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THE NATIONAL PLAN OF RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT

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LIST OF ABBREVIATIONS ANS DESIGNATIONS

A	
B	
BJiOR/NSRP	Nuclear Safety and Radiological Protection
C	
D	
E	
EK-10	Designation of nuclear fuel type for the EWA research reactor in the years 1958-1966
EJ/NPP	Nuclear Power Plant
F	
G	
GBq	Gigabecquerel
GTRI	Global Threat Reduction Initiative
H	
I	
J	
IChTJ/INChT	Institute of Nuclear Chemistry and Technology
IFR	Investment Feasibility Report
K	
KSOP/NRWR	National Radioactive Waste Repository
L	
Ł	
M	
MAEA/IAEA	International Atomic Energy Agency
MG/ME	Ministry of Economy
MOX	Nuclear fuel produced from a mixture of uranium and plutonium oxides (mixed oxide fuel)
MR	Designation of nuclear fuel type for the Maria research reactor
MWe	Megawat of electric power
MWh	Megawatt hour
MWt	Megawatt thermal power
N	
NCBiR/NCRD	National Centre for Research and Development
NCBJ/NCNR	National Centre for Nuclear Research
NCN/NCS	National Centre of Science

NFOŚiGW/NFEPWM	National Fund for Environmental Protection and Water Management
NSPOP/NSRWR	New Surface Radioactive Waste Repository
O	
OECD	Organization for Economic Co-operation and Development
OEJ/NEF	Nuclear Energy Facility
OOŚ/EIA	Environmental Impact Assessment
OR Polatom	Radioisotope Centre Polatom
P	
PAA/NAEA	National Atomic Energy Agency
PIG-PIB/PGI-NRI	Polish Geological Institute - National Research Institute
PPEJ/PNPP	Polish Nuclear Power Program
PURL	Polish Underground Research Laboratory
R	
S	
SAR	Safety Assessment Report
SGOP/DRWR	Deep Radioactive Waste Repository
SOOŚ/SEIA	Strategic environmental impact assessment
T	
TBq	Terabecquerel
tHM	Tons of heavy metal (uranides)
TWh	Terawatt hour
U	
W	
WWR	Designation of nuclear fuel type for the EWA research reactor in the years 1966-1995
Z	
ZUOP/RWMP	State-owned public utility – „Radioactive Waste Management Plant”
ZSRR/USSR	Union of Soviet Socialist Republics

INTRODUCTION

Radioactive waste is a solid, liquid or gaseous material containing radioactive substances or contaminated by such substances, use of which is not anticipated or contemplated, including spent nuclear fuel intended for depositing[1].

Any activity related to production or use of radioactive isotopes (in industry, medicine, science, agriculture) is accompanied by production of radioactive waste. Due to its special nature, radioactive waste requires special management. This includes its collection, reprocessing, solidification, transportation, storage and depositing.

Radioactive waste should be classified to the appropriate category, sorted, appropriately reprocessed, solidified, packaged, and then safely deposited. The primary aim of the abovementioned activities is its protection and isolation, so as it does not create hazards to humans or the environment.

Proper management of radioactive waste and spent nuclear fuel is also one of key issues related to implementation of nuclear energy industry. It is not possible to use nuclear energy without implementation of socially acceptable, effective and safe management of radioactive waste. Therefore, proper management of radioactive waste and spent nuclear fuel is particularly important both for the users of radioactive materials, as well as for the society. This document has been prepared in order to meet the expectations in this regard.

The National Plan for management of radioactive waste and spent nuclear fuel (the National Plan) aims at ensuring development and implementation of the national consistent, integrated and sustainable system of management including all categories of nuclear waste produced in the country. The actions provided for in the National Plan will ensure responsible, safe and sustainable management of radioactive waste and spent fuel, in accordance with Art. 57c of the Act - Atomic Law[2]. The National Plan is a strategic tool permitting to define all necessary actions and designate tasks that will result in achievement of objectives of the national policy concerning management of radioactive waste and spent nuclear fuel. In order to do that the National Plan identifies new needs and determines objectives of subsequent works. Moreover, it overviews the existing and new methods of radioactive waste and spent nuclear fuel management, the existing and future infrastructure for such management, including the existing division into categories, as well as the quantities of waste collected so far and its forecast future supplies. The National Plan also aims at ensuring the consistency in management of such substances, optimizing development and use of the resources for radioactive waste and spent nuclear fuel management.

Since participation of the society is an equally important issue in management of radioactive waste the actions provided for in the National Plan focus at transparency, dialogue and consultations with representatives of the civil society.

The National Plan is the result of cooperation of all institutions involved in management of radioactive waste and spent nuclear fuel, with consideration of experience of other countries.

[1] Art. 3 point 22 Act of 29 November 2000 – Atomic Law (Journal of Laws from 2014, item 1512).

[2] Act of 4 April 2014 about amendments to the Act – Atomic Act and some other Acts (Journal of Laws, item 587) introduced the Council Directive 2011/70/Euroatom to the Polish legal system, establishing Community framework in regard to responsible and safe management of spent nuclear fuel and radioactive waste (Official Journal of EU L 199 from 2 August 2011, p. 48).

It also shows that Poland has the required experience and knowledge necessary to ensure the effective, safe and sustainable management of radioactive waste and spent nuclear fuel.

This document has been prepared in accordance with the provisions of the Act - Atomic Law and the guidelines of the Council Directive 2011/70/Euratom of 19 July 2011 establishing Community frameworks in regard to responsible and safe management of spent nuclear fuel and radioactive waste.

CHAPTER 1. OBJECTIVES, TASKS AND COSTS OF RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT IN THE REPUBLIC OF POLAND

The National Plan is the fulfillment of the obligation imposed on the Minister competent for economic affairs in Art. 57c of the Act - Atomic Law and commitments of Poland arising from the Joint Convention on the Safety of Spent Nuclear Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention), adopted in Vienna on 5 September 1997[3].

According to the Act - Atomic Law, the National Plan will be updated every four years, which will allow for verification of data on the financial resources needed for its implementation, as well as for introduction of other necessary changes, including the ones directly relating to management of radioactive waste and spent nuclear fuel.

The period of the validity of the National Plan is determined for the years 2015-2050, with a horizon until the middle of the 22nd century, i.e. to the intended closing of the deep repository of radioactive waste.

1.1. OBJECTIVES OF THE NATIONAL PLAN

The objective of the National Plan is to ensure the efficient and safe management of radioactive waste and spent nuclear fuel in Poland as well as to ensure development and implement the national consistent, integrated and sustainable system of management concerning all categories of radioactive waste produced in the country. In order to achieve this aim the National Plan defines all necessary actions and designs tasks that will result in achievement of objectives of the national policy concerning management of radioactive waste and spent nuclear fuel, with particular emphasis on the principle of transparency and ensuring public participation in the making of key decisions.

1.1.1. THE SCOPE OF THE NATIONAL PLAN

The National Plan provides for a safe and appropriately secured management of all categories of radioactive waste produced in Poland from the moment of their production to depositing, and monitoring of the closed repository.

The Polish law[4] provides the following classification of radioactive waste:

Table 1.1. Categories of radioactive waste

Category		Subcategory		
		Transitional	**Short-lived**	**Long-lived**
Low-level activity waste	EAC< A ≤ 10^4 EAC	After three years – radioactive concentration of isotopes will drop below the value defined for low-level activity waste[5]	$t_{1/2}$ ≤ 30 years A ≤ 400 kBq/kg for long-lived isotopes	$t_{1/2}$ > 30 years A > 400 kBq/kg for long-lived isotopes
Intermediate level activity waste	10^4 EAC < A ≤ 10^7 EAC			

[3] Journal of Laws from 2002 No. 202, item 1704.

[4] Art. 47 Act – Atomic Law and Ruling of the Council of Ministers of 3 December 2002 about radioactive waste and spent nuclear fuel (Journal of Laws No. 230, item 1925).

[5] Values of activity and radioactive concentration for particular isotopes, constituting the basis for classification of waste to radioactive waste categories are defined in appendix No. 1 to resolution of the Cabinet of Ministers of 3 December 2002 about radioactive waste and spent nuclear fuel.

High-level activity waste	**A** >10^7 EAC			

Table 1.2. Spent sealed radioactive sources

Spent sealed radioactive sources[6]	**Subcategory**			
	Low-level activity	**Intermediate-level activity**	**High-level activity**	
EA < **A** ≤ 10^8 Bq	10^8 < **A** ≤ 10^{12} Bq	**A** >10^{12} Bq	**Short-lived** $t_{1/2}$ ≤ 30 years	
			Long-lived $t_{1/2}$ > 30 years	

A – radioactive concentration of the isotope in waste (kBq/kg) or activity of isotopes contained in the source (Bq),

EAC – value of radioactive concentration of isotope constituting the basis for classification of waste to radioactive waste categories (kBq/kg),

EA – value of activity constituting the basis for classification of waste into radioactive waste categories (Bq).

The scope of the National Plan does not include waste originating from exploitation of mines, since according to §4 Resolution of the Council of Ministers of 3 December 2002 about radioactive waste and spent nuclear fuel, low-activity earth or rock mass removed or displaced due to execution of investments or excavation of minerals along with their reprocessing, containing radioactive isotopes is not classified into the radioactive waste category, if the sum of maximum concentrations ratios for such isotopes resulting from non-homogeneity of waste to the values defined in Appendix No. 1 does not exceed 10 for the represented sample of waste with mass of 1 kg.

On the territory of Poland in the post-war years, i.e. until the 70s, the uranium ore was excavated and reprocessed. Nowadays "The Radiation Monitoring Program of Areas Contaminated by Excavation and Reprocessing of Uranium Ore" is implemented by the NAEA on the territory of the earlier uranium ore mining.

1.1.2. TASKS RELATED TO MANAGEMENT OF RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL DEFINED IN THE NATIONAL PLAN

The key tasks include:

- preparations for closing, final closing and long-term monitoring of the National Radioactive Waste Repository (NRWR) in Rozan;
- selection of a location, construction and commissioning of the new surface radioactive waste repository(NSRWR);
- preparation for the construction of the deep radioactive waste repository (DRWR) - including implementation of the Polish Underground Research Laboratory (PURL) program;
- start-up of the DRWR before decommissioning of the first Polish nuclear power plant;
- modification of rules for radioactive waste management, including radioactive waste originating from nuclear energy industry;
- modification of the financing system for radioactive waste management, based on the "polluter pays" principle;

[6] Spent sealed radioactive sources constitute an additional category of radioactive waste.

- creation of a development-and-research program concerning management of radioactive waste and spent nuclear fuel;
- preparation of the personnel for national institutions and economic entities involved in management of radioactive waste and spent fuel and supervision of this management.

1.1.2. RULES OF RADIOACTIVE WASTE MANAGEMENT

The system of radioactive waste and spent nuclear fuel management in Poland is based on the following rules:

- designing, construction, operation and closing of the system facilities, ensuring nuclear safety and radiological protection;
- minimizing the quantity, volume and activity of radioactive waste as well as sorting, classifying, reprocessing, packaging and appropriate designation of packaged radioactive waste, taking into account its composition;
- application of the "polluter pays" principle;
- application of the decision-making process based on documented evidence in all stages of radioactive waste and spent nuclear fuel management;
- use of an open fuel cycle and monitoring of trends concerning the nuclear fuel cycle. If economic and technical conditions arise, which are favorable for introduction of a closed cycle, an analysis will be made of the validity and advisability of its introduction in Poland;
- monitoring of storage, depositing and transportation of radioactive waste and spent nuclear fuel;
- a ban on entry to Poland of radioactive waste for depositing and exports, with the exception of exports to the country with which an agreement has been concluded on depositing of radioactive waste in radioactive waste repositories;
- an appropriate approach to radiation hazards, emergency response and crisis management being in accordance with international standards;
- continuity of personnel training to guarantee safety in management of radioactive waste and spent nuclear fuel;
- developing training-and-information activities;
- transparency of the undertaken activities and providing information to the society;
- ensuring public participation in the decision-making process;
- constant cooperation with international organizations and institutions dealing with radioactive waste and spent nuclear fuel management;
- application of the latest achievements of science and technology concerning radioactive waste and spent nuclear fuel management.

1.2. MONITORING METHODS AND EVALUATION OF THE DEGREE OF OF THE NATIONAL PLAN IMPLEMENTATION

The Minister competent for economy shall monitor the implementation of the National Plan. In the case of deviations from the intended results he shall analyze their causes and take the appropriate corrective actions.

The results of the monitoring and evaluation of the implementation stage of the National Plan will be included in the reports of the Minister competent for economy submitted for approval to the Council of Ministers, in accordance with the requirements set out in Art. 57f of the Act - Atomic Law.

In accordance with Art. 57c paragraph 4 of the Act - Atomic Law, the National Plan will be updated at least once every four years, and its subsequent versions will take into account the technical and scientific progress, good practice in management of spent fuel and radioactive

waste, as well as conclusions and recommendations resulting from an international external review.

1.3. TASKS TO BE IMPLEMENTED FOR APPROPRIATE MANAGEMENT OF RADIOACTIVE WASTE IN POLAND

1.3.1. TASKS CONCERNING LOW-LEVEL AND INTERMMEDIATE–LEVEL RADIOACTIVE WASTE

1.3.1.1. PREPARING FOR CLOSING, FINAL CLOSING AND LONG-TERM MONITORING OF THE NATIONAL RADIOACTIVE WASTE REPOSITORY IN ROZAN

The aim of the undertaken actions is preparation for closing of the NRWR in Rozan in connection with the completion of its capacity, and then its final closing and long-term monitoring.

Entities responsible for the implementation:

- Minister competent for economy – the leading authority;
- Minister competent for the environment;
- State-owned public utility - Radioactive Waste Management Plant (RWMP).

1.3.1.2. SELECTION OF A LOCATION, CONSTRUCTION AND COMMISSIONING OF THE NEW SURFACE RADIOACTIVE WASTE REPOSITORY

In relation to completion and consequently planned closing of the existing NRWR in Rozan, it is necessary to find a location, construct and commission a new surface radioactive waste repository, taking into account the needs arising from development of nuclear energy industry in Poland.

The NSRWR shall receive for depositing short-lived low-activity and intermediate-activity radioactive waste originating from nuclear energy industry and from medical, scientific and industrial applications, including spent sealed radioactive short-lived low-activity and intermediate-activity sources. A storage facility will be located on the premises of the repository to store long-lived low-activity and intermediate-activity radioactive waste until the start-up of the DRWR, where it will be transferred for depositing.

The key element in selection of the location, except for meeting the conditions required by the law, will be the acceptance by the local community.

Entities responsible for the implementation:

- Minister competent for economy – the leading authority;
- Minister competent for the environment;
- RWMP.

1.3.2. PREPARATIONS FOR THE CONSTRUCTION OF THE DEEP RADIOACTIVE WASTE REPOSITORY, INCLUDING IMPLEMENTATION OF THE POLISH UNDERGROUND LABORATORY PROGRAM - SELECTION OF ITS SAFE LOCATION

The aim of works in this regard shall be finding the optimal final location for the deep repository.

This task will include the following activities:

- carrying out works on the implementation of an open fuel cycle in Poland and monitoring of trends and scientific achievements concerning spent fuel reprocessing;

- ensuring participation of Polish institutions and research centers in the ongoing research on issues related to management of long-lived radioactive waste and spent nuclear fuel;
- monitoring of trends in the use of the MOX fuel (fuel produced from a mixture of uranium and plutonium oxides) and the possibilities of its application in Poland;
- monitoring of progress in works on implementation of the technology allowing for a separation of minority actinides and their use as fuel for fast Generation IV reactors or burning in subcritical systems driven with accelerators;
- establishing a permanent international cooperation concerning long-lived radioactive waste management - consistent updating of knowledge about the programs of other countries in this regard;
- monitoring of initiatives that may result in construction of joint regional deep repositories, taking into account the opinion of the Polish society;
- implementation of the research program on deep depositing of long-lived intermediate-level and high-level waste – carrying out works and preparations for finding a location for the DRWR.

In connection with the adoption of the Polish Nuclear Power Program[7] (PNPP) an agreement will be signed by the Minister competent for economy, the Polish Geological Institute - National Research Institute (PGI-NRI) and other institutions interested in promotion of the concept and adoption of integrated research on deep radioactive waste depositing and construction of the Polish underground research laboratory. The purpose of the agreement shall be:

- supporting of scientific research aimed at development of techniques for underground depositing and identification of geological determinants in the Polish conditions, ensuring safe depositing in deep geological structures, while contributing to development of the scientific staff and technologies necessary to conduct future works;
- ensuring coordination of the abovementioned works in Poland;
- the maximum use of the international experience concerning deep depositing of radioactive waste;
- providing objective information about deep depositing to the public;
- support for the creation of the PURL;
- supporting activities of the PURL organizationally embedded in the PGI-NRI;
- use of PURL experience in the construction of a deep radioactive waste repository.

The objectives of creation of the PURL include:

- conducting works prior to the creation of a deep repository for high-level radioactive waste;
- gaining knowledge necessary to make a rational decision about depositing of spent nuclear fuel and type of the adopted fuel cycle;
- coordination of works in Poland and gathering of the obtained results;
- international cooperation concerning deep radioactive waste depositing, in particular of high-level activity waste;

[7] It was adopted with a resolution of the Council of Ministers No. 15/2014 of 28 January 2014 about a long-term program under the name of the "Polish Nuclear Power Program" (Official Gazette of the Polish Government item 502). Also see: Announcement of the Minister of Economy of 28 May 2014 about adoption by the Council of Ministers of a resolution about a long-term program under the name of the "Polish Nuclear Power Program" (Official Gazette of the Polish Government item 503).

