Government Decree (733/2008)
on the Safety of Nuclear Power Plants

Issued in Helsinki on 27 November 2008

According to the Government decision made on the submission by the Ministry of Employment and the Economy, the following provisions are issued under Section 7 q of the Nuclear Energy Act (990/1987), issued on 11 December 1987, in the form laid down in Act 342/2008:

Chapter 1
Scope of application and definitions

Section 1
Scope of application

This Decree lays down provisions on the safety of nuclear power plants. Moreover, the Decree shall apply, as necessary, to other nuclear facilities equipped with a nuclear reactor.

Section 2
Definitions

For the purposes of this Decree:

1) *annual dose* shall refer to the sum of the effective dose arising from external radiation within the period of one year, and of the committed effective dose from the intake of radioactive substances within the same period of time;
2) *criticality* shall refer to a state whereby the output and loss of neutrons, created in fission and maintaining a chain reaction, are in equilibrium so that a steady chain reaction continues;
3) *criticality accident* shall refer to an accident caused by an uncontrolled chain reaction of fissions maintained by neutrons;
4) *anticipated operational occurrence* shall refer to such a deviation from normal operational conditions that can be expected to occur once or several times during any period of a hundred operating years;
5) *accident* shall refer to postulated accidents, design extension conditions and severe accidents;
6) *postulated accident* shall refer to such a deviation from normal operating conditions that can be assumed to occur more rarely than once during any period of a hundred operating years and which the nuclear power plant is required to withstand without severe fuel damage, even if individual components of systems important to safety are rendered out of operation due to servicing or faults; postulated accidents are grouped into two classes on the basis of the frequency of their initiating events:
a) postulated accidents of Class 1, which can be assumed to occur less frequently than once during any period of a hundred operating years, but at least once during any period of a thousand operating years;
b) postulated accidents of Class 2, which can be assumed to occur less frequently than once during any period of a thousand operating years;
7) *design extension condition* shall refer to a situation caused by a rare external event, or a situation where the initiating event of an anticipated operational occurrence or Class 1 postulated accident involves a common-cause failure in the safety systems, or a complex combination of failures, and which the facility is required to withstand without severe fuel damage;
8) *severe accident* shall refer to a situation where a considerable part of the fuel in the reactor is damaged;
9) *probabilistic risk assessment* shall refer to quantitative assessments of probabilities and consequences of event sequences originating from threats influencing the safety of a nuclear power plant;
10) *safety functions* shall refer to functions important from the safety point of view, the purpose of which is to prevent the emergence or propagation of disturbances and accidents or to mitigate the consequences of accidents;
11) *redundancy principle* shall refer to the implementation of systems important from the safety point of view using several parallel subsystems, so that the system will be able to function even though individual subsystems are out of operation e.g. due to maintenance or failure;
12) *diversity principle* shall refer to securing functions important from the safety point of view through systems or equipment based on different operating principles, each of which is able to implement a function separately;
13) *separation of subsystems* shall refer to the placement of parallel subsystems of systems

important from the safety point of view in separate premises;
14) *operational separation* shall refer to rendering systems that secure each other as independent of each other as possible, and the placement of systems important from the safety point of view in rooms separate from other parts of the plant;
15) *separation principle* shall refer to the separation of subsystems from each other and operational separation;
16) *controlled state* shall refer to a state where the reactor is shut down and the removal of its decay heat is secured; and
17) *safe_state* shall refer to a state where the reactor is shut down and non-pressurised, and the removal of its decay heat is secured.

Chapter 2
General safety

Section 3
Assessment and verification of safety

The safety of a nuclear power plant shall be assessed when applying for a construction licence and operating licence, in connection with plant modifications, and at regular intervals during the operation of the plant.
Unless compliance with safety regulations can be directly verified on the basis of the nuclear power plant's design solution, compliance must be demonstrated. Nuclear power plant safety and the technical solutions of its safety systems shall be substantiated by using experimental and calculational methods. These include analyses of operational occurrences and accidents, strength analyses, failure mode and effect analyses, and probabilistic risk assessments. Analyses shall be maintained and revised if necessary, taking into account operating experience, the results of experimental research, plant modifications and the advancement of calculation methods.
The calculation methods employed for demonstrating compliance with safety regulations shall be reliable and well qualified for the purpose. They shall be applied so that the resulting system design bases meet the acceptance criteria with high certainty. Any uncertainty in the results shall be assessed and considered when defining safety margins.

