Regulations on Radiation Protection and Use of Radiation (Radiation Protection Regulations)

Chapter I Introductory provisions

Section 1 Purpose

The purpose of these regulations is to ensure the proper use of radiation, prevent harmful effects of radiation on human health and contribute to the protection of the environment.

Section 2 Scope

The regulations apply to any manufacture, import, export, transfer, possession, installation, use, handling and extraction of radiation sources.

The regulations also cover human activity which in itself involves elevated levels of natural ionising radiation from the environment or which leads to such radiation. This will include inter alia radon in existing buildings and premises where people may be present.

The regulations do not apply to

(a) radon and elevated levels of other natural ionising radiation in dwellings and holiday homes in which the owner lives or stays
(b) employers obligations with regard to radon levels in the workplace
(c) transport of radiation sources outside a closed area
(d) electrical appliances and components that unintentionally produce x-ray radiation provided the dose in normal use does not exceed 1 μSv/h from accessible surfaces, or that maximal energy of the radiation produced does not exceed 5 keV
(e) use of consumer products containing weak non-ionising radiation sources unless such sources are covered by section 4(j).

The following radiation sources are exempted from requirements stated in Section 8, Subsection one, Paragraphs j) and r), and Sections 11, 12, 16, 17 and 26.

(a) use of smoke detectors containing less than 40 kBq Am-241
(b) use of other permitted consumer products containing radioactive substances
(c) welding electrodes containing thorium
(d) depleted uranium used as balancing weights or shielding material.

Where specifically stated in the regulations, other radioactive radiation sources are also exempt from the requirements stated in Section 8, Subsection one, Paragraph r), Sections 12, 16, 17 and 26 provided the activity content does not exceed the exemption limits in the table in the annex. The exemption limits in the table refer to maximum specific activity (Bq/g)/activity (Bq) in a source, alternatively the total activity handled at any time by individuals. Exemption from the requirements mentioned requires either that total activity or specific activity is lower than or equal to the exemption limit.

For work with open radioactive radiation sources in laboratories, the exemption limits will apply to the individual laboratory. Where work involves various radionuclides at the

same time, the sum of the ratio between the total activity for each radionuclide and the corresponding exemption limit must be lower than or equal to 1. This is illustrated by the following example:

$$\sum_K \frac{A_K}{A_{E,K}} \leq 1, \qquad or \qquad \sum_K \frac{C_K}{C_{E,K}} \leq 1$$

where

A_k = activity of radionuclide k
$A_{E,K}$ = exemption limit of activity of radionuclide k
C_K = specific activity of radionuclide k
$C_{E,K}$ = exemption limit of specific activity of radionuclide k.

Section 3 Territorial scope

On Svalbard and Jan Mayen the Regulations of 9 May 2003 no. 568 concerning Application of the Act on Radiation Protection and Use of Radiation apply. In addition, the provisions of chapter IV in this regulation apply to Svalbard and Jan Mayen. The same is the case for section 34 in this regulation in relation to occupational exposure.

Section 4 Definitions

In these regulations

(a) *activity:* The intensity of a radioactive radiation source expressed as the number of nuclear transformations (disintegrations) per unit of time. Stated in units of becquerel (Bq);
(b) *consumer product* : object or appliance intended for use by consumers;
(c) *orphan radiation source* : a radiation source that is not under the control of a public authority, either because it has never been so, or because it has been abandoned, lost, misplaced, stolen or transferred without authorization or notification;
(d) *medical use of radiation* : the application of radiation to persons for the purpose of medical examination or treatment, in occupational medical examinations, in screening programmes, in forensic examinations, in insurance assessments or in research programmes;
(e) *nuclear medicine* : the application of open radioactive radiation sources in the form of radiopharmaceuticals for medical diagnostic or treatment purposes;
(f) *radioactive radiation source* : a radiation source containing a radioactive substance, i.e. a substance that emits alpha-, beta- or gamma radiation;
(g) *sealed radioactive radiation source* : a radioactive substance that is sealed in a capsule in order to prevent leakage of the radioactive substance to the surroundings;
(h) *open radioactive radiation source* : a radioactive substance that is not sealed;
(i) *solarium:* an appliance with one or more ultraviolet radiation sources designed for irradiation of the skin;
(j) *strong non-ionising radiation sources:* sources which may lead to exposure of persons and which at the same time exceed limits set in Guidelines for limiting exposure to non-ionising radiation from the International Commission on Non-Ionizing Radiation Protection;

(k) *IPL*: intense pulsed light, intense pulsed visible light, included in combinations with radiofrequent, ultraviolet or infrared radiation;
(l) *laser pointer*: a handheld laser, battery operated or with other separate power supply, intended to be held in the hand and to point out an object on a distance;
(m) *radiation dose / dose* : the amount of energy absorbed per unit mass in an exposed individual or material from ionising radiation;
(n) *screening* : systematic examination of a large group of symptom-free persons in order to identify their state of health in relation to a particular disease;
(o) *representative dose* : dose value, determined by the undertaking itself, in x-ray diagnostics where the dose value is based on the average of dose measurements of a given number of patients using a particular x-ray appliance in respect of a particular x-ray examination where a standard examination protocol is used;
(p) *representative activity:* the average value of administered activity, determined by the undertaking itself, in a typical nuclear medical examination. The representative activity is based on the average value of activity administered to a group of adult patients using a standard procedure and a well-functioning system;
(q) *diagnostic reference value / reference level:* an established value used in the optimisation of patient doses for examinations;
(r) *exemption limits:* limits, expressed in activity and/or specific activity, at which a radioactive substance may be exempted from the entire Radiation Protection Regulations or parts thereof;
(s) *occupational exposure:* exposure incurred by employees in the course of their occupation, where the radiation source or exposure situation is an expectable part of, and is connected to, the practice of that occupation;
(t) *radon level:* the concentration of radon in the air determined according to the measurement procedure in effect at any time as prescribed by the Norwegian Radiation Protection Authority;
(u) *employer*: employer as defined in section 1-8 (2) of Act of 17 June 2005 No. 62 relating to Working Environment, Working Hours and Employment Protection, etc.;
(v) *harmonised standard:* technical specifications adopted by European standardisation organisations in conformity with a mandate from the European Commission and the EFTA countries. These standards are published in the Official Journal of the European Union. Norwegian standards that are "harmonised standards" are published by the Norwegian Standards Association or the Norwegian Electrotechnical Committee.

For other definitions, see section 3 of Act of 12 May 2000 No. 36 on Radiation Protection and Use of Radiation (Radiation Protection Act).