- conducting scientific research on deep radioactive waste depositing, in particular of high-level activity waste;
- broadening of knowledge on the geological conditions of potential repositories;
- popularization of knowledge about deep depositing of radioactive waste, in particular of high-level activity waste;
- dissemination of knowledge about the DRWR in the society;
- preparation of personnel and organizational structures for the operation of the repository.

Entities responsible for the implementation:

- Minister competent for economy – the leading authority;
- Minister competent for the environment;
- RWMP;
- PGI-NRI;
- scientific and research institutes.

1.3.3. MODIFICATION OF RULES FOR RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT, AND DECOMMISSIONING OF NUCLEAR POWER PLANTS

The objective of this task shall be development of the financing system for radioactive waste and spent nuclear fuel management, ensuring consistent, reliable and sustainable management of radioactive waste and spent nuclear fuel now and in the future.

This task will include the following activities:

- updating of legal regulations on the final management of radioactive waste and spent fuel originating from nuclear energy industry, as well as from decommissioning of nuclear power plants;
- implementation of the financing system for the final management of radioactive waste and spent nuclear fuel with particular emphasis on radioactive waste and spent fuel from nuclear energy industry, as well as providing funding for decommissioning of nuclear power plants.

The scope of this task includes:

- amendments to the regulations to allow for a division of the amount specified in the regulation of the Council of Ministers of 10 October 2012[8] into two parts:
  - write-offs to cover the cost of the final management of radioactive waste and spent nuclear fuel, i.e. write-offs to the Fund for Depositing of Radioactive Waste and Spent Nuclear Fuel, supplied by the operators of nuclear power facilities,

  - write-offs to cover the cost of decommissioning of the nuclear power plant, i.e. write-offs to the Fund for Decommissioning of the Nuclear Power Facility being a nuclear power plant[9];
- development and implementation into the legal system of the rules for management of funds accumulated in the Fund for Depositing of Radioactive Waste and Spent Nuclear Fuel and the Fund for Decommissioning of the Nuclear Power Facility;

[8] Regulation of the Council of Ministers of 10 October 2012 about the amount of contribution to cover costs of the final management of spent nuclear fuel and radioactive waste and to cover costs of decommissioning of the nuclear power plant made by the organizational unit which had been given a permit to operate the nuclear power plant (Journal of Laws item 1213).

[9] In the event the nuclear power plant does not operate at the expense of the system or is periodically switched off from operation, a different system of settlement will be applied – e.g. relating the write-offs for the Funds to each fuel assembly placed in the reactor.

- selection of an institution supervising the Fund for Disposal of Radioactive Waste and Spent Nuclear Fuel and the Fund for Decommissioning of the Nuclear Power Facility, along with its scope of supervision;
- identification and implementation into the legal system of rules for updating the amount of write-offs made to the Fund for Depositing of Radioactive Waste and Spent Nuclear Fuel and the Fund for Decommissioning of the Nuclear Power Facility;
- a change of the rules to allow for lifting of the target subsidy limit specified in the Public Finance Act[10] in relation to the RWMP in order to finance the construction of the NSRWR;
- carrying out analyses, development and implementation into the legal system of the rules for financing the construction of radioactive waste and spent fuel repositories.

Funds accumulated in the Fund for Depositing of Radioactive Waste and Spent Nuclear Fuel and the Fund for Decommissioning of the Nuclear Power Facility will come from quarterly payments to the funds, made by the operator of the nuclear power plant and revenues resulting from investments of the fund resources, that are permitted by law. The financial resources accumulated in both funds will be excluded from the operator's bankruptcy estate. These funds will be exempt from the enforcement procedure. The Fund for Decommissioning of the Nuclear Power Facility which is a nuclear power plant will remain the responsibility of the operator of the nuclear power plant, but the payment will be possible after obtainment of a positive opinion of the institution acting as the fund supervisor.

Contributions to the funds will depend on the amount of electricity produced in the nuclear power plant. The amount of the write-offs will be periodically updated by the institution acting as the fund supervisor.

Payments from the funds will be possible after obtainment of a positive opinion of the institution acting as the fund supervisor.

Entities responsible for the implementation:

- Minister competent for economy - the leading authority.

1.3.4. CREATION OF THE RESEARCH-AND-DEVELOPMENT PROGRAM ON RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT

The objective of this task is the development and implementation of a research-and-development program concerning radioactive waste and spent nuclear fuel management, while taking into account the financial resources available and involving Polish experts and scientists from scientific and research institutes as well as specialists in radioactive waste management in the domestic industry. Key areas of research are presented in Chapter 6 of this document.

Entities responsible for the implementation:

- National Centre for Research and Development (NCRD) - the leading entity;
- Minister competent for economy;
- Minister competent for science;
- RWMP;
- scientific and research institutes;
- National Centre of Science (NCS).

[10] Art. 133 Act of 27 August 2009 on Public Finance (Journal of Laws from 2013, item 885 as amended).

1.3.5. PREPARATION OF PERSONNEL FOR THE NATIONAL INSTITUTIONS AND ECONOMIC ENTITIES INVOLVED IN MANAGEMENT OF RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL AND SUPERVISION OF SUCH MANAGEMENT

The objective of this task is to ensure adequate number of qualified personnel for the operation and development of institutions and economic entities involved in radioactive waste management.

Entities responsible for the implementation:

- Minister competent for economy – the leading authority;
- President of the NAEA - in the scope of their own personnel;
- RWMP;
- scientific and research institutes;
- Investor / operator of the nuclear power plant - in the scope of their own personnel.

A detailed description of the activities for the period 2015-2020 in regard to the tasks listed in chapter 1.3 are presented in Appendix No. 1 under the title: The Plan of Actions for the period 2015-2020.

1.4. COSTS OF IMPLEMENTATION AND SOURCES OF FUNDING OF THE NATIONAL PLAN

The cost calculation of the National Plan implementation has been made for the years 2015-2025. Cost estimates will be updated along with the update of the National Plan, pursuant to provisions of Art. 57c § 4 of the Act - Atomic Law.

Table 1.1. Costs of implementation of the National Plan in the years 2015-2025

Item	Task	Expenditures until 2025 thousands PLN	Including expenditures in the years 2015 -2018 thousands PLN			
			2015	2016	2017	2018
1.	2.	3.	4.	5.	6.	
1.	**Location analyses for a new repository (NFEPWM funds)**	**4,000**	**3,000**	**1,000**		
2.	**Preparations for construction of a deep repository***	**40,000**	**320**	**500**	**500**	**1,000**
3.	**Implementation of the National Plan (ME funds)**	**2,500**	**500**	**100**	**100**	**100**
4.	**Closing of NRWR ROZAN - preparations for closing of NRWR Rozan (funds of the long-term program)[11]**	**8,900**		**800**	**1,600**	

[11] Upon adoption of the National Plan by the Council of Ministers and upon a detailed estimate of implementation costs of the above in order to ensure financing and simplify the procedure of fund release, the ME will apply to the Council of Ministers with a request for development of a long-term program (in understanding of art. 136 Act on Public Finance) for closing of the NRWR ROZAN.

5.	**Safety assessment for closing of NRWR Rozan***	**20,000**			**10,000**	**10,000**
6.	**Safety assessment for NSRWR ***	**20,000**				**10,000**
7.	**Construction of NSRWR (funds of the long-term program)[12]**	**243,200, including funds of the long-term program of 240,000**	**1,600 the funds not included in the long-term program**	**1,600 the funds not included in the long-term program**		**3,000**
8.	**Research-and-development program** concerning radioactive waste management (Funds of the Ministry of Science and Higher Education (NCRD))**	**50,000**		**5,000**	**5,000**	**5,000**
	TOTAL	**388,600**	**5,420**	**9,000**	**17,200**	**29,100**

* Own funds of the Minister of Economy within the limit specified for him for a given budgetary year, without the need of its extension, and possibly funds of the NFEPWM, if a possibility arises (according to provisions of PNPP). In the event the financing of these actions is not possible from these two sources, the execution of these tasks will be financed from funds of the long-term program.

** Funds of the Program developed according to art. 26 § 1 Act of 30 April 2010 on rules of financing science (Journal of Laws of 2014, item 1620 as amended).

[12] Upon adoption of the National Plan by the Council of Ministers, selection of the site for NSRWR and after detailed estimation of costs of the implementation of the above, in order to ensure financing and simplify the procedure for activation of the funds, ME will apply to the Council of Ministers with a request for development of a long-term program (in the understanding of art. 136 Act on Public Finance) for the construction of a new surface repository of radioactive waste.

CHAPTER 2. STAGES OF IMPLEMENTATION OF THE NATIONAL PLAN TASKS

This chapter shows the timetable of implementation of individual tasks presented in chapter 1.

2.1. TASKS CONCERNING MANAGEMENT OF LOW-LEVEL AND INTERMEDIATE-LEVEL RADIOACTIVE WASTE

2.1.1. PREPARATIONS FOR CLOSING AND CLOSING OF THE NATIONAL RADIOACTIVE WASTE REPOSITORY IN ROZAN

This task will include the following actions:

- selection of an option to close the NRWR in Rozan and execution of safety reports for its further operation, closing and the post-closing period - 2015 – 2018;
- developing the concept of closing the NRWR in Rozan - 2019 – 2020;
- preparations for closing, development of the Repository Closing Program and obtaining a permit for closing - 2021 - 2024;
- closing of the repository - 2025 - 2029;
- preparation of a report on the repository closing, obtaining a decision of the President of the NAEA approving the report, closing of the repository – 2025 - 2029;

Upon the closing of the repository, long-term repository monitoring will be continued (for circa 300 years).

2.1.2. SELECTION OF A LOCATION, CONSTRUCTION AND COMMISSIONING OF THE NEW SURFACE RADIOACTIVE WASTE REPOSITORY

This task will include the following actions:

- identification of potential locations for the NSRWR – 2013 - 2017;
- selection of the location for the NSRWR – 2017 - 2018;
- preparation of a design of the NSRWR, and safety assessment – 2017 – 2019;
- obtaining all necessary decisions and permits - 2018 - 2021;
- execution of the investment (construction) – 2021 - 2024;
- obtaining a permit for use of the NSRWR, and permission to operate the NSRWR – 2024 – 2025;
- operation – 2025 - 2144;
- closing of the surface repository in the years 2145 - 2155;

Upon closing of the repository, long-term repository monitoring will be continued (for circa 300 years).

2.2. SELECTION OF A SAFE LOCATION FOR THE DEEP RADIOACTIVE WASTE REPOSITORY AND CONSTRUCTION OF THE REPOSITORY

The selection and evaluation procedure for the location of the deep radioactive waste repository depends largely on whether the planned PURL will be linked to the future repository, or there are plans to conduct studies dedicated directly to the location of the repository regardless of works on the PURL. The decision about whether the DRWR may be located at the same place as the PURL can be taken upon completion of studies in the PURL.

In addition, in the Polish conditions, there are possibilities of adaptation of the existing underground facilities or parts thereof to the PURL, but it will require appropriate actions to these ends.

Therefore, there are two model options of execution of the deep repository program, taking into account the foregoing considerations in the Polish conditions – i.e. the time limits and variants of the localization process:

- for the process of localization of the DRWR with the PURL potentially linked with the future location of the repository;
- for the process of localization of the DRWR with the PURL unlinked with the location of the DRWR or with the possibility of adaptation of the existing facilities for the PURL.

There is also a possibility that as a result of study conducted in the PURL, initially unlinked with the location of the repository, the same massif or layer will be found useful for the depositing. Then the path of the proceedings does not change. This approach, however, requires implementation of the research program in accordance with the principle of minimizing the interference in the massif or layer from the moment of commencement of the works (in contrast to the classical mining).

Nowadays there is a discussion on the reasonability of incurring the cost of construction and maintenance of underground laboratories in the countries with small nuclear programs and countries without nuclear energy industry. The proposed alternative solution consists of the use of the laboratories existing in the world. It is cost effective, yet at least two basic substantive conditions must be met:

- the same lithological type;
- similar parameters of the rock within the same lithological type.

At the same time it was assumed that regardless of the ability to conduct studies in other centers, in order to make a proper evaluation of the local conditions it is necessary to carry out one's own analyzes for a specific location of the DRWR.

Option 1 – the PURL potentially linked with the future location of the repository

An essential condition for option 1 requires location of the underground laboratory in a layer of the same lithological type as the repository itself. It is possible in the Polish conditions in selected regions (e.g. the Kujawy domes; the Sudety Monocline - claystone).

Taking into account the national conditions and the experience of other countries, it is possible to create the repository at the site of the existing laboratory, while maintaining the need to prove the safety of the location. Taking into account this option requires a proper design of the research center. The following actions will have to be taken in the implementation of this option:

- feasibility study and concept of studies - 2 years;
- small study - a review of the locations based on the legal criteria (nuclear safety, protection of the environment and natural resources - water and natural resources, conflicts with land development) - 3 - 4 years - selection of the prospective areas for the research;
- non-invasive field studies of selected structures and massifs (layers) as well as an analysis of archival materials (documentation, cores) - 8 years; selection of the lithological type of the host rock for the repository and location of the PURL;
- carrying out arrangements and obtaining a decision on the construction of the PURL;
- update of the concept of research and the feasibility study for the PURL - 2 years;
- preparation and approval of the license application and the report "Environmental Impact Assessment (EIA) for the PURL" - 2 years;
- construction of the PURL - about 5 years;

- conducting research in the PURL and detailed research on the location of the repository, development of a design concept of the DRWR - about 15 years;
- preparation of documentation in regard to nuclear safety and radiological protection (NSRP) for the building permit, the license application and the EIA for the repository - 5 years;
- approval of the documentation and obtaining a decision - about 5 years;
- construction of the repository - about 7 - 8 years[13];
- submitting a safety report (SAR) and obtaining a permit for the operation - about 3 years;
- operation of the DRWR – about 50 years;
- cessation of waste supply and preparatory work for closing of the DRWR - 10 years;
- closing of the DRWR - 8 years;
- post-closing monitoring of the DRWR.

Option 2 – the PURL unlinked to the future location of the repository, possible adaptation of the existing facilities to the PURL

If the underground laboratory is not planned in the massif or layers selected as prospective for depositing, it will affect the extension of part of the studies and the construction period of the PURL. With the adaptation of an existing object in the layer (massif) with similar or identical lithological characteristics, some actions may be carried out in a shorter period of time (the existing infrastructure, more archival material from previous studies).

The following actions will have to be taken in the implementation of this option:

- feasibility study and concept of research – 2 years;
- small study - revision of locations based on the legal criteria (nuclear safety, protection of the environment and natural resources - water and natural resources, conflicts with land development) – 3 - 4 years, selecting the prospective areas for research;
- non-invasive field studies of the selected structures and massifs (layers) and analysis of archival materials (documentation, cores) - 8 years; selection of the lithological type of the host rock for the repository and location of the PURL;
- carrying out arrangements and obtaining a decision for the construction of the PURL or adaptation of the existing facilities for the PURL;
- update of the concept of studies and the feasibility study for the PURL - 2 years;
- adaptation of the existing facility for the PURL - 3 years or construction of the PURL - 5 years;
- conducting research in the PURL and detailed research on the location of the repository, development of a design concept for the DRWR - about 15 years;
- preparing the NSRP documentation for the building permit, the license application for the construction and the EIA for the repository - 5 years;
- application for approval of the documentation and obtaining a decision - about 5 years;
- construction of the repository - 10 years;
- submission of the SAR and application for obtaining the authorization to operate - 3 years;
- operation of the DRWR - 50 years;
- cessation of the waste supply and preparatory work for closing of the DRWR - 10 years;

[13] It is assumed that in the event the deep repository is built on the site of the laboratory the existing access and technical infrastructure will be used. It will permit for shortening of the construction period and save financial resources.

- closing of the DRWR - about 8 years;
- post-closing monitoring of the DRWR.

In spite of research in the laboratory located in the structure of the same lithology, but in a separate massif or layer, it will be necessary to carry out research directly at the site of the future location as well.

2.3. MODIFICATION OF RULES FOR RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT AND FOR DECOMMISSIONING OF NUCLEAR POWER PLANTS

Implementation of this task will include the following actions:

- development of a detailed institutional concept of the system of radioactive waste management in Poland, including waste originating from nuclear energy industry - 2015 - 2019;
- introduction of necessary changes into the legal system to enable implementation of the abovementioned concept - 2019 – 2021.

The implementation of this task in regard to changes of the financing system for the radioactive waste and spent nuclear fuel management, taking into account nuclear energy industry, will include the following actions:

- development of a detailed concept for financing of the system of radioactive waste management in Poland, including waste originating from nuclear energy industry - 2015 - 2019;
- introduction of necessary changes into the legal system to enable implementation of the abovementioned concept - 2020 – 2023.

It should be emphasized that a change the legal form of the operator, i.e. of the state-owned public utility is not contemplated.

