Decree of the Nuclear Regulatory Authority of the Slovak Republic No. 430/ 2011 Coll. as amended by Decree No. 103/2016 Coll. on nuclear safety requirements (consolidated version)

The Nuclear Regulatory Authority of the Slovak Republic (herein referred to as the "Authority"), pursuant to Section 23 (5) of the Act No. 541/2004 Coll. on the peaceful use of nuclear energy (the Atomic Act) and on the Amendments and Supplements to certain Acts as amended by Act No. 350/2011 Coll. (hereinafter referred to as the **"**Act**"**), lays down as follows

Section 1

Subject of the Decree

(1) This decree lays down the details on nuclear safety requirements for nuclear installations.

(2) The nuclear safety requirements for nuclear installations shall be fulfilled at the stages of siting, design, construction, putting into operation (hereinafter referred to as the "commissioning"), operation, decommissioning and during the stage of repository closure.

(3) The nuclear safety requirements for nuclear installations also include criteria for the categorisation of classified equipment into safety classes.

(4) This decree also regulates the details on assessment of the scope, content and impacts of modifications, details on evaluation, documenting, feedback scope, the scope and content of probabilistic assessment of nuclear safety, and details on monitored indicators and nuclear safety parameters.

Section 2

Definitions

For the purposes of this decree

a) An abnormal operation shall mean an operating condition differing from normal operation, the occurrence of which is to be expected at least once during the operating lifetime of an installation but which, in view of the corresponding design provisions, neither causes any significant damage to items important to nuclear safety, nor will it lead to accident conditions,

b) safety group shall mean an assembly of equipment designated to perform all actions required for a postulated initiating event to ensure that the limits specified in the assignment for the design basis are not exceeded,

c) safety system shall mean a system providing for the safe shutdown of the nuclear reactor or the heat removal from the reactor core or for the limitation of the consequences of abnormal operation and design basis accidents,

d) decommissioning stage shall mean the chronologically and materially defined period of decommissioning of a nuclear installation or part of it with a clearly defined initial and end states,

e) accident conditions shall mean deviations from normal operation that are less frequent but more severe than abnormal operation, and comprise design basis accidents and design extension conditions,

f) nuclear reactor shall mean an installation which, in mutual cooperation with support systems, uses nuclear energy as a source for other forms of energy making it possible to use nuclear installations pursuant to Section 2 (f) (1) of the Act for the purpose for which they were constructed,

g) conservative approach to the provision of nuclear safety shall mean an approach leading to pessimistic results in relation to the specified acceptance criteria,

h) fail-safe criterion shall mean the ability of a failed component or system to go to a safe state without the need to initiate any actions,

i) single failure criterion shall mean that a single component or system must be capable to perform its task in the presence of any single failure that can result in the loss of capability of a single component or system to perform its intended safety functions and any consequential failures which might result from it,

j) qualification shall mean confirmation that classified equipment is capable of fulfilling, throughout its design service life, the requirements for performing its functions, while taking account of the effect of service conditions during the period of its usage, while the service conditions shall include anticipated changes in operation, with respect to ageing, wear and tear and the impact of events,

k) safe state shall mean plant state, following an anticipated operational occurrence or accident conditions, in which the reactor is subcritical and the fundamental safety functions can be ensured and maintained stable for a long time,

l) design extension conditions shall mean an event (postulated accident conditions) that is (are) not considered for design basis accidents, but that is (are) considered in the design process of the nuclear facility in accordance with best estimate methodology, and for which releases of radioactive material do not exceed the established limits; these conditions can be

1. without severe degradation of nuclear fuel,

2. with melting of nuclear fuel.

m) normal operation shall mean operation within specified operational limits and conditions,

n) graded approach shall mean gradation of requirements for functionality, reliability, resistance to the environment and ageing and quality assurance of classified equipment to be applied is commensurate with equipment importance with regard to nuclear safety and also with regard to consequences of equipment failure, taking account of the scope of testing and maintenance,

o) defence in depth means a system of multiple physical barriers preventing the propagation of ionising radiation and radioactive substances into the working environment or the environment with the repeated use of technical and organisational measures to protect and maintain the effectiveness of such barriers and also to protect people and the environment,

p) common cause failure shall mean failures of two or more structures, systems or components due to a single specific event or cause ,

q) postulated initiating event shall mean an event taken into consideration in design as capable of leading to the state of abnormal operation or accident conditions with the exception of severe accidents,

r) design shall mean a unique process with the outcomes in a form of design documentation, requirements, documents, records, plans, drawings, analyses or calculations comprising coordinated or managed activities performed in order to achieve set objective, in accordance with defined specifications for nuclear installation or its parts, including restrictions in a form of time, costs and resources,

s) design basis accident shall mean accident conditions for which operation of the nuclear installation is designed and for which damage to the nuclear installation and the releases of radioactive substances to the environment do not exceed the established limits,[1]

t) control system shall mean a system providing control of technological equipment of the nuclear installation during steady and transient state; its objective is to transfer the technological equipment from one controlled state to another,

u) seismic level 1 shall mean maximum calculated earthquake that can strike the particular site once in 100 years and after which the nuclear installation can be brought back to operation,

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[1]) Sec. 2 (2) (f) of the Act No. 355/2007 on the protection, support and development of public health, and on changes and amendments to some acts.
Annex 10 to the Order of the Government of the Slovak Republic No. 345/2006 Coll. on basic safety requirements for the protection of health of workers and the population from ionizing radiation.

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v) seismic level 2 shall mean maximum calculated earthquake that can strike the particular site once in 10 000 years and in which case it still shall be possible to shutdown the nuclear installation and bring it to a safe state,

w) plant states of nuclear installation considered in the design of the nuclear installation shall mean

1. normal operation,

2. abnormal operation or

3. accidents conditions,

x) a severe accident shall mean a state of nuclear installation involving an event with melting of nuclear fuel that requires implementation of protective actions to protect the public.

Section 3

Categorisation of classified equipment into safety classes

(1) Classified equipment shall be identified and then based on their functions and their safety significance, categorised into safety classes I through IV. For categorisation of classified equipment the graded approach shall be used, so that Class I comprises classified equipment for which there are the most stringent requirements for reliability, qualification, quality assurance, frequency and scope of inspections and related documentation. Classified equipment shall be designed, constructed, manufactured, operated and maintained so that their quality and reliability are adequate to their categorisation.

(2) Categorisation pursuant to Paragraph 1 shall be carried out for every nuclear installation so as to produce

a) preliminary list of classified equipment which, at the level of design elaboration for construction proceedings, identifies individual classified equipment and its auxiliary systems and subsystems, indicating their safety functions and assignment to safety classes pursuant to Annex No. 1; classified equipment of instrumentation and control system is identified and subsequently categorised also according to relevant technical standards,

b) list of classified equipment, which

1. precisely identifies individual classified equipment and its auxiliary systems and subsystems, indicating their safety functions and assignment to safety classes pursuant to Annex No. 1, classified equipment of instrumentation and control system is identified and subsequently categorised also according to relevant technical standards,

2. comprises text and graphic sections, clearly defining the boundaries of a classified equipment or system and interface between classes, need for emergency power supply, the availability or unavailability status of systems serving the safety functions to be considered in deterministic safety analyses and the applicable quality requirements, including respective computer codes and standards for designing, manufacturing, assembly and inspection.

(3) Categorisation of classified equipment shall

a) be primarily based on deterministic methods and if necessary, also probability methods and engineering judgement may be used, with regard to

1. the safety functions to be performed by the item,
2. the consequences of failure to perform a safety function,
3. probability that during the equipment failure there is a demand for performing its function,
4. duration of postulated initiating event during which there may be demand for performing the function,

b) identify, in graded manner, for every safety class

1. a need of emergency power supply,
2. requirements for a qualification procedure to qualify the equipment for service environment,

3. the availability or unavailability status of systems serving safety functions to be considered in deterministic safety analyses,
4. quality requirements applicable to classified equipment,
5. the appropriate codes and standards in design, manufacturing, construction, assembly, testing and inspection.

(4) Classified equipment forming a boundary between different safety classes within the safety system shall be assigned to a safety class with a lower sequence number, to ensure conservative approach.

(5) The procedure pursuant to Paragraph 4 may also be used for categorisation of classified equipment that is not equipped with sufficient monitoring systems, when reliable separation of the items is not possible, the items do not sufficiently meet the requirements for redundancy or resistance to common cause failure.

(6) Verification of proposed categorisation shall be carried out on the basis of
a) the design basis,
b) a probabilistic method focused on corresponding equipment,
c) the postulated initiating events for safety functions,
d) a selected conservative approach if there is a deviation in outputs between probabilistic methods and deterministic approach.

(7) Reassessment of the list of classified equipment shall be performed during periodic safety review of nuclear installation, as well as in proposals for modifications pursuant to Section 2 (v) and (w) of the Act.

(8) Failure of classified equipment in any safety class shall not cause failure of classified equipment assigned to a safety class with a lower sequence number. Auxiliary systems and subsystems that support classified equipment function shall be assigned to appropriate safety class with regard to the assignment of the related or the parent system.

Section 4

Requirements for nuclear safety of nuclear installations during siting

(1) During siting process of the nuclear installation assessment of geological and seismic loading of a selected site shall be elaborated and it shall include

a) the probabilistic analysis of seismic threat to the site,
b) the assessment of seismic and geological conditions in the region and of engineering-geological aspects and geo-technical aspects of the proposed site
c) the determination of a threat related to earthquakes, by means of seismic-tectonic assessment of the region using the widest possible range of gathered information,
d) the assessment of a threat due to earthquake induced ground motions taking into account the seismic-tectonic characteristics of the region and site specific conditions,
e) the analysis of uncertainties as a part of seismic threat assessment,
f) the assessment of an impact of the potential for surface fault displacement at the site,
g) the review of geological, geophysical and seismological characteristics of the region regardless the state borders and geotechnical characteristics of the site in accordance with the international practice, performed so that the acquired database shall be homogeneous for the entire region or shall be at least such to allow sufficient characterization of seismic-tectonic structures for the site and the size of region examined; the gathered information type and the scope and details of the review were determined by the nature and complexity of the seismic-tectonic conditions,
h) the demonstration of sufficiency of the scope and detail of the gathered information and performed investigation for determination of threats due to seismic movement and fault displacements.

(2) Regardless the results of analyses carried out pursuant to Paragraph 1 the minimum level of seismic loading of the site determined for siting of the nuclear installation shall be represented by a horizontal free field standardized response spectrum corresponding to peak ground acceleration value equal to 0.1g.
(3) The requirements for nuclear safety of nuclear installations during the siting stage are also characterised by area features which preclude the siting of nuclear installations in that area and are listed in Annex No. 2.

Section 5

Requirements for nuclear safety of nuclear installations during design

(1) The requirements for nuclear safety of nuclear installations during design comprise general requirements for the design of the nuclear installation, special requirements for the design of the nuclear installation with a nuclear reactor and special requirements for the design of a repository site.

(2) The requirements pursuant to Paragraph 1 are listed in Annex No. 3.

Section 6

Requirements for nuclear safety of nuclear installations during construction, commissioning, operation, decommissioning and in the case of repository including its closure

(1) Nuclear safety during the construction of nuclear installations, their commissioning, operation, decommissioning and, in the case of repository including closure of it shall be subject to fulfilment of the general requirements for nuclear installations, special requirements for nuclear installations with nuclear reactors and special requirements for nuclear installations pursuant to Section 2 (f) (2) to (5) of the Act.

(2) The requirements for nuclear safety pursuant to Paragraph 1 are listed in Annex No. 4.

Section 7

Transitional provision

Categorisation of classified equipment into safety classes pursuant to Section 3 shall, in case of nuclear installations that are in construction at this decree's effective date, be subject to the existing decree until 31 December 2014.

Section 8

Repealing provision

Decree of the Nuclear Regulatory Authority of the Slovak Republic No. 50/2006 Coll. laying down details on requirements for nuclear safety of nuclear installations during siting, design, construction, commissioning, operation, decommissioning, and during repository closure, as well as criteria for categorisation of classified equipment into safety classes, shall be repealed.

