

**INTEGRATED  
REVIEW SERVICE FOR  
RADIOACTIVE WASTE AND  
SPENT FUEL MANAGEMENT,  
DECOMMISSIONING AND  
REMEDICATION (ARTEMIS)**

**MISSION**

**TO**

**POLAND**

*WARSAW, POLAND*

*1 to 10 October 2017*

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY  
DEPARTMENT OF NUCLEAR ENERGY





**REPORT OF THE  
INTEGRATED REVIEW SERVICE FOR RADIOACTIVE WASTE AND SPENT  
FUEL MANAGEMENT, DECOMMISSIONING AND REMEDIATION (ARTEMIS)  
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FUEL MANAGEMENT, DECOMMISSIONING AND REMEDIATION (ARTEMIS)  
MISSION  
TO  
POLAND**

**Mission dates:** *1 to 10 October 2017*  
**Location:** *Warsaw, Poland*  
**Organized by:** *IAEA*

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IAEA - October 2017

**The number of recommendations, suggestions and good practices is in no way a measure of the status of the national radioactive waste and spent fuel management. Comparisons of such numbers between ARTEMIS reports from different countries should not be attempted.**

## CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>I. INTRODUCTION.....</b>	<b>3</b>
<b>II. OBJECTIVE AND SCOPE.....</b>	<b>4</b>
<b>III. BASIS FOR THE REVIEW.....</b>	<b>5</b>
<b>1. NATIONAL POLICY AND FRAMEWORK FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT .....</b>	<b>6</b>
<b>1.1. NATIONAL POLICY.....</b>	<b>6</b>
<b>1.2. LEGAL, REGULATORY AND ORGANISATIONAL FRAMEWORK .....</b>	<b>6</b>
<b>2. NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT .....</b>	<b>10</b>
<b>3. INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE .....</b>	<b>13</b>
<b>4. CONCEPTS, PLANS AND TECHNICAL SOLUTIONS FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT .....</b>	<b>17</b>
<b>5. SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES.....</b>	<b>19</b>
<b>6. COST ESTIMATES AND FINANCING OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT .....</b>	<b>23</b>
<b>7. CAPACITY BUILDING FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT – EXPERTISE, TRAINING AND SKILLS .....</b>	<b>25</b>
<b>APPENDIX 1: TERMS OF REFERENCE .....</b>	<b>28</b>
<b>APPENDIX 2: MISSION PROGRAMME.....</b>	<b>31</b>
<b>APPENDIX 3: RECOMMENDATIONS AND SUGGESTIONS .....</b>	<b>1</b>
<b>APPENDIX 4: IAEA REFERENCE MATERIAL USED FOR THE REVIEW.....</b>	<b>1</b>



## EXECUTIVE SUMMARY

At the request of the Government of Poland, the IAEA organized an ARTEMIS review of Poland's *National Plan of Radioactive Waste and Spent Nuclear Fuel Management*. The objective of the ARTEMIS Peer Review Service is to provide independent expert opinion and advice on radioactive waste and spent nuclear fuel management, based upon the IAEA safety standards and technical guidance, as well as international good practice. Poland requested this review to fulfill its obligations under article 14(3) of the European Council Directive 2011/70/EURATOM of 19 July 2011 establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste (EC Waste Directive).

The review was performed by a team of senior international experts in the field of radioactive waste and spent fuel management, from IAEA Member States, with IAEA staff providing coordination and administrative support.

The review addressed the following topics consistent with the elements of the EC Waste Directive:

- National policy and framework
- National strategy
- National inventory
- Concepts, plans and technical solutions
- Safety case and safety assessment of activities and facilities
- Cost estimates and financing
- Capacity building

The ARTEMIS team noted the strong commitment of the Government of Poland to ensure that a comprehensive National Plan is established and acknowledged the intention that the resources required for implementing this plan will be available. The ARTEMIS team further noted the long-standing experience in maintaining a comprehensive national radioactive waste and spent fuel inventory. In addition, the predisposal management steps needed for the existing radioactive waste and research reactor spent fuel are implemented. The estimation of waste arising from the potential future nuclear power programme provides a good basis for update and refinement as the programme progresses. Regarding the plan for the waste management costs associated with possible future nuclear power the ARTEMIS team commends the early establishment of financial provisions for the future nuclear power.

The National Plan identifies the main tasks and related actions for safe management of all current and future radioactive waste and spent fuel and proposes timeframes for their implementation. The implementation, however, is delayed, mainly due to changes in Government policy for nuclear power programme (NPP programme), delays in anticipated progress in the NPP programme and partly to the delays in achieving public acceptance in relation to the new surface disposal facility. Consequently, an update of the National Plan is needed with clear specification of objectives, coherence, timeframes, and tasks prioritization. Furthermore, supporting research and development (R&D) and relevant resources should be available when needed.

