

Radiation and Nuclear Safety Authority Regulation on the Emergency Arrangements of a Nuclear Power Plant (STUK Y/2/2024), explanatory memorandum

MAIN CONTENT

The Radiation and Nuclear Safety Authority Regulation on the Emergency Arrangements of a Nuclear Power Plant is enacted under paragraphs 5, 6 and 23 of section 7q of the Nuclear Energy Act (990/1987). It repeals the Radiation and Nuclear Safety Authority Regulation on the Emergency Arrangements of a Nuclear Power Plant (Y/2/2018) that entered into force on 15 December 2018.

The regulation governs the planning of emergency arrangements at nuclear power plants, maintaining emergency preparedness and actions during emergency situations. Section 2 Definitions of the regulation has been amended with regard to the extent of the precautionary action zone and the emergency planning zone. There is a new Section 3a concerning the designation of the precautionary action zone and the emergency planning zone, and Section 11(1) has been amended to comply with the current Nuclear Energy Act. The definition of a severe accident has been removed from Section 2 of the Regulation, and Section 3(4) has been amended so that the design basis for emergency arrangements refers more generally to accidents instead of severe accidents. Otherwise, the new regulation corresponds to the regulation being repealed.

The changes are intended to make it possible to select locations for new nuclear power plants without compromising the safety of the population, by removing from the regulation the numeric distance values 5 kilometres for the precautionary action zone and 20 kilometres for the emergency planning zone considered problematic and unnecessarily large from the point of view of selecting sites for small nuclear power plants. The licence applicant is required by regulation to propose a precautionary action zone and an emergency planning zone and to justify their adequate size.

In the International Atomic Energy Agency (IAEA) Code, the definition of the sizes of these zones is discussed in General Safety Requirements No. GSR Part 7: Preparedness and Response for a Nuclear or Radiological Emergency and in Safety Guide No. GS-G-2.1: Arrangements for Preparedness for a Nuclear or Radiological Emergency. These documents define as the criterion for the zones that, in the event of an accident, a risk of a dose with deterministic effects must not exist beyond the precautionary action zone. The criterion for the emergency planning zone is that the dose criterion requiring sheltering indoors must be unlikely to be exceeded outside the zone. Therefore, the criteria presented in IAEA documents correspond to the criteria presented in the updated regulation.

Although there exist international recommendations for criteria for the size of the zones, no uniform international practice has emerged concerning the models used or the assumptions applied therein for the assessment of these criteria. The IAEA has led a coordinated research project to address these topics and is preparing recommendations to underpin the assessment methods and assumptions to be used.

General rationale

1 Introduction

The requirements for emergency arrangements at a nuclear power plant are laid down in section 7p of the Nuclear Energy Act. General safety regulations of the Radiation and Nuclear Safety Authority clarifying the requirements of the act were first issued on 22 December 2015 and entered into force on 1 January 2016

2 Current status

The current Radiation and Nuclear Safety Authority Regulation on the Emergency Arrangements of a Nuclear Power Plant, which entered into force on 15 December 2018, was issued pursuant to section 7q(1)(23) of the Nuclear Energy Act. Section 2 of the regulation defines the precautionary action zone as an area extending to a distance of approximately five kilometres from the nuclear power plant, where land use restrictions are in force. Correspondingly, it defines the emergency planning zone as an area extending to a distance of approximately 20 kilometres from the nuclear power plant and for which authorities shall draft an external rescue plan referred to in section 48(1)(1) of the Rescue Act (379/2011).

3 Key objectives and change proposals

The key objective is to amend the Regulation on the Emergency Arrangements of a Nuclear Power Plant so as to define the size of precautionary action zones and emergency planning zones based on studies and analyses to be prepared, eliminating the current requirement for distances of 5 km and 20 km. The regulation would enable nuclear power plants to be located, for example, closer to densely populated areas if this is feasible based on the studies and analyses prepared. The Radiation and Nuclear Safety Authority would process the designation of the precautionary action zone and the emergency planning zone as part of the plans for emergency arrangements for the construction and operating licence phases referred to in sections 35 and 36 of the Nuclear Energy Decree (161/1988). In addition, the Radiation and Nuclear Safety Authority issues a statement on the planning of land use in accordance with Section 58 of the Nuclear Energy Act.