Section 9

This Decree has been adopted in accordance with a legally binding act of the European Union in the area of technical standards and technical regulations.[3])

Section 10

Entry into force

This decree shall enter into force on 1st January 2012.

Marta Žiaková, m. p.

[3]) European Parliament and Council Directive 98/34/EC as of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations, as well as rules relating to information society services (Special release i (Special issue of O.J. of EU, Chapter 13, Volume 20, as amended.

Annex No. 1
to the Decree No. 430/2011 Coll.

CRITERIA FOR THE CATEGORISATION OF CLASSIFIED EQUIPMENT

I **Classified equipment assigned to safety class I** shall be equipment forming the boundary of a cooling circuit of a nuclear reactor, except the equipment whose damage can be compensated by a normal system of coolant make up.

II **Classified equipment assigned to safety class II** shall be equipment

a) forming the boundary of a cooling circuit of a nuclear reactor not included in safety class I,

b) for shutting down a nuclear reactor in states of abnormal operation, which might result in accident conditions, and for shutting down the nuclear reactor in order to mitigate the consequences of accident conditions,

c) for maintaining sufficient inventory of coolant to cool the core of the nuclear reactor under accident conditions, under and after which there is no failure of the cooling circuit of the nuclear reactor,

d) determined by the design as basic systems for management of the event requiring heat removal from the core of the nuclear reactor when the cooling circuit in the nuclear reactor has failed, with the aim to limit damage to the fuel,

e) determined by the design as basic systems for management of the event requiring residual heat removal in normal operation, abnormal operation and under accident conditions when there has been no failure of the integrity of the cooling circuit in the nuclear reactor,

f) for preventing releases of radioactive substances from nuclear fuel to the environment,

g) essential for limiting releases of radioactive substances from irradiated fuel from the containment under and after accident conditions,

h) determined for limiting the penetration of ionising radiation outside the containment under and after accident conditions,

i) essential with respect to performing safety functions for the supply of energy or for controlling other components assigned to safety class I or II and intended for operation in the environment that arises after the accident with a loss of coolant from the cooling circuit of the nuclear reactor or following the accident with rupture of high energy pipeline,

j) intended for the shipment of spent nuclear fuel,

k) for preventing releases of radioactive substances to the environment.

III **Classified equipment assigned to safety class III** shall be equipment

a) for preventing inadmissible transition process associated with reactivity changes,

b) for maintaining the nuclear reactor in safe shutdown conditions following each shutdown,

c) for maintaining sufficient inventory of coolant to cool the core of the nuclear reactor during normal operation and abnormal operation,

d) for heat removal from safety systems up to the first storage volume sufficient for the performance of safety functions, except the basic heat removal systems assigned to safety class II, Letters d) and e),

e) essential for maintaining the irradiation of the population and employees of nuclear installations below the established limits under accident conditions associated with the release of radioactive substances or ionising radiation from sources outside the containment, and even after the accident conditions have elapsed,

f) essential for maintaining the environmental conditions inside the nuclear installation required for the operation of safety systems and for access for employees to carry out activities of important to nuclear safety,

g) for preventing radioactive releases from irradiated fuel being stored in the operation area of nuclear installations in normal operation and abnormal operation,

h) for residual heat removal from irradiated fuel stored in the operation area of nuclear installations,

i) essential for maintaining adequate subcriticality of nuclear fuel stored in the operation area of nuclear installations,

j) essential with respect to performing safety functions for the supply of energy or for controlling other components not assigned to safety class II,

k) essential with respect to performing safety functions to safeguard the functional capabilities of other components categorised to safety classes I to III, which do not relate to instrumentation and control systems or energy supplies,

l) determined for management of nuclear materials, radioactive wastes and spent nuclear fuel,

m) determined for the shipment of nuclear materials and radioactive waste in type B (U), B (M) and C consignments,

n) essential for limiting the discharge or releases of solid, liquid or gaseous radioactive substances and ionising radiation during the normal operation and the abnormal operation.

IV **Classified equipment assigned to safety class IV** shall be equipment intended to prevent or mitigate the consequences of failures of other equipment assigned to safety classes I to III.

Annex No. 2
to the Decree No. 430/2011 Coll.

AREA FEATURES WHICH EXCLUDE ITS USE FOR THE SITING OF NUCLEAR INSTALLATIONS

Area features which exclude its use for the siting of nuclear installations shall be as follows:

a) during operation, abnormal operation or in the event of a nuclear or radiological emergency, it is not possible to ensure in the area

   1. to keep of population established irradiation[1]) doses and set level of noise and vibrations affecting people, and also on the surrounding lands and construction sites,[4])
   2. protection of life, health and property against consequences of extraordinary events,[5])
   3. protection against harmful effects of extreme weather conditions and floods on nuclear installation,[6])

b) the area is threatened by landslide or in break, irruptions of mine water or powerful tremors resulting from mining activities, extraction of gas or oil or there are reserves of groundwater supply on it ,

c) in the area there are geodynamic and karst phenomena threatening the stability of the rock mass, such as caving, motion ally and seismically active faults, fluidification of the soils, tectonic activity or other phenomena, which may alter the inclination of the surface of the environs beyond the established technological requirements,

d) the area contains protective zones for natural medicinal sources and natural mineral sources, areas with climatic conditions for treatments, spa place and spa area,[7]) underground and surface sources of drinking water,

e) in the area are placed notified mining premises for the extraction of raw materials,

f) the area extends into a protective zone for industrial or other economic structures with which there may be undesirable operational clashes,

g) population density and distribution in the area make non effective use of emergency preparedness measures possible,

h) in the area it is not possible to assure sufficient safe and reliable power out-put of the capacity of planned and installed power transmission capacity,

i) in case of repository, it is the existing high or difficult to predict risk arising from external events and human activity-induced events, or if the development of such events cannot be reliably predicted over the designed service life.

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[4]) Section 16 and 20 of the Decree of Ministry of Environment of the Slovak Republic No. 532/2002 Coll. laying down detail on general technical requirements for construction and on general technical requirements for structures used by persons with limited movement and orientation abilities.
[5]) Act of the National Council of the Slovak Republic No. 42/1994 Coll. on civil protection as amended.
[6]) Section 48 of the Act No. 50/1976 Coll. on territorial planning and the building code (the Building Act) as amended.
Section 3 (4) (i) of the Decree of Ministry of Environment of the Slovak Republic No. 453/2000 Coll. implementing certain provisions of the Building Act.

[7]) Section 26, 30 and 35 of the Act No. 538/2005 Coll. on natural healing waters, natural healing spas, spa sites and natural mineral water and on amendments to certain acts as amended.

Annex No. 3
to the Decree No. 430/2011 Coll.

REQUIREMENTS FOR NUCLEAR SAFETY OF NUCLEAR INSTALLATIONS DURING DESIGN

PART A

LIST OF REQUIREMENTS

I. General requirements for the design of nuclear installation

A. Basic requirements for nuclear safety

B. Approach to nuclear safety, safety functions and safety characteristics

C. Defence in depth

D. Proven engineering practices and operational experience

E. Research findings in the field of nuclear safety

F. Accidents considered in the design

G. Radiation protection, ventilation systems and filtration systems

H. Prevention of the occurrence and development of equipment failures

I. Fire protection

J. Protection against external phenomena

K. Control rooms

L. Safety and I&C systems

M. Electric power supply systems

N. Heat removal

O. Monitoring installation during the operational state

II. Special requirements for the design of nuclear installation with nuclear reactor

A. Primary circuit, pressure vessel and core of nuclear reactor

B. Primary circuit coolant and cleaning coolant system

C. Nuclear reactor core cooling system

D. Containment system

E. Safety and severe accident analyses

F. Fire protection

G. Emergency response and control centre

H. Safety systems

I. Electric power supply system

III. Special requirements for repository design

PART B

CONTENT OF REQUIREMENTS

I. General requirements for the design of nuclear installation

A. Basic requirements for nuclear safety

The design shall

1) comply with the assignment and meet the requirements of the supervisory authorities,

2) take account of the requirements of the authorisation holder, including all standardised technical conditions, in particular with respect to observance of nuclear safety and operating reliability,

3) comply with the technical specifications and safety analysis; ensure that all systems, structures and components, including software, are designed so that their quality and reliability corresponds to their safety categorisation,

4) meet the requirements of the appropriate quality assurance programme,

5) take account of the impact of every design modification on nuclear safety,

6) ensure that all systems, structures and components have properties which guarantee the safe operation of the nuclear installation over its entire design lifetime, the prevention of events and protection of the health of persons in the nuclear installation, the population and the environment,

7) categorise every proposed modification of systems, structures and components important to nuclear safety in accordance with its safety significance,

8) ensure that the production of radioactive waste, with respect to activity and quantity, is kept to as low as reasonably achievable level,

9) include proposed measures to provide an adequate level of safety for protection against seismic events, including adequate justification of the input data used to establish the level of seismic resistance,

10) include a set of design limitations in accordance with the major technical parameters of each system, structure or component for normal operation, abnormal operation and design basis accidents,

11) ensure that the nuclear installation can be safely operated within a defined set of parameters and that, for safety systems, a sufficient set of classified auxiliary systems for ensuring of all safety functions performed by safety systems is constantly available,

12) include a list of relevant postulated initiating events, their categorisation according to the frequency of possible occurrence and the acceptance criteria for the assessment of processes arising after these events,

13) include appropriate limits for systems, structures and components importance to nuclear safety taking into account the mechanism of ageing and wear-out in normal operation, abnormal operation and design basis accidents,

14) ensure that systems that could contain nuclear materials or radioactive substances guarantee adequate safety in normal operation, abnormal operation and design basis accidents,

15) include requirements for equipment qualification,

16) establish a set of limits and conditions; justify in writing the need for and wording of each limit or condition,

17) include principles for the development of commissioning programmes and inspection, test and maintenance programmes that demonstrate the nuclear installation meets the design objectives and complies with safety requirements and the requirements for the quality of the nuclear installation,

18) demonstrate that buildings and equipment important to nuclear safety that are to be shared by several parts of the nuclear installation do not affect its safe operation; when an event occurs on one part of the nuclear installation, the functioning of the other parts shall not be threatened,

19) include a requirement for implementation of pre-operational monitoring of the radiation situation in the area of the nuclear installation and its surroundings,

20) include a requirement for repeated assessment of nuclear safety and at the same time its scope and level shall be expanded in accordance with the design stages; assessment of nuclear safety shall confirm that the design documentation meets the safety requirements in the assignment for the design,

21) make use, for assessment of safety, data derived from safety analyses, previous operational experience, the results of research and proven design procedures,

22) specify rules for the planning and design of systems, structures and components; the rules shall be in accordance with the relevant technical regulations or with the technical standards that are established in the country of the customer of the design or equipment for the nuclear installation, or are used internationally, if applicable,

23) include a requirement for the submission of an independent verification of the safety assessment and binding opinions of the supervisory bodies involved prior to the submission of the design for assessment by the

Authority; the safety assessment shall be performed by legal persons or natural persons independent of those who have prepared the design,

24) include supervisory rules for monitoring and on-going documentation of compliance with all technical requirements for the design of the nuclear installation, including significant deviations from the original design, by the authorisation holder during the construction of the nuclear installation,

25) take account, through design characteristics, the planned decommissioning, considering assumed levels of contamination and activation of the nuclear installation at the end of operation.

B. Approach to nuclear safety, safety functions and safety characteristics

1) The safety approach shall ensure sufficient resources to keep the nuclear installation in operation, provide the appropriate prompt response following a postulated initiating event and simplify control of the nuclear installation for all postulated initiating events considered in the design, in and after them, and also under design extension conditions.

2) The design shall retain a systematic approach to the identification of systems, structures and components needed to fulfil the safety functions at different times following postulated initiating events.

