

Unofficial translation from Finnish

21.12.2015

5/0007/2016

**Radiation and Nuclear Safety Authority Regulation on the Safety of Mining and Milling Operations Aimed at Producing Uranium or Thorium, explanatory memorandum****General rationale****1 Introduction**

Amendment 676/2015 of the Nuclear Energy Act (990/1987) transferred the authority for issuing general regulations regarding safety to the Radiation and Nuclear Safety Authority. Therefore, this regulation is based on the authority for issuing regulations of a technical nature that is regulated by Section 7 q of the Nuclear Energy Act and that enters into force on 1 January 2016.

The requirements set forth in this regulation proposal are based on Section 7 q(27) of the Nuclear Energy Act, *the safety of mining and milling operations aimed at producing uranium or thorium*.

**2 Current status**

Currently, Government Decrees are used to specify general safety regulations. However, provisions that are similar to the this regulation have not been previously issued via a Government Decree.

**3 Purpose of regulation and key proposals**

The regulation is used to issue provisions that specify the Nuclear Energy Act as regards the safety of mining and milling activities aimed at producing uranium and thorium. Issuing a safety regulation is necessary since uranium production is now possible in our country.

The regulation is applied to mining and milling activities that fall within the scope of the Nuclear Energy Act and whose purpose is the production of uranium or thorium. The safety requirements apply both to the safety of the operation of the mine and processing plant and the safety of the disposal of production waste originating from them. This regulation specifies the general requirements included in Chapter 2A of the Act. A Government Decree has not been previously issued on the topic.

The regulation applies to the safety of operations insofar as is decreed in the Nuclear Energy Act and in Section 2 and Chapter 9 of the Radiation Act (592/1991). The purpose of the regulation is to ensure that the radiation exposure and detrimental environmental effects caused by the activities are kept as low as reasonably achievable, and that the generated production waste is handled appropriately. The regulations concerning the other safety aspects of the activities are provided in the provisions issued on the basis of the appropriate legislation. The requirements in the regulation are directly binding to the licence holder of a mining or milling operation referred to in the Nuclear Energy Act, but the requirements shall be considered as soon as the planning these activities begins.

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#### **4 Impacts of the regulation**

The regulation does not have any significant financial or societal impacts or impacts related to authority activities. The purpose of the regulation is to ensure, among other things, that the mining does not cause radiation exposure or adverse environmental effects; in this respect, the regulation will also have a positive effect on the environment and public health. In practice, the current legislation already obliges the operator to ensure the radiation safety of mining and milling operations aimed to produce uranium and thorium. This regulation clarifies the legal obligations of the operator.

During the amendment of the Nuclear Energy Act, Section 82 that concerns the authority for issuing decrees has been supplemented with the matters for which a Government Decree will be provided. These include the radiation exposure of the population, which requires a higher-level decision in terms of its social significance, and matters that fall under the mandate of other authorities.

#### **5 Drafting of the regulation**

The regulation on the safety of mining and milling operations aimed at producing uranium or thorium has been drafted at the Radiation and Nuclear Safety Authority (STUK) as standard clerical work within the framework of the project (VALMA) that STUK established in order to guide the drafting of the regulations, to ensure coherence between the different regulations and to manage the conformity to law and layout of STUK's regulations.

Statements concerning the regulation proposal were requested from the Ministry of Employment and the Economy, the Ministry of Social Affairs and Health, the Ministry of the Environment, the Ministry of the Interior, the Ministry for Foreign Affairs, the Advisory Commission on Nuclear Safety, Fortum Power and Heat Oy, Teollisuuden Voima Oyj, Fennovoima Oy, VTT Technical Research Centre of Finland Ltd, the Finnish Safety and Chemicals Agency (Tukes), Talvivaara Sotkamo Oy, the Regional State Administrative Agency of Northern Finland and the Centre for Economic Development, Transport and the Environment for Kainuu.

Statements were received from the Ministry of the Environment, the Advisory Committee on Nuclear Safety, Talvivaaran Kaivososakeyhtiö Oyj, Posiva Oy and Teollisuuden Voima Oyj. The statements pointed out that the draft regulation did not clearly indicate that the radioactive waste created by the operations is nuclear waste (Advisory Committee and Posiva) and that it did not define whose radiation exposure was being discussed (Advisory Committee). Furthermore, the Advisory Committee remarked that emergency activities are not discussed in the regulation and that the regulation on emergency arrangements at nuclear power plants does not apply to mining and milling operations. It is the opinion of TVO that the general design requirements should be laid down in the Nuclear Energy Act or Decree.

