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Swedish Radiation Safety Authority Regulatory Code

Strål säkerhets myndigheten
Swedish Radiation Safety Authority

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The Swedish Radiation Safety Authority's regulations concerning basic provisions for the protection of workers and the general public in practices involving ionising radiation

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The Swedish Radiation Safety Authority's regulations concerning basic provisions for the protection of workers and the general public in practices involving ionising radiation;[1]

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On the basis of Section 7 and Sections 9 to 11 of the Radiation Protection Ordinance (1988:293), the Swedish Radiation Safety Authority hereby issues2 the following regulations.

Chapter 1 Application and definitions

Section 1 These regulations apply to workers and the general public in practices involving ionising radiation. The regulations also apply to pregnant women who may be exposed to ionising radiation in their work.

Section 2 In these regulations, the following terms and concepts are used with the meanings specified here.

a party that conducts a practice:	a natural or legal person that conducts a practice involving ionising radiation and is licensed in accordance with Section 20 of the Radiation Protection Act (1988:220) or Section 5 of the Act on Nuclear Activities (1984:3)
effective dose:	the sum of all equivalent doses to organs or tissues, weighted for their different sensitivity to radiation (see also Appendix 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 Appendix 1)
external exposure:	irradiation from a radiation source outside the human body

[1] These regulations were issued previously in the Swedish Radiation Protection Authority's Regulatory Code (SSI FS 1998:3, SSI FS 1998:4, SSI FS 1998:5 and SSI FS 1998:6).

[2] Cf. Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation. OJ L 159, 29/06/1996, p. 1 (Celex 31996L0029) .

outside worker:	an individual who, for the purpose of his or her work or training, is present within a controlled area but who is not an employee of the party that conducts the practice
skin contamination:	radioactive substances in or on the skin
committed effective dose:	the total effective dose after an intake of radioactive substances, estimated over 50 years (see also Appendix 1)
internal exposure:	exposure to radioactive substances after intake into the body by means of respiration, ingestion or through the skin
medical examination:	medical examination with a scope of no less than that defined in Appendix 4 with the aim of determining whether the examined individual runs a particular risk of injury from exposure to ionising radiation in his or her work or whether, due to other medical obstacles, the individual should avoid work involving ionising radiation
National Dose Register:	database at the Swedish Radiation Safety Authority of individual doses measured and reported
individual dose:	a generic term for either effective dose, equivalent dose, committed effective dose or committed equivalent dose
periodic health review:	evaluation of a submitted health declaration in accordance with Appendix 5, which serves as the basis for a medical certificate in accordance with Appendix 6
personal dose equivalent:	the equivalent dose to soft tissue at a suitable depth *d* (mm) below a given point on the body[3]
laboratory for individual dose monitoring:	undertaking or the like (dosimetry service) that provides individual dose meters and evaluates such doses
individual dose meter:	an instrument containing one or more detectors for measurement of the personal dose equivalent, designed to be worn by the user and having at least one function where the reading cannot be manipulated by the user.

[3] In dose reports concerning external exposures, these recorded personal dose equivalents are used: For the whole body, Hp(10); for the lens of the eye, Hp(3); and for hands and skin, Hp(0.07). These are considered to reflect the effective dose and the equivalent dose respectively if no particular event has caused doses close to or exceeding the annual dose limits.

Chapter 2 General obligations

Section 1 A party conducting a practice involving ionising radiation shall ensure that:

1. the practice is justified, by which is meant that the use of radiation provides 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 restricted to be as low as reasonably achievable while taking economic and societal factors into account, and
3. no dose limit stipulated in these regulations is exceeded.

Section 2 In the process of planning a practice or in a single case, the Swedish Radiation Safety Authority may establish a dose constraint, by which is meant an exposure restriction for individuals in relation to a given source.

Chapter 3 Dose limits

Section 1 The dose limits stipulated in these regulations shall not apply to:

1. persons who receive radiation exposure for medical purposes (medical exposure)[4]
2. persons who, outside their occupations, willingly and knowingly receive exposures while assisting in the support or comfort of patients undergoing medical examinations or treatment
3. exposure of volunteers participating in medical or biomedical research programmes

Section 2 Limits for effective dose and equivalent dose are given in Table 1.

[4]Medical exposure is defined in Council Directive 97/43/Euratom of 30 June 1997 on health protection of individuals against the dangers of ionizing radiation in relation to medical exposure, and repealing Directive 84/466/Euratom, OJ L180, 09/07/1997, p. 22 (Celex 31997L0043).

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

Table 1: Dose limits for persons working with ionising radiation

Section 3 If external and internal exposure occur at the same time, the sum of the dose contributions during the period in question shall apply on comparison with the dose limits.

