STUK

GUIDE **YVL C.6** / 15 NOVEMBER 2013

RADIATION MONITORING AT A NUCLEAR FACILITY

With regard to new nuclear facilities, this Guide shall apply as of 1 December 2013 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 7.11.

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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, 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 (STUK) are binding on the licensee, while preserving the licensee's right to propose an alternative procedure or solution to that provided for in the regulations. If the licensee can convincingly demonstrate that the proposed procedure or solution will implement safety standards in accordance with this Act, the Radiation and Nuclear Safety Authority (STUK) may approve a procedure or solution by which the safety level set forth is achieved.*

Translation. Original text in Finnish.

1 Introduction

101. According to the Nuclear Energy Act (990/1987), *the use of nuclear energy must be safe; it shall not cause injury to people, or damage to the environment or property.* Accordingly, the radiation safety of the employees and the environment shall be ensured in the design of a nuclear facility. The objective is to keep the radiation doses of workers as low as practically possible, not exceeding the dose limits set. The maximum values of an individual's radiation exposure are determined in the Radiation Decree (1512/1991) issued by virtue of the Radiation Act (592/1991).

102. Government Decree (717/2013) presents the general provisions governing the safety of nuclear power plants. Chapter 3 of the Decree details the regulations concerning radiation exposure and the monitoring of the emissions of radioactive substances, and Section 27 contains the regulations concerning radiation monitoring and the monitoring of the release of radioactive substances.

103. Government Decree (736/2008) presents the general provisions governing the safety of the final disposal of nuclear waste. Chapter 2 of the Decree details the regulations concerning radiation safety, and Section 18 contains the regulations concerning operation and radiation monitoring.

104. The permanently installed (stationary) and portable radiation monitoring systems and equipment are used to ensure the radiation safety of a nuclear facility and its environment. The purpose of these systems and equipment is to measure the radiation dose rates and radiation exposures within the plant, as well as to monitor the concentrations of radioactive substances in the systems. They are also used to measure radioactive releases.

105. The radiation monitoring systems and equipment used at a nuclear facility shall be of high quality and operational reliability, since they have a monitoring task that is immediately related to the radiation safety of the location, and they are used for the alarm and control functions of the nuclear facility. The safety significance of the measurements related to the alarm and control functions depends on the safety solutions that are in place at the nuclear facility. The control functions may include a reactor protection function or a process control.

106. Compared with other I&C systems and equipment, the special requirements set by radiation monitoring systems and equipment are caused, for example, by the various sensor types and their physical principles of measurement, sampling arrangements and protection from background radiation. The performance of radiation monitoring instruments is connected with the statistical phenomena related to the physical implementation of radiation monitoring. Not all properties of the radiation monitoring instruments can be tested at the site of manufacture and operation but at an appropriate measurement standard laboratory for radiation.

2 Scope of application

201. This Guide shall be applied to the design of radiation monitoring systems of a nuclear facility. The Guide sets forth requirements for the design, manufacture, installation, commissioning and operation of the stationary radiation monitoring systems and equipment as well as the portable radiation monitoring equipment of a nuclear facility. The Guide also describes the regulatory control pertaining to these issues.

202. Some of the requirements concerning radiation monitoring systems in this Guide are only applicable to nuclear power plants, but similar principles may also be applied at other nuclear facilities.

203. Radiation monitoring systems are I&C systems, for which special requirements are laid down in this Guide. Portable radiation monitoring equipment are either individual instruments or they make up sets of equipment, the requirements of which are also laid down in this Guide. The requirements defined in the following Guides also apply to radiation monitoring systems and equipment: YVL B.1 "Safety design of a nuclear power plant", YVL B.2 "Classification of systems, structures and components of a nuclear facility",

and YVL E.7 "Electrical and I&C equipment of a nuclear facility". The commissioning of a nuclear facility and its systems, and related procedures, are discussed in Guide YVL A.5 "Construction and commissioning of a nuclear facility". General requirements concerning the accuracy of radiation monitoring, and the approval, calibration and verification of operability of radiation meters for facilities other than nuclear facilities are presented in Guide ST 1.9 "Radiation practices and radiation measurements".