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## Detailed rationale

### Section 1 Scope

Section 1 of the regulation defines the scope to cover mining and milling operations aimed at producing uranium or thorium or uranium and thorium insofar as the activities fall within the scope of the Nuclear Energy Act. These operations can take place either separately or as one function that occurs within the same area. Pursuant to Section 2(1)(2) of the Nuclear Energy Act, the Act is applied to mining and milling operations aimed at producing uranium and thorium. By virtue of Subsection 3 of the above Section, however, Section 9 b of the Nuclear Energy Decree (161/1988) excludes from the scope those mining and milling activities in which the quantity of uranium or thorium produced during a period of one year is no more than 10,000 kilograms or the average content of uranium and thorium in the processed ore is lower than the limits imposed in Section 2, and the combined content of uranium and thorium in refined products is less than 0.5 kilograms per tonne.

The regulation also applies to the disposal of waste generated during the production of uranium or thorium insofar as the waste falls within the scope of application of the Nuclear Energy Act. A part of the disposal operations may take place after the mining and milling operations have been completed.

The Radiation Act contains requirements concerning the radiation protection of workers, for example, which have not been included in this regulation. Therefore, the second paragraph states that the provisions of Section 2 of the Radiation Act regarding the general principles of operation and the provisions of Chapter 9 of the same Act regarding the radiation protection of workers also apply as regards radiation safety.

### Section 2 Definitions

Section 2 of the regulation contains the definitions of terms used.

The definition of licensee has been included in order to clarify that the requirements set forth apply to the licensee referred to in the Nuclear Energy Act. The definition of anticipated operational occurrence corresponds to the definition used earlier in the Government Decrees (for example, Government Decree 736/2008 on the disposal of nuclear waste).

Production waste is considered nuclear waste since it is waste generated in the use of nuclear energy. The figures in the definition of production waste are based on the EU's base directive for radiation protection enacted in 2013 (Council directive 2013/59/EURATOM) where these values are stated as exemption levels and clearance levels for naturally occurring radioactive substances. The activity concentration only considers long-lived radioactive substances ( $T_{1/2} > 20$  years), since short-lived radioactive substances such as polonium are expected to be at equilibrium with the parent nuclide or to reach such a state during the storage of the waste.

### Section 3 Radiation safety of workers and environment

Paragraph 1 contains provisions regarding the limiting of worker radiation exposure. The provision is based on the Radiation Act and Radiation Decree (1512/1991). Section

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2 of the Radiation Act states that, to be considered acceptable, the use of radiation and practices involving exposure to radiation shall meet the following criteria:

- 1) The benefits derived from the practice shall exceed the detriment it causes (principle of justification);
  - 2) The practice shall be arranged so that the resulting exposure to radiation hazardous to health is kept as low as is reasonably achievable (principle of optimisation);
- No person shall be exposed to radiation exceeding the maximum values prescribed by Decree (principle of limitation).

Paragraph 2 concerns the limiting of exposure due to radon. If the radon concentration within the premises of the production unit exceeds 400 becquerels per cubic metre, the concentration shall be reduced by improving ventilation and blocking any water leaks, for example.

Paragraph 3 applies to the limiting of exposure to the members of the population in the vicinity of the production unit. The provision is based on the Radiation Act and Radiation Decree. The general principles from Section 2 of the Radiation Act mentioned above also apply to the radiation exposure of the members of the population.

The maximum values for radiation exposure caused by the operation of the production unit and the disposal of production waste to the members of the population in the vicinity of the facility are laid down in Section 22 c of the Nuclear Energy Decree.

#### **Section 4 Estimating the radiation doses of the population**

Environmental sample analyses alone cannot be used to estimate the radiation doses caused by the operations, since the dose caused by the normal operation of the production unit, in particular, is so small that the environmental sample measurements do not differ from the background values. On the other hand, radiation doses during accident situations are impossible to measure in advance. For these reasons, compliance with the maximum values laid down in Section 3 shall be demonstrated by calculating the doses.

An accident situation refers to an anticipated abnormal event during mining and milling that can be assumed to occur less frequently than once over a span of one hundred years and where the annual dose received by a representative of the members of the population will exceed 0.1 mSv.

In this context, expected evolutions shall refer to evolutions where the disposal of production waste is implemented as planned or where one or more structures affecting long-term safety are assumed to be degraded.

#### **Section 5 Planning of mining operations**

The planning of mining and milling operations can affect worker radiation exposure and the dispersion of radioactive substances into the environment. The best possible option for managing the disposal of waste containing radioactive substances shall also be considered during the planning stage. Limiting of radiation exposure shall be considered during the design of the rooms, systems and ventilation of the mine, for example.

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Radioactive substances can be dispersed from the mine if they are carried by dust or water, for example. The limiting of releases shall be taken into account in the methods used for excavation, crushing and water treatment.

