

Government Decree (736/2008)

on the safety of disposal of nuclear waste

Issued in Helsinki 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 shall apply to the disposal of spent nuclear fuel and other nuclear waste, originating in a nuclear facility, into a facility to be constructed in bedrock.

The decree shall also apply to radioactive waste as referred to in section 10 of the Radiation Act (592/1991), if such waste is sited in a disposal facility for nuclear waste, as referred to in subsection 1.

Provisions on the handling and storage of spent nuclear fuel and other nuclear waste in a nuclear facility attached to a nuclear power plant are laid down in the Government Decree on the Safety of Nuclear Power Plants (733/2008).

Section 2

Definitions

For the purposes of this Decree:

- 1) *nuclear waste facility* shall refer to a nuclear facility used for the encapsulation of spent nuclear fuel or conditioning of other nuclear waste for disposal, and to a disposal facility for spent nuclear fuel or other nuclear waste;
- 2) *disposal facility* shall refer to an entirety comprising the rooms for disposal of the waste packages (*emplacement rooms*) and the adjoining underground and above-ground auxiliary facilities.
- 3) *disposal site* shall refer to the location of the disposal facility and, after disposal has been completed, the area entered in the real estate register in accordance with Section 85 of the Nuclear Energy Decree (161/1988), and the underlying ground and bedrock.
- 4) *short-lived waste* shall refer to nuclear waste, the activity concentration of which after 500 years is below the level of 100 megabecquerels (*MBq*) per kilogram in each disposed waste package, and

below an average value of 10 MBq per kilogram of waste in one emplacement room;

5) *long-lived waste* shall refer to nuclear waste, the activity concentration of which after 500 years is above the level of 100 megabecquerels (*MBq*) per kilogram in a disposed waste package, or above an average value of 10 MBq per kilogram of waste in one emplacement room;

6) *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;

7) *long-term safety* shall refer to the safety of disposal after the operational period of the disposal facility, taking account of radiological impacts on man and the environment;

8) *safety case* shall refer to documentation for demonstrating compliance with the long-term safety requirements ;

9) *safety functions* shall refer to factors preventing and limiting the releases and migration of disposed radioactive materials;

10) *barrier* shall refer to an engineered or natural structure or material used for achieving safety functions;

11) *assumed operational occurrence* shall refer to such incident influencing the safety of a nuclear waste facility that can be expected to occur at least once during any period of a hundred operating years;

12) *postulated accident* shall refer to such incident influencing the safety of a nuclear waste facility that can be assumed to occur more rarely than once during any period of a hundred operating years; postulated accidents are grouped further into two classes on the basis of their frequency:

a) class 1 postulated accidents, which can be assumed to occur at least once during any period of a thousand operating years;

b) class 2 postulated accidents, which can be assumed to occur less frequently than once during any period of a thousand operating years;

13) *expected evolution scenario* shall refer to such change affecting the performance of barriers that has a high probability of causing radiation exposure during the assessment period and which can be caused by interactions occurring in the disposal facility, by geological or climatic phenomena or by human action; and

14) *unlikely events impairing long-term safety* shall refer to such potential events significantly affecting the performance of barriers that have a low probability of causing radiation exposure during the assessment period and which can be caused by geological phenomena or by human action.

Chapter 2

Radiation safety

Section 3

Operation of nuclear waste facility

A nuclear waste facility and its operation shall be designed so that:

- 1) the radiation exposure of workers at the facility is limited by all practicable means and so that the maximum values laid down in the Radiation Decree (1512/1991) are not exceeded;
- 2) as a consequence of undisturbed operation of the facility, releases of radioactive materials into the environment remain insignificantly low;
- 3) as a consequence of assumed operational occurrences, the annual dose to the most exposed people other than workers of the facility remains below the value of 0.1 millisievert (*mSv*); and
- 4) as consequence of a postulated accident, the annual dose to the most exposed people other than workers of the facility remains below:
 - a) the value of 1 mSv when a Class 1 postulated accident occurs;
 - b) the value of 5 mSv when a Class 2 postulated accident occurs.

When applying this section, radiation doses arising from natural radioactive materials in the host rock of or released from groundwater bodies into the underground rooms of the disposal facility, shall not be taken into account.

