REPUBLIC OF ESTONIA
MINISTRY OF THE ENVIRONMENT

REPUBLIC OF ESTONIA
ENVIRONMENTAL BOARD

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

Sixth Estonian National Report as referred to in Article 32 of the Convention

Seventh Review Meeting of Contracting Parties

Tallinn 2020

Contents

Section A. Introduction

Estonia is a Member State of the IAEA since 1992. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (hereinafter *the Joint Convention)* was adopted on 29 September 1997 at a diplomatic conference in Vienna, Austria. Estonia signed the Joint Convention on 5 January 2001. The *Riigikogu* (Parliament of Estonia) ratified the Joint Convention on 19 October 2005. Estonia deposited the instrument of accession to the Joint Convention on 3 February 2006. The Joint Convention entered into force on 4 May 2006.

Estonia is a member state of the European Union (EU) from 1 May 2004. Thus, EU legislation has been implemented into the Estonian national legal and administrative framework. When necessary, Estonian legislation will be amended to take into account of changes of EU legislation.

This is the Sixth National Report (hereinafter *the Report*) from Estonia, which provides an update on previous report under the terms of the Joint Convention. The Report is structured in conformity with the "Guidelines regarding the form and structure of national reports" (INFCIRC/604/Rev.3) adopted at the Second Extraordinary Meeting of the Contracting Parties, 12–13 May 2014, held in Vienna. The comments, questions and remarks given to Estonia's last national report and Estonia's presentation at the Sixth Review Meeting have been incorporated. The Report pays attention on the progress made in the areas identified as challenges during the Sixth Review Meeting:

1) Completion of the remediation activities at a former radioactive waste disposal site in Tammiku to allow unrestricted site release by 2022.
2) Steps towards construction of the national disposal facility and planning for the decommissioning of Paldiski sarcophagi.
3) Implementation of human resources education in radiation protection.
4) Implementation of relevant 2016 IRRS mission recommendations / suggestions in preparation for follow up in 2019.

The Report aims to provide sufficient background where necessary to enable reading it as a stand-alone document. The information contained in the Report were gathered and updated at 1 October 2020, unless stated otherwise.

There are no nuclear power plants or facilities operating with nuclear fuel cycle in Estonia, neither are any activities related to nuclear fuel cycle performed. Therefore, the Section G of this Report concerning the safety of spent fuel management covering Articles 4-10 of the Joint Convention is not applicable for Estonia.

In Estonia, main source of radioactive waste is from decommissioning of facilities from past practices (from Soviet period) as well as the use of radioactive sources in industry, medicine, and to a small extent from the use in education and research. Estonia has two shut-down nuclear submarine reactors from Soviet period, in long term safe storage stage in Paldiski (hereinafter *Paldiski site*). Spent nuclear fuel was sent back to Russia. There is also a facility for interim storage for the low and intermediate level radioactive waste in the Paldiski site. RADON-type radioactive waste management facility, which was used in the former Soviet Union, situated in Tammiku site is under decommissioning since 2008. The feasibility study, related to the decommissioning of the reactor compartments of the former Paldiski military nuclear site and for the establishment of a radioactive waste repository was implemented in 2014-2015. The aim of it was to conduct preliminary technical investigations and gather necessary data, which will enable to plan further decisions and activities, as well as start the environmental impact assessment process. Based on these studies, the Government

of the Republic made the decision to establish a final disposal site in Estonia at the cabinet meeting of 28 April 2016.

Main developments since the Sixth Review Meeting are the following:
The most relevant activity since the Sixth Review Meeting that can be highlighted is the adoption of the National Radiation Safety Development Plan for 2018-2027 and its annexes approved by the Decree of the Minister of the Environment on January 2020. The annexes are the National Action Plan for Radioactive Waste Management, the National Radon Action Plan and the action programme for implementing the National Radiation Safety Development Plan in 2018-2021. The National Action Plan for Radioactive Waste Management presents the sub-objectives of the described elements, measures and expected results until 2050. In the period 2019-2023, research for site selection of the final disposal facility, and technical and radiological studies of the facilities in Paldiski site are carried out, coordinated by the Ministry of the Environment.

Estonia hosted an Integrated Regulatory Review Service (IRRS) Follow-up Mission in March 2019 and Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) Mission in the end of March 2019. Improvements are made in all areas covered by the IRRS mission in 2016. In the field of radiation safety and protection, further attention needs to ensure sustainable education, training, as well as develop, and management of human resources of regulatory bodies. To improve and ensure implementation of the National Programme for Radioactive Waste Management, ARTEMIS mission concluded that Estonia needs to focus on the following issues: improve national legal and regulatory framework concerning the establishment of radioactive waste disposal covering site selection and design, construction, operation, and closure of the disposal facility; establish requirements and guidance for safety documentation for disposal facilities, including waste acceptance requirements; and capacity building to provide the necessary human and financial resources to deliver all aspects of the National Programme for Radioactive Waste Management. Most of the recommendations and suggestions made during missions are included in National Radiation Safety Development Plan 2018-2027 and transposed into national legislation.

The 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, and Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionizing radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom were transposed into national legislation.

The decommissioning activities in Tammiku site are ongoing and the Report will provide an update of the situation and planned activities.

On 17 June 2020, the *Riigikogu* (Parliament of Estonia) passed changes in the law that will result in the merger of the Environmental Board and the Environmental Inspectorate on 1 January 2021. The merged authority will bear the name of the Environmental Board. The aim of merging the Environmental Board and the Environmental Inspectorate is to simplify communication between citizens and the State, to organise services more efficiently and to reduce bureaucracy. The new authority will carry out the same tasks and responsibilities as the current Environmental Board and the current Environmental Inspectorate. This will include authorisation, review and assessment,

inspection and enforcement of radiation practices. Since this Report describes the legislative and regulatory system as on 1 October 2020, it does not provide an overview of the structure and tasks of the new authority. More details on the new authority will be given during the Seventh Review Meeting of the Joint Convention.

The General Part of the Environmental Code Act and the Radiation Act cover the main legislation of radiation safety and radioactive waste. While the purpose of the General Part of the Environmental Code Act is more general, such as the reduction of environmental nuisances to the maximum extent possible in order to protect the environment, human health, well-being, property and cultural heritage, it contains information regarding licence proceedings and the extent of the state supervision. The Radiation Act provides the basic safety requirements for the protection of people and the environment against the adverse impact of ionizing radiation, the rights and obligations of persons in using radiation, the requirements for radiation practices, the organisation of state supervision over compliance, and the liability for failure to comply with the requirements provided in the Radiation Act. Radioactive waste management in particular is regulated in the framework of the Radiation Act. General Part of the Environmental Code Act and Radiation Act are further discussed in Article 19 of this Report.

The structure of the Report is as follows:
1) Section B provides an overview of the radioactive waste management policy and relevant activities in Estonia;
2) Section C provides scope of application;
3) Section D provides an overview of the inventories of activities provided in Section B;
4) Section E presents an overview of the Estonian legislative and regulatory system;
5) Section F presents an overviev of the other general safety provisions e.g. human and financial resources, and emergency preparedness;
6) Sections H to J provide an article-by-article overview of safety of radioactive waste management, transboundary movements of radioactive waste and management of disused sealed sources;
7) Section K provides an overview of the challenges and planned measures to improve safety which were identified during the Sixth Review Meeting, and the efforts made and measures taken to address those challenges. It also describes planned future actions;
8) Section L, which includes Annexes A to D, i.e. matrix of current practice of radioactive waste management, inventory of radioactive waste in interim storage, references to Estonian national laws and regulations as well as national and international reports related to safety of spent fuel and radioactive waste.

The Report is prepared by the Environmental Board in co-operation with the Ministry of the Environment, the Environmental Inspectorate and the radioactive waste management agency A.L.A.R.A. Ltd.

Based on the evaluation, it is the understanding of the Estonian authorities that:
1) Estonian radiation and waste safety legislation fulfils the obligations of the Joint Convention;
2) Estonian regulatory infrastructure is in compliance with the Joint Convention obligations;
3) the regulatory and licensing policies and the practical implementation of radioactive waste management comply with the Joint Convention obligations;
4) improvements are foreseen to enhance safety, these are discussed in the Report.

It is concluded in the Report that Estonia meets all obligations of the Joint Convention.

Section B. Policies and Practices

ARTICLE 32. REPORTING

1. *In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address it`s:*
   - *i. spent fuel management policy;*
   - *ii. spent fuel management practices;*
   - *iii. radioactive waste management policy;*
   - *iv. radioactive waste management practices;*
   - *v. criteria used to define and categorize radioactive waste.*

1. Radioactive waste management policy

The Estonian radioactive waste management policy is based on national legislative drafting and international principles. The policy and practice for radioactive waste management is to collect, characterize, manage, and store all Estonian radioactive waste under safe and secure conditions in dedicated facilities. Legislation relevant to radiation protection and safety as well as radioactive waste management can be accessed from Annex C.

The activities related to radiation safety shall be organised by the Ministry of the Environment within the limits of its competence through the Environmental Inspectorate and the Environmental Board. Whereby, the interim storage and final disposal of radioactive waste shall be organised by the Ministry of Economic Affairs and Communications.

The Radiation Act provides two measures to assess the national radiation protection system: preparation of the national radiation safety development plan and its action plan for implementation, and state audit of radiation safety. The national radiation safety development plan is a ten-year programme for developing and enhancing radiation safety in Estonia; it analyses the situation of radiation safety in the country, determines the measures for improvement of radiation safety, and gives an assessment on how the development plan promotes pursuing of the objectives and principles of radiation safety and protection. Its objectives are ensuring radiation protection and nuclear safety, radioactive waste management, responding to accidental and existing exposure situations, increasing radiation awareness and issues concerning natural and medical exposures. The state audit of radiation safety shall be organizde at least every ten years.

Pursuant to Article 26 (1) and Aricle 29 (2) of the Radiation Act, the Ministry of the Environment is responisble for organizing the state audit of radiation safety and drafting the national radiation safety development plan.

The first national radiation safety development plan (NRSDP) was adopted in 2008 and covered the period until the end of 2017. The NRSDP for the period of 2018-2027 and its annexes (National Action Plan for Radioactive Waste Management (NPRWM), National Radon Action Plan) were approved by the Decree of Minister of the Environment in early 2020. The NRSDP 2018-2027 will be implemented based on action programmes which are composed for periods of up to four years.

Action programme for 2018-2021 was approved together with the NRSDP 2018-2027. The second action programme will be composed for years 2022-2025 and the third one for years 2026-2027. The NRSDP is reviewed and updated as often as needed, taking into account technical and scientific achievements and expert recommendations, best experiences and practices. The National Radiation Safety Development Plan for 2018-2027 and National Programme for Radioactive Waste Management published on the website of the Ministry of the Environment are available to the public. Both documents can be accessed from Annex D.

The need for the preparation of a national action plan for radioactive waste management arises from both the NRSDP and the Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste. In August 2015, the Minister of the Environment approved the first NPRWM; it was reviewed and updated in January 2020. The revision was motivated by the feasibility studies for the decommissioning of the reactor compartments of the former nuclear facitity and the radioactive waste disposal site in Paldiski, which were completed in 2015. The feasibility studies concluded that the only way to safely store radioactive waste is to establish a final disposal facility in Estonia. The long-term policy for safe management of radioactive waste is to establish the radioactive waste disposal site by 2040. The Government made the decision to establish a final disposal site in Estonia at a cabinet meeting on 28 April 2016. Information related to the decommissioning of the reactor compartments of the former nuclear site of Paldiski and the establishment of the final disposal site for radioactive waste have also been specified in the current NPRWM. The NPRWM describes the institutions, technical and financial resources, and research and development activities for safe radioactive waste management, and provides sub-objectives, measures, and expected results in the field until 2050. Based on NRSDP 2018-2027 and its annex on radioactive waste management (NPRWM), the Minister of the Environment approved by the Decree of 4 April 2019 that financing for pre-activities necessary for the construction of a final disposal facility is secured for the period 2019-2023. The objective of financing is to conduct studies and gather data for the following purposes:

1) carry out research and collect the necessary data for site selection which would be the basis for the preparation of a local government designated spatial plan for the construction of a final disposal facility and a strategic environmental impact assessment.
2) carry out the technical and radiological surveys of the the building, interim storage and rector compartments in the Paldiski site to characterise their condition. Based on the results the requirements for safe storage and maintenance of facilities until decontamination and/or dismantling will be establish, including the develop of a decommissioning plan of the reactor compartments.

The responsibility for implementation lays on the radioactive waste management company A.L.A.R.A. Ltd. Implementation will take place through a public procurement procedure and a call for tenders announced in October 2020.

Estonia hosted an Integrated Regulatory Review Service (IRRS) Follow-up Missioon in March 2019 and Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) Mission in the end of March 2019. Improvements are made in all areas covered by the IRRS mission in 2016. 28 out of 36 recommendations and 10 out of 14 suggestions identified in the IRRS mission 2016 have been closed. During the IRRS follow-up mission, the IRRS review team developed 2 new recommendations and 4 new suggestions. The purpose of the ARTEMIS review mission was to provide an independent international evaluation of

the National Programme for Radioactive Waste Management in Estonia, requested by the obligations of the Council Directive 2011/70/EURATOM of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste. The ARTEMIS review assessed the overall programme for the management of all types of radioactive waste in Estonia against the relevant IAEA Safety Standards and proven international practices. During the ARTEMIS mission 11 recommendations and 3 suggestions were made to improve and ensure implementation of the National Programme for Radioactive Waste Management. The IRRS and the IRRS Follow-up mission pointed out the necessity to improve national framework and supplement regulations with provisions required to safe decommissioning. As a conclusion of both missions – the IRRS Follow-up and the ARTEMIS – further attention is needed to ensure sustainable education and training as well as development and management of human resources of regulatory bodies. When establishing the radioactive waste disposal Estonia needs to focus on the following issues: improve national legal and regulatory framework covering site selection and design, construction, operation and closure of the disposal facility; establish requirements and guidance for safety documentation for disposal facilities, including waste acceptance requirements; and capacity building to provide the necessary human and financial resources to deliver all aspects of the national programme for radioactive waste management. Most of the recommendations and suggestions are transposed into national legislatsion and into NRSDP 2018-2027, the latter includes recommendations and suggestions which implementations require a long-term planning. The reports are publicly available on the website of the Ministry of the Environment and can be accessed from Annex D.

2. Criteria used to define and categorize radioactive waste

According to the definition given in the Article 56 of the Radiation Act, radioactive waste is any substances or items which contain or are contaminated with radioactive substances and the activity concentration of which exceeds the clearance levels established on the basis of Article 62 subsection 3 of the Radiation Act and which are not intended to be used in the future.