2.4. CREATION OF THE RESEARCH-AND-DEVELOPMENT PROGRAM ON RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT

The implementation of this task will include the following actions:

- development of a research-and-development program for the years 2016 - 2019;
- implementation of the above program - 2016 - 2019;
- development of the subsequent research program for the years 2020 - 2023;
- implementation of the program - 2020 – 2023.

2.5. PREPARATION OF PERSONNEL FOR THE NATIONAL INSTITUTIONS AND ECONOMIC ENTITIES[14] INVOLVED IN THE MANAGEMENT OF RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL AND SUPERVISION OF SUCH MANAGEMENT

The implementation of this task will include the following actions:

- assessment of the needs of individual institutions in this regard and preparation of programs for the increase of employment and staff training - 2015 - 2016;
- implementation of the programs mentioned in the above paragraph - 2017 – 2025, ultimately – an increase of employment is expected in the following institutions:
  - RWMP,
  - ME,
  - research institutes – based on needs and possibilities.

[14] Economic entities will be preparing staff on their own and it will be included in the subsequent update of the National Plan.

CHAPTER 3. THE QUANTITIES OF SPENT NUCLEAR FUEL AND RADIOACTIVE WASTE

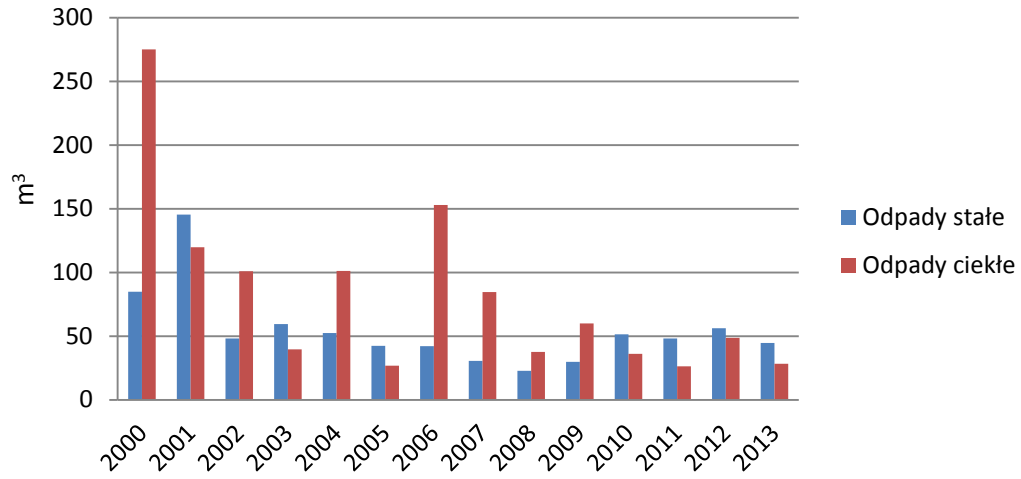
The biggest producer of solid radioactive waste in Poland is NCNR, where mainly low-level and intermediate-level radioactive waste is generated due to operation of the MARIA research reactor and in the Radioisotopes Centre (the plant producing radioactive isotopes used in medicine for diagnostics and therapies). The remaining part, i.e. circa 60% of solid radioactive waste comes from hospitals, clinics and other institutions that use isotope techniques all over the country.

Spent nuclear fuel comes also from the MARIA reactor.

According to the Act - Atomic Law a register of radioactive sources is kept in Poland. The entity responsible for keeping this register is the President of the NAEA. According to the NAEA data, at the end of 2013 in Poland there were 23,089 radioactive sources[15] in operation as well as already decommissioned and transferred to the RWMP.

Appendix No. 2 presents a balance of radioactive waste collected by RWMP for management in the years 2000-2013.

Fig. 3.1 Quantities of radioactive waste collected by RWMP in the years 2000 - 2013. Source: RWMP
[m³]



Odpady stałe – solid waste; Odpady ciekłe – liquid waste

[15] The annual report by the President of the NAEA „The Activity of the President of National Atomic Energy Agency and Assessment of the State of Nuclear Safety and Radiological Protection in Poland in 2013", Warsaw 2014, p. 35.

3.1. LOW-LEVEL AND INTERMEDIATE-LEVEL RADIOACTIVE WASTE AND SPENT SEALED RADIOACTIVE SOURCES COLLECTED TO DATE

The quantities of radioactive waste and used sealed radioactive sources collected in Poland to date and deposited at the NRWR in Rozan are presented in Table 3.1:

Table 3.1. The quantities of waste collected in Poland (stored and deposited at the NRWR-Rozan)[16]

Waste in Rozan (state as of 27 November 2013)			
Facility	Volume less packaging [m^3]	Total activity [MBq] (27 Nov. 2013)	Categories and subcategories of waste
Facility No. 1	810.83	14 002 590	Long-lived low-level radioactive waste
Facility No. 2	46.95	346 518	
Facility No. 3	530.49	2 805 749	
Total: Facilities No. 1, 2 and 3	1 388.27	17 154 857	
Facility No. 3a (sources)	0.05	6 641 732	Spent sealed short-lived low-level and intermediate-level sources
Facility No. 8	2 402.51	25 972 095	Short-lived low-level radioactive waste
Facility No. 1 Chamber K-5 (wastes kept temporarily in the reception chamber)	6.40	3 350	
Total: Facility No. 8 and Chamber K-5	2 408.91	25 975 445	
TOTAL AT the NRWR ROZAN 3797.23 m^3 radioactive waste			

109 spent sealed high-level activity radioactive sources, originating from medical and scientific applications are stored at the RWMP storage in Otwock-Świerk.

[16] In the future long-lived waste will be transferred to the DRWR for depositing, but before that they will be sent to the NSRWR for storage.

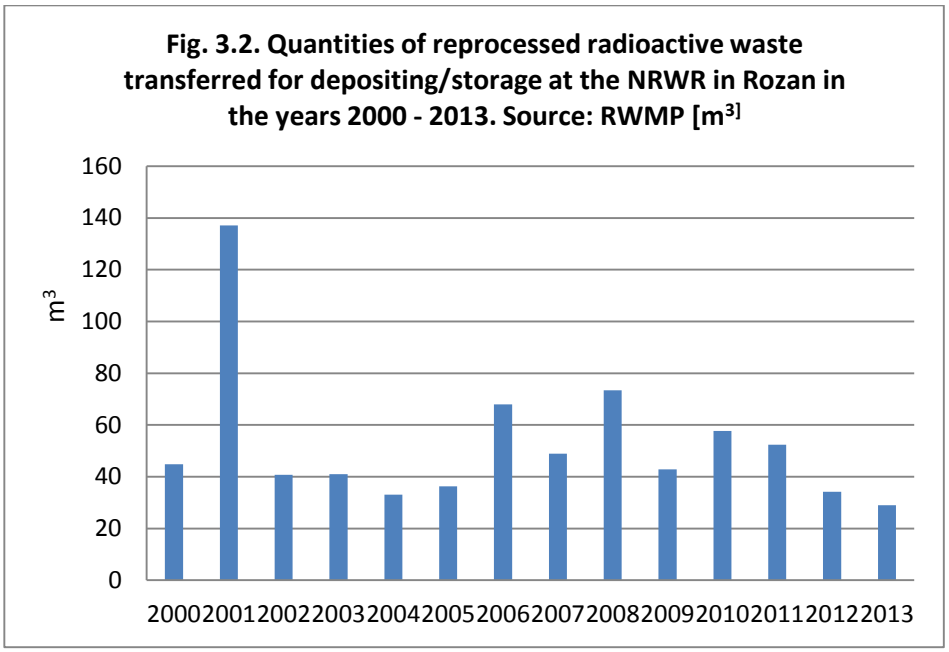


Fig. 3.2. Quantities of reprocessed radioactive waste transferred for depositing/storage at the NRWR in Rozan in the years 2000 - 2013. Source: RWMP [m^3]

3.2. FORECAST QUANTITIES OF RADIOACTIVE WASTE FROM MEDICAL, SCIENTIFIC AND INDUSTRIAL APPLICATIONS (FROM OUTSIDE OF THE NUCLEAR ENERGY INDUSTRY)

For the purposes of the National Plan the RWMP has estimated the amount of waste from medical, scientific and industrial applications (outside of the nuclear energy industry) from 2013 onwards:

• until 2023, the following quantities of radioactive waste are expected:

- solid short-lived low-level and intermediate-level radioactive waste: 40 m^3 per year, with a total of 440 m^3,
- solid long-lived low-level radioactive waste: 2 m^3 per year, with a total of 22 m^3.

Solid short-lived low-level and intermediate-level radioactive waste will be deposited at the existing NRWR in Rozan, whereas long-lived low-level and intermediate-level radioactive waste will be placed there temporarily, i.e. until the closing of the NRWR in Rozan. Then they will be transferred for storage to the NSRWR until the launch of the DRWR, where it will be transferred for depositing.

• In the years from 2024 to 2050, the following quantities of radioactive waste are expected:

- solid short-lived low-level and intermediate-level radioactive waste: 40 m^3 per year, with a total of 1,080 m^3,
- solid long-lived low-level and intermediate-level radioactive waste: 2 m^3 per year, with a total of 54 m^3.

Solid short-lived low-level and intermediate-level radioactive waste will be deposited at the NSRWR, whereas long-lived waste will be placed there for storage until the launch of the DRWR, where it will be transferred for depositing.

3.3. FORECAST QUANTITIES OF RADIOACTIVE WASTE FROM THE MARIA REACTOR

For the purposes of the National Plan, the RWMP has estimated the quantities of radioactive waste from the MARIA reactor from 2013 onwards:

• until 2023, the following quantities of radioactive waste are expected:

- solid short-lived low-level radioactive waste: 4 m^3 per year, with a total of 44 m^3,
- liquid short-lived low-level radioactive waste: 25 m^3 per year, with a total of 275 m^3 (ultimately for depositing in the solid form, as products of cementing of post-evaporation concentrates: 1 m^3 per year, with a total of 11 m^3).

Solid short-lived low-level radioactive waste will be deposited at the NRWR in Rozan.

• In the years from 2024 to 2040 (where the period of operation of the MARIA reactor is extended until 2040):

- solid short-lived low-level radioactive waste: 4 m^3 per year, for a total of 68 m^3,
- liquid short-lived low-level radioactive waste: 25 m^3 per year, with a total of 425 m^3 (ultimately for depositing in the solid form, as products of cementing of post-evaporation concentrates: 1 m^3 per year, with a total of 17 m^3).

• In the period from 2024 to 2050 (where the period of operation of the MARIA reactor is extended until 2050):

- solid short-lived low-level radioactive waste: 4 m^3 per year, with a total of 108 m^3,
- liquid short-lived low-level radioactive waste: 25 m^3 per year, with a total of 675 m^3 (ultimately for depositing in the solid form, as products of cementing of post-evaporation concentrates: 1 m^3 per year, with a total of 27 m^3).

Solid short-lived low-level radioactive waste will be deposited at the NSRWR.

3.4. FORECASTS ON USE OF LOW-ENRICHED NUCLEAR FUEL ASSEMBLIES TYPE MR IN THE MARIA REACTOR

For the purposes of the National Plan, the quantities of radioactive waste from the MARIA reactor have been estimated, taking into account the projected annual consumption of fuel (it amounts from 20 to 25 fuel assemblies type MR) and the projected operation time of the MARIA reactor (it is expected that its operation will be extended until 2040, allowing for the possibility of extension of its operation for another 10 years - until 2050).
The calculation in terms of quantity and volume concerning the assemblies of spent low-enriched fuel type MR is presented in the following Table 3.2.
The calculations were made for four options, assuming that the reactor shutdown occurs in 2040 or 2050 while using 20 or 25 fuel assemblies type MR.

Table 3.2 Projected consumption of fuel type MR in the MARIA reactor (from 2013 onwards)

Projected consumption of fuel type MR in the MARIA reactor (from 2013 onwards)		
Consumption:	20 assemblies/year	25 assemblies/year
Until 2040	540 assemblies -191 m^3	675 assemblies – 238 m^3
Until 2050	740 assemblies - 261 m^3	925 assemblies – 327 m^3

The spent fuel from the MARIA reactor in the future will be deposited in the RWDR.

3.5. FORECASTS ON AMOUNT OF SPENT SEALED RADIOACTIVE SOURCES

For the purposes of the National Plan the RWMP has estimated the amount of spent sealed radioactive sources:

- until 2050 the following amounts of spent sealed short-lived radioactive sources are estimated for receipt:
  - low-level activity – 53 780 pieces;
  - intermediate-level activity – 27 029 pieces;
  - high-level activity – 81 pieces.
- until 2050 the following amounts of spent sealed long-lived radioactive sources are estimated for receipt:
  - low-level activity – 3 498 pieces, and 647 548 pieces of smoke detectors;
  - intermediate-level activity – 16 625 pieces.

3.6. RADIOACTIVE WASTE ORIGINATING FROM NUCLEAR ENERGY INDUSTRY

While developing the balance of radioactive waste produced in nuclear power plants in Poland, for which the investment process is carried out in accordance with the scenario of development for nuclear energy industry adopted in the PNPP, the following assumptions have been made:

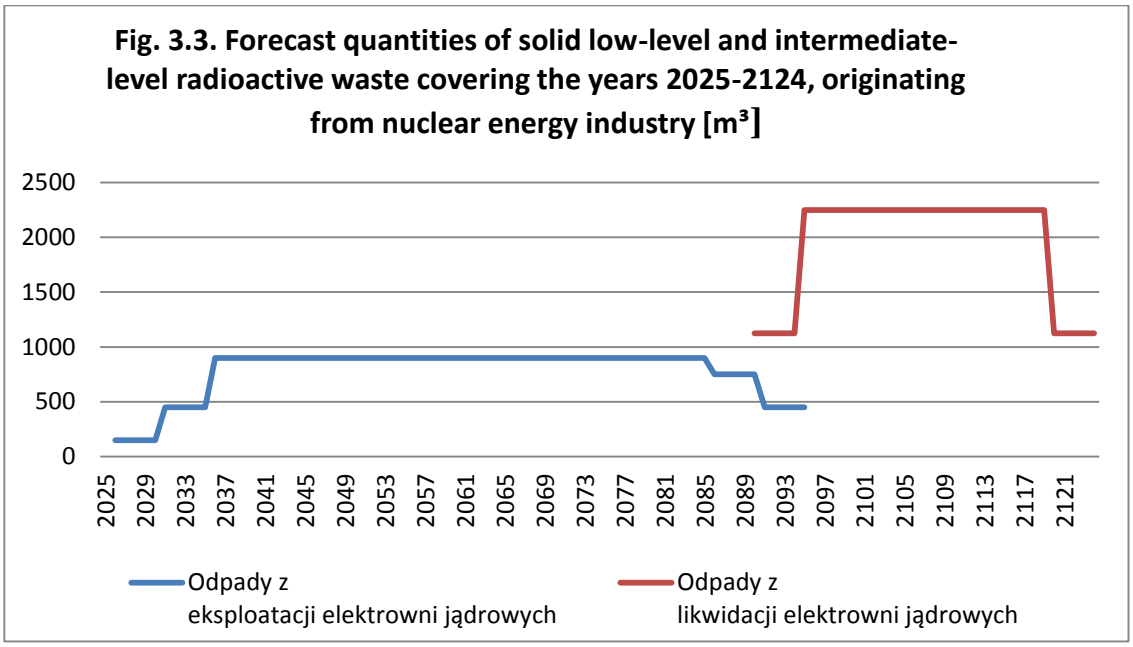
- two nuclear power plants will be built in Poland, with a capacity of approximately 3,000 MW each, equipped with Generation III reactors;
- the assumed period of operation for each reactor shall be 60 years;
- radioactive waste from the decommissioning of individual reactors will be included in the balance for 30 years starting from the block shutdown;

The NCNR calculations made for the light water technology (PWR) were used to determine the amount of the demand for nuclear fuel as well as of the quantity of radioactive waste and spent nuclear fuel produced by the nuclear power sector[17].

3.6.1. SHORT-LIVED LOW-LEVEL AND INTERMEDIATE-LEVEL RADIOACTIVE WASTE

On the basis of the analysis of the abovementioned data it is assumed that the total quantity of short-lived low-level and intermediate-level radioactive waste coming from a 60-year operation of both nuclear power plants will be 54 000 m^3 (45 000 m^3 of low-level and 9 000 m^3 of intermediate-level waste).

