GUIDE YVL C.2

RADIATION PROTECTION AND EXPOSURE MONITORING OF NUCLEAR FACILITY WORKERS

Definitions

Authorisation

According to Section 7 r of the Nuclear Energy Act (990/1987), *the Radiation and Nuclear Safety Authority (STUK) shall specify detailed safety requirements for the implementation of the safety level in accordance with the Nuclear Energy Act.*

Rules for application

The publication of a YVL Guide shall not, as such, alter any previous decisions made by STUK. After having heard the parties concerned STUK will issue a separate decision as to how a new or revised YVL Guide is to be applied to operating nuclear facilities or those under construction, and to licensees' operational activities. The Guide shall apply as it stands to new nuclear facilities.

When considering how the new safety requirements presented in the YVL Guides shall be applied to the operating nuclear facilities, or to those under construction, STUK will take due account of the principles laid down in Section 7 a of the Nuclear Energy Act (990/1987): *The safety of nuclear energy use shall be maintained at as high a level as practically possible. For the further development of safety, measures shall be implemented that can be considered justified considering operating experience and safety research and advances in science and technology.*

According to Section 7 r(3) of the Nuclear Energy Act, *the safety requirements of the Radiation and Nuclear Safety Authority are binding on the licence holder, while preserving the licence holder's right to propose an alternative procedure or solution to that provided for in the regulations. If the licence holder can convincingly demonstrate that the proposed procedure or solution will implement safety standards in accordance with this Act, the Radiation and Nuclear Safety Authority may approve the procedure or solution.*

With regard to new nuclear facilities, this Guide shall apply as of 15 November 2019 until further notice. With regard to operating nuclear facilities and those under construction, this Guide shall be enforced through a separate decision to be taken by STUK. This Guide replaces Guide YVL C.2 (20.05.2014).

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1 Introduction

101. The use of nuclear energy is prescribed in the Nuclear Energy Act (990/1987) and in the Nuclear Energy Decree (161/1988) issued by virtue of the Act, and regulations of the Radiation and Nuclear Safety Authority regarding nuclear safety (STUK Y/1/2018, Y/2/2018 and Y/4/2018). Some requirements of the Radiation Act (859/2018) and the Government Decree on Ionising Radiation (1034/2018) and the Ministry of Social Affairs and Health Decree on Ionising Radiation (1044/2018) issued by virtue of the Act, and of the regulations of the Radiation and Nuclear Safety Authority regarding radiation safety are also applied to the use of nuclear energy with the aim of protecting individuals against the harmful effects of radiation. The Radiation Act regards existing exposure situations, radiation practices and emergency exposure situations. **[**2019-11-01 **]**

102. The ICRP's recommendations and the IAEA's regulations have affected the Finnish radiation protection legislation. The national legislation of Finland has taken into account also the Council of Europe's decisions. **[**2019-11-01 **]**

103. According to Sections 5-7 of the Radiation Act, the general principles of radiation protection are as follows:

1. Radiation practices and protective measures are justified if the overall benefit achieved is greater than the detriment caused (principle of justification);
2. To optimise radiation protection, occupational exposure and public exposure to ionising radiation shall be kept as low as reasonably achievable, and medical exposure shall be limited to what is necessary to achieve the intended examination or treatment result and performance of the procedure (principle of optimisation);
3. In radiation practices the radiation dose of workers and members of the public may not be higher than the dose limit (principle of limitation).

In radiation protection, the optimisation principle is called the ALARA principle (As Low As Reasonably Achievable). **[**2019-11-01 **]**

104. Chapter 12 of the Radiation Act presents the provisions regarding occupational exposure. **[**2019-11-01 **]**

105. Radiation protection at nuclear facilities is based on good planning of activities; appropriate working methods; up-to-date radiation protection methods, instruments and protective equipment; utilisation of previous experience; control of human factors; as well as co-operation between the nuclear facility's different organisation units. Commitment to the

implementation of radiation protection objectives concerns the nuclear facility's entire personnel. **[**2019-11-01 **]**

106. The radiation safety of the nuclear facility's workers is looked after for the facility's entire lifetime. A detailed assessment of radiation protection is conducted in a scope deemed necessary when construction and operating licences are applied for, in connection with plant modifications, periodically during the facility's lifetime and finally during decommissioning. **[**2019-11-01 **]**

2 Scope of application

201. This Guide applies to the radiation protection and radiation exposure monitoring of nuclear facility workers. The grounds for the protection of a worker's health against the harmful effects of ionising radiation are regulated by the Radiation Act and the Government Decree on Ionising Radiation and the Ministry of Social Affairs and Health Decree on ionising radiation issued thereunder. Regulations regarding radiation safety published by STUK complement the requirements of the Radiation Act and decrees issued thereunder. The application of the Radiation Act in the use of nuclear energy is regulated in the Nuclear Energy Act. **[**2019-11-01 **]**

202. A nuclear facility's structural radiation safety is addressed in Guide YVL C.1 "Structural radiation safety at a nuclear facility". Radiation monitoring systems and equipment in nuclear facilities are addressed in Guide YVL C.6 "Radiation monitoring at a nuclear facility". A nuclear power plant's emergency arrangements and radiation protection procedures during emergency situations are addressed in Guide YVL C.5 "Emergency arrangements of a nuclear power plant". A nuclear facility's decommissioning, its treatment and transports of waste are addressed in Guides YVL D.3 "Handling and storage of nuclear fuel", YVL D.4 "Predisposal management of low and intermediate level nuclear waste and decommissioning of a nuclear facility" and YVL D.5 "Disposal of nuclear waste". **[**2019-11-01 **]**

203. Guide YVL A.4 "Organisation and personnel of a nuclear facility" deals with a nuclear facility's organisation and personnel. Guide YVL A.3 "Leadership and management for safety" describes the management systems of nuclear facilities. Reporting on a nuclear facility's operation is dealt with in Guide YVL A.9 "Regular reporting on the operation of a nuclear facility". A nuclear facility's operating experience feedback is addressed in Guide YVL A.10 "Operating experience feedback of a nuclear facility". **[**2019-11-01 **]**

204. The Radiation Act and decrees [26, 27] issued thereunder and STUK regulations [29, 30, 31] regulate the definitions of the measurands and concepts applied in radiation exposure monitoring, medical surveillance of a radiation worker, occupational exposure to radon and the relevant radiation measurements, calculation of the committed effective dose caused by internal radiation and the conversion factors for calculation, reporting of data to STUK's Dose Registry, approval of dosimetry services, and operations requiring a safety licence. **[**2019-11-01 **]**

3 Occupational radiation protection

301. Chapter 12 of the Radiation Act regulates the arrangement of radiation protection for workers, the bases of radiation exposure monitoring and medical surveillance, and responsibilities of the responsible party and employer to protect its own and outside workers engaging in radiation work. **[**2019-11-01 **]**

301a. According to Section 27 of the Radiation Act, the responsible party shall categorise the radiation practices on the basis of the radiation exposure caused by the practices (appendix Table A03) and present them in a safety assessment. The classifications regarding radiation practices are presented in the Government Decree on Ionising Radiation. **[**2019-11-01 **]**

301b. A radiation worker refers to a worker who engages in such radiation work in which the radiation exposure to a worker can exceed the dose limits of the members of the public. **[**2019-11-01 **]**