In this regard, the Artemis team has provided the following advice:

- The Government should consider enhancing the transparency of the site selection process for the new surface facility by making publicly available the description of the process for involving the public and potential host municipality at the various stages of site selection.

- The Government should ensure that a programme is established for the R&D activities to be undertaken in Poland to support the implementation of the National Plan. The programme should establish priorities with clear timeframes and the associated resources for its timely execution.
- During the coming update of the National Plan the Government should consider providing measurable indicators with clearly identified timeframes and indication of dependencies, so that progress in the implementation of the National Plan can be monitored effectively.
- The Government should undertake a review of the life-time cost estimate and ensure that funding to cover the required activities is made available to ZUOP in a timely manner.
- For the effective implementation of the National Plan, the Government should consider further developing its human resource framework plan to ensure that the specific needs for the management of radioactive waste and spent nuclear fuel are explicitly identified and prioritized.

ZUOP is designated as the organization responsible for the overall radioactive waste and spent fuel management, and as such has the prime responsibility for its safety. It is currently operating the existing facilities in Świerk and Różan and will also be responsible for the design, construction, operation and closure of the new surface disposal facility. The development of an appropriate safety case supported by a safety assessment is an essential part of these activities. In order to efficiently carry out the tasks, the operator needs a clear implementation programme, adequate resources and competences including the post-closure safety expertise, and a dedicated R&D programme to support these activities.

In this regard, the Artemis team has provided the following advice:

- ZUOP should provide for an external or internal independent verification of its pre-disposal management activities and disposal of radioactive waste.
- ZUOP should prepare up to date safety case for the Różan Facility including a safety assessment and waste acceptance criteria and submit these to the regulator for review.
- On the basis of safety case and safety assessment, ZUOP should establish its own programme of prioritized R&D for the current and planned surface disposal facilities.
- ZUOP should develop a comprehensive estimate of the life-time cost for the management of institutional waste including disposal.
- ZUOP should update its human resource plan to provide further detail on the specific expertise needed and the recruitment timeframe and in particular to prioritize the recruiting of the additional specialists needed for the safety demonstration of the current and future facilities at Różan and Świerk as well as of the planned new repository.

In summary, the ARTEMIS team considers that Poland has established a good basis for the safe and responsible management of radioactive waste and spent fuel upon which further improvements can be implemented.

The ARTEMIS team is in the opinion that by adequately considering the outcomes of the present review Poland will be in a good position to continue meeting high standards of safety for radioactive waste and spent fuel management in the country.

In this regard, the ARTEMIS team suggests that Poland requests a follow-up mission within the next 5 years.

## I. INTRODUCTION

In April 2016, the Ministry of Energy of the Republic of Poland formally requested the IAEA to organize an independent international peer review of Polands *National Plan of Radioactive Waste and Spent Nuclear Fuel Management*. Poland intends to submit the outcome of this review to the European Commission, to meet its obligations under article 14(3) of the European Council Directive 2011/70/EURATOM of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste.

## II. OBJECTIVE AND SCOPE

This review covers the entire national system for radioactive waste and spent fuel management, for all the recognized radioactive waste and spent nuclear fuel streams and activities. It includes the national policy, governmental, legal and regulatory framework, as well as the implementation of the radioactive waste and spent fuel management.

Establishing a well-structured national policy and framework is a recognized prerequisite for safe and effective radioactive waste and spent nuclear fuel management on all its stages. The policy, responsibilities, as well as legal and regulatory framework should be formulated on the basis of international legal instruments and/or standards, recognizing the State's ultimate responsibility for safe and long-term management of its radioactive waste, without undue burden to future generations. Following the formulation of a national policy, a national strategy needs to be established for management of radioactive waste and spent fuel over the lifetime of facilities and duration of activities, from decommissioning (if applicable) to disposal with its post-closure phases.

The overall governmental responsibilities for radioactive waste management and the regulatory framework of Poland were reviewed under the auspices of the IRRS mission hosted in 2013 and the IRRS follow-up mission hosted in June 2017. The ARTEMIS review service is designed to avoid overlapping with the IRRS review service and to avoid undue work overload on the Member States. In this regard, outcomes of IRRS missions are considered and, as appropriate, taken into account, as part of implementation of ARTEMIS review service. Therefore, the ARTEMIS peer review has been focusing on implementation of the national programme and aspects of legal and regulatory framework in relation to its implementation.