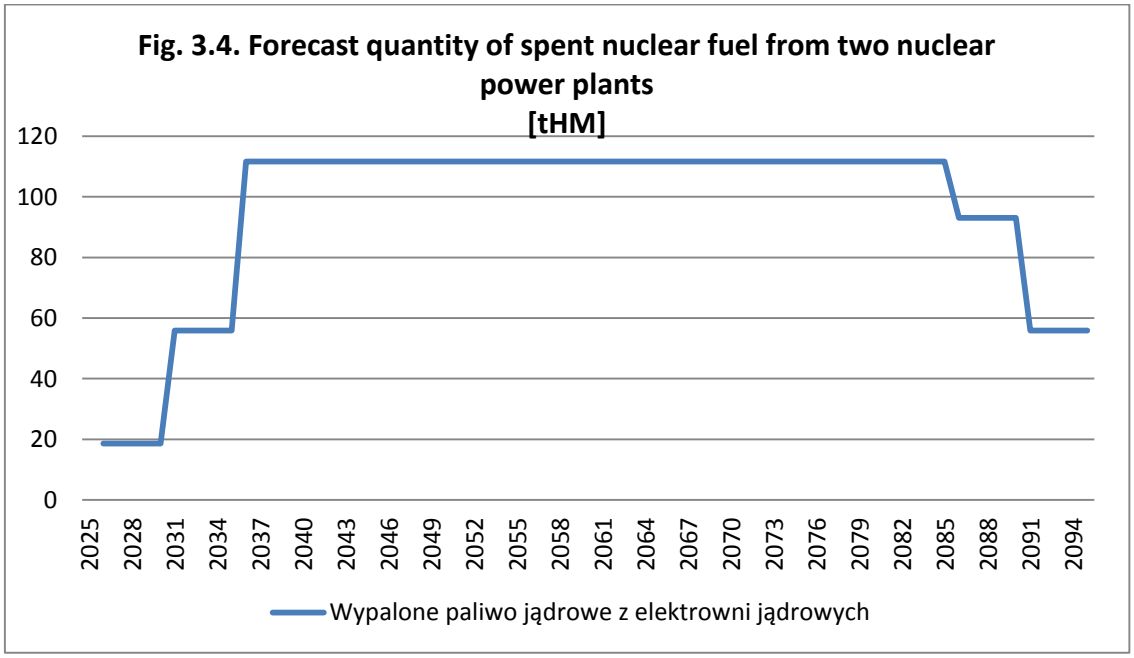
[17] S. Chwaszewski " The analysis of the amount of contribution to cover costs of the final spent nuclear fuel and radioactive waste management and to cover costs of decommissioning of the nuclear power plant", NCNR report, February 2012.



Odpady z eksploatacji elektrowni jądrowych – waste from operation of nuclear power plants; Odpady z likwidacji elektrowni jądrowych – waste from decommissioning of nuclear power plants

3.6.2. SPENT NUCLEAR FUEL

It has been assumed that due to execution of the PNPP (construction of two nuclear power plants with power of circa 6000 MW), within 60 years of their operation 6,700 tHM of spent fuel will be produced.



Wypalone paliwo jądrowe z elektrowni jądrowych – spent nuclear fuel from nuclear power plants

The actual amount of spent nuclear fuel will be known after the selection of the technology and transfer of data by the future technology provider on the amount of radioactive waste and spent nuclear fuel generated in the operating process. These amounts will be included in the subsequent updates of the National Plan.

3.7. RADIOACTIVE WASTE ORIGINATING FROM DECOMMISSIONING OF NUCLEAR FACILITIES

3.7.1. THE MARIA REACTOR

On the basis of the analysis of the Institute of Atomic Energy[18], the following quantities of solid short-lived radioactive waste are projected:

- low-level activity - 100 m^3,
- intermediate-level activity - 50 m^3,
- low-level products of solidification of post-evaporation concentrates - 30 m^3.

In 2012 the NCNR estimated a capacity of the surface radioactive waste repository necessary as the reserve for decommissioning or upgrading of the MARIA reactor and laboratories of NCNR linked to the MARIA reactor to be 20 000 m^3 (assuming the decommissioning of the facilities to the third degree – the so-called "green grass").

3.7.2. NUCLEAR POWER PLANTS

The amount of short-lived radioactive waste from the decommissioning of both nuclear power plants will be about 67 500 m^3 (including 6 000 m^3 of intermediate-level waste). See: Fig. 3.3.

3.8. SUMMARY OF THE QUANTITIES OF RADIOACTIVE WASTE

Based on the data presented in the above paragraphs the following amounts of radioactive waste was estimated (section 3.8.1 and 3.8.2) to be deposited at the NSRWR and NDRWR.

3.8.1. SHORT-LIVED LOW-LEVEL AND INTERMEDIATE-LEVEL RADIOACTIVE WASTE (UNTIL 2144) INTENDED FOR DEPOSITING AT THE NSRWR.

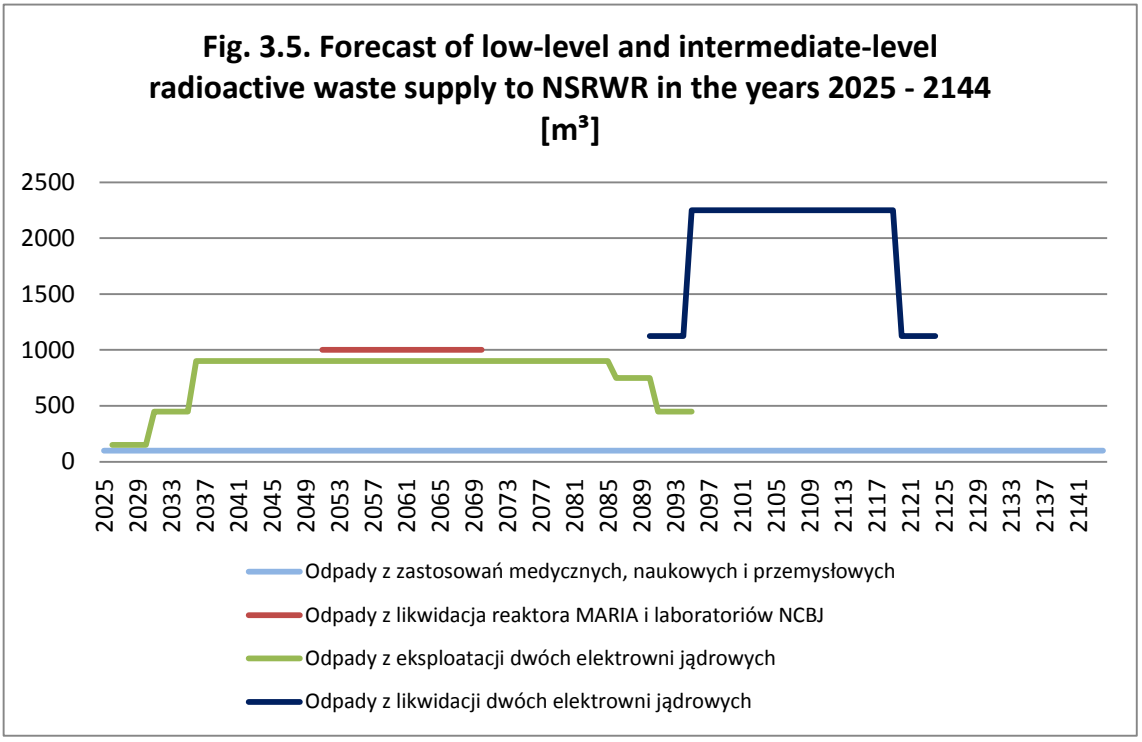
The amount of short-lived low-level and intermediate-level radioactive waste intended for depositing at the NSRWR until 2144 will be 153 500 m^3, of which:

- 54 000 m^3 (45 000 m^3 of low-level and 9 000 m^3 of intermediate-level) from the operation of two nuclear power plants,
- 67 500 m^3 (including 6 000 m^3 of short-lived intermediate-level) from the decommissioning of two nuclear power plants,
- 12 000 m^3 of short-lived low-level and intermediate-level radioactive waste from medical, scientific and industrial applications (including the MARIA reactor), from outside of the nuclear energy industry (100 m^3 per year)[19], and
- from the decommissioning of the MARIA reactor and the isotopes laboratories of the NCNR linked to the MARIA reactor (20 000 m^3 of short-lived low-level and intermediate-level waste).

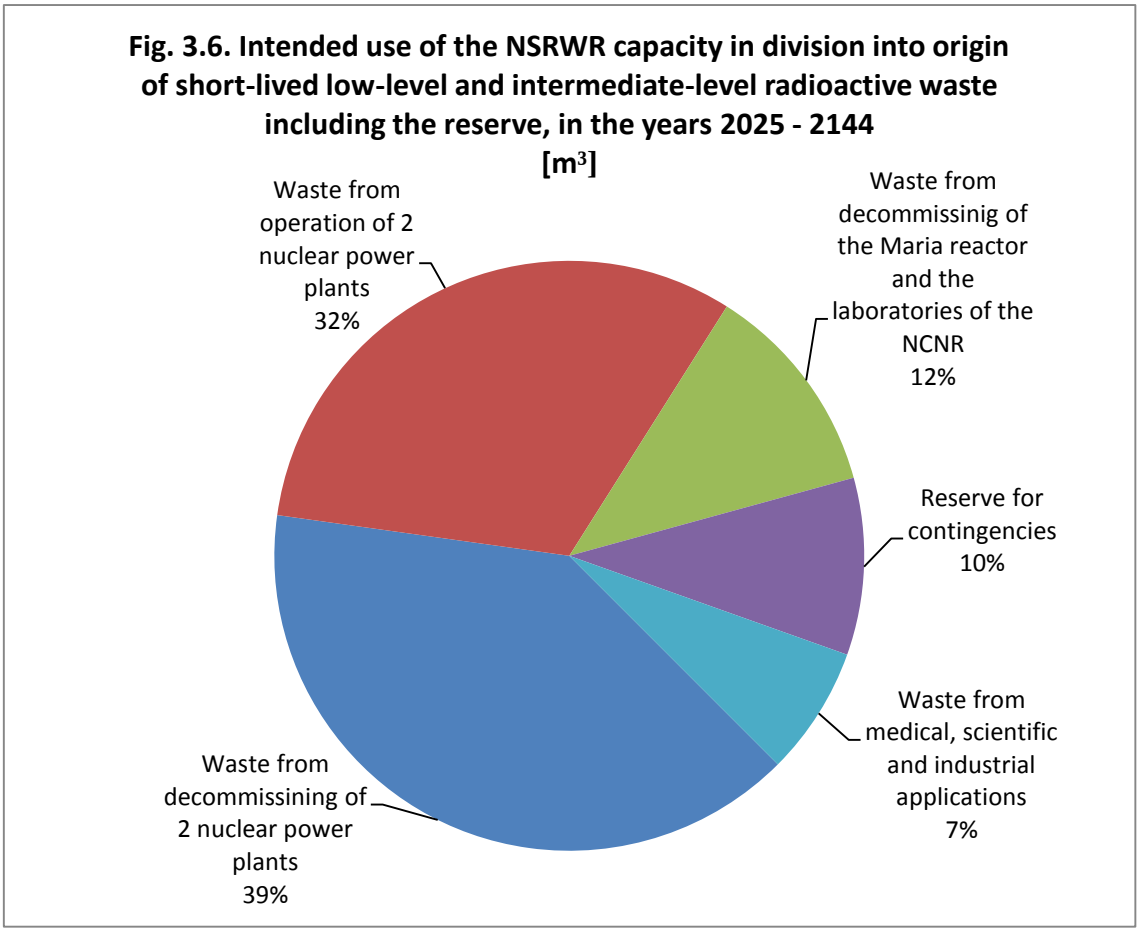
After the addition of the reserve for contingencies in the amount of 16,500 m^3, it defines the total necessary capacity of the NSRWR of 170 000 m^3.

[18] A. Hryczuk, A. Cholerzyński „The Preliminary Plan of Decommissioning of the MARIA Reactor", Institute of Nuclear Energy – ORB; Dec. 1998.

[19] The data adopted in this calculation differ from the data adopted in section 3.2. and 3.3. since the average amount of radioactive waste in here is applied in a considerably longer period of time, i.e. 120 years.



Odpady z zastosowań medycznych, naukowych i przemysłowych – Waste from medical, scientific and industrial applications
Odpady z likwidacji reaktora Maria i laboratoriów NCBJ – Waste from decommissioning of the MARIA reactor and laboratories of the NCNR
Odpady z eksploatacji dwóch elektrowni jądrowych – waste from operation of two nuclear power plants
Odpady z likwidacji dwóch elektrowni jądrowych – Waste from decommissioning of two nuclear power plants



3.8.2. RADIOACTIVE WASTE, INCLUDING SPENT NUCLEAR FUEL, INTENDED FOR DEPOSITING AT THE DRWR

The following amounts of radioactive waste will be intended for depositing at the DRWR:

- spent nuclear fuel originating from nuclear energy industry: 6 700 tHM ;
- spent nuclear fuel originating from the research reactor of 800 tHM;
- high-level activity spent sealed radioactive sources originating from oncology (medicine): 190 pieces received until 2050;
- long-lived low-level radioactive waste accumulated to date at the NRWR in Rozan – 1 388.3 m^3;
- solid long-lived low-level radioactive waste to be accumulated in subsequent years (from 2014 to 2120) – 2.0 m^2 per year, with a total of 214 m^3.

3.8.3. POSSIBILITIES OF A CHANGE IN CLASSIFICATION OF RADIOACTIVE WASTE

In certain countries (e.g. France, Spain, Slovakia) the classification of radioactive waste includes an additional category of radioactive waste – very low-level activity. It is waste originating mainly from decommissioning of the nuclear power facilities. Usually circa 90% of waste, coming from decommissioning of a nuclear power plant is very low-activity waste and only 10% is low-level and intermediate-level activity waste.

Due to low level of activity of isotopes waste contained in the very low-level activity waste, of slightly higher than levels defined for exemption of materials from the surveillance control, its management is simplified, requires a lower number of barriers, and therefore is less costly than management of low-level and intermediate-level waste.

In the future introduction of the category of very low-level activity waste should be analyzed along with the approaching dates of decommissioning of nuclear power facilities in Poland. Introduction of this category of waste should be also taken into account by NSRWR by the possibility to locate storage facilities for this type of waste on its premises.

CHAPTER 4. SPENT NUCLEAR FUEL AND RADIOACTIVE WASTE MANAGEMENT

Each organizational unit, which generates radioactive waste or spent nuclear fuel, is committed to providing opportunities for management of such waste and its financing from the moment of its creation until its transfer for depositing, including financing of its storage[20].

The RWMP is the institution appointed by the Act - Atomic Law to pursue activities in management of radioactive waste and spent nuclear fuel[21]. It also performs activities involving receipt, transportation, storage and depositing of nuclear materials, radioactive sources and other radioactive substances. The seat of the RWMP is Otwock-Swierk, where radioactive waste is reprocessed and stored. Upon the reprocessing solid and solidified radioactive waste is deposited at the NRWR Rozan.

The RWMP operates the NRWR Rozan, where short-lived low-level and intermediate-level radioactive waste and spent sealed radioactive sources (short-lived low-level, intermediate-level and high-level) are deposited as well as long-lived low-level and intermediate-level waste is stored. Before the final closing of the NRWR, which is planned for the years 2024 - 2029, long-lived waste will be transferred for further storage at the NSRWR.

The closing of the NRWR in Rozan will be preceded by the launch of the NSRWR for short-lived low-level and intermediate-level waste. The NSRWR will be equipped with facilities for management of radioactive waste originating from the manufacturers in the medical sector, scientific institutions and industry (outside of the nuclear energy industry). The exception will be leaving the installations for reprocessing of liquid waste on the premises of the RWMP Otwock-Swierk, due to the location of the MARIA research reactor at this place, from which comes 90% of liquid radioactive waste currently produced in Poland.

4.1. MANAGEMENT OF SHORT-LIVED LOW-LEVEL AND INTERMEDIATE-LEVEL RADIOACTIVE WASTE

MANAGEMENT OF RADIOACTIVE WASTE AT THE PLACE OF ITS ORIGIN

The producer of radioactive waste shall be responsible for providing the possibility of its management[22], including the reduction of its amount[23]. The head of the organizational unit conducting its activity involving exposure to ionizing radiation is obliged to classify radioactive waste into the appropriate category and sub-category on the basis of the criteria set out in the relevant legislation[24]. He also has an obligation to keep records of radioactive waste on record cards[25]. Waste shall be stored in the manner protecting humans and the environment.

4.1.2. RECEIPT OF RADIOACTIVE WASTE

[20] Art. 48a section 1 Act – Atomic Law.

[21] Art. 114 Act – Atomic Law.

[22] Art. 48a section 1 Act – Atomic Law

[23] Art. 48b section 2 Act – Atomic Law.

[24] Art. 47 section 1 – 1c Act – Atomic Law.

[25] Art. 49 section 1 – 1d Act – Atomic Law.

The RWMP collects solid and liquid low-level and intermediate-level radioactive waste, and spent sealed radioactive sources.

4.1.3. TRANSPORTATION OF RADIOACTIVE WASTE

Transportation of radioactive waste can be performed by the RWMP or another economic entity, which has been authorized by the President of the NAEA to perform this kind of activity.

Transportation of radioactive waste to the radioactive waste repository is performed only by the RWMP[26].

4.1.4. REPROCESSING OF RADIOACTIVE WASTE

In order to prepare radioactive waste for storage and depositing, it undergoes reduction, reprocessing, solidification and packaging. The purpose of these activities is providing adequate protection of radioactive waste in such a way that it does not create hazards for humans and the environment.

The management of short-lived low-level and intermediate-level waste arising in nuclear power plants will take place on its premises. Properly reprocessed waste will be put in packages that enable its transportation and depositing in the surface radioactive waste repository.

Short-lived low-level and intermediate-level waste, collected by the RWMP from nuclear power plants will have to comply with the acceptance criteria for radioactive waste from nuclear power plants to be deposited in the surface radioactive waste repository, as determined by the RWMP.

4.1.5. STORAGE OF RADIOACTIVE WASTE

Radioactive waste must be stored in such a way as to ensure the protection of humans and the environment from the effects of the ionizing radiation in normal conditions and in situations posing a threat, in particular, by protecting it from spilling, dispersal or release[27].

