

This is an unofficial translation of the text.

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Annex 7 to the Govt Decree No. 118/2011 (VII. 11.)

NUCLEAR SAFETY CODE

Volume 7

Site survey and assessment of nuclear facilities

7.1. INTRODUCTION

7.1.1. The purpose of the regulation

7.1.1.0100. The purpose of the regulation is to identify the nuclear safety requirements for the site and for the identification of the characteristics of the site of nuclear facilities, with regard to the life cycle phases including the site survey, construction, commissioning, and operation phases.

7.1.1.0200.

7.1.2. The effect of the regulation

7.1.2.0100. The effect of the regulation covers only the events among those of human origin, which may occur as a consequence of deliberate human activities not purposely intended against nuclear facilities or as a result of inadvertent on-site or off-site human activities.

7.1.2.0200. The Regulation does not cover the environmental protection assessment requirements for the site and the nuclear facility.

7.1.2.0300. The provisions included in Section 7.2 shall apply to the site survey of all nuclear facilities covered by the present regulation. The requirements specified in Section 7.3 shall be used in due consideration of the different provisions included in Sections 7.5 to 7.7. The detailed regulations to be applied to each type of nuclear facilities are specified in Section 7.5 to 7.7.

7.2. GENERAL REQUIREMENTS FOR THE SITE SURVEY

7.2.1. Basic requirements for the site survey and assessment

7.2.1.0100. The purpose of the site survey and evaluation shall be the identification of site characteristics that may exclude the construction, the assessment and evaluation of hazard factors relating to the site, and the establishment of data on the site and the nuclear facility, to be taken into account during design:

a) for the design of the nuclear facility;

b for the analysis of the nuclear safety of the nuclear facility and the effects of potential radioactive discharges; and

c) for planning the nuclear emergency response measures and for the assessment of their feasibility.

7.2.1.0110. On the basis of the data specified under Section 7.2.1.0100, the non-suitable sites shall be disqualified from any further investigation.

7.2.1.0200. The site survey and evaluation shall be carried out in the following major stages, taking into account the specifications of Annex 3, 3/A, 5 or 6, depending on the type of the nuclear facility:

a) hazard factors of natural or human origin shall be identified, which may potentially jeopardise nuclear safety and are to be considered in the design and the safety assessment of the nuclear facilities,;

b) the events and conditions that are verifiably not relevant to the nuclear safety of the nuclear facility shall be excluded from further investigation;

c) hazard factors of natural or human origin that are not excluded on the basis of paragraph *b*) and the effects thereof shall be assessed and evaluated;

d) the suitability of the site shall be evaluated; and

e) the site characteristics to be taken into account during design shall be identified.

7.2.1.0300. The following shall be taken into account in the identification of hazard factors of natural or human origin, which may potentially jeopardise nuclear safety and are to be considered in the design and the safety assessment of the nuclear facilities:

a) hazard factors and conditions of natural or human origin occurring on the given site and in its vicinity, which may have potential effects on nuclear facility;

b) properties of the plant site and its environment, which may influence the dispersion and effects of released radioactive materials; furthermore

c) the density and distribution of the population, and the particularities of the surrounding environment, which may potentially influence the consequence of releases and the feasibility of nuclear emergency response actions.

7.2.1.0400. The acceptability of the designation of the area to be investigated shall be demonstrated in the framework of the identification of events, the site and the environmental parameters subject to the investigation.

7.2.1.0500. In the course of the investigation and assessment of the potential site, those possible hazard factors can be excluded from further investigation with appropriate verification, which are at a distance from the plant site that, considering the mitigation effect of such a distance between the location of the

hazard factor and the plant site and based on engineering considerations, experience, normative limit value or vulnerability analysis of the nuclear facility, the effect of the hazard factor on the nuclear facility is neutral or tolerable for the nuclear safety functions and for any person staying on the site of the nuclear facility.

7.2.1.0600. In the course of the survey and evaluation of the site, probabilistic hazard curves shall be determined for the hazard factors, i.e. the intensity of the hazard factors as a function of frequency. All hazard factors shall be examined from the point of view whether they can trigger a cliff edge effect.

7.2.1.0700. Those on-site events and conditions shall also be characterised in the framework of the site survey, the single effect of which can be considered negligible as a result of engineering considerations or analyses but, due to their occurrence frequency, may contribute to the risk on nuclear safety.

7.2.1.0800. Methods and standard technological tools, which reflect the state-of-the-art science and technology and are adapted to the properties of the site and its neighbouring environment, shall be used for the description and forecasting of external events.

7.2.1.0900. The identification and evaluation of external hazards to the site may be based on engineering considerations, probabilistic considerations or a combination of the two.

7.2.1.1000. Historical data and investigation results relating to the occurrence and severity of hazard factors of natural and human origin important to nuclear safety shall be collected and carefully analysed for their reliability, accuracy, and completeness. The suitability of the analytical data and results shall be demonstrated.

7.2.1.1100. If it is necessary for the determination of the site properties in compliance with the relevant regulations, targeted investigations shall be undertaken to identify the occurrence and characteristics of hazard factors of natural and human origin. These investigations shall be carried out in accordance with the relevant standards and proven practice used by the relevant professional fields, unless specific nuclear safety requirements are specified by the relevant legal regulations for this work.

7.2.1.1200. In the investigation of external events and conditions, simple procedures, such as literature data, may be used instead of targeted investigations, if the conservatism and the enveloping nature of the results can be demonstrated.

7.2.1.1300. The phenomena and conditions of natural origin, and the human activities in the vicinity of the site shall also be assessed by their impact on nuclear safety, in consideration of the design of the potential types of the nuclear facility.

7.2.1.1400. The selected site shall be considered suitable if the relevant nuclear safety criteria are met with proven and tested engineering solutions when the events and conditions characteristic to the site prevail.

7.2.1.1500. During the survey of the site, all required technical or administrative site protection measures shall be identified. An acceptably low level of the risk can be ensured by appropriate design and by technical and administrative site protection measures. Of these, the design and technical site protection measures shall be preferred. If the effect of a hazard factor or unfavourable site property is modified by an appropriate technical solution, the probability of the occurrence of the given hazard factor under the new conditions so attained shall be below the relevant screening level, even if the cliff edge effect is taken into consideration.