For evaluation of the implementation of the National programme the peer review was focusing on the following elements of the national programme:

- national inventory of spent fuel and radioactive waste (including legacy waste and future estimates),
- the concepts, plans and technical solutions that are intended for implementation of spent fuel and radioactive waste management facilities and activities,
- safety case and or safety assessment for management of spent fuel and radioactive waste. The topic addresses reviews of national-level aspects of safety demonstration, for which the actual safety of particular facilities and activities are not reviewed in detail,
- cost estimates for spent fuel and radioactive waste management and its financing,
- capacity building for safe and continuous spent fuel and radioactive waste management: expertise, training and skills.

The review is applicable to fulfil the obligations required under Article 14(3) of the EC 2011/70 EURATOM Directive establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste.

### **III. BASIS FOR THE REVIEW**

#### **A) PREPARATORY WORK AND IAEA REVIEW TEAM**

At the request of the Government of Poland, a preparatory meeting for the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) mission was conducted 10 and 11 January 2017. The preparatory meeting was carried out by the appointed Team Leader Mr Jussi Heinonen and IAEA representatives, Mr Gerard Bruno (Team Coordinator) and Mr Stefan Mayer (Deputy Team Coordinator). The Terms of Reference (Appendix 1) for the ARTEMIS review in Poland were discussed, also the relevant detailed aspects for organization and conduct of the review.

#### **B) REFERENCES FOR THE REVIEW**

The articles of the EU Waste Directive, the draft guidelines for the ARTEMIS review service and the responses to the self-assessment questionnaire were used as review criteria. The complete list of IAEA publications used as the references for this mission is provided in Appendix 4.

#### **C) CONDUCT OF THE REVIEW**

The initial ARTEMIS Review team meeting took place on Sunday, 1 October 2017 in Warsaw, directed by ARTEMIS Team Leader, Mr Jussi Heinonen and ARTEMIS IAEA Team Coordinator, Mr Gerard Bruno.

The National Counterpart, Mr Chwas was present at the initial ARTEMIS Review team meeting, in accordance with the ARTEMIS Guidelines, and presented logistical arrangements planned for the mission.

The ARTEMIS entrance meeting was held on Monday, 2 October 2017, with the participation of Ministry of Energy senior management and staff. Opening remarks were made by Director Mr J. Sobolewski and Director Mr Z. Kubacki (Ministry of Energy), Mr Jussi Heinonen, ARTEMIS Team Leader and Mr Gerard Bruno, ARTEMIS Team Coordinator. Mr A. Chwas (Ministry of Energy) and K. Madaj (ZUOP) gave an overview of the Poland context.

During the ARTEMIS mission, a review was conducted for all review areas within the agreed scope with the objective of providing Poland with recommendations and suggestions for improvement and where appropriate, identifying good practice.

The ARTEMIS Review team performed its review according to the mission programme given in Appendix 2.

The ARTEMIS exit meeting was held on Tuesday, 10 October 2017. The opening remarks at the exit meeting were presented by Mr Andrzej Piotrowski Undersecretary of State (Ministry of Energy) and were followed by the presentation of the results of the mission by the ARTEMIS Team Leader Mr Jussi Heinonen. Closing remarks were made by Mr Juan Carlos Lentijo, Deputy Director General, Head of the Department of Nuclear Safety and Security (IAEA).

An IAEA and Ministry of Energy press releases were issued.

# **1. NATIONAL POLICY AND FRAMEWORK FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT**

## **1.1. NATIONAL POLICY**

### **Poland position**

According to the Advanced Reference Material (ARM), provided by the Polish counterpart, the Poland national policy for the management of radioactive waste is defined by the Act of 29 November 2000 – Atomic Law (2017 Off. Journal Item 576, as amended). Policy details are provided for by the National Plan for the Management of Radioactive Waste and Spent Nuclear Fuel (the National Plan), as adopted by Council of Ministers’ Resolution No. 195 of 16<sup>th</sup> October 2015.

The principles of radioactive waste management, described in the Poland Atomic Law and National Plan include, for example principle of waste minimization, application of “polluter pays” principle, use of open fuel cycle with the aim for direct disposal, transparency and public participation in the decision-making process.

### **ARTEMIS observation**

The Atomic Law and National Plan of Poland identify the safety fundamentals in relation to radioactive waste and spent fuel management. There is however no separate document compiling the elements of national policy on radioactive waste and spent fuel management. Evaluation of the policy elements of the National Plan relating to its implementation, resources, responsibilities, framework for safety and public information and involvement is discussed in more detail in the subsequent sections of this report.

