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GOVERNMENT OF THE REPUBLIC OF LITHUANIA

RESOLUTION
ON THE APPROVAL OF RADIOACTIVE WASTE MANAGEMENT DEVELOPMENT PROGRAMME

No. 1427 of 23 December 2015
Vilnius

Pursuant to Article 4 (4) and Article 8^1 (1) of the Law on the Management of Radioactive Waste of the Republic of Lithuania, hereby the Government of the Republic of Lithuania:

1. Approves the Radioactive Waste Management Development Programme (attached hereto).

2. Renders Resolution No. 860 of 3 September 2008 "On the approval of Radioactive Waste Management Strategy of the Government of the Republic of Lithuania", including all its amendments and supplements, null and void.

Prime Minister — Algirdas Butkevičius

The Minister of National Defence, substituting for the Minister of Energy — Juozas Olekas

APPROVED
by Resolution No. 1427 of the Government
of the Republic of Lithuania of 23
December 2015

THE RADIOACTIVE WASTE MANAGEMENT DEVELOPMENT PROGRAMME

CHAPTER I
INTRODUCTION

1. The Radioactive Waste Management Development Programme (hereinafter the Programme) sets the objectives and goals to be pursued in the area of managing spent nuclear fuel and radioactive waste, the applicable evaluation criteria and their values as well as the envisaged needs for funds required for the implementation of the Programme.

2. The Programme has been developed within the framework of implementing 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 (OJ L 199, 2011) in accordance with the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (hereinafter the Joint Convention) and the Law on Radioactive Waste Management of the Republic of Lithuania (hereinafter the Law on Radioactive Waste Management).

3. Herein used terms shall be interpreted as they are defined in the Law on Radioactive Waste Management as well as the Law on Nuclear Energy of the Republic of Lithuania, the Law on Nuclear Safety of the Republic of Lithuania and the Law on Radiation Protection of the Republic of Lithuania.

4. In Lithuania, spent fuel and the major portion of radioactive waste has been generated at the Ignalina Nuclear Power Plant (hereinafter the Power Plant). A smaller amount of radioactive waste (making up less than 1 percent of all radioactive waste, as per data for the last decade) is being generated at industrial enterprises as well as healthcare, scientific and education institutions.

5. Currently, both RBMK-1500 reactors at the Power Plant have been shut down and are already being dismantled. The first reactor was in operation from 1983 until the end of 2004, and the second one - from 1987 until the end of 2009. Spent fuel and part of radioactive waste was generated in the result of Power Plant operation, however, some amount of radioactive waste is still being generated upon dismantling it.

6. Radioactive waste has various physical and chemical properties and is classified into short-lived and long-lived, depending on the half-life value of radionuclides contained in the radioactive substances. Based on the radiological properties of waste and the technological specifics of its management, solid radioactive waste is further classified as follows: short-lived very low-level radioactive waste (class A), short-lived low-level radioactive waste (class B), short-lived intermediate-level radioactive waste (class C), long-lived low-level radioactive waste (class D) and long-lived intermediate-level radioactive waste (class E). Disused sealed sources of ionising radiation are attributed to a separate class of radioactive waste (class F). Waste, wherein contained radionuclides in terms of their specific activity values do not exceed the clearance levels, is attributed to cleared waste and can be handled as ordinary non-radioactive waste. Such high-level radioactive waste as spent nuclear fuel forms a separate class. The classes of radioactive waste are also linked with the way radioactive waste is emplacement into a waste disposal facility (hereinafter the disposal facility) and the type of

disposal facility. Depending on the methods of treating radioactive waste, the solid radioactive waste is further classified into combustible, non-combustible, compressible, non-compressible and non-treatable waste. The liquid radioactive waste is classified based on the volume activity: waste with the volume activity of up to $4 \cdot 10^5$ Bq/l is considered to be low-level radioactive waste, whereas that with the volume activity of $4 \cdot 10^5$ Bq/l and higher – intermediate-level radioactive waste.

7. The solid radioactive waste that has been produced since the start of the Power Plant operation and that is not fully treated is stored in radioactive waste storage facilities located on the territory of the State enterprise Ignalina Nuclear Power Plant (INPP) (hereinafter the Power Plant storages). The safety analysis performed with respect to these storages has shown that the solid radioactive waste needs to be removed from the storages, sorted out, characterised, treated and disposed of in disposal facilities that ensure long-term passive safety. Although the scope of work to be done is very big, the INPP does not yet have all the equipment necessary for the purpose of handling radioactive waste. Therefore, the solid radioactive waste of classes B, C, D, E and F currently is not being fully treated. To this end, the INPP is constructing a complex for the management and storage of solid radioactive waste (hereinafter the complex), wherein radioactive waste will be sorted, described, subjected to different processes of treatment and immobilised (compressed, incinerated, cemented). Moreover, the complex will also include 2 storages for storing radioactive waste: one for short-lived waste and the other for long-lived waste. The complex is expected to be constructed and put into operation by 2018. The intention is to keep on treating waste within the complex until the Power Plant is decommissioned and to keep on storing it until new disposal facilities, where to waste shall be removed for storage, are constructed, but not longer than until the year 2068, when the design lifetime of the complex will expire.

8. The industrial waste at the Power Plant used to go to an industrial waste landfill located on the territory of the INPP. The landfill contains approximately 30 000 m^3 of waste. Based on the existing classification, part of waste accumulated in this landfill is attributed to short-lived very low-level radioactive (class A) waste.

9. The liquid radioactive waste from the Power Plant is solidified and handled as the solid radioactive waste.

10. Spent nuclear fuel shall be stored at dry storages and at a later stage it shall be transferred to a deep geological disposal facility located on the territory of the Republic of Lithuania.