Section 4
Safety classification

The safety functions of a nuclear power plant shall be defined and the related systems, structures and components classified on the basis of their safety significance.
Systems, structures and components important to safety shall be designed, manufactured, installed and used so that their quality level, and the assessments, inspections and tests, including environmental qualification, required to verify their quality level, are sufficient considering the safety significance of the item in question.

Section 5
Ageing management

The design and construction of a nuclear power plant shall include provision for the ageing of systems, structures and components important to safety. The condition of systems, structures and components shall be monitored to ensure that they retain their operability and conformity in design-basis conditions. Their replacement by new or similar technology, as well as repairs and modifications, shall be carried out in a systematic manner.

Section 6
Management of human factors

Special attention shall be paid to the avoidance, detection and correction of any human error during design, construction, operation and maintenance. The possibility of human error shall be taken into account in the design of the nuclear power plant and in the planning of its operation and maintenance, so that human error and deviations from normal plant operations due to human error do not endanger plant safety. The impacts of human error shall be reduced by using various safety design methods, including defence-in-depth, redundancy, diversity and separation.

Chapter 3
Limitation of radiation exposure and releases of radioactive materials

Section 7
Radiation safety of nuclear power plant workers

Occupational radiation exposure of nuclear power plant workers shall be kept as low as reasonably achievable. Furthermore, the design and operation of nuclear power plants shall be implemented so that the radiation exposure of workers can be restricted in compliance with the provisions of the

Radiation Act (592/1991) and Radiation Decree (1512/1991).

Section 8
Limit for normal operation

The limit for the annual dose of an individual in the population, arising from the normal operation of a nuclear power plant, is 0.1 millisievert (*mSv*). Based on this limit, the Radiation and Nuclear Safety Authority (STUK) shall confirm release limits for radioactive materials during the normal operation of a nuclear power plant.

Section 9
Limit for an anticipated operational occurrence

The limit for the annual dose of an individual in the population arising as the result of an anticipated operational occurrence is 0.1 mSv.

Section 10
Limits for accident

A postulated accident and a design extension condition shall not result in such high releases of radioactive materials that extensive measures should have to be taken in the vicinity of the facility in order to limit the radiation exposure of the population.
The limit for the annual dose of an individual in the population arising as the result of an accident is
- 1 mSv for Class 1 postulated accidents;
- 5 mSv for Class 2 postulated accidents; and
- 20 mSv for a design extension condition.

The limit for the release of radioactive materials arising from a severe accident is a release which causes neither acute harmful health effects to the population in the vicinity of the nuclear power plant, nor any long-term restrictions on the use of extensive areas of land and water.
The requirement applied to long-term effects will be satisfied if there is only an extremely small possibility that, as the result of a severe accident, atmospheric release of cesium-137 will exceed the limit of 100 terabecquerel (*TBq*).

Chapter 4
Nuclear safety

Section 11
Siting of a nuclear power plant

The safety impact of local conditions, as well as the security and emergency preparedness arrangements, shall be considered when selecting the site of a nuclear power plant. The site shall be such that the impediments and threats posed by the facility to its environment remain extremely minor and heat removal from the plant to the environment can be reliably implemented.

Section 12
Prevention of accidents and mitigation of consequences

In order to prevent operational occurrences and accidents, and to mitigate the consequences thereof, the operational principle of defence-in-depth shall be implemented in the manner laid down in this section.