Section 4 An equivalent dose to the skin from a narrow beam or a local skin contamination shall, on comparison with the dose limits, be evaluated as the mean equivalent dose over an area of 1 cm^2 regardless of the size of the exposed area.

Protection for women who are pregnant or breast feeding

Section 5 The party that conducts the practice shall inform female workers of reproductive capacity about the risks to a foetus posed by exposure to ionising radiation.

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

Section 6 If a pregnant woman is not transferred, the work shall be planned in such a way that the equivalent dose to the foetus is as low as reasonably achievable and so that it is unlikely that the dose to the foetus will exceed 1 mSv during the remaining time of pregnancy provided pregnancy has been established.

Section 7 A woman who is breast feeding shall notify the party that conducts the practice of this. While breast feeding, she must not be assigned to work entailing her running a risk of contamination with radioactive

substances and thereby possibly giving the child a radiation dose that is significant from a radiation protection point of view.

Exposure of the general public

Section 8 The sum of the dose contributions from practices involving ionising radiation to individuals from the general public not working with ionising radiation 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 determined as the mean equivalent dose over an area of 1 cm^2 regardless of the size of the exposed area.

If there are particular reasons, the Swedish Radiation Safety Authority may permit a higher effective dose in one single year, provided that the mean effective dose over five consecutive years does not exceed 1 mSv per year.

The Swedish Radiation Safety Authority takes the dose limits into account when reviewing licences for various practices. As several practices may contribute to the exposure of an individual, special regulations or conditions are issued for the various practices.

Dose limits for students and trainees

Section 9 For students and trainees who use radiation sources for their studies, the following applies:

1. for those who are 18 years or older, the same dose limits as for workers in practices involving ionising radiation, 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 individuals from the general public according to Section 8.

Dose limits in exceptional circumstances

Section 10 If there are particular reasons, the Swedish Radiation Safety Authority may permit specially authorised exposure which implies that the dose limits as given in Table 1 are exceeded if this is required for a special task. For this kind of planned exposure, Sections 11 to 13 shall be applied. An application for permission shall, in every single case, contain a detailed description of the reasons for the exposure as well as the estimated individual doses caused by the task.

Section 11 The work shall be performed during a limited period of time and within a specified working area. The specially permitted dose limits for the work as stipulated by the Swedish Radiation Safety Authority must not be exceeded.

Section 12 The work must be performed only by volunteer workers in category A. Prior to the work, the party that conducts the practice shall provide information about the risks related to the work and about the necessary protective and preventive measures to be taken.

Section 13 A radiation dose received in connection with specially planned exposure shall not be an obstacle to future work with ionising radiation unless otherwise prescribed in the single case.

Emergency exposure

Section 14 In connection with rescue work in emergency situations, the dose limits stipulated in these regulations do not apply. Such rescue work must be performed only by volunteers if the effective dose from this work is estimated to exceed the annual limit (50 mSv). Women of reproductive capacity may participate in rescue work only if they personally can rule out the possibility of their own pregnancy.

Rescue work that implies an effective dose higher than 100 mSv must only be carried out for the purpose of saving lives by persons well aware of the radiation risks related to the work.

Chapter 4 Categorisation of workers and workplaces

Section 1 Categorisation of workers and workplaces shall be performed where workers may receive radiation doses in such a way that:

1. the annual effective dose amounts to 1 millisievert (mSv) or more, or
2. the annual equivalent dose to the lens of the eye amounts to 15 mSv or more, or
3. the annual equivalent dose to the hands, forearms, feet, ankles or the skin amounts to 50 mSv or more.

Categorisation of workers

Section 2 The party that conducts the practice shall classify the workers into category A or B. A worker shall belong to category A if the likelihood is not negligible that:

1. the annual effective dose amounts to 6 mSv or more, or
2. the annual equivalent dose to the lens of the eye amounts to 45 mSv or more, or
3. the annual equivalent dose to the hands, forearms, feet, ankles or the skin amounts to 150 mSv or more.

Judging the likelihood in accordance with the first paragraph shall take into account the risk of mistakes or accidents that could imply radiation doses, including practices that normally do not imply high doses. Classification as category A shall be carefully considered for workers encompassed by Appendix 2.

Workers not belonging to category A shall belong to category B. For workers belonging to category B, surveillance of doses shall be performed

to such an extent enabling demonstration that the classification in category B is correct.

Controlled area

Section 3 A workplace where the workers may receive any of the annual radiation doses stated in Section 2 or from which radioactive contamination that is significant from a radiation protection point of view could be spread to nearby spaces shall be defined as a controlled area.

Section 4 The party that conducts the practice shall for each controlled area lay down local instructions in writing describing how the work is to be performed and the protective measures to be taken by those working in the area. The instructions shall be adapted to the kind of work and radiation sources in question and be available at the workplace.