The waste rock generated during mining may release radioactive substances as it disintegrates. Therefore, Paragraph 6 contains requirements regarding the storage of the waste rock and a requirement for limiting the creation of waste rock that is classified as production waste.

Radioactive substances shall be observed when preparing for operational occurrences. The Mining Act contains provisions regarding preparation for mining accidents. In addition to what has been decreed in the Mining Act, the preparation for mining accidents shall also take into account the hazards caused by radioactive substances.

### **Section 6 Planning of ore processing activities**

References are made to the rationale in Section 5 as regards the five first items.

Different radionuclides have different radiation characteristics and chemical properties. Their passage in the process differs and the radiation exposure caused by them depends on the nuclide. In order to reliably assess and determine the radiation effects of the operation, Paragraph 6 contains provisions regarding the operator's duty to analyse the passage of different radionuclides inside the process. The results of the analysis shall be observed when planning operations and ensuring the radiation safety of the operations.

Paragraph 7 contains provisions regarding the processing and storage of or mineral processing waste. Mineral processing waste classified as production waste may release radioactive substances (radon, dust containing radioactive substances, water leaks). For this reason, special requirements shall be set for its processing and storage.

Ore processing operations may potentially involve substantial amounts of radioactive substances. Therefore, Paragraph 8 contains provisions on the obligation to identify already at the design stage the risk factors that could result in the release of substantial amounts of radioactive substances into the facility's rooms or its environment. Amounts that cause a need for decontaminating the environment or initiating protective measures towards the members of the population shall be considered substantial. It also contains provisions regarding the operator's duty to prepare for operational occurrences and accident situations by means of technical and administrative arrangements that mitigate the consequences of the accident and implement rescue activities if necessary.

### **Section 7 Ensuring the safety functions**

The purpose of this section is to ensure that the licensee verifies the functionality of the production unit before its commissioning and remains continuously aware of the functioning of the structures, systems and components that are important in terms of radiation safety, during normal operating conditions as well as operational occurrences and accident situations.

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**Section 8 Radiation protection arrangements**

Limiting worker radiation exposure in the necessary manner requires that the limitation of radiation exposure is taken into account in the working methods and conditions, and that working time is reduced if necessary.

In order to ensure the safety of the workers, Section 8 contains provisions regarding the licensee's duty to draw up and maintain written radiation protection instructions.

In order to monitor the radiation situation at the production unit and the worker radiation exposure, the production unit shall have in place equipment for measuring the contamination of workers as well as vehicles, machines and other items and materials leaving the area. In order to prevent the dispersion of radioactive substances, it shall be possible to clean any vehicles, machines and other material leaving the area if necessary.

Access of the public into areas where exposure to radiation may occur shall be monitored.

**Section 9 Radiation monitoring**

The Nuclear Energy Decree contains provisions regarding the maximum values of exposure caused by the operations. In order to ensure compliance with the requirements and to detect any deviations, the licensee shall perform regular measurements within the premises of the mine or milling facility and along the possible release routes of radioactive substances.

For the purposes of monitoring worker radiation exposure, the licensee shall carry out monitoring within the area of the production unit pursuant to Chapter 9 of the Radiation Act in accordance with the nature and scope of the activities.

**Section 10 Environmental radiation safety**

In order to determine how the operations affect the radiation situation in the environment, Section 10(1) obliges the licensee to determine the natural radiation situation (*base line survey*) in the vicinity of the production unit before the unit enters into production.

Paragraph 2 contains provisions on the licensee's obligation to monitor any possible releases of radioactive substances from the production unit and their concentrations within the environment. STUK will also monitor the vicinity of the mine in accordance with its own radiation monitoring programme. The operator will simultaneously perform less extensive radiation monitoring in the vicinity of the mine. The results can be used to detect any changes in the environment that may have been caused by the operations.

Paragraph 3 obliges the licensee to arrange the implementation of decontamination activities if radioactive substances are released into the environment to such an extent that environmental decontamination measures are required in order to avert consequent health or environmental hazards. The obligation for decontamination is independent of whether the release is due to negligence or wilful behaviour.

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**Section 11 Exceptional situations, operational occurrences and emergency arrangements**

Pursuant to Section 7 p of the Nuclear Energy Act, the planning of emergency response arrangements for the use of nuclear energy shall be based on analyses of operational occurrence and accident conditions, and the consequences assessed on the basis of these analyses. Furthermore, emergency response arrangements shall be consistent with the rescue and preparedness plans drawn up by the authorities, considering the provisions laid down in Section 9(2) of the Rescue Act (468/2003).

Paragraph 1 requires preparation for cases where substantial amounts of radioactive substances are released into the area of the production unit or its surroundings. A substantial amount is one that may cause radiation exposure to workers or the members of the population in the vicinity.