302. According to Section 89 of the Radiation Act, the responsible party shall assess the worker's radiation exposure and measures for reducing it prior to engaging in radiation work.The assessment shall be adjusted if there is a change in the activity affecting the occupational radiation exposure. The worker's previous occupational radiation exposure shall also be established prior to the commencement of radiation work. **[**2019-11-01 **]**

303. Occupational dose limits in radiation work are enacted in Section 13 of the Government Decree on Ionising Radiation as follows:
The effective dose of a radiation worker shall not be higher than 20 millisieverts a year.
The equivalent dose of the lens of the eye shall not be higher than 100 millisieverts during a time period of five consecutive years. However, during a single year, the dose shall not be higher than 50 millisieverts.
The equivalent dose of skin shall not be, as an average dose, higher than 500 millisieverts a year on the most exposed skin area the size of a quadrat centimetre.
The equivalent dose of hands, arms, feet and ankles shall not be higher than 500 millisieverts a year.
According to Section 8 of the Radiation Act, the Radiation and Nuclear Safety Authority (STUK) may grant an exemption to a radiation dose higher than the dose limit for a designated worker in exceptional situations. **[**2019-11-01 **]**

304. Annual dose is the sum of the effective dose arising from external radiation during a calendar year and of the committed effective dose incurred from the intake of radioactive

substances within the same period of time. **[**2013-11-15 **]**

305. Section 15 of the Government Decree on Ionising Radiation enacts dose limits for young students and trainees. Dose limits for members of the public are addressed in Section 14 of the Government Decree and the protection of the foetus in Section 41. The Government Decree states i.a. the following:
The effective dose of members of the public attributable to radiation practices shall not be higher than 1 millisievert a year. The equivalent dose of the lens of the eye shall not be higher than 15 millisieverts a year. The equivalent dose of skin shall not be, as an average dose, higher than 50 millisieverts a year on the most exposed skin area the size of a quadrat centimetre. The work of a pregnant worker must be organised in such a way that the foetus's equivalent dose is as low as reasonably achievable and that it is no higher than one millisievert during pregnancy once the worker has informed the responsible party or, in the case of an external worker, the employer of her pregnancy. **[**2019-11-01 **]**

306. The nuclear facility's organisational structure and operations shall be planned to continuously implement radiation protection in accordance with regulations, facility-approved instructions and the ALARA principle. Special attention shall be paid to work during which radiation protection and the correct use, or supervision of use, of protective equipment is demanding due to working conditions, the scope or exceptional nature of work, or other reasons. **[**2013-11-15 **]**

307. The nuclear facility's management system shall describe procedures enabling the efficient correcting of any shortcomings detected in radiation protection. Systematic records shall be kept of observations, events, shortcomings, arrangements and measurement results significant to radiation protection. **[**2013-11-15 **]**

308. In addition to individual occupational doses, collective doses (the total of radiation doses) shall be monitored by task and worker group. The nuclear facility shall undertake measures if collective doses indicate a need to improve the radiation protection measures. **[**2013-11-15 **]**

309. The nuclear facility shall have a written programme (the ALARA action programme) to keep doses low. The programme shall include both short-term and long-term plans and measures to limit the doses of occupationally exposed workers. The action programme shall take into account from the overall viewpoint of radiation protection e.g. the facility's operation, water chemistry, plant modifications, materials, decontamination, nuclear waste management, testing and inspections etc. The programme shall include dose constraints for the highest individual annual dose and collective dose (manSv/GW) that shall not be exceeded based on

the principle of continuous development. The ALARA action programme shall be kept up-to-date and submitted to STUK for information. **[**2019-11-01 **]**

310. If the collective occupational dose at one nuclear power plant unit exceeds the licensee-set collective dose constraint per one GW net electric power as an average of two consecutive years, a report of the causes and the measures to improve radiation safety shall be drawn up and submitted to STUK for information. **[**2019-11-01 **]**

311. In order to limit individual radiation exposure in accordance with the ALARA principle, the nuclear facility shall enforce dose constraints lower than the dose limits set in the Government Decree on Ionising Radiation. **[**2019-11-01 **]**

312. Removed. **[**2019-11-01 **]**

313. If the annual equivalent dose to the lens of the eye of a worker at a nuclear facility exceeds 20 mSv in a year, a report shall be submitted to STUK for information. **[**2013-11-15 **]**

314. Before the nuclear power plant's refuelling, extensive repair and maintenance outage, a report shall be drawn up and submitted to STUK, stating i.a. the following

- the number of personnel taking part in radiation protection monitoring and control, their shift arrangements and responsibilities
- planning of radiation protection training
- arrangements for radiation protection, housekeeping and waste management during an outage
- arrangements for monitoring of doses and contamination
- estimated number of outage workers, highest individual doses and task-specific doses
- collective dose estimate.

[2019-11-01 **]**

315. If the dose resulting from a task or a combination of certain tasks at the nuclear facility is anticipated to exceed 0.05 manSv, or if a significant risk relating to contamination management or to a high individual dose is associated with a task or a combination of certain tasks, a detailed work plan and a document describing radiation protection measures shall be submitted to STUK for information well before work is started. **[**2013-11-15 **]**

316. A summary report describing the realisation of radiation protection of realised refuelling outages as well as of extensive maintenance and repair outages shall be drawn up in accordance with Guide YVL A.9. **[**2013-11-15 **]**

4 Operation of the radiation protection organisation

4.1 Personnel

401. The nuclear facility's responsible manager is responsible for the nuclear facility's safe and reliable operation. The responsible manager manages activities relating to the nuclear facility's operation and maintenance as well as technical support at the facility. The responsible manager shall ensure sufficient resources and authority for the personnel implementing radiation protection. These resources shall be adequate already before the plant's commissioning. **[**2013-11-15 **]**

401a. According to Section 28 of the Radiation Act and Section 2 a of the Nuclear Energy Act, the responsible party shall appoint a radiation protection officer and a deputy for them when necessary. The radiation protection officer is tasked with assisting the responsible party in the implementation of radiation protection. **[**2019-11-01 **]**

401b. According to Section 32 of the Radiation Act and Section 2 a of the Nuclear Energy Act, the responsible party *shall use a radiation protection expert in the planning, implementation and monitoring of the radiation protection of workers and members of the public.* According to Section 17 of the Government Decree on Ionising Radiation, the responsible party shall ensure that *the radiation protection expert is closely involved in the radiation practice if the class of the occupational or public exposure is 1 or 2.* **[**2019-11-01 **]**

401c. The competence, work experience and supplementary training requirements of a radiation safety officer and a radiation safety expert are described in the Ministry of Social Affairs and Health Decree on Ionising Radiation. **[**2019-11-01 **]**

401d. The time for having the radiation safety officer approved and their duties are presented in Guide YVL A.4. The use of the radiation safety expert, such as other experts in radiation protection and radiation safety, is described in Guide YVL C.1. Section 18 of the Government Decree on Ionizing Radiation presents the areas for using a radiation safety expert. **[**2019-11-01 **]**

402. An operational unit responsible for implementing radiation protection in practice and for co-ordinating related functions shall be established within the nuclear facility's operating organisation or such a unit shall be made available to it. The radiation protection manager of the plant acts as the unit's head. Tasks and responsibilities relating to the implementation of radiation protection shall be described in the facility's management system. **[**2013-11-15 **]**

