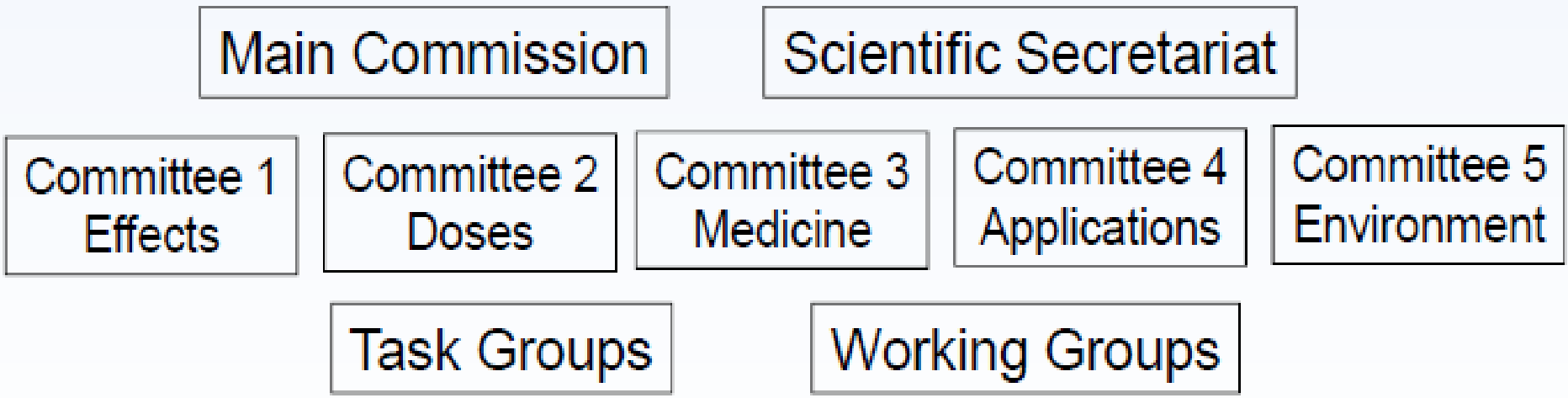
What is ICRP?

- The Commission is an independent charity, i.e., a non-profit-making organisation. The Commission works closely with its sister body, the International Commission on Radiation Units and Measurements (ICRU)

ICRP Mission

Advance for the public benefit the science of radiological protection by providing recommendations and guidance on all aspects of protection against ionizing radiation.

ICRP Structure



Committee number	Committee name	Mission statement
Committee 1	Radiation effects	Committee 1 considers the risk of induction of cancer and heritable disease (stochastic effects) together with the underlying mechanisms of radiation action; also, the risks, severity, and mechanisms of induction of tissue/organ damage and developmental defects (deterministic effects).
Committee 2	Doses from radiation exposure	Committee 2 is concerned with development of dose coefficients for the assessment of internal and external radiation exposure, development of reference biokinetic and dosimetric models, and reference data for workers and members of the public.
Committee 3	Protection in medicine	Committee 3 is concerned with protection of persons and unborn children when ionising radiation is used for medical diagnosis, therapy, or for biomedical research; also, assessment of the medical consequences of accidental exposures.
Committee 4	Application of the Commission's recommendations	Committee 4 is concerned with providing advice on the application of the recommended system of protection in all its facets for occupational and public exposure. It also acts as the major point of contact with other international organisations and professional societies concerned with protection against ionising radiation.
Committee 5	Protection of the environment	Committee 5 is concerned with radiological protection of the environment. It aims to ensure that the development and application of approaches to environmental protection are compatible with those for radiological protection of man, and with those for protection of the environment from other potential hazards.