Section 4

Long-term radiation impacts of disposal

Disposal of nuclear waste shall be planned so that radiation impacts arising as a consequence of expected evolution scenarios will not exceed the constraints given in subsections 2 and 3.

In any assessment period, during which the radiation exposure of humans can be assessed with sufficient reliability, and which shall extend at a minimum over several millennia:

- 1) the annual dose to the most exposed people shall remain below the value of 0.1 mSv; and
- 2) the average annual doses to other people shall remain insignificantly low.

During assessment periods after the period referred to above in subsection 2, average quantities of radioactive materials over long time periods, released into the living environment from the disposed nuclear waste, shall remain below the maximum values specified separately for each radionuclide by the Radiation and Nuclear Safety Authority (STUK). These constraints shall be specified so that:

- 1) at a maximum, radiation impacts caused by disposal can be equivalent to those caused by natural radioactive materials in earth's crust; and
- 2) on a large scale, the radiation impacts remain insignificantly low.

Section 5

Consideration of unlikely events

The significance of unlikely events impairing long-term safety shall be assessed by evaluating the reality, probability and possible consequences of each event. Whenever possible, the acceptability of the expectancies of radiation impacts caused by such events shall be evaluated in relation to the annual dose and release rate constraints of radioactive materials, as referred to in section 4.

Chapter 3

Design requirements for a nuclear waste facility

Section 6

Handling of spent nuclear fuel and other nuclear waste

Spent nuclear fuel and other nuclear waste shall be conditioned and packed in accordance with disposal specifications. Waste packages shall be classified on the basis of their characteristics. Constraints and other quality specifications shall be defined for each class, necessary in terms of the operational safety of the nuclear waste facility and the long-term safety of disposal, and which the waste packages are required to meet.

The nuclear waste facility shall employ effective radiation protection arrangements in order to limit the occupational radiation exposure and radiation impacts caused in the environment of the facility. In waste handling, releases of radioactive materials inside the facility and into the environment shall be prevented and limited as necessary with containment, recovery and filtering systems. Sufficient radiation protection shall be ensured in handling of spent nuclear fuel or other highly irradiating nuclear waste by using remote handling and radiation shielding. In handling of spent nuclear fuel, any damage to the fuel and occurrence of a self-sustaining chain reaction of fissions shall be prevented, and sufficient cooling of the fuel shall be ensured, to a high degree of certainty.

Section 7

Safety classification

The systems, structures and components of a nuclear waste facility shall be classified on the basis of their significance in terms of the operational safety of the facility, or the long-term safety of disposal. The required quality level of each classified object, and the inspections and testing necessary for verifying the quality, shall be adequate as regards the significance of the object in terms of safety.

Section 8

Prevention of operational occurrences and accidents

In order to prevent operational occurrences and accidents, the design, construction and operation of a nuclear waste facility shall employ proven or otherwise carefully examined high quality technology. A nuclear waste facility shall encompass systems that facilitate quick and reliable detection of an operational occurrence or accident and prevent the aggravation of any event. Effective technical and administrative measures shall be provided for the mitigation of the consequences of potential accidents. The functions at a nuclear waste facility, the failure of which could result in a significant release of radioactive materials or radiation exposure of personnel at the facility, shall be ensured. Ensuring the functions important to safety shall primarily be based on inherent safety features, alongside systems and components that do not require external power supply or which, as a consequence of a loss of power supply, will

settle into a state deemed preferable from the safety point of view.

The design of a nuclear waste facility shall take account of any impacts caused by potential natural phenomena and other events external to the facility. As external events, even unlawful activities aiming at damaging the facility shall be taken into account.

In a nuclear waste facility, the placement and protection of systems alongside operative methods shall ensure that fire, explosions or other events inside the facility do not pose a threat to safety.

Section 9

Disposal operations

The transfer of waste packages into the emplacement rooms shall be carried out so that the possibility of accidents remain low and the packages cannot be damaged in any way that would affect long-term safety.

The disposal package containing spent nuclear fuel shall be designed so that no self-sustaining chain reaction of fissions can occur, even in the disposal conditions.