Section 5 A controlled area shall be delineated and access to it restricted to authorised persons, by which is meant persons who have been sufficiently trained with respect to:

1. the risks that the work in a radiation environment may imply,
2. the radiation protection measures to be taken, and
3. the local instructions that apply to the controlled area.

Temporary visitors may have access to a controlled area only if accompanied by an authorised person.

Section 6 If there are radioactive substances in a controlled area which may contaminate surrounding areas, the party that conducts the practice shall take appropriate measures to prevent contamination by radioactive substances outside the area.

Section 7 A controlled area shall be marked with signs stating that it is a controlled area and the kind of radiation sources located within the area.

Supervised area

Section 8 A workplace that is not a controlled area under Section 3 but to which these regulations apply shall be defined as a supervised area.

Section 9 The party that conducts the practice shall for each supervised area lay down local instructions for the work in writing adapted to the kind of work and radiation sources in question. The instructions shall be available at the workplaces.

Under the first paragraph, written instructions may be replaced by verbal information if this is judged to be sufficient.

Section 10 A supervised area shall be marked with signs stating that it is a supervised area and what kind of radiation sources are located within

the area. Supervised areas that are marked in accordance with previous regulations do not need to be marked once again.

Monitoring of workplaces

Section 11 The party that conducts the practice shall in controlled and supervised areas perform:
1. measurements of external dose rates where it is not clear that the field of radiation is geometrically limited, marked or otherwise well known, and
2. checks of the concentration of activity in the air and on surfaces that might be contaminated if there are radioactive substances in the workplace that might contaminate the surroundings.

Section 12 Work environments shall be monitored using suitable methods with respect to the kind(s) of radiation present, energies and the physical and chemical properties of radioactive substances. The results of monitoring shall be recorded and, if necessary, enable the estimation of individual doses.

Chapter 5 Monitoring and reporting of individual radiation doses

Monitoring of individual doses

Section 1 The party that conducts the practice involving ionising radiation shall ensure that monitoring of individual doses is performed for all workers belonging to category A.

Section 2 If an unexpected change of the dose registered for a worker takes place, the reason shall be investigated by the party that conducts the practice.

Section 3 If a measurement shows that a worker has received a personal dose equivalent in one month corresponding to:
1. an effective dose higher than 6 mSv, or
2. an equivalent dose to the lens of the eye higher than 45 mSv, or
3. an equivalent dose to the hands, forearms, feet, ankles or the skin higher than 150 mSv, the party that conducts the practice shall report the dose to the Swedish Radiation Safety Authority and state the reason.

Section 4 Immediately following an event that may be suspected of having led to abnormally high individual doses, the party that conducts the practice shall report the event to the Swedish Radiation Safety Authority.

The dose meters of the persons involved shall be evaluated immediately.

Section 5 If the Swedish Radiation Safety Authority has issued regulations for particular practices concerning other periods of monitoring, levels of reporting or other circumstances concerning individual dosimetry which differ from the provisions of these regulations, the special regulations for the particular practices shall apply instead of the corresponding provisions in these regulations.

External exposure

Section 6 Measurements of individual doses shall be performed with individual dose meters from a laboratory for individual dose monitoring which is approved by the Swedish Radiation Safety Authority. The monitoring period shall be either one month or four weeks.

An individual dose meter shall be appropriate for the practice conducted and the kind(s) of radiation present. The readings must not be affected by agents other than ionising radiation during normal use.

Section 7 If the work is of a nature implying that particularly high doses can be expected to the lens of the eye, the hands, forearms, feet, ankles or the skin, measurements of these parts of the body shall be performed. If continuous dose monitoring obstructs the performance of work in a material way, the dose monitoring may be performed as spot tests to such an extent enabling estimation of the annual individual dose.

Internal exposure and skin contamination

Section 8 In workplaces where there is a risk of intake of radioactive substances into the human body or where there is a risk of skin contamination, monitoring shall be performed in a way that is appropriate for the radionuclide(s) and kind of work in question.

The dose from internal exposure shall be determined by estimating the intake of activity. The committed effective dose shall be determined with the aid of the dose coefficients stated in Appendix 1.

Reporting and archiving

Section 9 The party that conducts the practice shall ensure that the recorded personal dose equivalents are reported to the National Dose Register within 6 weeks after the end of each monitoring period. Reporting may be assigned directly to the dosimetry service engaged for individual dose monitoring.

Dose recordings that are subject to particular, time consuming investigations may be reported at a later date following notification to the Swedish Radiation Safety Authority.

The party that conducts the practice shall, within 6 weeks after the turn of the calendar year, report the yearly estimates made in accordance with Section 7 concerning the previous calendar year to the National Dose Register.

Section 10 Information about committed effective dose shall be sent to the National Dose Register if the intake of radioactive substances implies a committed effective dose exceeding 1 mSv.
Information about equivalent dose to the skin by skin contamination shall be sent to the National Dose Register if the equivalent dose exceeds 20 mSv.