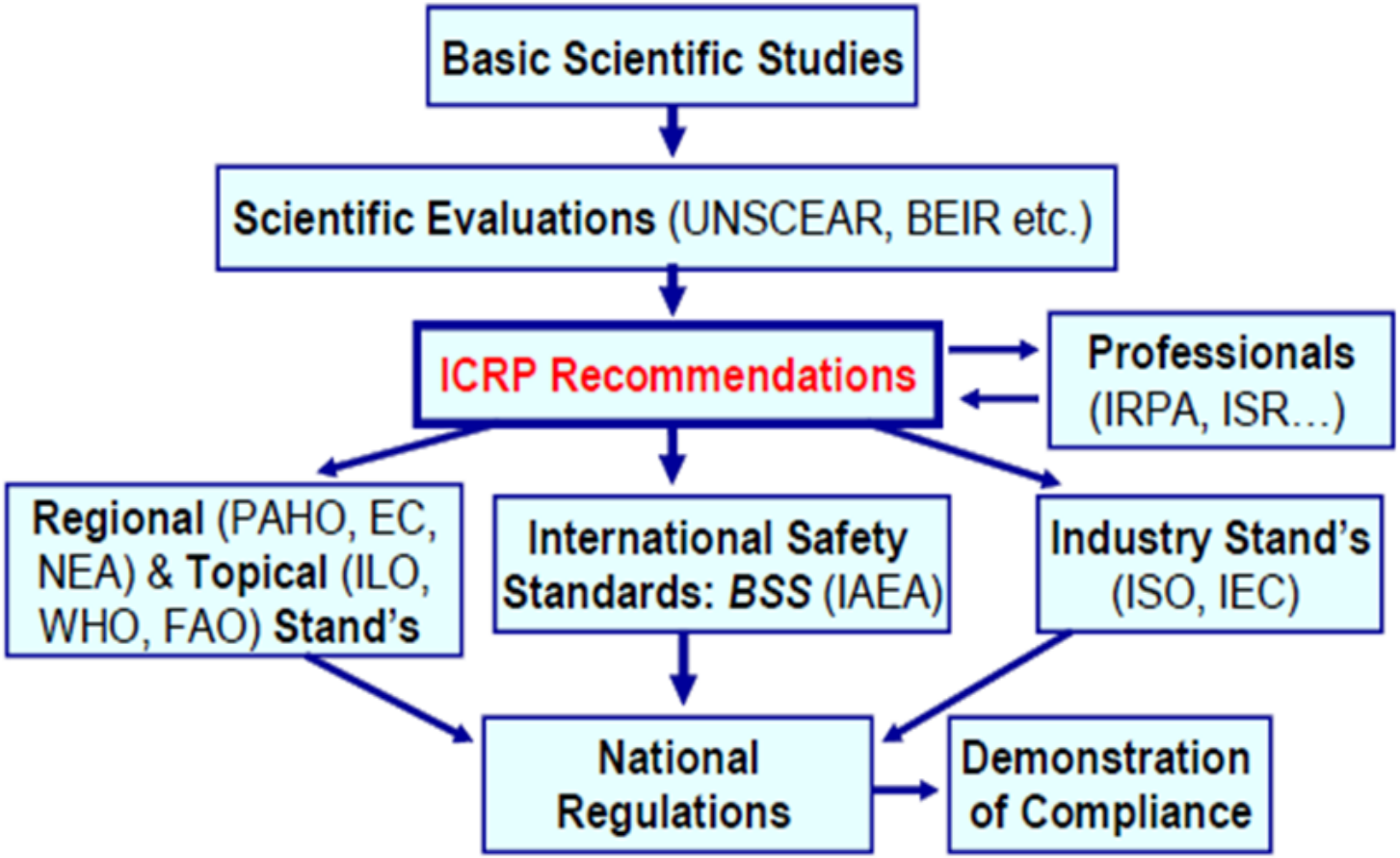
Association of ICRP with other bodies

Has official relationships with

- United Nations Scientific Committee on the Effects of Atomic Radiation(UNSCEAR),
- World Health Organization (WHO),
- International Atomic Energy Agency (IAEA).
- International Labour Organization (ILO),
- United Nations Environment Programme(UNEP),
- Commission of the European Communities ('European Commission',EC)
- Nuclear Energy Agency of the Organization for Economic Co-operation and Development (OECD/NEA),
- International Organization for Standardization(ISO)
- International Electrotechnical Commission (IEC)
- International Radiation Protection Association (IRPA)