Temporary radioactive waste is stored to allow the decay of short-lived radioisotopes to a level at which such waste may be excluded from the surveillance control and there will not be a need to place it in a radioactive waste repository.

A storage facility for radioactive waste on the premises of a nuclear power plant will have an area that allows for storage of non-reprocessed and reprocessed radioactive waste arising from its operation for a period permitting reprocessing of waste and waiting for transportation to a repository.

[26] Art. 56 section 2 Act – Atomic Law.

[27] Art. 50 section 1 Act – Atomic Law.

Fig. 4.1. Plan of low-level and intermediate-level radioactive waste management in Poland

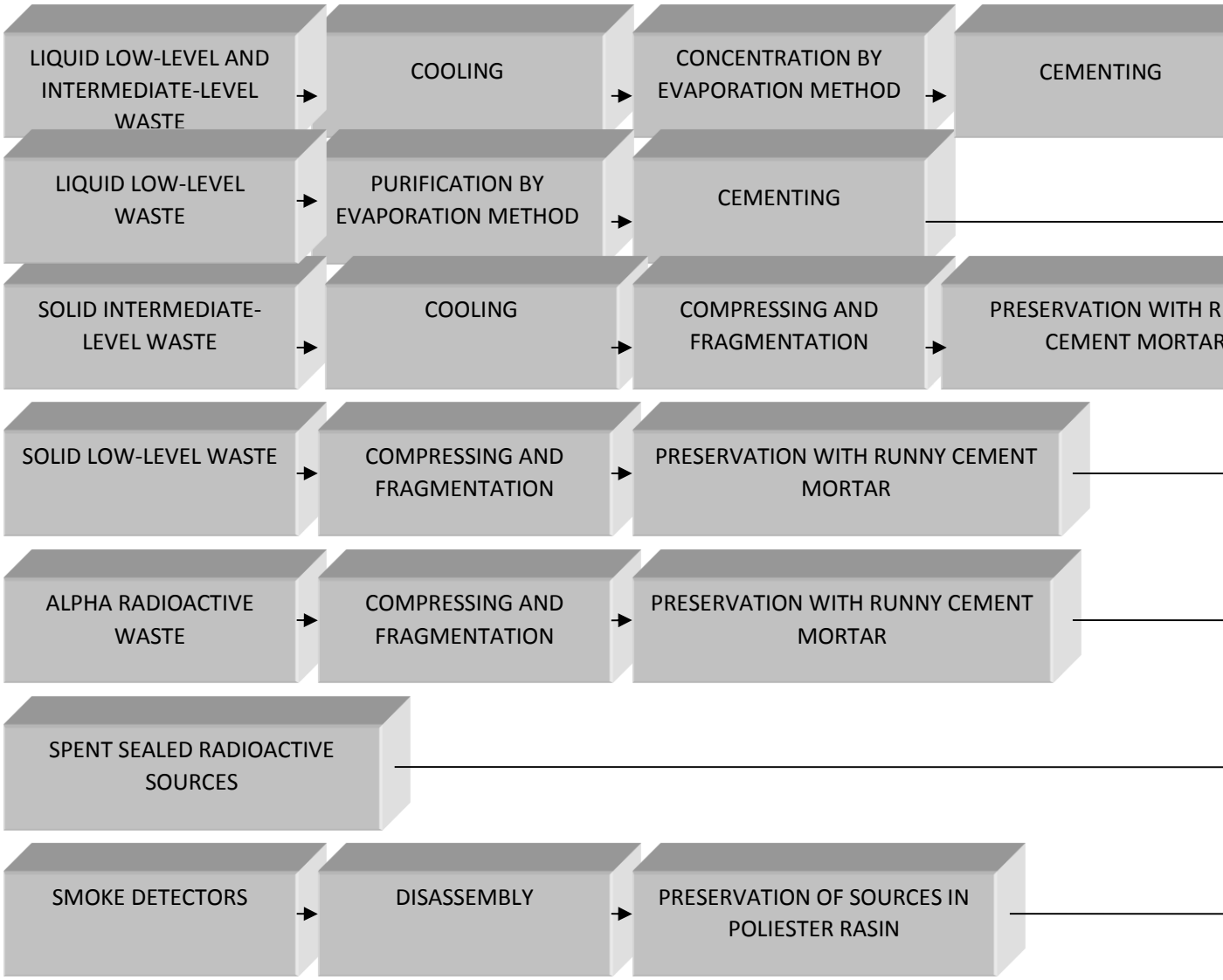


Fig. 4.2. Management of low-level and intermediate-level radioactive waste originating from nuclear energy industry

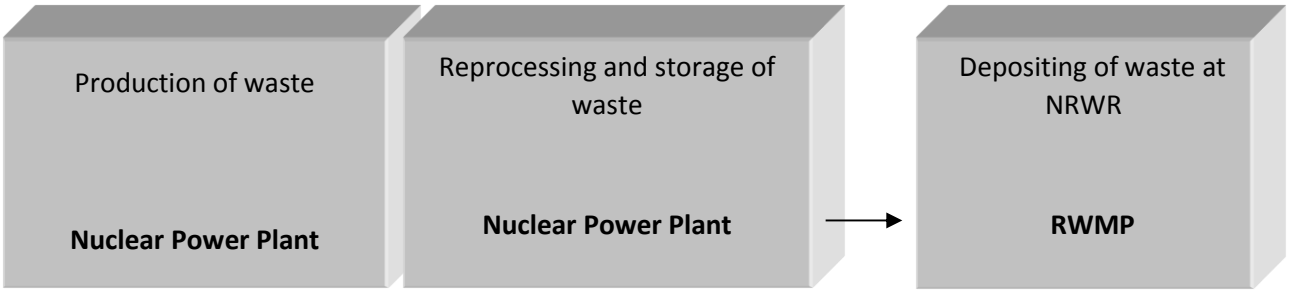
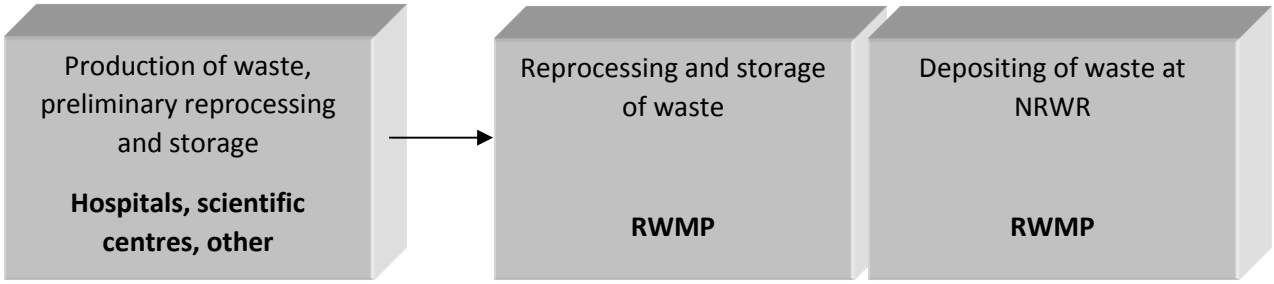


Fig. 4.3 Management of low-level and intermediate-level radioactive waste originating from outside of nuclear energy industry



4.1.6. DEPOSITING OF RADIOACTIVE WASTE

Depositing of radioactive waste means a placement of such waste in a radioactive waste repository without an intention of its future retrieval[28]. The aim of depositing is a removal of radioactive isotopes from the widely accessible environment and their isolation in such a way that they undergo the on-site decay to such a low level of radioactivity that their possible release will not pose a significant risk to humans and the environment.

Radioactive waste can be deposited only in the solid state in packaging ensuring safety of humans and the environment from the effects of the ionizing radiation, while providing heat dissipation and a constant control of these factors throughout the period of depositing and after the closing of a repository[29].

Short-lived low-level and intermediate-level radioactive waste and spent sealed radioactive sources (short-lived low-level, intermediate-level and high-level) may be deposited in a surface radioactive waste repository[30].

The isolation of radioactive waste is provided by protective barriers, which prevent the release of radioactive substances at the place of their depositing and prevent their migration to the environment. Protection barriers can be divided into artificial and natural.

[28] Art. 3 paragraph 44 Act – Atomic Law.

[29] Art. 52 section 3 Act – Atomic Law.

[30] Art. 55b Act – Atomic Law.

4.1.7. THE NATIONAL RADIOACTIVE WASTE REPOSITORY IN ROZAN

The NRWR in Rozan has been in operation since 1961 and according to the classification of the International Atomic Energy Agency (IAEA) is a repository of the surface type. The repository, occupying an area of 3,045 hectares, is located in one of the old forts, built in 1905-1908. Groundwater is under a layer of clay with very low permeability and a layer of soil with the sorption properties at a depth of several meters below the repository.

The place of waste depositing in the repository consists of concrete facilities of the fort, partially covered with earth and fragments of the moat, whereas long-lived alpha-radioactive waste are stored in concrete chambers.

It is expected that the closing process for the NRWR in Rozan will take place in the years 2025-2029, due to the depletion of the repository capacity for acceptance of radioactive waste.

The closing of the NRWR in Rozan will be preceded by preparatory actions, which include specification of actions enabling preparation of the repository for safe closing and long-term monitoring, including a selection of a cover variant. Based on the abovementioned specifications a concept will be prepared of the closing and next a plan of the closing to be submitted to the President of NAEA, which will result in obtainment of a permit for the closing of the NRWR in Rozan.

Works related to the closing of NRWR in Rozan will be carried out according to the received permit for the closing. After the closing the RWMP will be obliged to make a report on the closing of the repository and submit it for approval to the President of the NAEA. Upon approval of the abovementioned report a long-term monitoring of the closed repository will start, for which the RWMP is responsible. It is assumed that monitoring will be continued for the period of 300 years.

4.2. MANAGEMENT OF LONG-LIVED LOW-LEVEL AND INTERMEDIATE-LEVEL RADIOACTIVE WASTE

Management of long-lived low-level and intermediate-level radioactive waste includes management of waste at the place of its creation, receipt, transportation, reprocessing, which are similar to those concerning short-lived low-level and intermediate-level radioactive waste.

Long-lived low-level and intermediate-level radioactive waste is stored at the storage facility of radioactive waste on the premises of the RWMP in Otwock-Swierk and NRWR in Rozan.

Closing of the NRWR in Rozan will be preceded by retrieval and transfer of long-lived waste to the NSRWR for further storage.

Long-lived low-level and intermediate-level radioactive waste will be stored until the launch of the DRWR, where it will be deposited.

4.3. MANAGEMENT OF SPENT SEALED RADIOACTIVE SOURCES

Management of spent sealed radioactive sources includes: management at the place of their creation, receipt, transportation, reprocessing, which are similar to those concerning short-lived low-level and intermediate-level radioactive waste.

Spent sealed short-lived low-level and intermediate-level radioactive sources are deposited at the NRWR in Rozan, whereas high-level sources are stored at the storage facility of radioactive waste on the premises of the RWMP in Otwock-Swierk.

Spent sealed long-lived radioactive sources are stored at the storage facility of radioactive waste on the premises of the RWMP in Otwock-Swierk and the NRWR in Rozan..

Closing of the NRWR in Rozan will be preceded by retrieval and transfer of spent sealed long-lived sources to the NSRWR for further storage.

Spent sealed long-lived radioactive sources and spent sealed short-lived high-level radioactive sources will be stored until the launch of the DRWR, where they will be deposited.

4.4. MANAGEMENT OF HIGH-LEVEL RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL

Since high-level waste contain high concentrations of radioisotopes, both short-lived and long-lived, it requires the use of methods that ensure a higher level of security than those used in the case of the above discussed categories of waste. This waste produces significant amounts of heat coming from the radioactive decay. A separate group of waste, usually classified as high-level, is spent nuclear fuel. Countries using a closed cycle along with reprocessing do not include spent fuel into the radioactive waste, considering it raw material for further use. In Poland, spent nuclear fuel for depositing is classified as high-level radioactive waste[31].

4.4.1. SPENT FUEL MANAGEMENT IN POLAND

The need to implement a system of spent nuclear fuel management in Poland arose with the launch of the first EWA research reactor in 1958[32]. This system was based on the principle that spent fuel from the EWA reactor and the later launched MARIA reactor was successively transferred to the wet pool storage facilities where it was cooled for about five years. The aim of this process was to reduce its activity and generate heat from the fuel. Fuel elements used in Polish reactors have a coat made of aluminum alloy, which protects them against the effects of the aquatic environment in the reactor and the storage facility. Upon this period spent nuclear fuel was to be transported to the repository. However, in the absence of a repository, the spent nuclear fuel was stored at all times in a wet storage facility. The oldest spent fuel elements were stored in these conditions for 50 years. In 2000 studies were made of the physical condition of the spent nuclear fuel elements of all types (EK-10, WWR, MR). The results allowed for determination, how many and which of the elements required a change of the storage environment from wet to dry. Moreover, they allowed for determination of the degree of overall degradation of the coats of fuel elements as well as the associated time horizon, in which a change of the manner of storage would be necessary.

In reference to the above, in the former Institute of Atomic Energy, part of which was then the RWMP, a concept of a dry storage facility for spent fuel was developed to ensure the proper storage conditions for the next 100 years. The concept involved placing fuel in a concrete

[31] Art. 47 section 1c Act – Atomic Law.

[32] The first Polish nuclear reactor operated in the years 1958-1995. Since 1997 it has been in the stage of decommissioning.

biological shield of the tank of the decommissioned EWA reactor. It was assumed that spent elements would be tightly sealed in capsules made of stainless steel and filled with helium. The presence of helium was to reduce corrosion of the fuel elements, improve the conditions for heat removal from the spent fuel and allow for controlling of the capsule tightness.

The technology of encapsulating of spent fuel elements was implemented at the RWMP.

In 2006 Poland joined the international initiative to reduce global proliferative threats (Global Threat Reduction Initiative - GTRI), under which relevant agreements were signed in 2009 with the governments of the United States and the Russian Federation[33]. They allowed for export of spent fuel from the Polish research reactors to the manufacturer's country (the Russian Federation) to be reprocessed. Radioactive waste resulting from the reprocessing of spent nuclear fuel will remain on the territory of the Russian Federation. In execution of the abovementioned agreements in the years 2009 - 2014 seven shipments of spent fuel, including low-enriched (EK-10) were sent to the Russian Federation. The RWMP is responsible for the implementation of this program in Poland. Storage facilities for spent fuel from the EWA and MARIA research reactors are now empty and serve as a reserve for emergencies. Small amounts of spent high-enriched nuclear fuel are located in the technological pool of the MARIA reactor and are waiting for export to Russia.

The completion of the above program is planned for 2016.

Small amounts of high-level waste and high-level sources other than spent nuclear fuel are currently stored in storage facilities on the premises of the Centre Swierk.

4.4.2. THE FUEL CYCLE

The nuclear fuel cycle (the fuel cycle) is a set of industrial operations and technological processes divided into four phases:

1) preparation of nuclear fuel for the reactor;

2) burning nuclear fuel in the nuclear reactor;

3) chemical reprocessing of spent fuel to recover fissile materials, including uranium and plutonium (e.g. U-235, Pu-239, Pu-241);

4) permanent solidification and safe depositing of radioactive waste.

If the fuel cycle, upon the second phase, after a period of temporary storage, provides for a transfer of spent nuclear fuel to safe depositing in deep geological formations (without the third phase) it is called open, if it includes also reprocessing - closed. If only uranium and plutonium is recovered in the cycle – it is a partially closed cycle, and if it provides for separation of not only fissile uranium and plutonium from radioactive waste, but also other the most long-lived radionuclides (primarily minority actinides - especially americium, neptunium and curie) - it is a closed cycle.

One of the most important aspects of development of the Polish nuclear energy industry is a choice of the fuel cycle. It is difficult to make a choice of the fuel cycle at the moment, among others, due to the difficulty in determination of the costs of particular phases of the fuel cycle in the longer term - especially uranium prices, cost of depositing of spent nuclear fuel and high-level radioactive waste, transportation of nuclear materials, and availability of the fuel cycle services.

[33] See: Chapter 9.

Considering the option of an open cycle, one needs to pay attention to its advantage, which is no need for spent fuel reprocessing services. On the other hand, the consumption of uranium as well as the need for services in regard to its conversion and enrichment are higher. It is accompanied by high costs of storage and deep depositing of spent fuel.

Determining the degree of efficiency of a partially closed fuel cycle is a more complex issue. Selecting this option of the fuel cycle in the current context entails the need for use of foreign services, which are expensive and difficult to access. One must take into account high costs of transportation and reprocessing of spent fuel, as well as management, among others, of the resulting plutonium or the costs of its storage. A full analysis of a fully closed cycle, including the separation of all actinides - including the minority ones and their subsequent nuclear transmutation (Generation IV reactors) is not possible in the present state of knowledge yet.

A comparative analysis of all the above mentioned options of the fuel cycle leads to the conclusion that in the present situation, in the economic terms, an open fuel cycle is the most favorable for Poland. The results of tests conducted on behalf of the Ministry of Economy by scientific and research institutes as well as entities specializing in radioactive waste management indicate that in the Polish conditions an open cycle will be more beneficial economically (from 30 to 50%) than a partially closed cycle. Yet global trends in this area will be constantly monitored and, if the need arises, if appropriate, suitable changes will be introduced in the proposed solutions.