Section 11 All reports for the National Dose Register shall, unless stated otherwise, be submitted electronically in a format decided by the Swedish Radiation Safety Authority.

Individual doses received through specially planned exposure, exposure in connection with accidents or incidents or in emergency situations shall be reported separately.

Section 12 The party that conducts a practice involving ionising radiation shall keep records on doses until the persons involved are or would have been 75 years of age. However, the records must be kept for at least 30 years after the person's work in category A ceased.

Information concerning individual doses received in accordance with the second paragraph of Section 11 shall be recorded separately.

If the practice ceases before the record retention period expires, the Swedish Radiation Safety Authority must be informed.

Approval of laboratories for individual dose monitoring

Section 13 Applications for approval as a laboratory for individual dose monitoring are submitted to the Swedish Radiation Safety Authority. An application shall include a description as stipulated in Section 14, first paragraph, information on the kinds of radiation and energy intervals that the approval is to cover and the type and design of the intended detector to be used.

If the laboratory for individual dose monitoring has chosen to be accredited according to the Technical Conformity Assessment Act (1992:1119), approval is granted following notification to the Swedish Radiation Safety Authority. Such notification shall include details about the type of detector, kind of radiation and the intended energy interval as well as a certificate showing accreditation. The same applies to a laboratory for individual dose monitoring which is accredited to the standard EN ISO/IEC 17025 by an accreditation body in another country within EEA that fulfils and applies the requirements of the standard ISO/IEC 17011:2004.

Section 14 An approved laboratory for individual dose monitoring shall have a documented quality control programme corresponding to the principles laid down in the ISO 9000 family. In particular, the quality control programme shall define:

1. the organisation,
2. the internal responsibilities and competence, and

3. the routines for the work.

Instead of the provisions contained in the first paragraph, an accredited laboratory for individual dose monitoring shall meet the requirements established by the accreditation body.

The laboratory shall have access to technical equipment and resources for calibration that are suitable for the dosimetry system.

Section 15 A laboratory for individual dose monitoring that applies for approval shall send unexposed dose meters in the quantity stated by the respective testing laboratory to the Swedish National Metrology Laboratory for ionising radiation or some other testing laboratory that is accredited for the intended quantity to the standard ISO/IEC 17025 by an accreditation body within EEA that fulfils and applies the requirements of the standard ISO/IEC 17011:2004.

The dose meters are to be returned for evaluation by the laboratory for individual dose monitoring following exposure to doses that are known to the National Metrology Laboratory or to the testing laboratory. If the dose meter is of an instant reading type, the evaluation shall be conducted by the National Metrology Laboratory or the testing laboratory engaged.

When applying for approval or if test exposures are part of the accreditation procedure at the time of application, documentation is to be submitted demonstrating that the dose meters fulfil the performance requirements stated in Appendix 3.

Section 16 The type or types of individual dose meters included in the system at an approved dosimetry laboratory must not be changed in any respect without the consent of the Swedish Radiation Safety Authority.

Section 17 An approval is valid for two years. A new approval may be granted after an evaluation in accordance with Section 15.

Section 18 The Swedish Radiation Safety Authority may revoke an approval if the conditions for such approval have changed in a way so that the practice fails to meet the requirements or if these regulations and other conditions that may be linked to the approval are not complied with.

Chapter 6 Medical examination

Section 1 A medical examination shall be conducted before an individual in category A is engaged in a practice.

Exposure pathways

Section 2 A medical examination shall determine whether a worker is fit for service based on the assumptions that:

1. there is mainly a risk of external exposure and where the probability of contamination by radioactive substances is very low,

2. there is a risk of contamination by radioactive substances through the skin or via the gastric and intestinal tract but where the probability of internal contamination through inhalation is very low, or that
3. there is a risk of internal contamination by radioactive substances through inhalation.

Medical examinations

Section 3 Registered doctors with specialist competence in general medicine, occupational medicine or with specialist competence in internal medicine are authorised to carry out medical examinations under these regulations.

Section 4 A medical examination shall be conducted no less than once every three years for as long as the individual is engaged in the work.

Periodic health reviews shall be conducted in interim years when medical examinations are not conducted.

A doctor may, if the doctor considers it to be justifiable taking into account the nature of the work, conduct examinations in addition to those specified in Appendix 4. If considered necessary, a doctor can also decide to conduct more frequent medical examinations or periodic health reviews.

Section 5 The party that conducts the practice shall ensure that medical examinations and periodic health reviews are conducted for relevant personnel.

The party that conducts the practice shall also ensure that medical examinations or periodic health reviews have been conducted with respect to outside workers before they start working within a controlled area.

The examining doctor is entitled to obtain information concerning the radiation doses received by the examined individual during the past twelve-month period as well as concerning other working conditions which may be of importance to the examination.