Chapter 1I General provisions on ionising and non-ionising radiation

Section 5 Justification and optimisation

All use of radiation shall be justified. In order for radiation to be justified, the benefits of the radiation use shall outweigh the radiation detriments. Moreover, the radiation shall be optimised; i.e the radiation exposure shall be kept as low as reasonably achievable, taking

into account social and economic factors (the ALARA principle – As Low As Reasonably Achievable).

Section 6 Dose limits and action level

Specific dose limits shall apply to individuals who become exposed to radiation.

Dose limits for occupational exposure are specified in sections 30 and 34.

The dose limit for ionising radiation regarding the general public and employees who are not occupationally exposed, is 1mSv/year. An undertaking shall plan radiation and protective measures to ensure that exposure of the general public, which may involve an individual becoming exposed to more than 0.25 mSv/year, does not occur.

For non-ionising radiation exposure limit values of the general public and employees who are not occupationally exposed are regulated in section 34.

Radon mitigation measures shall be implemented in kindergartens, schools etc., that are covered by section 2 of Regulations of 1 December 1995 No. 928 on Environmental Health Protection at Schools, Day Care Centres etc., if the radon level exceeds 100 Bq/m^3 (action level). The same applies to dwellings in which the owner neither lives nor stays. The radon level shall in any case not exceed a limit value of 200 Bq/ m^3 in such buildings and premises.

Section 7 Dose limits for rescue work

Rescue work in emergency situations shall as far as possible be carried out within the upper dose limits mentioned in Section 30, Subsection one, Paragraph a) to c). If the work may result in doses in excess of 50 mSv, the work shall be carried out by volunteers only who are fully informed about the actual risks and dangers involved. Women of fertile age may only participate provided they are not pregnant. Exceeding this limit can only be accepted in order to save lives, avert serious damage to health or prevent a dramatic escalation of the accident. Radiation doses above 500 mSv shall as far as possible be avoided. The provisions of Sections 29 and 32 apply correspondingly.

Section 8 Authorization

Undertakings intending to engage in the following activities that involve use ionising radiation shall hold an authorization from the Norwegian Radiation Protection Authority:

(a) performance of industrial radiography and maintenance of industrial radiography equipment.
(b) irradiation activities, i.e. the application of ionising radiation to animals, other biota, materials, products etc. for treatment, sterilisation, polymerization or other purposes;
(c) logging activity, i.e. use of sealed radioactive radiation sources or accelerators for the characterisation of structures around bore holes;
(d) comprehensive, non-medical radiation use for research purposes;
(e) administration of radiopharmaceuticals or substance in connection with medical and veterinary diagnostics and therapy;
(f) radiation therapy of humans, including use of accelerators;

(g) use of x-ray diagnostic apparatus within the specialist health service, including ordinary x-ray radiography and fluoroscopy, angiography- and intervention procedures, computer tomography, mammography and dedicated child diagnostics;
(h) non-medical use of accelerators, except for electron microscopes;
(i) manufacture and import of radiopharmaceuticals;

(j) addition of radioactive substances in the manufacture of products, and/or sale of such products. The sale of consumer products mentioned in Section 2, Sub-section four of the regulations is exempt from the requirement of authorization;
(k) manufacture of radioactive radiation sources;
(l) use of open radioactive radiation sources for tracer examinations outside laboratory;
(m) use of sealed radioactive radiation sources with activities greater than 2×10^6 times the exemption limits stated in the annex to the regulations; see Section 2;
(n) use of open radioactive radiation sources with activities greater than 10^4 times the exemption limits in the annex to the regulations and requiring type A isotope laboratory; see Section 26;
(o) use of ionising radiation to check persons for security purposes or to search for concealed objects on the body;
(p) import and export of high activity sealed radioactive radiation sources requiring authorization under (m);
(q) extraction of radioactive substances in connection with mining activity;
(r) sales/lease of radiation sources. Requirements for authorization do not apply to radiation sources and areas of use mentioned in Section 2, Subsections four and five.

The following activities regarding non-ionising radiation shall be subject to authorization by the Norwegian Radiation Protection Authority:

(s) undertakings procurement and use of magnetic resonance imaging (MRI) for medical purposes;
(t) undertakings or personal possession and use of laser pointers class 3R, 3B or 4 in public places; see Section 35.

Section 9 Conditions for authorization

In the authorization the Norwegian Radiation Protection Authority may set further conditions to assure proper use of radiation and protect against harmful effects of radiation on human health. These further requirements may include conditions for radiation use, notification, reporting, competence, physical protection, use of measuring equipment, maintenance routines, quality control of apparatus and equipment for medical radiation use, return schemes, financial guarantees, import and export, emergency preparedness and design of premises.

Section 10 Application for authorization

In the case of authorization under Section 8, application must be made in writing and necessary information must be given to enable the Norwegian Radiation Protection

Authority to evaluate whether authorization should be granted and what conditions should be set.

Section 11 Change or withdrawal of authorization

The Norwegian Radiation Protection Authority may withdraw, change or set new conditions in an authorization pursuant to Act of 12 May 2000 on Radiation Protection and Use of Radiation, and if necessary cancel an authorization if

(a) the disadvantage of the radiation use proves to be significantly greater or different from what was expected when the authorization was granted
(b) the disadvantage of the radiation use can be reduced without unreasonable costs for the undertaking
(c) the radiation can be significantly reduced or the radiation use can be substituted; see Section 22
(d) conditions set or orders made pursuant to the Radiation Protection Act are materially or repeatedly ignored
(e) this follows from an authorization issued under section 8 or from other rules of reversal.

Section 12 Notification

Undertakings that procure, use or handle x-ray apparatus, accelerators and radioactive radiation sources above the exemption limits in the annex, see Section 2, Subsection four and five, and that are not subject to authorization under section 8, shall notify the Norwegian Radiation Protection Authority. Undertakings that offer solariums for cosmetic purposes for sale, lease or use shall notify the Norwegian Radiation Protection Authority. The radiation sources must not be procured, used or handled before the undertaking has received confirmation that notification has been received.

The notification requirement applies also to the procurement, use and handling of class 4 laser products and to IPL, and to solarium models and tube combinations; see Section 36.

The notification must contain the information needed by the Norwegian Radiation Protection Authority in order to assess whether the activity is covered by the notification duty.

Undertakings shall as far as possible give notification by electronic means.

Section 13 Disposal of radiation sources

Undertakings that procures sealed radioactive radiation sources have a duty to assure that a return scheme exists in the country of origin and to utilise that scheme. Furthermore, the undertaking has a duty to inform the Norwegian Radiation Protection Authority of the return scheme in connection with authorization or notification under Sections 8 and 12.