403. Unforeseen conditions burdening the radiation protection function, e.g. unplanned maintenance outages, shall be taken into account in the operations and resources management of a radiation protection unit. The unit shall be capable of operation at all times of the day, where necessary. **[**2013-11-15 **]**

404. The radiation protection manager shall manage and develop the implementation of radiation protection at the facility. He or she shall ensure that radiation protection functions take into account research results from the field, national and international development and operating experience feedback. **[**2019-11-01 **]**

405. The radiation protection unit shall know the structure of the facility, its operating principles and the radiation sources at the facility. The unit shall monitor radiation conditions at the facility by making measurements and oversee from the viewpoint of radiation protection work and measures carried out in the controlled area. **[**2013-11-15 **]**

406. The radiation protection unit shall ensure the availability of an adequate number of radiation monitoring instruments and protective equipment at the facility. The unit shall also ensure that these instruments and equipment are operable and used in accordance with the instructions given. **[**2013-11-15 **]**

407. The radiation protection unit shall participate in the planning of work done in the controlled area that is anticipated to cause occupational radiation exposure. Radiation protection shall be taken into account in the different implementation phases of work. Radiation protection personnel shall have adequate authority to stop work on radiation-protection grounds and implement measures that aim to restrict doses. **[**2019-11-01 **]**

408. During the nuclear power plant's refuelling outages as well as extensive maintenance and repair outages, those responsible for radiation protection shall implement internal quality control in radiation protection. To be recorded are i.a. events and issues relating to items of radiation protection monitoring, essential radiation protection measures and decisions as well as deviations in radiation protection and the relevant corrective actions. Corresponding monitoring of the scope necessary shall be carried out during the facility's operation. **[**2019-11-01 **]**

409. If, in addition to the facility's radiation protection personnel, temporary radiation protection workers are employed at the nuclear facility, they shall act in accordance with the facility's radiation protection instructions, trained by the nuclear facility and under its control. **[**2013-11-15 **]**

410. The nuclear power plant shall have a team of experts co-operating in radiation protection and in other plant operations (e.g. operation, maintenance, safety) or some other procedure to ensure that radiation protection is taken into account extensively enough within the various domains of technology at the facility. **[**2013-11-15 **]**

4.2 Radiation protection training

411. Under Section 33 of the Radiation Act, the responsible party shall ensure that all workers engaged in radiation practices or whose tasks otherwise require special expertice in radiation protection are in possession of the qualifications, radiation protection education and training and introduction to their duties required by the practices and the tasks. The responsible party shall keep a worker-specific record on the radiation protection training and introduction for which it is responsible. **[**2019-11-01 **]**

411a. According to Section 34 of the Radiation Act, the responsible party shall ensure that workers engaged in radiation practices are provided with sufficient and regular supplementary training on radiation protection. The responsible party shall keep a worker-specific record on the supplementary radiation protection training under their responsibility. The supplementary training requirements of a worker engaging in radiation practices are presented in the Ministry of Social Affairs and Health Decree on Ionising Radiation. **[**2019-11-01 **]**

412. STUK shall be informed about the contents of and plans for radiation protection training arranged at the nuclear facility. **[**2013-11-15 **]**

413. Radiation protection training shall be given to those working in the controlled area in good time before the commissioning of the facility. **[**2013-11-15 **]**

4.3 Introductory radiation protection training

414. Introductory radiation protection training (hereinafter 'introductory training') aims at providing workers with knowledge about radiation legislation and the regulations issued under it as well as at providing them with the preconditions for correct working in the controlled and supervised areas as well as at furthering the accomplishment of radiation protection goals. The introductory training shall provide preconditions for consistent actions in accordance with safety aspects if unexpected situations occur at the workplace. In training and giving instructions, the worker’s responsibility for taking care of their own radiation safety, and that of others, shall be highlighted. **[**2019-11-01 **]**

415. Introductory training shall be given to all permanent and temporary workers of the nuclear facility working in the controlled area irrespective of their nationality. Knowledge of languages shall be taken into account so that workers understand markings essential for radiation protection at the facility. **[**2019-11-01 **]**

416. Workers shall demonstrate the adequacy of their radiation safety knowledge in a written or computer-based exam of the introductory training. A record shall be prepared of the exam indicating the individual who made the evaluation and the worker taking the test and the date of the exam. **[**2019-11-01 **]**

417. In addition to introductory training, refresher training shall be given at regular intervals. Training equal in scope to introductory training shall be arranged at least every three years. **[**2013-11-15 **]**

418. Introductory training may be considered to apply at all Finnish nuclear facilities if plant-specific administrative and structural characteristics and differences have been taken into account in the training. This can be ensured for example by handing out written material to the workers. Introductory training given in Sweden may apply at Finnish nuclear facilities on the same grounds. **[**2013-11-15 **]**

4.4 Other radiation protection-related training

419. The functioning of the nuclear facility's organisation shall be continuously developed to obtain the objectives set for radiation protection. Training programmes shall be prepared to develop and maintain the expertise of those holding positions vital to radiation protection. Permanently employed radiation protection personnel shall undergo an exam to demonstrate their understanding of the radiation protection regulations and measures presupposed by their duties and their knowledge of the use of information systems, tools and instruments required in radiation protection work. **[**2013-11-15 **]**

420. Specific radiation protection training shall be given to those whose work (e.g. work planning) significantly affects the results of radiation protection. This applies to the facility's own and contractor personnel. **[**2013-11-15 **]**

421. In co-operation with radiation protection experts, personnel contributing to work planning shall ensure that work phases are reviewed or practised before their implementation at work sites that are challenging in terms of radiation protection. **[**2019-11-01 **]**

4.5 Radiation protection instructions

422. The nuclear facility shall have instructions to implement radiation protection. They shall include at least the following

- radiation protection principles and the organisation responsible for implementing them
- organising radiation protection training
- regulations for procedures in the controlled and supervised areas
- classification of radiation workers
- medical surveillance of radiation workers
- radiation measurements in the controlled and supervised areas
- monitoring of individual radiation exposure
- real-time dose monitoring
- decontamination of workers
- radiation work permit procedure
- work planning process for maintenance and modifications important to radiation protection
- radiation protection procedures for unexpected and urgent repairs or maintenance during power operation
- use requirements for personal protective equipment
- procedures to ensure the implementation of the ALARA principle
- procedures for radiation protection quality control.