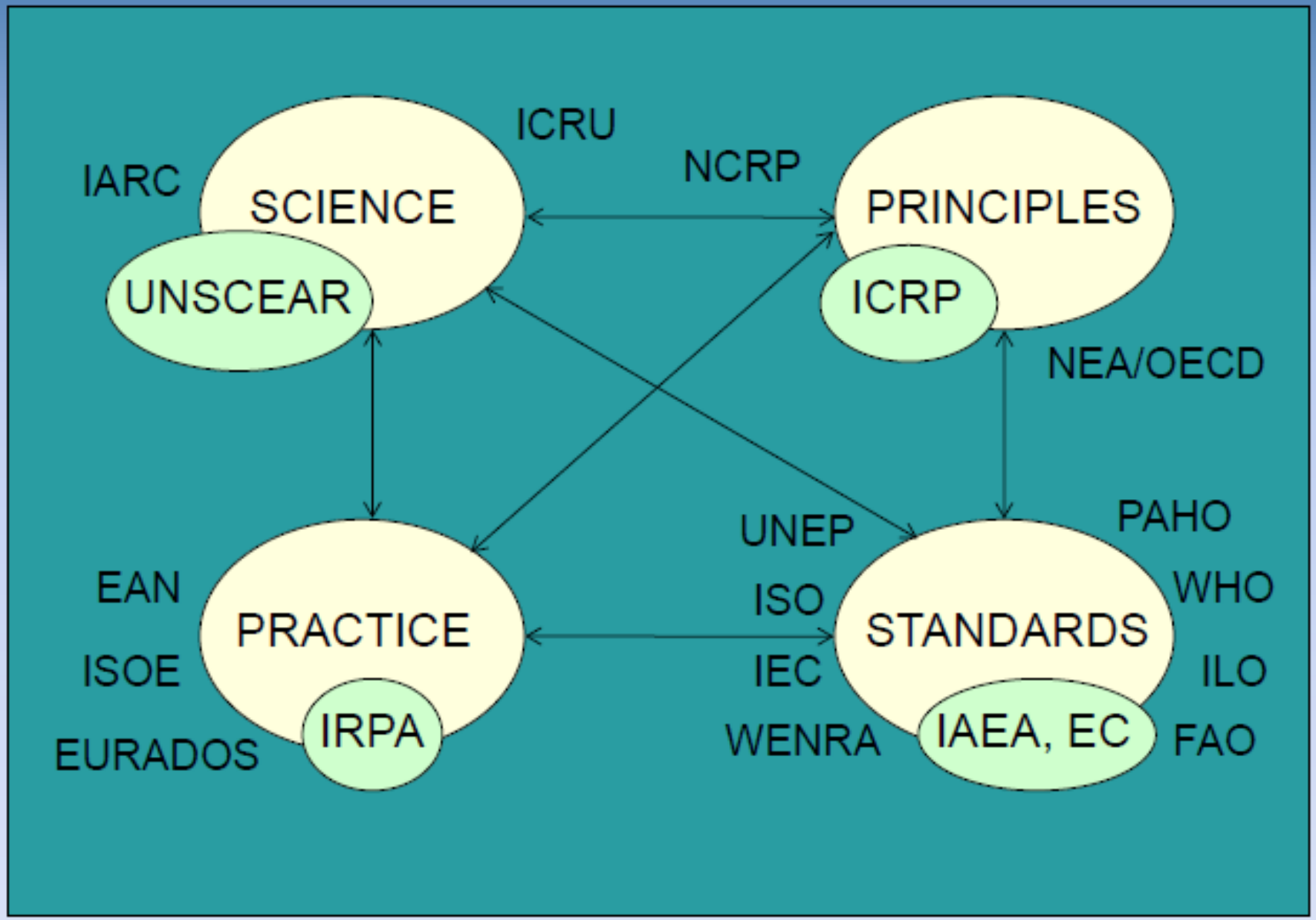
Structure Radiation protection standards

ICRP Publication 109



The basis for and use of ICRP recommendations on radiological protection policy.

The network of global radiation protecti



Evolution of ICRP policies

- First recommendations (IXRPC, 1928),
- concerned with avoiding deterministic effects, initially in a qualitative manner
- The effects to be guarded against are injuries to superficial tissues, derangements of internal organs and changes in the blood.
- As a remedy, a prolonged holiday and limitation of working hours were recommended.
- No form of dose limit was proposed, but Lindell (1998) estimated that occupational annual effective doses to medical staff at the time **may have** averaged around 1000 mSv

(a) Not more than seven working hours a day.

(b) Not more than five working days a week. (c) Not less than one month's holiday a year.

(d) Whole-time workers in hospital X-ray and radium departments should not be called upon for other hospital service.