11. In the period from 1963 to 1988, the disused sealed sources of ionising radiation and radioactive waste from industrial enterprises as well as from healthcare entities, scientific institutions and military facilities used to emplaced in the Maišiagala radioactive waste storage facility. Over that time, about 120 m^3 of radioactive waste (including the intermediate layers of concrete aggregate) has accumulated there. Since 1989, after the Maišiagala radioactive waste storage was closed and its basement was sealed, the waste of small-size radioactive waste generators has been stored at the INPP storages together with the waste of the Power Plant.

12. Detailed data on spent nuclear fuel and radioactive waste, their volumes, levels of activity, radionuclide composition and storage sites is presented in the Report on the Implementation of Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management drafted by the State Nuclear Power Safety Inspectorate (VATESI) and in the INPP Final Decommissioning Plan adopted by the order of the Minister of Energy. The radioactive waste quantity fact sheet is available at the INPP web page.

CHAPTER II
PROGRAMME OBJECTIVES AND GOALS

13. The objective of the Programme is to manage all spent nuclear fuel and radioactive waste that have been, are being or will be produced in Lithuania, in order to protect individuals and the environment from the harmful effects of ionising radiation and avoid imposing undue burdens on future generations.

While implementing the principles of safety, the spent nuclear fuel and radioactive waste shall be isolated for a long time from people and the residential environment and the safety thereof shall be ensured through the application of passive methods and measures. This can be achieved by emplacing spent nuclear fuel and radioactive waste in disposal facilities. However, storage of spent nuclear fuel and radioactive waste, including the long-term storage, represents only a temporary solution that is not able to ensure safety in the long run. Storage cannot be an alternative to waste disposal.

14. The primary goal of the Programme (Goal 1) is to reduce the volumes of radioactive waste.

The Law on the Management of Radioactive Waste sets the obligation to try to keep the generation of radioactive waste to the minimum which is reasonably practicable in terms of volume.

15. Measure 1 to achieve Programme Goal 1 – pursue the reuse of cleared waste:

15.1. Since 2006, measuring equipment has been operated at the Power Plant used for the purposes of measuring waste activity and verifying whether this waste conforms to the condition of clearance and may be disposed of without control. Waste that does not exceed the clearance levels in terms of its contamination by radionuclides shall be disposed of in ordinary landfills or reused without applying the radiation protection requirements. About 5.000 tonnes of waste is thus checked per year. As the pace of Power Plant dismantling works accelerates, it may be required to use the aforementioned equipment in a more efficient manner and check up to 15.000 tonnes of waste per year.

15.2. In 2016, the INPP will install a complex for decontaminating metal waste (hereinafter the decontamination complex), in order to improve the efficiency of decontaminating the waste generated upon dismantling the Power Plant and increase the volume of reused cleared waste. Within the decontamination complex, the surface of metal waste will be subjected to chemical and mechanical treatment. The decontaminated metal waste with the values of radiological properties not exceeding the clearance levels will be subjected to reuse, while the secondary radioactive waste generated will be handled together with the Power Plant waste of the respective class. The decontamination complex shall be operated until the year 2038.

15.3. With the view to reducing the exposure of staff to radiation and increasing the volume of reused waste, the INPP will equip places for storing solid radioactive waste in the Power Plant facilities that are no longer used. These shall be used for storing class A waste generated upon dismantling the Power Plant, the activity of radionuclides whereof is expected to reach the clearance levels. Otherwise this waste shall be decontaminated and further managed, taking into account its residual contamination with radionuclides. Technical solutions for storing waste at the Power Plant facilities shall be developed in 2017.

15.4. The volume of radioactive waste generated upon dismantling the Power Plant shall be reduced by reusing the equipment: the aim shall be to ensure that the equipment used for performing the works of dismantling Unit 1 is also used for dismantling Unit 2.

16. Measure 2 to achieve Programme Goal 1 – develop and deploy technologies reducing the volumes or activity levels of radioactive waste.

The INPP intends to draft a justification report regarding the use of metal melting equipment and deliver it by 2016. The application of metal melting technology may enable improvements of waste properties, reduction of waste volume and, with the reduction of

cavities in them, more accurate determination of the radionuclide composition as well as partial decontamination of metal waste by way of melting it. Thus, melting of metal would make it possible to increase the quantity of cleared metal waste.

17. The second goal of the Programme (Goal 2) is to seek to achieve the high level of nuclear safety and radiation protection as well as the high level of environmental protection while managing spent nuclear fuel and radioactive waste.

18. Measure 1 to achieve Programme Goal 2 – manage short-lived very low-level radioactive waste:

18.1. Within the framework of implementing the Interinstitutional Ignalina Nuclear Power Plant Decommissioning Action Plan adopted by Resolution No. 137 of the Government of the Republic of Lithuania "On the approval of the Interinstitutional Ignalina Nuclear Power Plant Decommissioning Action Plan" of 9 February 2015, the solid radioactive waste accumulated in the Power Plant storages will be removed, sorted in accordance with the established requirements, described and appropriately treated. The removal of radioactive waste from the Power Plant storages will start in 2018 and shall completed in 2028. The waste generated upon operating the Power Plant is mostly short-lived very low-level radioactive waste (class A). While sorting, this waste will be segregated from waste of other classes. Having undergone the initial treatment, this waste will be packed and further stored in a buffer storage, wherein very low-level radioactive waste will be accumulated (hereinafter the buffer storage).

18.2. Very low-level radioactive waste is generated upon dismantling the Power Plant. It is expected to be growing in quantity until the dismantling of Units is completed, as it is not possible or reasonable to decontaminate all the equipment and buildings being dismantled. The INPP carries out the primary treatment of very low-level radioactive waste (drying, crushing, compressing, depending on the type of waste) and then encloses it in packages envisaged in the design of the disposal facility for very low-level radioactive waste. Subsequently the packages with waste are transported to the buffer storage, wherein their suitability for acceptance at the disposal facility of very low-level radioactive waste is checked.