7.2.1.1600. The hazard factors characteristic to the site shall be differentiated by considering whether the hazard factor induces an immediate effect and there is no way to monitor or predict the effect or the development of the nuclear emergency situation makes monitoring and taking appropriate actions possible.

7.2.1.1700. If engineering and administrative measures are applied to ensure the protection of the site, it shall be demonstrated that, as a result of the measures, the site is suitable and the measures exclude the effect of hazard factors that would make the site unsuitable.

7.2.1.1800. The potential and the effect of simultaneous occurrence or the cause-effect occurrence of events and on-site environmental conditions shall be considered in the assessment of the site events. The criterion for the probability screening of individual events, prescribed in Annex 3, 3/A, 5 or 6 depending on the type of the nuclear facility, shall be coherently used in the assessment of the simultaneous occurrence of various external events and conditions.

7.2.1.1900. The transport and storage safety of nuclear materials shall be considered in the suitability assessment of the site.

7.2.1.2000. In the case of events having natural and human origin and occurring with very low frequency that are relevant for the design of nuclear facilities, the extreme natural circumstances and events affecting similar sites and nuclear facilities shall also be evaluated in order to establish the hazard level of the site.

7.2.1.2100. To ensure the well-planned and proper implementation of the site survey, an survey and assessment programme shall be developed, which shall include the following:

- a) identification of the purpose and the scope of investigation and limitation of the investigation areas and parameters, which are important to nuclear safety;
- b) introduction of the requirements and regulations and an overview of acceptance criteria, methodology requirements and international good practices;
- c) processing of the available data in a critical manner;

- d) specification of the targeted research and measurement work;
- e) evaluation;
- f) documentation;
- g) identification of areas subject to independent review; and
- h) quality management requirements.

7.2.1.2200. Independent and detailed programs shall be developed for each professional field, which include the specific investigation and measurement and evaluation methods.

7.2.1.2300. The interface between the programs developed for each professional field, the overlap between the contents of the individual tasks, the methodology, a description of the applied standards and normative system, the harmony of criteria, and the completeness of compliance with the regulation requirements shall be ensured in the site survey and assessment programme.

7.2.1.2400. If technological/scientific assumptions, analysis results, or considerations are used in the site survey and assessment work, the adequacy and the analysis results of which can not be verified directly by experiments or by other pre-defined and later verifiable techniques, the adequacy of the investigation and assessment shall be verified by independent review.

7.2.1.2500. For investigations and assessments carried out to existing standard procedures and methods, the review required in item 7.2.1.2400 is not obligatory.

7.2.1.2600. The site survey and the identification of the input data to be taken account during the design may also take place according to the requirements specified for nuclear facility of a higher risk class.

7.2.2. Requirements specified for the design and nuclear safety assessment

7.2.2.0100. The scope and the level of details of the site investigations shall be in conformity with the specific design and nuclear safety requirements specified by the legal regulations for the site data with regard to the design and the nuclear safety of the given nuclear facility.

7.2.2.0200. The site properties and events and the possible combinations thereof shall be described in accordance with the specifications stated in Annex 3, 3/, 5 or 6 depending on the type of the nuclear facility in a way to allow that the standard parameters and data to be taken into account during the design, and the data required for the safety assessment and the probabilistic safety analysis of the nuclear facility, and for the development of the nuclear emergency response measures can be derived.

7.2.2.0300. Site-specific data shall be used in the determination of the external hazard factors to be taken into account during the design. If no such data is available and can neither be produced by targeted investigations, then data

obtained from other areas with similar properties, and data, which are considered relevant on the basis of professional judgment or specified in standards, can also be adopted. Appropriate and approved simulation techniques can also be adopted. The site-specific data may be completed by data obtained from similar areas or produced by simulation techniques. However, the adequacy of such data shall be verified.

7.2.2.0400. The uncertainty of the determination of the site properties shall be analysed and evaluated.

7.2.2.0500. The parameters of the hazard factors to be taken into account in the design basis shall be determined on the basis of site-specific parameters, with appropriate margins to avoid the cliff edge effect, in accordance with the procedures applicable to the given hazard factor.

7.2.3. Requirements specified for the radioactive releases of nuclear facilities

7.2.3.0100. All possible direct or indirect release paths, in which radioactive materials can reach the population and can have an effect on the members of the population, shall be identified and assessed by taking the site properties and the affected area into consideration.

7.2.3.0200.

7.2.3.0300. For the dispersion of radioactive releases, the present and future variation of all those parameters shall be assessed, which may influence the potential consequences of the radioactive releases. In the frame of this work, particularly the role of the use of land and water and the biosphere in the accumulation and transport of radionuclides, or the possibility of interaction of nuclear and conventional releases shall be assessed.

7.2.4. Requirements for nuclear emergency response

7.2.4.0100.

7.2.4.0200.

7.2.4.0300. The site assessment shall cover the evaluation of the feasibility of the nuclear emergency response measures; within that, the following shall be examined:

a) the density and distribution of the population, the distance from the centres of population, the characteristics and distribution of public facilities capable of accommodating crowds of people, and groups, which are difficult to protect or evacuate in case of nuclear emergency, and the variation of all these data and characteristics for the entire design service life of the nuclear facility;

b) specific geographical circumstances, traffic, and communication conditions;
and

c) relevant properties of the areas surrounding the site to allow the quick evaluation of the dispersion of radioactive materials released and for the identification of the medium- and long-term nuclear emergency response measures.

7.2.5. Prediction and monitoring of the site properties

7.2.5.0100. The variation of hazard factors having natural and human origin affecting nuclear safety shall be predicted and assessed for the entire lifetime of the nuclear facilities.

7.2.5.0200. If a previously licensed nuclear facility is extended, the site properties shall be identified using the already available knowledge of the site.

7.2.5.0300. The foreseeable significant changes in the use of the site, such as extension of existing facilities and human activities, or construction of facilities of high risk, shall be considered.

7.2.5.0400. The monitoring of hazard factors having natural and human origin affecting nuclear safety shall be started before the construction and shall continue until representative series of data are available for the assessment of the site.