## **1.2. LEGAL, REGULATORY AND ORGANISATIONAL FRAMEWORK**

### **Poland position**

The Atomic Law Act of 29 November 2000, which entered into force on 1 January 2002, is a framework act governing all nuclear and radiation activities in Poland. It establishes and determines the competences of the regulatory body in the fields of nuclear safety and radiological protection within Poland, under the authority of the President of the National Atomic Energy Agency Polish (PAA). The President of the PAA is a governmental official under the authority of the Minister of the Environment.

The Atomic Law Act recognizes the need to develop nuclear energy for peaceful purposes, but in a manner that protects life, health, property and the environment. It consists of the following chapters which establishes a licensing system that applies to:

- nuclear installations (from site selection to decommissioning),
- manufacture, use of and trade in nuclear materials,
- manufacture and use of ionising radiation sources,
- predisposal management of radioactive waste and spent nuclear fuel, construction, operation and closure of radioactive waste repositories,
- transport of nuclear materials, radioactive sources and radioactive waste.

The 2014 amendment to the Atomic Law Act transposed the requirements of the EC Waste Directive into the Polish law.

Trading in radioactive waste as well as import into the territory of the Republic of Poland of radioactive waste and spent nuclear fuel for disposal is prohibited in accordance with Article 62e.

Article 57c 1 of the Atomic Law assigns the responsibility for development of the Polish National Plan for management of radioactive waste and spent nuclear fuel, to the Minister of Energy. This section of the act details the content of such plans consistent with the requirements of the EC Waste Directive. The act further requires that the plan and all future updates of the plan:

- include a forecast encompassing a period of at least 20 years from the date of last approval or update,
- be updated at least every four years,
- be approved by the Council of Ministers.

Current National Plan has been approved by the Council of Minister on 16<sup>th</sup> October 2015.

Further Chapter 14 of the Atomic Law establishes and details the responsibilities of the Radioactive Waste Management Plant (the ZUOP). The ZUOP has national responsibility for collection, transport, processing/treatment, storage and disposal of radioactive waste, including disused sealed radioactive sources and spent nuclear fuel.

The Atomic Law prescribes that radioactive waste management facilities including disposal facilities are not categorized as nuclear facilities and as a result the requirements and procedures are described separately for nuclear facilities and radioactive waste management facilities. For nuclear facilities, the investor can apply to PAA for an opinion on the preliminary assessment of the site of a future nuclear facility. The law also defines the content and review process for this kind of preliminary enquiry.

The first step in the formal licensing process for radioactive waste management facilities, including disposal facilities, is a construction licence. For disposal facilities, the subsequent licensing steps are operating and closure licenses. The site selection is a Government-led process and the Ministry of Energy is in a process of site selection for a new surface disposal facility for radioactive waste. ZUOP and other national expert organizations are supporting the Ministry in technical aspects related to site characterization and concept development.

During the site selection process host municipalities of several sites were consulted as regard their willingness to host the surface disposal facility. One municipality granted acceptance that further site evaluation be undertaken in their territory. In 2015 the Ministry of Energy expanded the number of candidate sites to be further evaluated by the inclusion of four sites on Government-owned land. The choice of Government-owned land as candidate sites was to mitigate the public concern related to loss of available agricultural land.

After detailed site characterization the potential host municipality will be requested to provide consent for hosting of the planned disposal facility. Potential host municipality or municipalities consent is a prerequisite for Ministry of Energy to make decision about the site.

During the on-going site selection process the Ministry of Energy has had an active role in facilitating public involvement in the proposed host municipalities and also in surrounding municipalities. Further, the Ministry of Energy has consulted PAA during the site selection of the new surface disposal facility. These consultations have been on voluntary basis to seek preliminary opinion from the regulator. PAA has not been otherwise involved in the site selection process or related public engagement.

### **ARTEMIS observation**

The overall governmental responsibilities for radioactive waste management and the regulatory framework were reviewed under the auspices of the IRRS mission hosted in 2013 and the IRRS follow-up mission

hosted in June 2017. The 2017 IRRS follow-up mission noted the progress made in addressing the recommendations and suggestions from the 2013 mission and considered all of them as closed based on evidence presented or the progress made since the IRRS mission in 2013. The ARTEMIS review service is also designed to avoid overlapping with the IRRS review service and to avoid undue work overload on the Member States. In this regard, outcomes of IRRS missions are considered and, as appropriate, taken into account, as part of implementation of ARTEMIS review service. Therefore, the ARTEMIS peer review has been restricted to aspects of legal and regulatory framework in relation to implementation of the National Plan.

In relation to the on-going site selection process for the new surface disposal facility, it is unclear to the ARTEMIS team what rights a host municipality has to change its decision to host the disposal facility during further steps of its development.