3) The design shall be produced so that its sensitivity to a postulated initiating event is minimised. The expected response of the nuclear installation to each postulated initiating event shall be the one of the following which can reasonably be achieved in order of importance

a) the postulated initiating event does not cause any significant effect relating to safety or causes just a change in the nuclear installation leading to a new safe state by means of inherent characteristics,

b) following the postulated initiating event, the nuclear installation remains in safe state owing to passive safety characteristics or through the action of safety systems, which are constantly operational and brought into action as a reaction to the postulated initiating event,

c) following the postulated initiating event the nuclear installation is brought into a safe state using specified procedural actions.

4) Fulfilment of the requirements pursuant to paragraphs 1 and 3 shall be documented in the design by deterministic or possibly probabilistic safety analyses.

5) In order to ensure safety during commissioning, normal operation, events pursuant to Section 2 letters (q) and (s), abnormal operation, design-basis accidents and, to an appropriate extent, also during selected severe accidents, the design of a nuclear installation shall fulfil the following fundamental safety functions:

a) control of reactivity,

b) heat removal,

c) confinement of radioactive substances[8]) inside physical barriers,

d) control and limitation of the amount and type of radioactive substances released into the environment.

C. Defence in depth

(3) Defence in depth is divided into five levels, with the objective of

a) the first level of protection is to prevent a state of abnormal operation and system failures,

[8]) Section 2 (2) (q) of the Act No. 355/2007 Coll.

b) the second level of protection is to identify and limit the development of states of abnormal operation so as to prevent their escalation to accident conditions,
c) the third level of protection is to manage design basis accidents so that stable and acceptable conditions are achieved following such events,
d) the fourth level of protection is to manage design extension conditions, prevent their further progression and keep releases of radioactive substances to the minimum possible level; in case of design extension conditions with melting of nuclear fuel, to mitigate their consequences,
e) the fifth level of protection is to mitigate the radiological consequences of significant releases of radioactive substances or ionising radiation arising as a result of accident conditions.

(4) defence in depth shall be included in the design of the nuclear installation in such a way that the design shall

a) use a conservative approach to ensure nuclear safety with the aim of limiting the occurrence of operational events,
b) provide multiple physical barriers against the release of radioactive substances into the work environment and also into the environment,
c) provide multiple facilities to perform safety functions, by ensuring the effectiveness of physical barriers and mitigating the consequences of their failure,
d) apart from inherent safety characteristics, also include reliable technical facilities to ensure safety,
e) include preventive measures against the occurrence of operational events, to overcome them and moderate the consequences of them using systems, structures and components and also operating procedures,
f) provide for supplementary control of the nuclear installation by means of the automatic operation of safety systems and interventions by classified and professionally qualified employees.

(5) As regards the design of defence in depth, the design of the nuclear installation must prevent the following with a high degree of probability:

a) challenges to the integrity of physical barriers, except for the action of interlock facilities
b) failure of physical barriers when they are required to operate,
c) failure of a barrier as a result of the failure of another physical barrier.

(6) The design shall take account of the fact that the existence of multiple levels of defence in depth protection is not sufficient to ensure continuation of nuclear installation operation if one level of protection is inoperative. Allowed duration of unavailability of barriers may be defined for different operational states.

D. Proven engineering practices and operational experience

1) Systems, structures and components shall be designed in accordance with the relevant technical standards, their design shall be proven with similar previous applications and shall be selected so as to meet the reliability objectives of the nuclear installation in terms of nuclear safety.

2) The design of a nuclear installation shall take account of operational experience from similar nuclear installations.

E. Research findings in the field of nuclear safety

1) The design of a nuclear installation shall take account of the available results of research programmes. If an unproven design is introduced or unproven functions are introduced, research programmes or reviews of operational experience from similar applications shall be used to demonstrate the use of a sufficiently conservative approach to ensure nuclear

safety. New solutions shall be tested prior to commissioning and monitored during operation.

2) The design of a nuclear installation shall take account of operational experience from similar nuclear installations. If it is impossible to exclude the failure of systems, structures or components, priority shall be given to installations which are characterised by a predictable mode of failure and which facilitate repair or replacement.

F. Accidents considered in the design

1) The design shall include a list of design basis accidents, which shall be derived from the list of postulated initiating events, for the purpose of establishing the boundary conditions according to which the systems, structures and components important to safety shall be designed.
2) The design shall include measures for the automatic actuation of the actions of the required safety system, if a prompt and reliable reaction to a postulated initiating event is needed, in order to prevent transition to more severe conditions, which might threaten the next level of defence in depth.
3) The design shall allow for the manual actuation of systems or other interventions by licensed staff needed for diagnosis of the state of the nuclear installation and to bring it timely into a stable long term shutdown conditions provided that the need for intervention is detected in a timely manner and there are defined procedures to ensure the reliability of such interventions while adequate instrumentation for monitoring the state of the nuclear installation and controls for manual control of these systems shall be available.

G. Radiation protection, ventilation systems and filtration systems

1) The design of the nuclear installation shall respect and adhere to the principles and requirements for ensuring radiation protection of employees, the population and the environment and their on-going and emergency monitoring.[9])
2) Equipment coming into contact with radioactive substances shall be designed, located and shielded so that the risk of irradiation of persons in the nuclear installation in all operational states is as low as reasonably achievable, taking account of the technical, economic and social factors, and so that the irradiation is lower than the established limits.[1])
3) The design shall include technical safety measures and procedures for monitoring and mitigation1 of potential radiological consequences.
4) The design shall ensure that operational states that can result in high doses of radiation or the release of radioactive substances have a very low frequency of occurrence and operational states with a significant frequency of occurrence have either negligible or no potential radiological consequences.
5) The design shall be developed so that

a) it includes appropriate facilities for warning the population and informing people in the area of the nuclear installation and in the emergency planning zone during incidents and accidents,
b) it includes clearly marked escape routes with emergency lighting, ventilation and other systems and equipment essential for the safe use of such routes,
c) it includes ventilation and filtration systems which, during normal operation, abnormal operation and also in accident conditions
1. reduce the volume activity of radioactive substances in designated areas in accordance with the requirements for access to such areas,
2. prevent the dispersion and uncontrolled releases of gaseous radioactive substances and aerosols into designated areas and reduce the volume activity below the established values,
3. in designated areas, provide a suitable working environment,
4. keep releases of radioactive substances into the environment below the established limits,[1])
d) in areas where the systems, structures and components which contain radioactive substances are located, the specific and total values of activity and irradiation of persons in a nuclear installation are as low as reasonably achievable by using technical and organisational measures,

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[9]) Section 16 (7) of the Act of National Council of the Slovak Republic No. 42/1994 Coll. on civil protection of population in wording of Act No. 117/1998 Coll.

Section 4 (1) of Decree of Ministry of Interior of the Slovak Republic No. 533/2006 Coll. on details on population protection from effects of dangerous substances.

e) the filters used have the required reliability and efficiency of retention and tests of their efficiency are possible,
f) equipment important to nuclear safety are backed up and ventilation systems can continue to operate also in the presence of a single failure,
g) systematic monitoring of parameters important for the assessment of the radiation situation, irradiation of persons in the nuclear installation and the population in normal and abnormal operations and also under accident conditions is provided.

H. Prevention of the occurrence and development of equipment failures

1) The design shall take account of measures to prevent the occurrence and development of failures. In the event of a malfunction or failure of a system important to nuclear safety, the redundant equipment which takes over its function shall meet the fail-safe criterion and the single failure criterion.
2) The fail-safe criterion is required for equipment important to nuclear safety wherever practicable.
3) The single failure criterion shall be applied in the design of a nuclear installation in each safety group. A safety group satisfies the single failure criterion if it is shown that it performs its safety function in the following cases:
    a. the occurrence of all the potential unfavourable consequences of a postulated initiating event on a given safety group is expected,
    b. the worst possible allowed configuration of the safety systems, taking account of maintenance, functional testing, in-service inspections and repairs is considered.
4) Non-compliance with the single failure criterion is acceptable in exceptional cases and shall be justified in the safety analysis.
5) In equipment important to nuclear safety, if there is a possibility of common-cause failures, the principles of diversity, redundancy and independence shall be applied to achieve the required reliability.
6) The design shall provide for appropriate preventive and mitigating measures against potential flooding, fire, explosion, missile generation and pipe whip, the effect of media flow or the release of liquids from failed systems, structures and components, or from other equipment in the nuclear installation.
7) The design shall give consideration to the action of external postulated initiating events, which can initiate internal fire or flooding and may result in missile generation. This simultaneous action of external and internal events shall be included in the design.
8) Interfaces between systems, structures and components in different safety classes shall be designed so that to ensure that any failure in the equipment categorised in a lower class is not propagated into equipment categorised in a higher class.
9) The design shall include analyses of the designed installation response to postulated initiating events, including equipment failures or human errors, so as to identify all internal events which can affect nuclear safety. All consequential effects shall be considered to be part of the original postulated initiating event.
10) The design shall include the effect of various combinations of individual random events which can result in abnormal operation or accident conditions.

I. Fire protection

1. For every nuclear installation a fire hazard analysis or other fire hazard review shall be elaborated and regularly updated, which also includes an assessment of potential effect of the fire on nuclear safety.
2. Based on the analysis pursuant to Paragraph 1, the documentation of fire protection of nuclear installation must be elaborated and measures providing maintenance of acceptable level of nuclear safety also in case of a fire in the nuclear installation shall be proposed.

3. Installations of importance with regard to the nuclear safety of a nuclear installation shall be designed so as to achieve the following objectives:

a) fire prevention,

b) detection, signalling and extinguishing of fires,

c) localization of fires which have not been extinguished.

4. Designs shall make use of non-combustible materials, fire retardant materials and fire resistant structures.

5. Nuclear installations shall have fire protection equipment which shall be designed and located so that their rupture or spurious or inadvertent operation would not significantly impair the capability of equipment important to safety.

6. Fire protection equipment and fire protection systems shall be qualified.

J. Protection against external phenomena

(1) Classified installations shall be designed so that, during natural disasters or extreme natural conditions which may realistically be assumed, such as earthquake, gale, floods, extreme external temperatures, extreme temperatures of cooling water, precipitation of all forms, humidity, icing, action of flora, fauna and the like, or during events caused by human activities outside the nuclear installation or during combinations of them, it is possible

a) to shutdown the nuclear installation safely and maintain it in subcritical conditions,
b) to remove residual heat from spent nuclear fuel or radioactive waste,
c) to maintain releases of radioactive substances below the specified values.

(2) Apart from the conditions for the physical protection of nuclear installations and nuclear materials established by the special legislation,[10]) designs shall take account of

a) the most severe natural phenomena historically recorded in the area of the nuclear installation siting and extrapolated, considering the limited accuracy with respect to the extent and time of occurrence,
b) combinations of effects of phenomena caused by natural conditions and human activities,
c) maximum expected ground acceleration given for the area of siting, based on assessment of the site seismic load developed during siting of nuclear installation, specified as the seismic level 1 and seismic level 2,
d) requirements for seismic resistance of systems, components and civil structures of nuclear installations or their parts, which shall correspond to their safety function and expected effects of earthquake according to the specified seismic level 1 and seismic level 2,
e) aircraft crashes.

(3) Protective zones shall be designed to protect nuclear installations against external phenomena which can be caused by natural conditions or human activities.

K. Control rooms

(1) The nuclear installation shall be equipped with an operational control room (herein referred to as the "control room"), from which the nuclear installation can be safely and reliably controlled and operated.

(2) The control room shall be designed so that, with respect to protection of the health of employees at work, it allows for an access and a safe and healthy stay even under accident conditions. The design shall include ergonomic principles including man-machine interface.

[10]) Decree of the Nuclear Regulatory Authority of the Slovak Republic No. 51/2006 Coll. laying down details of requirements for provision of physical protection.

(3) The design shall provide for the identification of internal and external events directly challenging the continuous operation of the control room and propose measures to limit their impact as effectively as possible.

(4) Nuclear installations shall be designed so that it is possible to shutdown and maintain the nuclear installation in a safe state, even if the control room becomes unusable. Relevant equipment, preferably located in a single room, shall be physically and functionally separate from the control room (herein referred to as the "supplementary control room").