Undertakings that dispose or transfer radiation sources subject to authorization or notification under Sections 8 and 12 to new users, through a return scheme or to a waste disposal facility shall notify this to the Norwegian Radiation Protection Authority. For

open radioactive radiation sources it is sufficient that the undertaking has updated lists of radionuclides and activity quantities.

Section 14 Closing, shutdown etc.

If an undertaking in possession of radiation sources shuts down, the undertaking shall do what is at any time necessary to keep control over the radiation sources. If the facility or the undertaking may cause harm to human health after the closure or shutdown, pre-notification shall be given in due time to the Norwegian Radiation Protection Authority .

The Norwegian Radiation Protection Authority may order the owner or the user to provide a financial guarantee to cover future costs and possible liability compensation.

Anyone who intends to restart an undertaking having an authorisation under Section 8 or is notified under Section 12, and who intends to do so after the undertaking has been closed down or operations have been shut down for more than two years, shall contact the Norwegian Radiation Protection Authority. The Radiation Protection Authority will decide whether new authorization must be applied for before the undertaking is restarted.

The undertaking is obliged to give notification in writing to the Norwegian Radiation Protection Authority without undue delay concerning any name change, transfer or cessation of business involving activities covered by Section 8 on authorization or Section 12 on notification.

Section 15 Internal control – competence, instructions and procedures

The duty for the undertaking with regard to internal control is stated in the Regulations of 6 December 1996 no. 1127 relating to systematic health, environmental and safety activities in enterprises.

Undertakings shall ensure that employees and other associated persons who install or work with radiation sources, or who may become exposed to radiation, have sufficient competence in the field of radiation protection including safe handling of radiation sources and measuring and protective equipment.

The undertaking shall prepare instructions and work procedures in writing that ensure proper radiation protection and prevent persons from being exposed to levels that exceed dose limits or exposure limits pursuant to these regulations, applicable standards or international guidelines; see Section 35.

Section 16 Requirements regarding the radiation protection coordinator

Undertakings which are subject to authorization under Section 8 or notification under Section 12 shall designate one or more persons who shall be able to:

(a) carry out or order measurements and assessments to determine radiation doses
(b) guide the employees in the safe use of the radiation sources as well as the use of protective and measuring equipment.

This applies also to undertakings which apply or install strong non-ionising radiation sources.

The radiation protection coordinator shall work to ensure that the undertaking meets the requirements for health, environment and safety as stated in the radiation protection legislation. The number of radiation protection coordinators and their organisation will depend on structure of the undertaking and the complexity of the radiation use.

In the case of particularly extensive use or other handling of ionising radiation sources, the radiation protection coordinator must be able to carry out or order physical, technical and radiochemical measurements and assessments in order to determine radiation doses, and must also be able to assess health risks and consequences of various accidents, incidents and abnormal events which may occur.

Section 17 Risk assessment and preventive measures

Undertakings which plan to use or handle radiation sources shall identify and assess the risk factors associated with the radiation. New activities involving radiation sources shall not be initiated before the risk has been assessed and necessary preventive measures implemented. The risk assessment shall be documented in writing.

If the assessment shows that employees or other persons are at risk, or that radiation sources may be orphaned, the undertaking shall take measures to prevent such risk, including

(a) preparation of appropriate work routines
(b) utilising appropriate protective equipment and materials
(c) protection of the radioactive radiation sources against theft, sabotage and damage, including fire and water damage
(d) give the employees the necessary information and training.

The requirements of this provision do not apply to radiation sources and areas of use mentioned in Section 2, Subsection four and five.

Section 18 Emergency preparedness

In order to reduce possible consequences of accidents and abnormal events, the undertaking shall, based on the risk assessment, draw up an emergency preparedness plan and implement measures that maintain the ability to handle accidents and abnormal events.

Section 19 Duty to warn in the event of accidents and abnormal events

The undertaking shall immediately give notice of accidents and abnormal events to the Norwegian Radiation Protection Authority. A written report shall be sent by the responsible undertaking to the Norwegian Radiation Protection Authority as soon as possible and within 3 days at the latest.
The terms “accident” and “abnormal events” mean

(a) events which cause or may have caused unintended exposures of employees, patients or other persons significantly above normal levels.
(b) loss or theft of radiation sources
(c) unintended discharges of radioactive substances to the environment.
(d) events which involve irradiation to the general public whereby an individual may become exposed to more than 0.25 mSv/year
(e) significant technical failure of importance for the radiation protection at the radiation source
(f) significant deviation from adequate dose/activity to the treated tissue of a patient
(g) serious radioactive contamination at the site of the undertaking or its equipment
(h) discovery of orphan radiation sources

Section 20 Requirements concerning overview and control over radiation sources

An undertaking has the obligation to maintain an overview of and control over ionising radiation sources. The same applies to strong non-ionising sources. This duty imply inter alia that information concerning location, source type and temporary relocations shall be registered. For radioactive radiation sources, specification of radioactive substances and activity shall also be registered, as well as the serial number or other data able to uniquely identify the source. For open radioactive radiation sources it is sufficient for the undertaking to have updated lists of radionuclides and activity quantities. For other radiation sources the serial number, manufacturer/model or other data able to uniquely identify the source shall be registered.

Section 21 Requirements concerning radiation sources

The owner, distributor and manufacturer are obliged to ensure that radiation sources are in a state that the risk for accidents and abnormal events and undesired radiation exposure of the users and other persons is as low as reasonably achievable.

Radiation sources shall comply with harmonised standards from the Norwegian Electrotechnical Committee and the Norwegian Standards Association.

Documentation concerning the technical specifications of the radiation source output, instructions for use, maintenance, and descriptions of radiation protection and safety shall be available in Norwegian or English, and follow relevant harmonised standards.

Ionising radiation sources shall be marked with standard symbol for ionising radiation. The symbol design is as described in the prevailing NS 1029: NS 1029: “Symbol for ioniserende stråling”[ISO 361:1975 Basic ionizing radiation symbol] . For radioactive radiation sources, information concerning source type, serial number or other data able to uniquely identify the radiation source, and activity on a specified date, shall appear from the marking.

For each individual apparatus a technical measurement protocol should be available showing results from completion, acceptance testing and periodic checks on the equipment, as well as maintenance and service reports.