At present, the process for site selection, including the site selection criteria, the approach to decision making and public participation employed by the Ministry of Energy is described in an internal document, which is not made publicly available. After the decision by the Ministry of Energy, a formal environmental impact assessment and preparation for construction license application will be initiated. Provisions and processes related to these activities are described in the relevant legislation.

The ARTEMIS team was informed that the Ministry of Energy had requested PAA's opinion on a limited set of elements related to on-going site characterization and selection. This was a voluntary initiative from the Ministry of Energy and therefore PAA is not involved in the review of safety case development during the site selection process. Recognising that early engagement with the regulatory body during the pre-licensing phase has been proven to be beneficial for the step-wise development of disposal facilities in other countries, establishing such a process is encouraged in Poland. The existing process for pre-licensing engagement for nuclear facilities may provide a good model.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *The process for decision making and public participation for site selection for the proposed new surface disposal facility is described only in a government internal document, which is not made publicly available. Recognizing the need for transparency in decision making a description of the process to be followed should be made publicly available.*

(1)

**BASIS: GSR Part 1 Requirement 2, para. 2.5 states that** *“The government shall promulgate laws and statutes to make provision for an effective governmental, legal and regulatory framework for safety. This framework for safety shall set out the following: [...] (5) Provision for the involvement of interested parties and for their input to decision making;”*

**SSR-5 Requirement 1, para. 3.7 states that:** *“Matters that have to be considered include: [...] (d) Defining the overall process for the development, operation and closure of disposal facilities, including the legal and regulatory requirements (e.g. licence conditions) at each step, and the processes for decision making and the involvement of interested parties;”*

S1

**Suggestion:** **The Government should consider enhancing the transparency of the site selection process for the new surface facility by making publicly available the description of the process for involving the public and potential host municipality at the various stages of site selection.**

## 2. NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

### Poland position

According to the ARM, 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 the development and implementation of the national consistent, integrated and sustainable programme of management for all classes of radioactive waste and spent fuel 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.

Radioactive waste and spent fuel in Poland arises from research reactor and from applications of radioisotopes in industry, medicine and science. Whilst Poland aspires to embark on a nuclear power programme, at present there is no radioactive waste from power reactors' operation or spent fuel reprocessing activities in Poland.

The National Plan details the strategies to deal with the radioactive waste and spent nuclear fuel from existing facilities in Poland and provides for the potential waste arisings from the planned nuclear power programme.

As described above, radioactive waste and spent fuel management in Poland comprises the management of the current radioactive and spent fuel management and wastes arising from the potential Polish NPP programme. The National Plan describes main tasks concerning management of the current low- and intermediate level radioactive:

- Preparation for and execution of closure of the existing surface disposal facility in Różan. The tasks include some actions related to safety assessment for this facility and closure concept/solution, preparations for closure, implementation of closure and long-term monitoring after closure.
- Site selection, construction and commissioning of the new surface radioactive waste disposal facility. The task includes: identification of potential locations, site selection, design and safety assessment of the disposal facility, construction, operation and closure of the disposal facility.

The execution of these actions is interrelated as the new disposal facility is needed for the future management of some of the waste currently being stored at the Różan disposal facility. The new surface disposal facility will also be used for disposal of waste arising from the proposed NPP operation.

The National Plan has also identified tasks related to establishment of a deep geological disposal facility for disposal of the NPP spent nuclear fuel. The deep geological disposal facility will serve as endpoint for the long lived wastes currently stored at Różan and Świerk sites. The studies related to development of the geological disposal facility were scheduled to start in 2015 but have been delayed due to uncertainty with respect to the proposed NPP programme.

Other main tasks identified in the National Plan are:

- Modification of radioactive waste and spent nuclear fuel management principles and decommissioning of nuclear power plants
- Development of a scientific research program for the management of radioactive waste and spent nuclear fuel
- Capacity building for domestic radioactive waste management and management supervision institutions and businesses

In relation to above mentioned task Poland has identified in the National Plan following progress indicators that are based on proportional progress of the identified tasks. However, indicators are not directly connected to actual deliverables of the identified tasks or actions.

According to Atomic Law Article 57f, the Minister of Energy should prepare a progress report on implementation of the National Plan for submission to the Council of Ministers every two years. The counterparts described that the first such report is scheduled to be prepared for June 2018. This will provide the opportunity to include proposals to adjust the National plan.

### **ARTEMIS observation**

In general, the ARTEMIS team considers that the National Plan identifies the main tasks and related actions for safe management of radioactive waste and spent fuel and proposes time schedules for their execution. However, the National Plan lacks an integrated programme that shows the dependencies between the planned tasks and actions and the absence of this programme means that the feasibility of implementation of the proposed programme cannot be assessed. In addition to enable effective monitoring and reporting of progress on implementation of the National Plan the deliverables for tasks and actions should be represented more clearly. The IAEA in its publications provide advices for the establishment and implementation of policy and strategy for radioactive waste management (e.g. IAEA nuclear energy series No NW-G-1.1).