The radiation protection instructions shall be submitted to STUK for information. **[**2019-11-01 **]**

423. The radiation protection instructions shall be kept comprehensive, up-to-date and they shall be regularly evaluated as defined in the nuclear facility's management system. Activities in accordance with in the radiation protection instructions shall be evaluated as part of the facility's quality management. **[**2019-11-01 **]**

424. The nuclear facility shall have the necessary detailed instructions listing practices in radiation protection and radiation measurement as well as information on instruments for measuring or analysing radiation. These instructions shall be incorporated in the facility's management system. **[**2013-11-15 **]**

5 Radiation conditions-based area and zone classification of a nuclear facility

5.1 General principles of zone classification

501. In the nuclear facility area, dose rates shall be measured as well as the airborne radionuclide concentration and surface contamination (surface activity) systematically determined. Based on the results of the measurements, work sites are divided into controlled and supervised areas. **[**2013-11-15 **]**

502. The area outside the controlled and supervised areas is uncategorised in terms of radiation protection. **[**2013-11-15 **]**

503. The zone classification at nuclear facilities does not apply to radon. Radon in workplaces is addressed in the Radiation Act, Ministry of Social Affairs and Health Decree on Ionising Radiation and STUK's regulation on practices causing exposure to natural radiation (STUK S/3/2019). **[**2019-11-01 **]**

504. In industrial radiography, the zone classification in the nuclear power plant's uncategorised area complies with STUK's guideline regarding industrial radiography. In the controlled area, industrial radiography induced radiation beams shall be taken into account by using unambiguous warning signs and access restrictions. **[**2019-11-01 **]**

5.2 Supervised area

505. If the effective dose in an area can exceed 1 mSv, or the equivalent dose to the eye (15 mSv) or the equivalent dose to hands, feet or skin (50 mSv) per year, the area shall be classified as a supervised area at minimum. **[**2013-11-15 **]**

506. Exposure conditions in the supervised area and, where necessary, individual radiation exposure shall be monitored according to the nature and extent of radiation exposure. Radiation sources in the area and the associated radiological danger shall be appropriately marked. The markings in the area shall indicate that the area is a supervised area. **[**2019-11-01 **]**

507. Workers shall be provided with instructions on working in the supervised area, the use of radiation sources and the radiological danger associated with the sources. The outlines of the supervised area, radiological conditions and the adequacy of protective measures shall be regularly checked. **[**2013-11-15 **]**

5.3 Controlled area

508. At least those rooms in the facility where the external dose rate can exceed 3 µSv/h or where a 40-hour weekly stay can cause an internal dose in excess of 1 mSv per year due to radionuclides originating from a nuclear facility shall be defined as a controlled area. **[**2013-11-15 **]**

509. In the controlled area, special rules and procedures shall be followed, which aim to protect workers from ionising radiation and prevent the spreading of radioactive substances. **[**2013-11-15 **]**

510. The attached appendix (Table A01) lists the limit values for surface contamination in the lowest zone of the controlled area as well as limits for when exiting the controlled area. **[**2013-11-15 **]**

5.4 Zones of the controlled area

511. The rooms in the controlled area shall be divided into zones based on external dose rate, surface contamination and airborne radionuclide concentration. There shall be at least three zones. The minimum zone classification of the facility is given in the attached appendix (Table A02). **[**2013-11-15 **]**

512. External dose rate, surface contamination or airborne radionuclide concentration may locally exceed the classification limit provided that access to the area in question is restricted by access barriers and visibly marked with signs indicating the radiation situation, potential stay limitations and the protective equipment required. Exceptional radiation sources shall be visibly marked. **[**2013-11-15 **]**

513. The classification of an area into zones shall be clearly indicated by signs at the entrance. If the radiation situation changes, the signs indicating an area's classification shall be changed correspondingly. **[**2013-11-15 **]**

514. An up-to-date record shall be kept of the zone classification of and radiation conditions in the nuclear facility's rooms. The record shall cover conditions during normal operation and the annual maintenance outage. **[**2013-11-15 **]**

5.5 Access to the controlled area

515. Access to the controlled area shall be controlled. If the dose rate in a room can exceed 25 µSv/h, the room shall be locked or entrance controlled. **[**2019-11-01 **]**

516. The spreading of contamination in the controlled area shall be restricted where necessary by keeping rooms locked and limiting access to them. **[**2013-11-15 **]**

517. The use of dose monitoring devices shall be easy to verify. Those accessing the controlled area shall have a personal badge visible for identification. **[**2019-11-01 **]**

518. At least protective overalls and shoe covers shall be used as protective clothing together with additional protective gear (protective gloves and shoes, respirators) required in a specific task. Shoe covers may be replaced by shoes (plant shoes) that are only used in the controlled area. Protective overalls may be replaced by protective coats in case of justified exceptions if the contamination risk of clothes is low. If any of these principles are deviated from, approval for substitutive procedures shall be obtained from STUK. **[**2013-11-15 **]**

519. Eating, drinking and smoking are prohibited in the controlled area. Separately allocated cafeterias, break areas and use of water dispensers can constitute an exception to this rule. However, these premises and dispensers may only be used when it can be ensured by radiation measurements that their use will not cause any internal radiation exposure to workers. **[**2019-11-01 **]**

520. Those leaving the controlled area shall be checked with a measuring instrument for surface contamination. The instrument's measuring geometry shall be such that it duly covers the body, limbs and head of those being measured. The area may be normally exited if a worker's contamination limits are not exceeded (see the appendix, Table A01). If any of these principles are deviated from, approval for substitutive procedures shall be obtained from STUK. **[**2013-11-15 **]**

521. Measurement results exceeding the surface contamination limit shall be registered. Procedures shall be in place for the changing of contaminated protective clothing. Appropriately equipped personnel decontamination rooms shall be available at the nuclear facility for the elimination of surface contamination in workers. **[**2013-11-15 **]**

522. Materials removed from the controlled area shall be measured for surface contamination. Materials may be removed if the limits in Table A01 are not exceeded. Clearance of nuclear waste is described in Guide YVL D.4. **[**2013-11-15 **]**

5.6 Radiation work permit

523. A radiation work permit or instruction is required for work done in the controlled area if justifiable on radiation safety grounds. A permanent permit may be issued for routine and repetitive tasks. The methods and responsibilities for issuing the radiation work permit shall be defined in the facility's radiation protection instructions. If necessary, a radiation work permit for multi-phased work may be divided into different phases. **[**2013-11-15 **]**

524. The radiation work permit or related documents shall include at least the following:

- issuer (also who approves it, if not the same individual)
- date of issue
- foreman (or the names and number of workers)
- work site and its radiation conditions
- description of work
- requirements for measurement of dose rate, surface contamination and airborne nuclide concentration
- radiation protection measures or instructions and required protective equipment
- estimation of the radiation exposure of workers.

[2019-11-01 **]**

525. The radiation work permit shall be kept visible at the work site. If not possible due to a lack of space etc., the radiation work permit shall be made available so that the workers and radiation protection personnel can, where necessary, easily check the work site requirements indicated in the radiation work permit. **[**2013-11-15 **]**

6 Classification and medical surveillance of radiation workers

6.1 Classification of radiation workers

601. According to Section 90 of the Radiation Act, radiation workers shall be classified into category A or B. According to Section 34 of the Government Decree on Ionising Radiation, a radiation worker belongs to category A if the effective dose caused by the radiation work can be higher than 6 millisieverts in a year or the equivalent dose of the lens of the eye higher than 15 millisieverts a year or the equivalent dose of the skin, hands, arms, feet or ankles higher than 150 millisieverts a year. Other radiation workers belong to category B. **[**2019-11-01 **]**

602. Removed. **[**2019-11-01 **]**

603. Those working in the controlled area of nuclear facilities usually belong to category A. However, if category B workers are allowed to carry out work in the controlled area of the nuclear facility, this shall be justified. If a category B worker's radiation exposure at the nuclear facility exceeds 6 mSv in a year, this event and its causes shall be immediately reported to STUK. **[**2019-11-01 **]**

604. According to Section 99 of the Radiation Act, a radiation worker shall be at least 18 years old. The radiation protection of a trainee or student shall be organised in the same manner as the radiation protection of a worker engaged in the radiation practice. A trainee or student under the age of 18 but at least 16 years of age may only engage in the use of radiation sources to the extent that is necessary for their education and training and the related vocational training. They may not, however, be classified in category A or assigned to an equivalent task. **[**2019-11-01 **]**

6.2 Medical surveillance

605. The Occupational Health Care Act (1383/2001) and regulations given under it enact in general terms the arranging of occupational health care for workers. **[**2013-11-15 **]**

606. The responsible party shall ensure that radiation workers are covered by medical surveillance for those engaging in radiation work. Medical surveillance of category A workers shall be arranged in accordance with Section 95 of the Radiation Act. **[**2019-11-01 **]**

607. The medical surveillance of radiation workers aims, among other things, to

- ensure their suitability for radiation work and that their health does not prevent it
- ensure that they are capable of using the protective equipment required in radiation work

- monitor their health during radiation work to detect in particular such potential changes that would prevent them to continue radiation work
- determine the health significance of exposure whenever it is established or suspected that exposure exceeds the dose limit or is otherwise exceptional.