Chapter III Provisions on ionising radiation

Section 22 Selection of radiation source, duty to consider substitution

When using ionising radiation the undertaking shall assess alternatives to the use, including the feasibility of methods which do not involve the use of ionising radiation. The undertaking shall in such a case select the latter alternative provided this can be done without unreasonable expense or inconvenience.

Where radioactive radiation sources must be used, they shall involve as little risk as is practically achievable.

For non-medical use of radiation, x-ray apparatus shall be used rather than radioactive radiation sources when practically achievable.

Existing areas of use and methods shall be reconsidered when new information emerges relating to their justification.

Section 23 Technical requirements regarding sealed radioactive radiation sources and other ionising radiation sources

The encapsulation shall be sufficiently strong to prevent leakage of the radioactive substance and shall comply with the requirements recommended in ISO 2919 (Sealed radioactive sources - classification). A leakage test shall be performed at points where the source encapsulation is regularly exposed to mechanical or chemical wear and tear, and in the event of concrete suspicion that the source encapsulation is damaged.

Industrial nuclear gauges in permanent installations containing radioactive radiation sources shall comply with the requirements stated in ISO 7205 for class xx2323xxxxx as regards radiation leakage. The equipment shall moreover be constructed in such a way as to ensure that it is not possible to open or disassemble it without using special tools, or it shall be sealed in such a manner that the radioactive radiation source cannot be removed without breaking the seal.

Permanently positioned equipment in closed systems for non-medical imaging and technical analyses, including x-ray in process, laboratory equipment containing sealed radiation sources or x-ray tubes, luggage x-ray, body imaging equipment etc., shall

(a) be shielded such that the dose rate on the surface does not exceed 5 μSv/h.
(b) have light or sound signals indicating when radiation is generated if it is x-ray equipment
(c) not be possible to generate radiation without the use of a key or code if it is x-ray apparatus.

Section 24 Storage of radioactive radiation sources pending final disposition

The undertaking is responsible for safe and proper storage of radioactive radiation sources. This entails inter alia that

(a) storage of open radioactive radiation sources shall be limited to a minimum
(b) at the storage site an inventory description of radiation sources, including activity levels, shall be available
(c) the storage site shall be secured against access by unauthorised persons
(d) the storage site shall be marked with an ionising radiation warning sign in compliance with Regulations of 6 December 2011 no. 1356 relating to the workplace
(e) the radiation level outside the storage site shall not exceed 7.5 μSv/h
(f) radioactive radiation sources shall not be stored together with explosives, highly flammable substances or in a corrosive environment.

Section 25 Shielding and safety equipment

Radiation shielding and other safety equipment such as personal protective equipment and technical safety systems shall be available where necessary. Such equipment/systems shall be designed such that the risk of radiation doses to occupationally exposed employees, other employees and the general public, see Sections 6, 29 and 30, and the risk of accidents, incidents and abnormal events, is as low as reasonably achievable.

The undertaking shall regularly ensure that safety equipment and safety functions function as intended.

Section 26 Work with open radioactive radiation sources and classification of isotope laboratories

All work with open radioactive radiation sources shall take place in an isotope laboratory of type A, B or C, depending on the activity. The activity limits for the various types of isotope laboratory are as follows:

Type of laboratory	***Activity that can be used per occasion in the laboratory***
Type C	Up to 10 times the exemption limit for activity stated in the annex to the regulations
Type B	Up to 10^4 times the exemption limit for activity stated in the annex to the regulations
Type A	Above 10^4 times the exemption limit for activity stated in the annex to the regulations

The activity limits apply to normal chemical work. For simple work processes, for example extraction of stock solutions and dilutions, the stated limits may be raised by a factor of 10 or lower. In the case of especially hazardous work, like work involving dry substances, the activity limits shall be reduced by a factor of 10.

When working with open radioactive radiation sources, measuring equipment for control of radioactive contamination shall be available. Measuring equipment and other safety equipment such as extraction cabinets and fans shall be checked regularly.

Requirements regarding laboratory class A, B or C do not apply to work involving activity below the exemption limits in the annex to the regulations; see Section 2, Subsection five.

Section 27 Requirements on isotope laboratories

All isotope laboratories shall be equipped and designed in such a way that

(a) the radiation doses to personnel can be kept as low as reasonably achievable
(b) any risk of contamination and of intake of radioactive substances is minimal
(c) surfaces are impervious and smooth to facilitate cleaning and resistant to the chemicals used in the laboratory
(d) recirculation of radioactive substances to the laboratory or other premises is prevented, normally by means of extraction cabinets. It shall, if necessary, be possible to install absorbent filters in the ventilation system
(e) hand washing can take place.

Section 28 Additional requirements on type A and type B isotope laboratories

Type A laboratories require authorization pursuant to Section 8Paragraph n). Authorization will cover particular requirements as to design and equipment in addition to the requirements on type B laboratories under this Section.

Type B isotope laboratories shall be reserved for work with radioactive substances, and shall be designed in such a way that

(a) there is a transition zone into the controlled area, containing a contamination monitor, a suitable wash basin and an emergency shower. The transition to the active area shall be clearly marked with a stripe painted on the floor or a physical barrier
(b) the laboratory has reduced air pressure compared with the surroundings so that radioactive substances do not enter the working atmosphere
(c) the ventilation system for exiting air is connected to a separate ventilation duct whose discharge point is placed such that the air is not recirculated into the working atmosphere. The fan shall be placed close to the ventilation duct's discharge point.

Chapter IV Provisions on occupational exposure to ionising radiation

Section 29 Requirement for classification and marking of the workplace

The undertaking shall classify the workplace as a controlled area if employees may be exposed to radiation doses above 6 mSv per year or if the dose to the hands may exceed 150 mSv per year.

The undertaking shall classify the workplace as a supervised area if employees may be exposed to radiation doses in excess of 1mSv per year, or if the dose to the hands may exceed 50 mSv per year.

The undertaking shall ensure that occupationally exposed employees outside a controlled and supervised area cannot be exposed to radiation doses larger than 1 mSv per year.

A controlled area shall be physically demarcated or marked clearly by other means where physical demarcation is not possible. A controlled and supervised area shall be marked with a sign showing that it is a controlled or supervised area. Regarding marking with an ionising radiation warning sign the requirements laid down in Regulations of 6 December2011 no. 1356 relating to the workplace do apply.

The requirements regarding marking of the workplace do not apply in the case of elevated cosmic radiation to aircraft personnel.