204. The radiation safety requirements of a nuclear facility's rooms and systems are presented in Guide YVL C.1, "Structural radiation safety at a nuclear facility". Guide YVL C.3 "Limitation and monitoring of radioactive releases from a nuclear facility" discusses the limitation of radioactive releases, Guide YVL C.4 "Assessment of radiation doses to the public in the vicinity of a nuclear facility" discusses the radiation monitoring of the environment, and Guide YVL C.2 "Radiation protection and exposure monitoring of nuclear facility workers" discusses radiation protection of the workers of a nuclear facility during the operation of the facility. The assessment of emissions in emergency situations is covered in Guide YVL C.5 "Emergency arrangements of a nuclear power plant". Guide YVL D.4 "Predisposal management of low and intermediate level nuclear waste and decommissioning of a nuclear facility" sets forth requirements for the handling and storage of low and intermediate level waste of a nuclear facility, and the decommissioning of a nuclear facility. The general requirements of radionuclide laboratories are presented in Guide ST 6.1 "Radiation safety when using unsealed sources".

3 Radiation monitoring systems and equipment of a nuclear facility

3.1 General requirements for radiation monitoring systems

301. A nuclear facility shall have stationary radiation monitoring systems for the radiation monitoring of rooms, facility processes, releases, spent nuclear fuel, nuclear wastes, and the environment. To supplement the stationary monitoring systems, a nuclear facility shall have portable or locally installed monitoring equipment. Appropriate laboratory facilities and equipment for analysing radioactive samples, as well as the equipment needed for individual dose monitoring, shall also be available. Besides this Guide, the radiation monitoring systems and equipment are specifically governed by the requirements of Guides YVL B.1, YVL B.2 and YVL E.7. More detailed requirements concerning environmental radiation monitoring are set forth in Guide YVL C.4.

302. For the purpose of accident monitoring and management, appropriate radiation monitoring and control instrumentation shall be designed for a nuclear power plant, by means of which the operating personnel obtain sufficient data to evaluate the situation as well as plan and implement the necessary actions. During accidents, it shall be possible to carry out at least the following actions:

- measurement of dose rate inside the containment
- sampling of radioactive substances in the primary coolant and determination of activity concentrations
- sampling of radioactive substances in the containment gas plenum and water, and determination of their activity concentrations
- continuous measurement of radioactive releases and sampling from the stack, and the determination of concentrations in a laboratory
- Dose rate measurement at the site area and inside the protective zone (more detailed requirements for the measuring stations of external radiation dose rate and collection stations are presented in Guide YVL C.4).

303. Radiation monitoring shall be available to a sufficient extent during all stages of a nuclear facility's life cycle where radioactive substances may occur at the facility.

304. During decommissioning, the scope and design bases of the radiation monitoring system shall be checked prior to every extensive implementation phase described in the decommissioning plan.

305. Continuously operating monitoring systems designed for the measuring of radioactive releases, accident monitoring and management shall maintain operability even in the event of a single failure. The single failure criterion shall also be applied to the external dose rate measurements of the reactor hall and the spent fuel storage facilities, and the design of radiation measurements that have a control function limiting the radiation dose of workers (such as the radiation monitoring of a nuclear fuel transfer machine).

306. The power supply to the nuclear facility's stationary, safety-classified radiation monitoring systems shall be redundant in accordance with subsection 5.4 of Guide YVL B.1. The redundancy bases and implementation, as well as any need for uninterrupted power supply, shall be described for each monitoring instrument and related function.