Section 6 There are three alternatives for the outcome of a medical examination or a periodic health review:

1. fit for service,
2. fit for service under certain conditions, or
3. not fit for service.

Anyone who is assessed as being fit for service may, from a medical standpoint, be employed for any type of work involving ionising radiation.

If an individual is considered to be fit for service under certain conditions, the doctor shall, together with the party that conducts the practice, decide whether these conditions are fulfilled or not. If the practice involving ionising radiation is such that one or more exposure pathways in accordance with Section 2 can be ruled out, medical difficulties related to

the exposure situations ruled out shall not pose any obstacle to engaging the examined individual in the practice.

An individual who is assessed as not being fit for service must not work with ionising radiation.

Section 7 A medical certificate issued on the basis of a medical examination or a periodic health review shall be formulated in accordance with Appendix 6 and is to be valid for a maximum of one year after the date of signature.

Section 8 The party that conducts the practice shall ensure that a medical examination is conducted immediately after it has been found that someone has exceeded any of the annual dose limits stipulated by the Swedish Radiation Safety Authority. If a dose limit has been exceeded, the party that conducts the practice shall consider the conditions for continued exposure to radiation.

A medical examination shall also be conducted if the Swedish Radiation Safety Authority has issued special regulations concerning a medical examination following events or incidents in certain practices, regardless of the dose received.

Documentation

Section 9 The party that conducts the practice shall for each employee document the medical examinations and periodic health reviews conducted in accordance with these regulations. The documentation shall contain information concerning the nature of the employment, radiation doses received in the practice and the outcome of medical examinations and periodic health reviews.

Section 10 Documentation in accordance with Section 9 shall be kept up to date for as long as the individual participates in work involving ionising radiation and shall subsequently be retained in an archive until the individual has reached or would have reached the age of 75, though no less than 30 years after termination of the individual's category A employment.

If the practice ceases before the record retention period expires, the Swedish Radiation Safety Authority must be informed.

Appeal

Section 11 Decisions made on the basis of a medical examination or evaluation in accordance with Section 4, third paragraph, or Sections 6 or 8 in these regulations can be appealed to the Swedish Radiation Safety Authority for consideration. The individual concerned shall be informed of the possibility to appeal when the decision is issued.

Chapter 7 Exemptions

Section 1 If there are particular grounds, the Swedish Radiation Safety Authority may grant exemptions from these regulations if this can be done without circumventing the aim of the regulations.

These regulations enter into force on 1 February 2009.

SWEDISH RADIATION SAFETY AUTHORITY

ANN-LOUISE EKSBORG

Gunilla Hellström

Some dose concepts

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 2, 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 1 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 2 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		

Appendix 1

Committed effective dose (E_T)

The committed effective dose (E_T) after an intake of radioactive substances is the sum of the committed equivalent doses to organs or tissues, each of which multiplied by the appropriate weighting factor.

The committed equivalent dose (H_T) to the organ or tissue T is defined as the integral over the time 50 years (for children 70 years) of the equivalent dose rate [H'_T (t)] to the organ or tissue T at the time t after the intake such that

$$H_T = \int^{50\,y} H'_T\,(t)\,dt.$$

Summing up all committed equivalent doses to the organs and tissues multiplied by the weighting factors w_T respectively gives the committed effective dose E_T:

$$E_T = \sum_T w_T\, H_T$$

The calculations are simplified by the use of the dose coefficients. If the estimated intake (Bq) is multiplied by the dose coefficient (Sv/Bq) the committed effective dose is obtained for each nuclide. The dose coefficients include such parameters as kind of radiation, where in the body the nuclide is absorbed and the biological half-life. The integrating time 50 years (for children 70 years) is also taken into account.

The dose coefficients to be used are given in annex III in the Council Directive 96/29/Euratom laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation (OJ no L159, June 29th 1996). The coefficients concerning workers are also published in a report from the Radiation Protection Authority. The Authority can give information about coefficients that are omitted in the report.

If there is an intake of different nuclides at the same time or via different ways (ingestion or inhalation) the total committed effective dose (E_{INTERN}) is calculated by:

$$E_{INTERN} = \sum_i H_{i,or}\, J_{i,or} + \sum_i H_{i,in}\, J_{i,in}$$

where $H_{i,or}$ = the dose coefficient for intake of nuclide i by ingestion,
$J_{i,or}$ = the intake of activity by ingestion of nuclide i,
$H_{i,in}$ = the dose coefficient for intake of nuclide i by inhalation,
$J_{i,in}$ = the intake of activity by inhalation of nuclide i.

Appendix 2

Examples of practices where classification in category A shall be considered for workers

Other kinds of work not listed in the table may exist.