In order to ensure correct operation during emergency situations, Paragraph 2 requires that written instructions are prepared for them.

Both the Mining Act (621/2011, applies to mines) and the Act on the safety of handling dangerous chemicals and explosives (390/2005, applies to separate milling facilities for uranium or thorium) require that an internal rescue plan be prepared. Paragraph 3 requires that radioactive substances causing radiation exposure are also taken into account. A separate emergency response plan is not required.

Paragraph 4 reminds the licensee of the requirement in Section 7 p of the Nuclear Energy Act, according to which the emergency arrangements shall be coordinated with the rescue and emergency plans drawn up by the authorities.

Paragraph 5 states that STUK shall immediately be notified of any releases of radioactive substances in order for it to assess the severity of the situation and provide advice to the citizens and authorities if necessary. Other abnormal events may also affect radiation safety, and they reveal the operation of the organisation. Abnormal events may create public interest and will likely result in questions regarding radiation effects, as well.

**Section 12 Management, organisation and personnel**

This section applies to the licensee's organisation, personnel and management. The management relationships at the facility and the tasks and responsibilities that are significant in terms of radiation safety shall be defined and documented. Radiation safety requires the licensee to employ sufficient, responsible personnel with the training and professional skill required for the tasks and an awareness of the significance of their duties in terms of safety.

Training programmes shall be drawn up in order to develop and maintain the radiation protection competence of the persons guiding and supervising functions related to radiation safety, and their adequate understanding of the information required for their tasks shall be verified. Furthermore, basic information regarding radiation safety matters shall be provided to all permanent and temporary personnel of the production unit.

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**Section 13 Nuclear safeguards and security arrangements**

The section reminds the licensee of security arrangements and nuclear safeguards obligations. These are based on the Nuclear Energy Act and Decree.

**Section 14 Principle of nuclear waste management**

The section contains provisions on the principle of nuclear waste management. Production waste generated during the production of uranium and thorium may contain radioactive substances in quantities that necessitate setting special requirements for its processing and disposal. The required disposal activities will depend on the amount of nuclear waste, its activity concentration and other factors impacting radiation exposure as well as local conditions.

**Section 15 Disposal of production waste**

The section contains more detailed provisions on the disposal of production waste. Pursuant to Section 63(1)(6) of the Nuclear Energy Act, the Radiation and Nuclear Safety Authority is authorised to issue prohibitions on measures regarding the property in order to ensure safety whenever the property has disposal facilities for nuclear waste. Pursuant to Section 15(1), the licensee shall reserve an adequate protection zone around the disposal area for the implementation of the prohibitions on measures mentioned above.

The requirements set forth herein aim to ensure that the disposal of production waste will not cause a radiation hazard even in the long term. The isolation of the emplacement room for production waste shall withstand degradation due to natural phenomena.

**Section 16 Materials contaminated by radioactive substances**

In addition to production waste, other radioactive waste generated during operation shall also be appropriately managed. For example, radioactive substances may accumulate inside piping and other structures during ore processing. If structures, items, components and materials contaminated by radioactive substances cannot be cleaned, they shall be disassembled and disposed of in a manner approved by the Radiation and Nuclear Safety Authority. If the level of contamination is low after decontamination activities have taken place, disposal with production waste may be possible.

**Section 17 Record-keeping and reporting**

In order to make the information concerning the amount and location of radioactive waste disposed of in the area easy to find after operations have ceased, for example, the licensee shall arrange the records concerning disposed production waste and other nuclear waste into a file that includes information concerning the location of the waste area, the characteristics of the waste and the amounts of radioactive substances in the waste. The characteristics of the waste are used to specify the information concerning the quality and origin of the waste, such as waste consisting of waste rock, biological dilution piles and tailings, radioactive waste from maintenance or disassembly work at the milling facility that cannot be reused etc. The information shall be continuously kept up to date for as long as the mining and milling activities continue. The information shall be regularly submitted to the Radiation and Nuclear Safety Authority. The Radiation and



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Nuclear Safety Authority may define the format and schedule for the submission in more detail within the YVL Guides.

**Section 18 Rehabilitation in areas used for production**

The Mining Act contains provisions on the rehabilitation of the area. In addition to the provisions of the Mining Act, the rehabilitation of a production area for uranium and thorium shall ensure that the rehabilitation meets the safety requirements laid down on the basis of the Nuclear Energy Act and Radiation Act. More detailed safety requirements will be provided in a YVL Guide.

**Section 19 Entry into force**

This regulation shall enter into force on 1 January 2016.

Upon the entry into force, this regulation shall 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: <http://www.finlex.fi/en/viranomaiset/normi/555001/>. The regulation is also available from the Radiation and Nuclear Safety Authority.