

Content

Title : Safety Standards for Protection against Ionizing Radiation [Ch](#)

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Content : Article 1

The Standards are stipulated pursuant to Article 5 of the Ionizing Radiation Protection Act.

Article 2

The terms used in the Standards are defined as follows:

1. Nuclide refers to a species of atom characterized by its neutron number, proton number, and nuclear energy state.
2. Exposure refers to the process whereby the human body is exposed to irradiation by ionizing radiation, or contact with, or intake of radioactive material.
3. External exposure refers to body exposure due to irradiation by ionizing radiation from outside the body.
4. Internal exposure refers to exposure due to irradiation by ionizing radiation arising from the intake of radioactive material.
5. Activity refers to the number of spontaneous disintegrations occurring in a certain amount of radionuclides at a given time. The unit of activity is the becquerel (Bq). One (1) spontaneous disintegration per second is one (1) becquerel.
6. Neutron fluence rate refers to the number of neutrons passing through a spherical cross section per unit time.
7. Dose refers to the radiation energy absorbed by material.
  - (1) Absorbed dose refers to the mean energy imparted by radiation per unit mass of material. The unit of absorbed dose is the gray (Gy). One (1) joule imparted per kilogram of mass is one (1) gray.
  - (2) Dose equivalent refers to the product of absorbed dose of body organ or tissue multiplied by quality factor. The unit of dose equivalent is the sievert (Sv). The quality factors used for radiation protection are seen in Tables 1 and 2.
  - (3) Deep dose equivalent refers to the dose equivalent of the external exposure of whole body, including head, trunk, arms above the elbow, and legs above the knee, at a depth of 1 cm.
  - (4) Shallow dose equivalent refers to the dose equivalent of the external exposure of skin or extremities at a tissue depth of 0.007 cm.

(5)Eye dose equivalent refers to the dose equivalent of the xternal exposure of the lens of the eye at a tissue depth of 0.3 cm.

(6)Effective dose equivalent refers to the sum of the products of the average dose equivalent to each irradiated organ or tissue and its corresponding weighting factor. The weighting factors are listed in Table 3.

(7)Committed dose equivalent refers to the dose equivalent to an organ or tissue accumulated in fifty (50) years following a single intake of radioactive material in the body.

(8)Committed effective dose equivalent refers to the sum of the products of the committed dose equivalent to each internally irradiated organ or tissue and its corresponding weighting factor.

(9)Collective dose refers to the sum of doses received by a specific group of population exposed to a certain radiation source. The unit is the person-sievert.

8.Reference man refers to a man representing an aggregation of human

physical and physiological characteristics proposed by the International Commission on Radiological Protection (ICRP) for the purpose of radiation protection assessment.

9.Annual limit on intake (ALI) refers to the intake of a given radionuclide in one year by the reference man that would result in

(1) a committed effective dose equivalent of 50 mSv, or  
(2) a committed dose equivalent of 500 mSv to any organ or tissue, whichever is the smaller.

10.Derived air concentration (DAC) refers to the derived concentration of a given radionuclide in a cubic meter of air.If a reference man, breathes in air with such a concentration for two thousand hours (2000 h) while doing light work, his intake would amount to one (1) ALI.

11.The health effects of radiation are divided as follows:

(1) stochastic effect: referring to an effect whose probability of occurrence increases in proportion to the magnitude of the dose received, and is independent of its severity. There is no threshold dose for the occurrence of this type of effect;

(2) non-stochastic effect: referring to an effect whose degree of severity increases in proportion to the magnitude of the dose received.

A threshold dose may exist for this type of effect.

12.Year refers to any twelve (12) consecutive months beginning with January 1st.

13.As low as reasonably achievable (ALARA) Observing the ALARA principle means making every reasonable effort to maintain, in a practical way, radiation exposure far below the dose limits of the Standards. The key points are:

(1)the activity must be consistent with the original permit;  
(2)the present state of technology, public health improvement, the

economic benefits of safety, and societal and socioeconomic factors must be taken into account;

(3) the use of radiation must be in the public interest.

14. Critical group refers to a group of people

(1) representing the general public,

(2) who receive rather uniform exposure from a known radiation source or a group of radiation sources, and

(3) whose members have received the maximum dose.

15. Radiation workplace refers to the place where the facility operator plans and performs the practice.

### Article 3

#### Paragraph 3.1

The "individual dose" in the Standards refers to the sum of dose received by individual resulting from external and internal exposures.

Doses occurring from background radiation and medical exposures are not included.

#### Paragraph 3.2

The formulas for combined calculation of doses resulting from external and internal exposures are specified by the Competent Authority.