[2019-11-01 **]**

608. The licensee shall give to outside workers, either directly or via their employer, all necessary information and explanations on work site circumstances and on any changes in operation. The licensee and employer of the outside worker shall ensure for their part forwarding the information to an occupational physician familiar with radiation. In addition, the licensee shall obligate external employers to forward the dose information of their workers to the occupational physician familiar with radiation. **[**2019-11-01 **]**

609. The nuclear facility shall keep a record of the medical examinations of category A workers. **[**2019-11-01 **]**

610. The medical surveillance of workers participating in emergency situations is addressed in Guide YVL C.5. **[**2019-11-01 **]**

7 Monitoring of radiation exposure

7.1 General principles in radiation exposure monitoring

701. Section 92 of the Radiation Act states the following about dose monitoring: Individual dose monitoring shall be arranged for category A workers. The individual dose monitoring shall be based on individual measurements performed by a dosimetry service. **[**2019-11-01 **]**

701a. According to sections 92, 101 and 104 of the Radiation Act, the responsible party shall ensure the individual dose monitoring of its own and outside workers and forwarding the data to the Dose Registry. **[**2019-11-01 **]**

702. All workers in the nuclear facility's controlled area shall be provided with personal dosimeters. **[**2013-11-15 **]**

703. When not in use, personal dosimeters shall be kept by the entrance of the controlled area or in some other way approved by STUK so that

- their use can be monitored
- their exposure to background radiation, ultraviolet radiation and strong light is low
- ambient humidity and temperature of the dosimeter racks does not compromise their functioning
- reading of dose and checking for surface contamination are easily done.

[2013-11-15 **]**

704. Dosimeters and their racks shall be provided with identification data. Dosimeters in permanent use shall be provided at least with the identification number and the user's name. **[**2013-11-15 **]**

705. A personal dosimeter is used for determining the average radiation dose of the whole body. The dosimeter shall be placed in a position enabling a representative measurement. Other dosimeters shall be used where necessary to determine, e.g. in cases of uneven radiation exposure, the dose to the different parts of the body. **[**2013-11-15 **]**

706. The radiation exposure of personnel working in the supervised area shall also be evaluated. **[**2013-11-15 **]**

707. According to Section 92 of the Radiation Act, exposure conditions shall be regularly monitored in the controlled and supervised areas. Monitoring shall enable

1. confirming the correct classification of workers
2. determining the radiation exposure of workers
3. detecting without delay unforeseen deviations in factors impacting occupational exposure.

In addition, the Radiation and Nuclear Safety Authority's regulation on the establishment, assessment and monitoring of occupational exposure (STUK S/1/2018) requires that monitoring the exposure conditions shall include the performance of measurements or analyses that can be used in confirming that the exposure conditions of workers have not changed. **[**2019-11-01 **]**

708. If transfers of material are made in the nuclear facility's supervised area or uncategorised areas that could entail an occupational dose deviating from regular background radiation in the area, workers shall be subject to personal dose monitoring considering the possibility of a work-related event leading to abnormal radiation exposure. **[**2013-11-15 **]**

709. In order to ensure that dose limits are not exceeded, occupational doses earlier in the year and during the previous four years shall be established prior to engaging in radiation work at a nuclear facility. Those responsible for dose monitoring at the nuclear facility shall, where necessary, obtain user rights to the national Dose Registry to access such dose data. In other cases, the worker's radiation passbook or, where necessary, other official document shall be used to establish their dose data. **[**2019-11-01 **]**

710. Emergency situations shall be taken into account in determining radiation exposure and the availability of dosimeters. Emergency situations are addressed in Guide YVL C.5. **[**2013-11-15 **]**

7.2 Determination of external radiation exposure

711. According to the Radiation Act, the dosimetry service shall refer to an operational unit and service provider responsible for performing individual dose monitoring of workers. The dosimetry service shall be approved by the Radiation and Nuclear Safety Authority. **[**2019-11-01 **]**

712. Section 60 of the Radiation Act states the following about the approval of a dosimetry service:
STUK approves a dosimetry service until further notice or, for a special reason, for a fixed period of time. The approval requires:

1. the use of a documented dosimetry system compliant with the requirements laid down in Section 59
2. the sufficient competence of the personnel
3. an accredited quality system applicable to steering the practice, including the operation of the dosimetry service and the methods employed by it
4. the necessary technical means for delivering the dose data to the workers' dose register.

In lieu of accreditation, STUK may accept a quality system pursuant to the standard concerning the competence of European testing and calibration laboratories, provided that there is an adequate, justified reason for the lack of accreditation related to the operation of the dosimetry service. **[**2019-11-01 **]**

713. The measurand in dose monitoring shall be personal dose equivalent Hp(10) (penetrating) for high-energy photon radiation and Hp(0.07) (superficial) for low-energy photon radiation and beta radiation. The measurand for a dose to the lens of the eye is Hp(3). **[**2013-11-15 **]**

714. Valid standards, guidelines and recommendations shall be taken into account in the planning, approval and use of the dosimetry system. The essential documents at the time of publishing this Guide are presented in references [21, 22, 23, 24]. **[**2019-11-01 **]**

715. The prerequisites for approval and operation are that

- the measuring system has been tested, inspected and suits the task in question
- training for the users of the measuring system and the operating organisation is sufficient for the performance of the task
- a quality assurance programme is used to ensure the reliability of measurements
- the measuring system's calibration can been traced to a national or international metrology laboratory.

[2019-11-01 **]**

716. The operation of an approved dosimetry service requires the presence of trained experts at the plant capable of quickly determining the radiation dose of a worker, where necessary. **[**2013-11-15 **]**

717. A personal dosimeter is to

- distinguish between a deep dose and skin dose
- reliably measure a deep dose arising from gamma radiation within the range of 0.1 mSv…1 Sv when photon energy is between 80 keV...3 MeV
- detect neutron doses, if necessary
- detect dose to the lens of the eye, if necessary.