Radioactive waste will be categorized by activity or activity concentration, by half-life, by type of radiation and by heat generation as a result of radioactive decay. Categories are established by Regulation No 34 of 4 October 2016 of Minister of the Environment “The Classification of Radioactive Waste, the Requirements for Registration, Management and Transfer of Radioactive Waste and the Acceptance Criteria for Radioactive Waste”. When conditioning and storing radioactive waste, their producer has to take into account, beside their type, also the physical, chemical and biological properties of the radioactive waste. Radioactive waste categorization given in the Regulation No 34 of 4 October 2016 is presented in Table 1.

Table 1. Categorization of radioactive waste

Type of radioactive waste	Description of radioactive waste	Type of storage facility
Exempt waste	Waste arising from radiation practices, for which the activity and activity concentration or activity concentration on the surface is lower than the clearance levels established under Article 62 (3) of the Radiation Act	Not restricted after release. Handled pursuant to the "Waste Act"
NORM (Naturally Occurring Radioactive Material – substances containing natural radionuclides) waste	Radioactive waste produced as a result of handling raw materials containing substances that contain natural radionuclides (Th-232 and U-238 and radionuclides belonging to their decay series), the specific activity of which is greater than the clearance levels established under Article 62 (3) of the Radiation Act	Storage facility of NORM waste
Short-lived waste	Radioactive waste containing radionuclides with less than a 100-day half-life that will decay below the clearance levels established under Article 62 (3) of the Radiation Act within up to 5 years	Storage room or interim storage facility
Low and intermediate activity short-lived waste	Radioactive waste that contains β- and γ-sources with a half-life less than 30 years and a limited amount of long-lived α- sources (no more than 4,000 Bq/g for one waste package and no more than 400 Bq/g averaged over the total waste package amount)	Interim storage facility or final disposal facility
Low and intermediate activity long-lived waste	Radioactive waste containing radionuclides with half-life higher than 30 years with the activity concentration higher than that for low and intermediate activity short-lived waste and which will generate less than 2 kW/m^3 heat energy by radioactive decay	Interim storage facility or final disposal facility
High level waste	Radioactive waste, which generates more than 2 kW/m^3 heat energy by radioactive decay	Final disposal facility

3. Radioactive waste management practices

Information on radioactive waste management based on the current practice and on the National Radiation Safety Development Plan is summarised in the matrix in Annex A.

In Estonia, there are two radioactive waste management facilities subject to the Joint Convention: radioactive waste storage facility in Paldiski site and former radioactive waste storage facility in Tammiku site. In addition, two PWR reactor compartments in the sarcophagi are located in Paldiski – on the same site and in the same building as the radioactive waste interim storage. Reactors were part of the former USSR nuclear submarine training centre. Both, the Paldiski site and the Tammiku site are under the administration of the state-owned A.L.A.R.A. Ltd., responsible for radioactive waste management. A.L.A.R.A. Ltd. reports to the Ministry of Economic Affairs and Communications. Site locations are shown in Figure 1. Further description of the radioactive waste storage facility in the Paldiski site is provided in chapter 3.1 of Section B while the information on the Tammiku site and of two PWR reactor compartments in the sarcophagi is covered in chapter 3.2 of Section B of the Report.

Figure 1 Radioactive waste management facility sites in Estonia

3.1 Radioactive waste management facility

The radioactive waste interim storage in Paldiski site is in operation since 1997 and is intended to be used for both decommissioning and institutional waste. The site is operated by the A.L.A.R.A. Ltd. The interim storage accepts low and intermediate activity long-lived waste. The capacity of interim storage is 1040 m^3. Facilities for treatment and conditioning of radioactiwe waste as well as initial storage area are located on the same site. A fee that covers interim storage and later disposal of the waste needs to be paid to hand radioactive material over to A.L.A.RA. Ltd. When necessary, A.L.A.R.A. Ltd provides transport of radioactive material to the Paldiski site (mostly disused sealed sources and material contaminated with radionuclides from medical use, research and industry). The radiation practice licence for activities in the Paldiski site was issued in 2016 for a term of 5 years. It covers radioactive waste management and interim storage, including data of radioactive waste package and waste package acceptance criteria; radiation safety requirements for transport of radioactive material; the requirements for radiation safety and radiation monitoring arising from the radiation practice and its specific character, e.g. workplace monitoring programme and environmental monitoring programme. In addition, the radiation practice licence contains conditions and monitoring programme for storage of the reactor compartments which will be discussed below. As the radiation practice licence for activities in the Paldiski site will expire in May 2021, A.L.A.R.A. Ltd has submitted an application to continue its activities to the national regulatory body, Environmental Board, for authorisation. Radioactive waste management and its associated activities in the Paldiski site are funded through the budget of the Ministry of Economic Affairs and Communication.

3.2 Facilities under decommissioning

3.2.1 Tammiku Radioactive Waste Storage

RADON-type storage facility for institutional waste in Tammiku with capacity 200 m^3 was commissioned in 1963. In 1996, it was temporarily closed and the storage vaults were covered with concrete slabs and a soil layer. The latter was removed in 2004 and replaced with metal roofing. In 2008, A.L.A.R.A. Ltd started the decommissioning process, after approval of the Environmental Impact Assessment Report by the Minister of the Environment in 2007. After analysis of several possible options, the following option was chosen: to retrieve all radioactive waste from Tammiku, to transport it to the Paldiski site, where it is conditioned and storeed in the interim radioactive waste storage. In the end, the Tammiku site will be converted into a green field area. All cavities have to be filled to the surface level. Decommissioning has two stages – the first, retrieval and transportation of the waste, and the second, the decontamination and dismantling of the facility and site release from regulatory control.

The storage facility was filled with waste in an amount of 110 m^3 with a mass about 97 tons. In September 2008 A.L.A.R.A. Ltd got the radiation practice licence for retrieval of radioactive waste from the storage facility and for transport of the radioactive waste to the Paldiski site for management and storage. By the end of September 2011 the first stage was completed, all waste was retrieved from vaults and transferred to Paldiski. The transportation was undertaken following Estonian legislation for shipment of dangerous goods, including radioactive material. A new radiation practice

licence was issued in 2012 for a term of 5 years to continue with the second stage of decommissioning. In 2013-2017, the radiological survey of inner surfaces of the facility was carried out. Based on the radiation practice liceneces the following data were collected: map of distribution of radioactive contamination, radiological characterization of the facility, results of radioactivity analysis, distribution map of radioactive contamination after decontamination and environmental monitoring data, including environmental monitoring of a reference area. The surfaces of the storage vaults were decontaminated, with a resulting amount of ca 14 m^3 (11.2 tons) of radioactive waste (low active dust and fragments of concrete), which transported to the Paldiski site for treatment and storage. In 2018, a new radiation practice licence was issued with a validity up to 2023. Following the requirements of newly issued licence, the radiological survey of outer surfaces of the facility was carried out. The metal roofing was dismantled in 2018, transported to Paldiski site and after checking for possible contamination, released from regulatory control. Concrete structures of the vaults were cut into pieces (with a total weight of ca 200 tons), which are temporarily stored in Tammiku site. For the release of decontaminated and dismantled concrete structures of facility, and the site from regulatory control, clearance conditions and clearance levels stated in national legislation and in radiation practice licence have to be met. To evaluate conformity with the clearance conditions and clearance levels, the operator is in a procees of preparation of a radiation safety assessment report, which must submitted to the regulatory authority for review. The radiation safety assessment report should include the evaluation of the need for a post-release environmental monitoring. Taken into account current state of decommissioning and the validity of the radiation practice licence, the decommissioning activities in the Tammiku site will continue at last up to 2022 and site is expected to release from regulatory control in 2023. The decommissioning of the Tammiku site is funded through the budget of the Ministry of Economic Affairs and Communication.

3.2.2 The former USSR nuclear submarine training facility

The former USSR nuclear submarine training facility, with 2 PWR reactor compartments (see Table 2 for characteristics), at the Paldiski site is in the process of deferred decommissioning. In 1994, based on the Agreement between the Republic of Estonia and the Russian Federation, the reactors were defuelled and the spent nuclear fuel was transported to Russia before the site was handed over to the Estonian authorities. During the period 2005-2007, a number of activities have been undertaken on the site under the EU Phare project 632.03.01 “Safe long-term storage of Paldiski sarcophagi and related dismantling activities”. The main objective of the project was to guarantee the safe storage of the reactor compartments for a period of at least 50 years. The ventilation/air drying and monitoring systems were installed in the sarcophagi. As described in chapter 1 of Section B, the tong-term policy for safe management of radioactive waste is to establish a radioactive waste disposal site by 2040. The radioactive waste disposal facility must receive and dispose the radioactive waste arising from the decommissioning of the reactor compartments. Therefore, the decommissioning of the reactor compartments can start when the radioactive waste disposal facility is in place and operational. Until this safe storage of the reactor compartments must ensured. The reactor compartments do not contain any nuclear material and it is not possible to restart the reactors as they partly filled with concrete. The condition of the reactor compartments has not changed from the time they were put into safe storage in 1994. They are still seal welded and untouched (intrusions – authorized or unauthorized – have not occurred). Security measures have been improved over time. The storage of reactor compartments is covered with radiation practice licence for Paldiski site discussed earlier. Based on the radiation practice licence, the licencee has to ensure preservation of the integrity of concrete

reactor compartments and their sarcophagi, to ensure ventilation and radiation monitoring equipment to sarcophagi, monitoring in sarcophagi. The following parameters are measured under the monitoring programme: concentration of radioactive aerosols in air, gamma dose rate, relative humidity, CO_2 content in the air.

Table 2. Characteristics of the reactors in Paldiski site

Description	**Unit 1**	**Unit 2**
Reactor type	PWR/BM-A	PWR/BM-4
Thermal power	70 MW	90 MW
Fuel enrichment	20%	20%
First criticality	April 1968	February 1983
Last criticality	January 1989	December 1989
Refuelling and maintenance	1980 – 1981	never
Operating time	~ 20,000 h	~ 5,300 h
Encasement (submarine hull segment) – diameter – length	7.5 m ~ 50 m	9,5 m ~ 50 m

In 2014-2015, a feasibility study was conducted, related to the decommissioning of the reactor compartments of the former Paldiski military nuclear site and for the establishment of a radioactive waste repository. Details of the feasibility study are covered in the final report "Preliminary Studies for the Decommissioning of the Reactor Compartments of the Former Paldiski Military Nuclear Site and for the Establishment of a Radioactive Waste Repository. Final Report. December 28, 2015". The report is published on the website of A.L.A.R.A. Ltd and is available to the public, it can be accessed from Annex D of this Report. The study covered the following topics:

1) overview of the applicable international and national requirements;
2) different strategies for the reactor compartments decommissioning;
3) final disposal options, taking into account existing (including reactor compartments in Paldiski) and possible future radioactive wastes;
4) cost calculations for decommissioning of Paldiski reactor compartments, handling and final disposal of radioactive waste;
5) communication strategy.

Depending on the decommissioning strategy, the volume of radioactive waste generated during decommissioning process varies in a rather large range. However, using the strategy proposed by the study, it would result in about 987 m^3 of conditioned waste, 650 m^3 of which will be suitable for disposal in a subsurface intermediate depth type facility (reactors, shielding tanks – activity concentration more than 4000 Bq/g) and 337 m^3 will be suitable for disposal in a near-surface type facility (steam generators, pumps, etc.).

The activities planned for 2019-2023 concerning the reactor compartments are described in chapter 1 of Section B of this Report.

Section C. Scope of Application

ARTICLE 3. SCOPE OF APPLICATION

1. *This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.*
2. *This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.*
3. *This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.*
4. *This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.*

As Contracting Party to the Joint Convention, Estonia declares that:

1) airborne and liquid discharges from radioactive waste management facilities are included in the scope of this Convention;
2) waste that contains only naturally occurring radioactive materials is not radioactive waste for the purpose of the Convention;
3) there is no radioactive waste from military or defence programmes;
4) there is no spent fuel and thus no reprocessing of it.

However, waste that contains only naturally occurring radioactive materials is managed identical to radioactive waste described in this Report, as this kind of waste is covered by the legislative and regulatory system mentioned in Section E.

Section D. Inventories and Lists

ARTICLE 32. REPORTING

2. This report shall also include:

i. a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

ii. an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

iii. a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

iv. an inventory of radioactive waste that is subject to this Convention that:

(a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;

(b) has been disposed of; or

(c) has resulted from past practices.

This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

v. a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

Information about the radioactive waste management facility in Estonia and an inventory of radioactive waste that is subject to the Joint Convention is described in Table 3.

Table 3 Radioactive waste management facility

Owner	Ministry of Economic Affairs and Communications
Location	Paldiski, 50 km West of Tallinn
Purpose	Treatment, conditioning and interim storage of low and intermediate activity long-lived waste
Inventory	Most of the current waste in Estonia originates from D&D projects. 50% of the overall waste volume is characterized and is assessed to have an activity *ca* 900 TBq. Uncharacterized waste is mostly low active and its contribution to overall activity is small. Most of the activity is concentrated in spent sealed sources of Sr-90, Cs-137, Co-60 and Pu-Be, which account for only ca 10 % of the total amount of waste. The total volume of the waste is about 1060 m^3, 450 m^3 from which is stored in interim storage and 610 m^3 in storage area.
Essential Features	Sorting, decontamination, compaction, cementation and packaging of solid of long-lived radioactive waste with low or medium activity Storage area for conditioned waste
Remarks	Detailed information on inventory see Annex B

Facilities under decommissioning are listed and the status of decommissioning activities is described in chapter 3.2 of Section B.

Section E. Legislative and Regulatory System

ARTICLE 18. IMPLEMENTING MEASURES

Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

The necessary legislative, regulatory and other measures to fulfill the obligations of the Joint Convention in terms of legislative, regulatory and administrative activities are described mainly in Articles 19 and 20 and detailed in the relevant Articles of this Report.

ARTICLE 19. LEGISLATIVE AND REGULATORY FRAMEWORK

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.
2. This legislative and regulatory framework shall provide for:
i the establishment of applicable national safety requirements and regulations for radiation safety;
a system of licensing of spent fuel and radioactive waste management activities;
ii. a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;
iii. a system of appropriate institutional control, regulatory inspection and documentation and reporting;
iv. the enforcement of applicable regulations and of the terms of the licences;
v. a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.
3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

1. National legislative and regulatory framework

The parliament of the Republic of Estonia – the *Riigikogu* – is responsible for establishing regulatory requirements. The coordinator of legislative drafting is the Ministry of Justice, who stands for the systematic development of law and supports the formation of quality legislative drafting. In accordance with Article 6 of the Regulation of the Government No 186 of 10 December 2009 "Statute of the Ministry of Environment", area of government of the Ministry of Environment includes ensuring radiation protection, compiling related strategic documents and drafting legislation. The Ministry of Environment through the Environmental Board and Environmental Inspectorate manages radiation protection related actions according to the Article 25 of the Radiation Act.