7.3. INVESTIGATION AND ASSESSMENT OF INDIVIDUAL EXTERNAL IMPACTS

7.3.1. Earthquakes and permanent surface displacements

Earthquakes

7.3.1.0100. The seismic hazard exposure shall be determined from the seismotectonic assessment of the area intended to accommodate the site.

7.3.1.0200. In the framework of identifying the seismic hazard, the data collection, the identification of the boundaries of the investigated area and the investigation methodology shall be in conformity with the data available on the level of hazard, which is required for the characterisation of the safety earthquake.

7.3.1.0300. For the determination of the seismic hazard, the seismological, geological, and geophysical as well as geotechnical parameters shall be collected and assessed and a catalogue of historical and instrumentally recorded earthquakes shall be available.

7.3.1.0400. In addition to the use of the available historical data and instrumental measurement records, targeted geological, geophysical and geotechnical explorations shall be undertaken to substantiate the identification of the seismic hazards. This exploration work shall be carried out to the professional norms and standards and proven practice of the given professional field, unless otherwise specified by specific nuclear safety requirements.

7.3.1.0500. The microseismic activity shall be monitored in the surroundings of the site with the use of an installed sensitive detection system, and all available

relevant data shall be collected. The monitoring shall cover a period, which represents the microseismic activity.

7.3.1.0600. The characteristics of the safety earthquake, particularly the peak ground acceleration, response spectra, and the duration of the intensive movements shall be established by considering the seismotectonic parameters.

7.3.1.0700. The determination of the characteristics of the safety earthquake may be carried out using deterministic or probabilistic methods, in which the uncertainties of the data and methods shall also be considered. The characteristics included in the design basis shall be determined on the basis of site-specific data, with appropriate adjustments in order to avoid the cliff edge effect.

7.3.1.0800. The potential of the occurrence of permanent surface displacements on the site shall be assessed and analysed. The assessment shall be sufficiently comprehensive to ensure that the potential of permanent surface displacements can be judged.

7.3.1.0900. A fault shall be considered hazardous in view of the permanent surface displacement if geological, geophysical, geodesic and seismological data meet one or more of the following criteria:

a) the data refer to reiterative movements, significant deformation, or dislocation, or to all of the three at a time interval, upon which the potential can not be excluded that the next earth displacement will extend to the surface or near the surface;

b) structural connection exist with a hazardous fault, in view of a known permanent surface displacement, the movement of which may cause the displacement of the fault near the site;

c) the seismogenic structure is presumed to be such that the maximum possible earthquake is sufficiently large and occurs in a focal depth, which, if geodynamic data of the site is considered, presumably allows the occurrence of permanent surface displacement.

7.3.1.1000. The criteria described in Item *a)* of 7.3.1.0900. shall be considered for a shorter period in very active regions characterised by geological and seismic data implying short recurrence intervals, but for a sufficiently long period in less active areas.

7.3.1.1100. If the potential of occurrence of a permanent surface displacement on the site can not be reliably excluded by scientific evidences, and the displacement may affect the nuclear facility, the site shall be qualified as unsuitable.

7.3.2. Geotechnical hazard factors

Slope instability

7.3.2.0100. It shall be investigated and assessed whether a slope on the site may become instable or not. It shall be clarified, whether or not these hazard factors can have an effect, owing to their degree and occurrence frequency, on the nuclear safety of the nuclear facility. The hazard of instability shall be assessed in consideration of the soil movements typical to the site. The regulations specified for the gradient of slope shall be considered in the assessment. It is not allowed to construct a nuclear facility on steep or strongly indented surface or on an area subject to erosion, flowage, or creeping hazard.

Collapse, slumping, settlement, or emergence of the surface of the site

7.3.2.0200. The geological structure of the area shall be assessed to determine whether natural formations and human-made objects are present, which may cause the collapse, settlement, or emergence of the surface.

7.3.2.0300. No nuclear facility shall be constructed:

a) over formations, which are liable to karst formation at a depth less than 100 m and within 1 km distance therefrom;

b) over natural or artificial subsurface caves, caverns, mines, cellars, or other non-recultivated structures and within their geomechanical range.

7.3.2.0400. If feasible and proven engineering solutions are available to prevent the collapse, slumping, settlement, or emergence of the surface of the site, the site conditions shall be identified with reliable methods for the identification of the design basis of these engineering solutions, as part of the design basis of the nuclear facility. As a result of the engineering solution, the collapse, slumping and settlement shall be excluded by deterministic analysis.

Soil liquefaction

7.3.2.0500. The potential of the occurrence of soil liquefaction shall be assessed by studying the characteristics of the typical safety earthquake and the geotechnical parameters of the site.

7.3.2.0600. The assessment of the risk of soil liquefaction shall be carried out with the use of approved soil mechanics, geophysical, and analysis methods. The uncertainties of the data and the methods shall be considered in the evaluation of the assessment results.

7.3.2.0700.

7.3.2.0800. If soil liquefaction can occur upon the effect of the safety earthquake, the site shall be qualified unsuitable, unless proven technical solutions are available to prevent the soil liquefaction or it can be demonstrated that the soil liquefaction occurring upon the effect of the safety earthquake is of a local nature

and will not cause relative displacements, which involve structural consequences that prevent the fulfilment of nuclear safety functions.

Behaviour of the foundation of the nuclear facility

7.3.2.0900. The geotechnical properties and the uncertainties thereof shall be assessed for the design of the foundation of the buildings and building structures of the nuclear facility. The geotechnical properties of the soil and the uncertainties of these data shall be assessed for the design of the foundation of the buildings and building structures of the nuclear facility. The soil profiles shall be determined in a way to meet the design input data requirements.

7.3.2.1000. The stability of properties of the load-bearing soil shall be assessed for static and dynamic loads. The possible corrosive effects arising in connection with the crumbling of rocks and soils found in the vicinity of the foundation of the nuclear facility, occurring as a result of coming into contact with water shall be assessed.

7.3.2.1100. The variation and the chemical properties of the subsurface waters shall be determined.

7.3.3. Meteorological properties

7.3.3.0100. The extreme weather conditions and rarely occurring meteorological phenomena typical to the site and the climatic and meteorological properties of the region shall be assessed.

7.3.3.0200. Data shall be available for the wind, the precipitation, temperature, and storm conditions for an area and a time period and in a depth of details, which are sufficient for the implementation of input data to be taken into account during the design of the nuclear facility and for the dispersion calculations. The uncertainties caused by the quantity and quality of data and the avoidance of the cliff edge effect shall be considered in the evaluation of the assessment results.