(5) The arrangement of the instruments and the method of presenting information shall provide an appropriate overall picture of the state and operating characteristics of the nuclear installation.

(6) All equipment required in the process of manual control shall be located in a place which is accessible during normal operation, abnormal operation, design basis accidents and, to an appropriate extent, also under design extension conditions.

(7) The design shall include equipment effectively providing visual and acoustic indications of the state of operating parameters that have deviated from the normal and can affect nuclear safety.

L. Safety and control systems

(7) Safety systems shall be designed with the maximum achievable functional reliability, redundancy and independence of the individual channels so that a single failure does not cause

a) a loss of the system's protective function,

b) reduction of the number of independent measuring channels and information channels to one.

(8) Safety systems shall provide for periodic testing of the functions of the individual independent information channels during normal operation and testing of their common circuits with the nuclear installation shutdown. These common circuits shall be designed so that their possible failures lead at most to the shutdown of the nuclear installation and not to the loss of their protective function.

(9) The safety system shall be designed so that the effectiveness of the protection system cannot be avoided by an incorrect intervention, but correct interventions shall not be restricted.

(10) The safety system shall be designed so that the effects of conditions in normal operation, abnormal operation and design basis accidents on the redundant channels of the system do not cause the loss of its functionality; otherwise, its reliability shall be demonstrated on another principle.

(11) If a control system or safety system is dependent on the reliability of a computer system, specific quality criteria shall be established and applied, along with procedures for the development, supply and testing of the hardware and, primarily, the software of the computer system throughout the service life of the control system and safety system.

(12) The level of required reliability of the computer system shall be commensurate with its safety importance. The level of reliability shall be achieved by means of a comprehensive strategy, using complementary means in each phase of the process development, taking account of an effective method of analysis and testing and also of a verification and validation strategies to confirm the design requirements.

(13) Verification and validation of the user software of the safety computer system shall be provided by a person independent of its supplier.

(14) An analysis of failure states and failure consequences shall be performed for safety systems in order to identify vulnerability of the system in case of component failures and to assess suitability of the design strategy for failure detection or for mitigation of their consequences.

(15) The level of reliability assumed in the safety analysis for computer based systems shall include a specified degree of conservatism, balancing the complexity of the technology used and the difficulty of the safety analyses performed.

(16) The process of development of the computer system, safety system or control system shall be documented and monitored, allowing for retrospective review, including testing and commissioning and also design modifications to these systems.

(17) A computer system for a safety system or control system affecting nuclear safety shall be qualified. A computer system for a safety system or control system affecting nuclear safety shall have a secured and documented managed system of protection against physical attack, unauthorized access and against malicious code throughout its service life.

(18) Safety systems based on computer systems shall meet the following conditions:

a) high quality of hardware and software used is required,
b) the entire development process including inspection, testing, commissioning and modifications to the design shall be systematically documented and revised,
c) if it is not possible to demonstrate reliability of the system with a high level of confidence, the diversity of performing the protection functions shall be provided.

(19) If it is not possible to demonstrate the existence of a sufficient quantity of data from the operational activities of identical systems used in similar cases, the conservative level of reliability assumed in the safety analysis for the computer system shall be adopted.

(20) Safety systems and control systems shall be separated or if it is not possible to achieve separation, their functionally necessary and appropriate interconnection shall be restricted so that failures in control systems do not affect the safety functions.

(21) Safety systems and control systems shall have built-in automated safety actions so that no human intervention is required within a justified period of time from the onset of an event and information shall be available on the automated safety actions so that their effect can be monitored.

(22) Safety systems shall be designed so as not to exceed the design parameters, even if the control system is not functioning correctly. The action of the safety system shall override the action of the control system and of the human action and it shall be possible to activate the safety system manually.

(23) Computer based safety systems shall have their reliability confirmed by experts who are independent of the designers and suppliers and, if the required system integrity cannot be demonstrated with the proposed level of reliability, other means shall be used to fulfil the safety functions.

(24) Safety systems shall be designed so as to recognize postulated initiating events and activate systems intended to mitigate their consequences.

(25) Control systems shall be designed so as to provide the required signals on deviations of the important operating parameters and processes from the permissible limits.

(26) Control systems shall be fitted with instruments to monitor, measure, record and control values and systems important to nuclear safety during normal and abnormal operation.

(27) Control systems shall continuously record, at regular intervals or as required, the parameters identified by the safety analysis as important to nuclear safety.

(28) Display, signalling and control instruments shall be designed and located so that employees always have sufficient information on operations and can intervene promptly, if necessary.

(29) Measuring, display, signalling and recording instruments shall be designed so as to provide the following in case of an event,

a) current status data,
b) basic information on the course of events and their record,

c) data to characterize the propagation of radioactive substances and ionising radiation into the working environment and the environment.

M. Electric power supply systems

1) Electric power supply systems shall be designed so that external and internal failures in the electric power distribution system affect the operation of the nuclear installation as little as possible.
2) Systems affecting nuclear safety which require uninterrupted power supply shall be supplied with power from storage batteries.
3) The storage batteries shall have sufficient capacity to maintain their functional capability for at least 2 hours under any circumstances. These sources shall be, similarly as systems supplied by them, separate and independent.
4) Technological systems which are redundant to ensure nuclear safety shall be supplied with power from at least two independent electrical systems and sources. If the number of sources is less than the number of independent technological systems, it shall be demonstrated that reliability is not reduced.
5) If a single failure in the power supply systems does not impair their functioning, a single failure in the electrical system or power source is also permitted.
6) If the operability of any system is essential to ensure nuclear safety, its electrical system shall supply the required power input even during a single failure.
7) Power supply sources and systems shall be ready to supply the necessary power in less time than is needed to start the appliances which they supply.
8) The design of electric power supply distribution systems important to nuclear safety shall provide for power supply from emergency sources, regardless of whether operating power supplies are in operation, and shall ensure the possibility of functional testing of emergency sources of electrical power supply also during normal operation.

N. Heat removal

1) Equipment involved in the removal of heat released by fission and residual heat shall be designed so as to provide for reliable cooling of materials in all states.
2) Heat removal systems shall be redundant, physically separated and isolated and shall be able to be interlinked so that they can perform their functions during normal operation, after shutdown, during design basis accidents, and during a single failure but also under design extension conditions and in case of the loss of off-site power.
3) If the nuclear installation is also used for heat generation to be supplied outside the nuclear installation, it shall be designed so as to prevent the transfer of radioactive substances from the nuclear installation to the heat distribution system during normal operation, abnormal operation, design basis accidents and, to the appropriate extent, also under design extension conditions.

O. Checking the condition of the equipment during operation

Classified equipment shall be designed so that it is possible to monitor and test them during normal operation and without reducing the level of nuclear safety.

II. Special requirements for the design of a nuclear installation with a nuclear reactor

A) Primary circuit, pressure vessel and core of the nuclear reactor

(1) The pressure vessel of the nuclear reactor, the primary circuit and its auxiliary systems, control systems and safety systems shall be designed so that

a) during normal operation, abnormal operation and design basis accident states, the required strength, qualified life and functional reliability are provided for their components and installations with an adequate margin,
b) there is no impermissible release of coolant,
c) the materials used for their production are selected so that they are activated as little as possible during normal operation,
d) they are sufficiently resistant to onset and development of failures.

(2) The pressure vessel of the nuclear reactor and primary circuit equipment shall be designed so that it is possible, during normal operation, to undertake regular or continuous monitoring of their status and the testing needed to verify nuclear safety.

(3) Design of the nuclear reactor pressure vessel and primary circuit equipment shall include
a) programmes and methods of in-service inspections and testing,
b) criteria for assessing the results of in-service inspections and tests,
c) applied multiple physical barriers to prevent release of radioactive substances into the working environment and into the environment,
d) at least three diverse types of systems to monitor and evaluate leakages during operation, if the "leak before break" approach is used.

(4) The conservative approach used to design the core of a nuclear reactor and the associated control systems and safety systems shall ensure that
a) all internal reactor components are designed, manufactured and assembled to resist static and dynamic effects during normal operation, abnormal operation and design basis accidents to the extent needed to ensure the safe shutdown of the nuclear reactor, maintain subcriticality and adequate core cooling,
b) the limit parameters of fuel assemblies and fuel elements are not exceeded during normal operation and abnormal operation,
c) under accident conditions
    1. excess reactivity is not released which might result in an uncontrollable fissile reaction,
    2. the nuclear reactor can be safely brought into subcritical conditions and kept in these conditions,
    3. the core can be cooled throughout the entire period of heat release,
    4. the limit failure of the fuel elements is not exceeded.

(5) The design of fuel elements and fuel assemblies shall ensure that

a) the specified maximum parameters acting as the basis for the design of further installations are not exceeded during normal operation, abnormal operation and design basis accidents,
b) it is based on the properties of the materials used, the radiation effects and chemical effects on these materials, the effects of static loading, dynamic loading and thermal loading and on the accuracy of calculations, production and assembly,
c) the data used are sufficiently supported by experimental or operational experience.

(6) Mechanical parts of the core or mechanical parts located in its vicinity shall be designed so as to resist static effects and dynamic effects during operation and during anticipated operating events. They shall be constructed so that their failure does not increase reactivity, does not prevent shutdown of the nuclear installation or the removal of residual heat.

B) Primary circuit make-up system and coolant cleaning system

(1) The primary circuit make-up system shall be designed so as to be able to compensate for releases and volumetric changes of coolant during normal operation and abnormal operation, taking account of draw-off of coolant for cleaning.

(2) The coolant cleaning system shall be designed so as to be able to remove the products of corrosion and fission products leaking from the damaged fuel elements, while maintaining the required parameters of the primary circuit coolant purity.

C) Core cooling system of the nuclear reactor

(1) The design of the emergency core cooling system shall ensure
   a) reliable core cooling during design-basis accidents caused by loss of coolant so that
      1. the cladding temperature of the fuel elements does not exceed the established values,
      2. the energy contribution of chemical reactions in the fuel element cladding and coolant does not exceed the permissible value,
      3. there are no geometrical changes to the fuel elements, fuel assemblies and internal parts of the nuclear reactor, which could affect cooling effectiveness,
      4. residual heat is removed throughout the entire period of its release,

   b) adequate redundancy, capability for interconnection, control of releases and possibility of their confinement so that the emergency core cooling system operates reliably also in the presence of a single failure,
   c) ability of the system to support the removal of heat from the core under design extension conditions considered in the design ,
   d) possibility to perform periodic tests and inspections of
      1. the strength and tightness of the system,
      2. active system elements and functional testing of them,
      3. the system as a whole and its functional testing in conditions close to its operation.

(2) The residual heat removal system shall be designed so that the limit parameters of the fuel elements and fuel assemblies are not exceeded on the shutdowned nuclear installation.

(3) The design shall include redundancy of the residual heat removal safety systems, coolant release monitoring and possibility of its retention so that the residual heat removal system also operates reliably in the presence of a single failure and loss of off-site power supply.

(4) The design of the secondary circuit shall ensure
   a) reliable heat removal from the primary circuit,
   b) detection of any releases from the primary circuit into the secondary circuit and, if such releases are detected, preventing their further spread.

(5) The design shall include a solution for reliable ultimate heat removal from classified installations in normal operation, abnormal operation, design basis accidents and under design extension conditions without severe degradation of nuclear fuel; under design extension conditions with melting of nuclear fuel the design can solve the heat removal also in another way than it is solved in other plant states. Ultimate heat removal shall mean the removal of residual heat into the atmosphere or into water or a combination of them.

(6) The reliability of systems contributing to ultimate heat removal by its transfer, by the provision of energy or supply of media to ultimate heat removal systems shall be achieved, for example, through the selection of proven equipment and systems, their redundancy, diversity, physical separation, interconnection and isolation.

(7) Postulated initiating events caused by natural conditions or human activities shall be taken into account in the design of ultimate heat removal systems, in the appropriate selection of diversity for the heat transfer facilities and storage systems from which the heat transfer media are supplied.