18.3. Very low-level radioactive waste is represented by certain industrial waste accumulated in the landfill of industrial waste located on the INPP site. Plans are made to conduct studies and investigate the alternative options for managing this landfill, namely to leave waste in the landfill or remove it; this work shall be completed by 2017. Depending on the solution selected, the works of enhancing the landfill safety or, alternatively, removing waste from it shall be finished by 2025.

18.4. Pursuant to Nuclear safety requirements BSR-3.1.2-2010 "Pre-disposal Management of Radioactive Waste at the Nuclear Facilities" approved by the Head of the State Nuclear Power Safety Inspectorate, short-lived very low-level radioactive waste shall be emplaced in a near surface very low-level radioactive waste disposal facility installed in the vicinity of the Power Plant. Under the legislation of the Republic of Lithuania it is allowed to emplace therein the waste, both treated and non-treated, that meets the waste acceptance criteria applicable with respect to this disposal facility.

18.5. The emplacement of waste in the short-lived very low-level radioactive waste disposal facility with the available capacity of 60.000 m^3 of waste shall be effected in some stages. The volume of waste to be emplaced at each stage shall amount approximately to 4.000 m^3. During the interim period between the stages, waste shall be stored in the buffer storage. This storage shall be operated until the emplacement of very low-level radioactive waste into the disposal facility is completed, but not longer than until the year 2063, when its design lifetime expires.

18.6. Upon the completion of each stage of waste emplacement in the disposal facility, the packages with waste will be covered by a protection layer. The emplacement of waste in the disposal facility will be performed from 2018 until 2038. When the disposal facility is

filled, it will be closed. The closed disposal facility will be subjected to active maintenance (until 2068), while at a later stage (until 2138) it shall be undergoing passive maintenance. During the stage of active maintenance, radiological monitoring of environment, food products, their raw materials and drinking water as well as monitoring of population exposure to radiation shall be performed. During the stage of passive maintenance, restrictions on the use of land shall be applied.

19. Measure 2 to achieve Programme Goal 2 – manage -level short-lived low- and intermediate-level radioactive waste:

19.1. The solid radioactive waste of classes B and C generated as part of Power Plant operations shall be removed from the Power Plant storages and subjected to treatment within the complex. This is where the solid waste will be sorted, compressed, incinerated and cemented and the activity of radionuclides will be measured. The secondary radioactive waste generated upon incinerating combustible waste (filters and ash) shall be enclosed in metal casks and compressed. Waste treatment operations shall be performed within the complex from 2018 until 2038. The containers with fully treated radioactive waste initially will be stored in the complex storage of short-lived radioactive waste and at later stage – in a near surface disposal facility for short-lived low-and intermediate-level radioactive waste (hereinafter the low-and intermediate-level radioactive waste disposal facility), as soon as it becomes operational. The solid radioactive waste generated upon dismantling the Power Plant shall be handled in the same manner.

19.2. The treated (solidified) liquid waste attributed to waste of B and C classes includes the cemented ion-exchange polymers used for cleaning liquid waste and the bituminised residue from waste evaporation. Bituminisation of residue from evaporation has been applied at the INPP since 1987, whereas the process of cementing ion-exchange polymers was introduced in 2006. The process of bituminising the residue from the evaporation of liquid waste shall be further applied until 2021, where after, i.e. from 2021 and onwards, the process of residue cementing shall be applied. The process of cementing the spent ion-exchange polymers is supposed to be applied until 2038.

19.3. The casks with the cemented spent ion-exchange polymers shall be loaded into reinforced concrete containers and stored in the storage of cemented radioactive waste located on the territory of the INPP. The available capacity of this storage is 36.000 $m^{3.}$ The design lifetime of the storage expires in 2066. The cemented waste will start being transferred to the low- and intermediate-level radioactive waste disposal facility as soon as it becomes operational.

19.4. The bituminised waste is poured into a storage of bituminised waste installed on the site of the INPP. Plans are made to conduct a feasibility study by 2019, in order to determine whether this storage can be converted into a disposal facility. If the conversion of storage into a disposal facility proves to be the optimum waste management solution in line with the applicable safety requirements, the works of converting the storage into a disposal facility shall be launched in 2022. If the conversion proves to be unfeasible, there shall be implemented a project for the removal and treatment of waste from the above-mentioned storage and its transfer to the low-and intermediate-level radioactive waste disposal facility, to be launched by 2020. Based on the preliminary estimates, the conversion of the storage into a disposal facility would cost EUR 5.2 million, otherwise a significantly higher amount would be required.

19.5. The packages with fully treated short-lived low-and intermediate-level radioactive waste meeting the criteria of acceptance in the low- and intermediate-level radioactive waste disposal facility, as established by the State Nuclear Power Safety Inspectorate, shall be emplaced in reinforced concrete cellars of the low-and intermediate-level radioactive waste disposal facility. The aforementioned disposal facility shall be designed and the first group of its cellars shall be constructed by 2021. The disposal facility

should be able to accommodate 100.000 m^3 of packages with fully treated waste and become operational in 2021.

19.6. Following the discontinuation of the practice of emplacing waste in the low-and intermediate-level radioactive waste disposal facility the latter will be closed, where after engineering barriers envisaged in the technical design will be installed and the unused auxiliary structures will be dismantled. The active maintenance of the closed disposal facility shall be performed for 100 years and include the radiological monitoring of environment, food products, their raw materials and drinking water, the monitoring of population exposure to radiation, the application of restrictions on human access to it and the performance of corrective works. Afterwards the disposal facility shall be subjected to the passive maintenance, covering, *inter alia*, the application of restrictions on the use of land, to be continued for at least 200 years.