Practice	**Workers whose belonging to category A shall be carefully considered**
Medical, dental or veterinary radiology:	Anyone who takes part in work with fluoroscopy or more than 30exposures per week and stays with the patient not behind a radiation shield or anyone who takes part in work where the hands or some other unprotected part of the body is occasionally within or close to the primary beam.
Service or installation of equipment for which a licence is required:	Anyone who installs, performs service, changes radioactive sources, maintains or checks the equipment. This also applies to accessories if radiation is emitted during the work.
Intracavitary and interstitial therapy with sealed sources:	Anyone who handles radioactive sources or nurses patients during the treatment.
Radiotherapy except Grenz ray therapy:	Anyone who handles the sources.
Practices with open radioactive sources emitting gamma radiation:	Anyone who works with more than 100 MBq per step.
Practices with open radioactive sources emitting beta radiation:	Anyone who works with more than 10 MBq per step if the maximum β-energy is more than 0.3 MeV or anyone who works with more than 100 MBq per step if the maximum β-energy is between 0.1 and 0.3 MeV.
Nuclear activity:	Anyone who works within a controlled area.
Radiography except X-rays used within sealed boxes with interlock:	Anyone who takes part in the work.
Work with accelerators except shielded ones in industrial production lines:	Anyone who has access to the accelerator room.
Practices with sealed sources in industry or research:	Anyone who routinely takes part in work in positions where the dose rate exceeds 6 μSv/h or where it is possible to occasionally be within a radiation field having a dose rate exceeding 100 μSv/h.
Transport:	Anyone who routinely is in positions where the dose rate exceeds 6 μSv/h or for extended periods must be in positions where the dose rate exceeds 20 μSv/h.

Appendix 3

Performance requirements on dose meters[4]

A) Lowest dose required to be measured
The lowest dose required to be measured (H_o) is 1/10 of the dose given by the dose limit for five consecutive years uniformly spread over the monitoring periods during the five years.

> Example: If the 5 years limit is 100 mSv and the monitoring period is one month then $H_o = 0.1 \cdot 100/(5 \cdot 12) = 0.17$ mSv.

B) Highest dose required to be measured
A personal dose meter shall be able to measure at least 100 mSv.

C) Accuracy
The evaluated values (H_m) are acceptable if they are within the interval

$$L_{r,l} = H_m / H_t = L_{r,u}$$

where the true personal dose equivalent is H_t. $L_{r,l}$ (the lower relative limit) and $L_{r,u}$ (the upper relative limit) are given by

$$L_{r,l} = 0 \qquad \text{if } H_t < H_o,$$
$$L_{r,l} = (1/1{,}5) \cdot [1 - 2H_o/(H_o + H_t)] \qquad \text{if } H_t \geq H_o.$$

$$L_{r,u} = 1{,}5 \cdot [1 + H_o/(2H_o + H_t)]$$

However $L_{r,u}$ must not exceed 2.

D) Requirements on angular response
The personal dose equivalent depends on the angle of incidence. The reading of a personal dose meter therefore shall also vary with the angle. The magnitude of the variance is also dependent on the energy.

When testing at personal dose meter system regarding the angular response the dose meters are exposed from four different directions for one or more energies within the appropriate interval.

For each energy (E) the response i.e. the ratios (R_{E0}, R_{E20}, R_{E40} and R_{E60}) between the measured and true values at exposure from the angles 0°, 20°, 40° and 60° versus perpendicular incidence are determined. Perpendicular incidence has the angle of incidence 0°. The mean ($\Sigma R_{E,i}/4$) is denoted R_E. The dose meters are acceptable if

$$|R_E - 1| \leq 0{,}4$$

[4] A more comprehensive technical description and recommendations is given by the European Commission in the report Radiation Protection 73: Technical recommendations for monitoring individuals occupationally exposed to external radiation; EUR 14852 EN, 1994.

Appendix 3

An example on tolerances on acceptable ratio (H_m/H_t) where H_m is the evaluated value and H_t is the true value is shown in figure 1 for $H_t = H_p(10)$. The example is based upon the requirements that yields for 100 mSv/5 years. Of 10 exposures with known doses, one reading at the most may lie outside the borders.

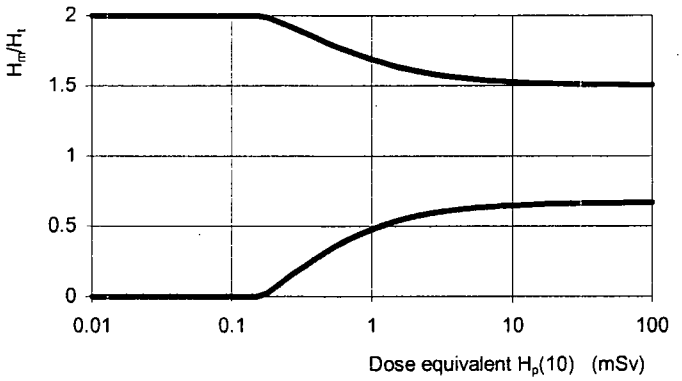


Figure 1 Tolerances on upper and lower readings of the personal dose equivalent at the dose limit 100 mSv/5 years. The monitoring period is 4 weeks.