D) Containment system

(1) The nuclear installation shall be fitted with a containment system which, in the event of postulated initiating events associated with the release of radioactive substances and ionising radiation into the environment, limits such releases so that they are lower than the established leakage limits, unless this function is provided by other means.

(2) The containment system shall be designed so that the required leak tightness is retained even in design basis accidents. Furthermore, account shall be taken of the possibility of mitigating the consequences of design extension conditions and limiting the release of radioactive substances into the environment.

(3) The pressure parts of containment systems shall be designed with sufficient margins for the maximum pressures, or possible vacuums and the maximum temperatures which might occur during design basis accidents.

(4) The containment system shall comprise a full pressure containment system or containment equipped with systems for reducing pressure and temperature, isolating equipment and ventilation and filtration systems dimensioned for all postulated initiating events and shall ensure that the allowed parameters are not exceeded even during design basis accidents.

(5) Equipment inside the containment system shall be designed so as to fulfil its functions and so that its impact on other systems, structures and components is limited.

(6) Insulating materials, coverings and coatings for systems, structures and components inside the containment shall be designed so as to fulfil their safety functions and to resist the impact of the environment even during design basis accidents.

(7) The containment system and the systems, structures and components of importance for its leak tightness shall be designed so that it is possible

a) to test the leak tightness at the design pressure after
   1. constructing all penetrations and airlocks,
   2. making repairs,
b) prior to the commissioning to demonstrate integrity of the containment system by a pressure test at a pressure higher than the design pressure,
c) during normal operation of a nuclear installation, to carry out
   1. regular inspections of the individual structures and components in the containment,
   2. functional tests on the individual systems, structures, and components in the containment,
   3. regular tests of the leak tightness of the containment at the design pressure or at lower pressures which allow for extrapolation,
d) to prevent a reduction in leak tightness due to missiles and pipe whip.

(8) Penetrations passing through containment walls shall be designed so that

a) releases can be detected,
b) their regular leak tightness tests can be carried out at the design pressure independently of the leak tightness tests on the hermetic containment,
c) penetrations are protected against the effects of dynamic forces,
d) their number is kept to a minimum,
e) all penetrations meet the same design requirements as the containment system itself.

(9) Piping of the primary circuit penetrating the containment walls or piping directly connected to the containment atmosphere shall be fitted with reliable automatic closures, each of which shall have at least two closing elements arranged in series, located outside and inside the containment and controlled independently and reliably. The external sealing elements shall be located as close to the containment as practicable.

(10) Other pipes penetrating the containment walls shall have at least one external closing element located as close to the containment as practicable.

(11) Closing elements shall be designed so that

a) it is possible to perform regular leak tightness tests,
b) they perform their function, even in the presence of a single failure, except for their mechanical part.

(12) Operational airlocks through containment walls shall be equipped with double doors controlled alternately so that leak tightness is always maintained. The leak tightness of assembly airlocks shall correspond to the leak tightness of the containment system.

(13) Flow paths between parts of the space inside the containment shall be designed so that the differences in pressure occurring during operational events do not damage the containment or other equipment of the containment system.

(14) If a system for removing heat from the containment is used, it shall be designed so as to ensure the reliability and redundancy of the functions of the system in the presence of a single failure.

(15) The containment shall be equipped with systems to monitor hydrogen and radioactive substances which could enter it during and after the postulated initiating events. Together with other systems, these systems shall

a) reduce the volumetric activity and adjust the composition of fission products,
b) check and maintain the volumetric concentration of hydrogen at the permitted values so as to ensure the integrity of the containment.

(16) Containment equipped with a pressure and temperature reduction system shall have redundancy for the important support systems, structures and components, so as to ensure their function even in the presence of a single failure.

(17) Under design extension conditions it shall be possible to isolate the containment. If the event leads to the bypass of the containment, its consequences shall be mitigated.

(18) Containment leak tightness shall not be significantly reduced for adequately long time following design extension conditions.

(19) Pressure and temperature inside the containment shall be managed under design extension conditions.

(20) Concentration of the combustible gasses shall be managed under design extension conditions.

(21) The containment shall be protected against internal overpressure under design extension conditions.

(22) Scenarios of the core melting at high pressure shall be prevented.

(23) Containment degradation by molten fuel shall be prevented as far as reasonably achievable.

E. Safety analyses and severe accidents

(1) The design shall include analyses of the response of the nuclear installation to at least the following postulated initiating events:

a) small, medium and large releases of primary circuit coolant,

b) bursting of the steam mains and water feed piping,

c) reduction of flow of coolant through the reactor,

d) increase or reduction in the flow of feed water,

e) increase or reduction in the flow of steam,

f) unexpected opening of safety valves on a pressuriser,

g) unexpected activation of the emergency core cooling system,

h) unexpected opening of safety valves on a steam generator,

i) unexpected closing of the main steam fittings on steam generator steam piping,

j) breakage of heat-exchange pipes on a steam generator,

k) uncontrolled movement of emergency, control and compensation wrapper tubes,

l) discharge of emergency, control and compensation wrapper tubes,

m) loss of external electric power supply,

n) accident with fuel handling,

o) failure of normal primary circuit top-up,

p) releases of coolant from the primary circuit into intermediate circuits – outside the hermetically sealed zone,

q) heat removal failure in natural circulation cooling mode,

r) failure of storage pond cooling

s) fall of load due to lifting equipment failure,

t) fires, explosions, and floods.

(2) The design shall include analyses of the response of the proposed installation to at least the following external postulated initiating events:

a) unfavourable natural conditions including

1. extreme wind loading,
2. extreme external temperature,
3. extreme precipitation and local flooding,
4. extreme cooling water temperatures and icing,
5. earthquakes,

b) aircraft crashes,

c) impact of human activities and industrial activities, including explosions, in the vicinity of the nuclear installation,

(3) The design shall include analyses of the following accidents under design extension conditions:

a) event involving abnormal operation with an automatic reactor protection failure,

b) complete loss of internal power supply,

c) complete loss of feed water,

d) release of primary coolant with failure of emergency core cooling,

e) loss of coolant in reactor in natural circulation cooling mode,

f) complete loss of process water,

g) loss of heat removal from core when the reactor has been shutdown,

h) uncontrolled dilution of boric acid in reactor,

i) rupture of several heat-exchange pipes in a steam generator,

j) rupture of steam piping associated with simultaneous breakage of heat-exchange pipes in a steam generator

k) loss of safety system needed in a long-term phase after a postulated initiating event,

l) loss of cooling of a pond for storage of spent nuclear fuel.

(4) Analyses carried out pursuant to the previous paragraph may be carried out in a realistic way, using modified acceptance criteria.

(5) On the basis of operational experience, appropriate safety analyses and research findings, the design shall also address design extension conditions with melting of nuclear fuel, taking account of

a) possibility of multiple failures of safety systems with a consequent threat to the integrity of physical barriers with respect to the release of radioactive substances; preventive or mitigating measures do not need to include the application of a conservative approach for ensuring nuclear safety,

b) set of selected events identified from postulated initiating events using a combination of probabilistic methods, deterministic methods and engineering judgement and subsequently reviewed using a set of criteria in order to determine which severe accidents the design covers,

c) assessment and implementation of any design modifications or modifications in documentation or operating procedures, which could reduce the probability of occurrence of selected events pursuant to Letter b) or mitigate their consequences, if their implementation is reasonably practicable,

d) possibility of using certain safety systems and also systems not directly associated with nuclear safety, possibly supplementary temporary systems to perform functions other than those originally considered and under conditions other than the anticipated operating conditions to bring the nuclear installation into a controlled state or to mitigate the consequences of selected events pursuant to Letter b),

e) wording of operating procedures to deal with emergency conditions during the course of them,

f) for multi-unit nuclear installations with nuclear reactors, use of the available support facilities from other units providing the safe operation of such units is not threatened.

(6) Analyses of design basis accidents shall take account of used parameter uncertainty providing conservatism of analysis results.

(7) Due to conservatism, only actions of safety systems may be considered in analyses of design basis accidents. Action of systems not categorised as safety shall be considered only if they have negative impact on initiating event.

(8) In analyses of design basis accidents, getting stuck of a control rod assembly as an additional aggavating factor to all other postulated initiating evens shall be considered.

(9) The design shall include analyses which shall verify nuclear installation behaviour under design extension conditions in order to minimise the releases of radioactive substances harmful to the population and the environment in such extent as is reasonably achievable.

F. Acceptance criteria

(1) Initiating events shall be grouped into a limited number of categories that correspond to a state of a nuclear installation with nuclear reactor or nuclear reactors in accordance with their frequency of occurrence. Radiological and technical acceptance criteria shall be assigned to each state of nuclear installation with a reactor or reactors, so that frequent initiating events shall have no or only minor radiological consequences and those events that could result in severe consequences shall be of extremely low probability of occurrence.

(2) Criteria for maintaining the fuel elements integrity, fuel temperature, margin to crisis of boiling and temperature of cladding shall be specified. In addition, criteria shall be specified for the maximum allowable fuel damage during any design basis event.

(3) Criteria for protection of the primary circuit integrity and also for protection of secondary circuit shall be specified which, to an adequate extent, include the permitted pressure, temperature, thermal and pressure transient processes and internal stresses.

(4) Criteria for protection of the containment, including the maximum temperature, pressure, and quantity of releases, shall be specified.

G) Fire protection

The design shall be such that the occurrence of fire at any point does not prevent the safe shutdown of the nuclear reactor and keeping it in a safe state and does not give rise to the release of radioactive substances or the irradiation of people above the established limits**.**

H) Emergency control centre

(1) The design shall also include an emergency control centre, which shall be separate from the control room and also from the supplementary control room and, during accidents, shall act as the workplace for a control group from the emergency response organisation. It shall contain information on the important parameters of the nuclear installation and on the radiation situation in the nuclear installation and in its immediate environs and shall also have means of communication with the control room or supplementary control room, radiation control workplaces, shelters, places to gather people, with other important locations in the nuclear installation and the state administration bodies. To provide protection of persons the emergency control centre shall meet conditions of civil protection facilities[11]) and be constructed in accordance with special legislation[12]) so that the protection against possible threats arising out of the event is provided for a sufficient length of time.

(2) The design shall comprise equipment that shall provide back-up of the emergency control centre in case of its non-functioning or inapplicability. The backup emergency control centre shall be constructed so that all activities that need to be carried out in accordance with the emergency plan shall be provided and it shall be located in a safety distance from the nuclear installation.

I) Safety systems

(1) The design shall ensure that the safety systems have an output to activate the nuclear reactor shutdown system and also these systems shall

a) be automatically activated in order to ensure that the design parameters are not exceeded during the occurrence of events pursuant to Section 2 (q) and (s),

b) be capable of bringing the nuclear reactor into subcritical conditions in all operational states and maintain it in subcritical conditions, even in situations with a maximum level of core reactivity,

c) be capable of preventing the spontaneous occurrence of a critical conditions; this requirement shall be met, even during anticipated activities increasing reactivity while bringing the nuclear reactor into subcritical conditions, and even in the presence of a single failure of such systems,

d) comprise at least two independent systems based on different principles and capable of performing their functions even in the presence of a single failure,

e) be designed so that one of the systems pursuant to Letter d) is capable of bringing the nuclear reactor as quickly as possible into subcritical conditions with a margin of negative reactivity,

f) be designed so that one of the systems pursuant to Letter d) is capable of bringing the nuclear reactor into subcritical conditions and keeping it in such conditions even in situations with a maximum level of core reactivity,

g) provide for the control of reactivity or regulation of the flux distribution so that the margin of negative reactivity is constantly retained to bring the nuclear reactor into subcritical conditions.

(2) The design shall also cover the occurrence of possible postulated initiating events in low-power or reactor shutdown states, when the availability of the safety systems or control systems can be reduced.

(3) The design shall provide for qualified instruments including recording equipment to determine the essential information for monitoring changes in the state of the nuclear installation environment, the state of its safety systems for automatic reactor shutdown and mitigation of the consequences of accidents and also other systems of importance for safety during and after the accident conditions, in case of design extension conditions only to the appropriate extent. This system shall provide licensed employees with the necessary information on the course of the accident and release of radioactive substances.