Based on Article 5 (2) 3) of the Minister of the Environment No 13 of 20 May 2014 "Statute of the Environmental Board", the Environmental Board participates, where necessary and within its mandate, in the drafting of environmental legislation, also in the development of environment-related strategies, programs and plans, and is responsible for their implementation to the extent set forth in legislation. Based on Article 5 (2) 44) the Environmental Board tables proposals to the Ministry of the Environment to supplement legislation. Based on Article 7 11) of the Regulation of the Minister

of the Environment No 12 of 31 March 2008 “Statute of the Environmental Inspectorate”, the Environmental Inspectorate analyses the effect of legislation in its area of activity and tables proposals for their improvement, participates in the drafting of legislation, and in its coordination.

Radiation safety requirements are developed mainly in cooperation between the Ministry of the Environment (including subdivisions Environmental Board, Environmental Inspectorate), Ministry of Social Affairs (Health Board, hospitals), Ministry of Interior (Police and Border Guard Board, Rescue Board, Security Police Board), Ministry of Finance (Tax and Customs Board), Ministry of Economic Affairs and Communications (radioactive waste management company A.L.A.R.A. Ltd.). The Estonian legislative and regulatory system implements all legislative requirements with regard to the Treaty Establishing the European Atomic Energy Community (Euratom).

Main legal acts to govern radiation protection and safety are the General Part of the Environmental Code Act and Radiation Act. First Radiation Act entered into force in 1997. Current version of Radiation Act was adopted in 2016 and the latest amendments entered into force in June 2020. As of 1 October 2020, there were 15 regulations in force on the basis of the Radiation Act and for its implementation. The Radiation Act consists of 11 chapters. The General Part of the Environmental Code Act entered into force in 2014. Amendments of the Radiation Act and its regulations in period 2017 – 2020 resulted from following:

1) the transposition of 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,
2) the transposition of Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionizing radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom,
3) the implementation of indings of the IAEA 2016 IRRS mission and 2019 IRRS follow-up mission.

The Radiation Act and its regulations relevant to the Joint Conevntion, as in force on 1 October 2020, are given in Annex C.

This Report also reflects other important legislation relevant to the Joint Convention, such as:

1) The Emergency Act and its implementing regulations deal with emergency preparedness;
2) Environmental Impact Assessment and Environmental Management System Act.

2. Radioactive waste management

General requirements for managing of radioactive residues, radioactive waste and radioactive discharges are described in Chapter 3 Division 4 of the Radiation Act. Radioactive waste manangement includes pre-processing, conditioning of radioactive waste, transportation thereof at the management facility, storage, decommissioning, interim storage or final disposal and other activities related to radioactive waste. Whereby, the interim storage and final disposal of radioactive waste shall be organised by the Ministry of Economic Affairs and Communications.

The Environmental Board may decide that the requirements of the Radiation Act shall not apply to radioactive substances generated during radiation practices and the holder thereof if the substances

have so low activity or activity concentration that the processing and storing thereof as radioactive waste is not necessary for radiation safety. The decision can be made on the basis of a well-reasoned application from the holder of the radioactive substances.

A relevant general regulation for radioactive waste management, besides the Radiation Act, is the Regulation No 34 of 4 October 2016 of the Minister of the Environment „The Classification of Radioactive waste, the Requirements for Registration, Management and Delivery of Radioactive Waste and the Acceptance Criteria for Radioactive Waste". It specifies the requirements for radioactive waste management and sets the following:

1) Definitions;
2) Classification of radiactive waste;
3) Requirements for radioactive waste pre-treatment and storage;
4) Requirements for radioactive waste treatment and conditioning;
5) Requirements for radioactive waste treatment storage in producer premises;
6) Requirements for interim storage facility of radioactive waste;
7) Requirements for radioactive waste package;
8) Acceptance criteria for waste package;
9) Delivery of radioactive waste;
10) Registration, accountancy and reporting of radioactive waste.

The Regulation No 60 of 24 November 2016 of the Minister of the Environment "Detailed requirements for applications for radiation practice licences, lists of data of applications and radiation practice licences, and lists of data characterising radiation sources used to keep lists of nuclear materials" specifies the requirements for:

1) data of radioactive waste and discharges for waste producers;
2) data for radioactive management in interim storage facility and final disposal;
3) safety assessment of interim storage facility and final disposal of radioactive waste;
4) data of closure of final disposal of radioactive waste.

3. System of licensing

Article 2 of the Radiation Act states that the Administrative Procedure Act shall apply to the administrative procedure and Chapter 5 of the General Part of the Environmental Code Act shall apply to the proceedings of radiation practice licences issued for radiation practices provided for and taking account of the specifications provided for in the Radiation Act. The licensing system for radiation practices is prescribed in Chapter 4 of the Radiation Act. According to the definition given in Article 4 of the Radiation Act, radiation practices are any activities which increase or may increase the exposure of people to radiation emanating from artificial or natural sources of radiation. Radiation practices *inter alia* include:

1) production, processing, use, possession, holding, storage, transportation, including import and export, and interim storage or final disposal of radioactive substances;
2) use of any electrical equipment emitting ionizing radiation and operating at a potential difference of more than 5 kilovolts;
3) operation of nuclear facilities.

Radiation practice licence is issued by the Environmental Board (hereinafter *issuer of licences*). The Article 68 of the Radiation Act sets forth the activities for which a radiation practice licence is required:

1) exploitation, closure and decommissioning of any facility of nuclear fuel cycle;
2) production, use, storage and transportation of radioactive substances and products containing it, including for import and export;
3) use and storage of electrical radiation apparatuses;
4) management and transportation of radioactive waste;
5) activities related to the presence of increased natural exposures in the case of which the exposure caused by natural radionuclides is important from the radiation safety point of view.

The scope of the application is described under the Article 42 1) and 3) of the General Part of the Environmental Code Act and Article 70 1) of the Radiation Act. In order to obtain a radiation practice licence, an applicant shall submit an application to the Environmental Board with the following information and documents:

1) the name and personal identification code or registry code of the applicant;
2) the address and contact details of the applicant and of the contact person;
3) the clearly formulated substance of the application;
4) the requested term of validity of the licence;
5) the purpose and reasons of the planned activity;
6) the characteristics of the planned activity;
7) the preferred manner of delivery of the environmental licence and the contact details required for delivery;
8) the date of submission of the application and the signature of the applicant;
9) the plan of the location of the activity and the site map of the installation;
10) data which characterise the radiation source and technology used and the equipment;
11) data on radioactive waste or emissions generated during radiation practices, the management thereof and waste packaging compliance criteria and radioactive waste storage premises;
12) management plan of radiation source after the termination of use of the radiation source;
13) upon application for a licence for management, interime storage and final disposal of radioactive waste, data on the management or methods of final closure of storage facilities;
14) radiation safety assessment, which gives an overview of the aspects of radiation practices which are related to the protections of people and safety of radiation sources, including of the protective and safety measures used, and of the potentially assessed doses of exposed workers and members of the public both under normal working conditions and in the cases of accidental and existing exposure situations, to which data on measures adopted to ensure radiation safety are appended;
15) in the case of moderate and high risk radiation practices, dose constraints on annual equivalent or effective doses of exposed workers and on effective doses of members of the public upon proposed radiation practices under normal working conditions;
16) emergency response plan to accidental exposure in the case of radiation practices involving high risk which is based on the assessment of potential exposures;
17) data on financial collaterals required for management of radioactive source, equipment containing thereof after termination its use and radioactive waste;
18) description of the radiation safety quality management system;
19) data on exposed workers and their professional training;
20) radiation work rules, which must contain activities for the use of a radiation source, discontinuation of the use thereof and activities related thereto depending on the specific character

of the radiation work;
21) plan for radiation monitoring and data on the equipment used for radiation monitoring.

An application for a radiation practice licence together with the annexes thereto shall be submitted to the issuer of licences through the Information System for Environmental Decisions and the application shall be certified by a digital signature by the legal person of the applicant. According to the Article 5 (6) of the Administrative Procedure Act, in administrative procedure, electronic operations shall be equal to written operations. In determining the terms of the licence, and in amending or revoking of the licence, the Environmental Board proceeds from the specific radiation practice, based on the main principles of radiation safety. The terms of the licence shall be weighted and justified based on the Radiation Act and the Administrative Procedure Act.

The data and documents to be submitted when applying for the radiation practice licence are specified in the Regulation No 60 of 24 November 2016 of the Minister of the Environment, "Detailed requirements for applications for radiation practice licences, lists of data of applications and radiation practice licences, and lists of data characterising radiation sources used to keep lists of nuclear materials". The Regulation No 60 of 24 November 2016 sets forth the requirements:
1) the entry and proceeding of an application for a radiation practice licence;
2) for the conduct of an open proceedings upon issue or amendment of a radiation practice licence;
3) amendment of the radiation practice licence;
4) lists of data of applications and radiation practice licences, and lists of data characterising radiation sources;
5) a list of data of radiation practice licence.

Granting of a radiation practice licence can be subject to additional conditions needed to ensure safety. Pursuant to the Regulation No 60 of 24 November 2016, the issuer of a licence reviews the data and documents submitted by the applicant and, if needed, checks their conformance to the actual situation. If the issuer of the licence imposes a deadline for the applicant to remedy deficiencies or submit specifying data on the materials of the application, the deadline for the processing of the application will be extended by the time of remedying the deficiencies or submitting specifying data. If the applicant fails to do so by the given term, the issuer of the licence will return the application without review within 5 days after the deadline. The review and evaluation of the application takes up to 90 days.

According to the Article 34 of the Radiation Act depending on the category of radioactive sources or the extent of risk connected with radiation practices, difference is made between:
1) low risk radiation practices during which an exposed worker incurs or may incur an effective dose of up to one millisievert per year;
2) moderate risk radiation practices during which an exposed worker incurs or may incur an effective dose of up to six millisieverts per year;
3) high risk radiation practices during which an exposed worker incurs or may incur an effective dose exceeding six millisieverts per year.

In addition, radiation practices involve high risks if a radiation practice licence is applied for:
1) radiation practices related to high-activity sealed sources;
2) operation of nuclear facilities;
3) exploitation, closure and decommissioning of any facility of nuclear fuel cycle;

4) interim storage or final disposal of radioactive waste.

A radiation practice licence for moderate risk and high risk radiation practices remains valid for up to 5 years. Since the Radiation Act does not provide for the extension of the radiation practice licence, a new licence needs to be applied to continue the radiation practice.

Pursuant to Article 71 of the Radiation Act, the provisions of open procedure are applied to the procedure of granting and amending radiation practice licences, if a radiation practice licence is applied for the following activities:
1) exploitation, closure and decommissioning of any facility of nuclear fuel cycle;
2) management and transportation of radioactive waste;
3) activities related to the presence of increased natural exposures in the case of which the exposure caused by natural radionuclides is important from the radiation safety point of view.

Pursuant to the Environmental Impact Assessment and Environmental Management System Act, an environmental impact is assessed upon application for a permit or amendment of a permit if the planned activity may cause significant environmental impact. Activities with significant environmental impact include also:
1) construction, dismantling or decommissioning of a nuclear power station or other nuclear reactors, except research installations for the production and conversion of fissionable and fertile materials, whose maximum power does not exceed 1 kilowatt continuous thermal load;
2) production or enrichment of nuclear fuel, processing or handling or final disposal of used nuclear fuel or disposal of used nuclear fuel for over ten years on a site other than the place of generation thereof;
3) handling high level waste, final disposal of radioactive waste or disposal thereof for over ten years on a site other than the place of generation.

The issuer of licences may refuse to issue the radiation practice licence in the following cases:
1) the planned practice is not the best practice for economic, social or other benefits with regard to potential health detriment caused by the radiation practice;
2) the practice for which the radiation practice licence is applied for involves or may involve a risk to national or international security;
3) the applicant for the radiation practice licence has no exposed workers with required professional training;
4) the location applied for radiation practice or other terms and conditions do not allow for compliance with radiation safety requirements;
5) the applicant for the radiation practice licence does not prove the existence of the collateral in the amount and on the requirements determined by the issuer of licences.

The issuer of licences may revoke the radiation practice licence at the following cases:
1) the holder of a licence does not ensure existence of a financial collateral;
2) the holder of a licence has repeatedly failed to ensure compliance with radiation safety principles, obligations and the requirements provided for in the licence involving a serious risk of radiation;
3) the holder of a licence, its representatives or employees have purposefully and in bad faith prevented the Environmental Inspectorate and its representatives from controlling the practice of the holder of the licence.
4) at the request of the holder of a licence;

5) the holder of a licence dies and the activity permitted under the licence is related to the person of the holder of a licence or the passive legal capacity of the holder of a licence terminates without legal succession;
6) it becomes evident that the holder of a licence has knowingly given false information in the application for the licence or submitted a forged document;
7) if the public interest or the interest of a third party cannot effectively be protected by amending the licence;
8) the holder of a licence does not fulfill the requirements provided by the licence or law and the revocation of the licence is demanded by an overriding public interest or the holder of a licence has been penalised for such offence.

4. System of the inspection and enforcement

The Environmental Inspectorate as stated in Article 112 of the Radiation Act carries out state supervision of radiation safety. The radiation safety inspections of the Environmental Inspectorate are carried out either based on the work plan, in the course of control raids, or as a response to complaints. The Environmental Inspectorate, which is granted a right to withdraw licences and suspend operations in unsafe situations, has direct access to all premises, buildings, etc., for inspection purposes.

Inspections are carried out on the basis of:
1) legal requirements set out in the Radiation Act and its regulations;
2) the terms and conditions laid down in the radiation practice licence;
3) check-lists, which have been developed for various sectors on radiation practices and are used for the purposes of quality control and harmonization.

The following in-house documents have been composed to aid the inspection process: guidelines for drafting the work plan; guidelines for conducting inspections, including radiation practice inspection; check-lists for the inspection of various types of radiation practices, which are developed in accordance to international recommendations (IAEA, EU), guidelines for enforcement actions (e. g. penalty matrix). Basic features of an inspection of the holder of a radiation practice licence include verification of the data and conditions specified in the radiation practice licence. Where relevant, the data submitted in the application for radiation practice licence, as stated in the Article 70 of the Radiation Act, is checked.

According to the Statutes of the Environmental Inspectorate, in the cases provided in law, the Environmental Inspectorate is an extra-judicial body that conducts misdemeanor proceedings and pre-trial proceeding of crimes.

The Environmental Inspectorate has the right to suspend unlawful activities damaging or dangerous to the environment, as well as lawful activities related to the use of natural resources if such activities endanger the life, health or property of people. Regarding radiation safety, the responsibility of Environmental Inspectorate is to implement measures provided by law for the prevention of illegal activities and implementation of mandatory environmental protection measures. Upon identification of a practice not compliant with the Radiation Act, the Environmental Inspectorate initiates administrative or misdemeanor proceedings according to the procedure set forth in the Administrative

Procedure Act (Articles 2 and 8) and the Code of Misdemeanour Procedure (Articles 1, 8, 9 and 10).