Appendix 4

Scope of the medical examination in accordance with Chapter 1, Section 2.

A medical examination in accordance with these regulations shall comprise, at a minimum, the following diagnoses and tests:

- lung function
- heart function
- kidney function

Occurrence or signs of

- skin disease
- neurological disease
- mental illness
- alcohol or drug abuse
- blood disease
- diabetes

Laboratory tests:

Hb
LPK
TPK
U protein

In uncertain cases, the examining doctor can refer the individual to another specialist or consult with the Swedish Radiation Safety Authority.

Appendix 5

HÄLSODEKLARATION
för arbete med joniserande strålning

(HEALTH DECLARATION
for work with ionising radiation)

Fylls i och h u ndertecknas av ar betstagaren samt lämnas t ill läkaren
(To be filled in and signed by the employee and handed over to the doctor)

Namn, personnummer, adress, telefon
(Name, security-number, address, telephone)

Deklarationen gäller nuvarande/fortsatt arbete ☐
(This declaration concerns present work)

Anställd sedan
(Employed since) .....

Deklaration inför förstagångsanställning i arbete med joniserande strålning ☐
(This declaration is prior to the first employment with work with ionising radiation)

Tillträdesdatum
(Commencement of employment)
.....

Arbetsgivare
(Employer) .....
.....

Tidigare långvarig eller allvarlig sjukdom eller skada nej *(no)* ☐ ja *(yes)* ☐
(Previous long-term disease or serious injury)

Om ja, beskriv sjukdomen eller skadan
(If yes, specify the type of disease or injury) .....
.....

Överkänslighet nej *(no)* ☐ ja *(yes)* ☐
(Hypersensitivity) .....
.....

IFYLLES VID FORTSATT ARBETE MED JONISERANDE STRÅLNING
TO BE FILLED IN AT CONTINUED WORK WITH IONISING RADIATION

Registrerad stråldos under den senaste tolvmånadersperioden
(Recorded dose in the last twelve months) .....mSv

Har du sedan föregående hälsodeklaration/läkarundersökning
(Have you since the last health declaration/medical examination)

vårdats på sjukhus? *(been admitted to hospital?)* nej *(no)* ☐ ja *(yes)* ☐

kontrollerats av läkare på grund av nyupptäckt sjukdom? nej *(no)* ☐ ja *(yes)* ☐
(been examined by a doctor because of a newly diagnosed disease?)

ändrat medicinering av någon sjukdom? nej *(no)* ☐ ja *(yes)* ☐
(changed medication for any disease?)

Om något svar är ja, ange tidpunkt, sjukdom och vårdinrättning
(If any answer is yes, specify time, disease and hospital)
.....
.....

Datum och underskrift *(Date and signature)*
.....

Appendix 6

LÄKARINTYG **för arbete med joniserande strålning** Intyg enl igt S trålsäkerhetsmyndighetens f öreskrifter SSMFS 2008:51 *(DOCTOR´S CERTIFICATE* *For work with ionising radiation* *Certificate according to the Regulations (SSMFS 2008:51) of the Swedish Radiation Safety Authority)* Fylls i oc h un derteckn as av l äkaren samt l ämnas till arbetstagaren *(To be filled in and signed by the doctor and handed over to the employee)*	Namn, personnummer, adress, telefon, *(Name, security-number, adress, telephone)*

Detta intyg grundar sig på en genomförd läkarundersökning ☐
(The basis for this certificate is a medical examination)

Detta intyg grundar sig på periodisk kontroll ☐
(The basis for this certificate is a health review)

Vid undersökning/uppföljning har inte framkommit något som utgör hinder för arbete med joniserande strålning, Den undersökte bedöms tjänstbar.

(At the medical examination/health review nothing that would prevent work with ionising radiation has been found. The examined person is regarded as fit.) ☐ .....
sign

Vid undersökning/uppföljning har inte framkommit något som utgör hinder för arbete med joniserande strålning under förutsättning att:

(At the medical examination/health review nothing that would prevent work with ionising radiation has been found provided that:)

.....

.....

.....