(4) The design shall include adequate instrumentation applicable in the severe accident environment according to the severe accident management guidelines.

(5) Necessary information on measurements according to the previous paragraph shall be displayed on a unit control room, supplementary control room, but also on emergency control centre in such a way that shall allow assessment of current state of nuclear installation and its fundamental safety functions in severe accidents conditions.

(6) Activation of and handling safety systems shall be automated or performed in a passive way so that the intervention by the operating staff is not needed during at least 30 minutes after the initiation event. Any interventions by the operating staff required by the design during the first 30 minutes after the initiating event shall be well-founded and justified.

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[11]) Section 4 (1) of Act of the National Council of the Slovak Republic No. 42/1994 Coll. As amended by Act No. 117/1998 Coll.

[12]) Section 10 of Decree of the Ministry of Interior of the Slovak Republic No. 532/2006 Coll. on details for provision of construction technical requirements and technical conditions for civil protection facilities as amended by Decree of the Ministry of Interior of the Slovak Republic No. 444/2011 Coll.

J) Electric power supply system

(1) The design shall have access to the following energy sources for systems of importance with regard to nuclear safety:
   a) working power supply from the main generator,
   b) two different mains sources from different high voltage substations,
   c) emergency power supply from an independent source located in the area of the nuclear installation.

(2) A design with several units on one site shall also ensure that
   a) each unit has its own source of emergency power,
   b) each unit has its own mains connection from which to draw power, which is functionally separate from the others, all interconnections being removed,
   c) if a common reserve connection is used, the power from it shall be sufficient for the simultaneous start of all units.

III. Special requirements for repository design

The repository design shall include

a) consideration of the amount, class and hazardous properties of radioactive waste assumed for dumping so that physical and chemical compatibility with the selected site is provided,
b) a solution of adequate isolation of radioactive waste or spent nuclear fuel, taking account of their properties, the characteristics of the site and other safety aspects relating to the operation of the repository, its closure and institutional monitoring,
c) consideration of operational activities, a plan for its closure and other factors contributing to the protection of stored radioactive waste and the stability of the repository,
d) definition of structural barriers, supplementing the natural features of the area and together preventing or slowing the release of radioactive substances from stored radioactive waste or spent nuclear fuel into the environment over the long term,
e) requirement for provision of isolation of radioactive waste from the environment, always relying on multi-barrier protective system whose safety features are based on various physical or chemical processes preventing or slowing the release of radioactive substances into the environment.
f) requirements for a gravity drainage system and measurement of the activity of collected drainage water,
g) requirements for the implementation of monitoring and verification programmes to check the ability of the system to prevent the undesirable release of radioactive substances into the environment with a view to reducing the need for active maintenance of the barriers and monitoring during the period after the repository closure,
h) a solution of maintenance of safety during designed lifetime of the repository preferentially through passive characteristics so that the necessity of active actions is minimised after the repository closure,
i) consideration of the duration of institutional monitoring and the activities required to be undertaken with regard to its active and passive parts,
j) preliminary solution for its covering and method of closure,
k) a solution to the possibilities for removal of radioactive waste, if such possibilities may be considered without reducing the level of safety of the repository.

Annex No. 4 to Decree No. 430/2011 Coll.

REQUIREMENTS FOR NUCLEAR SAFETY OF NUCLEAR INSTALLATIONS DURING CONSTRUCTION, COMMISSIONING, OPERATION, DECOMMISSIONING AND, IN THE CASE OF REPOSITORY, CLOSURE OF IT

PART A

LIST OF REQUIREMENTS

I. General requirements for nuclear installations

A. Organisation of provision of nuclear safety and principles of safe construction, commissioning, operation, decommissioning and of the repository closure
B. Limits and conditions for safe operation or safe decommissioning
C. Principles of safe decommissioning
D. Documentation of activities and modifications
E. Fire protection
F. Requirements for handling of nuclear materials
G. Operating procedures
H. Requirements for regular maintenance, inspection and testing
I. Application of feedback from operational experience

II. Special requirements for nuclear installations with nuclear reactors

A. Readiness for commissioning and fulfilment of requirements in physical phase and power start-up phase
B. Readiness for commissioning following fuel exchange (hereinafter "re-start")
C. Nuclear safety in operation
D. Records and operational documentation
E. Provision of regular maintenance, inspections and testing

III. Special requirements for nuclear installations pursuant to Section 2 (f) (2) to (5) of the Act

A. Readiness for commissioning
B. Readiness for start-up of nuclear installations or parts of them at operating parameters following shutdown (hereinafter "start-up")
C. Nuclear safety in operation
D. Records and operational documentation
E. Principles for closure of the repository

PART B

CONTENT OF REQUIREMENTS

I. General requirements for nuclear installations

A. Organisation of provision of nuclear safety and principles of safe construction, commissioning, operation, decommissioning and closure of the repository

(1) The construction of nuclear installations, commissioning, operation, decommissioning and closure of the repository shall be guided by the relevant stage programmes for quality assurance and safety culture rules.

(2) For the purposes of activities pursuant to Paragraph 1, the authorisation holders shall create organisational structures with defined responsibilities and functional obligations and shall regularly review them so that those structures consider the actual status of nuclear installations.

(3) A test programme shall be developed for each of the classified equipment. If the classified equipment forms part of a technological system or forms an integral system, the test programme shall be developed for the integral system or a part of it.

(4) Test programmes for classified equipment shall be produced so that to verify the activities and functions of the installation being commissioned in the prescribed operational states envisaged by the design and specified in the pre-operational safety report.

(5) Before starting the commissioning, the authorisation holder shall check the readiness of the nuclear installation for commissioning by reviewing and protocol-based recording of the fulfilment of the success criteria for the post-assembly testing of systems, structures and components, keeping records of incomplete works and shortcomings. Continuation of commissioning shall be subject to rectification of incomplete works and shortcomings which could affect nuclear safety.

(6) Commissioning is a process during which the authorisation holder shall verify whether the systems, structures and components have been produced in accordance with the design, whether they are ready for operation and whether they meet the nuclear safety requirements of the pre-operational safety report.

(7) Before starting the commissioning, the authorisation holder shall complete the verification of the functional capabilities of individual systems under non-active conditions pursuant to programmes, the results of which shall be supported by the protocols and shall be in line with the success criteria set out in these programmes. The authorisation holder shall produce a report on the test results.

(8) The authorisation holder shall conduct commissioning in accordance with commissioning programmes approved by the Authority so that each stage and sub-stage forms an integral set of tests and the next stage or sub-stage shall not start before the proper completion and protocol-wise evaluation of the fulfilment of all success criteria set out in the programme of the preceding stage or sub-stage, which is one of the conditions for the transition to the next stage or sub-stage of commissioning.

(9) Before the start of the relevant stage, the authorisation holder shall verify readiness for the stage, checking on

a) completion of the work and testing required for the stage in question,

b) fulfilment of the success criteria, of works and tests set out in the programmes for the preceding stage and readiness of the installation for the next stage in accordance with the programme for the stage in question,

c) completeness and accuracy of the prescribed documentation, including documents and protocols on testing and readiness of the systems, structures and components involved in this stage of commissioning,

d) fulfilment of the stage quality assurance programme,

e) documents on fulfilment of previous conditions issued by the Authority,

f) documents on fulfilment of the requirements of other supervisory bodies,

and the authorisation holder shall elaborate a report on the results of these checks,

(10) The nuclear installation at which the first stage of commissioning has started is be covered by the limits and conditions in the appropriate mode.

(11) During commissioning, the authorisation holder shall verify the correctness of the operating procedures with regard to their technical accuracy and shall rectify any shortcomings identified on an on-going basis.

(12) When a state which is hazardous with respect to nuclear safety occurs, the authorisation holder shall suspend the tests performed during commissioning and bring the nuclear installation into a safe state.

(13) The nuclear installation shall be considered to have started up upon fulfilment of the commissioning success criteria established in the commissioning programmes.

(14) Before the start of operation, the authorisation holder shall check the readiness of the nuclear installation for operation by verifying and formally recording

a) completion of testing at all commissioning stages,

b) fulfilment of success criteria for the individual commissioning stages pursuant to the appropriate approved stage programmes,

c) completion and assessment of trial operation,

d) readiness of the technological installation and its staff for operation,

e) compliance of documentation pursuant to Annex No. 1 Point (C) of the Act with the current state of the nuclear installation.

(15) The authorisation holder shall separate the part of the nuclear installation, which is being started up, operated or decommissioned from the part where construction is continuing, so that assembly work or possible events on the part of the nuclear installation under construction do not affect the nuclear safety of the part of the installation which is being started up, operated, decommissioned or closed.

(16) The relevant authorisation holder shall develop safety indicators of operation, decommissioning or closure of the repository.

(17) The authorisation holder shall undertake trials, tests or handling procedures and mode changes that are not described in the operating procedures, only on the basis of a procedure prepared in advance in accordance with the current stage quality assurance programme.

(18) In case of occurrence of deviations in operation, decommissioning or closure of the nuclear installation or a part of it from the states considered in the operating procedures or in case of occurrence of situations hazardous with respect to nuclear safety, or if it is not possible to make sure whether the nuclear installation functions within valid limits and conditions, or if the nuclear installation response is in conflict with expected response at start-up, during operation or decommissioning, the authorisation holder shall take steps and measures to bring the nuclear installation or the part of it into a safe state without delay. When such a situation arises, the authorisation holder may continue in the activity only after the causes leading to the situation have been clarified and eliminated.

(19) The authorisation holder shall send to the Authority for each nuclear installation separately

a) Daily progress report on operation containing as follows:

1. Nuclear installation operational status,
2. Flow or breach of the limits and conditions passing and,

b) Daily reports if there is a nuclear installation in commissioning stage that contains information as follows:

1. On actual performed works with indication of the number of the relevant programme
2. Flow or breach of the limits and conditions,
3. Type and quantity of radioactive waste produced,
4. Technological equipment operation,

c) Daily progress report containing on numbers of concrete containers if there is the radioactive waste repository

d) a quarterly and annual assessment of operational safety which shall include data on

1. the status of nuclear safety, including assessment using safety indicators,
2. operational reliability status of the classified equipment,
3. improvements in safety,
4. radiation protection, including quantities and forms of radioactive substances released into the environment,
5. fire protection,
6. emergency preparedness,
7. internal supervision of nuclear safety,
8. production and radioactive waste management including shipment,
9. production and spent nuclear fuel management including shipment,

e) quarterly and annual assessment if there is nuclear installation within the decommissioning stage containing data on

1. actual ongoing decommissioning activities for the period under review

2. comparison of achieved state of decommissioning with the decommissioning stage plan if there is a nuclear installation in decommissioning stage.

(20) If there is a radioactive waste repository, the authorisation holder will send the authority for each nuclear installation separately quarterly assessment containing the data

a) On inventory activity individual radionuclides declared in the limits and conditions of safety operation of the radioactive waste repository

b) On the number of stored fibre-concrete containers

(21) If there is a radioactive waste repository the authorisation holder will send for each nuclear installation

(22) When set parameters are exceeded, safety systems shall be activated automatically. If the safety systems fail, selected licensed employees of the authorisation holder shall be obliged to activate them manually.

(23) The authorisation holder shall only re-start or start nuclear installations or parts of them at the operating parameters after shutdown if all the installations and systems essential for ensuring reliable and safe operation have been tested and are functional and if they are in accordance with the design, the pre-operation safety report, the limits and conditions for the nuclear installation and the operating procedures. Following an

inspection, the authorisation holder shall produce a summary document on the results of a check on the readiness of the nuclear installation and employees of the authorisation holder for further operation.

(24) The authorisation holder shall re-start or start nuclear installations on the basis of programmes.

(25) The purpose of testing for re-starting and starting is to verify the functionality of the commissioned nuclear installation in the prescribed operational states specified in the pre-operation safety report.