Pursuant to Article 7 of the Law Enforcement Act, in the performance of state supervision a law enforcement agency shall adhere to the following proportionality principles:

1) out of several suitable and necessary state supervision measures the law enforcement agency shall apply the one which will presumably harm a person as well as the public the least;
2) applies only such a state supervision measure that is proportional, taken into account the goal pursued by the measure and the situation requiring urgent implementation;
3) applies a state supervision measure only as long as its goal has been achieved or can no longer be achieved.

Pursuant to Article 8 of the Law Enforcement Act, in the performance of state supervision a law enforcement agency shall act purposefully and efficiently, and within the limits of lawful discretion shall apply state supervision measures flexibly. Inspectors of the Environmental Inspectorate have the right to apply enforcement measures (conduct proceedings in environmental violations, precepts, suspension or termination of illegal activities, penalty payment, substitutive enforcement etc.) if a violation is found.

Liability and the rates of fines arise from the Radiation Act. Penalties in case of radiation practice are imposed on the basis of the rates set forth in Articles 117-121 of the Radiation Act and the Code of Misdemeanor Procedure.

In addition to supervision of radiation practices, the Environmental Inspectorate in co-operation with the Environmental Board performes supervision over implementation of protective measures in radiological emergency and in existing exposure situations. From 2018, the Environmental Inspectorate in co-operation with the Labor Inspectorate supervises employers who are obliged to measure the indoor radon concentrations in workplaces.

ARTICLE 20. REGULATORY BODY

1. *Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.*
2. *Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation.*

In Estonia, policy shaping (Ministry of the Environment), implementation of policies (Environmental Board) and environmental supervision (Environmental Inspectorate) are separate from each other. This contributes to independence from pressures from various sectors. From the perspective of the Environmental Board, independence is also furthered by the fact that radiation safety issues are within the mandate of the Environmental Board, not subordinated to the Ministry of Social Affairs or the Ministry of Economic Affairs and Communications, which would implicate a more robust economic pressure on decision-making in the field of radiation safety.

According to Article 25 of the Radiation Act, the activities related to radiation safety shall be organised by the Ministry of the Environment within the limits of its competence through the Environmental Inspectorate and the Environmental Board. The Environmental Board is authorized to fulfill the obligation of the regulatory authority in the country and the Environmental Inspectorate is provided an authorization to carry out regular inspections of the radiation practices. Both regulatory bodies as governmental institutions have separate budgets to fulfil their obligations, which cannot be influenced by political circumstances. The Ministry of the Environment gives to the organizations within its scope of administration, including the Environmental Board and Environemental Inspectorate, the absolute budgetary amount. It is in the competence of the institutions to allocate the budget within the organization. The Environmental Board and the Environmental Inspectorate are required to prepare an annual activity report on its development plan, which is submitted to the Ministry of the Environment. The activity report of the Ministry of the Environment, in turn, is forwarded to the Ministry of Finance that coordinates the reporting of the development plans of all ministries. The status, areas of activity and tasks as well as the management of the organizations are set forth in the Statutes of the Environmental Board and the Statutes of the Environmental Inspectorate, listed in Annex C. The State Audit Office in their sectoral audits in turn, inspects the activities of the Environmental Board and the Environmental Inspectorate.

According to Radiation Act Article 61 (4) the interim storage and final disposal of radioactive waste shall be organised by the Ministry of Economic Affairs and Communications. The Radiation Act and its administration belong to the responsibility of the Ministry of Environment, which as such, is independent from the Ministry of Economic Affairs and Communications. The latter elaborates, manages and implements the state`s economic policy and economic development plans, in a number of fields.

Estonia uses an opportunity to train staff under the IAEA Technical co-operation programme since 1992. The participation in the IAEA's Technical co-operation programme is continuously relevant, regarding the development of competences of people working in regulatory bodies.

1. The Environmental Board

The Environmental Board was established in 2009. The mission, vision, core values and management system of the Environmental Board proceed from the tasks vested in the Environmental Board by legislation. The area of activity of the Environmental Board is set forth in the Article 5 (1) of the Statutes of the Environmental Board: "The area of activity of the board is national environmental and nature conservation protection and use as well as the implementation of radiation safety policies, programs and action plans." According to its statutes, the Environmental Board has the following duties in the field of radiation safety:

1) to participate in the development and implementation of the radiation safety policy, development plans and programs;
2) to advise the regulatory authorities in radiation protection and safety;
3) to perform licensing of radiation practices;
4) to evaluate the radiation safety of existing and applied radiation practices;
5) to organise the assessment of population doses and doses to critical groups arising from radiation practices;

6) to maintain the registries related to radiation safety (state registry of the doses of exposed workers; registries of the radioactive sources, nuclear material and radioactive waste);
7) in cooperation with the Environmental Inspectorate to execute regulatory supervision of the radiation practice licences;
8) to organise the monitoring of radionuclides in air, soil, water and food, radioactivity in the environment and to analyze the results;
9) to perform laboratory analyses related to radiation safety;
10) to perform assessment of public exposures;
11) to secure functioning of the early-warning system pursuant to the provisions of legal acts and to the conditions established by international conventions and treaties and timely warning in the case of a radiation emergency;
12) to serve as a contact point for EURATOM and IAEA;
13) to serve as a national data centre (NDC) in the exchange of information in the framework of the CTBT agreement;
14) to participate in international cooperation, to prepare and to participate in international projects in the field of radiation safety;
15) to participate in the preparation of emergency situation management plans, in the testing of these plans and in the management of possible emergency cases.

Organizational structure of the Environmental Board is given in Figure 2. The tasks and management of each structural unit of the Environmental Board, including the Radiation Safety Department, are defined in the statutes of each structural unit, approved by the General Director of the Environmental Board. As of October 2020, the Environmental Board employs 355 people, 18 of them in the Radiation Safety Department. The Radiation Safety Department is divided into two bureaus: the radiation protection bureau and the radiation monitoring bureau (Figure 3).

1.1 Competence and resources

A variety of measures is applied to develop and maintain competence of employees. The performance of employees and their various competences are evaluated during an annual employee performance review. Direct supervisors conduct performance reviews and evaluate competencies of the employees As a result of the performance review interviews, training needs are identified which the human resource manager consolidates in the training plan of the Environmental Board. The results of performance reviews (incl. competence evaluation) are integrated in the information system for work plans. The management approves the annual training plan and allocates funds for this from the budget. Over the past three years, the budget of the Radiation Safety Department has remained unchanged. The budget is sufficient to fulfill the obligations of the regulatory body. The Radiation Safety Department has technical resources to carry out radiation surveillance.

In order to give a basic knowledge to new employees, the Radiation Safety Department has carried out a one-week training course every year. Upon request specialists from the Radiation Safety Department of Environmental Board, train the people from other national authorities as well.

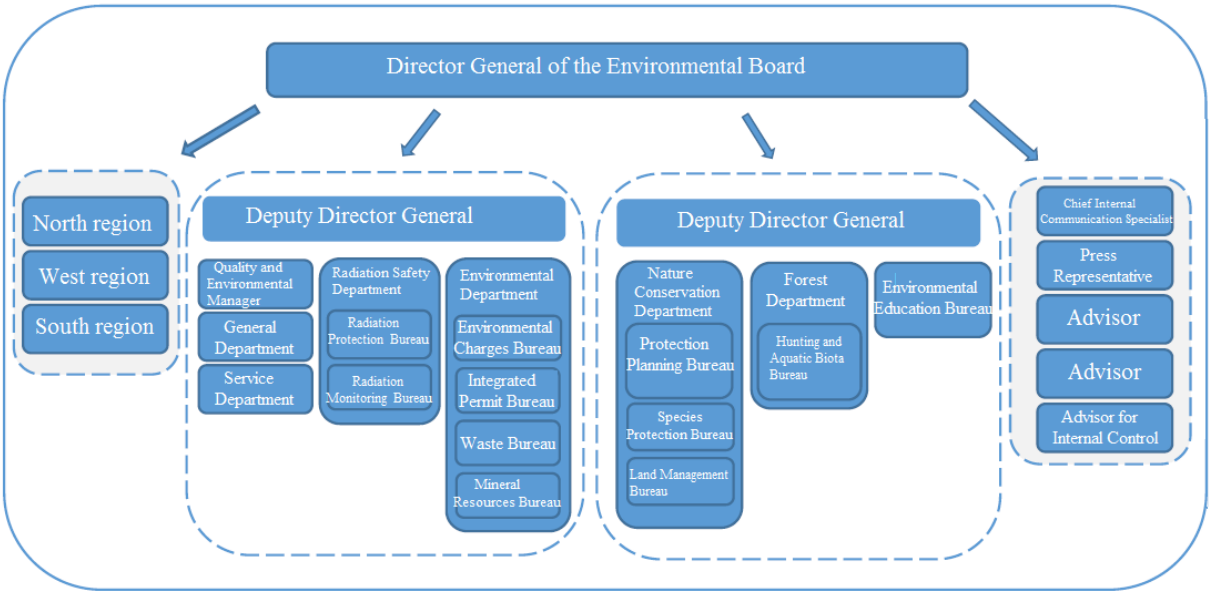

Figure 2. Organizational structure of the Environmental Board

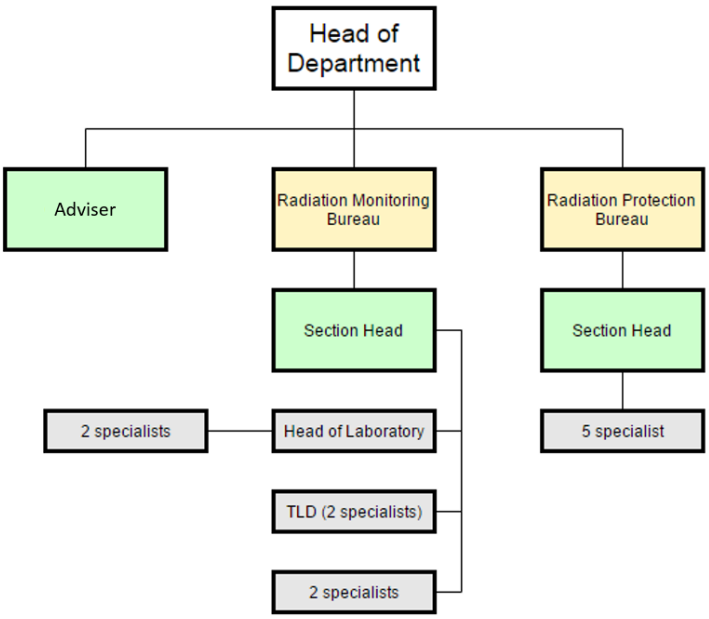

Figure 3. Structure of the Radiation Safety Department of the Environmental Board

2. The Environmental Inspectorate

Pursuant to the Environmental Supervision Act, the Environmental Inspectorate executes environmental supervision in Estonia at the state level. Environmental Inspectorate coordinates and executes supervision of all areas of environmental protection and the use of natural resources, as well as conducts proceedings in environmental violations.

The Environmental Inspectorate exercises supervision in all areas of environmental protection, such as forest and mineral resources, the protection of fisheries, hunting requirements, waste management, protection of water, hazardous substances and chemical safety, radiation issues, ambient air issues etc, altogether 20 areas of supervision. The main legal acts regulating environmental supervision are the Environmental Supervision Act, Law Enforcement Act, Code of Misdemeanor Procedure, Radiation Act and Statutes of the Environmental Inspectorate.

The structure of the Environmental Inspectorate is presented in Figure 4. As of October 2020, the Inspectorate has 175 employees, 122 of them inspectors. At the local office level, there are 15 inspectors involved in radiation supervision (planned inspections, resolving complaints, misdemeanors). They also oversee adherence to the requirements of legislation for environmental protection in other fields.

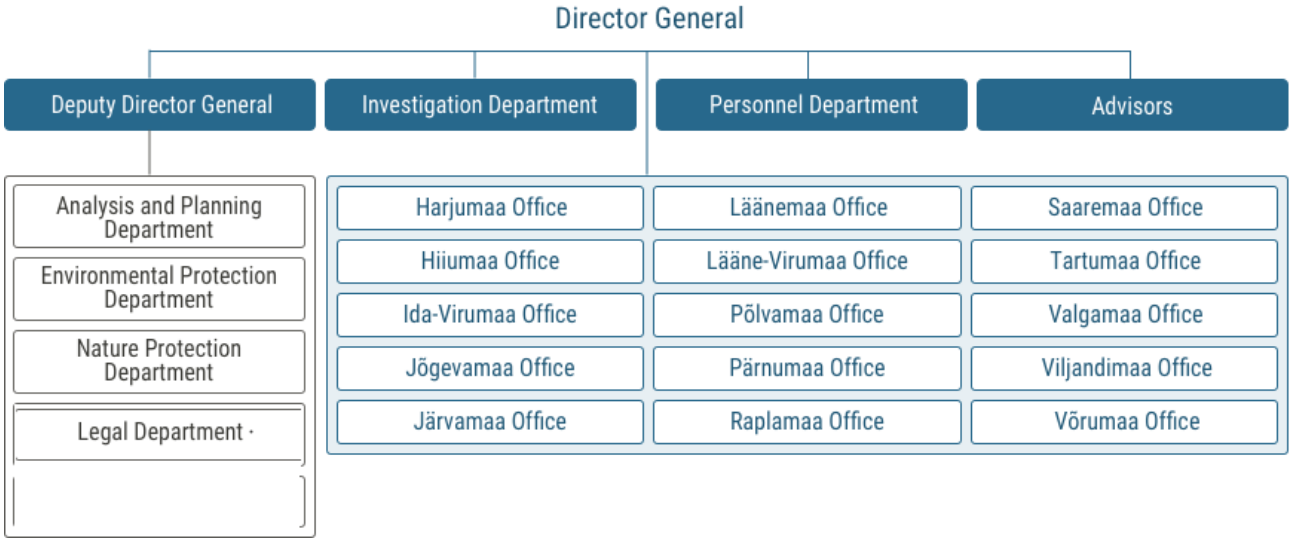

Figure 4. Organizational structure of the Environmental Inspectorate.

2.1 Competence and resources

The Environmental Inspectorate does not have inspectors who are involved solely in the radiation practice supervision. The environmental protection department has a chief inspector who deals with the coordination of the supervision activities, trainings, risk evaluation and quality management. The

competence of inspectors is developed through training. Internal trainings take place on a regular basis (1-2 times a year) and are organised in cooperation with the Radiation Safety Department of the Environmental Board. The number of inspectors of radiation supervision has not changed in the last three years. As the Environmental Inspectorate executes supervision in all areas of environmental protection, there are no separate financial resources planned for areas of radiation protection. The Environmental Inspectorate does not have special technical resources to carry out radiation surveillance. If necessary, external technical support is gained from the Radiation Safety Department of the Environmental Board. Supervision results are publicly available. They are published in press releases, briefings and in the yearbooks of the Environmental Inspectorate. Information about the work schedule and supervision results can also be obtained upon request by contacting the Environmental Inspectorate.