The emplacement activities shall be separated from the excavation and construction work of the disposal facility in such a manner as to ensure that excavation and construction work cannot have any harmful impact on the operational safety of the facility or the long-term safety of disposed waste. The long-term performance of barriers shall be confirmed by establishing an investigation and monitoring programme, to be implemented during the operational period of the final disposal facility. A record shall be maintained of disposed waste, including waste package specific data on the waste type, radioactive materials, location within the waste emplacement room, and other necessary data. The Radiation and Nuclear Safety Authority (STUK) shall arrange the permanent recording of information concerning the disposal facility and disposed waste.

An adequate protection zone shall be reserved around the disposal facility as a provision for the prohibitions on measures referred to in paragraph 6, section 63(1) of the Nuclear Energy Act.

Chapter 4

Long-term safety of disposal

Section 10

General requirements concerning disposal

Disposal shall be implemented in stages, with particular attention paid to aspects affecting long-term safety. The planning of the construction, operation and closure of a disposal facility shall take account of reduction of the activity of nuclear waste through interim storage, the utilisation of high-quality technology and scientific data and the need to ensure long-term safety via investigations and monitoring. However, the implementation of the various stages of disposal shall not be unnecessarily postponed.

Section 11

Multibarrier principle

The long-term safety of disposal shall be based on safety functions achieved through mutually complementary barriers so that a deficiency of an individual safety function or a predictable geological change will not jeopardise the long-term safety.

Safety functions shall effectively prevent releases of disposed radioactive materials into the bedrock for a certain period, the length of which depends on the duration of the radioactivity in waste. For short-lived waste, this period shall be at least several hundreds of years, and for long-lived waste, at least several thousands of years.

Section 12

Disposal site

The geological characteristics of the disposal site shall, as a whole, be favourable to the isolation of the radioactive substances from the environment. Any area with a feature that is substantially adverse to long-term safety shall not be selected as the disposal site.

The planned final disposal site shall contain sufficiently large, intact rock volumes that facilitate the construction of the waste emplacement rooms. For the purposes of disposal facility design and acquiring data required for safety assessments, the geological characteristics of the host rock at the site shall be characterized through investigations at the intended disposal depth, in addition to surface based investigations. The layout, excavation, construction and closure of underground facilities shall be implemented so that the characteristics of the host rock deemed important in terms of long-term safety are retained, as far as possible.

The depth of the waste emplacement rooms shall be selected appropriately as regards the waste type and local geological conditions. The goal related

to disposal depth shall be that any impacts on the long-term safety of above-ground events, activities and environmental changes will remain minor and that intrusion into the waste emplacement rooms will be difficult.

Chapter 5

Demonstration of compliance with safety requirements

Section 13

Operational safety of nuclear waste facility

Compliance with safety requirements concerning the operation of a nuclear waste facility shall be proven in connection with commissioning as far as possible. Insofar as this is not possible, operational safety shall be demonstrated through experimental or computational methods, or via a combination thereof. Computational methods shall be selected so that the actual risk or harm remains below the results of calculations, with a high degree of certainty. Computational methods shall be reliable and validated for dealing with the events under analysis. The selection of operational occurrences and accidents to be analysed shall take account of their estimated probabilities.

Section 14

Long-term safety

Compliance with the requirements concerning long-term radiation safety, and the suitability of the disposal method and disposal site, shall be proven through a safety case that must analyse both expected evolution scenarios and unlikely events impairing long-term safety. The safety case comprises a numerical analysis based on experimental studies and complementary considerations insofar as quantitative analyses are not feasible or involve considerable uncertainties. Compliance with the radiation exposure constraints for the most exposed people, as referred to in section 4 above, shall be proven by considering a community that derives nutrition from the immediate surroundings of the disposal site and is most exposed to radiation. In addition to impacts on people, possible impacts on flora and fauna shall be analysed.

Section 15

Reliability of the safety case

The input data and models utilised in the safety case shall be based on high-quality research data

and expert judgement. Data and models shall be validated as far as possible, and correspond to the conditions likely to prevail at the disposal site during the assessment period.

The basis for selecting the computational methods used shall be that the actual radiation exposure and quantities of radioactive materials released remain below the results of safety analyses, with a high degree of certainty. The uncertainties involved in the safety analysis, and their significance, shall be separately assessed.

Section 16

Presentation of, and updates to, the safety case

The safety case shall be presented in connection with the construction licence application and the operating licence application of the nuclear waste facility. The safety case shall be updated at 15 year intervals unless otherwise provided in the licence conditions. Furthermore, the safety case shall be updated prior to the permanent closure of the facility.