307. The preliminary safety analysis report, the final safety analysis report and the system pre-inspection documentation shall present the location of the radiation monitoring equipment and their accessories. The location of the radiation detectors inside the room or process system shall be presented in a manner whereby any environmental burden can be verified and the spatial geometry measured by the device indicated. The location and structure of the sampling channels and sampling rakes related to the monitoring of radioactivity shall be presented in the safety analysis report and the system pre-inspection documentation.

3.2 Stationary monitoring of external radiation

308. The controlled area shall have stationary monitoring equipment of the external radiation monitoring system, particularly in accessible areas where changes to the plant's operational state or other events may cause a significant increase in the local dose rate. At light water reactor plants, monitoring instruments shall be placed at least on the following premises:

- containment
- reactor hall
- spent fuel storages and the fuel handling machine
- nuclear waste treatment and storage facilities
- decontamination facilities.

309. The equipment that measures the containment external dose rate and is designed to function during a severe accident shall be capable of displaying the dose rate that is caused by the release of radioactive substances of the reactor core into the containment. The appropriateness of the lower and upper limits of the measurement range shall be separately demonstrated in an analysis that is attached to the requirement specification.

3.3 Stationary and portable air activity monitoring

310. The air activity concentration shall be determined for accessible rooms in the controlled area, the air of which may contain radioactive substances in amounts significant for the workers' radiation doses during plant operation and outages. The determination may be based on continuously-operating stationary or portable monitoring instruments or laboratory analysis of the collected samples. In the containment of a pressurised water reactor, continuous air activity concentration measurements shall be possible.

311. Air activity concentration measurements shall be as representative as possible irrespective of local differences in concentration. In addition, monitoring instruments shall be placed or samples taken such that no significant air contamination goes unnoticed. The location of potential radioactive substances and ventilation in the area in question shall be taken into account.

312. If a detectable activity concentration may have a bearing on occupational radiation safety or environmental releases, the monitoring instrument shall be equipped with a ventilation system control function (such as start-up of filtering), where possible.

313. Even during severe accidents, it shall be possible to assess radionuclide concentrations in the containment gas plenum based on sampling or some other method. As regards monitoring instruments based on sampling in the containment gas plenum, the measuring range of iodine iso-

tope and radioactive aerosol concentrations shall extend to at least 10^{15}Bq/m^3, or the adequacy of the measuring range shall be separately demonstrated. Justifications shall be given for the locations of the sampling points.

3.4 Stationary radiation monitoring of process

314. A nuclear facility's systems shall be fitted with stationary radiation monitoring instruments to observe the radioactivity of liquids and gases to provide information about any fuel failures and leaks of radioactive substances and to monitor the operational state of systems. Radiation monitoring instruments shall be placed, for example, in the radioactive gas treatment system as well as in steam and water circuits that may become contaminated in case of leaks in systems containing radioactive substances.

315. In addition, for a pressurised water reactor, at least the activity of the primary coolant and its purification system as well as the steam generator blowdown system and the condenser exhaust gas system shall be observed using stationary radiation monitoring equipment. A pressurised water reactor shall also be equipped with a stationary radiation monitoring system to promptly detect any primary-to-secondary leak.

316. In addition, for a boiling water reactor, at least the activity concentration of live steam and turbine condenser exhaust gases shall be observed using stationary radiation monitoring instruments.

3.5 Stationary monitoring of radioactive releases

317. Any significant release paths of radioactive substances into the atmosphere and water shall be monitored using stationary and continuously operating radiation monitoring systems. The monitoring of radioactive releases is addressed in more detail in Guide YVL C.3.

3.6 Portable radiation monitoring equipment

318. Portable instruments shall be available at a nuclear facility to measure the dose rate of gamma radiation in the working areas and plant rooms. Some of the instruments shall have a telescopic arm to enable remote measurements of objects emitting radiation. A sufficient number of portable measuring instruments to measure external radiation with an upper limit of the measuring range of no less than 10 Gy/h (Sv/h) shall be available for measurements carried out during an accident.

319. Instruments for monitoring neutron radiation shall be provided for rooms and situations where neutron radiation may occur (including spent fuel transfers).