Section F. Other General Safety Provisions

ARTICLE 21. RESPONSIBILITY OF THE LICENCE HOLDER

1. *Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.*
2. *If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.*

The Radiation Act provides that a responsible party shall manage the practice so that it meets all radiation safety requirements prescribed in the Act and ensures that the holder of radiation practice licence has sufficient funds to cover the expenses of management radioactive substances, radiation sources containing radioactive substances and radioactive waste. According to the Article 24^1 of the Radiation Act, the holder of a radiation practice licence shall be liable for the performance of the obligations provided for in the Radiation Act and the terms and conditions of the licence for the purposes of ensuring radiation safety and protection of employees in any exposure situations relating to any source of radiation in the possession of the holder of the licence or any radiation practice of the holder of the licence.

Based on the Article 32 of the Radiation Act the holder of a radiation practice licence has the general obligations to:

1) comply with the radiation safety principles;
2) ensure radiation safety and physical protection of the radiation sources in the holder's possession and to verify at least annually that the radiation source or the equipment containing thereof is present at the place of use or storage and in apparently good condition;
3) ensure the safety of the radiation source by correct installation and placement of the radiation source in the premises, mark the radiation source and the premises and use protective equipment;
4) keep records of every radiation source and radioactive waste for which the holder is responsible, the location and transfer thereof, take annual inventories of radiation sources and radioactive waste;
5) prepare the rules necessary for carrying out radiation works and instructing exposed workers and ensure updating of these rules upon commissioning of new technology or equipment;
6) organise health surveillance of exposed workers;
7) ensure regular control and calibration of measuring instruments used and be responsible for their fitness for use and professional use thereof;
8) at the request of competent authorities, prove the legality of possession of radioactive substances or radiation apparatuses containing radioactive substances;
9) ascertain that the recipient has an appropriate radiation practice licence before transfer of radiation sources;
10) manage radiation sources after the use thereof is terminated pursuant to the management plan submitted in the application for the licence;
11) ensure that radioactive waste is managed in such a manner that the estimated harmful effect on future generations will not exceed the effect permitted by this Act or legislation established on the basis thereof;
12) cover all expenses incurred in radioactive waste management;

13) ensure that the activity and quantities of generated radioactive waste and emissions are as low as possible;
14) alleviate the consequences of accidental exposure situations;
15) immediately inform the Environmental Board and the Emergency Centre of loss, theft or unauthorised use of radiation sources and of any incidents or accidents which took place during radiation practices and resulted in unintentional exposure of workers or members of the public;
16) control the integrity of radiation sources after each incident if it may have damaged the radiation source and, if necessary, inform the Environmental Board of this incident and the measures implemented;
17) during procurement procedures for radiation sources, prefer manufacturers who agree to include a clause in the contract of sale regarding return of the radiation source to the producer.

Upon high risk radiation practices, the holder of a radiation practice licence which includes radioactive waste management is obliged to:
1) prepare a response plan to accidental exposure situations;
2) ensure that a radiation expert has approved the design documentation of the facilities of radiation practices and the commissioning of new radiation sources.

According to Radiation Act article 39 in the case of radiation practices related to radioactive waste management, it is additionally required for a holder of such radiation practice licence to do the following:
1) ensure safety of the radioactive waste management facilities during the entire of use thereof;
2) organise the management of radioactive waste if this is necessary for modifying the properties of the radioactive waste prior to the release thereof into the environment, or the conditioning and interim storage and final disposal thereof;
3) take into account other risks and various stages of generating radioactive waste and interaction of radioactive waste when planning activities and in the course of activities;
4) transfer radioactive waste management facility within five years from the generation thereof at the latest.

To enhance radiation safety, the Radiation Act authorizes the Environmental Board to establish requirements to a radiation practice licence. According to the Radiation Act, the organization engaged in radiation practice is required to take any measures to render harmless radioactive wastes arising from its operation. Rendering radioactive waste harmless means any measure needed to treat, isolate or dispose of the waste, or to restrict its use so that it does not endanger human health or the environment. The state has the secondary responsibility in case when a producer of radioactive waste is incapable of fulfilling its management obligation. There are two options for the management of such radioactive waste, either to return the sealed source to the supplier/manufacturer or to deliver it to the radioactive waste management facility against the fee. Chapter 6 of the Radiation Act gives to the regulatory body the right to demand financial collateral from the applicant to ensure that the funds necessary for safe storage of the radioactive source or waste are immediately available.

Article 66 of the Radiation Act sets the oppurtunity for the Environmental Board to order a holder of a radiation practice licence to submit a new application for a radiation practice licence for closure of final disposal facility on the basis of the information provided. A radiation practice licence shall establish requirements for closing of final disposal facilities. According to the Article 67 of the

Radiation Act, after closure of radioactive waste disposal facilities, the Environmental Board shall:

1) preserve the documents concerning the location and design of the radioactive waste disposal facilities and the inventory of radioactive waste for an indefinite time;
2) organise radiation monitoring and control the restriction of access, if necessary;
3) organise intervention if, based on monitoring results or upon inspection, release of radioactive substances into the environment is established.

ARTICLE 22. HUMAN AND FINANCIAL RESOURCES

Each Contracting Party shall take the appropriate steps to ensure that:

i. qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;

ii. adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;

iii. financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

According to the Article 48 of the Radiation Act, a holder of a radiation practice licence is required to ensure that exposed workers receive radiation safety training and instructions, which take into account the nature of work and the conditions at workplace. In addition, in case of high risk radiation practice or if the holder of a radiation practice licence has more than ten exposed workers, designation of a radiation safety specialist is mandatory. Radiation safety specialist is a person with technical competence in the issues connected to relevant radiation practices who may be designated the person in control of compliance with radiation safety requirements at the undertaking by the holder of radiation practice licence. Requirements of training a radiation safety specialist is described in the Regulation No 57 of 28 November 2016 of Minister of the Environment "Requirements of providing radiation safety training to exposed workers and radiation safety specialists". When applying the radiation practice licence, the applicant has to submit data on exposed workers and their professional training. Data on exposed workers includes a copy of a document, which ensures that the worker has a professional training and/or the worker has received radiation safety training. If a radiation safety specialist is required, application also has to include the job description of a radiation safety specialist. Designation of a radiation safety specialist does not release the holder of a radiation practice licence of the responsibility to ensure radiation safety.

The holder of a radiation practice licence is obliged to instruct exposed workers before starting the work. In case of a moderate or high risk radiation practice the reinstruction has to be done at least once a year. The holder of a radiation practice licence arranges the initial radiation safety training of exposed workers and radiation safety specialists, and provides retraining at least once every five years.

The financial arrangements are in place to manage activities in Paldiski and Tammiku facilities as these are state properties. The owner of the Paldiski site is the Ministry of Economy and Communication. Each year an agreement will be made between the Ministry of Economy and Communication and radioactive waste management organization A.L.A.R.A. Ltd to manage and decontaminate the Paldiski and Tammiku sites. The agreement will be financed from resources of

state budget. Thus, the financial capacity to maintain and the safety of facilities for radioactive waste management in accordance with the regulatory requirements is ensured. The financing of the activities to establish disposal facility and decommission the reactor compartments will be based on the National Radiation Safety Development Plan (see chapter 1 in Section B).

The staff and financial arrangements of the A.L.A.R.A. Ltd. are adequate for radioactive waste management, including for the long-term safe storage of the reactor compartments in Paldiski and decommissioning of the Tammiku radioactive waste management facility. The staff members are trained. Estonia uses an opportunity to train staff of the radioactive waste management company under the IAEA Technical co-operation programme.

ARTICLE 23. QUALITY ASSURANCE

Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.

Principal obligations of holders of radiation practice licences include being responsible for radiation safety and guaranteeing the physical protection of the radioactive sources in the holder`s possession, also developing and implementing a radiation safety quality system. Article 70 (1) of the Radiation Act prescribes that an application for a practice licence shall include description of the radiation safety quality management system. Article 35 of the Radiation Act prescribes that a holder of a radiation practice licence is required to develop and implement a quality management system for radiation safety and other activities related thereto which ensures compliance with the requirements provided for in this Act and legislation issued on the basis thereof and the requirements determined in the radiation practice licence. Radiation safety quality management system must cover:

1) planned and systematic activities which objective is to ensure radiation safety;
2) analysis of duties, and skills required for and requirements for use of radiation sources which include, in particular, description of radiation practice, guidelines for radiation practice, workers' training procedure;
3) requirements for procurement, use and disuse of materials and equipment;
4) description of radiation safety procedures implemented during radiation practices;
5) procedure for controlling the functioning and improvement of the radiation safety quality management system.

This programme should describe the ways of assuring that all quality-related activities will be performed in properly controlled conditions, i.e. by properly qualified personnel using appropriate tools, equipment, methods and technological processes and under suitable environmental conditions, so that the required quality is attained and may be verified by inspection or test. Review and assessment of the relevant radiation safety quality system is carried out by the regulatory body at all stages of the licensing process, i.e. prior to and during the construction, operation, closure and decommissioning of radioactive waste storages and repositories. The regulatory body, through the requirements concerning the preparation and implementation of the radiation quality system, obliges the applicant/holder of the radiation practice licence to plan, perform, verify and document all their activities in an organised and systematic way. An effective radiation safety quality system, established and implemented by the licence holder, allows the regulatory body to obtain satisfactory confidence

in the quality of facility's equipment and in the quality of all performed activities. The regulatory body confirms that the holder of the radiation practice licence has established and implemented and effective radiation quality system by document reviews and inspections of work.

The management system of A.L.A.R.A. Ltd. is certified accordingly to the ISO 9001 and ISO 14001. The quality and environmental management system of A.L.A.R.A. Ltd covers aspects of activities like management of radioactive and non-radioactive waste, including radioactive discharges, decontamination and decommissioning, and transport of radioactive materials. The quality assurance is guaranteed by implementing a set of regulations covering radiological protection of workers and appropriate training, physical safety, waste acceptance criteria, radiation monitoring of workplace and exposed workers, environmental monitoring and written work procedures.

ARTICLE 24. OPERATIONAL RADIATION PROTECTION

1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:

- *i. the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;*
- *ii. no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and*
- *iii. measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment*

2. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:

- *i. to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and*
- *ii. so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.*

iii. 3. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented control the release and mitigate its effects.

During the operating lifetime, all radioactive waste management practices and the management facility itself shall implement the requirements of the Radiation Act and the regulations issued on its basis. The Radiation Act describes the principles of justification, optimisation and dose limitation. According to the Article 32 of the Radiation Act, the holder of a radiation practice licence has the obligation:

1) to ensure that radioactive waste is managed in such a manner, that the estimated harmful effect on future generations will not exceed the effect permitted by Radiation Act or legislation established on the basis thereof,

2) to ensure that the activity and quantities of generated radioactive waste and emissions are as low as possible.

Before starting a radiation practice, the radiation licence applicant shall present an estimation of radioactive waste and discharges, as well as emergency plan and actions/measures to prevent unplanned and uncontrolled releases of radioactive materials into the environment, and procedures

taken in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs.

Based on the Radiation Act, the holder of a radiation practice licence shall organise monitoring of individual doses incurred by exposed workers and submission of monitoring data to a dose register. The national system for radiation dose control for exposed workers is based on the Regulation No 97 of 15 September 2016 of the Government "Effective Dose and Equivalent Dose Limits for the Lens of the Eyes, Skin and Extremities for Exposed Workers and Members of the Public." As prescribed in the abovementioned regulation, the limits of the effective dose are the following:
1) for exposed workers 20 mSv in one year;
2) members of the public 1 mSv in one year.
The Radiation Act provides categories of exposed workers that are following:
1) exposed workers of category A who may incur an effective dose exceeding six millisieverts or exceeding three tenths of the equivalent dose limit for the lens of the eye, skin and extremities established on the Radiation Act;
2) exposed worker of category B who are exposed workers and who are not classified as exposed workers of category A.

A holder of a radiation practice licence is required to ensure health surveillance of exposed workers of category A at least once a year. If exposure exceeding the established dose limits to exposed workers is ascertained, the holder of a radiation practice licence shall immediately refer the exposed workers to health surveillance.

Workplaces shall be divided into the following areas depending on the type of premises and building in which the radioactive source is located, the category of the radioactive source, and the radiation risk category: controlled areas or supervised areas. Depending on the need, monitoring of controlled and supervised areas shall include monitoring of dose rates; monitoring of levels of radioactive contaminants in the air and on surfaces together with testing the properties of the radioactive waste, and determining their physical and chemical status. The holder of a radiation practice licence shall register the results of monitoring and shall preserve the results during the entire period of operation. The requirements for controlled and supervised areas, the premises, where radiation sources are located, the marking of such premises and the radiation sources, and the rules for the performance of radiation practices are established in the Regulation No 52 of 16 November 2016 of the Minister of Environment "Requirements for the Rooms Where the Radiation Sources Are Situated and for Labelling of Rooms and Radiation Sources, Categories of Radiation Sources and the Activity Levels of Radionuclides."

A.L.A.R.A. Ltd has two radiation practice licences: one for radioactive waste management in the Paldiski site and another for decommissioning activities in the Tammiku site. Both licences include monitoring of individual doses of exposed workers, workplace monitoring and environmental monitoring programme. The location, main purpose and essential features of the Paldiski site are described in Section B and Section D, and for the Tammiku site in Section B of this Report. Environmental monitoring reports of both sites are published on the website of A.L.A.R.A. Ltd. and are available to the public[1].

[1] https://alara.ee/seire/

The exposed workers of A.L.A.R.A. Ltd are classified as category A exposed workers and doses are assessed monthly using thermoluminescent-dosimeters. Annual doses of the exposed workers in the period 2017-2019 were less than 6 mSv and did not exceed 1.6 mSv per year. This is the total annual dose obtained from activities on the Paldiski and Tammiku sites.