(26) The success criterion for re-starting and starting of a nuclear installation shall be compliance of the measured values with the set values given in the programmes. These values, however, shall not exceed the limits set in the pre-operation safety report. Meeting the test success criteria shall be a condition for starting another testing of the re-start.

(27) A nuclear installation is considered to be re-started after meeting the start-up success criteria established in the programmes.

(28) Prior to the commencement of decommissioning or commencement of closure of the repository, the authorisation holder shall check the readiness of the nuclear installation for decommissioning or, in case of the repository, its readiness for closure by reviewing and formally recording

a) readiness of the installation and employees,

b) compliance of documentation pursuant Annex No. 1 Point (D) or (E) of the Act with the current state of the nuclear installation.

(29) When implementing modifications to the nuclear installation the authorisation holder is obliged to evaluate the proposed modification from the point of view of impacts on operational documentation, personnel preparation, and configuration of a representative full-scope simulator and to incorporate the identified modifications.

B. Limits and conditions for safe operation or safe decommissioning

(1) The authorisation holder shall have a system in place to resume compliance with the limits and conditions in the event of a breach of them.

(2) In case the requirements within the meaning of the wording of the limits and conditions cannot be fulfilled, the activities, including the time interval for their implementation, which will bring the nuclear installation into a safe state, shall be specified.

(3) For all modes of normal operation, the minimum number of systems important to nuclear safety which shall be able to operate shall be specified.

(4) The authorisation holder shall analyse cases of breaches of the limits and conditions and shall develop a system of preventative measures to prevent the recurrence of the breach. The results of all violations shall be properly documented and stored.

C. Principles of safe decommissioning

(1) Authorisation holders shall immediately inform the Authority of the planned termination of operation of a nuclear installation.

(2) To the installations which are operating during decommissioning stages and to technological units constructed to support decommissioning or which are in protective storage, but also to activities associated with the dismantling, preparation for disposal and disposal of technological units, the safety requirements for operation shall apply appropriately.

(3) The decommissioning conception plan and the decommissioning stage plan, including relevant safety analyses, shall consider the type of the nuclear installation, inventory of radioactive waste and performed activities in accordance with their significance for the nuclear safety by using a graded approach.

(4) No activity of decommissioning shall be performed without prior assessment of its impact on nuclear safety. The risk of performing such activity shall be assessed by safety analyses.

(5) The authorisation holder shall decommission the nuclear installation or part of it in such a way that, as far as reasonably achievable, the characteristics of passive safety are preferably used.

(6) All activities of decommissioning in a particular stage shall be demonstrably directed at achievement of the final state defined in the decommissioning stage plan.

D. Documentation of performed activities and modifications

(1) Values of importance with regard to nuclear safety shall be truly and clearly continuously recorded by the authorisation holder during construction, commissioning, operation and decommissioning of the nuclear installation and in case of the repository during its closure, so as to capture the timeframe of their changes before, during, and after the transitional states.

(2) From the start of commissioning and during operation the authorisation holder shall record

a) results of tests of installations during construction and commissioning,

b) flow or breach of the limits and conditions,

c) course of operation during working shifts,

d) results and records of tests, inspections, maintenance, and repairs of classified equipment,

e) parameters and records of importance in providing information on the nuclear installation status,

f) surface contamination values of equipment,

g) operational event data,

h) results of verification of medical fitness and mental fitness of employees,

i) results of verification of special professional competence of employees,

j) results of verification of professional competence of employees,

k) data on the form and quantity of radioactive substances discharged, the level of radiation in the area of the nuclear installation and the dose burden on employees,

l) data on modifications made to the nuclear installation,

m) data on the quantity and movement of nuclear materials, special materials and installations and radioactive waste,

n) data on generation of and management of radioactive waste,

o) data on inspections made in accordance with the requirements prescribed in the limits and conditions.

(3) During commissioning, operation, decommissioning and closure of the repository, the authorisation holder shall ensure that the following documentation is maintained, registered and stored

a) Operating procedures,

b) Operating diagrams,

c) Handling cards,

d) Regulations for maintenance, (prescriptions)

e) Operating schedules,

f) Emergency procedures

g) Operating diaries,

h) Assessment of inspections and tests in accordance with a stage programme for quality assurance, quality requirements for nuclear installations and requirements for the quality of classified equipment,

i) Documents of satisfying qualification requirements,

j) Records from professional training and preparation.

(4) Modifications shall be made in accordance with the design requirements applying for the original systems, structures and components or the documentation for them.

(5) The authorisation holder shall establish procedures and responsibility for the revision of documentation approved by the Authority or of documentation reviewed before implementing modifications.

(6) The authorisation holder shall develop and use systems to manage temporary modifications, ensuring that every temporary modification is indicated on the spot and in the documentation.

(7) After implementing modifications prior to re-starting or further decommissioning or closure of the repository, the authorisation holder shall demonstrably notify the employees of the modifications made and update the relevant operating documentation.

E. Fire protection

The authorisation holder shall create a system for the prevention of fire and fire control pursuant to the conclusions contained in the safety report for the nuclear installation, during decommissioning in the decommissioning stage plane or during closure of the repository in the repository closure plan and institutional inspection, including safety analyses, and pursuant to special legislation.[13])

[13]) E. g. Act No. 314/2001 Coll. on fire protection as amended, Decree of the Ministry of the Interior Affairs of the Slovak Republic No. 121/2002 Coll. on fire prevention as amended, Decree of the Ministry of the Interior Affairs of the Slovak republic No. 719/2002 Coll. laying down the properties, operating conditions and provision of regular inspections for portable fire-fighting equipment and mobile fire-fighting equipment, Decree of the Ministry of the Interior Affairs of the Slovak Republic No. 726/2002 Coll. laying down the properties for electrical fire signalling, the operating conditions and the provision of regular inspections.

F. Requirements for handling of nuclear materials

(1) When handling nuclear materials in the nuclear installation, the authorisation holder shall exclude any possibility of the development of fissile chain reactions and release of radioactive substances into the environment.

(2) When handling nuclear materials, the authorisation holder shall ensure nuclear safety by

a) using installations envisaged by the design and installations which have been tested,

b) performing activities pursuant to the operating documentation and on the basis of the results of safety analyses stated in a safety report.

(3) Handling of nuclear materials and the associated activities shall be carried out by the authorisation holder pursuant to the operating documentation containing

a) a procedure for individual steps during operations,

b) requirements for the readiness of systems, structures and components,

c) requirements for safety measures,

d) identification data and cartograms for the storage of nuclear materials,

e) in case of the nuclear reactor and storage pool, also data on the concentration of dissolved neutron absorbers in the primary circuit coolant and the storage pool.

(4) Each technological operation associated with the relocation of nuclear materials shall be recorded by the authorisation holder in a separate document, stating their point of origin and final destination. The authorisation holder shall add to this document the safety measures adopted unless they are specified in the operating documentation.

(5) When shipping and storing nuclear fuel, the authorisation holder shall ensure subcriticality in accordance with the limits and conditions, taking account of the accident situations envisaged by the pre-operation safety report.

(6) Spent nuclear fuel shall be cooled by authorisation holders during the shipment and storage so that the heat released by the fuel is removed.

G. Operating procedures

(1) Activities of important to nuclear safety shall only be performed by the authorisation holder in accordance with the operating documentation and with the procedures developed or with written instructions so that they are in accordance with approved stage programmes for quality assurance and the limits and conditions and in accordance with the approved documentation and so that such activities do not infringe or threaten nuclear safety.

(2) Operating procedures shall be produced by the authorisation holder for normal operation, abnormal operation and for accident conditions, for all modes of decommissioning or closure of the repository and shall be developed so as to take account of the current status of systems, structures and components.

(3) Operating procedures for accident conditions shall be divided into emergency operating procedures and severe accident management guidelines.

(4) Emergency operating procedures shall be developed for design basis accidents and shall provide instructions for recovery of the safe state of the nuclear installation.

(5) Emergency operating procedures shall be developed also for design extension conditions up to beginning of the nuclear reactor core degradation but without its inclusion. Their aim shall be to re-establish or compensate for the lost safety functions and perform interventions to prevent degradation of the nuclear reactor core.

(6) Severe accidents management guidelines shall be intended for mitigation of consequences of severe accidents when measures provided by emergency operating procedures have not been successful in prevention of the nuclear reactor core degradation.

(7) Emergency operating procedures for design basis accidents shall be symptom based or a combination of symptom based and event-based procedures. Emergency operating procedures for design extension conditions shall be symptom based.

(8) Emergency operating procedures shall be developed in a systematic way and supported by realistic and plant specific analyses performed for this purpose. Emergency operating procedures shall be consistent with other operational procedures and severe accident management guidelines.

(9) Emergency operating procedures shall allow permanent operating staff of the control room to recognise quickly accident conditions to which the staff shall apply the procedures. The procedures shall define input and output conditions which allow the permanent operating staff of the control room to choose suitable procedures, move between the procedures and to switch from the procedures to severe accident management guidelines.

(10) Severe accident management guidelines shall be developed in a systematic way using a plant specific approach. They shall address strategies to cope with accident scenarios identified by severe accident analyses.

(11) Emergency operating procedures and severe accident management guidelines shall be verified and validated in a form in which they will be used in the field to ensure that they are administratively and technically correct and compatible with the environment where they will be used.

(12) A procedure of verification and validation of the emergency operating procedures and severe accident management guidelines shall be documented. Validation shall be specific for the particular nuclear installation. During validation, the effectiveness of human factor incorporation into the procedures and guidelines shall be assessed. The validation of procedures shall be based on simulations by using a representative full-scope simulator, if the simulator allows it.

(13) The permanent operating staff of the control room and the operating personnel shall be trained and regularly exercised for the emergency operating procedures by using the representative full-scope simulator.

(14) The permanent operating staff of the control room and other professionally qualified employees appointed by the authorisation holder shall be trained and regularly exercised for severe accident management guidelines by using the representative full-scope simulator.

(15) Training pursuant to Paragraphs 13 and 14 shall also include the transition from the emergency operating procedures to severe accident management guidelines.

(16) Interventions by the permanent operating staff of the control room resulting from the severe accident management guidelines and required to restore necessary safety functions shall be planned and regularly exercised.

(17) The authorisation holder shall be responsible for observing the operating procedures and for updating them.

(18) The authorisation holder shall perform regular reviews of the operating procedures, applying experiences from its own operation and from the operation of other comparable nuclear installations and also current knowledge of science and technology.

(19) The authorisation holder shall be responsible for equipping the control room and supplementary control rooms with one complete and updated set of operating procedures.

H. Requirements for regular maintenance, inspection and testing

(1) The authorisation holder shall plan, perform and check maintenance, inspection and testing of classified equipment at such technical level and at such intervals that the reliability and functioning of classified equipment are in line with the design and with the assessments made in the safety report and during decommissioning in the decommissioning stage plan.

(2) The authorisation holder shall perform maintenance and in-service inspections of classified equipment in accordance with the developed programme of in-service inspections and inspections pursuant to special legislation.[14]) The programme shall be reviewed by the authorisation holder on the basis of operational experience.

(3) The authorisation holder shall ensure that classified equipments are taken out of service for maintenance and in-service inspections only with the permission of the authorised employees and in compliance with the limits and conditions.

(4) The activities related to handling deviations from acceptable criteria identified during maintenance, examinations, tests and inspections of classified equipment shall be included in the relevant procedures.

(5) Non-destructive tests of structures, systems or components of the nuclear installation shall be performed in accordance with the qualified testing procedures by qualified testing facilities and qualified employees.

(6) After the completion of maintenance and inspections, the authorisation holder shall perform a test of the systems, structures and components according to the specified programme and its results shall be documented in the test report.

(7) The tests on systems, structures and components on which modifications have been implemented shall be carried out by the authorisation holder in accordance with developed programmes.

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[14]) Act No. 125/2006 Coll. on labour inspection and alternations and amendments of Act No. 82/2005 Coll. on illegal work and illegal employment and alternations and amendments of certain acts as amended.