Chapter 6

Construction and operation of the nuclear waste facility

Section 17

Construction and commissioning

The holder of a construction licence for the nuclear waste facility shall ensure that the facility will be constructed in compliance with the approved plans and procedures. Moreover, the licensee shall ensure that the plant supplier and subcontractors producing services and products important in terms of safety act in an appropriate manner.

In connection with the commissioning of a nuclear waste facility, the licensee shall ensure that the systems, structures and components and the facility as a whole operate in the planned manner. The licensee shall also ensure that an expedient organisation is in place for the future operation of the facility, alongside a sufficient number of qualified personnel and instructions suitable for the purpose.

Section 18

Operation

The operation of a nuclear waste facility shall be based on written instructions that correspond to the current structure and state of the facility.

Instructions shall be made available for the identification and control of operational occurrences and accidents. Significant events influencing safety shall be documented so as to facilitate their later analysis.

The Technical Specifications of a nuclear waste facility shall include the technical and administrative requirements for ensuring the operation of the facility in compliance with design bases. The licensee shall operate the facility in compliance with these requirements and restrictions, and supervise compliance and report any deviations from them.

The nuclear waste facility shall have a condition monitoring and maintenance programme for ensuring the integrity and reliable operation of systems, structures and components. Written orders and appended instructions shall be issued for the service and repair of components.

Compliance with requirements concerning the operational radiation safety of the nuclear waste facility shall be ensured through continuous or periodic measurements inside the facility, in possible significant release routes and in the environs of the facility.

Chapter 7

Organisation and personnel

Section 19

Safety culture

When designing, constructing, operating and decommissioning or closing a nuclear waste facility, a good safety culture shall be maintained. In its decisions and operations, the management of the organisation concerned shall demonstrate its commitment to procedures and solutions promoting safety. Personnel shall be motivated to perform responsible work and an open working atmosphere shall be promoted in the working community, in order to encourage the identification, reporting and elimination of factors endangering safety. Personnel shall be given the opportunity to contribute to the continuous safety enhancement.

Section 20

Safety and quality management

Organisations participating in the design, construction, operation and decommissioning or closure of a nuclear waste facility shall employ a management system for ensuring the management of safety and quality. The objective of the

management system is to ensure that safety is prioritised without exception, and that quality management requirements are commensurate with the significance to safety of the activity. This management system shall be systematically assessed and further developed.

Safety and quality management shall cover all activities influencing the safety of the nuclear waste facility. For each activity, requirements significant in safety terms shall be identified, and planned measures described in order to ensure compliance with requirements. The processes and procedures shall be systematic and based on instructions.

Systematic procedures shall be in place for identifying and correcting deviations significant in safety terms.

The licensee shall commit and oblige its employees and suppliers, subcontractors and other partners contributing to safety relevant activities to engage in systematic safety and quality management.

Section 21

Lines of management, responsibilities and expertise

The lines of management in the organisation of a nuclear waste facility, alongside the positions and related responsibilities of employees, shall be defined and documented. The organisation shall have access to the professional expertise and technical knowledge required for the safe operation of the nuclear waste facility and long-term safety of nuclear waste disposal.

Duties significant to safety shall be designated. Training programmes shall be prepared for the

development and maintenance of the professional skills of the persons working in these positions, and adequate command of the knowledge required for the positions shall be verified.

Chapter 8

Miscellaneous provisions

Section 22

Disposal in the ground

If nuclear waste, as referred to in the Nuclear Energy Act, will be disposed of in a facility constructed in the ground, said disposal shall be planned and implemented in compliance with the requirements laid down in sections 3—9 and 13—21 herein. Only very low-level waste, the average activity concentration of which does not exceed the value of 100 kBq per kilogram, and the total activity of which does not exceed the limits laid down in section 6(1) of the Nuclear Energy Decree, can be placed in a facility constructed in the ground.

Section 23

Entry into force

This Decree enters into force on 1 December 2008.

This Decree repeals the Decision of the Council of State on the general regulations for the safety of a disposal facility for reactor waste (398/1991), issued on 14 February 1991, and the Government Decision on the safety of disposal of spent nuclear fuel (478/1999), issued on 25 March 1999. Measures required for the enforcement of the Decree can be undertaken prior to the entry into force of the Decree.

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