Section 30 Dose limits

All radiation exposure shall be kept as low as reasonably achievable, and the following dose limits shall not be exceeded:

(a) The dose limit for occupationally exposed employees over the age of 18 is 20 mSv per calendar year. The Norwegian Radiation Protection Authority may grant dispensation for individuals where in consideration of the nature of the work it is not practically possible to establish an annual limit of 20 mSv. In such cases a permit may be granted to practise a limit of 100 mSv over a consecutive five-year period, provided that the dose does not exceed 50 mSv in any single year.
(b) The radiation dose to the lens of the eye shall not exceed 150 mSv per year.
(c) The radiation dose to skin, hands and feet shall not exceed 500 mSv per year.
(d) For apprentices between the age of 16 and 18 who are using radiation sources as part of their education, dose limits of respectively 5, 50 and 150 mSv per year apply instead of the doses stated under (a) to (c).
(e) For occupationally exposed pregnant women the dose to the foetus shall not exceed 1 mSv for the remainder of the pregnancy, i.e. after the pregnancy has been declared.

The requirements as to transfer of pregnant women, health checks on employees, medical practitioners' notification duty, employers' duty to register etc., are laid down in Regulations of 14 June 1985 no. 1157 on work with ionising radiation.

Where there is a reason to believe that an employee has exceeded the dose limit, the employer shall immediately carry out an examination to identify the causes thereof, and initiate measures to avoid repeats.

Section 31 Exception regarding radon

The provisions on classification and marking of the workplace and dose limits etc. in this chapter do not apply in relation to radon.

Section 32 Personal dosimetry
The undertaking shall ensure that employees working within a controlled or supervised area have their personal radiation exposure determined and the employees shall contribute in this matter.

The undertakings shall ensure that the employees are informed in writing of the dose readings and shall initiate measures as and when needed.

Section 33 Dose reporting
Undertakings which determine personal radiation exposure in their own undertaking or on behalf of other undertakings shall regularly, and at least annually, report the dose readings to the Norwegian Radiation Protection Authority. The doses shall be reported at the individual level.

Personal dose reports shall be kept for 60 years.

Chapter V Provisions on non-ionising radiation

Section 34 Limit values **etc. regarding exposure of persons**
All exposure of humans to non-ionising radiation shall be kept as low as reasonably achievable.

Guidelines and limit values in the area of optical radiation and electromagnetic fields set forth in the latest updated version of the Guidelines for limiting exposure to non-ionising radiation from the International Commission on Non-Ionizing Radiation Protection shall apply as regulations.

Section 35 Use of IPL and strong non-ionising sources
For IPL and strong non-ionising sources, including laser class 3R, 3B or 4, where exposure of humans is intended, Sections 37, 38, 41, 42, 43, 45, 47, 48 and 53 shall apply insofar as they are relevant.
Use of strong non-ionising sources shall be in compliance with the following harmonised standards:

(a) EN 60825: Safety of Laser products - Part 1: Equipment classification, requirements and user's guide, and
(b) NEK IEC/TR 60825; Safety of laser products - Part 8: Guidelines for the safe use of laser beams on humans.

Section 36 Technical requirements for solariums
Solariums shall be in compliance with harmonised standard EN 60335 with annex; Household and similar electrical appliances - Safety - Part 2-27: Particular requirements for appliances for skin exposure to ultraviolet and infrared radiation. Only solariums belonging to UV type 3 are permitted for sale, lease or use for cosmetic purposes. Anyone who imports/sells a solarium is responsible for ensuring that the requirements are met and that necessary measurements have been performed. Measurements confirming the classification shall be carried out by a laboratory that meets the quality requirements of the Norwegian Radiation Protection Authority.

It is forbidden for undertakings to offer solariums for cosmetic purposes for sale, lease or use to persons under the age of 18 years.

The undertaking has a duty to ensure that appliances and marking meet prevailing requirements and to inform the customer of the recommended schedule of exposure. The undertaking also has a duty to have protective goggles available for the customer. Specification of permitted radiation sources shall be physically available next to each appliance. The settings of the solarium's timer shall be compatible with the times specified in the recommended schedule of exposure. The undertaking has a duty to post a notice with a warning text and safety rules in compliance with EN 60335-2-27 with annex in an easily visible position on the premises.

Chapter VI Provisions on medical use of radiation

Section 37 Justification

The justification of new methods and applications in medical use of radiation shall be evaluated on a general basis before such methods and applications become available for general use. Existing areas of use and methods shall be reassessed when new information emerges about their justification.

An assessment shall be made of whether the use of radiation is justified for the individual patient based on the individual circumstances. If possible, previous patient information shall be obtained in order to avoid unnecessary use of radiation. Irradiation may be justified in a particular case, even if not justified in general.

Section 38 Optimisation

The undertaking shall on a continual basis ensure that medical use of radiation is optimised. Optimisation includes choice of method, apparatus and equipment; assessment of diagnostic information or the effect of therapy; practical feasibility of the examination or treatment, as well as an assessment of work technique and radiation dose to the patient.

Each undertaking shall establish protocols for the most common and relevant medical procedures. The protocols shall provide information on procedures and apparatus settings for implementing examinations and treatment. These procedures shall be audited on a regular basis.

Section 39 Referral

X-ray diagnostic, nuclear medical and MRI examinations and treatments shall only be undertaken after referral from health personnel with requisitioning rights. This requirement does not apply to examinations carried out under the screening programme in accordance with Section 46.

The justification for the above examinations shall be evaluated against applicable guidelines before the examinations are carried out. In non-acute cases where the examination involves a high radiation dose, the justification shall be evaluated by a

relevant medical specialist; see Section 42 on requirements regarding medical competence.

Section 40 Representative doses / activity administered to patients

The undertaking shall maintain an overview of representative doses / activity administered to patients regarding typical x-ray diagnostic and nuclear medical examinations. These values shall be compared with diagnostic reference values / reference levels laid down by the Norwegian Radiation Protection Authority. If the undertaking's representative dose / representative activity for a given examination is higher than the Radiation Protection Authority's reference value / reference level, the cause thereof shall be found, and measures to reduce the values shall be elucidated and implemented as far as practically possible. Similarly, image quality and diagnostic safety shall be evaluated if the representative dose / administered activity is significantly lower than the reference value / reference level.

Section 41 Women of fertile age

When treating or examining women of fertile age particular attention shall be given to protecting the embryo/foetus where the woman is pregnant or pregnancy cannot be ruled out. When evaluating justification, consideration shall be given to the expected dose to the embryo/foetus, whether the examination or the treatment can be deferred in view of the woman's state of health and if alternative methods are available that imply less risk of harm to the embryo/foetus.