20. Measure 3 to achieve Programme Goal 2 – manage long-lived low- and intermediate-level radioactive waste and disused sealed sources of ionising radiation:

20.1. While sorting the solid radioactive waste that has resulted from the operations of the Power Plant and has been removed from the Power Plant repositories, the long-lived radioactive waste (of classes D and E) and disused sealed sources of ionising radiation (radioactive waste of class F) shall be segregated from the short-lived waste and loaded in containers without having been fully treated. This shall be done within the complex under construction. The containers with long-lived waste shall be stored in a long-lived waste storage of the complex. This storage shall be operated until 2068. The waste generated upon dismantling the Power Plant reactors shall be handled in the same manner. In 2018–2028, graphite waste generated upon operating the Power Plant shall be removed to the complex storage of long-lived waste. In 2022–2038, the graphite waste removed from the reactors being dismantled shall be transferred to the storage.

20.2. As the capacity of the complex storage for long-lived waste is not sufficient to accommodate all long-lived waste generated at the INPP, an investigation into the possibility of adapting the existing storage of cemented radioactive waste to the needs of storing long-lived waste shall be carried out and competed by 2019. If the adaptation of this storage to the needs of storing long-lived waste proves to be unfeasible, the complex storage of long-lived waste shall have to be expanded through the construction of an additional storage module.

20.3. Upon the expiry of radioactive waste storage period (by 2066), long-lived radioactive waste will be emplaced in a geological deep disposal facility. Should it appear that the emplacement of long-lived waste being stored in the disposal facility at that time would not be feasible (the geological deep disposal facility would not be installed by that time), a process of investigating the possibility to extend the period of operating the storages of long-lived waste shall be launched in 2056.

21. Measure 4 to achieve Programme Goal 2 – manage spent nuclear fuel:

21.1. The conception of storing spent nuclear fuel selected by Lithuania is storing it in a dry storage. At the present time, the nuclear fuel is found in the nuclear fuel pools of Power Plant Units 1 and 2, in the reactor of Unit 2 and in an open dry storage. This storage is completely filled. By 2017, a new dry storage shall be constructed, whereto spent nuclear fuel from both Units shall be relocated for storage by 2022. The design lifetime of the containers at the existing storage facility will expire in 2050, whereas the lifetime of containers at the storage facility under construction is supposed to last until 2067. Upon the expiry of lifetime of spent fuel storage containers, there shall be installed a geological deep disposal facility or implemented another alternative solution for the ultimate management or long-term storage of spent nuclear fuel.

21.2. As the lifetime of containers at the existing spent nuclear fuel storage expires prior to the envisaged date of installing the geological deep disposal facility or implementing another alternative solution for the ultimate management or long-term storage of spent nuclear fuel, the possibility of extending the period of storing spent nuclear fuel in the dry storage will

be analysed. The programme for this analysis shall be drafted and launched in 2025 and the conclusion on the feasibility of extending the period of storage shall be issued by 2038.

22. Measure 5 to achieve Programme Goal 2 – remove radioactive waste from the Maišiagala radioactive waste storage and transfer its territory for the use not subject to control.

The Maišiagala radioactive waste storage is used for storing non-sorted and non-treated short- and long-lived radioactive waste. The barriers installed on the ground surface are not capable of ensuring the long-term protection from the leakage of radionuclides in the environment. The environmental and societal impact of the storage is further aggravated by the fact that it is located in the vicinity of the telmological reserve in Barkuškis and the cultural reserve in Kernavė (the object of UNESCO world heritage). In order to remove this impact and reduce the costs of maintenance, the radioactive waste shall be taken from the storage, whereas the territory of the storage shall be re-cultivated and deregulated in terms of radiation control. The radioactive waste removed from the Miašiagala radioactive waste storage shall be handled within the INPP radioactive waste management facilities. The waste shall be removed and the territory shall be re-cultivated until 2023 through the implementation of a project funded by the European Union (EU).

23. Measure 6 to achieve Programme Goal 2 – retain data on the disposal facility and therein contained radioactive waste:

23.1. The data on packages with the waste of classes A, B, C, D, E and F shall be compiled and stored in a computerised database of INPP decommissioning management system and shall be retained until the end of disposal facility passive maintenance periods. In order to ensure a higher level of data storage reliability, it is necessary to keep the data repositories and the software regularly updated.

23.2. The data on spent nuclear fuel shall be stored in a separate computerised database and shall also available in paper form. The data shall be stored for as long as the spent nuclear fuel is kept stored in temporary repositories, but not shorter than 5 years after the removal of spent nuclear fuel for emplacement in the disposal facility or for recycling. This computerised database shall be stored and the data shall be copied in compliance with specific procedures related to the safety requirements applicable to this information.

23.3. When the disposal facilities become operational, the reliability of data storage shall be increased, as the data will be stored in physically separated data repositories. Moreover, the data being stored will be accessible to stakeholders.

24. Measure 7 to achieve Programme Goal 2 – enhance the qualification of specialists in charge of managing radioactive waste.

Currently, the institutions, organisations and enterprises engaged in the activities of managing radioactive waste have staff possessing the required qualification. The majority of radioactive waste management specialists are employed at the INPP. However, management of spent nuclear fuel and radioactive waste is a particularly long process, therefore, given the natural ageing and turnover of staff, it is necessary to ensure the systematic training of new employees. As specialist training in the area of radioactive waste management is not provided in Lithuania, the existing staff shall have to be retrained. All institutions, organisation and enterprises involved in radioactive waste management activities shall plan and ensure the required number of employees possessing the required qualification for the entire nuclear fuel and radioactive waste management period, shall build a team of competent and motivated managerial and other staff, develop their expertise and skills and ensure accumulation and transfer of knowledge.