7.3.3.0300. The assessment of the meteorological properties shall be in conformity with the level of hazard exposure and recurring time required for characterisation of the extreme events, which are critical to the nuclear facility and are to be considered during design. The monitoring of the site shall cover a time period, which represents the meteorological conditions of the site. All relevant data from other sources shall also be gathered.

7.3.3.0400. The occurrence frequency and properties of lightning shall be assessed.

7.3.3.0500. The occurrence probability of tornados shall be assessed. If the occurrence of tornado is assumed, the characteristics (the rotational and translational velocity, radius of the maximum rotation velocity, pressure difference and pressure variation), and the hazard caused by missiles caught in the tornado, shall be determined.

7.3.4. Inundations

Flooding of the site

7.3.4.0100. The potential of flood due to rainfall or inundation, which may have an effect on nuclear safety of the nuclear facility, shall be assessed.

7.3.4.0200. All relevant data, including the meteorological and hydrological historical data shall be obtained and evaluated to allow the assessment of the flood hazard. The data shall also be assessed for their reliability, adequacy, and completeness.

7.3.4.0300. With the knowledge of the historical and measured data, an appropriate meteorological and hydrological model shall be developed in due consideration of all known past changes of the properties of the studied area. The possible combinations of various reasons for flood and inundation shall also be assessed. The flood and inundation hazard to the site shall be derived from the model. The maximum flood level and response time, the duration of the flooding and the flow conditions shall be provided to allow the characterisation of the hazard of flood.

Hazards caused by water structures

7.3.4.0400. The potential of occurrence of serious damage to water structures shall be assessed. If the effect of the failure of water control structures involves hazard to the site, the failures and their effect on the site shall be characterised to ensure that they can be considered in the design and the safety assessment of the nuclear facility. If there is no internal regulation or standard for the evaluation of the safety of given water structure, the safety of such structures can be assessed with the application of methods used for the design and safety assessment of the nuclear facility.

7.3.4.0500. If it is concluded in consideration of the site properties that the nuclear facility is capable of withstanding the effects of any significant failure of the water control structures, then no further assessment of the structures is required.

7.3.4.0600. It shall be assessed what is the probability of occurrence of upstream or downstream damming of the water and the resulting flooding, and the associated events, which may have an effect on the nuclear safety.

7.3.4/A. Fires occurring in the vicinity of the site

7.3.4.0610. It shall be examined if large extent fires occurring in the vicinity of the site can endanger the nuclear safety of the nuclear facility through toxic gases or smoke generation, or through heat effects.

7.3.5. External hazard factors of human origin

Aircraft crash

7.3.5.0100. The risk of falling of a military or civil aircraft onto the site shall be assessed by considering the use of the air space, the place of airports, the actual situation of the air transport and the variation thereof, and the development of aeronautics and air transport anticipated for the future.

7.3.5.0200. If it is shown by the evaluation that a risk of aircraft crash exists and it may influence the safety of the nuclear facility, then the occurrence frequency and the characteristics of the aircraft crash shall also be shown.

7.3.5.0300. If it is possible by appropriate analysis, the effect of measures taken to restrict the entry into the air space above the site on the air crash occurrence probability shall be considered in the site suitability assessment.

7.3.5.0400. The site shall be declared unsuitable if, due to its occurrence probability, the air crash is to be considered during the design of the nuclear facility and there is no appropriate engineering solution to eliminate the impacts and to reduce the risk of air crash to an acceptable level.

Explosion of hazardous chemical agents, cloud of toxic gases, smoke and thermal impacts

7.3.5.0500. The activities including the management, processing, transport, and storage of hazardous chemical materials, which may involve the potential of serious explosion, and formation of gas clouds, shall be identified.

7.3.5.0600. It shall be assessed, whether there is a potential for the occurrence of a large fire, which may jeopardise the nuclear safety of the nuclear facility by generation of toxic gas, or heavy smoke or thermal impact.

7.3.5.0700. The site shall be declared unacceptable, if the impacts caused by human activities pursued in the adjacent areas are to be considered during the design of the nuclear facility and there is no engineering solution to eliminate the impacts and to reduce the risk to an acceptable level.

Other important hazard factors of human origin

7.3.5.0800. The site and the immediate environment thereof shall be assessed for the potential effects of nuclear facilities or hazardous industrial, agricultural, commercial and military facilities being present in the area independently of the planned nuclear facility. This shall include the facilities, which are in connection with the given nuclear facility, even though their site is separated in legal sense, but their potential effects may reach the planned nuclear facility.

7.3.5.0900. This assessment shall cover the items of equipment, the malfunction of which may make objects to become a missile. The possibility of generation of

electromagnetic interference, eddy current in the soil and other interactions shall also be identified and assessed.

7.3.5.1000. If the nuclear facility cannot be protected against the impacts of the phenomena occurring on the site, or no proven engineering solution is available to compensate these impacts, the site shall be declared unsuitable for the construction of a new nuclear facility or for the extension of an existing one.

7.3.6. Identification of radioactive discharges and site-specific data required for nuclear emergency response measures

7.3.6.0100. The characteristics and the phenomena typical to the neighbouring areas of the site, which define the dispersion of radioactive materials, shall be assessed to allow the evaluation of the radioactive releases, the development of the emergency plans and the assessment of their feasibility, and the evaluation of the effects occurring under emergency conditions.

Atmospheric dispersion of radioactive materials

7.3.6.0200. The meteorological properties of the site shall be assessed, and the assessment shall cover the fundamental meteorological parameters and phenomena, such as wind velocity, wind direction, air temperature, precipitation, humidity, atmospheric stability parameters and long lasting temperature inversions, which define the dispersion and behaviour of releases.

7.3.6.0300. The site meteorological conditions shall be monitored and the local meteorological parameters shall be determined for specified altitudes. The site monitoring shall cover a one-year period at least, which represent the meteorological conditions of the site, and all relevant data from other sources shall also be gathered. The anticipated variation of the site meteorological parameters, including the potential changes caused by the operation of the nuclear facility shall be predicted for the life time of the nuclear facility.