[2013-11-15 **]**

718. The dosimeter's response to photon radiation shall be known also outside the energy range mentioned above. The energy response shall be taken into account in the determination of both a deep dose and skin dose. **[**2013-11-15 **]**

719. Dose measurement may be hampered by the simultaneous presence of different radiation types and energies. This shall be taken into account in tests surveying the properties of dosimeters. **[**2013-11-15 **]**

720. The nuclear facility shall have procedures and instructions in place to ensure continuous high-quality individual dose monitoring. **[**2019-11-01 **]**

721. The monitoring of radiation exposure shall also function under such exceptional conditions where it is not possible to use the equipment normally employed for dose reading. Examples of such conditions include a long-term loss of power supply to equipment used for the determination of radiation exposure or contamination of rooms and equipment used for the determination of radiation exposure. The facility shall have action plans and predetermined procedures for exceptional conditions of this kind. **[**2013-11-15 **]**

722. The measurement data yielded by individual dose monitoring, the dose data calculated based on it and the calculation method shall be recorded. In addition, records shall be kept of the quality assurance, maintenance, repair and testing of the equipment used for dose monitoring. The storing time of such information shall be defined in the dose monitoring instructions. **[**2019-11-01 **]**

723. The results of the annual periodic inspections of the individual dose monitoring system shall be submitted to STUK for information. **[**2019-11-01 **]**

7.3 Determination of an internal radiation dose

724. The nuclear facility shall have monitoring equipment for the detection of internal radioactivity in those working in the controlled area. The equipment shall be sensitive enough to detect with adequate accuracy from the upper body area such radioactive substances originating from nuclear facilities and emitting gamma radiation, which may, based on the level of radioactivity at the moment of measurement, cause an effective dose exceeding the recording level. **[**2019-11-01 **]**

725. In addition, technical equipment and a calculation method shall be available at the nuclear facility for determining the internal dose caused by radionuclides originating from nuclear facilities. In this context, an internal dose means an accumulated effective dose during a period of 50 years arising from the intake of radioactive substances. **[**2013-11-15 **]**

726. A nuclide-specific measurement shall be conducted on workers assessed to be at risk from internal contamination due to the nature of their work. Workers from the nuclear facility's permanent staff and from contractors' staff shall be chosen for the measurement. The number of workers chosen shall be adequate to ensure representativeness of monitoring. **[**2013-11-15 **]**

727. The data required to determine the internal radiation dose shall be recorded. Information of this kind includes the place and time of exposure, amounts of work-site surface contamination and airborne radionuclide concentration, and also data on previous individual contaminations that required decontamination. **[**2013-11-15 **]**

728. Exposure caused by internal radiation shall be assessed and determined, if necessary, whenever measurements to detect contamination of the skin and protective clothing of those leaving the controlled area or some other observation indicate that exceptional internal contamination is possible. **[**2019-11-01 **]**

729. If an internal occupational exposure originating in a nuclear facility, which exceeds the recording level, is detected based on measurement results, the internal radiation exposure of the other participants in the same work shall be assessed and determined, if necessary. **[**2019-11-01 **]**

730. Measurement results shall be recorded. The records shall show the personal data of those measured, the time of measurement and the total activity of measured radionuclides. Measurements not exceeding the detection level shall also be recorded. **[**2013-11-15 **]**

731. Excretion or other biological samples, if necessary, may be used to assess an internal dose. The measurement dates shall be chosen to best detect a potential exposure. **[**2013-11-15 **]**

732. Internal dose shall be determined by a procedure approved by STUK and described in the licensee's documentation. If the procedure undergoes changes that can impact the determination of an internal dose, STUK's approval for the changes is required. Such changes include changed measuring principles or dose calculation models. **[**2019-11-01 **]**

7.4 Determination of a radiation dose in special cases

733. The radiation doses of visitors to the controlled area shall be measured. Group dosimeters may be used if they yield a radiation dose representative of every individual. **[**2013-11-15 **]**

734. A calculation method to determine the equivalent dose to the skin or the lens of the eye caused by surface contamination or a radioactive particle, which is approved by STUK, shall be used at the nuclear facility. **[**2013-11-15 **]**

735. If only a part of the body (such as head, eyes, hands) is mainly exposed to radiation, the licensee shall have a procedure for the determination of partial body doses approved by STUK. **[**2013-11-15 **]**

736. In the monitoring of radiation exposure caused by neutron radiation, dosimeters applicable to the purpose shall be used. An individual monitoring of neutron doses shall be arranged if the deep dose arising from neutron radiation can, under exceptional circumstances, exceed 0.2 mSv per month. Situations of this kind can occur during spent fuel transfers or handling, for example. **[**2013-11-15 **]**

7.5 Real-time monitoring of radiation exposure

737. In addition to a system that monitors individual occupational radiation exposure, the nuclear facility shall have a measurement system for the real-time monitoring of the accumulation of occupational radiation dose in the controlled area caused by external radiation. In real-time radiation exposure monitoring, teledosimetry shall be used, where necessary. **[**2013-11-15 **]**

738. The information yielded by the real-time dose measuring system shall be used to verify the reliable operation of the measuring instruments used for individual dose monitoring. **[**2013-11-15 **]**

739. If the official dose measuring fails due to the dosimeter having been lost or due to some other exceptional event, the dose measurement data recorded by the real-time dose monitoring system may be utilised in radiation exposure assessment. The dose for such a monitoring period shall be reported to the Dose Registry as an estimated dose. **[**2013-11-15 **]**

740. Real-time dosimeters shall have a dose display and an adjustable dose alarm as well as a dose rate alarm if necessary. **[**2013-11-15 **]**

741. The real-time monitoring of radiation exposure shall gather information for work planning and ensuring that the radiation protection measures are adequate. **[**2013-11-15 **]**

8 Reporting radiation doses to the Dose Registry

8.1 General principles

801. Section 20 of the Radiation Act states the following about the keeping of the Dose Registry:
STUK maintains a workers' dose register to ensure the health and radiation safety of radiation workers, emergency workers and emergency helpers.
In terms of individual monitoring, the register contains the identifying information of each worker and information on:

1. their tasks
2. responsible parties and employers of outside workers
3. the methods employed for determining individual radiation doses
4. factors impacting radiation exposure
5. the results of individual dose monitoring.

In addition, the register contains information on the monitoring methods and results concerning the exposure conditions insofar as they are employed in the determination of a worker's individual radiation dose. **[**2019-11-01 **]**

802. The licensee shall observe to the Data Protection Act (1050/2018) in recording doses. **[**2019-11-01 **]**

803. Radiation dose reporting procedures shall be described in the licensee's instructions. The instructions shall include procedures for normal operational states and exceptional events. **[**2019-11-01 **]**

804. If dosimeters other than those of the licensee are used in the controlled area of the facility, it shall be ensured that individual doses are not recorded twice in the Dose Registry. **[**2019-11-01 **]**

8.2 Regular reporting

805. Nuclear facilities shall report at least once a month the individual radiation doses of radiation workers to STUK's Dose Registry. In addition, according to Sections 93 and 95 of the Radiation Act, the operator shall ensure that

1. the worker is provided with the results of their individual dose monitoring for information without delay
2. an occupational physician familiar with radiation is provided with the necessary data on the worksite conditions, results of the worker's individual dose monitoring and other data necessary for medical surveillance.