25. Measure 8 to achieve Programme Goal 2 – strengthen and develop the radioactive waste manager’s infrastructure for managing the radioactive waste produced by small generators of radioactive waste and the orphan sources of ionising radiation.

The manager of radioactive waste shall create and maintain an infrastructure dedicated for managing the radioactive waste produced by small generators of radioactive waste and the

orphan sources of ionising radiation as well as the waste containing nuclear substances or long-lived radionuclides. The infrastructure shall be in place before the completion of Power Plant dismantling works, when the equipment for managing radioactive waste will no longer be operated.

26. The third goal of the Programme (Goal 3) – ensure long-term safety of spent nuclear fuel and long-lived radioactive waste:

26.1. Spent nuclear fuel can be processed (recycled). If the spent nuclear fuel to be recycled is recycled abroad, the resulting secondary waste shall be returned to Lithuania. At the present time, it is not reasonable to recycle spent nuclear fuel in order to segregate fissile materials suitable for reuse, as the scope for using these materials is very limited, whereas the resulting long-lived high-level radioactive waste must be handled in the similar way as non-processed spent nuclear fuel and be emplaced in a geological deep disposal facility. Storage of spent nuclear fuel and radioactive waste is only an interim solution, therefore, the emplacement of non-processed spent nuclear fuel and long-lived radioactive waste in the geological deep disposal facility at the present time seems to be the only one sustainable method of their disposal to be considered. Segregation of spent nuclear fuel components and transmutation of radionuclides is not an alternative to the disposal in the geological deep disposal facility but rather a measure to optimise this facility.

Under the Law on the Management of Radioactive Waste, export of spent nuclear fuel and radioactive waste to another country that assumes the responsibility for final handling and disposal of this waste in a disposal facility is not prohibited. However, at present not a single country of the world intends or is able to accept from other countries the aforementioned waste and emplace it in a disposal facility. Joint installation of a geological deep disposal facility by EU member states is not feasible, either, as none of them agrees to have a common disposal facility installed on its territory. The engagement of Lithuania in the initiatives of installing or siting that type of disposal facility is restricted by the provision in its legislation prohibiting imports into the territory of the Republic of Lithuania of spent nuclear fuel and radioactive waste produced outside the territory of the Republic of Lithuania.

26.2. The experience of nuclear states, such as the US, Sweden, Finland, France or Spain, shows that the most safe and sustainable option nowadays is the emplacement of spent nuclear fuel and long-lived radioactive waste in a geological deep disposal facility. It is the only solution that enables safety to be ensured through the use of passive measures and that does not require long-term maintenance. While implementing the Programme for evaluating spent nuclear fuel and long-lived radioactive waste disposal options in 2003-2007 approved by Director of the State enterprise Radioactive waste management agency, the Lithuanian and Swedish experts, acting within the framework of a bilateral cooperation project, carried out the analysis of the possibility to install in Lithuania a geological deep disposal facility and emplace there spent nuclear fuel and long-lived radioactive waste. Apart from the possibility of installing a geological deep disposal facility in Lithuania, other options, such as the construction of a common regional geological deep disposal facility by several member states or the export of spent nuclear fuel to countries that have suitable facilities and are ready to assume full responsibility for this waste, were also considered. The studies carried out have proved that the installation in Lithuania of a geological deep disposal facility meeting up-to-date requirements of safety and the emplacement of spent nuclear fuel and long-lived radioactive waste in it is a feasible option. The studies refer to crystalline basement and clay sedimentary rocks as the most perspective types of rock. Based on the conception of a geological deep disposal facility developed in Sweden, a conservative preliminary estimate of the costs of installing a geological deep disposal facility in Lithuania was produced. Under the scenario whereby this disposal facility would be installed in 2036-2066 on crystalline basement rocks in the southeast of Lithuania, the costs of installing it and emplacing in it spent nuclear fuel and long-lived radioactive waste would amount to EUR 1.984 million at 2004 prices. Given the potential uncertainties (monetary erosion, project specifics, effects of

administrative factors, etc.), the price most likely would amount to EUR 2.610 million. Based on detailed analysis of collected information carried out in subsequent studies, the most perspective territories (the northeast, southwest and southeast regions of Lithuania) were identified and proposed for a further detailed exploration.

27. Measure 1 to achieve Programme Goal 3 – plan the installation of the geological deep disposal facility.

The geological deep disposal facility will be required at the time when the lifetime of spent nuclear fuel and long-lived radioactive waste storages will be coming to an end (in 2050-2067). The analysis of programmes on installing geological deep disposal facilities implemented in countries that are more advanced in this area demonstrates that the most important stages in the process of installing the geological deep disposal facility, namely research and development studies, siting, exploration and construction, last for about 30 years each. Therefore, plans are made to draft a project on the development of a geological deep disposal facility in 2016-2017, covering the project implementation schedule, the projected needs for initial studies, including their scope, and the administration of disposal facility design, construction and operation activities.

28. Measure 2 to achieve Programme Goal 3 – siting of the geological deep disposal facility.

This work shall be performed in consecutive stages, step-by-step, and include a feasibility study, drafting of disposal facility siting study programme, selection of suitable geological formation as well as exploration of the disposal facility site and its description. The most important stages of disposal facility siting are these: siting process planning (2016-2019), overview of perspective areas identified in previous studies in order to select several sites for further detailed analysis (2019-2022), detailed exploration and description (geophysical tests to be carried out in the selected sites and laboratory tests of samples taken from wells, as envisages in the programme) (2022-2030) and site approval (2030-2033). While moving from one stage to another, the specific characteristics of explored geological formations and sites shall be compared and a shortlist of the sites to be further explored shall be drafted. The closing stage will cover the assessment of environmental impact and the exercise of benchmarking the alternative sites, where after a particular site will be selected, taking into account the technical, social and economic conditions. The selection of the disposal facility site and the site-related studies shall be completed by 2033.