In the ARM, the Polish counterpart stated that many of the tasks and actions have been delayed. Based on the ARM and discussions during the mission, it can be concluded that delivering the proposed near future actions in accordance with existing National Plan time schedule is highly challenging.

During the mission, the Polish counterpart acknowledged that the National Plan and planned tasks and actions are out-of-date due to changes in Government policy for NPP programme, delays in anticipated progress in the NPP programme and partly to the delays in achieving public acceptance in relation to the new surface disposal facility. This has made clear elaboration of deliverables very difficult.

The regular update for the National Plan is prescribed in the Atomic Law set to take place at least every four years, with progress reports being provided to the Council of Ministers every two years. Noting the current delay in implementation of the plan, the need for more timely updates in response to any significant changes should be considered, instead of waiting for the prescribed update period. In addition, the National Plan could be supported by more detailed planning documents for the individual activities, which may facilitate update.

The National Plan identifies a number of Research and Development (R&D) activities, but does not specify the plans to ensure that the required R&D is undertaken in the required timeframe and that the necessary resources (both human and financial) will be available. The National Plan identifies the need to develop a R&D programme. As a first action drafting a R&D programme was planned to be undertaken in 2015. According to discussion during the mission such a programme does not yet exist. The ARTEMIS team considers that such a programme with prioritization of tasks in connection with the objectives to be achieved and time schedule for implementation would facilitate the timely execution of R&D needs.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *whilst the National Plan of radioactive waste and spent nuclear fuel management, contains, in section 6, a listing of potential lines of research to be undertaken in the interest of radioactive waste and spent nuclear fuel management, there currently does not exist a formal plan, with concomitant resources, for the undertaking of research needed.*

(1)	<p><b>BASIS: GSR Part 1 Requirement 1 National policy and strategy for safety para. 2.3 (e) states that:</b> <i>“National policy and strategy for safety shall express a long term commitment to safety. The national policy shall be promulgated as a statement of the government’s intent. The strategy shall set out the mechanisms for implementing the national policy. In the national policy and strategy, account shall be taken of the following:</i></p> <p style="margin-left: 20px;">...</p> <p style="margin-left: 20px;"><i>(e) The provision and framework for research and development;”</i></p> <p><b>GSR Part 1 para 2.32 states that:</b> <i>“The government shall make provision for appropriate research and development programmes in relation to the disposal of radioactive waste, in particular programmes for verifying safety in the long term.”</i></p>
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R1	<p><b>Recommendation:</b> <b>The Government should ensure that a programme is established for the R&amp;D activities to be undertaken in Poland to support the implementation of the National Plan. The programme should establish priorities with clear timeframes and the associated resources for its timely execution.</b></p>
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## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *The existing National Plan identifies the main tasks for implementation of safe radioactive waste management in Poland. However, the National Plan does not show the dependencies between different tasks and also the deliverables of identified tasks and actions are vaguely presented. Therefore, monitoring and reporting progress in the National Plan implementation may be difficult.*