At the Paldiski site on-site environmental monitoring includes the following: upper groundwater aquifer (borehole) on a quarterly basis, grass on a semi-annual basis, and soil on an annual basis, drinking water on an annual basis and gamma radiation on a monthly basis. The reported activity concentrations for the period 2017–2019 for the Paldiski site are listed below:

1) upper groundwater aquifer: tritium – less than 3 Bq/L, Cs-137 and Co-60 both less than 0.13 Bq/L, Sr-90 concentration varies between boreholes being less than 0.02 Bq/L up to maximum 0.4 Bq/L;
2) grass: Cs-137 less than 1.1 Bq/kg up to maximum 42.7 Bq/kg in 2017, Co-60 less than 1.2 Bq/kg, Sr-90 from 0.1 up to 1.0 Bq/kg. Elevated Cs-137 level is unclear and subsequent samples from the same point did not show higher values any more.
3) soil: Cs-137 varies from 2.2 Bq/kg up to 15 Bq/kg, but in 2019 79.9 Bq/kg was measured; Co-60 less than 0.2 Bq/kg up to 1.4 Bq/kg; Sr-90 less than 2.1 Bq/kg. Elevated Cs-137 level is unclear and subsequent samples from the same point did not show higher values any more.
4) drinking water: tritium less than 3 Bq/L, Cs-137 and Co-60 both less than 0.16 Bq/L, Sr-90 less than 0.033 Bq/L.

Gamma radiation level in the territory of the Paldiski site in period 2017–2019 laid between 0.05–0.13 μSv/h. The monitoring programme also includes quarterly sampling of off-site sewage water at coastal outfall. Activity concentrations for Cs-137 and Co-60 were under 0.16 Bq/L, for H-3 under 3 Bq/L and for Sr-90 less than 0.05 Bq/L. According to the radiation practice licence for Paldiski site, A.L.A.R.A. Ltd has a right to discharge the radioactive liquids, mostly originating from active laundry, decontamination activities etc through its sewage system. It has to be collected into discharge tanks prior to discharges, and the content of radionuclides has to be analysed. The Environmental Board needs to be notified before each discharge event. In 2017–2019, altogether 21.2 m^3 of liquids were released containing *ca* 4.5 MBq of H-3, 4.0 MBq of Sr-90, 12 kBq Am-241 and 0.3 MBq of Cs-137. Gaseous effluents do not arise from the radiation practice in the Paldiski site.

At the Tammiku site on-site environmental monitoring includes the following: upper groundwater aquifer (borehole) on a quarterly basis, grass on a semi-annual basis, soil on an annual basis and gamma radiation on a monthly basis. In a reference area (*ca* 0.5 km from the site), designated for the assessment of the release of the Tammiku site from regulatory control, soil monitoring is carried out on an annual basis. The reported activity concentrations for the period 2017–2019 for the Tammiku site and reference area are the following:

1) upper groundwater aquifer: maximum results for tritium were 10.3 Bq/L (2017) and 14 Bq/L (2019), all other results were less than 4.6 Bq/L; Sr-90 up to 0.05 Bq/L; Cs-137 and Co-60 both less than 0.13 Bq/L; Am-241 less than 0.81 Bq/L and Ra-226 less than 0.1 Bq/L;
2) grass: maximum result for Cs-137 was 64 Bq/kg in 2017, all other results were less than 0.7 Bq/kg up to 16,9 Bq/kg; maximum result for Sr-90 was 71 Bq/kg in 2017, other results were from 0.14 to 8.9 Bq/kg;
3) soil: Cs-137 from 0.2 to 15.1 Bq/kg, Sr-90 less than 1.7 Bq/kg; Ra-226 from 31 to 48 Bq/kg, Am-241 less than 0.8 Bq/kg.

4) soil from reference area: Cs-137 from 3.5 to 11.9 Bq/kg, Sr-90 less than 2.7 Bq/kg, Ra-226 from 27 to 51 Bq/kg and Am-241 less than 1.5 Bq/kg.

In period 2017-2019 gamma radiation level in territory of the Tammiku site lay between 0.11-0.21 μSv/h.

The Environmental Board carries out independent monitoring around radioactive waste management facilities, which covers fish, seaweed, seawater, mushrooms and berries. Sampling is generally conducted on an annual basis. The results are published in annual environmental radiation monitoring reports. For the period 2017–2019, the activity concentrations of Cs-137 were the following: in the seawater 17-21 Bq/m^3, the fish from 2.6 to 3.1 Bq/kg, the seaweed from 7.7 Bq/kg to 12.9 Bq/kg, and in berries and mushrooms from less than 0.10 up to 115 Bq/kg. There have been no measurements of sea sediments. As decontamination and decommissioning of facilities can cause the discharges to the environment and the most probable pathways include water, water samples from wells (both the Tammiku and the Paldiski site) are sampled on a quarterly basis. At the Paldiski site the the activity concentrations of tritium was less than 3 Bq/L. At the Tammiku site, the maximum results for tritium were 10.2 Bq/L in 2017 and 19 Bq/L in 2019. All other measurement results were under 5.30 Bq/L. The environmental ionizing radiation monitoring annual reports are published on the website of the Environmental Board and are available to the public[2].

ARTICLE 25. EMERGENCY PREPAREDNESS

1. Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.

2. Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

The national legal framework for emergency preparedness, including nuclear and radiological emergency, is based on the Emergency Act. A number of regulations specifying requirements of the Act have been passed by the Government and by the Minister of the Interior. The Estonian emergency preparedness system is coordinated by and under the responsibility of the Minister of the Interior.

The Emergency Act provides the legal basis for crisis management, including preparing for emergencies and responding to emergencies as well as ensuring the continuity of vital services. The Emergency Act also governs the declaration, resolution and termination of an emergency situation.

According to the Regulation No. 63 of 26 July 2018 of the Government "Emergency situations for which a contingency plan is to be drawn up and for which a risk communication is to be carried out and the authorities responsible for the management of emergencies" issued pursuant to the Emergency Act, Environmental Board directs and resolves radiological and nuclear emergencies since July 2018. The Environmental Board has developed the risk assessment of the radiological emergencies, which include assessment of the types of radiological event that could cause an emergency and a risk matrix to assess the likelihood and severity of these events.

[2] https://www.keskkonnaamet.ee/en/node/3809

Pursuant to the Radiation Act, one of the main obligations of the high risk radiation practice licence holder is to prepare an emergency plan to accidental exposure situation which is based on the assessment of potential exposures and to test it in accordance with the requirements and frequency established by the radiation practice licence. The Environmental Board evaluates the emergency response plans, trainings and exercises during the pre-authorization inspection based on the documentation provided by the applicant. By granting the radiation practice licence the Environmental Board also approves the emergency response plan. The Environmental Board is notified according to the on-site emergency response plan during the exercises. The Environmental Board may also be involved in the on-site emergency response plan testing. According to the Radiation Act, the holder of the radiation practice licence must immediately inform the Environmental Board and the Emergency Centre of loss, theft or unauthorised use of radiation sources and of any incidents or accidents, which took place during radiation practices, and resulted in unintentional exposure of workers or members of the public. Responsibility of licencees specified by the Radiation Act also includes preventing or reducing the release of radioactive material and exposure of workers and the public.

The radioactive waste management organisation A.L.A.R.A Ltd. has an emergency response plan, which describes actions in the case of a radiation emergency in the radioactive waste management facility, as radioactive waste management is classified as a high-risk radiation practice according to legislation. In accordance with the radiation practice licence for the Paldiski site, A.L.A.R.A. Ltd has to test emergency response plan regularly and register the test results.

ARTICLE 26. DECOMMISSIONING

Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

i. *qualified staff and adequate financial resources are available;*
ii. *the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;*
iii. *the provisions of Article 25 with respect to emergency preparedness are applied; and*
iv. *records of information important to decommissioning are kept.*

The planned activities towards decommissioning reactor compartments in Paldiski site in connection with the establishing of the disposal facility are described in Section B of this Report.

Section H. Safety of Radioactive Waste Management

ARTICLE 11. GENERAL SAFETY REQUIREMENTS

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

i. *ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;*
ii. *ensure that the generation of radioactive waste is kept to the minimum practicable;*
iii. *take into account interdependencies among the different steps in radioactive waste management;*
iv. *provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;*
v. *take into account the biological, chemical and other hazards that may be associated with radioactive waste management;*
vi. *strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;*
vii. *aim to avoid imposing undue burdens on future generations.*

Estonian legislation accompanied by the National Radiation Safety Development Plan for 2018–2027 together with its activity programme for implementation provide the policy, principles and also the strategy for radioactive waste management. As set in the Radiation Act Article 32, it is the obligation of the holder of a radiation practice licence to guarantee safe management of radioactive waste and radioactive emissions created in the course of radiation practices and shall make sure that:

1) radioactive waste is managed such that the estimated harmful effect on future generations of such practices will not exceed the effect permitted by the Act or legislation established on the basis thereof;
2) the activity and quantities of created radioactive waste and emissions are as low as possible;

In addition to the general obligations provided for in Article 32 of this Act, a holder of a radiation practice licence is required to do the following in the case of radiation practices related to radioactive waste management:

1) ensure safety of the radioactive waste management facilities during the entire of use thereof;
2) organise the management of radioactive waste if this is necessary for modifying the properties of the radioactive waste prior to the release thereof into the environment, or the conditioning and intermediate storage and final disposal thereof;
3) take into account other risks and various stages of generating radioactive waste and interaction of radioactive waste when planning activities and in the course of activities;
4) transfer radioactive waste to a radioactive waste management facility within five years from the generation thereof at the latest.

Classification of radioactive waste and the detailed requirements for registration, management and transfer of radioactive waste are described in Regulation No 34 of 4 October 2016 of the Minister of the Environment “The Classification of Radioactive Waste, the Requirements for Registration,

Management and Transfer of Radioactive Waste and the Acceptance Criteria for Radioactive Waste." The latter sets the requirement that the holder of a radiation practice licence shall collect and store:

1) different type of radioactive waste and waste with different physico-chemical properties separately;
2) untreated radioactive waste separately from the conditioned waste;
3) radioactive waste separate from corrosive, oxidising, explosive and highly flammable substances;
4) the biological radioactive waste frozen, placed in a suitable solution or treated in some other suitable manner;
5) used sealed radiation sources in their own or in another suitable radiation shield;
6) sharp solid radioactive waste separately in a suitable container marked "sharp radioactive articles";
7) unconditioned wet solid radioactive waste in at least two layer storage containers in order to prevent the leakage of radioactivly contaminated liquid;
8) unconditioned liquid radioactive waste in a container surrounded by absorbent material in an amount that ensures that the liquid contained in the container is coupled to twice the amount of liquid.

The Regulation No 43 of 27 October 2016 of the Minister of the Environment "Clearance Levels for Radioactive Substances and Materials Contaminated with Radioactive Substances Resulting from Radiation Practices, and the Requirements for Their Clearance, Recycling and Reuse" establish the clearance levels of materials containing slightly radioactive substances generated in the radiation practice or devices and facilities contaminated by radioactive substances and waste and emissions, as well as conditions for their recycling, recovery or discharge in the environment. The regulation describes the following requirements:

1) general clearance and establish general clearance levels;
2) the clearance levels and conditions for radioactive materials generated as a result of radiation practice;
3) clearance levels and requirements for buildings connected with radiation practice;
4) clearance levels and requirements for radioactive material and radioactive metal waste connected with radiation practice;
5) discharge of radioactive emissions (gaseous, aerosols, liquids) in the environment;
6) application in order to release radioactive substances or items contaminated by radioactive substances.

The content of an application in order to release radioactive substances or items contaminated by radioactive substances is the following:

1) the data of the owner of radiation practice licence and of radiation practice licence
2) the justification of the release of radioactive substances or items contaminated by radioactive substances
3) the characterisation of the radioactive substances or items contaminated by radioactive substances including physical and chemical properties
4) the data of person receiving the released radioactive substances or items contaminated by radioactive substances;
5) the procedures to release into the environment with the aim of dispersion thereof;
6) when appropriate the radiation safety assessment composed by the radiation expert.

Regulatory decision of clearance of radioactive substances or items contaminated shall be decided within 90 days as of the receipt of a conforming application. The Environmental Board may decide to release radioactive substances exceeding the clearance levels set in the Regulation No 43 of 27

October 2016 based on the radiation safety assessment, if the radiation safety assessment demonstrates that release of radioactive substances is the best solution taken into account economic, social and environmental factors.

ARTICLE 12. EXISTING FACILITIES AND PAST PRACTICES

Each Contracting Party shall in due course take the appropriate steps to review:

i. *the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;*
ii. *the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.*

The radioactive waste management facilities in the Paldiski and Tammiku sites existed before the first Radiation Act was put into force in 1997. Consequently, this law did not regulate the original design of these installations and the initial constructions.

Radioactive waste management facility in the Paldiski site situates in the territory of the former Soviet Navy Nuclear Training Facility (hereinafter *the training facility*). The training facility once contained two nuclear submarine mock-ups, both equipped with working PWR type nuclear reactor (see chapter 3.2 in Section B). The territory of training facility also contained two waste storages (for liquid and solid waste, respectively) and several auxiliary buildings and facilities. In 1994, spent fuel was removed from reactors and transported to Russia for reprocessing. Shortly after that, the submarine mock-ups were dismantled, except the reactor compartments, which were put on safe storage. In 1995, the ownership of the site transferred from the Russian Navy to the Estonian government (represented by A.L.A.R.A. Ltd). In 1997, a radioactive waste interim storage was established at the same site. From 1996 to 2006 all remaining waste at former training facility was collected, conditioned and properly stored, unnecessary buildings (or parts of them) were decontaminated and demolished. The site infrastructure has been refurbished according its changed functions and needs. All the radioactive waste related to decommissioning activities from the former training facility have been placed under safe and secure conditions to the radioactive waste storage faclity in the Paldiski site. Since the establishment of the Radiation Act, the radioactive waste management facility in the Paldiski site has been continuously modernised with a view to safety enhancement. Status of the situation and overview of activities in the Paldiski site are described in Section B of this Report.

In 1963, the radioactive waste management facility for low- and intermediate-level waste (LILW) was established in Tammiku, 12 km south of Tallinn. The facility consisted of one storage tank for liquid waste and one storage vault for solid waste, the RADON-type near surface storage. In the mid-1980's, reconstruction began in order to upgrade this facility in accordance with then current USSR criterion on safe management of radioactive waste, but this work remained incomplete due to a lack of resources. The near surface storage facility for solid LILW in Tammiku was intended for institutional waste from Estonian non-military applications. Since 1995, A.L.A.R.A. Ltd manages the facility. By 1995, approximately 55% of the total volume (200 m^3) of solid waste storage vault filled

with unpacked and unsorted waste, the total activity being 76 TBq. Spent sealed sources Sr-90 and Cs-137 made up the main part of the waste. However, a clear overview of the waste stored in the facility was lacking and clearance works were very complicated. Until 1996, it served as a central storage facility for the waste generated from the use of radionuclides in Estonia. In 1996, it was temporarily closed and covered with concrete slabs and soil layer as a result of an accident with radioactive sources in 1994. Several studies have been carried out since then on radiological safety assessement of the facility. According to assessments, the facility did not comply with modern safety requirements established for radioactive waste storage facilities. The storage tank was made of concrete and it was demolished in year 2001. The near surface storage facility was made of concrete as well and covered by a shelter building of corrugated sheet iron. In 2005 a feasibility study was carried on retrival and conditioning of radioactive waste of the Tammiku site. In 2006, A.L.A.R.A. Ltd started with environmental impact assessment process to decommission the radioactive waste facility in the Tammiku site. Status of the situation and overview of activities in Tammiku site are described in Section B of this Report.