7.3.6.0400. The atmospheric dispersion of the radioactive releases shall be assessed using the data resulting from the assessment of the studied area and by the development of appropriate models. All topographical properties of the site or the region, which may have an effect on the atmospheric dispersion, shall be considered in the model.

Dispersion of radioactive materials via surface waters

7.3.6.0500. The surface hydrological properties, including the major characteristics of the natural and artificial waters within the studied area, and the effects of the possible short-, medium- and long-term changes of the meteorological conditions shall be identified. The major water control structures, water sources and the data on the use of water shall be described.

7.3.6.0600. The dilution and dispersion properties and data, potential dispersion paths, which are required for the calculation of the transport of radionuclides in

the hydrosphere, shall be identified in the framework of the hydrological assessment.

7.3.6.0700. A suitable model shall be used for the assessment of the potential effects of contamination of surface waters on the public radiation exposure.

Dispersion of radioactive materials via subsurface waters

7.3.6.0800. The subsurface water conditions within the surveyed area shall be identified and evaluated, including the most important parameters of aquifers, their interaction with surface waters, the effects of the short-, medium- and long-term changes of the meteorological conditions, and the data on the use of the subsurface waters.

7.3.6.0900. The data required for the determination of the transport of radionuclides in the hydrogeological units shall be determined in the framework of the hydrogeological assessments. This shall cover the knowing of the migration and retaining properties of the soil, the dilution and dispersion properties of the water retaining layers, and the physical and physical-chemical parameters properties of the soil, which are required for the determination of the transport of radionuclides.

7.3.6.1000. The potential effect of the potential contamination of the subsurface waters on the public dose exposure shall be evaluated with the use of an appropriate model.

Demography and the distribution of population

7.3.6.1100. The distribution of the population, and the demographical characteristics, including the existing and predicted data and the temporary and permanent inhabitants in the adjacent areas, shall be identified to support the assessment of the effects of radioactive releases and the emergency impacts and to allow the development of the Nuclear Emergency Plans and the assessment of the feasibility thereof. In the framework of the assessment work, highlighted priority shall be given to the densely populated areas in the direct environment of the site, and social institutions, and public centres in the region. Targeted surveys shall be undertaken if the available data are insufficient.

Land and water use

7.3.6.1200. The use of land and water shall be characterised to allow the assessment of the effects of radioactive releases and, particularly, the development of Nuclear Emergency Response Plans. Such assessments shall cover the earth and water bodies, which serve as biotope and play a role in the food chain.

Radioactivity of environmental origin

7.3.6.1300. The background radiation typical to the site and the neighbouring area shall be assessed in the framework of the site survey work, which will be used as reference data for the assessment of the potential radiological consequences and effects caused by the operation of the nuclear facility. The assessment period shall be selected to allow the use of the obtained data for the characterisation of the site conditions.

Suitability of the site in view of factors affecting radioactive releases

7.3.6.1400. The potential radiological consequences and the accident discharges induced by the operation of the nuclear facility shall be conservatively assessed, using site data.

Suitability of the site in view of the feasibility of the nuclear emergency response measures

7.3.6.1500. It shall be investigated and assessed with the use of site data whether there is a site condition or feature, which may prevent the implementation of the nuclear emergency response measures of the nuclear facility.

7.3.6.1600. If it is concluded as a result of the assessment that, due to a site conditions, the implementation of the nuclear emergency response measures is not possible, the site shall be considered unsuitable.

7.3.7. Summary evaluation of the suitability of the site

7.3.7.0100. The site is capable of accommodating a nuclear facility if:

a) the nuclear facility can be so designed as to ensure that it is protected against the effect of hazard factors, which are typical to the site and are to be taken into account during the design;

b) it can be demonstrated in the framework of the licensing procedure that the effects of the potential radioactive releases from the nuclear facility remain below the limits specified in the relevant legal regulations; and

c) there is no any site condition, which could prevent the implementation of the nuclear emergency response measures.

7.3.7.0200. The following properties shall be identified and assessed for the summary evaluation of the site:

a) the fundamental design features of the nuclear facility in view of the intended purpose, the power of the facility (including the thermal power of nuclear reactors and the storage capacity of interim spent fuel storage facilities), the attributes of the potential variations of the nuclear facility in relation to the site;

b) the density and distribution of population and the distance from the public centres;

c) the site properties that may influence the dispersion of radioactive releases, and the planning and implementation of nuclear emergency response actions;

d) the characteristics of human activities on the site and in its vicinity, which have an effect on the nuclear safety of the nuclear facility and thus shall be taken into account during design;

e) the physical (seismological, geotechnical, geological, hydrological and meteorological) characteristics of the site, which have an effect on the nuclear safety of the nuclear facility and thus shall be taken into account during design;

f) the results of assessment carried out to demonstrate that the site conditions described in Points d) and e) can be fully considered in the design of the nuclear facility and the answer to the question whether engineering solutions are available for addressing the physical properties of the site;

g) the results of assessment carried out to establish whether it is required to defend the site with the use of engineering tools and if proven solutions are available for this purpose;

h) the results of assessment carried out to establish whether it is required to take administrative measures for the protection of the site and the nuclear facility;

i) the demonstration of the fact that there are no conditions that exclude the suitability of the site or prevent the construction of the nuclear facility;

j) the monitoring activities to be carried out during the construction and operation in relation to the site properties.

7.3.7.0300. In its contents and structure, the summary evaluation report shall comply with the requirements specified for the license application, and with the purpose and the scope of the licensing procedures.

7.4. CLASSIFICATION OF NUCLEAR FACILITIES INTO CATEGORIES

7.4.1.0100. Considering the risk based differentiation, the nuclear facilities and the associated site survey requirements shall be classified into three major risk categories as follows:

a) nuclear power plants and special research reactors,

b) interim spent nuclear fuel storage facilities,

c) research and training reactors and critical and subcritical systems.

7.4.1.0200. The following considerations shall be used for the risk based differentiation:

a) differentiation by potential external impacts, by considering the design purpose, the thermal power, the quantity of the stored active materials, and the features of the process system;

b) differentiation by the nature of the external hazard factors by assessing their nature, to examine characteristics of the hazard factor such as the occurrence of common cause failure, the development of the hazard factor with the time, the possibility of monitoring and forecasting the hazard factors, and the possibility of taking protective measures;

c) differentiation by the nature of the external hazard factors by assessing their nature, with a view to the construction and the design of the nuclear facility, to examine such characteristics of a hazard factor whether the immediate failure of systems, structures or components important to safety of the nuclear facility occurs or the degree of the loss of function is continuously follows the growth rate of the effect.