A new analysis of the fuel cycle will be made after the commissioning of the first Polish nuclear power plant. According to the Act - Atomic Law[34], a decision regarding the classification of spent fuel as waste or raw material for further reprocessing will belong to the operator of the nuclear power plant. He will have to pay the reprocessing costs from his own resources.

4.4.3. DECISION REGARDING THE FINAL MANAGEMENT OF HIGH-LEVEL RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL

Nowadays, it is assumed that the safest solution of the problem of high-level radioactive waste and spent nuclear fuel is their depositing in deep radioactive waste repositories, built in geological structures.

After the cooling phase in the technological pool, which lasts about 10 years, spent nuclear fuel is transported to a (dry or wet) storage facility outside the reactor. In the Polish conditions one can consider the construction of a single, shared storage facility for both power plants, or two storage facilities - for each power plant separately. The entity responsible for storage of spent nuclear fuel is the NPP operator, who shall ensure the possibility to store spent nuclear fuel from the entire period of operation of the nuclear power plant. After several years of storage and upon the commissioning of the DRWR the fuel will be transferred for depositing. An issue concerning construction of the DRWR was considered for the purposes of the first nuclear program in Poland (NPP "Żarnowiec"). A series of studies was then performed related to a selection of a location for a deep repository of spent nuclear fuel. This work was continued in the years 1997-1999 within the Strategic Governmental Program "Radioactive Waste and Spent Nuclear Fuel Management in Poland", developed by the NAEA[35]. One of the objectives of this program was a selection of a location and development of a concept of the radioactive waste repository in deep geological formations.

[34] Art. 48 section 1 Act –Atomic Law.

[35] See: Final report on execution in the years 1997-1999 of the Strategic Governmental Program „Management of radioactive waste and spent nuclear fuel in Poland", NAEA, Warsaw, June 2000.

As a result of works carried out within the above mentioned program, 44 rock structures were identified on the Polish territory, in which there is a potential for the DRWR location. These structures include igneous and metamorphic rocks, clays and salt rocks. The conducted works resulted in a negative assessment of depositing high-level radioactive waste and spent nuclear fuel in mining excavations and surface geological formations as well as in undeveloped deep geological formations. As part of the work a negative assessment was made of the possibility to deposit high-level radioactive waste in the mine workings and surface geological formations as well as in undeveloped deep geological formations. Areas of groundwater reservoirs, retention of valuable minerals, seismically active areas, located within the mining work and finally areas attractive in terms of the natural landscape were also assessed in the negative. These exclusions are in accordance with the ones laid down in Art. 53 b section 1 of the Act - Atomic Law.

Therefore, it can be concluded that Poland has both the conditions and knowledge regarding the possibility of depositing spent nuclear fuel and radioactive waste on its territory.

The undertaken actions aiming at construction of the DRWR will be also based on experience of other countries.

In connection with the adoption of the PNPP there are plans to sign an agreement by the Minister of Economy, PGI-NRI and other interested institutions on the promotion of the concept and adoption of integrated research on a deep radioactive waste repository and the construction of the PURL (see: Paragraph 1.3.2). The collected results will be used in the future to select a location and construct the DRWR.

Until the completion of the DRWR, spent fuel will be stored in a storage facility (storage facilities) outside the reactor. The capacity of storage facilities must be sufficient for receipt of spent nuclear fuel from the entire period of operation of nuclear power plants. The size of the repository will depend on the development of nuclear energy industry in Poland. Due to the costs of DRWR construction, Poland will also participate in the European initiatives such as the European Repository Development Organization - ERDO, analyzing the possibility of construction of a common DRWR for several countries in the future. In accordance with the Polish law[36], it is not possible to locate such a repository on the territory of Poland.

4.2.3. WASTE FROM DECOMMISSIONING OF NUCLEAR FACILITIES

Decommissioning of a nuclear facility consists of administrative and technical activities leading to the attainment of a state which does not require any restrictions related to the NSRP in the performance of any activity[37], and therefore to a state in which it is possible to reduce or completely remove it from the nuclear surveillance control. It is a long-term process, complex and dynamic, responsive to technological progress and changes of legal regulations.

Due to the costs the process of decommissioning of a nuclear facility should be taken into account as early as at the stage of designing the facility, therefore the decommissioning program is presented to the President of the NAEA for approval along with an application for issuance of a permit for construction, commissioning and operation of a nuclear facility. In the course of operation of a nuclear facility the organizational unit responsible for its operation is obliged to update periodically (not less than every five years) the

[36] Art. 62e. section 2 Act – Atomic Law.

[37] Art. 3 paragraph 9 Act – Atomic Law.

decommissioning program along with a forecast of its costs to be submitted to the President of the NAEA for approval[38].

Decommissioning should be carried out in the manner ensuring the nuclear safety and radiological protection of the staff and the society. The process has to meet also the requirement specified in the permit by the President of the NAEA and in the integrated management system introduced in the entity[39].

According to the Act - Atomic Law, responsibility for ensuring the nuclear safety, radiological protection, physical protection and security of nuclear materials shall be borne by the head of the entity possessing a permit to perform activities involving exposure to ionizing radiation, consisting of construction, commissioning, operation or decommissioning of a nuclear facility. Responsibility of the head of the entity for nuclear safety of the facility ceases on the date of approval of a report on the decommissioning of the nuclear facility by the President of the NAEA[40].

Costs of decommissioning of a nuclear facility are incurred from the decommissioning fund, which should be created and fed with payments by the operator of the nuclear facility[41].

There are two basic types of decommissioning of a nuclear facility[42]:

• immediate decommissioning;
• postponed and spread in time decommissioning.

The choice of the decommissioning strategy depends, among others, on issues of nuclear safety and radiological protection, interdependence among structures, buildings and systems on the premises of the nuclear facility, possible burdens for future generations or possible loss of knowledge and competences related to the condition of the nuclear facility and its decommissioning with the passing of time. Poland has experience in decommissioning of nuclear facilities. In 1997 the decommissioning of the EWA reactor was commenced. Until 2002 the nuclear fuel and all radioactive substances, whose radioactivity level is important from the point of view of the radiological protection, had been removed. Further works were suspended, without providing for the total demolition of the reactor body.

The next task in this respect will be decommissioning of the research MARIA reactor after its decommissioning, which is expected in about 30 years.

[38] Art. 38b section 2 Act – Atomic Law.

[39] Art. 38a Act – Atomic Law.

[40] Art. 35 section 2 Act – Atomic Law.

[41] See: Chapter 8.

[42] Regulation of the Council of Ministers of 11 February 2013 about requirements concerning nuclear safety and radiological protection for the stage of decommissioning of nuclear facilities and content of the report on decommissioning of a nuclear facility (Journal of Laws, item 270).

CHAPTER 5. CLOSING OF THE SURFACE RADIOACTIVE WASTE REPOSITORY

Closing of the repository means the cessation of radioactive waste delivery to the repository and taking up actions aiming at ensuring the safety of the repository against:

• infiltration of rainwater;

• unintentional penetration by humans;

• destructive activity of plants and animals.

The aim of such actions is to provide effective and long-term isolation of the deposited radioactive waste from the environment and people.

The first radioactive waste repository to be closed in Poland will be the NRWR in Rozan (after over 60 years of operation). The execution of this process is planned for the years 2025-2029.

In order to preserve knowledge of the repository and the deposited radioactive waste for the future generations, registers of data will be prepared, which will be filed to the perpetual archives.

5.1. PREPARATORY ACTIONS PRIOR TO CLOSING OF THE NRWR IN ROZAN AND ITS CLOSING

Appropriate solutions allowing for closing of the repository should be included in its design[43].

The plan of repository closing shall be prepared by its operator and submitted for approval to the President of the NAEA along with an application for a permit for construction and operation of the repository[44]. The plan shall be updated not less than every 15 years[45] to be approved by the President of the NAEA.

The repository shall be closed according to the permit for closing issued by the President of the NAEA and the implemented integrated management system. Upon closing the operator of the repository shall make a report on the closure of the repository and submit it to the President of the NAEA for approval.

5.2. LONG-TERM POST-CLOSING MONITORING OF THE REPOSITORY

Monitoring is the observation of the status of the repository and its impact on the environment, through constant or periodic observations and measurements of the engineering, environmental and radiological parameters as well as maintenance of safety devices.

The plan of monitoring of the repository premises and its surroundings with the consideration of the waste properties and its duration is an element of the plan of the repository closing to be approved by the President of the NAEA.

The area of the monitored repository will be appropriately labeled and closed to unauthorized persons.

5.3. PRESERVATION OF KNOWLEDGE ABOUT THE REPOSITORY

Data registers will be made in order to preserve knowledge about the repository, its construction, deposited waste, monitoring systems and measurement data.

[43] Art. 55e Act – Atomic Law.

[44] Art. 44j section 1 Act – Atomic Law.

[45] Art. 55j section 3 Act – Atomic Law.

Data registers will be made in the paper form (on durable paper) and on electronic media, enabling their transfer to different data storage systems, according to the technological development.

Copies of the data registers will be forwarded to the perpetual archives of the following institutions:

• RWMP;

• National Atomic Energy Agency;

• Gmina Office where the monitored repository is located;

• State Archives.

CHAPTER 6. RESEARCH-AND-DEVELOPMENT ON RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT

In accordance with the experience of the countries with well-developed and functioning nuclear energy industry as well as radioactive waste and spent nuclear fuel management, it is important to build strong scientific and research facilities. Due to the ongoing progress in science, the assumptions of the National Plan include its constant evolution associated with the current state of knowledge. Progress in science, especially works on the geological repositories and research on the final stage of the fuel cycle will be of great importance in the choice of specific solutions in the future. The latter include a wide group of issues: methods of separation of spent fuel elements and the selective separation of minority actinides as well as their burning in Generation IV reactors or transmutation in hybrid systems consisting of subcritical reactors with particle accelerators. Work on these issues is advanced, but still does not provide ready-made solutions, which would give a basis to their inclusion in the national strategy.

In Poland, research institutes and centers have been operating for years, dealing with scientific work on the peaceful use of nuclear energy and the practical aspects of radioactive waste depositing - such as the Institute of Nuclear Chemistry and Technology (INChT) and the National Centre of Nuclear Research (NCNR), which cooperate closely with the RWMP. In the 70. and 80. of the 20th century they carried out work related to the development of nuclear energy industry in Poland. Now, after a renewed decision to implement nuclear energy industry, they are actively engaged in research in this field, in particular, in work on management of radioactive waste and spent nuclear fuel.

Polish research institutes and universities have participated in projects under the Framework Program of the European Community 2007 - 2013 (FP7) within the EURATOM program, especially in the second priority, whose objectives were, among others:

• to establish the scientific and technological bases of safe management of long-lived radioactive waste;

• to increase nuclear safety of reactors;

• to increase cost-effectiveness of nuclear energy;

• to ensure a socially acceptable system of protection from ionizing radiation for humans and the environment.

On the initiative of the Ministry of Economy, the NCRD supervised by the Ministry of Science and Higher Education, initiated in September 2011 and ended in July 2012, public procurement procedures for the execution of 10 research tasks planned for completion by mid-2015 within the strategic research project “Technologies for Development of Safe Nuclear Energy”. Some of the tasks relate to the fuel cycle, including management of radioactive waste and spent nuclear fuel:

• the bases for safeguarding the needs of the Polish nuclear energy industry for nuclear fuel (contractor - a consortium with the University of Warsaw as the leader);

• development of techniques and technologies in support of radioactive waste and spent nuclear fuel management (contractor: a consortium with INChT as the leader).

Given the above mentioned facts, it is necessary to conduct research in the country to allow for international cooperation in science and observation of trends in development of research on the final stage of the fuel cycle and new technologies of radioactive waste reprocessing.

This will allow for gaining relevant experience and training of the personnel, who in the future will help in a reasonable choice of solutions for radioactive waste and spent nuclear fuel management.

In particular, the following lines of research should be developed:
• development of methods for reprocessing of low-level and intermediate-level waste;
• advanced technologies of storage of radioactive waste, including high-level waste;
• management of bulky elements of nuclear power plants;
• the structure and properties of spent nuclear fuel;
• storage and transportation of spent nuclear fuel;
• radioactive waste packaging technologies;
• processes of selective separation of minority actinides;
• reprocessing of spent nuclear fuel elements in the systems for transmutation of long-lived actinides into short-lived or stable isotopes;
• materials and fuel for Generation IV reactors;
• procedures for management of radioactive waste of various types: long-lived intermediate-level or high-level and spent nuclear fuel as well as short-lived low-level and intermediate-level;
• land and maritime transport of waste and radioactive substances;
• methods of radioactive waste solidifying and stabilizing;
• methods and techniques of radioactive waste depositing in repositories;
• closing and monitoring of repositories;
• repository protective barriers to prevent migration of radionuclides;
• methodology of localization research and safety assessments for localization of surface repositories;
• methodology of research localization and safety assessments for localization of deep repositories;
• geological and geophysical criteria for localization of surface repositories and deep repositories;
• conducting research and analyses to select localization of surface repositories and deep repositories;
• nuclear safety, radiological protection, physical protection and non-proliferation of nuclear waste in repositories and nuclear facilities;
• innovative reactors in the systems controlled by accelerators in the fuel cycles;
• education and training of personnel for the purpose of radioactive waste and spent nuclear fuel management;
• involvement of the Polish industry in construction of radioactive waste repositories;
• analysis of funding schemes and management of funds for: management of radioactive waste and closing of repositories and their monitoring in the third-party countries.
In order to accomplish the above mentioned work there will be a need to include at least some of them to the new strategic research program or to develop a new program dedicated exclusively to the issues related to management of radioactive waste and spent nuclear fuel in Poland.

In the future, upon commissioning of nuclear power plants, the entities dealing with management of radioactive waste and spent fuel should take over the implementation of some research topics including, among others:
• impact of repositories on the environment in the external and internal environments;

• social relationships in the environment of repositories;
• methods of the radiological, geological and hydrogeological monitoring of repositories;
• principles of physical protection of repositories and other facilities, where management of radioactive waste and spent nuclear fuel is carried out.

6.1. RESEARCH ON THE FUEL CYCLE

As it has been mentioned above, work will be carried out in Poland on the implementation of an open fuel cycle, which at the moment is more economically efficient than a closed cycle. Poland, however, will closely monitor the ongoing changes in this field in the world and, if necessary, make appropriate adjustments in the solutions proposed for implementation.
Detailed research on the nuclear fuel cycle will focus on study of:
• methods of spent nuclear fuel reprocessing;
• use of thorium as fuel-generating material;
• fuel for Generation IV reactors;
• processes to prevent the migration of radionuclides from the regions of repositories;
- protective barrier systems (chemical, physical, engineering, natural);
- preparation of waste for depositing;
• methods and materials for solidification and stabilization of high-level radioactive waste;
• methods and materials for depositing of radioactive waste, especially spent nuclear fuel;
• new chemical, engineering and physical barriers;
• selection of location for a deep repository of radioactive waste, including stability and insulating properties of rock masses.

6.2. RESEARCH WORK PROGRAM FOR A SELECTION OF A SAFE LOCATION FOR THE SURFACE RADIOACTIVE WASTE REPOSITORY

The aim of works in this task is development of the safety assessment methodology, support in selection of the optimal location of the repository and then its construction with safeguarding the maximum level of safety for humans and the environment. They will focus on:
• geological studies, including geological-and-engineering, geophysical, hydrogeological and geochemical ones;
• studies of socio-economic conditions;
• geographical and nature studies;
• simulation and modeling of radionuclides transport through the system of protective barriers;
• technological and economic assessment of the possibility to apply modern sorbents as an additional sealing of the surface repository surroundings.

6.3. RESEARCH WORK PROGRAM FOR A SELECTIONOF A SAFE LOCATION FOR THE DEEP HIGH-LEVEL RADIOACTIVE WASTE REPOSITORY

The aim of works in this task is support in finding the optimal location of the deep repository of radioactive waste and then its construction with safeguarding the maximum safety for humans and the environment. They will focus on:

• geological studies (e.g. geological-and-engineering and geomechanical, structural and tectonic, seismological, hydrogeological, geomorphological, geochemical and mineralogical);

• study of socio-economic conditions;

• geographical and nature research;

• geophysical studies, in particular of thermal processes;

• simulation and modeling of radionuclides transport through the system of protective barriers.

Structures in the form of crystalline rocks, claystone complexes, salt formations and tufits will be considered as the location of the deep repository.

CHAPTER 7. ENTITIES INVOLVED IN THE IMPLEMENTATION OF THE NATIONAL PLAN AND KEY INDICATORS FOR MONITORING OF ITS IMPLEMENTATION.

7.1. MINISTER COMPETENT FOR ECONOMY

The Minister competent for economy shall be responsible for preparation and implementation of the state policy concerning spent nuclear fuel and radioactive waste management as well as for preparation and implementation of the relevant legislation[46]. He shall also supervise the RWMP.

7.2. MINISTER COMPETENT FOR SCIENCE

The Minister competent for science, together with the subordinate units (NCRD and NCS) shall be responsible for creation of research-and-development programs for management of radioactive waste and spent nuclear fuel.