- ICRP, 1951 report (post world war) Commission recommended a maximum permissible dose of **0.5 R in any 1 week** in the case of whole-body and **1.5 R in any 1 week** in the case of exposure of hands and forearms

- The first 60 years after the discovery of ionising radiation, the purpose of radiological protection was that of *avoiding deterministic effects* from occupational exposures, and the principle of radiological protection was to keep individuals below the relevant thresholds
- First recommendation on restrictions of exposures of members of the public appeared in the Commission's **1954 Recommendations**
- Recommended 10 times lower threshold for public - general public includes more sensitive persons such as children and those suffering from diseases and in view of possible genetic effects
- The concept of critical organ was now introduced

ICRP Major publications…

- Publication 1: 1958
- The weekly dose limit was replaced by accumulated limit of annual effective dose 5 rem (50 mSv)
- Publication 9 (ICRP, 1966): substantially renewed the radiation protection philosophy by moving from deterministic to stochastic effects

ICRP Major publications…

- ICRP Publication 26 (1977)
- Distinguished between stochastic and non-stochastic effects
- Introduced effective dose equivalent and collective dose
- Introduced the system of dose limitation based on principles of justification, optimization, and limitation (these ideas had been around since at least 1960)

ICRP Major publications…

- Publication 60 (1990)
- Recommendations expanded to include consideration of **waste disposal, protection during emergencies**
- Process-based system distinguished between practices and interventions

ICRP Major publications…

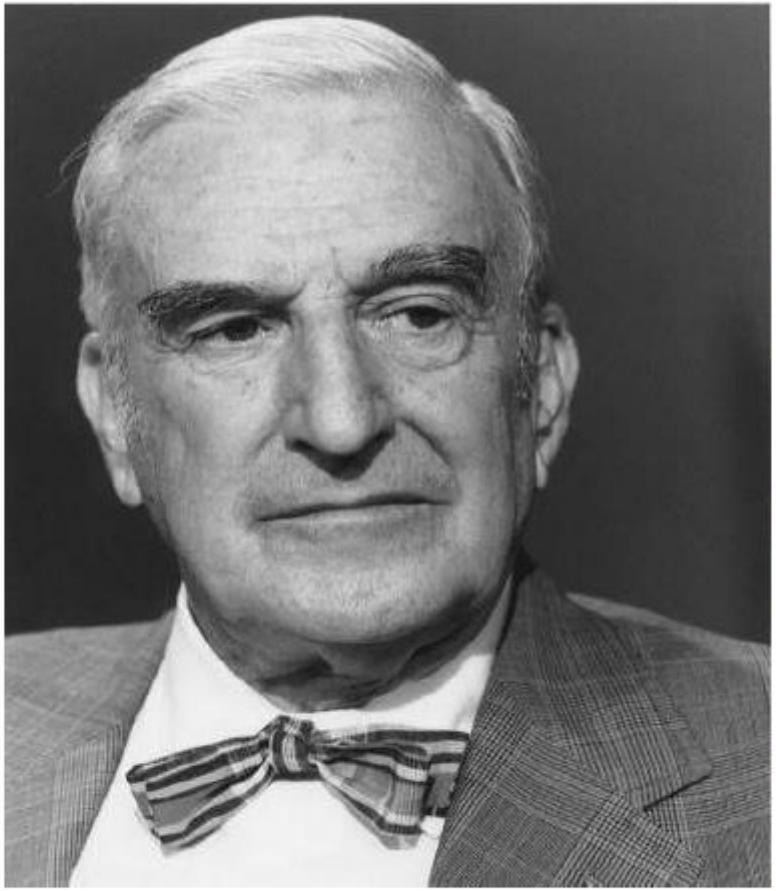
Publication 103 (2007)

Moves from process-based to situation-based system

- Planned exposure situations
- Emergency exposure situations
- Existing exposure situations

- Distinguishes between source-related protection using constraints and reference levels and individual-related protection using dose limits

NCRP History



Lauriston Sale Taylor
June 1, 1902 – Nov. 26, 2004

1929: U.S. Advisory Committee on X-ray and Radium Protection.

1946: U.S. National Committee on Radiation Protection.

1964: National Council on Radiation Protection and Measurements (NCRP) chartered by U.S. Congress.