..... ☐ .....
sign

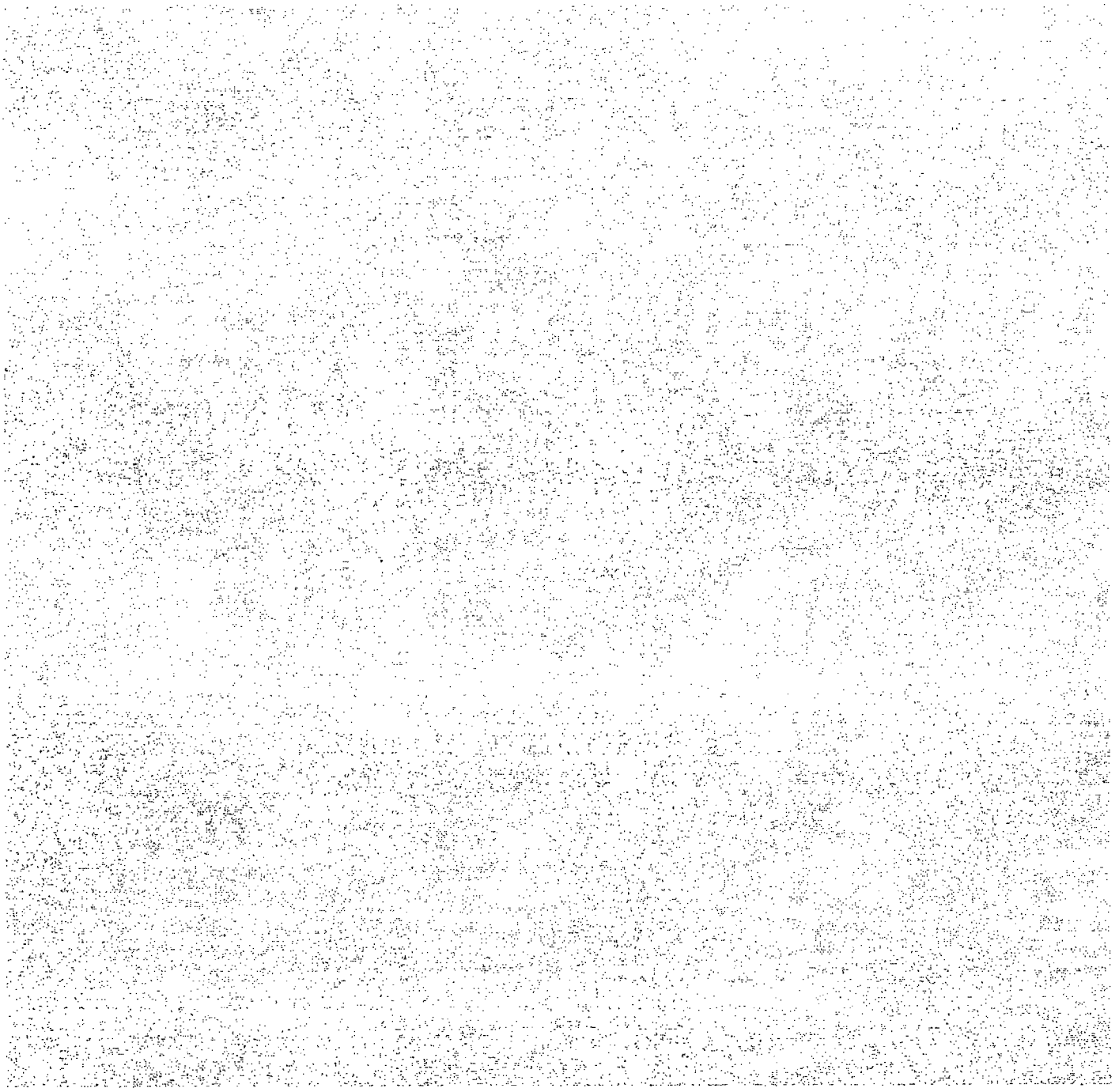
Den undersökte personen bedöms icke tjänstbar i arbete med joniserande strålning

(The examined person is regarded as unfit for work with ionising radiation) ☐ .....
sign

Datum, unde rskrift och s tämpel *(Date, si gnature and s tamp)*
.....

Den undersökte har enligt 6 kap. 12 § S trålsäkerhetsmyndighetens föreskrifter (SSMFS 2008:51) rätt att begära prövning om det skulle anses finnas hinder mot arbete med joniserande strålning. Prövning begärs skriftligen vid Strålsäkerhetsmyndigheten, 171 16 Stockholm. Skälet till att prövning begärs ska bifogas.

The examined person has according to Chapter 6. 12 § in the Regulations (SSMFS 2008:51) the right to appeal if something that would prevent work with ionising radiation is considered. This is done in writing to the Swedish Radiation Safety Authority, 171 16 Stockholm. The reason for the appeal shall be enclosed.



Strålsäkerhetsmyndigheten
Swedish Radiation Safety Authority

SE-171 16 Stockholm
Solna strandväg 96

Tel: +46 8 799 40 00
Fax: +46 8 799 40 10

E-post: registrator@ssm.se
Webb: stralsakerhetsmyndigheten.se