7.3. PRESIDENT OF THE NATIONAL ATOMIC ENERGY AGENCY

The scope of activities of the President of the NAEA includes execution of tasks related to nuclear safety and radiological protection of the country[47]. The President of the NAEA carries out, in the scope included in the National Plan, regulatory, supervisory and control actions, defined by the law, in reference:

- storage, transportation, reprocessing or depositing of radioactive waste;
- storage, transportation, reprocessing of spent nuclear fuel and turnover of this fuel;
- decommissioning of the nuclear facilities;
- construction, operation and decommissioning of radioactive waste repositories[48].

Moreover, his competences include control of the operator of a nuclear power plant in reference to the correctness of his contributions and functioning of the decommissioning fund.

7.4. THE RWMP

The RWMP is responsible for management of radioactive waste and spent nuclear fuel[49], including nuclear energy industry at the stage of the final management. It is the only institution in Poland, which can operate radioactive waste repositories[50]. Currently it operates the NRWR in Rozan. The RWMP is also responsible for preparations for the construction, construction and operation of a new surface repository of radioactive waste and for closing and monitoring of the NRWR in Rozan. A change of the legal form of the RWMP is not planned (currently it is a state-owned public utility).

[46] Art. 57 c Act – Atomic Law. Moreover, according to art. 9 section 2 paragraph 8 Act of 4 September 1997 about departments of governmental administration (Journal of Laws from 2015, item 812) the Minister of Economy is responsible for overall activities related to use of nuclear energy for the social-and-economic needs of the country.

[47] Art. 110 Act – Atomic Law.

[48] Art. 4 section 1 Act – Atomic Law.

[49] Art. 56 section 1 and art. 114 section 1 Act – Atomic Law.

[50] Art. 56 section 2 Act – Atomic Law.

7.5. INVESTORS / OPERATORS OF NUCLEAR POWER FACILITIES

The investor of nuclear power facilities, and after the commencement of their operation - their operator, is an entity responsible for ensuring adequate financial resources, adequately qualified staff and who has experience and knowledge necessary to construct and operate such facilities. An operator of a nuclear power plant will be responsible for ensuring the possibility to manage radioactive waste and spent nuclear fuel, including its storage, from the moment of its creation to its transfer for depositing, including the financing of depositing. In order to ensure means to cover costs of the final management of radioactive waste and spent nuclear fuel the operator shall create a decommissioning fund and will feed it with contributions proportionally to the amount of electric energy generated by the power plant.

7.6. RESEARCH INSTITUTES

Research-and-development institutes having appropriate knowledge and capacity to conduct research-and-development work in the field of nuclear energy industry, including in particular management of radioactive waste and spent nuclear fuel shall conduct research in the country, aiming at development of technologies used for management of radioactive waste as well as enabling for keeping in constant contact with the world science and monitoring of trends in development of research aiming at the final stage of the fuel cycle.

7.7. INDICATORS FOR MONITORING OF THE NATIONAL PLAN IMPLEMENTATION

In order to quantify the objectives of the National Plan and to allow for monitoring of the stage of its implementation, a set of performance indicators has been developed in relation to the objectives that can be quantified.

Table 4. Set of performance indicators of the National Plan.

Indicator	Base value 2014	Value 2020	Value 2025	Value 2030
Objective 1: Preparation for closing, final closing and long-term monitoring of the NRWR in Rozan.	0%	15%	30%	100% (ultimately)
Objective 2: Selection of localization, construction and commissioning of the NSRWR.	0%	30%	100%	100% (ultimately)
Objective 3: Preparation for construction of the DRWR, including implementation of the PURL program.	0%	5%	25%	50%
Objective 4: Modification of principles for management of radioactive waste, including radioactive waste originating from nuclear energy industry.	50%	80%	100% (ultimately)	100% (ultimately)

Objective 5: Modification of the financing system for management of radioactive waste based on the principle “the polluter pays”.	30%	70%	100% (ultimately)	100% (ultimately)
Objective 6: Creation of research-and-development program concerning management of radioactive waste and spent nuclear fuel.	0%	100% (ultimately)	100% (ultimately)	100% (ultimately)
Objective 7: Preparation of personnel for the national institutions involved in management of radioactive waste and supervision over this management.	0%	50%	100% (ultimately)	100% (ultimately)

CHAPTER 8. FINANCIAL SOLUTIONS FOR RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT

In Poland, we apply the 'polluter pays' principle - according to which an entity in which radioactive waste or spent nuclear fuel are generated is required to provide funding to manage them from the moment of their production until their transfer to a repository, including the financing of depositing[51]. This responsibility cannot be transferred to another entity.

There are two solutions concerning financing of radioactive waste and spent nuclear fuel management - one for waste originating from nuclear energy industry, and the other for waste originating from producers from outside of nuclear energy industry.

8.1. FINANCING OF MANAGEMENT OF SPENT NUCLEAR FUEL AND RADIOACTIVE WASTE ORIGINATING FROM NUCLEAR ENERGY INDUSTRY

Financing of the final management of radioactive waste and spent nuclear fuel originating from nuclear energy industry will be made from the means of the decommissioning fund.

The final management of radioactive waste and spent nuclear fuel includes costs of the following actions:

• depositing of spent nuclear fuel from the entire period of operation of the nuclear power plant;

• depositing of low-level, intermediate-level and high-level radioactive waste generated in a nuclear power plant throughout the entire period of its operation, including produced in storage facilities of spent nuclear fuel operating for the needs of the nuclear power plant;

• decommissioning of a nuclear power plant, storage facilities of radioactive waste and storage facilities for spent nuclear fuel located on the premises of the nuclear power plant;

• management of radioactive waste arising in the process of decommissioning of a nuclear power plant, storage facilities of radioactive waste and storage facilities for spent nuclear fuel operating for the needs of the nuclear power plant.

The decommissioning fund shall not finance the costs of radioactive waste and spent nuclear fuel management from the moment of their production in the nuclear power plant until their transfer to the final management in the RWMP. The cost of such activity shall be covered from the current assets of the nuclear power plant operator.

The decommissioning fund, created by the nuclear power plant operator, shall be a separated special fund with an associated separate bank account. It will be powered by quarterly payments made by the nuclear power plant operator, and the value of such payments will depend on the quantity of MWH of electricity produced in the nuclear power plant[52].

The Council of Ministers shall define by way of a regulation the amount of payment on each MWh of electric power produced in the nuclear power plant considering the intended period of operation of a nuclear power plant, the amount of radioactive waste produced by such a plant, including spent nuclear fuel, costs of the final management of such waste as well as costs of decommissioning of the nuclear power plant, which shall be updated not less than every five years[53]. In the Regulation of the Council of Ministers of 10 October 2012 the

[51] Art. 48a section 1 Act – Atomic Law.

[52] Art. 38d section 1 and 2 Act – Atomic Law.

[53] Art. 38b section 2 Act – Atomic Law.

Council of Ministers determined the amount of contribution as the sum of PLN 17.16 on each megawatt hour (MWh) of electricity produced in the nuclear power plant[54].

The updated forecast costs of decommissioning of the nuclear power plant are subject to validation by the President of the NAEA.

President of the NAEA will also receive reports from the operator of the nuclear power plant on the amount of contributions made to the decommissioning fund and the amount of MWh of electricity produced. In the case of delay in payment of at least 18 months, he will be able to issue an order to suspend the operation of the nuclear power plant[55].

The funds accumulated in the decommissioning fund can be invested only in term deposits, or intended to acquire long-term bonds issued by the Minister of Finance[56].

Each withdrawal from the decommissioning fund will require a favorable opinion of the President of the NAEA.

8.2. FINANCING OF MANAGEMENT OF SPENT NUCLEAR FUEL AND RADIOACTIVE WASTE ORIGINATING FROM OUTSIDE OF NUCLEAR ENERGY INDUSTRY

Costs of management of radioactive waste and spent nuclear fuel originating from producers outside of the nuclear energy industry, i.e. from medical, scientific and industrial applications shall be covered by producers of such waste.

The RWMP shall charge fees from producers of radioactive waste on account of the delivered services according to the price list approved by the Minister of Economy.

The scope of services rendered by the RWMP includes management and depositing of radioactive waste, management and depositing of radioactive sources, management and depositing of other radioactive sources, services associated with spent nuclear fuel, services in the scope of decontamination as well as transportation and escorting.

Costs related to collection, transportation, reprocessing, storage and depositing of radioactive waste and other radioactive substances originating from:
• illegal traffic of unknown origin;
• activity of an organizational unit which while terminating its activity is insolvent;
• resulting from contamination of the environment, of which the perpetrator is not known,
are covered from the state budget.

The RWMP receives an earmarked subsidy from the state budget for the implementation of the tasks as defined by the law[57], covering the following tasks:

• collection, transportation and registration of sources, waste and other radioactive substances and nuclear materials from all over the country, including spent nuclear fuel;

• storage and depositing of sources, waste and other radioactive substances and nuclear materials and physical protection of NRWR in Rozan;

[54] Journal of Laws from 2012, item 1213.

[55] Art. 38d section 7 Act – Atomic Law.

[56] Art. 38d Act – Atomic Law.

[57] Art. 119 section 1 Act – Atomic Law.

• reprocessing of radioactive waste;

• operation of storage facilities for spent nuclear fuel originating from research nuclear reactors and physical protection of nuclear facilities;

• ensuring nuclear safety and radiological protection concerning management of radioactive sources, waste and other radioactive materials and spent nuclear fuel;

• technical services and repairs of plant facilities, equipment and plant's own installations needed for management of radioactive waste and spent nuclear fuel as well as transportation, storage and depositing of nuclear materials and radioactive sources (delivered by the RWMP on their own).

The RWMP may receive a targeted subsidy from the state budget for implementation of investments related to execution of activities concerning management of radioactive waste and spent nuclear fuel[58].

[58] Art. 119 section 1a Act – Atomic Law.

CHAPTER 9. INTERNATIONAL COMMITMENTS CONCERNING MANAGEMENT OF RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL

9.1. JOINT CONVENTION ON THE SAFETY OF SPENT NUCLEAR FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

The basic act of international law governing the issue of radioactive waste and spent nuclear fuel management is the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, signed at Vienna on 5 September 1997, ratified by Poland on 9 March 2000.

The Joint Convention requires the Parties to take measures aiming at protection of individuals, society and the environment from radiological hazards in all stages of spent nuclear fuel and radioactive waste management[59].

Therefore, the Joint Convention imposes on the Parties a number of specific obligations regarding, among others:

• reviews of facilities for management of radioactive waste and spent nuclear fuel existing at the time of its entry into force;

• localization of new facilities taking into account all factors affecting the safety of the facility, after assessment of its impact on the society and the environment;

• designing, construction, operation and decommissioning of facilities for spent nuclear fuel and radioactive waste management;

• carrying out safety assessments of facilities for radioactive waste and spent nuclear fuel management;

• applying appropriate security measures after closing of radioactive waste repositories;

• radiation protection during the operation of the radioactive waste repository and emergency preparedness;

• export, import and transportation of radioactive waste and spent nuclear fuel through the territory of the Parties.

The motivating instrument to fulfill the provisions of the Joint Convention by the Parties is an obligation to develop and submit national reports at review meetings to inform on how each of the obligations imposed by the Joint Convention is implemented[60].

The provisions of the Act - Atomic Law are in accordance with provisions of the Joint Convention.

[59] Art. 4 and 11 Joint Convention.

[60] Art. 30 and 32 Joint Convention.

9.2 THE TREATY ESTABLISHING THE EUROPEAN ATOMIC ENERGY COMMUNITY

9.2.1. ART. 37 OF THE TREATY ESTABLISHING THE EUROPEAN ATOMIC ENERGY COMMUNITY[61] (THE EURATOM TREATY)

In the Euratom Treaty, the issue of radioactive waste is included in art. 37, which requires each Member State to provide the European Commission with general data relating to any plan for depositing of radioactive waste. The form of making these data accessible is optional, but it is required that on their basis it is possible to determine whether the implementation of the plan may result in the radioactive contamination of water, soil or air of another Member State.

The decisive opinion in this regard is issued by the European Commission, upon consultations with a group of experts appointed by the Scientific – Technical Board.

The purpose of this provision is to eliminate any possibility of radioactive contamination of another Member State.

Details to Article 37 are included in the Commission Recommendation of 11 October 2010 on application of Art. 37 of the Euratom Treaty (2010/635/Euratom)[62]. The Recommendation explains extensively the expressions used in Art. 37 of the Euratom Treaty: "depositing of radioactive waste" and "general data" as well as the specified manner and time for sharing the general information. In addition, it is set forth that the Member State shall inform the European Commission about the measures taken to implement the recommendations contained in the opinion issued by this authority.

9.2.2. COUNCIL DIRECTIVE 2006/117/EURATOM OF 20 NOVEMBER 2006 ON SURVEILLANCE AND CONTROL OF SHIPMENTS OF RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL[63].

The said Directive establishes a system of surveillance and control of transborder shipments of radioactive waste and spent nuclear fuel as well the principle of shipment of these substances between Member States of the European Union, as well as between Member States and the countries which are not members of the European Union.

Under this Directive, transborder shipments of radioactive waste and spent nuclear fuel are based on a system of permits and approvals issued by the competent authorities of the Member States of the European Union, and, in certain cases, the authorities of non-EU countries.

Council Directive 2006/117/Euratom was implemented into the national law by the provisions of Act of 11 April 2008 amending the Act - Atomic Law[64] along with the executive act[65].

[61] Official Journal EU C 327 of 26 October 2012, p. 20.

[62] Official Journal EU L 279 of 23 October 2010, p.36.

[63] Official Journal EU L 337 of 5 December 2006, p.21.

[64] Journal of Laws from 2008 No. 93, item 583.

[65] Regulation of the Council of Ministers of 21 October 2008 about granting a permit and approval for import to the territory of the Republic of Poland, export from the territory of the Republic of Poland and transit through this territory of radioactive waste and spent nuclear fuel (Journal of Laws No. 219, item 1402).

9.2.3. COUNCIL DIRECTIVE 2011/70/EURATOM OF 19 JULY 2011 ESTABLISHING A COMMUNITY FRAMEWORK FOR RESPONSIBLE AND SAFE MANAGEMENT OF SPENT NUCLEAR FUEL AND RADIOACTIVE WASTE

The Directive requires Member States to introduce national legislative, regulatory and organizational framework ensuring a high level of safety of spent nuclear fuel and radioactive waste management. In addition, it guarantees the society access to information and its participation in issues related to management of these materials. Directive 2011/70/Euratom places also an obligation upon each Member State to develop and implement the National Plan of spent nuclear fuel and radioactive waste management, which is to be an instrument for the implementation of State obligations deriving from the fact, that it bears the ultimate responsibility for radioactive waste and spent nuclear fuel produced on its territory.

This Directive was implemented into the Polish legal system by the provisions of Act of 4 April 2014 amending the Act - Atomic Law and some other acts (see: footnote No. 2).

9.2.4. COMMISSION RECOMMENDATION 2006/851/EURATOM CONCERNING MANAGEMENT OF DECOMMISSIONING FUNDS, DESIGNED FOR DECOMMISSIONING OF NUCLEAR INSTALLATIONS, SPENT NUCLEAR FUEL AND RADIOACTIVE WASTE[66]

The recommendation proposes measures to ensure availability of financial resources in due time necessary for decommissioning of nuclear installations and management of spent nuclear fuel and radioactive waste[67].

According to the recommendation, nuclear installations should accumulate adequate decommissioning funds from income gained from their operations in the period of operation. In addition, the recommendation provides guidelines for estimating the costs of liquidation and rules for the use of decommissioning funds, and provides that, due to differences in the use of decommissioning funds, technical liquidation and waste management should be considered separately, on the basis of separate cost calculations.

9.3. GLOBAL THREAT REDUCTION INITIATIVE (GTRI)

In 2006, Poland joined the GTRI initiative, whose main idea is to eliminate high-enriched uranium from use for peaceful purposes and gradually replace it with low-enriched uranium. Under this program, the countries using in research reactors high-enriched nuclear fuel originating from the United States of America or the former Union of Soviet Socialist Republics (USSR) and the Russian Federation have been offered financial assistance in its exports to the United States or the Russian Federation respectively. Until the end of 2014 seven shipments of spent nuclear fuel used in the EWA and MARIA research reactors, both of high-enriched and low-enriched, were executed to the Russian Federation. Due to these shipments the temporary storage facilities for spent nuclear fuel of the RWMP in Swierk-Otwock have been completely emptied. Other currently present in Poland high-enriched spent nuclear fuel is in the technological pool, which after cooling will be also exported to the Russian Federation.

[66] Official Journal EU L 330 of 28 November 2006, p. 31.

[67] The nuclear installation in the recommendation was defined as a civil facility and its associated premises, buildings and equipment, where radioactive materials are produced, reprocessed, operated, stored or managed.

The legal basis for implementation of the objectives of the GTRI by Poland are agreements with the United States of America and the Russian Federation.

9.3.1 AGREEMENTS WITH THE UNITED STATES OF AMERICA

• Agreement of 8 September 2009 between the Government of the Republic of Poland and the Government of the United States of America on cooperation in transfer to the territory of the Russian Federation of nuclear fuel that was supplied by the Union of Soviet Socialist Republics or the Russian Federation and is stored on the territory of the Republic of Poland (the framework agreement)[68]. The agreement entered into force on 8 September 2009.