(8) Repairs to classified equipment shall be designed and carried out without undue delay taking onto account the technical possibilities and conditions while safety significance of the damaged component, system or structure is considered.

I. Application of feedback

For feedback from decommissioning of nuclear installations or parts of them or from closure of the repository or a part of it the provisions of Section 10 (r) and Section 23 (2) (n) to (s) of the Act shall be used accordingly.

II. Special requirements for nuclear installations with nuclear reactors

A. Readiness for commissioning and fulfilment of requirements in physical phase and power start-up phase

(1) The authorisation holder shall manage commissioning as follows:

a) split them into two stages, as follows:
1. physical start-up, the purpose of which is to verify the neutron-physical properties of the nuclear reactor core and the selected safety functions, which are dependent upon the neutron-physical characteristics of the nuclear reactor core; the insertion of the first fuel assembly into the core of the nuclear reactor shall be considered to be the commencement of physical start-up; the authorisation holder shall split this stage into two separate sub-stages, as follows:
1.a) the loading of fuel into nuclear reactor core,
1.b) tests of physical start-up,
2. power start-up, the purpose of which is to verify, at different performance levels, the design characteristics of the installation and the design integration of all the systems in stable operation and in the transitional processes; the authorisation holder shall split this stage into two separate sub-stages taking account of the performance levels determined by tests,
b) proceed in accordance with an approved stage programme and approved programmes of the individual physical and power start-up tests,
c) proceed in accordance with a time schedule and the relevant stage start-up programme, which may, if necessary, be amended on the basis of test results.

(2) Physical start-up and power start-up programmes shall contain:

a) purpose of test,

b) starting conditions for test,

c) safety measures,

d) test procedure,

e) test success criteria,

f) appointment of a person responsible for performing and assessing the tests.

(3) The authorisation holder shall carry out loading of nuclear fuel into the nuclear reactor in accordance with a fuel insertion programme with a fuel insertion cartogram.

(4) After the loading of the nuclear fuel into the nuclear reactor the authorisation holder shall check the loading of the nuclear reactor core with the participation of the Authority.

(5) During the course of physical start-up the authorisation holders shall obtain the results of tests on the neutron-physical properties of the core, reactivity coefficients, characteristics of elements for the control, compensation and protection of the nuclear reactor.

(6) The authorisation holder shall produce a report on the summary results of physical start-up.

(7) The authorisation holder may commence the power start-up only after the successful completion of all physical start-up tests and after a preliminary assessment of the results obtained for physical start-up, confirming that the set conditions have been met.

(8) The authorisation holder shall undertake power start-up in accordance with a time schedule and the appropriate stage programme, which may be, if necessary, amended in accordance with the results of physical start-up.

(9) The authorisation holder shall undertake power start-up in stages pursuant to an approved stage start-up programme and approved partial programmes for the individual start-up sub-stages. The authorisation holder shall produce a report on each power start-up sub-stage.

(10) The authorisation holder may move on to the next power start-up sub-stage only after the results of tests on the preceding stage have been assessed and the criteria for the given stage have been successfully met.

B. Readiness for re-start

(1) Before the re-start, the authorisation holder shall provide

a) amendments and supplements to the pre-operation safety report containing modifications, if any were implemented,

b) updates for the limits and conditions and operating procedures as a result of modifications pursuant to sub-paragraph a),

c) documents and protocols on testing and readiness of equipment and systems which are essential for reliable and safe operation,

d) documents and protocols on the results of in-service inspections,

e) summary document on the readiness of the nuclear installation and its operating staff for further operation,

f) compliance with the success criteria relating to activities pursuant to sub-paragraphs c) and d),

g) notification of the exact date of the re-start of the nuclear installation to the Authority.

(2) The authorisation holder shall produce a summary report on the results of the re-start within two months of its completion.

C. Nuclear safety during operation

(1) Re-start of a nuclear installation following shutdown by the safety systems may be undertaken by the authorisation holder only after the causes of shutdown have been identified and eliminated.

(2) During operation, the authorisation holder shall ensure that

a) during operation the effectiveness of the power elements in the nuclear reactor control and protection system, the compensation elements, emergency protection and the effectiveness of the liquid absorber are always known,

b) the current effectiveness of the power elements in the nuclear reactor control and protection system guarantees with an adequate margin the shutdown of the nuclear reactor and maintenance of it in subcritical conditions,

c) the rate of introduction of positive reactivity into the reactor core is such that the power corresponding to the control level is achieved with a longer period than that specified in the limits and conditions and that there is no criticality on prompt neutrons,

d) his employees have sufficient information on the conditions of the reactor core and on the rate of change of important data affecting nuclear safety.

(3) The authorisation holder shall only begin to exchange fuel when the fuel exchange programme has been approved by the Authority.

(4) Fuel exchange programmes shall contain a proposal for the fuel loading, location of the fuel assemblies in the reactor core and storage pool before and after fuel exchange, specifying relevant safety characteristics which shall be compared with the characteristics and data given in the safety report.

(5) Unloading and loading of nuclear fuel from the nuclear reactor and into the nuclear reactor without changing the configuration of the fuel assembly arrangement in the core shall be undertaken by the authorisation holder in accordance with a nuclear fuel unloading and loading programme which includes a cartogram for fuel assembly arrangement in the nuclear reactor core and spent fuel storage pool. After the loading of the nuclear fuel into the nuclear reactor, the authorisation holder shall check the loading of the nuclear reactor core and spent fuel store with the participation of the Authority.

(6) The authorisation holder shall provide for nuclear safety when handling nuclear materials by means of:

a) constant monitoring of the nuclear reactor core when handling nuclear fuel in the nuclear reactor, including neutron flux density control, concentration of the soluble neutron absorber, coolant level and temperature,

b) loading of nuclear fuel into the nuclear reactor in accordance with a separate programme for each loading,

c) unloading of nuclear fuel from the nuclear reactor into the storage pool in accordance with a separate programme for each unloading,

d) when unloading nuclear fuel from the storage pool and into the spent nuclear fuel store in accordance with a separate programme,

e) by checking after the loading of nuclear fuel into the nuclear reactor recorded in a separate document,

f) by checking after the unloading of nuclear fuel from the nuclear reactor and into the storage pool recorded in a separate document.

(7) The authorisation holder shall use probabilistic assessment of nuclear safety for

a) Support of control and decision-making in the field of nuclear safety assurance,

b) Identification of necessary modifications to the installation and operating procedures, including severe accident management measures for the purpose of reducing the risk of the nuclear installation,

c) Assessment of the overall risk of the nuclear installation for the purpose of demonstration of a balanced risk profile and confirmation that there are no cliff-edge effects,

d) Assessment of adequacy of the modifications in nuclear installations, the limits and conditions of safe operation, operating procedures and operational event assessment,
e) Development and verification of programmes for professional training of the licensed employees and professionally competent employees, including training on representative full-scope simulator,
f) Verification that main factors contributing to the risk are included in the programme for maintenance, inspection and testing of equipment.

(8) When using probabilistic assessment of safety, it is necessary to

a) define its role and scope of application in the internal decision-making process of the authorisation holder,

b) recognise and consider limitations of the probabilistic assessment and make sure it is suitable for the specific use,

c) include into the assessment the systems and components, including their status and safety functions, which are important to assessment of changes in testing intervals and permitted duration of unavailability of those systems and components,

d) ensure that systems and components that have been identified in the probabilistic assessment as significant in terms of safety are able to operate and their significance is documented in the safety report.

(9) Probabilistic assessment of nuclear safety of the first and second level shall be regularly reassessed during operation within the periodic safety review of nuclear installation and whenever

a) there has been a significant modification in the design of the nuclear installation,

b) there has been a significant modification in operating procedures,

c) a new significant risk has been detected.

(10) The requirements pursuant to Paragraphs 1 to 6 shall also relate to the trial operation pursuant to special act.[15])

D. Records and operational documentation

From the commencement of commissioning and during operation, the authorisation holder shall record data on

a) transients states and changes in the parameter of classified equipment,
b) left indications in classified equipment ensuring the integrity of the primary circuit and their propagation,
c) newly created indications in classified equipment and their propagation.

E. Provision of regular maintenance, inspections and testing

(1) For in-service inspections of mechanical components and pipe systems, the systems for non-destructive testing shall be qualified with regard to test procedures, test equipment and staff.

[15]) Section 84 (1) and (2) of the Act No. 50/1976 Coll. as amended.

(2) The authorisation holder shall produce:

a) a schedule of in-service inspections of classified equipment one month prior to the start of a general repair or extended general repair,
b) a schedule of works during a general repair two weeks prior to the start of a general repair or extended general repair,
c) a schedule for re-start following a fuel exchange two weeks prior to the start of leak tightness testing of the primary circuit,
d) neutron-physical characteristics of the core applying to the next campaign, one month prior to the re-start,
e) upon completion of the general repair or the extended general repair:
1. a report on the results of in-service inspections,
2. a report on meeting the safety criteria for nuclear fuel,
3. a report on absorption of the design-limited number of operating modes for classified equipment in the primary circuit, steam pipes and feed water for the preceding campaign and in summary from the beginning of operation,
4. an assessment report on the absorption of lifetime of the pressure vessel in a nuclear reactor and classified equipment in the unit, including the critical temperature of a brittle fracture in the pressure vessel of a nuclear reactor,
5. a report on assessment of the success criteria for tests on re-start following fuel exchange.

III. Special requirements for nuclear installations pursuant to Section 2 (f) (2) to (5) of the Act

A. Readiness for commissioning

(1) During commissioning, the authorisation holder shall carry out

a) testing with inactive modelling media and active modelling media, the purpose of which is to demonstrate the functionality and operational capability of the individual technological assemblies and the entire technological unit,
b) testing with operating media, the purpose of which is to demonstrate the operational capability of the entire technological unit at power parameters established by the design.

(2) The authorisation holder may split commissioning into stages.

B. Readiness for start-up

(3) Prior to start-up, preceded by a shutdown for longer than two months, the authorisation holder shall provide:

a) amendments and updates of the approved documentation resulting from modifications implemented during shutdown of the nuclear installation,
b) documents and protocols on testing and readiness of systems, structures and components which are essential for reliable and safe operation,
c) documents and protocols on the results of in-service inspections,
d) summary document on the readiness of the nuclear installation and its operating staff for further operation, including documents on compliance with the requirements for radiation protection, fire safety and technical equipment safety,
e) compliance with the success criteria relating to results of activities pursuant to sub-paragraphs b) and c).

(4) Prior to start-up, the authorisation holders shall submit to the Authority a summary report on compliance with the requirements pursuant to Paragraph 1 and notify the exact date of start-up.

C. Nuclear safety during operation

(1) Start-up of nuclear installations or parts of them at operating parameters after a shutdown due to an operating event shall only be undertaken by authorisation holders after finding out the causes of the shutdown and eliminating them.

(2) The authorisation holder for the operation of the repository shall be responsible for observance of the programme for monitoring the repository during its operation, aimed at detecting failures in the barrier system, for checking the observance of nuclear safety, timely adoption of corrective measures and shall provide data for updating safety analyses.

D. Records and operational documentation

The authorisation holder shall record the data listed in Part B Point (I) Letter (D) Item (2) as appropriate.

E. Principles for closure of the repository

(1) Material used for filling interspaces in storage boxes shall have appropriate strength, water permeability and absorption properties.

(2) Repository coverings shall be distinguished by the ability to retain integrity, prevent the penetration of water and retain a long service life.

(3) The safety of repository shall not be based exclusively on institutional inspection and long-term active interventions.

(4) The authorisation holder shall adopt measures to provide for post-operation inspections in the period of the active part of institutional inspection.

(5) The results of post-operation monitoring shall be used to verify compliance with the radiological impacts determined on the basis of safety analyses and to demonstrate the anticipated behaviour of the repository.

(6) The authorisation holder shall record the data listed in Part B (I) (D) (2) as appropriate.

(7) For the closure of the repository and institutional inspection, the authorisation holder shall undertake regular and systematic assessments of the repository and reviews of the documentation at least every ten years following closure of the repository.