### Article 4

#### Paragraph 4.1

The radiation warning symbol is shown in the following diagram with yellow background and three-blade design in magenta, where R is the radius of the inner circle.

#### Paragraph 4.2

For the need of radiation protection, the colors of the symbol background

and the three-blade design are not restricted by the prescription in Paragraph 4.1, if

- (1) the radiation warning symbol is made by an eye-catching etching or hard press to label the radiation source or its container, or
- (2) the equipment components containing radioactive material inside is under high temperature condition.

An appropriate warning content shall be placed on the warning symbol or at a nearby eye-catching position if required.

### Article 5

#### Paragraph 5.1

For the purpose of preventing the detriment occurrence due to non-stochastic effect and lowering the probability of stochastic effect so as to achieve the goal of limiting radiation dose, the practice shall be

in compliance with the following rules:

- 1.the benefit shall exceed the cost;
- 2.all exposures shall be kept as low as reasonably achievable, economic and social factors being taken into account;
- 3.the individual dose shall not exceed the limits specified in the Standards.

Paragraph 5.2

The dose limit is expressed as the effective dose equivalent for the purpose of controlling stochastic effect, or as the dose equivalent for the purpose of preventing non-stochastic effect.

Article 6

Paragraph 6.1

The dose limits of occupational exposure for radiation workers are specified as follows:

- 1.the effective dose equivalent shall not exceed 100 mSv over a cycle of five (5) consecutive years, and not exceed 50 mSv in any single year;
- 2.a dose equivalent to the lens of the eye shall not exceed 150 mSv in one (1) year;
- 3.a dose equivalent to skin or extremities shall not exceed 500 mSv in one (1) year.

Paragraph 6.2

The “cycle” in Subparagraph 6.1.1 shall start from the date when the Standards become effective for five consecutive years as a cycle.

Article 7

Paragraph 7.1

The dose to radiation workers either by measurement or by calculation that meets the following prescription is deemed to be in compliance with the individual dose limits:

1. the ratio of deep dose equivalent to 100 mSv in a cycle of five (5) consecutive years plus the sum of the ratios of intake of each radionuclide to twice the ALI during the five-year cycle does not exceed unity; and the sum of the ratio of deep dose equivalent to 50 mSv and the sum of the ratios of intake of each radionuclide to ALI in any single year do not exceed unity;
2. the eye dose equivalent does not exceed 150 mSv in one (1) year;
3. the shallow dose equivalent does not exceed 500 mSv in one (1) year.

Paragraph 7.2

The ALI provided for control use in internal exposure and the DAC for reference are seen in the 4th, 5th, and 6th column of Table 4.

Paragraph 7.3

The mathematical formulas for each subparagraph of Paragraph 7.1 are seen in Table 5.

## Article 8

### Paragraph 8.1

Under special circumstances if an ALARA evaluation reveals that the corresponding occupational exposure for radiation workers in a practice still cannot comply with the provisions of

#### Subparagraph

6.1.1, the employer and the facility operator shall submit the following information to the Competent Authority for review after the consent of the radiation workers. After being approved and under the permitted conditions, the restriction need not be confined to the provisions in Subparagraph 6.1.1:

- 1.the content of practice, place, duration, and the name list of radiation workers,
- 2.the possible maximum individual effective dose equivalent, the collective dose, and their evaluation model,
- 3.the ALARA measures being evaluated,
- 4.a letter of consent from the radiation workers stating their agreement to receive the dose value,
- 5.a specific detailed plan for radiation protection.

### Paragraph 8.2

The practice in Paragraph 8.1 shall also be in compliance with the following rules:

- 1.the radiation workers participating in the operation shall be informed in advance by the employer and the facility operator about the possible risks to be encountered and the precautionary measures to be taken;
- 2.exceeding the occupational exposure specified in Subparagraph 6.1.1 shall not be considered by the employer or facility operator as a reason to exclude the radiation workers from their participation in daily work or to change their job assignment without a good reason or without their consent;
- 3.the dose received shall be written down in the individual's dose record, and is recorded separately from the dose received under general exposure conditions.

## Article 9

For those of 16 to 18 years of age who receive education for taking practice or job training, the individual dose limits are in accordance with following rules:

- 1.an effective dose equivalent shall not exceed 6 mSv in one year;
- 2.a dose equivalent to the lens of the eye shall not exceed 50 mSv in one year;
- 3.a dose equivalent to skin or extremities shall not exceed 150 mSv.

## Article 10

### Paragraph 10.1

The employer shall, after receiving the notification of pregnancy of a female radiation worker, review her working conditions so as to ensure that the exposure the embryo or foetus receives is in compliance with the dose limit specified in Article 11 for the general public during the entire pregnancy.