320. Monitoring instruments for portable air activity concentration shall be provided to measure the activity concentration of air in the working areas where stationary monitoring equipment does not provide representative results.

321. A nuclear facility shall have available portable instruments for measuring and sampling surface contamination (primarily for beta but also for alpha radiation) for use during various operational conditions.

322. All exit routes in the controlled area shall be provided with monitoring equipment to ensure that the tools, protective clothing and skin of individuals exiting the controlled area are not radioactive.

323. A nuclear power plant shall have available an instrument to measure employees' internal contamination detecting any intake of radioactive substances. Guide YVL C.2 contains more detailed requirements set for the monitoring instrument.

3.7 Activity monitoring equipment of a laboratory

324. The nuclear power plant's laboratory shall have sophisticated measurement and analysis equipment. Back-up equipment shall be available for the measurement and analysis of key parameters. Under normal operational conditions, equipment shall be available for determining the nuclide-specific activity concentrations of alpha, beta and gamma radiation. During accidents, it shall be possible to determine the nuclide-specific gamma activity concentrations. Equipment shall be available to determine the overall activity con-

centration of alpha and beta radiation. The general requirements of radionuclide laboratories are presented in Guide ST 6.1 "Radiation safety when using unsealed sources".

325. Effective and validated chemical separation methods shall be available for the analyses of radioactive substances, and a sufficient amount of various calibrated measurement geometries shall be available for gamma measurements.

326. The power supply of the most important analysis equipment in the laboratory shall be ensured.

3.8 Properties of radiation monitoring equipment

327. Radiation monitoring equipment shall be capable of measurement over the entire range within which the measured quantity may vary during operational conditions or accidents. If it is necessary to use two or more measuring channels to cover the measuring range of the object, the measuring ranges of the channels must overlap sufficiently.

328. A monitoring instrument shall be capable of maintaining the indication of the maximum value of the measuring range even if the maximum value of the measuring range is exceeded.

329. The response of instruments for monitoring external gamma radiation shall fulfil the requirements set in standards both with calibration radiation and as a function of the energy of radiation at least when the energy emitted by the radiation is between 80 keV and 1.5 MeV.

330. The indication of the monitoring equipment shall be able to follow the variation in the values measured in accordance with the requirements of the applicable design standards.

331. If ^{16}N is the main source of radiation, the instrument response to high-energy gamma radiation shall be known. If radiation other than gamma radiation (beta radiation, neutrons) can occur at the point of measurement, the response and effect on the measurement shall be known and considered.

332. The response of instruments intended for measuring the activity concentration and surface contamination shall be known. A monitoring instrument shall be capable of distinguishing the effect of changes in normal background radiation and, in addition, the measuring ranges shall exceed the contamination limit values set in Guide YVL C.2 for the highest class in the controlled area by at least a factor of ten.

333. The energy response of the personal dose equivalent and the measuring accuracy of equipment monitoring occupational radiation exposure in real time shall fulfil the requirements imposed on instruments for monitoring external gamma radiation.

334. Radiation monitoring data yielded by stationary monitoring instruments shall be displayed in the plant control room grouped according to the purpose of use. The measurement results shall be recorded to thus ensure that operational events and accidents at the plant can be analysed afterwards. The plant may, however, have in place stationary radiation monitoring instruments, the measurement data of which it is not required to be displayed in the control room. Such instruments include, for example, analysers that provide parallel information to the analysers located in the laboratory.

335. The stationary radiation monitoring instruments shall primarily be equipped with local alarms that indicate the unavailability of the equipment and when the alarm limit is exceeded. The alarm shall also be transmitted to the control room or a separate control centre. The implementation of the alarm limits and other equipment settings shall be designed such that only authorised individuals may adjust them and that an activated alarm does not stop without operator actions.

336. In the requirement specification for a radiation monitoring system, the licensee shall present the design standards. The standards used to fulfil the essential requirements of radiation monitoring instruments shall also be included. Some radiation monitoring standards in force

at the time of the publication of this Guide are listed under References.