29. Measure 3 to achieve Programme Goal 3 – develop a conception of the geological deep disposal facility based on the respective studies and safety analysis.

29.1. Regarding the conception of envisaged geological deep disposal facilities (facility structure, architecture), in the majority of cases worldwide these are underground spaces or tunnels with barriers surrounding waste that are specially installed at a suitable depth in stable geological rocks for the purpose of containing spent nuclear fuel or radioactive waste. The safety of such disposal facilities is based on the multi-barrier approach, i.e. the protection of environment from the leakage of radionuclides is ensured by a combination of several engineering and natural barriers. A likely alternative to that type of disposal facility could be the emplacement of radioactive waste in a specially drilled deep well. This concept, however, is not yet sufficiently mature.

29.2. The Lithuanian conception of a geological deep disposal facility shall be developed based on the achievements and experience of countries that are more advanced in that area. The conceptions of geological deep disposal facilities adapted to the geological environments similar to those found in Lithuania will be thoroughly analysed. Based on these conceptions, the Lithuanian conception of a geological deep disposal facility (or several conceptions, depending on the quantity of geological formations to be explored for the purpose of selecting the site) shall be developed. This will be done taking into account the specifics of Lithuania in terms of spent nuclear fuel and long-lived waste volumes and types and the geological media. In addition, there shall be specified the quantities, radionuclide

composition and other properties of waste not eligible for emplacement in surface disposal facilities, described the major stages of geological deep disposal facility installation works and drafted guidelines on their implementation. Safety requirements to be observed upon transferring spent fuel into the disposal facility containers and factory design requirements applicable with respect to fuel transfer and sealing will also be established.

The concept of the disposal facility will be developed gradually and coordinated with the process of siting, once its conformity to the requirements of safety is ascertained. Upon the completion of each siting process stage, a description of geological deep disposal facility concept and an updated estimate of facility installation costs shall be produced. The Lithuanian conception of the geological deep disposal facility shall be developed in 2031 and will serve as the basis in assessing the environmental impact of the facility and in designing it.

30. Measure 4 to achieve Programme Goal 4 – construct the geological deep disposal facility and emplace in it spent nuclear fuel and long-lived waste:

30.1. When the site of the disposal facility is selected, explored and described and when the conception of the disposal facility suitable for the local conditions is developed, a conceptual design (design proposals) and, at a later stage, a technical design will be drafted. The envisaged periods for drafting these designs are respectively 2031-2034 and 2035-2038. When drafting the technical design, the amount of funds required for the installation of the disposal facility shall be adjusted.

30.2. When the technical design expertise is completed, the safety of the technical design is justified and the required licences and permissions are obtained, the work of constructing the geological deep disposal facility and the auxiliary structures specified in its conception will commence (2039-2040). First, i.e. in 2049-2050, ground equipment to be used for reloading spent nuclear fuel into the containers specified in the conception of the geological deep disposal facility, wherein it shall be stored until the disposal facility is constructed, shall be installed and put into operation. The disposal facility shall be constructed and prepared for operation in 2066.

30.3. After the completion of waste emplacement in the geological deep disposal facility (2072), the facility shall be closed (sealed). The safety of the closed disposal facility shall be ensured through passive measures.

31. The fourth goal of Programme (Goal 4) – seek to ensure that spent nuclear fuel and radioactive waste is managed in a transparent manner and that the Lithuanian society is objectively informed about how this sort of waste is being managed.

Economic entities shall inform the public of Lithuania and the neighbouring countries about any planned projects related to the management of radioactive waste resulting from economic activities in compliance with the Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention), the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (the Aarhus Convention) and the Law on Environmental Impact Assessment of the Proposed Economic Activity of the Republic of Lithuania. The institutions, organisations and enterprises involved in the activities of radioactive waste management regularly disseminate information on radioactive waste and the ongoing projects of radioactive waste management, however, these efforts do not suffice. As public opinion surveys show, citizens of Europe, including Lithuania, have rather poor knowledge of radioactive waste and the threats it poses. Based on the Eurobarometer survey conducted in 2008, only 18 percent of the Lithuanian citizens believe being informed about radioactive waste. Social environment is a crucial factor in planning and implementing radioactive waste and spent nuclear fuel management projects. The international experience demonstrates that advancement in the area of radioactive waste management is often impeded by the lack of public acceptance. Therefore, efforts must be made to achieve public trust in and support to the ongoing activities of radioactive waste management.

32. Measure 1 to achieve Programme Goal 4 – educate and inform the public on issues of spent nuclear fuel and radioactive waste and their management.

32.1. In order to raise the awareness of the public and increase its trust, information on the generation and types of radioactive waste, the methods of managing it and ensuring safety will be disseminated.

32.2. The level of public awareness and the effectiveness of information measures shall be measured through public opinion surveys to be conducted on a regular basis. The results of these surveys shall be taken into account and the activities of public information shall be enhanced accordingly.

33. Measure 2 to achieve Programme Goal 4 – inform the public about the projects of radioactive waste management being implemented in Lithuania.

Efforts shall be made to inform the public and involve it in the activities of project planning and implementation at very early stages, so that the public would be aware of the ongoing radioactive waste and spent nuclear fuel management infrastructure development projects.

CHAPTER III
PROGRAMME IMPLEMENTATION

34. The Programme shall be implemented through the Interinstitutional Ignalina Power Plant Decommissioning Action Plan to be updated on an annual basis, the Annual Radioactive Waste Management Programme of Radioactive Waste Manager subject to approval by the Ministry of Energy of the Republic of Lithuania and the INPP Activity Strategy subject to approval by the institution exercising the rights and responsibilities of INPP owner.