The radiation practices in both sites are licenced and safety assessments have been performed. The Estonian authorities have reviewed and enforced safety procedures in connection with licence applications, and carried out regular inspections.

ARTICLE 13. SITING OF PROPOSED FACILITIES

Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

i. *to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;*
ii. *to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;*
iii. *to make information on the safety of such a facility available to members of the public;*
iv. *to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.*

In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

ARTICLE 14. DESIGN AND CONSTRUCTION OF FACILITIES

Each *Contracting Party shall take the appropriate steps to ensure that:*

i. *the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;*
ii. *at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;*
iii. *at the design stage, technical provisions for the closure of a disposal facility are prepared;*
iv. *the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.*

ARTICLE 15. ASSESSMENT OF SAFETY OF FACILITIES

Each Contracting Party shall take the appropriate steps to ensure that:

i. *before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;*
ii. *in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;*
iii. *before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).*

Legal foundation of siting of a proposed facility lies in the Radiation Act as well as in regulation No. 34 of 4 October 2016 of the Minister of the Environment "The Classification of Radioactive Waste, the Requirements for Registration, Management and Transfer of Radioactive Waste and the Acceptance Criteria for Radioactive Waste." Specific site is required to be in accordance with the Environmental Impact Assessment and Environmental Management System Act and Planning Act.

Pursuant to the Environmental Impact Assessment and Environmental Management System Act, an

environmental impact is assessed upon application for a permit or amendment of a permit if the planned activity may cause significant environmental impact. Article 6 of the Environmental Impact Assessment and Environmental Management System Act provides that significant environmental impact includes also:

1) construction, dismantling or decommissioning of a nuclear power station or other nuclear reactors, except research installations for the production and conversion of fissionable and fertile materials, whose maximum power does not exceed 1 kilowatt continuous thermal load;
2) production or enrichment of nuclear fuel, processing or handling or final disposal of used nuclear fuel or disposal of used nuclear fuel for over ten years on a site other than the place of generation thereof;
3) handling high level radioactive waste, final disposal of merely radioactive waste or disposal thereof for over ten years on a site other than the place of generation.

The environmental impact assessment (EIA) procedure consist of a programme and a report stage. The leading expert or an expert group will, on the basis of the compliant environmental impact assessment programme, prepare the environmental impact assessment report in which the leading expert or the expert group among other things:

1) describes the purpose of and the need for the proposed activity;
2) sets out a description of the proposed activity and reasonable alternatives therefor;
3) sets out a description of the environment potentially significantly affected by the proposed activity and reasonable alternatives therefor and assesses the state of the environment of the region;
4) evaluates the potential consequences associated with the proposed activity and reasonable alternatives therefor, e.g. water, soil or air pollution, waste generation, noise, vibration, light, heat, radiation and smell;
5) sets out a description of the methods to predict potential significant environmental impact of the proposed activity and reasonable alternatives therefor;
6) analyses the potential significant environmental impact of the proposed activity and its reasonable alternatives, including the indirect impact and combined impact with other types of activity on the state of the environment, impact on the health, well-being and property of persons, on plants, animals, soil, landscape, mineral resources, quality of air and water, climate, on protected natural objects;
7) assesses the potential effect of significant environmental impact and describes the measures to prevent or minimise the adverse environmental impact involved and assesses the potential efficiency of the measures;
8) compares the proposed activity with reasonable alternatives;
9) sets out an overview of the results of consultations upon assessment of environmental impact, involvement of the public and assessment of environmental impact in transboundary context;
10) submits information on sources used upon environmental impact assessment;
11) discusses the proposals, objections and questions submitted regarding the report
12) discusses minutes of the public consultation regarding the report

Based on the outcomes of the feasibility study described in Chapter 3.2.2 of Section B of this Report the suitable options for final disposal facilities were identified. It was found, that a significant fraction of the waste, currently stored in the Paldiski interim storage facility, as well as most of the waste, resulting from the reactor sections decommissioning, could potentially be disposed of in a landfill-type facility. Only the 52-ton iron-water shielding tank of one of the reactors could be, according to

its radiological characteristics, disposed of in a Near Surface Repository or Intermediate Depth Repository.

A thorough updating of law must also precede the construction of the final disposal site, since the current legal framework is insufficient on that matter. In addition to the Radiation Act and the regulations issued on its basis, the legislation concerning planning and constructing of constructions must be amended with the aim of establishing the requirements for the construction of the final disposal site. Based on the results of feasibility study the environmental impact assessment procedure will follow up on radiation practice application for decommissioning of reactor compartments. Planned activities in period 2019-2023 are described in Section B of this Report.

This initial process will make sure that all necessary steps are taken to implement fundamental principles and requirements for a disposal facility in compliance with national and international obligations and recommendations. The siting, construction and commissioning of the disposal facility is subject to the environmental impact assessment according to the Environmental Impact Assessment and Environmental Management System Act. As a member of European Union, Estonia shall provide the European Commission with such general data, relating to any plan for the disposal of radioactive waste in whatever forms as called for under the Article 37 of the Euratom Treaty. The goal is to determine whether the implementation of such a plan is liable to result in the radioactive contamination of the water, soil or airspace of another Member State.

ARTICLE 16. OPERATION OF FACILITIES

Each Contracting Party shall take the appropriate steps to ensure that:

i. *the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;*
ii. *operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;*
iii. *operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;*
iv. *engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;*
v. *procedures for characterization and segregation of radioactive waste are applied;*
vi. *incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;*
vii. *programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;*
viii. *decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;*
ix. *plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.*

The requirements for licence application is established with the Regulation No 60 of 24 November 2016 of the Minister of Environment „Detailed requirements for applications for radiation practice licences, lists of data of applications and radiation practice licences, and lists of data characterising radiation sources used to keep lists of nuclear materials“. In addition to this, the requirements of Regulation No 34 of 4 October 2016 of Minister of Environment “The Classification of Radioactive Waste, the Requirements for Registration, Management and Transfer of Radioactive Waste and the Acceptance Criteria for Radioactive Waste” as well as the Regulation No 43 of 27 October 2016 of the Minister of the Environment “Clearance Levels for Radioactive Substances and Materials Contaminated with Radioactive Substances Resulting from Radiation Practices, and the Requirements for Their Clearance, Recycling and Reuse” has to be followed. Among other documents, the applicant is required to present a radiation safety quality management system. The content of these regulations are prescribed in Section H and the legislative and regulatory system in Section E. Legal responsibilities of the holder of a radiation practice licence are described in Section F. Modifications of a radiation practice licenece are a subject to approval by the regulatory body and regulated through operational limits and conditions in accordance with the Radiation Act and requirements stipulated in the licences.

The radiation practice licence for activities in the Paldiski site was issued in 2016 for a term up to 5 years (see the scope of the licence in chapter 3.1 of Section B). Measurement methods for characterization of radioactive waste have worked out.

The Environmental Inspectorate inspects high risk radiation practices, including radioactive waste management facilities, once a year.

ARTICLE 17. INSTITUTIONAL MEASURES AFTER CLOSURE

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

i. *records of the location, design and inventory of that facility required by the regulatory body are preserved;*
ii. *active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and*
iii. *if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.*

A holder of a radiation practice licence shall collect and analyse data on the use of radioactive waste storage facilities and send such information to the Environmental Board for preservation. Article 66 of the Radiation Act sets the oppurtunity for the Environmental Board to order a holder of a radiation practice licence to submit a new application for a radiation practice licence for closure of disposal facilities on the basis of the information provided. A radiation practice licence shall establish requirements for closing of disposal facilities.

According to the Article 67of the Radiation Act, after closure of radioactive waste disposal facilities, the Environmental Board shall:

1) preserve the documents concerning the location and design of the radioactive waste storage facilities and the inventory of radioactive waste for an indefinite time;
2) organise radiation monitoring and control the restriction of access, if necessary;
3) organise intervention if, based on monitoring results or upon inspection, release of radioactive substances into the environment is established.

Section I. Transboundary movement

ARTICLE 27.TRANSBOUNDARY MOVEMENT

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments.

In so doing:

i. a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

ii. transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

iii. a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

iv. a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement;

v. a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

1. A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

2. Nothing in this Convention prejudices or affects:

i. the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

ii. rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

iii. the right of a Contracting Party to export its spent fuel for reprocessing;

iv. rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

The Chapter 2 of the Radiation Act describes requirements for radiation practice licences for import, export and transit of radioactive waste. The provisions of this chapter also apply to import, export and transit of spent nuclear fuel. The Environmental Board reviews the application for transport and issues a licence for transport. The Minister of Environment has issued the Regulation No. 33 of 3 October 2016 of the Minister of the Environemnt “Procedure Specifications for Processing Documents of Import, Export and Transit of Radioactive Waste Based on Country of Origin and Destination”. This regulation implements all obligations under Article 27 of the Joint Convention. The regulation is the Estonian implementation of the European Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste. Until now, the Environmental Board has never received an application and consequently has never issued any licence for a transboundary movement of radioactive waste with Estonia as the country of origin or with Estonia as the country of destination. Additionally, since the issuance of the above-mentioned regulation, there has been no authorisation for transboundary movement of radioactive waste between EU-countries with Estonia as a country of transit.

Section J. Disused sealed Sources

ARTICLE 28. DISUSED SEALED SOURCES

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

2. A Contracting Party shall allow for reentry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

Radioactive sealed sources are mainly used in medicine, industry and research institutions, minor quantities in service agencies. The Radiation Act and its regulations implement all obligations under Article 28 of the Joint Convention ensuring that the possession and storage of disused sealed sources take place in a safe manner.

Each radiation practice licence applicant has to present with its licence application a management plan of the radiation source after the termination of its use (disused source). Disused source is a radiation source which is no longer used or no longer intended to be used for the purposes which comply with the radiation practice licence. Management plan of disused sources includes all the activities, which are necessary to ensure safe management a radiation source upon termination of the radiation practices connected to the source. According to Article 98, the issuer of licences may require that applicants for radiation practice licences have financial collaterals to manage disused sources and radioactive waste safely (hereinafter *collateral*). The issuer of licences shall decide on the need for collateral within 20 days as of registration of an application for a radiation practice licence or the amendment thereof. The importance of ensuring safe management of disused sources or radioactive waste from the radiation safety point of view and the estimated cost of management shall be taken into account upon making the decision. The collateral must only be intended for management of disused sources and radioactive waste and it must be immediately available, when necessary. The amount of collateral shall be the estimated cost of management of disused sources or radioactive waste on the basis of the data submitted by the applicant of a radiation practice licence and it shall be determined by the issuer of licences. The availability of collateral shall be certified by a guarantee of an Estonian or and international credit or financial institution accepted by the issuer of licences. The issuer of the licences has the right to refuse to accept any issuer of guarantees if there are reasons to doubt the reliability of the guarantee issued by such issuer on the basis of the former activities, financial status or reputation of the issuer of the guarantee. Collateral must be valid up to the end of the management of disused sources or radioactive waste. The determination of the collateral shall take into account the activity of the radioactive source and handling costs of the radioactive source, including dismantling, transport and storage.

The obligations of the holder of a radiation practice licence are listed in Section F under Article 21 of this Report. The Radiation Act states that a holder of a radiation practice licence is required to submit a report to the Environmental Board on the inventory of radiation sources and radioactive waste by 1 March of the year following the accounting year. The requirements for the physical protection of radiation sources are described in Regulation No 52 of 16 November 2016 of the Minister of the Environment “Requirements for the Rooms Where the Radiation Sources Are Situated

and for Labelling of Rooms and Radiation Sources, Categories of Radiation Sources and the Activity Levels of Radionuclides". It defines categories of sealed radiation sources in purpose of their physical protection.

The Radiation Safety Department of Environmental Board maintains a register of radiation sources and nuclear materials with the aim of ensuring protection of people and the environment, safety and physical protection of radiation sources and nuclear materials. The register of radiation sources and nuclear materials contains data on radiation practice licences and holders thereof, and data charactering radiation sources and nuclear materials. For the purpose of ensuring protection of people and the environment, safety and physical protection of radiation sources and nuclear materials, the information in the register of radiation sources and nuclear materials is intended for internal use.

Disused radioactive sources must be returned immediately after discontinuing the use thereof to the manufacturer, transfer it to another holder of a radiation practice licence or to a radioactive waste management facility. The first option is preferred. In Estonia, neither manufacturing nor re-manufacturing of sealed sources takes place. For the use of a high-activity radioactive source, the licence applicant shall present with its licence application a copy of documents, which prove returning the sources to the supplier after termination of use the sources. Estonia has only one radioactive waste management facility (the interim storage). In a situation, where the options of returning the disused sealed source promptly to the manufacturer or transferring it to another licence holder are not viable, then sources are transferred to the interim storage.

The Environmental Inspectorate executes state supervision over radiation safety. All radiation practices using radioactive sources shall be inspected at least once every 5 years. Users of high-activity sealed sources are inspected once a year.

If the owner of radioactive substances, equipment containing thereof or radioactive waste is unknown or the person responsible for them cannot be established or if the possession thereof is illegal or there is reasonable doubt in connection with that an accidental exposure situation can occur, the state shall take possession of the radioactive substances, equipment containing thereof and radioactive waste. These objects shall be delivered for management to the radioactive waste management facility. If the owner of radioactive substances, equipment containing thereof and radioactive waste is unknown or the person responsible for them cannot be established, the state shall cover the costs related to taking the possession and management thereof. In the case of illegal possession of radioactive substances, equipment containing thereof or radioactive waste or if an accidental exposure situation may occur in connection therewith, the owner shall cover the costs related to taking the possession thereof by the state and management thereof.

Fixed monitors for vehicles and railway traffic have been installed to all major crossing points at the Estonian-Russian border and at the Tallinn Airport. In all crossing points the custom officers are equipped with portable monitors. Customs and Tax Board together with the Security Police Board have procedures of conduct for cases when radioactive sources are discovered at the border. In general, if undocumented material is discovered: suspicious parcel is isolated and the Security Police is notified. Common practice is, when radioactive material package arrives or when there is a suspicion on the radioactive material package, the Customs and Tax Board contacts the Environmental Board to find out information about the receiver of radioactive material package based

on the custom documents. Disused sealed sources can also enter into the recycling stream of scrap metal, therefore biggest scrap metal companies have installed fixed monitors at the gates of their installations.