Proven or otherwise carefully examined high-quality technology shall be employed in the design, construction and operation of a nuclear power plant. When arranging the operations of the licensee's organisation, the aim shall be to ensure reliable prevention of operational occurrences and accidents (*prevention*).
A nuclear power plant shall encompass systems that facilitate the quick and reliable detection of operational occurrences and accidents and prevent the aggravation of any event. Accidents leading to extensive releases of radioactive materials must be highly unlikely (*control of operational occurrences and accidents*).
Effective technical and administrative measures shall be taken to mitigate the consequences of any accident. Counter-measures for bringing an accident under control and preventing radiation hazards shall be planned in advance (*mitigation of consequences*).

Section 13
Engineered barriers for preventing the dispersion of radioactive materials

In order to prevent the dispersion of radioactive materials, the structural defence-in-depth safety principle shall be implemented in the manner laid down in this section.
Dispersion of radioactive materials from the fuel of the nuclear reactor into the environment shall be prevented by means of successive barriers which are the fuel and its cladding, the reactor cooling circuit (*primary circuit*) and the containment building.

The fuel and reactor, the primary circuit of a nuclear power plant and the secondary circuit of a pressurised water reactor power plant, their water chemistry, the containment building and safety functions shall be designed so as to meet the following safety objectives:

1) In order to assure the integrity of fuel
- the probability of fuel failure shall be low during normal operational conditions and anticipated operational occurrences;
- during postulated accidents, the rate of fuel failures shall remain low and fuel coolability shall not be endangered; and
- the possibility of a criticality accident shall be extremely low.

2) In order to ensure primary and secondary circuit integrity,
- the primary circuit shall be designed and manufactured in compliance with high quality standards so that the probability of hazardous faults in structures and that of mechanisms threatening their integrity remains extremely low and any faults which occur can be detected reliably through inspections;
- the primary circuit shall, with sufficient margins, withstand the stresses arising in normal operational conditions, anticipated operational occurrences, postulated accidents and design extension conditions;
- the primary circuit and systems immediately connected to it, and components important to the safety of the secondary circuit of a pressurised water reactor, shall be reliably protected during anticipated operational occurrences and all accident scenarios, in order to prevent damage caused by over-pressurisation; and
- in order to detect leakages, the facility shall be equipped with sufficient monitoring systems.

3) In order to ensure containment building integrity,
- the containment building shall be designed so as to maintain its integrity during anticipated operational occurrences and, with a high degree of certainty, during all accident scenarios;
- pressure, radiation and temperature loads, combustible gases, impacts of missiles and short-term high energy phenomena resulting of an accident shall be considered in the design of the containment building; and
- the possibility of fracturing of the reactor pressure vessel in a severe accident so that the leak-tightness of the containment building would be endangered shall be extremely small.

The nuclear power plant shall be equipped with systems that ensure the stabilisation and cooling of molten core material generated during a severe accident. Direct interaction of molten core material with the load bearing containment structure shall be reliably prevented.

Section 14
Safety functions and provisions for ensuring them

In ensuring safety functions, inherent safety features attainable by design shall be primarily utilised. In particular, the combined effect of a nuclear reactor's physical feedbacks shall be such that it mitigates the increase in reactor power.

If inherent safety features cannot be utilised in ensuring a safety function, priority shall be given to systems and components which do not require an off-site power supply or which, as consequence of a loss of power supply, will settle into a state that is preferable from the safety point of view.

In order to prevent accidents and mitigate the consequences thereof, a nuclear power plant shall be provided with systems for shutting down the reactor and maintaining it in a sub-critical state, for removing decay heat generated in the reactor, and for retaining radioactive materials within the plant. Principles ensuring the implementation of these safety functions even in the event of a malfunction must be applied in designing the systems in question. Such principles are redundancy, separation and diversity. The most important systems necessary for transferring to, and remaining in, a controlled state must be capable of fulfilling their function even if any individual system component is inoperable and even if any other component of the same system or of a supporting or auxiliary system necessary for its operation is simultaneously out of use due to required repair or maintenance.

Common-cause failures in safety systems shall only have minor impacts on plant safety.

A nuclear power plant shall have on-site and off-site electrical power supply systems. The execution of safety functions shall be possible by using either of the two electrical power supply systems.