#### Paragraph 10.2

For the female radiation worker who has notified pregnancy, the dose equivalent to her abdominal surface shall not exceed 1 mSv during the remaining period of the entire pregnancy, and the intake of radionuclides into the body shall not exceed 2% of an ALI; it is deemed to be not exceeding the dose limit of foetus in Paragraph 10.1.

#### Article 11

##### Paragraph 11.1

The dose limits of the general public are in accordance with the following rules:

- 1.an effective dose equivalent shall not exceed 1 mSv in one year;
- 2.a dose equivalent to the lens of the eye shall not exceed 15 mSv in one year;
- 3.a dose equivalent to skin shall not exceed 50 mSv in one year.

##### Paragraph 11.2

The dose limits in Paragraph 11.1 are applicable to the critical group in a population.

#### Article 12

##### Paragraph 12.1

The dose to the general public during planning, designing, and practicing by the facility operator shall be in compliance with the dose limits for general public specified in Article 11.

##### Paragraph 12.2

The facility operator shall take one of the following two ways to prove that the practice is in compliance with the dose limits for the general public specified in Article 11:

- 1.by measuring or modeling to calculate the dose received by the individual in a critical group is in compliance with the dose limits in Article 11;
- 2.the radionuclide concentrations in air and water at the boundary of a radiation workplace as a result of releasing waste gas or waste water containing radioactive material do not exceed the concentrations specified in columns 7 and 8 of Table 4, and a resultant dose from external exposure to the general public outside the radiation workplace does not exceed 0.02 mSv/h or 0.5 mSv/y.

#### Article 13

The waste water containing radioactive material shall be in compliance with the following subparagraphs, and then is permitted to release into the sewers:

- 1.the radioactive material must be soluble in water;
- 2.the monthly ratio obtained for the gross activity of radioactive material released into the sewers to the amount of water released into the sewers shall not exceed the concentrations specified in column 9 of Table 4;
- 3.the yearly release of gross activity for tritium shall not exceed  $1.85 \times 10^{11}$  Bq, that for carbon-14 shall not exceed  $3.7 \times 10^{10}$  Bq, and that for the sum of other radioactive material shall not exceed  $3.7 \times 10^{10}$  Bq.

#### Article 14

The facility operator shall submit the following information in advance under special circumstance, upon approval by the Competent Authority, the restriction in Subparagraph 11.1.1 can be lifted. Notwithstanding, the maximum dose shall not exceed 5 mSv in one year, and the average annual dose shall not exceed 1 mSv in five years:

1. the needs in practicing, the time duration, and the dose assessment, and
2. the dose control for general public and the ALARA measures.

#### Article 15

In order to control the collective dose the Competent Authority shall further restrict the radiation dose in the area outside the radiation workplace or the released amount of radioactive material in the radiation workplace.

#### Article 16

##### Paragraph 16.1

The action being taken for emergency exposure shall be in compliance with one of the following conditions:

- 1.for the purpose of saving life or preventing serious injury,
- 2.to reduce a large collective dose, or
- 3.to prevent the development of catastrophic conditions.

##### Paragraph 16.2

The facility operator shall inform and train the personnel participating in emergency exposure in advance.

#### Article 17

##### Paragraph 17.1

The facility operator shall make every reasonable effort to make the dose to personnel participating in emergency exposure be in compliance with following rules:

- 1.for the purpose of saving life the dose to the participants in emergency exposure does not exceed ten (10) times the dose limit in a single year in Subparagraph 6.1.1 to the extent possible;
- 2.besides the case in Subparagraph 17.1.1 the dose to the participants in emergency exposure does not exceed two (2) times the dose limit in a single year in Subparagraph 6.1.1 to the extent possible.

**Paragraph 17.2**

Personnel participating in emergency exposure, besides the case specified in Paragraph 16.1, the dose received shall not exceed that specified in Article 6.

**Paragraph 17.3**

The dose received from emergency exposure shall be written down in individual's dose record and is separately recorded from dose received under general exposure condition.

**Article 18**

The Standards are not applicable to the release of scintillator of a liquid scintillation counter containing tritium or carbon-14 with an activity less than  $1.85 \times 10^3$  Bq/g.

**Article 19**

The standards are not applicable to the discard of animal tissue or carcass containing tritium or carbon-14 with an activity less than  $1.85 \times 10^3$  Bq/g.

**Article 20**

The Standards shall become effective on the date of promulgation.

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Attachments : Table1.doc  
Table2.doc  
Table3.doc  
Table4.doc  
Table5.doc

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Data Source : Nuclear Safety Commission Laws and Regulations Retrieving System