The Evolution of Dose limits

- **At first**: Occupational exposures in medicine
  Avoid deterministic harm
  1928: Working hours limited (~1000 mSv)
  1934: ~500 mSv
- Then: Occupational exposures
  1950: ~150 mSv
- Now: Exposures
  …and minimise stochastic harm
  1956: 50 mSv; 5 mSv
  1959: Publ. 1; 1964: Publ. 6
  1966: Publ. 9, reduce doses if readily achievable
  1977: Publ. 26, …if reasonably achievable
  1990: Publ. 60: 20 mSv, 1 mSv

ICRP 60 & 103 Dose limit comparisons

Categories of exposure (Publications)	1990 recommendations and subsequent publications	2007 recommendations
Planned exposure situations		
	Individual dose limits [a]	
Public exposure (60)	1 mSv/year	1 mSv/year
Occupational exposure (60,68,75) including recovery operations (96)	20 mSv/year average over defined periods of 5 years	20 mSv/year average over defined periods of 5 years
- lens of the eyes	150 mSv/year [b]	150 mSv/year [b]
- skin	500 mSv/year [b]	500 mSv/year [b]
- hands and feet	500 mSv/year [b]	500 mSv/year [b]
- intake of radionuclides	20 mSv/year [c]	20 mSv/year [c]
- pregnant women, remainder of pregnancy	2 mSv to the surface of abdomen, 1 mSv to the fetus	1 mSv to the fetus

NCRP Effective Dose Limits for Occupational Workers

Exposure	Dose/S.I.	Dose/British
Occupational Exposure		
Effective D.E. limits for stochastic effects	Annual: 50 mSv Cumulative: 10 mSv x age in years.	Annual: 5 rem Cumulative: 1 rem x age in years.
Equivalent annual dose to tissues nonstochiastic effects:		
Lens of eye	150 mSv	15 rem
Skin, hands, feet	500 mSv	50 rem
Annual Public Exposures		
Effective dose for continuous or frequent exposure	1 mSv	100 mrem
Effective dose for infrequent exposure	5 mSv	500 mrem
Equivalent dose for tissues/organs:		
Lens of eye	15 mSv	50 mrem
Skin and Extremities	50 mSv	5 rem
Unrestricted area (1 hour)	0.02 mSv/hr	2 mrem/hr
Exposure Child under 18 yrs, or Educational training (Annual)		
Effective dose limit	1 mSv	100 mrem
Equivalent dose limits:		
Lens of eye	15 mSv	50 mrem
Skin and extremities	50 mSv	5 rem
Embryo/Fetus		
Total effective dose	5 mSv	500 mrem
Monthly effective dose	0.5 mSv	50 mrem
***Negligible Individual Dose**		
Annual per source	0.01 mSv	1 mrem

ICRP & NCRP dose limit comparison

Basic Exposure Limits from NCRP Report No. 116 and ICRP Publication 60

	NCRP-116	ICRP-60
Occupational Exposure		
Effective Dose		
Annual	50 mSv	50 mSv
Cumulative	10 mSv × age (y)	100 mSv in 5 y
Equivalent Dose		
Annual	150 mSv lens of eye; 500 mSv skin, hands, feet	150 mSv lens of eye; 500 mSv skin, hands, feet
Exposure of Public		
Effective Dose		
Annual	1 mSv if continuous 5 mSv if infrequent	1 mSv; higher if needed, provided 5-y annual average ≤ 1 mSv
Equivalent Dose		
Annual	15 mSv lens of eye; 50 mSv skin, hands, feet	15 mSv lens of eye; 50 mSv skin, hands, feet

AERB Dose limit

Dose Limitations		
Part of the body	Occupational Exposure	Public Exposure
Whole body (Effective dose)	20 mSv/year averaged over 5 consecutive years; 30 mSv in any single year	1 mSv/y
Lens of eyes (Equivalent dose)	150 mSv in a year	15 mSv/y
Skin (Equivalent dose)	500 mSv in a year	50 mSv/y
Extremities (Hands and Feet) Equivalent dose	500 mSv in a year	-

AERB Dose Limit to trainees

- Apprentices and trainees between 16 and 18 years of age
    - an effective dose of 6 mSv (20mSv for occupational) in a year;
    - an equivalent dose to the lens of the eye of 50 mSv (Occupational 150 mSv) in a year
    - an equivalent dose to the extremities (hands and feet) of 150 mSv (500 mSv) in a year and
    - an equivalent dose to the skin of 150 mSv(500 mSv) in a year.

Thank you