During the preparatory work, the Radiation and Nuclear Safety Authority has been aware that there are requirements in parts of the regulation other than those now proposed for amendment, which may not be suitable for all types of nuclear power plants. Since a comprehensive reform of the Nuclear Energy Act is under way as this regulation is being drafted, it is not appropriate to open the regulation to wider amendments at this point. Other requirements than the selection of the site would most likely be considered in possible plant projects only after the comprehensive reform of the Nuclear Energy Act.

4 Impacts of the regulation and change proposals

The amendment would have no impact on the safety of the population living in the vicinity of a nuclear power plant, as the protection measures applied to the reference

levels of an emergency exposure situation in the determination of the precautionary action zone and emergency planning zone will not change. On the other hand, precautionary action zones and emergency planning zones that are correctly dimensioned in relation to the threat posed by the nuclear power plant would enable more efficient planning and implementation of protective measures, as the zones would not be unnecessarily large.

For new nuclear power plants, a change in the definitions of precautionary action zones and emergency planning zones would also allow for the appropriate siting of plant alternatives that differ from existing nuclear power plants in terms of their power or operating principles, if this can be considered acceptable from a safety point of view. This is particularly emphasised if the nuclear power plant is intended to produce, for example, district or process heat instead of or in addition to electrical energy.

In order to carry out the necessary studies and analyses, the licence applicant should have at its disposal sufficient expertise either within its own organisation or in the form of external experts. This entails costs, the amount of which, however, is estimated to be very small in the overall picture of a nuclear power plant project. In addition, it must be taken into account that the licence applicant must, in any case, use the corresponding expertise at the various stages of the life cycle of the nuclear power plant.

The regulation will have an impact on land use in the precautionary action zone through land use planning. Compared to the 5km precautionary action zone required by the current regulation, land use restrictions could target a smaller area.

The new requirements set out in the regulation would not in themselves cause changes to the precautionary action zones or emergency planning zones currently in force. It would also not be necessary for existing licence holders to present new justifications for existing zones in this context.

5 Drafting of the regulation

The Regulation on the Emergency Arrangements of a Nuclear Power Plant was drafted at the Radiation and Nuclear Safety Authority as official work.

Opinions on the draft regulation were requested electronically via lausuntopalvelu.fi between 13 June and 16 August 2023.

The Advisory Committee on Nuclear Safety (YTN) was also asked for an opinion on the draft regulation on 12 June 2023.

Opinions were received from the Eastern Uusimaa Police Department, the Southwestern Finland Police Department, the Satakunta Rescue Department, the Eastern Uusimaa Emergency Services Department, the Ministry of the Environment, the Ministry of Economic Affairs and Employment, the Ministry of the Interior, Teollisuuden Voima Oyj and Posiva Oy, Fortum Power and Heat Oy, VTT Technical Research Centre of Finland Ltd, Lappeenranta-Lahti University of Technology LUT, Finnish Energy, the Ecomodernist Society of Finland and the Advisory Committee on Nuclear Safety.

The opinions received considered it appropriate to remove the required kilometre distance values for the precautionary action zone and the emergency planning zone from the regulation. The current zone limits are based on existing nuclear power plants and do not take into account the lower outputs and new safety features of new types of nuclear power plants. Due to this, the fixed zone limits are not sensible or appropriate for different types and sizes of nuclear power plants.

The opinions called for more precise definition of the criteria for the precautionary action zone and the emergency planning zone, for example based on dose criteria. The opinions suggested basing the zone definitions and the related requirements on safety objectives and requirements in line with international recommendations.

In addition, the opinions presented comments and proposed some clarifications to the texts of the regulation and the explanatory memorandum.

On the basis of the opinions, amendments were made to Sections 2, 3, 3a and 11 of the draft regulation, mainly concerning the definitions of and requirements for the precautionary action zone and the emergency planning zone. Correspondingly, the explanatory memorandum was supplemented and amended in Sections 4 and 5 of the general rationale and in Sections 2, 3, 3a and 11 of the detailed rationale for the sections.