7.5. SITE SURVEY AND ASSESSMENT FOR NUCLEAR POWER PLANTS

7.5.1. General requirements

7.5.1.0100. The requirements specified in Section 7.3 shall be applied in full to nuclear power plants.

7.5.2. Earthquakes and permanent surface displacements

7.5.2.0100. To ensure the representative character of the data, the microseismic monitoring of the neighbouring areas shall be started three years before the evaluation of the site, and shall continue during the entire service life of the power plant.

7.5.2.0200. The characteristics of the safety earthquake shall be determined with the use of professionally approved probabilistic method in due consideration of the geological, tectonic, and seismological properties of the country.

7.5.2.0300. The required level of details of the geological, geophysical, and seismological assessments necessary for the analysis of the earthquake hazard and the permanent surface displacements shall be specified according to the step-by-step principle.

a) extensive data collection and evaluation work shall be undertaken at regional level within a circle of 300 km radius, at least, for the identification of the sources of earthquake and for the general geodynamical characterisation;

b) the available data shall be collected, analysed and evaluated within a circle of at least 50 km radius for the wider environment of the site for the characterisation of the seismic potential of the active structures, and for the identification of areas where targeted investigation is required;

c) detailed geological, geophysical and geotechnical investigations shall be initiated in the immediate environment of the site to identify the potential of near surface tectonic deformations and to determine the transmission properties of the medium; and

d) detailed geological, geophysical and geotechnical characterisation and lithological, stratigraphic, and hydrogeological description of the site shall be provided to allow the identification of the free surface properties of the reference earthquake and the engineering geological data required for the design of the foundation and building structures.

7.5.2.0400. The uncertainty of safety earthquake properties shall be evaluated. In order to avoid the cliff edge effect, the site-specific properties shall be modified in a documented manner.

7.5.2.0500. Earthquake shall be identified with its maximum horizontal and vertical acceleration, the duration of the strong quakes, and the ground response spectra.

7.5.2.0600.

7.5.2.0700. No nuclear power plant site shall be selected in a fault section, including an area of 10 km radius, where surface displacement occurred during the past hundred-thousand years. The assessment of the potential of permanent surface displacement shall be carried out for a period, which allows that the suitability of the site can be demonstrated with regard to hundred-thousand years.

7.5.2.0800. For the identification of the operational basis earthquake, the hazard shall be determined within an occurrence frequency range from 10^{-1} /year to 10^{-3} /year.

7.5.2.0900. The earthquake hazard exposure and the hazard curve of the earthquake related phenomena shall be determined up to an occurrence frequency of 10^{-7} /year, at least. The uncertainties in the determination of the hazards shall be assessed and the hazard curve, taken for median value, shall be used.

7.5.3. Geotechnical hazard factors

7.5.3.0100. The soil mechanics parameters shall be determined both for static and dynamic conditions.

7.5.3.0200. If the site is exposed to geotechnical hazard for which no proven engineering solutions or measures can be taken to improve the characteristics of the site, then the probability of the hazard shall not be higher than 10^{-6} /year, taking into account the cliff edge effect.

7.5.3.0300.

7.5.3.0400. The parameters to be included in the design basis of the engineering solutions or measures used to improve the geotechnical conditions on the site shall be selected in a way to ensure that, as a result of such solutions or measures, the requirement set forth in Section 7.5.3.0200 can be met and that the occurrence

of the hazard can be excluded. The geotechnical characteristics to be used as input for the development of measures to be taken to improve the geotechnical conditions shall be identified up to an exceeding frequency of 10^{-6} /year, in compliance with the regulations specified for the development of such measures and in accordance with the nuclear safety considerations.

7.5.4. Meteorological features

7.5.4.0100. The meteorological monitoring of the site shall continue for a three-year period, at least. The monitoring period can be shorter if regional measurement data are available, and it can be demonstrated that these data are good representative of the local conditions.

7.5.4.0200. The effect of the nuclear power plant on the dispersion conditions, potentially caused by the caloric process, shall be predicted and considered in the evaluation.

7.5.4.0300. The meteorological monitoring of the site shall continue during the entire service life of the facility.

7.5.4.0400.

7.5.5. Inundations

7.5.5.0100.

7.5.5.0200.

7.5.6. External hazard factors of human origin

7.5.6.0100. The potentially hazardous activities pursued in the environment of the site shall be assessed, and this assessment shall cover an area with a radius of 10 km and, for airports, with a radius of 20 km, at least.

7.5.6.0200. The decision whether a given hazard of low probability is relevant for the nuclear safety of the power plant, shall be based on engineering judgement. The screening by distance may take place on the basis of technical assessment, by demonstration that the effect originating from the potential source cannot reach the nuclear power plant. In the absence of very low occurrence probabilities and empirical data, such technical assessments and judgements shall be verified by independent technical experts.

7.5.6.0300. If structures or engineering measures are required to ensure protection against the effect of human-made external events, the characteristics, necessary for the determination of the parameters to be included in the design basis, shall be identified for a recurrence interval of 10^{-4} to 10^{-7} /year.

7.5.6.0400.

7.5.6.0500. In the case of a postulated event, the characteristics shall be stated deterministically, with the parameters of the given hazard.

7.5.7. Identification of the site data required for the evaluation of radioactive releases and nuclear emergency response plans

7.5.7.0100. Probability levels, which are required by the regulations specified for the evaluation of risks and the effects of releases, shall be considered in the identification of data necessary for the evaluation of the dispersion and behaviour of radioactive releases. If such regulations do not exist, it shall be assumed in the assessment, that the combined probability of conditions, which are unfavourable for the dispersion and behaviour of the releases, and the events, which may lead to the occurrence of a nuclear emergency, is in conformity with the level of probability used in the risk assessment.

7.5.7.0200. The area to be investigated shall be determined by estimating the potentially affected area and with consideration of the logistical aspects of the implementation of nuclear emergency response measures. The radius of the investigated area shall not be less than 30 km.