The plant shall be provided with systems, structures and components for controlling and monitoring severe accidents. These shall be independent of the systems designed for operational conditions and postulated accidents. Systems necessary for ensuring the integrity of the containment building in a severe accident shall be capable of performing their safety functions, even in the case of a single failure.

The plant shall be designed so that it can be brought into a safe state after a severe accident.

Section 15
Fuel handling and storage

In the handling and storing of nuclear fuel, adequate cooling and radiation protection shall be ensured. Damage to fuel cladding during handling and storage must be prevented with a high degree of certainty. The possibility of a criticality accident shall be extremely low. Fuel storage conditions shall be maintained such that the leak-tightness or mechanical endurance of a fuel assembly is not substantially degraded during the planned storage period.

Section 16
Management and storage of radioactive waste

Waste generated during the operation of a nuclear power plant, the activity concentration of which exceeds the limits set by the Radiation and Nuclear Safety Authority (STUK), shall be treated as radioactive waste. Waste shall be sorted, categorised and handled in an appropriate manner in terms of its storage and final disposal, and stored safely.

Section 17
Protection against external events

The design of a nuclear power plant shall take account of external events that may challenge safety functions. Systems, structures and components are to be designed, located and protected so that the impacts of external events on plant safety remain minor. External events to be accounted for include at least exceptional weather conditions, seismic events and other factors resulting from the environment or human activity. Design must also take account of illegal activities undertaken to damage the plant, and a large airliner crash.

Section 18
Protection against internal events

The design of a nuclear power plant shall take account of any internal events that may challenge safety functions. Systems, structures and components shall be designed, located and protected so that the probability of internal events remains low and impacts on plant safety minor. Internal events to be considered include at least fire, flood, explosion, pipe breaks, container breakages, missiles, falling of heavy objects and component failures.

Section 19
Monitoring and control of a nuclear power plant

The control room of a nuclear power plant shall contain equipment that provides information on the operational state of the nuclear reactor and any deviations from normal operation. Furthermore, a nuclear power plant shall contain automatic systems that actuate safety functions whenever required and control and supervise their functioning during operational occurrences and accidents.
These automatic systems shall be capable of maintaining the plant in a controlled state long enough to provide the operators with sufficient time to consider and implement the correct actions.
The nuclear power plant shall have an emergency control post independent of the control room, and the necessary local control systems for shutting down and cooling the nuclear reactor, and for removing residual heat from the nuclear reactor and spent fuel stored at the plant.

Section 20
Decommissioning

The design of a nuclear power plant shall take account of decommissioning of the facility so as to limit the volume of waste destined for final disposal, accumulating during the dismantling of the plant, and the radiation exposure of workers due to the dismantling of the plant, and to prevent radioactive materials from spreading into the environment.

Chapter 5
Construction and commissioning of a nuclear power plant

Section 21
Construction

During construction the licensee shall ensure that the plant is constructed and implemented in compliance with the approved plans and procedures.
In addition, the licensee shall ensure that the plant supplier and sub-suppliers delivering services and

products important to safety act in the appropriate manner.

Section 22
Commissioning

In connection with the commissioning of a nuclear power plant, the licensee shall ensure that the systems, structures and components and the plant as a whole operate as designed.
At the commissioning stage, the licensee shall ensure that an expedient organisation is in place for the future operation of the nuclear power plant, alongside a sufficient number of qualified personnel and instructions suitable for the purpose.

Chapter 6
Operating of a nuclear power plant

Section 23
Operating

The control room of the nuclear power plant shall be constantly manned by a sufficient number of operators aware of the state of the plant, systems and components. Further, the control and supervision of a nuclear power plant shall utilise written instructions that correspond to the current structure and state of the plant. Written orders and related instructions shall be provided for the maintenance and repair of components.
For operational occurrences and accidents, instructions suitable for the identification and control of incidents shall be available.
Operational measures concerning the nuclear power plant, as well as events having an impact on safety, shall be documented so that they can be analysed afterwards.