Section 42 Medical competence

Undertakings which use radiation for the following specified purposes shall have personnel with the following competence:

(a) For x-ray diagnostics and MRI that are subject to an authorization requirement under Section 8 Paragraph g) and Section 8, Subsection two: a medical practitioner with specialist competence in medical radiology or a dentist with specialist competence in maxillofacial radiology. Within specific disciplines, including heart diseases and pulmonary diseases: a medical practitioner with specialist competence in his/her discipline.
(b) For nuclear medical examinations, a medical practitioner with specialist competence in nuclear medicine; for multi-modality examinations such as PET/CT and SPEC/CT also a medical practitioner with specialist competence in radiology if the apparatus is used for CT diagnostics.
(c) For high- and medium-energy radiation therapy, a medical practitioner with specialist competence in oncology.
(d) For skin therapy with tube voltage not exceeding 15 kV x-ray radiation, a medical practitioner with specialist competence in dermatology and venereal diseases.
(e) For nuclear medical therapy, a medical practitioner with specialist competence in oncology or nuclear medicine.
(f) For intraoral dental radiography, a dentist or dental hygienist, for extraoral dental radiography, a dentist with relevant and documentable competence.
(g) For use of x-ray apparatus in a chiropractic enterprise, a chiropractor.
(h) For other x-ray diagnostics not subject to an authorization requirement, a medical practitioner.

(i) For medical treatment with laser class 4 or IPL, a medical practitioner.
(j) For medical treatment with laser class 3B or other strong non-ionising sources, a medical practitioner, chiropractor or physiotherapist.
(k) For medical treatment of the oral cavity with optical sources, a medical practitioner or dentist.
(l) For treatment of eyes by laser, a medical practitioner with specialist competence in eye diseases.
(m) For treatment of jaundice in newborns with visible light, a medical practitioner with specialist competence in children's diseases.

The undertaking must designate a medically responsible person within each category.

Section 43 Training in radiation protection and medical use of radiation

Personnel shall on an annual basis be given relevant training in radiation protection and radiation use in relation to work methods and the individual's tasks. All affected personnel shall receive apparatus-specific training that includes factors influencing radiation dose and image quality before new apparatus or new methods are implemented for clinical use. All training provided to the individual employee shall be possible to document with regard to the scope and content.

Section 44 Competence in medical physics

Undertakings using radiation for medical purposes that require authorization under Section 8 shall have personnel with scientific competence to master's degree level with real competence in the relevant discipline of medical physics (x-ray diagnostics, MRI, nuclear medicine, radiation therapy). The number shall be adapted to the undertaking's scope and complexity to ensure that necessary tasks are duly attended to, including dosimetry, quality control and optimisation. The responsible physicist shall have a further two years' clinical experience.

Section 45 Competence to operate apparatus for medical use of radiation

X-ray and MRI apparatus shall be operated by a radiographer or a medical practitioner with relevant specialist competence, or by a dentist with specialist competence in maxillofacial radiology. The requirement as to specialist competence does not apply for simple mobile apparatus for photography and fluoroscopy or simple dental x-ray apparatus. CBCT/CBVT for use in maxillofacial radiology may be operated by a dentist with relevant and documentable competence. A chiropractor may operate simple x-ray apparatus subject to the notification requirement for a chiropratic undertaking under Section 12.

For radiation therapy, personnel who operate the apparatus on an independent basis shall be radiation therapists professionally educated to bachelor's degree level or have further education in radiation therapy or other health care education to the same level as a bachelor's degree.

Nuclear medical apparatus shall be operated by personnel with a health care education to bachelor's degree level (radiographer, bioengineer or the like) and with further education in nuclear medicine and radiation protection equivalent to at least 15 study credits in the Norwegian university and university college system, or a medical practitioner with relevant specialist competence.

Operation of multi-modality apparatus such as PET/CT and SPEC/CT requires competence in both nuclear medicine and radiography.

Apparatus for treatment of jaundice in newborns with visible light shall be operated by health personnel.

Laser class 3B and 4, IPL and strong non-ionising sources applied to humans shall be operated by health personnel.

Personnel undergoing education in the above categories may operate such apparatus where this forms part of their education.

Section 46 Screening activity etc.

Screening programmes and other examination programmes that use apparatus subject to authorization, see Section 8, and are prepared for symptom-free groups, shall be notified to the Norwegian Radiation Protection Authority. The undertaking must if necessary also be authorized for medical use of x-ray apparatus in compliance with Section 8, Paragraph g). The following requirements apply to such activity:

(a) The programme's justification shall be documentable and based on scientific and social assessments.
(b) The programme shall be systematic and well defined regarding what population group shall be included and have routines for follow-up positive findings and any ancillary findings.
(c) The screening programme shall be able to document positive and negative findings in order to enable the effect of the programme to be evaluated on a regular basis.
(d) The individual shall be informed of inconveniences and consequences of the examination.
(e) A technical and medical quality assurance programme shall exist.

Section 47 Duty to provide information

The undertaking shall, when requested by the Norwegian Radiation Protection Authority, provide information on the annual number of treatments and diagnostic examinations carried out in various medical inquires, as well as records of radiation doses to patients.

The undertaking shall, when requested by the Norwegian Radiation Protection Authority, be able to present a technical record of measurements for each individual apparatus showing results from completion, acceptance testing and periodical checks of the equipment, as well as maintenance and service reports.

Section 48 Quality control etc., of apparatus

Apparatus for medical use of radiation shall, in so far as the requirements are relevant to such apparatus, fulfil the requirements set out in Act of 12 January 1995 no. 6 on medical equipment, and regulations made pursuant to that Act. These include inter alia requirements concerning CE marking.

All apparatus shall be maintained and checked in a planned, systematic and documentable manner. Checks shall at minimum cover parameters that affect radiation doses/deposited energy and image quality.

Apparatus that is used must be adapted to the respective areas of application.

Where medical radiation apparatus is received and prepared for use that requires authorization under Section 8, the acceptance test shall include all parameters and factors which may affect radiation dose and image quality. A documentable system for periodic quality control of apparatus and equipment shall also be established.

Section 49 Dosimetry regarding ionising radiation therapy, x-ray diagnostics and nuclear medicine

The undertaking shall have a reference instrument for dose measurement in connection with radiation therapy. This reference instrument shall be calibrated every second year against the national standard. Radiation sources used for radiation therapy shall be calibrated against the reference instrument for those radiation qualities that are used clinically. Calibration of radiation sources for radiation therapy shall be performed in connection with acceptance testing, in connection with maintenance of significance for dosimetry and in accordance with planned routines, and shall be carried out in accordance with international protocols or with national protocols where such protocols have been issued.