7.5.7.0300. The safety zone, assumed conservatively, subject to the provisions of the Government Decree on the safety zone of the nuclear facility and the radioactive waste repository shall be surveyed in detail, particularly with regard to the structures, activities, land use and human residence. A cadastral register shall be kept of this zone, and this register shall be kept up to date and updated as required.

7.5.8. Continuous cooling

7.5.8.0100. In the framework of the assessment specified in Sections 7.3.3 to 7.3.5, the typical values of the wet and dry air temperatures shall be assessed with regard to the availability of the ultimate heat sink medium, and the availability of fresh cooling water, required for maintaining nuclear safety with regard to the volume of water, the minimum water level and the durability of the minimum water level and the water quantity. The occurrence of unfavourable conditions shall also be considered.

7.5.8.0200. The hazard factors of natural and human origin, which may cause the inoperability of systems required for the long-term cooling of the irradiated fuel assemblies shall be identified, in particular the blockage or diversion of the river, emptying of a water reservoir, blockage of a water reservoir or a cooling tower by freezing or ice formation, or in the case of a ship accident, oil spill or fire. If the occurrence frequency of such events is over the screening level, these events shall be considered when the technical measures ensuring the protection of the site are determined.

7.5.8.0300.

7.5.9. Assessment of effects of biological origin

7.5.9.0100. All hazard factors of biological origin that may adversely affect the safety of the nuclear power plant shall be identified specifically for the site. Special attention shall be paid to hazards of biological origin affecting the availability of the primary and secondary ultimate heat sinks.

7.5.9.0200. In accordance with Section 7.2.3.0100, the effects of biological origin that influence the dispersion of radioactive materials discharged, with special regard to the food chain, shall be identified in the vicinity of the site.

7.6. SITE SURVEY AND ASSESSMENT FOR SPENT NUCLEAR FUEL INTERIM STORAGE FACILITY

7.6.1. General requirements

7.6.1.0100. The provisions specified for the nuclear power plant, and the special provision described in Section 7.6 shall apply for the interim spent fuel storage facility.

7.6.1.0200. If the interim spent fuel storage facility is intended to be constructed on the same site, or on a site adjoining with the site of a nuclear power plant, the conclusions from the site survey carried out for the power plant can also be used for the design of the interim spent fuel storage facility. Nevertheless, it shall be assessed, whether there are scientific accomplishments achieved since the completion of the site surveys and assessments, which shall be considered for the interim spent fuel storage facility in the assessment and characterisation of hazards, and in the identification of reference data to be taken into account during the design.

7.6.1.0300. The results and the data obtained from monitoring programme of the nuclear power plant on identical or adjoining sites can be taken into account in the monitoring of the site properties, but it shall be ensured that the monitoring required for the interim spent fuel storage facility shall continue until the end of the service life of the storage facility, irrespective of the fact that the service life of the power plant on the same site expires before. The possibility of meeting this requirement shall be demonstrated in the framework of the site survey of the storage facility.

7.6.1.0400. If the interim spent fuel storage facility is intended to be constructed on the same site, or on a site adjoining with the site of the nuclear power plant, the protection and the defence of the storage facility can be provided with the use of the same systems used for the protection of the nuclear power plant. In such a case, it shall be ensured that these protection systems are available in the required technical condition up to the end of the service life of the interim spent fuel storage, irrespective of the fact that the service life of the power plant being on the same site expires before. The possibility of meeting this requirement shall be demonstrated in the framework of the site survey of the storage facility.

7.6.2. Facility specific requirements

7.6.2.0100. Depending on the type of the facility, the probability of exceeding the safety earthquake, for the entire service life, shall be within the range between 5×10^{-3} and 2.5×10^{-2} . The exceedance probability of 5×10^{-3} or less can be accepted without the requirement for any special verification.

7.6.2.0200. The characteristics of the data required for the design of the spent fuel storage facility, i.e. as those of safety earthquakes, such as peak ground acceleration, response spectra, and the attributes of duration of heavy movements, shall be established with the use of the local geotechnical, hydrogeological, and soil-mechanics parameters identified for the site of the interim spent fuel storage facility, irrespective of the fact that the earthquake hazard, and the characteristics of the reference earthquake typical to the bedrock have been established in the framework of the site survey of a different nuclear facility constructed on a site with identical seismological properties.

7.6.2.0300.

7.6.2.0400. The disqualification criteria formulated in Section 7.3, in the relevant legal regulations and in the standards shall be considered in the evaluation on the basis of a local assessment.

7.6.2.0500. The implementation and the use of local geotechnical, hydrogeological and soil-mechanics data are specifically required for the interim spent fuel storage facility:

a) for the analysis and assessment of the hazard of soil liquefaction and geotechnical stability,

b) for the determination of the load bearing capacity of the soil and for the establishment of data to be included in the design basis of the engineering solutions to be used to improve the soil stability, and

c) for the establishment of engineering geology data required for the foundation of the interim spent fuel storage facility and for the design of the structures, which are to be included in the design basis.

7.6.2.0600. With regard to the site data required for the assessment of radioactive releases and Nuclear Emergency Response Plans, the following work shall be specifically carried out for the interim spent fuel storage facility:

a) to identify an area of a radius of 30 km, at least, which is to be investigated on the basis of the estimated dimension of the environment potentially affected by radioactive releases, by considering the logistical aspects of the implementation of the nuclear emergency response plans, and

b) to assess and evaluate the properties of the site and its immediate environment, which are required for the evaluation of the feasibility of the nuclear emergency response measures.

7.6.2.0700. Depending on the design of the storage facility, the meteorological conditions and external impacts, which are necessary for the design of the cooling of spent fuels and for the assessment of the safety of the heat removal, shall be identified in the framework of the assessment specified in Section 7.3.3 and 7.3.5. The assessments shall be carried out for the maximum thermal power and in due consideration of the capacity of the cooling system of the storage facility to ensure that the occurrence of site conditions with adverse effect on the designed rate of heat removal remains below 5×10^{-4} for the entire service life. The simultaneous occurrence of several different unfavourable conditions shall also be considered, if the frequency of the simultaneous occurrence is higher than 10^{-5} /year. The meeting of this requirement shall be demonstrated in the framework of the licensing procedure.