35. The costs of radioactive waste management shall be borne by small generators of radioactive waste (industrial enterprises as well as healthcare, scientific and education institutions).

The spent nuclear fuel and radioactive waste of INPP shall be managed using the funds of the state budget of the Republic of Lithuania, the State enterprise Ignalina nuclear power plant decommissioning fund, the International Ignalina power plant decommissioning support fund as well as the EU support fund and other amounts received.

The management of orphan sources of ionising radiation and objects contaminated by radionuclides shall be financed from the state and municipality budgets of the Republic of Lithuania.

36. The Ministry of Energy of the Republic of Lithuania shall inform the Government of the Republic of Lithuania on the Programme implementation process and results in the previous year by March 1 of each current year.

37. The process of implementing the Programme shall be coordinated by the Ministry of Energy of the Republic of Lithuania.

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Annex 1 to the Radioactive Waste Management Development Programme

THE LIST OF CRITERIA FOR EVALUATING THE OBJECTIVES AND GOALS OF RADIOACTIVE WASTE MANAGEMENT DEVELOPMENT PROGRAMME TOGETHER WITH THEIR TARGET VALUES

Order No.	Criteria for evaluating the objectives and goals and units of measure	Target value of evaluation criterion			Responsible institution
		2016	2018	2022	
1.	The objective of the Programme is to manage all spent nuclear fuel and radioactive waste that have been, are being or will be produced in Lithuania, in order to protect individuals and environment from the harmful effects of ionising radiation and avoid imposing undue burdens on future generations.				
R-1-1	Quantity of State enterprise Ignalina nuclear power plant (INPP) radioactive waste emplaced in disposal facilities, %	0	2.5	12	INPP
R-1-2	Number of recorded radioactive waste- and spent nuclear fuel-related abnormalities at the INPP, as classified in accordance with the International Nuclear and Radiological Event Scale (INES) (of level 1 and higher levels), units	0	0	0	INPP
1.1.	Goal – reduce quantities or activity values of radioactive waste at the INPP				
P-1-1-1	Quantity of cleared waste removed from the territory of INPP, m^3	15.000	25.000	35.000	INPP
1.2.	Goal – seek to achieve the high level of nuclear safety and radiation protection as well as the high level of environmental protection while managing spent nuclear fuel and radioactive waste				
P-1-2-1	Removal of waste from the existing storages of the Power Plant, %	0	0	25	INPP
P-1-2-2	Installed a disposal facility for short-lived very low-level radioactive waste (hereinafter the disposal facility), %	0	100		INPP
P-1-2-3	Quantity of short-lived very low-level radioactive waste emplaced in the disposal facility, m^3	0	0	12.000	INPP
P-1-2-4	Constructed a complex for radioactive waste management and storage, %	80	100	–	INPP
P-1-2-5	Volume of cemented liquid waste (size of space occupied by containers with fully treated waste), m^3	8.120	10.440	15.080	INPP

Order No.	Criteria for evaluating the objectives and goals and units of measure	Target value of evaluation criterion			Responsible institution
		2016	2018	2022	
P-1-2-6	Volume of treated cemented liquid waste (size of space occupied by containers with fully treated waste), m^3	0	0	7.700	INPP
P-1-2-7	Constructed a disposal facility for low-and intermediate-level radioactive waste	0	20	100	INPP
P-1-2-8	The volume of fully treated short-lived low-and intermediate-level radioactive waste and waste packages emplaced in the low-and intermediate-level radioactive waste disposal facility, m^3	0	0	3.000	INPP
P-1-2-9	Completed a feasibility study related to the conversion of the bituminised waste storage to a disposal facility, %	0	80	100	INPP
P-1-2-10	Constructed a storage for long-lived waste, %	0	100	–	INPP
P-1-2-11	The volume of waste put in containers and transferred to the storage of long-lived waste, m^3	0	0	300	INPP
P-1-2-12	Constructed a new spent nuclear fuel storage, %	90	100		INPP
P-1-2-13	Spent nuclear fuel put into containers and transferred to the repositories, %	27.9	40.5	100	INPP
P-1-2-14	Preparedness for the decommissioning of Maišiagala storage of radioactive waste (obtaining of licence for the decommissioning of Maišiagala storage of radioactive waste), %	–	–	100	INPP
P-1-2-15	Removal of radioactive waste and its transportation to the INPP and preparation of Mašiagala radioactive waste storage site (territory) for the purpose of its deregulation in terms of radiation control, %	–	–	100	INPP
P-1-2-16	Meeting of staffing requirements, %	100	100	100	INPP
P-1-2-17	Annual turnover of managerial and technical staff, %	≤5	≤5	≤5	INPP
P-1-2-18	Implementation of measures included in the programme of attracting young highly skilled workers, %	–	100	100	INPP
1.3.	Goal – ensure long-term safety of spent nuclear fuel and long-lived radioactive waste				
P-1-3-1	Drafting of a geological deep disposal facility development project and a complex programme of geological deep disposal facility-related studies, %	100	–	–	INPP
P-1-3-2	Implementation of the complex programme of geological deep disposal facility-related studies, %	0	3	18	INPP
P-1-3-3	Development and implementation of a programme of geological deep disposal facility siting studies, %	2	5	15	INPP