3.9 Plans pertaining to radiation monitoring systems and equipment

337. Guides YVL B.1 and YVL E.7 present general requirements for the contents and submission to STUK of the conceptual plans, requirement specifications, pre-inspection documentation, quality management and commissioning plans, qualification plans, suitability assessments and safety analysis reports pertaining to I&C systems and equipment. In addition to these requirements, from final suitability analyses of all radiation monitoring equipment in safety class EYT/STUK, the licensee's conclusions and assessments on the components' suitability and conformity to requirements, in accordance with the requirements 348 and 349 of Guide YVL E.7, shall be submitted to STUK for information.

338. Portable or movable radiation monitoring equipment used for radiation protection purposes may form an assembly that can be considered a system. The system pre-inspection documentation for such systems shall be submitted to STUK for information as laid down in section 6 of Guide YVL B.1. This documentation shall describe the analysis methods and data processing of the software part of the equipment or assemblies. Furthermore, from the final suitability analyses concerning individual devices in such a system, the licensee's conclusions and assessments on the components' suitability and conformity to requirements, in accordance with the requirements 348 and 349 of Guide YVL E.7, shall be submitted to STUK for information.

339. From the final suitability analyses concerning radioactivity monitoring instruments that are located in or managed by laboratories and not included in the facility's safety-classified equipment, the licensee's conclusions and assessments on the components' suitability and conformity to requirements, in accordance with the requirements 348 and 349 of Guide YVL E.7, shall be submitted to STUK for information.

4 Manufacturing, installation and commissioning of radiation monitoring systems and equipment

401. The conformity to requirements of a nuclear facility's radiation monitoring systems and equipment shall be demonstrated by type tests, inspections and tests carried out during manufacture, as well as on-site acceptance tests, the installation inspection, pre-operational testing and the commissioning inspection. The licensee shall monitor the manufacture of the equipment, and the quality management during manufacture. The licensee shall perform its own site acceptance, installation and commissioning inspections of safety-classified radiation monitoring equipment. The more detailed requirements are presented in Guide YVL E.7.

402. Radiation monitoring equipment in safety class 2 and safety class 3, which are part of the essential accident instrumentation, shall have type approval. The type approval of electrical and I&C equipment is presented in more detail in Guide YVL E.7.

403. STUK shall be reserved the opportunity to inspect the manufacturing of safety-classified radiation monitoring systems and equipment as well as their in-production quality management, installation and commissioning. Guide YVL E.7 presents the general requirements concerning the delivery to STUK of the schedules, test programmes and result reports of the manufacture, installation and commissioning of I&C systems and equipment. Guide YVL A.5 presents the requirements of the delivery to STUK of the pre-operational testing programmes and result reports of the systems.

404. The installation inspection performed by the licensee shall include the inspection and testing of the installations couplings and actuators. The leak tightness of the flow channels and joints related to the measurements shall be checked.

405. Pre-operational testing shall verify that the alarms and alarm limits are functional.

406. The amount of background radiation and any possible interference it may cause on the results shall be verified during pre-operational testing.

407. The calibration of a stationary measurement channel shall be verified during pre-operational testing using a suitable radiation source or radioactive substance. The monitoring instruments intended for measuring external radiation of the containment shall be calibrated over their entire measuring range. Gamma radiation monitoring equipment intended for measuring high dose rates shall be calibrated over their entire operating range at a laboratory approved by STUK before their commissioning.

408. The response of a stationary radiation monitoring detector shall be defined using actual measuring geometry. If a radioactive calibration source or the measurement geometry deviates from the operational condition of the monitoring equipment, the analogy between the calibration measurement results and the operating measurement results shall be assessed and the data recorded.

409. During the pre-operational testing of release monitoring systems, extensive tests demonstrating operation shall be conducted that include tracer tests demonstrating the representativeness of sampling.