All devices that show a measure of radiation dose in x-ray diagnostics and nuclear medicine shall be calibrated/verified on a regular basis.

Section 50 X-ray diagnostics

The following types of examinations – computed tomography (CT), angiography and intervention, conventional x-ray examinations of the gastrointestinal tract and examinations that are specially prepared for children –the following requirements apply:

(a) X-ray apparatus shall be equipped with a device providing a measure of the radiation dose to the patient during the examination.
(b) The radiation dose to each patient shall be recorded. These data shall accompany the patient's medical journal or be obtainable by other means.

Standardised protocols shall be developed for optimal setting of the apparatus regarding the commonest medical inquiries. Such protocols are recommendable guidelines,
the apparatus settings shall be adjusted to the optimal settings for the individual patient.

Doses to the lenses of the eyes, breasts, thyroid gland and gonads shall be kept as low as reasonably achievable.

Section 51 Ionising radiation therapy

Therapy with ionising radiation for the purpose of curing disease or palliative care shall take place in accordance with professionally proper and documented procedures as regards description of target volume, organ at risk, fractionation and doses.

Tools shall be available for individual planning of radiation dose based on the patient's anatomy, and there shall be a professionally responsible person who is familiar with the dose calculation models and the limitations of the tools. Before therapy starts, the dose calculation shall be checked by at least two specialists. A verification system shall exist to check the therapy against planned values. Any change in relation to the therapy plan shall be documented. Manual transfer of therapy data to the therapy machine shall be kept to a minimum. The therapy shall be documented in order to permit reconstruction of the therapy setup, course of therapy and doses given to each individual patient. The patient is entitled to information about radiation doses and the risk regarding radiation therapy.

Procedures shall exist for reporting and follow-up of deviations with a separate register for the various types of deviation. The patient and any relatives shall be notified in the event of significant deviation of the therapy. A dosimetric and medical assessment of the deviation determines the further follow-up of the patient.

For external high-energy radiation therapy, a system shall exist for dosimetric and geometric control of the therapy, with documentation in the patient’s journal.

For brachytherapy, the positioning of radiation sources within the patient and therapy schedules shall be documented.

Section 52 Nuclear medicine

For nuclear medical diagnostics the activity shall be determined and verified before each individual administration to the patient.

For nuclear medical therapy, individual dose planning and the activity shall be determined and verified before administration to the patient.

Activity of radiopharmaceuticals, radionuclides, the chemical form of the radiopharmaceutical or its usual abbreviation that is used, shall be entered in the patient’s journal.

Section 53 Therapy with non-ionising sources

Therapy with non-ionising sources for the purpose to prevent or cure disease or palliative care shall take place in accordance with professionally proper and documented procedures. The same applies where the purpose of the treatment is cosmetic.

In the case of therapy with non-ionising sources there shall be a system for dosimetry based on an evaluation or control measurement of the source’s output.

Chapter VII Administrative provisions

Section 54 Supervision

The Norwegian Radiation Protection Authority shall be provided with such information as is necessary to enable it to carry out supervision and verify compliance with decisions made pursuant to these regulations.

The Norwegian Radiation Protection Authority decides itself which of the undertaking's representatives it will talk to and obtain information from during supervision.

The Norwegian Radiation Protection Authority shall prepare a report in writing after supervision.

The Norwegian Radiation Protection Authority's supervisory powers in respect of solariums, including the power to make necessary individual decisions, is delegated to the municipal authorities; see section 18 regarding radiation protection in Act of 12 May no. 36.

Section 55 Dispensation
If one or more of the provisions of these regulations would appear highly unreasonable, the Norwegian Radiation Protection Authority may grant dispensation.

Section 56 Amendments to the regulations
The Ministry may adopt amendments to these regulations.

The Norwegian Radiation Protection Authority may lay down and amend exemption limits in the annex to the regulations. Where exemption limits are amended, the Radiation Protection Authority shall lay down necessary transitional arrangements.

Chapter X Final provisions

Section 57 Entry into force
These regulations enter into force on 1 January 2011 with the exception of Section 6, Subsection five which enters into force on 1 January 2014. Regulations of 21 November 2003 no. 1362 on radiation protection and radiation use (Radiation Protection Regulations) are revoked as of the same date.

Section 58 Transitional provisions
Authorizations granted pursuant to Regulations of 21 November 2003 no. 1362 on radiation protection and radiation use (Radiation Protection Regulations) Section 5 are valid until they are superseded by authorization pursuant to Section 8, or until they expire.

Annex concerning exemption limits; see Section 2, Paragraph five and six

Radionuclide	*Activity Bq*	*Specific Activity Bq/g*
H-3	10^9	10^6
Be-7	10^7	10^3
B-10	10^6	10^4
C-11	10^6	10^1
C-14	10^7	10^4
N-13	10^9	10^2
O-15	10^9	10^2
F-18	10^6	10^1
Na-22	10^6	10^1
Na-24	10^5	10^1
Mg-28	10^5	10^1
Al-26	10^5	10^1
Si-31	10^6	10^3
Si-32	10^6	10^3
P-32	10^5	10^3
P-33	10^8	10^5
S-35	10^8	10^5
Cl-36	10^6	10^4
Cl-38	10^5	10^1
Ar-37	10^8	10^6
Ar-39	10^4	10^7
Ar-41	10^9	10^2
K-40	10^6	10^2
K-42	10^6	10^2
K-43	10^6	10^1
Ca-41	10^7	10^5
Ca-45	10^7	10^4
Ca-47	10^6	10^1
Sc-44	10^5	10^1
Sc-46	10^6	10
Sc-47	10^6	10^2
Sc-48	10^5	10^1
V-48	10^5	10^1
V-49	10^7	10^4
Cr-51	10^7	10^3
Mn-51	10^5	10^1
Mn-52	10^5	10^1
Mn-52m	10^9	10^4
Mn-53	10^6	10^1
Mn-54		
Mn-56	10^5	10^1
Fe-52	10^6	10^1