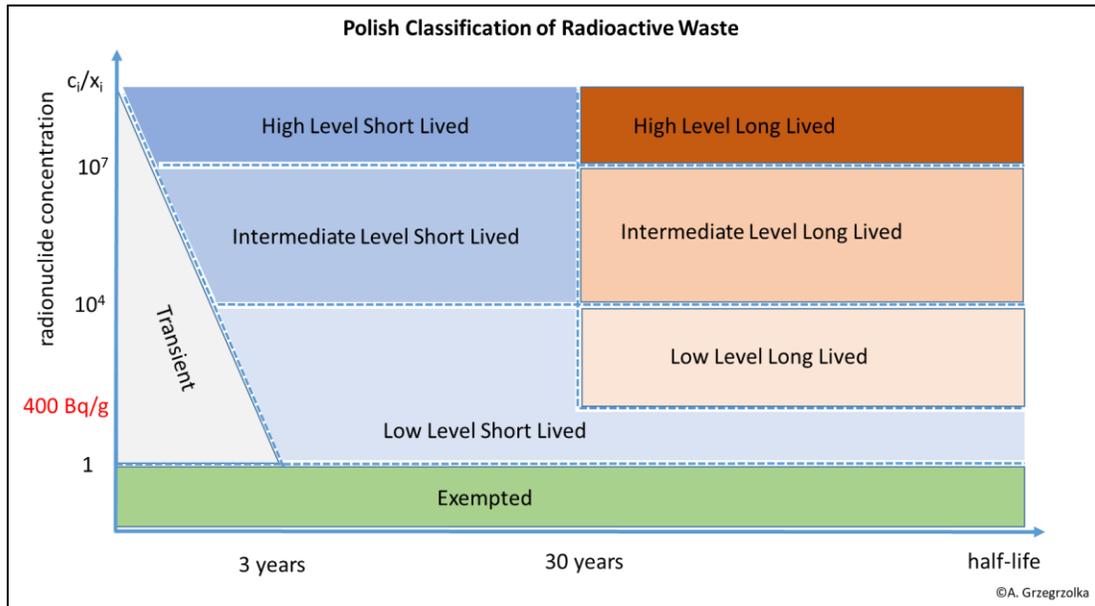
(1)	<p><b>BASIS: GSR Part 1 Requirement 10, para. 2.28 states that:</b> <i>“Decommissioning of facilities and the safe management and disposal of radioactive waste shall constitute essential elements of the governmental policy and the corresponding strategy over the lifetime of facilities and the duration of activities [3, 7]. The strategy shall include appropriate interim targets and end states. Radioactive waste generated in facilities and activities necessitates special consideration because of the various organizations concerned and the long timescales that may be involved. The government shall enforce continuity of responsibility between successive authorized parties.”</i></p>
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S2	<p><b>Suggestion:</b> <b>During the coming update of the National Plan the Government should consider providing measurable indicators with clearly identified timeframes and indication of dependencies, so that progress in the implementation of the National Plan can be monitored effectively.</b></p>
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### 3. INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE

#### Poland position

In Poland, the classification of radioactive waste is specified in the Atomic Law. Radioactive waste is classified by concentration of radionuclides, activity and half-life as illustrated in Figure below.



ZUOP is the only organization with responsibility for collecting and managing radioactive waste in Poland as well as for compiling and maintaining the radioactive waste national inventory.

Waste producers are required to transfer their waste to ZUOP within a specified time period after it is generated. Waste consignors are required to prepare inventory records in a prescribed format on cards designed for this purpose. The information collected includes physical composition, activity and isotopic concentration, type of materials, surface dose rate, unique identification (ID), date of transfer, transport details including name of receiving information. Some information about non-radiological content of waste package is also collected. During treatment, a number of waste consignments may be repackaged as a single package and a new card is completed after waste has been treated and repackaged as treatments but the original identification numbers are retained on new records, in order to guarantee traceability.

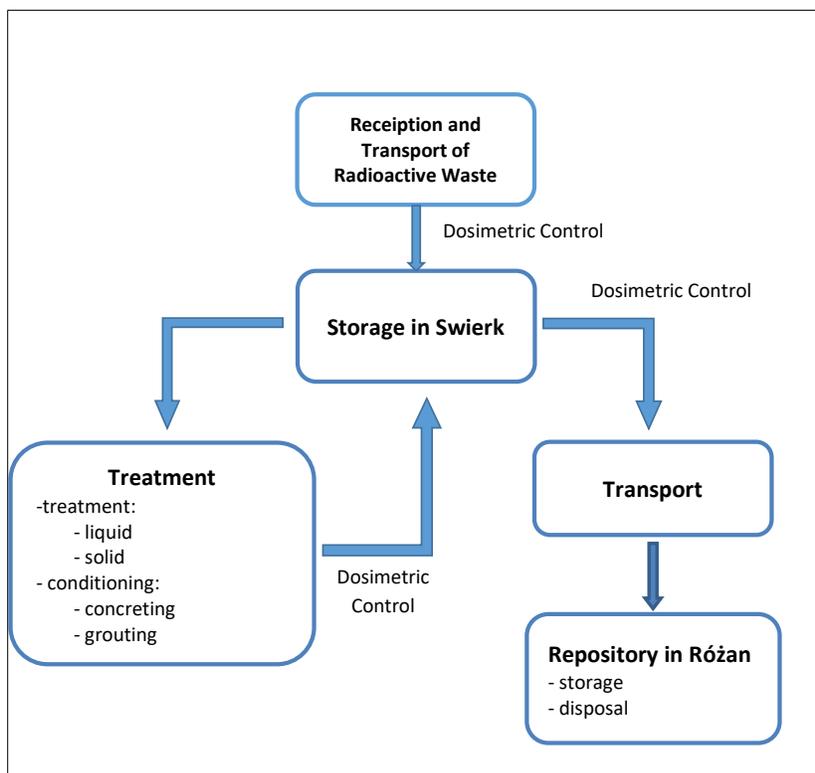
The current inventory record management system has been in place since 1995. Before that time, there were paper records but in some cases the information is incomplete. Therefore, ZUOP made a considerable effort to compile records in an operational data base for all historical waste packages in Różan though, assumptions had to be made in cases the original records were incomplete.