410. The linearity of the functioning of instruments intended for measuring neutron radiation shall be verified before their commissioning. An instrument representing each type shall be sent to a laboratory approved by STUK for calibration.

411. The functioning of instruments intended for measuring surface contamination shall be verified using surface sources of beta radiation with a distribution of radionuclide radiation energy corresponding to that of the plant. The facility shall have a test radiation source equivalent to the beta radiation limit value set for the lowest class of surface contamination in the controlled area.

412. The methods used in the measurements performed using the chemistry laboratory's activity analysers shall be validated before the analysers are taken into use.

5 Operation, in-service inspections and maintenance of radiation monitoring systems and equipment

501. Operating instructions shall be drawn up for all radiation monitoring systems and equipment. The instructions shall cover normal operational states and accidents. Key operating instructions of the radiation monitoring systems and equipment shall be submitted to STUK for information.

502. The condition of the radiation monitoring systems and equipment shall be regularly controlled during the operation of a nuclear facility. To this end, preventive maintenance, condition monitoring and in-service testing programmes shall be drawn up for the radiation monitoring systems and equipment.

503. The Operational Limits and Conditions of the nuclear facility shall include requirements for the operability and in-service testing of the radiation monitoring systems and equipment important to safety.

504. The preventive maintenance programme shall describe any such maintenance measures pertaining to the radiation monitoring systems and equipment that aim to ensure that the systems and equipment function reliably and as designed. The purpose of condition monitoring is to ensure that the overall operability of the equipment is maintained and that, for instance, the conditions at the measuring points are maintained as designed.

505. The in-service testing programme shall describe the system- and instrument-specific functional tests carried out at regular intervals to verify that the systems and equipment function as designed. The programme shall specify the testing frequencies or the plant operational states during which tests are required. The test procedures and the acceptance criteria of the tests shall be specified in the instructions. The in-service inspection programme instructions of radiation monitoring systems shall be submitted to STUK for information.

506. Operating experience shall be regularly reviewed in order to identify any type defects or weaknesses in the equipment. Advances in radiation monitoring technology shall be followed, and justified modifications made possible by technological progress shall be implemented, where necessary.

6 Regulatory oversight by the Radiation and Nuclear Safety Authority

601. During the construction licence phase and operating licence phase of a nuclear facility, STUK reviews the preliminary and final safety analysis reports to ensure that the requirements laid down in section 3 of this Guide are met. During construction, STUK reviews the radiation monitoring equipment suitability assessments to determine whether the requirements of section 3 are met. During the operation of a nuclear facility, STUK reviews the conceptual design plans, pre-inspection documentation and updates to the final safety analysis report related to modifications made to the radiation monitoring system to determine whether the requirements of section 3 are met.

602. At its discretion, STUK conducts inspection visits to oversee the manufacturing of safety-classified radiation monitoring systems and equipment and their quality management taking place during manufacturing, and their installation and pre-operational testing at the facility. STUK reviews the pre-operational testing programmes and pre-operational testing result reports of radiation monitoring systems and equipment that have been submitted for approval or information.

603. At its discretion, STUK carries out a commissioning inspection of radiation monitoring systems belonging to safety classes 2 and 3. As part of the pre-inspection of radiation monitoring systems, STUK defines the systems on which it will conduct a commissioning inspection. The commissioning inspection shall be requested from STUK in writing well in advance of the inspection day. STUK's commissioning inspection reviews, for example, the results from the licensee's commissioning inspection, related result documentation and the operating instructions drawn up for the radiation monitoring systems.

604. STUK inspects the validation reports of the measurement and analysis methods of the nuclear facility's laboratory during the review of the periodic inspection programme.

605. During the operation of a nuclear facility, STUK controls the radiation monitoring systems and equipment by assessing the operations of the licensee and the efficiency of its procedures whereby the licensee assures the reliable and correct operation of the systems and equipment. The licensee's operations shall be evaluated by means of periodic inspection programme inspections and, if necessary, through other inspections and in conjunction with the inspections of repairs and modifications.