7.7. SITE SURVEY AND ASSESSMENT FOR RESEARCH AND TRAINING REACTORS

7.7.1. General requirements

7.7.1.0100. The external hazard sources shall be classified in the framework of the site survey of research and training reactors, and in the identification of data to be included in the design basis.

7.7.1.0200. The classification of external hazards shall be reviewed and, if required, modified in a conservative manner after the design of the research or training reactor and the site have become known.

7.7.1.0300. For research and training reactors, the hazards, the occurrence frequency of which is not less than the annual occurrence frequency data presented in Table 1, shall not be involved in the site survey described in Section 7.2 and 7.3. The estimation of such hazards shall be based on the published data of site hazards, and on analyses and assessments.

	Screening level of the detailed investigation, with regard to the annual occurrence frequency, 1/year	
Reactor heat power MW	The hazard cannot be forecasted and immediate impact is assumed	The hazard can be monitored, forecasted and has no immediate impact
1-10	10^{-4}	10^{-3}
0.1-1	10^{-3}	10^{-3}
≤ 0.1	2×10^{-3}	2×10^{-3}

Table 1: Probability levels for the site survey for research and training reactors

7.7.1.0400. The site shall be declared unsuitable for the accommodation of a research or training reactor, if the occurrence of accidents with serious consequences cannot be excluded with reference to the following occurrence probability or to the distance from the site:

a) 10^{-7} /year or lower annual occurrence frequency of aircraft crash, calculated for the studied area; and

b) there is a 10^{-7} /year or lower annual probability that, considering the mitigation of the effect by the distance from the potential source of hazard, the effect of hazards caused by human activities in the vicinity of the site reaches the research or training reactor and has an effect on the nuclear safety thereof.

7.7.1.0500. The hazards and environmental impacts that cannot be screened, monitored and predicted and have an immediate impact, shall be considered in the design basis of the research and training reactors. The design basis data shall be identified with the exceedance probability values specified in Table 2, for the entire service life.

Reactor heat power MW	Exceedance probability of design basis hazards for the entire service life	
	The hazard cannot be forecasted and immediate impact is assumed	The hazard can be monitored, forecasted and has no immediate impact
1-10	0.05	0.05
0.1-1	0.05	0.1
≤0.1	0.1	0.1

Table 2: Probability levels for the identification of data to be included in the design basis for research and training reactors

7.7.1.0600. Engineering and administrative measures shall be taken to provide protection of the research and training reactor against hazards, which can be monitored, predicted and has no immediate impact.

7.7.1.0700. The data collection, the site measurements and investigations, the methodology and level of details of the assessment carried out for the site survey shall be specified in conformity with the annual occurrence frequency of the hazard, as follows:

a) if the annual exceedance probability of the data to be used in the design basis is equal to or less than 10^{-3} , the probabilistic safety assessment of the site hazards shall be carried out with the use of the available data, or a conservative estimation

shall be made with the consideration of the data available for the site, the environment, and the site hazards;

b) if the annual exceedance probability of the data to be used in the design basis is higher than 10^{-3} , hazard analyses and standard parameters available for non-nuclear facilities can be used with conservative extrapolation to the specified occurrence frequency.

7.7.1.0800. The events and conditions, which may occur in the immediate environment around the nuclear facility shall be specially assessed in the framework of the site investigation of the research and training reactors.

7.7.1.0900. The site can be considered acceptable for the construction of research or training reactor, if the effects associated with high risk can be screened out by considering technical aspects and there are proven and tried engineering solutions against the effect to ensure that the risk caused by the events and conditions typical to the site are as low as reasonably achievable.

7.7.2. Special requirements

7.7.2.0100. No research or training reactor shall be installed in an area, where the risk of occurrence of permanent surface displacements is presumed.

7.7.2.0200. No research or training reactor shall be installed in an area, where soil liquefaction may be caused by the safety earthquake, unless proven engineering solutions are in hand to ensure the soil stability.

7.7.2.0300. The site unsuitability criteria, specified in Section 7.3, in the relevant legal regulations and the standards, shall be considered in the evaluation.

7.7.2.0400. In the framework of the geotechnical assessment of the site, the load bearing capacity of the soil and the data required for the design of the foundation shall be determined as specified in standards used for non-nuclear facilities. If, for a nuclear reactor of the given power, lower exceedance probabilities are defined in Table 2 than those specified in the standards used for non-nuclear facilities, conservative estimation and extrapolation can be made for the required lower probability level.

7.7.2.0500. Standards used for non-nuclear facilities can be applied for the identification of meteorological data, which are typical to the site and are to be used in the design basis. The meteorological data can be established with the use of data from regional observations, but it shall be examined whether there are particular conditions, which are to be considered and specifically assessed to ensure the nuclear safety of the nuclear reactor. If, for a nuclear reactor of the given power, lower exceedance probabilities are defined in Table 2 than those specified in the standards used for non-nuclear facilities, conservative estimation and extrapolation can be made for the required lower probability level.

7.7.2.0600. The site of the research and training reactors shall be protected from inundation and floods, the exceedance probability of which is higher than specified in Table 2.

7.7.2.0700. The assessment of the site properties defining the dispersion of releases may take place using the available measurement data and handbook data, with conservative estimation and with the assessment of uncertainties. Targeted investigations shall be undertaken in the case, if the available data are not sufficient for the conservative estimation or, due to the uncertainties, the estimation cannot lead to rational outcome or the site properties give a special reason for doing so.

7.7.2.0800. The demographical and population distribution data shall be analysed and predicted for the entire service life of the research and training reactors. For the designation of the studied area, the potentially affected area shall be estimated by considering the design and nuclear safety features of the research and training reactor. The full compliance with this requirement shall be demonstrated in the framework of the licensing procedure.

7.7.2.0900. The assessment shall be carried out in two stages:

a) to allow the analysis of the effects of radioactive releases, a comprehensive analysis shall be carried out for the site and its immediate environment; and

b) in the wider environment of the site, the assessment can be performed with use of the available measurement data and handbook information, with conservative estimation and with the consideration of uncertainties.

7.7.2.1000. The hazard curve required for the nuclear safety assessments shall be taken in compliance with the regulations specified for the nuclear power plant.