

The Swedish Radiation Protection Institute's Regulations on Dose Limits at Work with Ionising Radiation;

issued on October 29th 1998.

On the basis of the sections 7, 9.2 and 10 of the Swedish Radiation Protection Ordinance (1988:293) the Swedish Radiation Protection Institute has issued regulations as follow¹.

§ 1 These regulations¹ apply to limitation of radiation doses to workers and the general public at practices with ionising radiation. The regulations also apply on the protection of pregnant women who else may be exposed to ionising radiation in their work.

Definitions

§ 2 In these regulations the following concepts are used with the meanings specified here.

Effective dose: the sum of all equivalent doses to organs or tissues, weighted for their different sensitivity for radiation, (see also annex 1),

equivalent dose: an absorbed dose to an organ or tissue, weighted by factors taking into account the biological efficiency of the kind of radiation, (see also annex 1),

external exposure: exposure to a source situated outside the human body,

internal exposure: exposure to radioactive materials after intake into the body orally, by inhalation or through the skin.

General obligations

§ 3 Anyone who conducts a practice with ionising radiation shall ensure that

1. the practice is justified by which is meant that the use of radiation gives a benefit that exceeds the estimated health detriment caused by the radiation,
2. the radiation protection measures are optimised by which is meant that human exposures are as low as reasonably achievable social and economic factors taken into account and
3. no dose limit in these regulations is exceeded.

§ 4 The dose limits given in these regulations shall not apply on

1. medical exposures,²
2. exposures to persons willingly and knowingly (outside their occupations) helping in the support and comfort of patients undergoing medical exposure and
3. exposure of volunteers participating in medical or biomedical research programmes.

¹ Council Directive 96/29/Euratom (May 13, 1996)

² Exposure as defined as medical exposure in the Council Directive 97/43/Euratom (June 30, 1997)

Dose limits for persons working with ionising radiation

§ 5 Limits for effective dose and equivalent dose are given in Table 1.

Table 1 Dose limits for persons working with ionising radiation

| | Period of time Quantity | Limits of effective dose or equivalent dose respectively (mSv) |
|---|--|--|
| Workers in general | Annual | 50 |
| | Effective dose | 150 |
| | Dose equivalent to the lens of the eye | 500 |
| | Dose equivalent to the skin | |
| | Dose equivalent to hands, forearms feet and ankles | 500 |
| | In addition, for 5 consecutive years Effective dose | 100 |
| Students and trainees aged 16 - 18 years | Effective dose | 6 |
| | Dose equivalent to the lens of the eye | 150 |
| | Dose equivalent to the skin | |
| | Dose equivalent to hands, forearms feet and ankles | 150 |

§ 6 In the process of planning a practice or in a single case, the Radiation Protection Institute has the right to establish a dose constraint, by which is meant an exposure restriction to individuals from a given source.

§ 7 If external and internal exposure occur at the same time, the sum of the dose contributions shall apply on comparison with the dose limits.

§ 8 An equivalent dose to the skin from a narrow beam or a local skin contamination shall, at comparison with the dose limits, be evaluated as the mean equivalent dose over an area of 1 cm², regardless of the size of the exposed area.

Protection to pregnant or breast feeding women

§ 9 Anyone who conducts a practice shall inform female workers of reproductive capacity about the risks to a foetus posed by the radiation.

A pregnant woman who has told her employer about the pregnancy, has the right to be transferred to work that does not imply exposure to ionising radiation during the remaining time of pregnancy.

§ 10 If a pregnant woman remains to her ordinary work, the work shall be planned in such a way that the equivalent dose to the foetus becomes as small as reasonably achievable and that it is unlikely that it exceeds 1 mSv during the remaining period of pregnancy.

§ 11 A woman who is breast feeding shall tell her employer. In that period of time she shall not work in such a way that she runs a risk of internal contamination with radioactive substances hereby giving the child a dose which is significant from a radiation protection point of view.