[2019-11-01 **]**

806. According to Section 42 of the Government Decree on Ionising Radiation, in addition to what is regulated in Section 20 of the Radiation Act, *the Dose Registry of workers shall include*
1) the first name, last name, personal identity code, gender and nationality of the worker, emergency worker and emergency helper as well as the start and end date of individual dose monitoring
2) with regard to the responsible party and employer of an outside worker, the name, address and individual identification of the responsible party and employer as well as the name of the employer's contact person
3) data on the radiation practices, quality of the exposure and category of the radiation worker
4) with regard to the results of individual dose monitoring, the time of the measurement period and the result of the measurement or dose determination and, with regard to determining internal exposure, data applied in determining the dose
5) with regard to radiation safety deviations, reports regarding the exposure conditions and performed measures. **[**2019-11-01 **]**

807. Removed. **[**2019-11-01 **]**

808. The following limits apply to reporting:

- The recording threshold for a deep dose is 0.1 mSv per month. Individual doses below this level shall be reported to the Dose Registry as zero doses.
- The neutron doses measured shall be reported to the Dose Registry separately. The recording threshold for deep doses resulting from neutrons is 0.2 mSv per month.
- Surface doses and finger doses shall be reported to the Dose Registry separately. Their

recording threshold is 1 mSv per month.

- The recording threshold for a dose to the eye is 1 mSv per month.
- The recording threshold for a dose to the thyroid is 2 mSv per month.

[2013-11-15 **]**

809. According to Section 101 of the Radiation Act, STUK issues more detailed regulations on delivering the information and data to the dose register. **[**2019-11-01 **]**

810. Doses caused by internal radiation shall be reported to the Dose Registry if the dose commitment arising from the intake of radioactive substances originating from work carried out at a nuclear facility exceeds 0.1 mSv. Internal radiation doses shall be separately reported to the Dose Registry within a month from the day of their detection. **[**2013-11-15 **]**

811. A nuclear facility shall ensure that the employer of an external worker receives information on the doses incurred by the worker at least once a month. This applies also to doses received by non-Finnish workers. The licensee shall inform the employer about the obligation to provide sub-contractors with the radiation dose data if such are employed by the contractor.
[2013-11-15 **]**

812. Removed. **[**2019-11-01 **]**

813. Dose incurred in work shall be marked in the workers' radiation passbook in an approved manner. **[**2019-11-01 **]**

8.3 Reporting exceptional situations

814. Section 94 of the Radiation Act regulates the responsible party's responsibility to report the following in the case of exceptional radiation exposure:
A radiation dose established or suspected to be higher than the dose limit shall be notified without delay to

1. the worker in question
2. an occupational physician familiar with radiation responsible for the medical surveillance of a radiation worker in category A
3. the Radiation and Nuclear Safety Authority.

The worker in question shall also be notified of exposure higher than the dose constraint without delay.

In addition, according to Section 131 of the Radiation Act, the responsible party shall ensure

that radiation safety deviations, causes behind it and exposure resulting from it shall be investigated. A record shall be kept of the radiation safety deviations, their investigations and investigation results. The responsible party shall ensure the implementation of corrective measures needed due to a radiation safety deviation in order to prevent similar events. The responsible party shall report the results of a radiation safety deviation investigation and the resulting corrective measures to the Radiation and Nuclear Safety Authority. **[**2019-11-01 **]**

815. If radiation exposure arises from a radiation safety deviation or emergency exposure situation, exposure shall be reported to the Dose Registry kept by STUK separate from exposure resulting from other radiation work. If no exposure measurement results are available, an exposure assessment together with its justifications shall be reported. The assessment justification shall be sent to the Dose Registry by letter, for example. **[**2019-11-01 **]**

816. Besides the identification data of each worker, the following information is recorded in the Dose Registry: type of radiation work, methods of monitoring for radiation exposure, factors affecting radiation exposure and the results of radiation exposure monitoring. **[**2013-11-15 **]**

817. Radiation doses determined using a non-regular method of determination shall be recorded and reported as estimated doses to the Dose Registry kept by STUK. This could be the case if the reading of a personal dosimeter fails or the dosimeter is contaminated, lost or broken. Those having the right to perform these radiation dose determinations shall be nominated in the facility's internal instructions. **[**2013-11-15 **]**

818. All events involving an occupational exposure in excess of dose limits or unclear radiation exposures shall be immediately reported to STUK in accordance with Guide YVL A.10. **[**2013-11-15 **]**

9 Regulatory oversight by the Radiation and Nuclear Safety Authority

901. STUK oversees the implementation of radiation protection at a nuclear facility over the nuclear facility's entire lifetime. STUK has separate inspection programmes for the construction, commissioning, operation and decommissioning of a nuclear facility. **[**2019-11-01 **]**

902. STUK reviews the descriptions of radiation protection procedures and the available measuring equipment and procedures as part of the review of the facility's Preliminary and Final Safety Analysis Reports and the facility's sets of instructions. **[**2013-11-15 **]**

903. STUK oversees the nuclear facility's design, construction, operation and decommissioning as described in Guide YVL A.1 "Regulatory oversight of safety in the use of nuclear energy". Guide YVL A.6 "Conduct of operations at a nuclear power plant" describes STUK's monitoring of the annual maintenance outage and Guide YVL A.8 "Ageing management of a nuclear facility" monitoring of modifications, repairs and maintenance work. **[**2019-11-01 **]**

904. STUK reviews the operational reports discussed in this Guide and approves the dosimetry services used by nuclear power plants. Documentation required in the procurement and use of instruments used for the measurement of radiation exposure is discussed in more detail in Guide YVL C.6. **[**2013-11-15 **]**

905. The Nuclear and Radiation Safety Authority inspects items significant for radiation protection and the implementation of modifications as well as conducts other inspections during outages. As a part of the periodic inspection programme, STUK oversees the implementation of radiation protection and the monitoring of radiation exposure at the plant site. STUK conducts at its discretion other inspections of operations essential for radiation protection. **[**2013-11-15 **]**

906. An approval shall be applied in accordance with Guide YVL A.1 for significant modifications at nuclear facilities. STUK conducts at its discretion a separate commissioning inspection of significant modifications to the controlled area. **[**2013-11-15 **]**

907. STUK conducts at its discretion blind tests of the dose measurement system to ensure its functionality and accuracy. **[**2013-11-15 **]**

908. In radiation protection and the determination of radiation exposure, STUK contributes to research, international operating experience feedback work, follows the advancement of science and technology nationally and internationally as well as reports the implementation of radiation safety in its reports (i.a. quarterly and annual reports). **[**2013-11-15 **]**

10 Appendix A Tables

A01. Table: Limit values for surface contamination at a nuclear facility.

Radioactive substance	Work sites and tools and materials used in work	Workers	
	Lowest zone in the controlled area Bq/cm^2	Clothes Bq/cm^2	Skin Bq/cm^2
Alpha emitters (radiotoxity class 1)	0.4	0.4	0.2
Other nuclides	4	4	2

Surface activity shall be determined from the amount of both non-fixed and fixed radioactive substances. Surface activity shall be determined as the average activity over an area of 100 cm^2, if possible. **[**2019-11-01 **]**

A02. Table: Zone classification of a nuclear facility.