6 Regulation's entry into force

The regulation shall enter into force on 1 February 2024.

Detailed rationale

Section 2 Definitions

The key terms and definitions used in the regulation are presented in Section 2 of the regulation.

The kilometre distances defining the size of the zones, approximately 5 km and approximately 20 km, have been removed from the definitions of precautionary action zone and emergency planning zone. The purpose of the precautionary action zone and the emergency planning zone, i.e., preventing or limiting the harmful effects of ionising radiation, has been added to the definitions. For the sake of clarity, a mention that the precautionary action zone is included in the emergency planning zone has been added to the definition of emergency planning zone.

The definition of severe accident has been removed from the definitions. This is justified in the text below.

Section 3 Planning criteria

In Paragraph 4, the requirement to investigate the "time-behaviour progress of severe accident scenarios resulting in a potential release" has been amended to investigating the "time-behaviour progress of accident scenarios resulting in a

potential release.” The reason for the change is that the possibility of a severe accident in accordance with the current regulation may be so unlikely in some power plant solutions that it is not justifiable to plan emergency response operations and prepare for protection measures in the event of such events.

A sentence on the possibility of using generic analyses for the definition of the precautionary action zone and the emergency planning zone has been added to Paragraph 4. Sufficiently conservative analyses can help to reduce duplication of work if similar power plants or locations are under consideration.

Section 3a Precautionary action zone and emergency planning zone

Pursuant to section 7p of the Nuclear Energy Act, the planning of emergency arrangements shall be based on analyses of operational occurrence and accident conditions, and the consequences assessed on the basis of these analyses.

A nuclear power plant must have a precautionary action zone, the extent of which is based on studies and analyses presented by the licence applicant. The determination of the extent of the precautionary action zone must take into account the characteristics of the plant and site as well as the criteria for population and environmental safety. The precautionary action zone is used to demarcate an area with the potential for severe deterministic health effects. The IAEA General Safety Requirement No. GSR Part 7 sets for this a dose criterion of 1 Gy (1 Sv) received by an unprotected person within 10 hours. According to GSR Part 7, the assessment must also take into account events with a very low probability, events that are beyond the plant's design basis, external threats to the plant and events that affect all facilities on the site simultaneously. In practice, a postulated accident at the plant is the most serious realistic accident possible, regardless of its probability. The radioactive releases of the accident used to define the precautionary action zone may exceed the acceptance criteria of the radioactive releases set for the plant, as the assessment also includes events with a very low probability. This is to ensure that the level of protection of the population is at an acceptable level even in the event of unforeseen accidents.

The Radiation and Nuclear Safety Authority processes the designation of the precautionary action zone in connection with the processing of the application for a construction and operating licence as part of the plans for emergency arrangements referred to in sections 35 and 36 of the Nuclear Energy Decree (161/1988). However, in terms of scheduling possible plant projects, it is necessary to define the zone in a timely manner even before the start of the land use planning process. Cooperation between authorities related to construction and planning of land use is provided for in section 58 of the Nuclear Energy Act. At the stages of land use planning mentioned in the section, STUK may present its assessment of the extent of the proposed zone in its opinions. The licence applicant may use generic analyses if it can be demonstrated that they cover differences between plants and sites. Buildings and functions that cannot be effectively evacuated as a precaution in the early stages of an accident must not be placed in the precautionary action zone. These include hospitals, medical facilities and other places where large numbers of people regularly stay or visit. The licence applicant should have a close dialogue with the regional rescue department responsible for drawing up the external emergency plan regarding the planning and implementation of the evacuation measures. According to the estimate presented in the guide on Protective Actions in a Nuclear or Radiological

Emergency (VAL 1) issued on 20 December 2022, the time required for evacuation measures is a minimum of approximately four hours from the moment of making the decision. Potential new nuclear power plants may differ in terms of, for example, thermal output and operating principles and therefore in the magnitude and potential for radioactive releases, so the size of the precautionary action zone and the population and activities allowed in the area will be determined on the basis of an overall site-specific assessment of each plant. The siting of a new nuclear power plant must take into account the critical societal functions already existing in the area.