Exposure to the general public

§ 12 The sum of the dose contributions from practices with ionising radiation to individuals of the general public shall not exceed

1. 1 mSv annual effective dose,
2. 15 mSv annual equivalent dose to the lens of the eye or
3. 50 mSv annual equivalent dose to the skin evaluated as the mean equivalent dose over an area of 1 cm² regardless of the size of the exposed area.

If there are particular reasons the Radiation Protection Institute may permit a larger effective dose in one single year, provided that the mean effective dose in 5 consecutive years does not exceed 1 mSv.

The Radiation Protection Institute takes the dose limits into account when judging conditions for licences. As several practices may contribute to the exposure of an individual, specified regulations or conditions are given for the various practices.

Dose limits for students and trainees

§ 13 For students and trainees who have to use radiation sources for their studies apply

1. for those who are 18 years or more, the same dose limits as for workers and
2. for those aged 16 to 18 years the special dose limits as given in Table 1.

For other students and trainees the same dose limits apply as for the general public according to § 12.

Dose limits in exceptional circumstances

§ 14 If there are particular reasons the Radiation Protection Institute may permit specially authorised exposure which implies that the dose limits as given in table 1 are exceeded, if so is required for a special task. On such a planned exposure the sections 15 - 17 shall apply. An application for permission shall in every single case completely state the reasons for the exposure as well as the estimated individual doses caused by the task.

§ 15 The work shall be performed in a limited period of time and within a specified working area. The specially permitted dose limits for the work, given by the Radiation Protection Institute must not be exceeded.

§ 16 The work must be performed only by volunteers in category A³. Prior to the work the person conducting the practice shall give information about the risks related to the work and about the protective measures to be taken.

§ 17 A radiation dose received in a specially authorised work shall not be an obstacle to future work with ionising protection if not otherwise is prescribed in the single case.

³ Category A is defined in the Swedish Radiation Protection Institute's regulations (SSI FS 1998:3)

Emergency exposure

§ 18 In case of emergency the dose limits given in these regulations do not apply. Rescue work must be performed only by volunteers if the effective dose is estimated to exceed 50 mSv. Women of reproductive capacity may participate in rescue work only if they themselves can exclude pregnancy.

Rescue work that implies an effective dose larger than 100 mSv must only be done in life-saving by persons well aware of the radiation risks related to the work.

These regulations enter into force as of January 1st 2000, when the regulations SSI FS 1989:1 (changed by SSI FS 1994:5) shall cease to apply.

On behalf of the Board of the Radiation Protection Institute

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Equivalent dose (H_T)

The equivalent dose H_T to an organ or tissue T is the sum of the mean absorbed dose $D_{T,R}$ in T, multiplied by the weighting factor w_R for each type of radiation R.

$$H_T = \sum_R w_R D_{T,R}$$

Effective dose (E)

The effective dose is the sum of all weighted equivalent doses in all organs and tissues of the body according to the Table 3, from external and internal exposure. E is calculated by

$$E = \sum_T w_T \sum_R w_R D_{T,R}$$

w_T is the weighting factor for the organ or tissue T.

Table 2 Weighting factors (w_R) for various types of radiation and energies

| Type of radiation and energy range | w_R |
|--|--------------------------------------|
| Photons, all energies | 1 |
| Electrons and muons, all energies | 1 |
| Neutrons of energy E (MeV) | $5 + 17 \exp \frac{-(\ln(2E))^2}{6}$ |
| Protons, other than recoil protons, energy > 2 MeV | 5 |
| Alpha particles, fission fragments, heavy nuclei | 20 |

Table 3 Weighting factors (w_T) for organs or tissues

| Organ or tissue | w_T | Organ or tissue | w_T |
|-------------------|-------|-----------------|-------|
| Gonads | 0.20 | Liver | 0.05 |
| Bone marrow (red) | 0.12 | Oesophagus | 0.05 |
| Colon | 0.12 | Thyroid | 0.05 |
| Lung | 0.12 | Skin | 0.01 |
| Stomach | 0.12 | Bone surface | 0.01 |
| Bladder | 0.05 | Remainder | 0.05 |
| Breast | 0.05 | | |