	External dose rate	Surface contamination (surface activity)	Derived Air Concentration (DAC)
Zone 1	≤ 25 µSv/h	Beta emitters ≤ 4 Bq/cm^2 Alpha emitters ≤ 0.4 Bq/cm^2	≤ 0.3 DAC
Zone 2	25 µSv/h...1 mSv/h	Beta emitters 4 Bq/cm^2...40 Bq/cm^2 Alpha emitters 0.4 Bq/cm^2...4 Bq/cm^2	0.3 DAC...30 DAC
Zone 3	≥ 1 mSv/h	Beta emitters ≥ 40 Bq/cm^2 Alpha emitters ≥ 4 Bq/cm^2	≥ 30 DAC

[2019-11-01 **]**

A03. Table: Radiation exposure classes

Exposure	Class			To be noted
	3	2	1	
Occupational exposure	Effective dose ≤ 1 mSv in a year[1]	Effective dose ≤ 6 mSv in a year	Effective dose > 6 mSv in a year or equivalent dose in an organ > 3/10 of the dose limit	Effective dose is the annual dose caused to a worker
Exposure of members of the public	Effective dose ≤ 0.1 mSv in a year[2]	Effective dose ≤ 0.3 mSv in a year	Effective dose > 0.3 mSv in a year	Effective dose is the annual dose caused to a representative person

[1]The class is 3 when the operations cause occupational exposure, but it is, however, so small that the workers are not classified as radiation workers. The class is E if the operations do not cause occupational exposure.

[2]The class is 3 when the operations cause exposure to members of the public. The class is E if the operations do not cause exposure to members of the public. **[**2019-11-01 **]**

11 References

1. Nuclear Energy Act (990/1987). **[**2013-11-15 **]**

2. Nuclear Energy Decree (161/1988). **[**2013-11-15 **]**

3. Radiation and Nuclear Safety Authority Regulation on the Emergency Arrangements of a Nuclear Power Plant (STUK Y/2/2018). **[**2019-11-01 **]**

4. Radiation and Nuclear Safety Authority Regulation on the Safety of Disposal of Nuclear Waste (STUK Y/4/2018). **[**2019-11-01 **]**

5. Radiation and Nuclear Safety Authority Regulation on the Safety of a Nuclear Power Plant (STUK Y/1/2018). **[**2019-11-01 **]**

6. Radiation Act (859/2018). **[**2019-11-01 **]**

7. Removed. **[**2019-11-01 **]**

8. Occupational Health Care Act (1383/2001). **[**2013-11-15 **]**

9. Data Protection Act (1050/2018). **[**2019-11-01 **]**

10. ICRP, Recommendations of the International Commission on Radiological Protection, Publication 103, 2007. **[**2014-05-20 **]**

11. ICRP, General Principles for the Radiation Protection of Workers. The International Commission on Radiological Protection, Publication 75, 1997. **[**2014-05-20 **]**

12. IAEA, Safety of Nuclear Power Plants: Commissioning and Operation, Specific Safety Requirements No SSR-2/2 (Rev. 1), Vienna 2016. **[**2019-11-01 **]**

13. IAEA, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, No. GSR Part 3, Vienna 2014. **[**2019-11-01 **]**

14. Removed. **[**2019-11-01 **]**

15. Removed. **[**2019-11-01 **]**

16. Removed. **[**2019-11-01 **]**

17. Removed. **[**2019-11-01 **]**

18. Removed. **[**2019-11-01 **]**

19. Removed. **[**2019-11-01 **]**

20. Removed. **[**2019-11-01 **]**

21. IEC 61066:2006 Thermoluminescence dosimetry system for personal and environmental monitoring. **[**2019-11-01 **]**

22. ISO/IEC-EN 17025:2017 General requirements for the competence of testing and calibration laboratories. **[**2019-11-01 **]**

23. RP 160:2009, Technical Recommendations for Monitoring Individuals Occupationally Exposed to External Radiation, EC. **[**2013-11-15 **]**

24. IEC 62387:2012 Radiation protection instrumentation – Passive integrating dosimetry systems for personal and environmental monitoring of photon and beta radiation. **[**2019-11-01 **]**

25. Removed. **[**2019-11-01 **]**

26. Government Decree on Ionising Radiation (1034/2018). **[**2019-11-01 **]**

27. Ministry of Social Affairs and Health Decree on Ionising Radiation (1044/2018). **[**2019-11-01 **]**

28. European Council Directive 2013/59/EURATOM. **[**2019-11-01 **]**

29. Radiation and Nuclear Safety Authority Regulation on the Establishment, Assessment and Monitoring of Occupational Exposure (STUK S/1/2018). **[**2019-11-01 **]**

30. Radiation and Nuclear Safety Authority Regulation on the Radiation Measurements (STUK S/6/2018). **[**2019-11-01 **]**

31. Radiation and Nuclear Safety Authority Regulation on Practices Causing Exposure to Natural Radiation (STUK S/3/2019). **[**2019-11-01 **]**

Definitions

Dose limit

Dose limit shall refer to the radiation dose arising from ionizing radiation which may not be exceeded during a specific period of time. (Radiation Act 859/2018)

Dose constraint

Dose constraint shall refer to a constraint on the individual radiation dose of a person other than a patient arising from ionizing radiation during a specific period of time, used to optimize radiation protection in radiation practices. (Radiation Act 859/2018)

Dose registry

Dose Registry shall refer to a file into which the dose information and identification information of the employees engaged in radiation work is saved.

Decontamination

Decontamination shall refer to cleaning radioactive substances from components, structures or rooms.

Effective dose

Effective dose shall refer to the weighted sum of the equivalent doses in tissues and organs exposed to radiation, where equivalent dose denotes the product of the mean energy imparted by radiation to tissue or to an organ, per unit mass, and a weighting factor specified for the radiation. Effective dose is presented as a formula in the Government Decree on Ionising Radiation (1034/2018).

Derived air concentration (DAC)

Derived air concentration shall refer to a radionuclide-specific maximum value for the average airborne activity concentration, under which 2,000 hours of work may be carried out annually without exceeding the dose limits.

Collective dose

Collective dose shall refer to the sum of the effective radiation doses in a given period of time by individuals exposed to radiation.

Contamination

Contamination refers to undesirable radioactive substances on surfaces (surface activity), or within solids, liquids or gases (also in the human body).

Radiation exposure

Radiation exposure shall refer to being exposed to radiation.

Radiation safety incident

Radiation safety incident means an event or situation that compromises or may compromise radiation safety and unplanned medical exposure. (Radiation Act 859/2018)

Emergency exposure situation

Emergency exposure situation means a situation in which the consequences of a radiation safety incident require or may require special measures to limit or reduce the radiation exposure of persons participating in the emergency work or protective measures or the exposure of members of the public. (Radiation Act 859/2018)

Supervised area

Supervised area shall refer to an area where working conditions are supervised in order to protect employees against radiation. However, area is not designed as controlled area and normally no special radiation protection measures are needed.

Controlled area

Controlled area shall refer to a working area in which specific radiation protection procedures shall be followed and to where access is controlled.

Annual dose

Annual dose shall refer to the sum of the effective dose arising from external radiation within the period of one year, and of the committed effective dose from the intake of radioactive substances within the same period of time. (Nuclear Energy Decree 161/1988)

Annual limit on intake (ALI)

Annual limit on intake (ALI) shall refer to a radionuclide specific maximum value for activity that may enter the body without the annual limit of the effective dose being exceeded. When more than one radionuclides enter the body, the annual limit of the effective dose is not exceeded when the sum of the activities entering the body from all radionuclides divided by the annual limits on intake of the said nuclides does not exceed one.

Zone classification

Zone classification shall refer to the division of the premises of the controlled area into zones based on the external dose rate, surface contamination and airborne radionuclide concentration.