Section 24
Operational experience feedback and safety research

Nuclear power plant operational experience feedback shall be collected and safety research results monitored, and both assessed for the purpose of enhancing safety. Safety-significant operational events shall be investigated for the purpose of identifying the root causes as well as defining and implementing the corrective measures. Improvements in technical safety, resulting from safety research, shall be taken into account to the extent justified on the basis of the principles laid down in section 7 a of the Nuclear Energy Act.

Section 25
Technical Specifications

The Technical Specifications of a nuclear power plant shall include the technical and administrative requirements for ensuring the plant's operation in compliance with design bases and safety analyses. The requirements for ensuring the operability of systems, structures and components important to safety, as well as the limitations that are to be observed in the event of equipment failure, shall also be presented in the Technical Specifications. The plant shall be operated in compliance with these requirements and restrictions, and compliance with them shall be monitored and any deviations reported.

Section 26
Condition monitoring and maintenance

The nuclear power plant shall have a condition monitoring and maintenance programme for ensuring the integrity and reliable operation of systems, structures and components. This programme shall define inspections, testing, maintenance, replacements and other procedures for controlling operability and the impacts of the operating environment.

Section 27
Radiation monitoring and control of releases of radioactive materials

The radiation levels of nuclear power plant rooms and the activity concentrations of indoor air and the gases and liquids in the systems shall be measured, releases of radioactive materials from the plant monitored, and concentrations in the environment controlled.

Chapter 7
Organisation and personnel

Section 28
Safety culture

When designing, constructing, operating and decommissioning a nuclear power plant, a good safety culture shall be maintained. The decisions and activities of the management of all organisations participating in the abovementioned activities shall reflect its commitment to safety-

promoting operating methods and solutions. Personnel shall be motivated to perform responsible work and an open working atmosphere shall be promoted in the working community to encourage the identification, reporting and elimination of factors endangering safety. Personnel shall be given the opportunity to contribute to the continuous enhancement of safety.

Section 29
Safety and quality management

Organisations participating in the design, construction, operation and decommissioning of a nuclear power plant shall employ a management system for ensuring the management of safety and quality. The objective of such a management system is to ensure that safety is prioritised without exception, and that quality management requirements correspond to the safety significance of the function. The management system shall be systematically assessed and further developed.
Safety and quality management shall cover all functions influencing nuclear power plant safety. For each function, requirements significant in safety terms shall be identified, and the planned measures described in order to ensure compliance with requirements. The processes and operating methods shall be systematic and based on instructions.
Systematic procedures shall be in place for identifying and correcting deviations significant in terms of safety.
The licensee shall commit and oblige its employees and suppliers, sub-suppliers and other partners participating in functions affecting safety, to adhere to the systematic management of safety and quality.

Section 30
Lines of management, responsibilities and expertise

The lines of management in the organisation of a nuclear power plant, alongside the positions and related responsibilities of employees, shall be defined and documented. Furthermore, the operations of the organisation shall be monitored and continuously developed.
Significant functions with respect to safety shall be designated. Training programmes shall be prepared for the development and maintenance of the professional qualifications of the persons working in these positions, and an adequate command of the functions in question must be verified.
The organisation shall have access to professional expertise and technical knowledge required for the safe operation of the plant, the maintenance of equipment important to safety, and the management of accidents.
The licensee shall have a group of experts, independent of the other parts of the organisation, working as support for the responsible manager, said group convening on a regular basis to handle safety-related issues and issue recommendations thereon if necessary.

Chapter 8
Entry into force and transitional provisions

Section 31
Entry into force

This Decree will enter into force on 1 December 2008.
The Decree will repeal the Decision of the Council of State on the general regulations for the safety of nuclear power plants, issued on 14 February 1991 (395/1991).
Measures required for the enforcement of the Decree can be undertaken prior to its entry into force.

Section 32
Transitional provision

The following shall not be applicable to a nuclear power plant for which an operating licence was issued prior to the entry into force of this Decree: section 10 (2-4), paragraph 3 of section 13(3), section 14, section 17 and section 19(3), unless their application is justified with respect to the technical solutions of the nuclear power plant in question, under the principle laid down in section 7 a of the Nuclear Energy Act.

Issued in Helsinki, 27 November 2008
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