606. STUK assesses the acceptability of requirements pertaining to the availability of safety-classified radiation monitoring systems and equipment, as well as the scope of periodic tests, during the review of the Operational Limits and Conditions of the nuclear facility.

607. STUK inspects and controls any supplements, additions and modifications to the radiation monitoring systems and equipment in accordance with the same procedures it uses to control their original implementation.

Definitions

Preliminary suitability analysis

Preliminary suitability analysis shall be used by the licensee to verify that a component is suitable for its intended location of use on the basis of its rated values. The qualification of the component is also inspected and designed. After the preliminary suitability analysis the requirement specification of the component is verified, and the procurement of the component may be started, if necessary.

Essential accident instrumentation

Essential accident instrumentation shall refer to measurement indications and status indications needed to guide a nuclear facility into and maintaining it in a controlled state, whereby the implementation of safety functions is confirmed in the manner required by the accident and disturbance instructions. Furthermore, essential accident instrumentation includes the containment dose rate measurements and radioactivity or dose rate measurements of off-gas emissions that have been put in place to prepare for accidents. Essential accident instrumentation comprises all equipment in the communication chain from the sensor to the monitor.

Contamination

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

Decommissioning

Decommissioning shall refer to the dismantling of a permanently closed nuclear facility so that no special measures are required at the facility site due to radioactive materials originating from the dismantled facility.

Final suitability analysis

Final suitability analysis shall refer to the licensee's assessment to demonstrate (validate) that a component meets its rated values. This can be achieved by means of type approval and testing, quality control procedures, and operating experience.

Normal operation (DBC 1)

Normal operation (DBC 1) shall refer to the planned operation of a nuclear power plant according to the Operational Limits and Conditions and operational procedures in place. These also include testing, plant start-up and shutdown, maintenance and refuelling. As far as other nuclear facilities are concerned, normal operation shall refer to similar plant operation.

Accident

Accident shall refer to postulated accidents, design extension conditions and severe accidents. (Government Decree 717/2013)

Internal contamination

Internal contamination shall refer to radioactive substances inside the body.

Laboratory approved by STUK

Laboratory approved by STUK shall refer to a laboratory whose calibration can be used to demonstrate the traceability of measurements into the international measurement system. Traceability shall, in this context, refer to the connection between a measurement result on the meter and the measurement standards through an uninterrupted chain of comparisons where uncertainties have been reported for each comparison.

Calibration of a radiation meter

Calibration of a radiation meter shall refer to a procedure whereby known kinds of radiation (radiation types and radiation energies) are used to determine the connection between the indication of a meter and the actual value of the radiation variable.

Safety-classified system/structure/component

Safety-classified system/structure /component shall refer to a system, structure or component assigned to safety classes on the basis of its safety significance.

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.

Site area

Site area shall refer to an area in use by nuclear power plant units and other nuclear facilities in the same area, and to the surrounding area, where movement and stay are restricted by the Decree of the Ministry of the Interior issued under Section 52 of the Police Act (493/1995). (Government Decree 716/2013)

Nuclear facility

Nuclear facility shall refer to facilities used for the generation of nuclear energy, including research reactors, facilities implementing the large-scale final disposal of nuclear waste, and facilities used for the large-scale production, generation, use, processing or storage of nuclear material or nuclear waste. However, nuclear facility shall not refer to:

a. mines or milling facilities intended for the production of uranium or thorium, or premises and locations with their areas where nuclear waste from such facilities is stored or located for final disposal; or
b. premises finally closed and where nuclear waste has been placed in a manner approved as permanent by the Radiation and Nuclear Safety Authority. (Nuclear Energy Act 990/1987, Section 3)

Nuclear power plant

Nuclear power plant shall refer to a nuclear facility for the purpose of electricity or heat production, equipped with a nuclear reactor, or a complex consisting of nuclear power plant units and other related nuclear facilities located at the same plant site. (Nuclear Energy Act 990/1987)

Single failure

Single failure shall refer to a failure due to which a system, component or structure fails to deliver the required performance.