The nuclear power plant must have an emergency planning zone, the extent of which is based on studies and analyses presented by the licence applicant. The definition of the emergency planning zone must take into account the characteristics of the plant and site as well as the criteria for population and environmental safety. Potential new nuclear power plants may be different in terms of, for example, their thermal output and operating principles, and therefore in terms of the magnitude and potential for radioactive releases, so the size of the emergency planning zone will be determined on the basis of an overall site-specific assessment.

The Radiation and Nuclear Safety Authority processes the designation of the emergency planning zone in connection with the processing of the application for a construction and operating licence as part of the plans for emergency arrangements referred to in sections 35 and 36 of the Nuclear Energy Decree (161/1988). The requirements for the emergency planning zone do not apply so much to land use as to rescue services plans, so it is not necessary to present the zone in planning maps. However, it is natural to make a timely determination in conjunction with the designation of the precautionary action zone. The licence applicant may use generic analyses if it can be demonstrated that they cover differences between plants and sites. A key protection measure that may be needed in the event of an accident in the emergency planning zone is sheltering indoors, which can be supplemented with a dose of iodine. The dose criterion used is a dose of 10 mSv received within 48 hours (two days) by an unprotected person. The dose criterion is derived from the reference level of exposure caused by a radiation emergency set by decision 5/8020/2020 of the Radiation and Nuclear Safety Authority based on section 132 of the Radiation Act (859/2018). The derivation of the dose criterion is presented in Radiation and Nuclear Safety Authority Guide VAL 1 (20 December 2022).

The time required for effective sheltering indoors is approximately four hours from the moment the protection decision is made. The licence applicant should have a close dialogue with the regional rescue department responsible for drawing up the external emergency plan regarding the planning and implementation of the protective measures required in the emergency planning zone. However, the size of the emergency planning zone should not exceed a distance of about 20 kilometres from the plant, regardless of the related analyses. At a distance of more than 20 kilometres from the plant, there is likely to be sufficient time to take the necessary protective measures without advance plans by the rescue services. The IAEA Code recommends limiting the radius of the emergency planning zone to a maximum of 20–30 kilometres (IAEA, Safety Guide GS-G-2.1).

Section 11 Command of operations in an emergency situation

Paragraph 1 has been amended by replacing the reference to the repealed section 147 of the Nuclear Energy Decree with a reference to section 7n of the Nuclear Energy Act.

Section 14 Entry into force

The section provides for the entry into force of the regulation. It repeals the Radiation and Nuclear Safety Authority Regulation on the Emergency Arrangements of a Nuclear Power Plant issued on 15 December 2018.

The regulation will enter into force on 1 February 2024.

A transitional provision has been added to the section for nuclear power plants for which a precautionary action zone and an emergency planning zone have already been defined at the time of entry into force of this regulation. The provisions on the extent of the precautionary action zone and emergency planning zone in force at the time of the entry into force of this regulation may be applied to these facilities.

Upon its entry into force, this regulation will be applied to any pending matters.

Availability of the regulation, guidance and advice

This regulation has been published as part of the regulations issued by the Radiation and Nuclear Safety Authority that can be found on Finlex at: <https://www.finlex.fi/fi/viranomaiset/normi/555001/>. The regulation is also available from the Radiation and Nuclear Safety Authority.

List of references

1. Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standard Series, General Safety Requirements GSR Part 7, IAEA Vienna, 2015.
2. WENRA Safety Reference Levels for Existing Reactors, Update in Relation to Lessons learned from Tepco Fukushima Dai-Ichi Accidents, WENRA RHWG, 2014.
3. Council Directive 2013/59/EURATOM of 5 December 2013, laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.
4. Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations.
5. Arrangements for Preparedness for a Nuclear or Radiological Emergency, IAEA Safety Standard Series, Safety Guide No. GS-G-2.1, IAEA Vienna, 2007.
6. Radiation and Nuclear Safety Authority Decision 5/8020/2020, Setting a reference level for the radiation exposure of the population caused by the event of radiation emergency, 18 September 2020.