The Ministry of the Environment and radioactive management company A.L.A.R.A. Ltd have conducted a campaign to collect radioactive sources in years of 2009, 2010, 2012, 2015 and 2019. During the campaigns the following items were collected: radioactively contaminated material, smoke detectros containing radionuclide, check sources and other equipment containing radioactive material. A final report was prepared on the results of each campaign. The report on 2019 campaign is publicly availabe on the website of the Ministry of the Environment. The campaigns were financed by the Ministry of the Environment.

The national emergency response and preparedness system is described in Section F under Article 25.

Section K. General Efforts to Improve Safety

The Report pays attention on the progress made in the areas identified as challenges and planned measures to improve safety during the Sixth Review Meeting:

1. Completion of the remediation activities in Tammiku to unrestricted site release

All waste was retrieved and transferred to Paldiski. The radiation practice licence was issued in 2012 for a term up to 5 years to continue with the second stage of decommissioning. In 2013-2017, the radiological survey of inner surfaces of the facility was carried out and based on its results the decontamination works were done. In 2018, new radiation practice licence was issued with a validity up to 2023. The radiological survey of the outer surfaces of the facility and its decontamination has been completed by now. To evaluate conformity with the clearance conditions and clearance levels, the operator is in a procees of preparation of a radiation safety assessment report. Taken into account current state of decommissioning and the validity of the radiation practice licence, the decommissioning activities in the Tammiku site will continue at last up to 2022 and site is expected to release from regulatory control in 2023. The decommissioning of the Tammiku site is funded through the budget of the Ministry of Economic Affairs and Communication.
For a detailed overview see chapter 3.2 of Section B.

2. Steps towards construction of the National disposal facility (design criteria and feasibility study) and planning for the decommissioning of Paldiski sarcophagi

Long-term policy for safe management of radioactive waste is to establish a radioactive waste disposal site by 2040. The principle decision to establish a final disposal site for radioactive waste was made on the government level in April 2016. National Radiation Safety Development Plan (NRSDP) 2018-2027 and its annex, National Plan for Radioactive Waste Management (NPRWM) were adopted in 2020 by the Minister of Environment. The NPRWM is a source document, which gives an overview of the legislation in force and directions for supplementing them. The programme describes the institutions, technical and financial resources, and research and development activities for safe radioactive waste management. It also provides sub-objectives, measures, and expected results of the field until 2050. Based on NRSDP 2018-2027 and its annex on radioactive waste management (NPRWM), the Minister of the Environment approved by the Decree of 4 April 2019 that financing for pre-activities necessary for the construction of a final disposal facility is secured for the period 2019-2023. The objective of financing is to conduct studies and gather data for the following purposes:

1) carry out research and collect the necessary data for site selection which would be the basis for the preparation of a local government designated spatial plan for the construction of a final disposal facility and a strategic environmental impact assessment.
2) carry out the technical and radiological surveys of the the building, interim storage and rector compartments in the Paldiski site to characterise their condition. Based on the results the requirements for safe storage and maintenance of facilities until decontamination and/or dismantling will be establish, including the develop of a decommissioning plan of the reactor compartments.

The responsibility for implementation lays on the radioactive waste management company A.L.A.R.A. Ltd. Implementation will take place through a public procurement procedure and a call for tenders announced in October 2020.

3. Implementation of human resources education in radiation protection

Ensuring competence of regulatory authorities is one of the main objectives of the NRSDP 2018-2027. Due to activities related to the establishing of the final disposal site for radioactive waste and the decommissioning of the reactor compartments, there is a need for additional staff in different regulatory authorities and agencies. Demand for additional staff also arises regarding reporting on the implementation of EU legislation and international conventions as well as radon consulting and indoor radon measurements. Concerning training of the staff of regulatory body, the 2019 IRRS follow-up mission made a recommendation to ensure sustainable education and training as well as development and management of human resources of regulatory authorities. In addition to measures already taken (e.g. weekly radiation safety training once a year, training provided in the framework of IAEA technical cooperation), new measures were adopted in NRSDP 2018-2027 such as training events for other agencies in the field of emergency preparedness and monitoring. It is also planned to compile an online learning programme possibly with different modules for employees from different agencies involved in radiation protection and safety.

4. Implementation of the relevant 2016 IRRS mission recommendations / suggestions in preparation for follow up in 2019

The 2019 IRRS follow-up mission concluded that compared to 2016, situation has improved. 28 out of 36 recommendations and 10 out of 14 suggestions identified in IRRS mission 2016 have been closed. During the IRRS follow-up mission, the IRRS review team developed 2 new recommendations and 4 new suggestions. The national radiation safety policy and strategy as well as legislation have been updated. Most of the recommendations and suggestions are transposed into national legislation and into the NRSDP 2018-2027, the latter includes recommendations and suggestions for which implementation requires long-term planning. The 2019 IRRS follow-up mission report is published on website of the Ministry of the Environment and is available to the public.

5. Preparation and commencement of dismantling of the Tammiku facility decontaminated concrete structure.

Please see the point 1 of this Section.

6. Completion of the National Radiation Safety Development Plan 2018-2027

National Radiation Safety Development Plan 2018–2027, the National Radon Action Plan, the National Action Plan for Radioactive Waste Management and the Activity Programme for implementation NRSDP for 2018–2021 was approved by the order of the Ministry of Environment in 23 of January 2020. The NRSDP 2018-2027 with its annexes were published on website of the Ministry of the Environment and are available to the public.

7. IAEA ARTEMIS mission in 2019

The ARTEMIS mission took place in 24 March – 1 April 2019 and in the course of it, international experts assessed the national organisation of radioactive waste management in Estonia. International

experts highlighted that with its small amount of radioactive waste, Estonia has been able to create a complete solutions for its management. During ARTEMIS mission 11 recommendations and 3 suggestions were made to improve and ensure implementation of the National Programme for Radioactive Waste Management. The conclusions of the audit provided recommendations for planning the activities necessary for the construction of a radioactive waste disposal site in Estonia by 2040. In connection with establishing radioactive waste disposal, Estonia needs to focus on the following issues: improve national legal and regulatory framework covering site selection and design, construction, operation and closure of the disposal facility; establish requirements and guidance for safety documentation for disposal facilities, including waste acceptance requirements; and capacity building to provide the necessary human and financial resources to deliver all aspects of the national programme for radioactive waste management. The recommendations and suggestions for which implementation requires long-term planning are included into NRSDP 2018-2027. The ARTEMIS mission report was published on website of the Ministry of the Environment and is available to the public.

8. Update regulatory framework to include final disposition

Updating the legislative and regulatory framework regarding establishment of final disposal for radioactive waste is included in the NRSDP 2018-2027. In addition, please see the point 9 in this Section.

9. Planned future actions

In order to implement the NRSDP 2018–2027, Estonia has submitted a national project concept to the IAEA within the framework of the IAEA technical cooperation program. The project will enhance the effectiveness of the legislative, regulatory and organisational infrastructure and technical capabilities on radiation protection and nuclear safety in Estonia. The legislation regarding establishing final disposal for radioactive waste will be reviewed and drafted as well as the organizational structure, including human resources and knowledge management are analysed to satisfy requirements for safe management of radioactive waste in a long term. For ensuring high level safety culture, qualified personnel is needed in the level of decision makers, regulatory authorities, operators as well as TSOs. In order to meet the needs of different institutions it is planned to compile an online learning programme with its different specific modules. During the project, modules and their content are developed and technical requirements for software are described. The project is planned for 2022-2025.

Annex A. Matrix of current practice of radioactive waste management

Type of Liability	Long Term Management Policy	Funding of Liability	Current Practice/Facilities	Planned Facilities
Spent Fuel	N/A	-	-	-
Nuclear Fuel Cycle Wastes	No NFCW generated	-	-	
Applications Wastes	Central Interim Storage, then Disposal	Waste producers, Government	Central Interim Storage	Disposal facility
Decommissioning	-	Government	Decommissioning of the Paldiski site; Decommissioning of the Tammiku RWS	Disposal facility
Disused Sealed Sources	Return to supplier/Disposal	Owners, Government	Return to supplier/ Central Interim Storage	Disposal facility

Annex B. Inventory of radioactive waste in interim storage

Waste category	Volume, m^3	Distribution, %
LLW and ILW (short-lived waste)	1012	95
LLW and ILW (long-lived waste)	19	2
NORM waste	29	3
Total	**1060**	**100**

Annex C. References to Estonian national laws and regulations related to safety of spent fuel and radioactive waste

The Estonian legislation listed below as in force of 1 October 2020 and published in the electronic database of the State Gazette www.riigiteataja.ee, the Acts are available in English language (https://www.riigiteataja.ee/en/).

Acts:

1. Radiation Act, passed 8 June 2016 and enforced in 1 November 2016, latest amendment enforced in 1 June 2020.
2. General Part of the Environmental Code Act, passed on 16 February 2011 and enforced in 1 August 2014, in part 1 January 2015 and 1 August 2017, latest amendment enforced in 1 January 2020.
3. Environmental Supervision Act, passed on 6 June 2001 and enforced in 6 June 2001, latest amendment enforced in 15 March 2019.
4. Emergency Act, passed on 8 February 2017 and enforced in 1 July 2017, latest amendment enforced in 18 May 2020.
5. Environmental Impact Assessment and Environmental Management System Act, passed on 22 February 2005 and enforced in 3 April 2005, latest amendment enforced in 1 January 2020.
6. Law Enforcement Act, passed on 23 February 2011 and enforced in 1 July April 2014, latest amendment enforced in 7 May 2020.
7. Code of Misdemeanour Procedure, passed on 22 May 2002 and enforced in 1 September 2002, latest amendment enforced in 7 May 2020.

Regulations of the Government:

1. Regulation No 95 of 15 September 2016, latest amendment enforced in 3 August 2018: Intervention and action levels and reference levels of emergency exposure.
2. Regulation No. 97 of 15 September 2016, latest amendment enforced in 3 August 2018: Effective Dose and Equivalent Dose Limits for the Lens of the Eyes, Skin and Extremities for Exposed Workers and Members of the Public Regulations of the Minister of the Environment.
3. Regulation No. 112 of 22 June 2017: The requirements and the procedure for coordinating the resolution of an emergency, cooperation between authorities and persons involved in the resolution, informing the public, interdepartmental exchange of information and mass evacuation
4. Regulation No 108 of 22 June 2017, latest amendment enforced in 2 June 2020: The list of events that could lead to an emergency and that are subject to a risk assessment and designates the authorities in charge of preparing an emergency risk assessment.
5. Regulation No. 63 of 26 July 2018: Emergency situations for which a contingency plan is to be drawn up and for which a risk communication is to be carried out and the authorities responsible for the management of emergencies

Regulations of the Minister of the Environment:

1. Regulation No 43 of 27 October 2016: Clearance Levels for Radioactive Substances and Materials Contaminated with Radioactive Substances Resulting from Radiation Practices, and the Requirements for Their Clearance, Recycling and Reuse.
2. Regulation No. 52 of 16 November 2016: Requirements for the Rooms Where the Radiation Sources Are Situated and for Labelling of Rooms and Radiation Sources, Categories of Radiation

Sources and the Activity Levels of Radionuclides
3. Regulation No. 57 of 24 November 2016: Requirements for Radiation Safety Training of Exposed Worker and Radiation Safety Specialist
4. Regulation No. 34 of 4 October 2016: The Classification of Radioactive Waste, the Requirements for Registration, Management and Transfer of Radioactive Waste and the Acceptance Criteria for Radioactive Waste
5. Regulations No 60 of 24 November 2016, latest amendment enforced in 22 June 2020: The Detailed requirements for applications for radiation practice licences, lists of data of applications and radiation practice licences, and lists of data characterising radiation sources used to keep lists of nuclear materials
6. Regulation No. 33 of 3 October 2016: Procedure Specifications for Processing Documents of Import, Export and Transit of Radioactive Waste Based on Country of Origin and Destination
7. Regulation No. 41 of 20 October 2016, latest amendment enforced in 6 July 2018: Statutes for the Maintenance of the State Dose Register of Exposed Workers
8. Regulation No 20 of 29 June 2017, latest amendment enforced in 3 July 2020: The environmental decisions information system and its statutes
9. Regulation No. 13 of 20 May 2014, latest amendment enforced in 7 October 2019: Statute of the Environmental Board
10. Regulation No. 12 of 31 March 2008, latest amendment enforced in 1 February 2020: Statute of the Environmental Inspectorate
11. Regulation No. 186 of 10 December 2009, latest amendment enforced in 1 June 2019: Statute of the Ministry of the Environment

Regulations of the Minister of the Interior

1. Regulation No. 30 of 21 June 2017: The requirements for an emergency response plan and the procedure for the preparation thereof.
2. Regulation No. 28 of 19 June 2017: The requirements for an emergency risk assessment and the procedure for the preparation of a risk assessment

Annex D. References to Estonian national and international reports related to safety of spent fuel and radioactive waste and to reports on international review missions performed at the request of a Contracting Party

National Reports

1. National Report from Estonia. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. Sixth Review Meeting. Tallinn, Estonia, October 2017. https://www.iaea.org/sites/default/files/national_report_of_estonia_for_the_6th_review_meeting_-_english.pdf
2. Convention on Nuclear Safety. 4th Estonian National Report on Compliance with the Obligations of the Convention on Nuclear Safety as referred to in Article 5 of the Convention. Seventh Review Meeting. Environmental Board, Tallinn, Estonia, August 2016. https://www.iaea.org/sites/default/files/estonia_nr-7th-rm.pdf

Other

1. National Radiation Safety Development Plan 2018–2027. Tallinn, 2019. https://www.envir.ee/sites/default/files/VOKO/national_radiation_safety_development_plan_2018-2027.pdf

1.1 Annex I National Action Plan for Radioactive Waste Management. Tallinn, 2019. https://www.envir.ee/sites/default/files/VOKO/annex_1._national_action_plan_for_radioactive_waste_management.pdf

1.2 Annex II NATIONAL RADON ACTION PLAN. Tallinn, 2019 https://www.envir.ee/sites/default/files/VOKO/annex_2._national_radon_action_plan.pdf

2. Preliminary Studies for the Decommissioning of the Reactor Compartments of the Former Paldiski Military Nuclear Site and for the Establishment of a Radioactive Waste Repository. Final Report. December 28, 2015. https://alara.ee/wp-content/uploads/2018/08/kodulehtPaldiskieeluuringudlopparuanneIngl.pdf

Reference to the reports on international review missions performed at the request of a Contracting Party

1. Integrated Regulatory Review Service (IRRS) Mission to Estonia, 4-14 September 2016. https://www.envir.ee/sites/default/files/irrs_estonia_final_report_2016-11-10_.pdf
2. Integrated Regulatory Review Service (IRRS) Follow-Up Mission to Estonia, 4-9 March 2019. https://www.envir.ee/sites/default/files/irrs_estonia_follow_up_mission_report_1.pdf
3. Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) Mission to Estonia, 24 March – 1 April 2019. https://www.envir.ee/sites/default/files/artemis_estonia_final_report_.pdf