References

1. Nuclear Energy Act (990/1987).
2. Nuclear Energy Decree (161/1988).
3. Government Decree on the Safety of Nuclear Power Plants (717/2013).
4. Government Decree on the Safety Disposal of Nuclear Waste (736/2008).
5. Radiation Act (592/1991).
6. Radiation Decree (1512/1991).
7. Council Directive 96/29/Euratom, 1996.
8. Radiation Protection Aspects of Design for Nuclear Power Plants, Safety Guide, Safety Standards Series No. NS-G-1.13, IAEA, 2005.
9. IEC 60532:2010, Radiation protection instrumentation – Installed dose ratemeters, warning assemblies and monitors – X and gamma radiation of energy between 50 keV and 7 MeV.
10. IEC 60761-1:2002, Equipment for continuous monitoring of radioactivity in gaseous effluents – Parts 1–5.
11. IEC 60768:2009, Nuclear power plants – Instrumentation important to safety – Equipment for continuous in-line or on-line monitoring of radioactivity in process streams for normal and incident conditions.
12. IEC 60846-1:2009, Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation – Part 1: Portable workplace and environmental meters and monitors.
13. IEC 60846-2:2007, Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation – Part 2: High range beta and photon dose and dose rate portable instruments for emergency radiation protection purposes.
14. IEC 60880:2006, Instrumentation and control systems important to safety – Software aspects for computer-based systems performing category A functions.
15. IEC 61017-1:1991, Portable, transportable or installed X or gamma radiation ratemeters for environmental monitoring – Part 1: Ratemeters.

16. IEC 61017-2:1994, Radiation protection instrumentation – Portable, transportable or installed equipment to measure X or gamma radiation for environmental monitoring – Part 2: Integrating assemblies.
17. IEC 61018:1991, High range beta and photon dose and dose rate portable instruments for emergency radiation protection purposes.
18. IEC 61031:1990, Design, location and application criteria for installed area gamma radiation dose rate monitoring equipment for use in nuclear power plants during normal operation and anticipated operational occurrences.
19. IEC 60951:2009, Nuclear power plants – Instrumentation important to safety – Radiation monitoring for accident and post-accident conditions – Parts 1–4.
20. IEC 61559-1:2009, Radiation protection instrumentation in nuclear facilities – Centralized systems for continuous monitoring of radiation and/or levels of radioactivity – Part 1: General requirements.
21. IEC 61559-2:2002, Radiation in nuclear facilities – Centralized systems for continuous monitoring of radiation and/or levels of radioactivity – Part 2: Requirements for discharge, environmental, accident, or post-accident monitoring functions.
22. IEC 60325:2002, Radiation protection instrumentation – Alpha, beta and alpha/beta (beta energy >60 keV) contamination meters and monitors.
23. IEC 61098:2003, Radiation protection instrumentation – Installed personnel surface contamination monitoring assemblies.
24. IEC 61256:1996, Radiation protection instrumentation – Installed monitors for the detection of radioactive contamination of laundry.
25. IEC 61031:1990, Design, location and application criteria for installed area gamma radiation dose rate monitoring equipment for use in nuclear power plants during normal operation and anticipated operational occurrences.
26. IEC 62302:2007, Radiation protection instrumentation – Equipment for sampling and monitoring radioactive noble gases.
27. IEC 62363:2008, Radiation protection instrumentation – Portable photon contamination meters and monitors.
28. IEC/TR 62461:2006, Radiation protection instrumentation – Determination of uncertainty in measurement.
29. ISO/IEC-EN 17025:2005, Competence of testing and calibration laboratories. General requirements.
30. SFS-EN ISO/IEC 17065:2012, Conformity assessment. Requirements for bodies certifying products, processes and services.