• Agreement of 11 September 2009 between the Minister of Economy of the Republic of Poland and the Department of Energy of the United States of America on cooperation in the field of countering the proliferation of nuclear materials and technologies (the executive agreement)[69]. The agreement entered into force on 11 September 2009.

The above agreements provide for, among others, free-of-charge assistance of the United States with exports to the Russian Federation of nuclear fuel and spent nuclear fuel, which was supplied by the former USSR or the Russian Federation. In execution of these agreements 2540 fuel elements type WWR with the initial enrichment of 36% and 498 fuel elements type MR with the initial enrichment of 80% or 36% were exported until the end of 2014. In addition, 23 elements of high-enriched nuclear fuel items were exported, that had not been used in the MARIA reactor due to the process of core conversion into low-enriched fuel. In 2016 the last export of spent nuclear fuel is planned including shipment of 51 fuel elements type MR.

9.3.2 AGREEMENT WITH THE RUSSIAN FEDERATION

• Agreement of 1 September 2009 between the Government of the Republic of Poland and the Government of the Russian Federation on cooperation in the entry of irradiated nuclear fuel from a research reactor to the Russian Federation[70].

The agreement was concluded for the period of 20 years, and will be automatically extended for successive two-year periods until its termination by either party.

The agreement sets out the conditions of entry of spent nuclear fuel to the Russian Federation for its storage, and then reprocessing and maintaining of the radioactive waste resulting from the reprocessing on the territory of the Russian Federation.

Under the agreement:

• low-enriched spent nuclear fuel has been exported to the Russian Federation. By June 2014, the export included 2595 fuel elements with the initial enrichment of 10%;

• radioactive waste arising from the reprocessing of high-enriched and low-enriched spent nuclear fuel imported from Poland will remain in the Russian Federation.

[68] Unpublished.

[69] Unpublished.

[70] Unpublished.

10. TRANSPARENCY,PUBLIC INFORMATION AND INVOLVEMENT IN THE DECISION-MAKING PROCESS CONCERNING MANAGEMENT OF RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL

10.1. LEGAL GROUNDS OF PUBLIC INFORMATION AND PARTICIPATION IN THE DECISION-MAKING PROCESS.

Principles of informing the society and its participation in the decision-making process concerning management of radioactive waste and spent nuclear fuel are regulated by the following legislative acts:

• Act of 3 October 2008 on the provision of information on the environment and environmental protection, public participation in environmental protection and environmental impact assessment[71] (EIA Act);
• Act – Atomic Law.

The provisions of the above normative acts are in accordance with the following binding acts of international and European law:

• Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, signed on 25 June 1998 in Aarhus, Denmark (Journal of Laws from 2003 No. 78, item 706);
• Convention on Environmental Impact Assessment in a Transborder Context, signed in Espoo on 25 February 1991 (Journal of Laws from 1999 No. 96, item 1110);
• Directive 2001/42/EC of the European Parliament and the Council of 27 June 2001 on assessment of the effects of certain plans and programs on the environment (Directive 2001/42/EC) (implemented with provisions of the EIA Act);
• Directive 2011/70/Euratom (implemented with provisions of the Act - Atomic Law).

10.2. PUBLIC INFORMATION

Provisions of the Act - Atomic Law provides the society an opportunity to obtain information concerning:

• status of radiological protection of the radioactive waste repository,
• its impact on human health and the environment,
• size and isotopic composition of radioactive releases from the repository into the environment.

Everyone can obtain such information in writing from the head of an organizational unit engaged in activities involving exposure, consisting of operation or closing of a radioactive waste repository (head of the entity). In addition, not less than once every 12 months, the head of the entity is required to place the above mentioned information on the website of the organizational unit. It should be emphasized that the rules do not foresee any situation in which the head of the entity may refuse to provide such information. Also, the phrase "everyone" ensures that any entity (whether a natural person or an organizational unit) will have the right to obtain the required information.

The President of the NAEA is also obliged to grant information under the EIA Act, providing information about:

[71] Official Journal from 2013, item 1235 as amended.

• state of the radiological protection of radioactive waste repositories, their impact on human health and the environment;
• size and isotopic composition of radioactive releases from radioactive waste repositories into the environment;
• incidents in radioactive waste repositories resulting in creation of hazards;
• permits issued in respect to radioactive waste repositories.

Information on the physical protection, nuclear material safeguards and information constituting a trade secret only are not subject to disclosure under the provisions of the Unfair Competition.

Also in such cases, in accordance with Art. 4 EIA Act, everyone is entitled to receive information about the environment and its protection under the conditions specified by law.

Additionally, in accordance with Art. 55c section 3 and 4 of the Act - Atomic Law, if any events likely to cause or causing hazards occur in a radioactive waste repository, the additional disclosure requirements rest with the head of the entity, namely:

• he shall immediately inform the President of the NAEA, the voivode, the starost and the voit (burgomaster, city mayor) of the municipality, on territory of which the repository is situated, and the voit (burgomaster, city mayor) of the municipalities adjacent to such a municipality of the events in the repository that are likely to cause or causing a hazard,
• he publishes on the website of this entity and transmits to the President of the NAEA the information on the events giving rise to danger that occurred in the previous 12 months.

The Act - Atomic Law regulates public information concerning nuclear facilities in a similar manner as indicated above[72].

10.3. PUBLIC PARTICIPATION IN THE DECISION-MAKING PROCESS

10.3.1. ENVIRONMENTAL ASSESSMENT

The Strategic Environmental Impact Assessment procedure (SEIA procedure) of the National Plan has been carried out in order to select the most favorable solutions in terms of possible environmental effects in regard to radioactive waste management and to ensure public participation in the planned activities related to management of radioactive waste and spent nuclear fuel,.

Within the Strategic Environmental Impact Assessment procedure a forecast of impact of the National Plan on the environment was developed. Next, the project along with a forecast underwent public consultation and was reviewed by the General Director for Environmental Protection and Chief Sanitary Inspector, in accordance with provisions of the EIA. Since the Forecast did not show the possibility of transborder impact, transborder consultations were not carried out. Upon the completion of the SEIA procedure, a written summary was made according to art. 55 section 3 Act EIA, including among others, the information about the manner and the extent to which the findings of the forecast environmental impact, opinions of relevant authorities and submitted comments and proposals were taken into account. The conclusions from this summary are included in Appendix No. 3 to the National Plan.

[72] Art. 35a Act – Atomic Law.

According to provisions of the regulation of the Council of Ministers of 9 November 2010 about enterprises that might have a significant impact of the environment[73] the installations related to management of spent nuclear fuel or radioactive waste mentioned in the National Plan constitute enterprises that always might have a significant impact on the environment. Therefore the execution of this type of investments shall require performance of the environmental impact assessment of the enterprise in accordance with provisions of EIA Act. In the course of this procedure proceedings with participation of the society will be required.

10.3.2. DECISIONS ISSUED BY PRESIDENT OF NAEA

According to the Act - Atomic Law, the President of the NAEA shall issue a permit for the construction, operation and closing of radioactive waste repositories and the construction, commissioning, operation and decommissioning of nuclear facilities (art. 4 section 1).

In both cases, the Act provides for similar arrangements for public participation in the decision-making process[74].

In accordance with Art. 55n section 1, the President of the NAEA, after receipt of an application for a permit for activities involving exposure, consisting of the construction of a radioactive waste repository, shall promptly announce on his website in the Public Information Bulletin the content of the application together with the summary report of safety and the information on:

• initiation of the procedure about issuance of a permit for the construction of the repository;
• possibility to submit comments and proposals;
• the manner and place where comments and proposals may be submitted, indicating at the same time the 21-day time limit for their submission;
• date and place of the administrative hearing.

The specific regulations of the Act - Atomic Law ensuring public participation are:

• Art. 55n section 3, which provides that the hearing referred to in Art. 89 Act of 14 June 1960 - Code of Administrative Procedure is open to the public;
• Art. 55n section 4, according to which the President of the NAEA provides in the justification of the decision the information about public participation in the procedure and about the manner in which the submitted comments and proposals were taken into account.

10.4. FEE FOR LOCATION OF THE NRWR ON THE GMINA TERRITORY

The gmina on whose territory the NRWR is located in the period of its operation is entitled to the annual fee from the stet budget of 400% of the gmina income from tax on real property received in the previous year, yet not higher than 10 500 thousand zlotys. Upon making a decision about closing of the repository the gmina shall be entitled to a fee of 50% of the gmina income due to tax on real property received in the year of the closing, for a period equal to the period of the repository operation[75].

The fee from the stet budget is vested to the gmina regardless of the type of radioactive waste deposited in the repository. The condition is recognition of the repository as the NRWR according to art. 53 section 2 Act – Atomic Law.

[73] Journal of Laws No. 213, item 1397 as amended.

[74] Art. 39d and art. 55n Act - Atomic Law.

[75] Art. 57 Act – Atomic Law.

APPENDIX 1. PLAN OF ACTIONS FOR THE YEARS 2015-2020

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Action I. Management of low-level and intermediate-level radioactive waste:

1. Preparations for closing and the final closing of NRWR Rozan.

2. Selection of a location, construction and commissioning of the NSRWR.

Action II. Management of high-level radioactive waste and spent nuclear fuel.

Action III. Modification of rules for management of radioactive waste and spent nuclear fuel as well as decommissioning of nuclear power plants.

Action IV. Creating a research-and-development program on radioactive waste and spent nuclear fuel management.

Action V. Preparation of personnel for national institutions involved in the management of radioactive waste and spent nuclear fuel.

ACTION I. MANAGEMENT OF LOW-LEVEL AND INTERMEDIATE-LEVEL RADIOACTIVE WASTE

1. Preparations for closing and the final closing of the NRWR Rozan.

Action 1.1.1.	**Safety assessment for closing of the existing NRWR**
Implementation instruments	• Act - Atomic Law and its implementing legislation
Responsible entities	• Minister competent for economy • Minister competent for the environment • RWMP
Deadlines	• Preparation of documentation for the implementation of the procedure to select a contractor - 2014 • Providing financing - 2014 • Selection of the contractor of Assessment - 2016 • Execution - 2018 • Receipt – 2019
Sources of financing	• Own funds of the Minister competent for economy within the limit of expenditures defined for him for a given budgetary year, • Possibly, if an opportunity arises, funds coming from the NFEPWM (according to provisions of the PNPP), • In the event there is lack of possibility to finance these actions from the above mentioned sources, the execution of these tasks will be financed from the funds of the long-term program.

Action 1.1.2.	**Development of the concept of the NRWR closing in Rozan**
Implementation instruments	• Act - Atomic Law and its implementing legislation
Responsible entities	• Minister competent for economy • RWMP

Deadlines	• Drafting of the preliminary concept – 2019 • Development of the plan of closing along with the costs and schedule – 2020
Sources of financing	• Own funds of the Minister competent for economy within the limit of expenditures defined for him for a given budgetary year

2. Selection of localization and preparations for construction of the NSRWR.

Action 1.2.1.	**Safety assessment for the NSRWR**
Implementation instruments	• Atomic Law Act and its implementing legislation
Responsible entities	• Minister competent for economy • Minister competent for the environment • RWMP
Deadlines	• Preparation of documentation for the implementation of the procedure to select a contractor - 2015 • Providing financing - 2015 • Selection of a contractor - 2016 • Execution - 2019 • Receipt – 2020
Sources of financing	• Own funds of the Minister competent for economy within the limit of expenditures defined for him for a given budgetary year, • Possibly, if an opportunity arises, funds coming from the NFEPWM (according to provisions of the PNPP), • In the event there is lack of possibility to finance these actions from the above mentioned sources, the execution of these tasks will be financed from the funds of the long-term program.

Action 1.2.2.	**Selection of a localization and preparations for construction of the NSRWR**
Implementation instruments	• Act - Atomic Law and its implementing legislation
Responsible	• Minister competent for economy

entities	• RWMP
Deadlines	• Finding potential sites for NSRWR – 2017 • Selection of localization of NSRWR – 2018 • Drafting a repository design – 2018 • Starting the process of obtainment of consents and permits necessary for the construction – 2019
Sources of financing	• Own funds of the Minister competent for economy within the limit of expenditures defined for him for a given budgetary year

ACTION II. MANAGEMENT OF HIGH-LEVEL RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL

Selection of a safe localization for a deep radioactive waste repository.

Action 2.1.1.	**Construction of the PURL**
Implementation instruments	• Act - Atomic Law and its implementing legislation - Geological and Mining Law Act and its implementing legislation
Responsible entities	• Minister competent for economy • Minister competent for the environment • Research-and-development institutes • RWMP
Deadlines	• Analysis of conditions and development of a draft of the enterprise - 2015 • Revision of the localization based on the law criteria - 2017 • Selection of promising areas for the research - 2020
Sources of financing	• Funds from NFEPWM, • Own funds of the Minister competent for economy within the limit of expenditures defined for him for a given budgetary year.

ACTION III. MODIFICATION OF RULES OF RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT AS WELL AS OF DECOMMISSIONING OF NUCLEAR POWER PLANTS

Action 3.1.	**Institutional-and-legal system**

Implementation instruments	• Amendments to the Act - Atomic Law and its implementing legislation
Responsible entities	• Minister competent for economy • President of the NAEA
Deadlines	• Development of a preliminary institutional concept of the system of radioactive waste management in Poland, including waste originating from nuclear energy industry – 2016 • Development of a detailed institutional concept of the system of radioactive waste management in Poland, including waste originating from nuclear energy industry – 2019
Sources of financing	• Own funds of the Minister competent for economy within the limit of expenditures defined for him for a given budgetary year.

Action 3.2.	**System of financing of radioactive waste and spent nuclear fuel management, including nuclear energy industry**
Implementation instruments	• Amendments to the Act - Atomic Law and its implementing legislation
Responsible entities	• Minister competent for economy
Deadlines	• Development of a preliminary concept of financing of the system of the radioactive waste management in Poland, including waste originating from nuclear energy industry – 2016 • Development of a detailed concept of financing of the system of the radioactive waste management in Poland, including waste originating from nuclear energy industry – 2019
Sources of financing	• Own funds of the Minister competent for economy within the limit of expenditures defined for him for a given budgetary year.

ACTION IV. CREATION OF A RESEARCH-AND-DEVELOPMENT PROGRAM CONCERNING RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT

Action 4.1.	**Creation of a research-and-development program concerning radioactive waste and spent nuclear fuel management**

Implementation instruments	• Act on research institutes
Responsible entities	• Minister competent for economy • Minister competent for science • NCRD • NCS • Research and development institutes
Deadlines	• Drafting a research-and-development program - 2015 • Selecting contractors - 2016 • Execution - 2019
Sources of financing	• Funds from NCRD and NCS

ACTION V. PREPARATION OF PERSONNEL FOR THE NATIONAL INSTITUTIONS AND ECONOMIC ENTITIES INVOLVED IN MANAGEMENT OF RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL AND SUPERVISION OF SUCH MANAGEMENT

Action 5.1.	**Preparation of personnel**
Implementation instruments	• Act - Civil Service Law • Act - Atomic Law
Responsible entities	• Minister competent for economy • President of the NAEA • RWMP • Research and development institutes • Investor
Deadlines	• Estimation of needs of individual institutions in this regard - 2016 • Execution of the actions – from 2017 – the continuous nature
Sources of financing	• Budget of individual institutions

APPENDIX NO. 2. BALANCE OF RADIOACTIVE WASTES COLLECTED BY THE RWMP IN YEARS 2000-2013

	2000		2001		2002		2003		2004		2005		2006	
	solid	liquid	solid	liquid	Solid	liquid	solid	liquid	solid	liquid	solid	liquid	solid	liquid
waste														
or (m^3)	16.55	265.00	14.60	110.00	8.00	95.00	6.00	30.00	6.00	98.21	5.030	21.00	12.92	152.09
(m^3)	4.65	-	1.20	-	-	-	-	-	-	-	-	-	-	-
M (m^3)	11.85	0.41	10.75	0.34	7.200	0.26	7.80	0.23	8.03	0.13	8.60	0.02	7.75	0.03
	5.89	8.50	76.95	8.00	3.10	4.00	18.95	8.00	7.06	-	2.56	4.00	0.33	0.00
ide of NCNR cientific applications)	45.83	1.30	41.98	1.39	29.73	1.59	26.79	1.45	31.39	2.88	26.13	1.66	21.17	0.96
	84.76	*275.20*	*145.48*	*119.73*	*48.03*	*100.85*	*59.54*	*39.68*	*52.48*	*101.22*	*42.32*	*26.68*	*42.17*	*153.08*
waste														
	63.22	274.81	128.14	119.40	39.77	100.64	47.62	39.66	40.17	28.19	31.26	26.68	41.57	153.08
evel (m^3)	-	0.40	-	0.33	-	0.21	1.88	0.02	1.35	73.03	0.65	-	0.60	0.02
(m^3)	3.74	-	1.66	-	5.07	-	2.16	-	0.79	-	1.90	-	2.46	-
detectors (pc)	24 367		20 490		10 148		9 995		12 211		14101		19 394	
(pc)	898		875		1235		1195		619		825		1 397	
rred for in NRWR Rozan														
	44.87		137.16		40.72		40.99		33.03		36.30		67.95	
31 December in a	1.40		1.57		2.41		1.24		0.52		1.87		1.74	