Fe-55	10^6	10^4
Fe-59	10^6	10^1
Fe-60	10^5	10^2
Co-55	10^6	10^1
Sr-85m	10^7	10^2
Sr-87m	10^6	10^2
Sr-89	10^6	10^3
Sr-90[a]	10^4	10^2
Sr-91	10^5	10^1
Sr-92	10^6	10^1
Y-87	10^6	10^1
Y-88	10^6	10^1
Y-90	10^5	10^3
Y-91	10^6	10^3
Y-91m	10^6	10^2
Y-92	10^5	10^2
Y-93	10^5	10^2
Zr-88	10^1	10^2
Zr-93[a]	10^7	10^3
Zr-95	10^6	10^1
Zr-97[a]	10^5	10^1
Nb-93m	10^7	10^4
Nb-94	10^6	10^1
Nb-95	10^6	10^1
Nb-97	10^6	10^1
Nb-98	10^5	10^1
Mo-90	10^6	10^1
Mo-93	10^8	10^3
Mo-99	10^6	10^2
Mo-101	10^6	10^1
Tc-95m	10^6	10^1
Tc-96	10^6	10^1
Tc-96m	10^7	10^3
Tc-97	10^8	10^3
Tc-97m	10^7	10^3
Tc-98	10^6	10^1
Tc-99	10^7	10^4
Tc-99m	10^7	10^2
Ru-97	10^7	10^2
Ru-103	10^6	10^2
Ru-105	10^6	10^1
Ru-106[a]	10^5	10^2
Rh-99	10^6	10^1
Rh-101	10^7	10^2
Rh-102	10^6	10^1
Rh-102m	10^6	10^2
Rh-103m	10^8	10^4

Rh-105	10^{7}	10^{2}
I-132	10^{5}	10^{1}
I-133	10^{6}	10^{1}
I-134	10^{5}	10^{1}
I-135	10^{6}	10^{1}
Xe-122	10^{9}	10^{2}
Xe-123	10^{9}	10^{2}
Xe-127	10^{5}	10^{3}
Xe-131m	10^{4}	10^{4}
Xe-133	10^{4}	10^{3}
Xe-135	10^{10}	10^{3}
Cs-129	10^{5}	10^{2}
Cs-131	10^{6}	10^{3}
Cs-132	10^{5}	10^{1}
Cs-134m	10^{5}	10^{3}
Cs-134	10^{4}	10^{1}
Cs-135	10^{7}	10^{4}
Cs-136	10^{5}	10^{1}
Cs-137[a]	10^{4}	10^{1}
Cs-138	10^{4}	10^{1}
Ba-131	10^{6}	10^{2}
Ba-133m	10^{6}	10^{2}
Ba-133	10^{6}	10^{2}
Ba-140[a]	10^{5}	10^{1}
La-137	10^{7}	10^{3}
La-140	10^{5}	10^{1}
Ce-139	10^{6}	10^{2}
Ce-141	10^{7}	10^{2}
Ce-143	10^{6}	10^{2}
Ce-144[a]	10^{5}	10^{2}
Pr-142	10^{5}	10^{2}
Pr-143	10^{6}	10^{4}
Nd-147	10^{6}	10^{2}
Nd-149	10^{6}	10^{2}
Pm-143	10^{6}	10^{2}
Pm-144	10^{6}	10^{1}
Pm-145	10^{7}	10^{3}
Pm-147	10^{7}	10^{4}
Pm-148m	10^{6}	10^{1}
Pm-149	10^{6}	10^{3}
Pm-151	10^{6}	10^{2}
Sm-145	10^{7}	10^{2}
Sm-147	10^{4}	10^{1}
Sm-151	10^{8}	10^{4}
Sm-153	10^{6}	10^{2}
Eu-147	10^{6}	10^{2}
Eu-148	10^{6}	10^{1}

Eu-149	10^{7}	10^{2}
Eu-150	10^{6}	10^{1}
Eu-152	10^{6}	10^{1}
Eu-152m	10^{6}	10^{2}
Eu-154	10^{6}	10^{1}
Eu-155	10^{7}	10^{2}
Eu-156	10^{6}	10^{1}
Tl-200	10^{6}	10^{1}
Tl-201	10^{6}	10^{2}
Tl-202	10^{6}	10^{2}
Tl-204	10^{4}	10^{4}
Pb-201	10^{6}	10^{1}
Pb-202	10^{6}	10^{3}
Pb-203	10^{6}	10^{2}
Pb-205	10^{7}	10^{4}
Pb-210[a]	10^{4}	10^{1}
Pb-212[a]	10^{5}	10^{1}
Bi-205	10^{6}	10^{1}
Bi-206	10^{5}	10^{1}
Bi-207	10^{6}	10^{1}
Bi-210	10^{6}	10^{3}
Bi-210m	10^{5}	10^{1}
Bi-212[a]	10^{5}	10^{1}
Po-203	10^{6}	10^{1}
Po-205	10^{6}	10^{1}
Po-207	10^{6}	10^{1}
Po-210	10^{4}	10^{1}
At-211	10^{7}	10^{3}
Rn-220[a]	10^{7}	10^{4}
Rn-222[a]	10^{8}	10^{1}
Ra-223[a]	10^{5}	10^{2}
Ra-224[a]	10^{5}	10^{1}
Ra-225	10^{5}	10^{2}
Ra-226[a]	10^{4}	10^{1}
Ra-227	10^{6}	10^{2}
Ra-228[a]	10^{5}	10^{1}
Ac-227	10^{3}	10^{-1}
Ac-228	10^{6}	10^{1}
Th-226[a]	10^{7}	10^{3}
Th-227	10^{4}	10^{1}
Th-228[a]	10^{4}	10^{0}
Th-229[a]	10^{3}	10^{0}
Th-230	10^{4}	10^{0}
Th-231	10^{7}	10^{3}
Th-232	10^{4}	10^{1}
Th-nat	10^{3}	10^{0}

Th-234[a] Pa-230 Pa-231	10^5 10^6 10^3	10^3 10^1 10^0
Cm-245 Cm-246 Cm-247 Cm-248 Bk-247 Bk-249	10^3 10^3 10^4 10^3 10^4 10^6	10^0 10^0 10^0 10^0 10^0 10^3
Cf-246 Cf-248 Cf-249 Cf-250 Cf-251	10^6 10^4 10^3 10^4 10^3	10^3 10^1 10^0 10^1 10^0

Substances marked [a] in the above table represent radioactive substances in equilibrium with the daughter products listed below. The exemption limit in the table refers to the mother nuclide alone, but radiation contribution from the daughter products is taken into account in determining the exemption limit for the mother nuclide.

Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Cs-137	Ba-137m
Ce-134	La-134
Ce-144	Pr-144
Ba-140	La-140
Bi-212	Tl-208 (0.36), Po-212 (0.64)
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Ra-226	Rn-222, Po-218, Pb 214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Bi-210, Pb-212, Tl-208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209

Th-nat	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235	Th-231
U-238	Th-234, Pa-234m
U-nat	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239.