Order No.	Criteria for evaluating the objectives and goals and units of measure	Target value of evaluation criterion			Responsible institution
		2016	2018	2022	
P-1-3-4	Developed 2 (or more, depending on how many geological formations are explored) conceptions of a geological deep disposal facility, adapted to the types of rock found in Lithuania and the estimate of geological deep disposal facility construction costs (adjustment and optimisation of costs, taking into account the specifics of geological environment and the conception of the disposal facility), %	50	55	65	INPP
1.4.	Goal – seek to ensure that spent nuclear fuel and radioactive waste are managed in a transparent manner and that the Lithuanian society is kept objectively informed about how this sort of waste is managed				
P-1-4-1	Increased awareness of the Lithuanian population regarding spent nuclear fuel and radioactive waste (based on the results of Eurobarometer public opinion surveys conducted by the European Commission), %	18	19	21	The INPP, the State Nuclear Power Safety Inspectorate, the Radiation Protection Centre
P-1-4-2	The number of citizens believing that they are informed about the management of radioactive waste, determined based on a public opinion survey conducted in Lithuania every 5 years, %	18	–	23	INPP

Annex amendments:
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Annex 2 to the Radioactive Waste Management Development Programme

FUNDS TO BE ALLOCATED FOR THE IMPLEMENTATION OF RADIOACTIVE WASTE MANAGEMENT DEVELOPMENT PROGRAMME

Order No.	Objective, goal	Financial requirement, million EUR[1]				Note
		until 2018	until 2022	until 2038	total	
	Objective – manage all spent nuclear fuel and radioactive waste that have been, are being or will be produced in Lithuania, in order to protect individuals and environment from the harmful effects of ionising radiation and avoid imposing undue burdens on future generations.					
1.	Goal – reduce the volumes of radioactive waste					
1.1.	Measure 1 – pursue the reuse of cleared waste	0.15	0.36	1.23	1.23	based on the data of State enterprise Ignalina nuclear power plant (INPP) megaproject[2]
1.2.	Measure 2 – develop and deploy technologies reducing the volumes or activity values of radioactive waste (the costs of justifying the need for metal melting equipment are excluded)	0	0.9	0.9	0.9	
2.	Goal – seek to achieve the high level of nuclear safety and radiation protection as well as the high level of environmental protection while managing spent nuclear fuel and radioactive waste					
2.1.	Measure 1 – manage short-lived very low-level radioactive waste	10.7	16.44	43.73	46.7 (until 2068)	based on the data of INPP megaproject[2]
2.2.	Measure 2 – manage short-lived low- and intermediate-level radioactive waste	136	182.64	402.92	412 (until 2138)	
2.3.	Measure 3 – manage long-lived low- and intermediate-level radioactive waste and disused sealed sources of ionising radiation	0.3	1.835	18.235	24.1 (until 2067)	
2.4.	Measure 4 – manage spent nuclear fuel	55.3	57.2	67.43	77.58 (until 2067)	

Order No.	Objective, goal	Financial requirement, million EUR[1]				Note
		until 2018	until 2022	until 2038	total	
2.5.	Measure 5 – remove radioactive waste from the Maišiagala radioactive waste storage and transfer its territory for the use not subject to control	0.36	16	16	16	The European Union Structural Funds investment action programme for 2014-2020
2.6.	Measure 6 – retain data on the radioactive waste disposal facility and therein contained radioactive waste	1.65	4.4	13.2	26.2 (until 2138)	based on the average annual INPP expenditure
2.7.	Measure 7 – enhance the qualification of specialists in charge of managing radioactive waste	0.945	2.52	7.56	12.64 (until 2067)	based on the average annual INPP expenditure
2.8.	Measure 8 – strengthen and develop the radioactive waste manager's infrastructure for collecting and managing the radioactive waste of small generators of radioactive waste and the orphan sources of ionising radiation	–	–	0.208	0.208	based on the assessment of radioactive waste manager needs
3.	Goal – ensure long-term safety of spent nuclear fuel and long-lived radioactive waste					
3.1.	Measure 1 – plan the installation of the geological deep radioactive waste disposal facility (including planning, initial studies, estimate of facility installation costs and project administration)	0.2	0.665	34	87	based on the data of reports submitted within the framework of Spent nuclear fuel and long-lived radioactive waste disposal feasibility study programme[4]
3.2.	Measure 2 – select a site for the geological deep disposal facility	0.2	1.2	95	95	
3.3.	Measure 3 – develop the conception of the geological deep disposal facility based on the respective studies and safety analysis	0.44	1.39	248	248	
3.4.	Measure 2 – construct the geological deep radioactive waste disposal facility and emplace in it spent nuclear fuel and long-lived waste	–	–	–	1.459	
4.	Goal – seek to ensure that spent nuclear fuel and radioactive waste are managed in a transparent manner and that the Lithuanian public is objectively informed about how this sort of waste is managed					
4.1.	Measure 1 – educate and inform the public on issues of spent nuclear fuel and radioactive waste and their management	0.475	1.24	3.88	8.61 (until 2067)	based on the average annual INPP

Order No.	Objective, goal	Financial requirement, million EUR[1]				Note
		until 2018	until 2022	until 2038	total	
						expenditure
4.2.	Measure 2 – inform the public about radioactive waste management projects implemented in Lithuania	INPP funds				

[1] The financial requirement indicated in the table of Annex 2 to Radioactive Waste Management Development Programme is determined on accrual basis.
[2] The INPP decommissioning megaproject approved by the Order of INPP Director General.
[3] *No longer valid as of 01-01-2019.*
[4] The report submitted within the framework of Spent nuclear fuel and long-lived radioactive waste disposal feasibility study programme for 2003-2007 approved by Director of State enterprise Radioactive waste management agency.

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Annex amendments:
No. 1343, 19-12-2018, published TAR 2018-12-28, ID 2018-21784

Amendments:

1.
Government of the Republic of Lithuania, Resolution
No. 1343, 19-12-2018, published TAR 2018-12-28, ID 2018-21784
on the amendment of Resolution of the Government of the Republic of Lithuania No. 1427 “On approval of radioactive waste management development programme” of 23 December 2015.