Disused high activity sealed sources are either returned to the manufacturer or are sent to ZUOP for storage awaiting disposal. As such, they are taken up in the operational inventory data base.

The spent fuel inventory is kept within ZUOP, in a separate database.

This inventory information is checked by ZUOP on receipt of the waste at Świerk and waste is transferred for storage pending treatment. On receipt at Świerk, the data are transferred from these paper records to an electronic database – the common waste register.

The current waste management scheme is illustrated below. Some measurements such as dosimetric control are made at each treatment step at the Świerk facility and before transport to the disposal facility.



For waste arising from the future nuclear power programme, projections are given in the National Plan based on expert judgement and benchmarking against typical plants in other countries with a nuclear program. The values were provided by the National Centre for Nuclear Research, verified by ZUOP and the Ministry of Energy and used to estimate the disposal capacity and spent nuclear fuel storage capacity required.

In view of reducing the volume of radioactive waste, ZUOP works together with the National Centre for Nuclear Research and with the Institute of Nuclear Chemistry and Technology as well as with organizations in other countries.

Clearance levels are not used in Poland – only the term “transitional waste” is used for stored waste to decay and subsequent release– e.g. in hospitals. The waste classification of Poland does not currently have a dedicated class for very low level waste (VLLW). There is a plan to introduce such a class of waste. This is mentioned in the National Plan (Section 3.8.3). There is some waste already at Rózan which would be VLLW when the new classification is introduced. This waste is already disposed of and will remain at Rózan. Future arisings may be treated differently e.g. to a licenced landfill at the same site as the new surface disposal facility. For the waste taken by ZUOP during the last two years, 10% would belong to the VLLW category.

It is foreseen that when the future NPP is operational, the power plant operator might undertake conditioning of its operational waste. ZUOP will then take charge of the transport of the conditioned waste package to its storage or disposal facility.

### **ARTEMIS observation**

The inventory compilation process described by ZUOP is well-established and has been followed for more than 20 years.

The ARTEMIS team recognized the efforts made to establish the national radioactive waste inventory and in particular, the information related to the historical waste.

The development of an ORACLE-based recording system provides an effective means for interrogation and analysis of inventory data.

The proposed introduction of a class of VLLW is welcomed and is expected to enable ZUOP to improve the efficiency of its waste management process and reduce costs in accordance with the graded approach to waste management based on the level of risk posed. Application of formal clearance could further assist in reducing the volumes of waste that need to be managed through to disposal.

In response to a suggestion in the IRRS follow-up report, PAA has initiated the development of guidance for the use of clearance levels. The ARTEMIS team considers that the finalization of this should be a priority.

ZUOP effectively implements all steps of waste management from treatment to disposal at Rózan. During the discussions ZUOP acknowledged that whilst they undertake some measurements at each step in the treatment chain up to disposal, at present, there is no independent verification. Also, PAA mentioned that during inspection, they perform administrative as well technical verification measurements. According to the IAEA safety standards (GSR Part1 Requirement-29 and GS-G-3.3 paragraph-6.7), the conformance of waste packages should be independently verified by personnel other than those who prepared the waste packages. Inspection by the PAA cannot diminish the responsibility for safety of ZUOP, and cannot substitute for the control, supervision and verifications activities conducted on the responsibility of ZUOP. The inspection undertaken by the regulatory body does not relieve ZUOP of its responsibility for verification of measurements undertaken. The team suggested that an independent verification can be performed either internally or externally. Should it be done internally, then the independence of the person/team in charge of the verifications should be demonstrated.

If the NPP programme is further developed, then regulations concerning ZUOP might be amended to confirm ZUOP as an independent body authorised to qualify treatment process and equipment of the NPP operator in order to accept waste for transport, treatment and disposal and to perform control at the waste generator site. If such verification should not be performed, then ZUOP, on becoming owner of the waste at the point of receipt of the waste will assume all liability related to hidden artefacts in packaged waste, should such be detected during the period of storage or during disposal.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *During the discussions ZUOP indicated that whilst they carry on their own checks at each step in the treatment chain up to disposal, at present, there is no independent verification.*

(1)	<p><b>BASIS: GSR Part 2 Requirement 10 Management of processes and activities para. 4.31 states that:</b> <i>“Any activities for inspection, testing, and verification and validation, their acceptance criteria and the responsibilities for carrying out such activities shall be specified. It shall be specified when and at what stages independent inspection, testing, and verification and validation are required to be conducted.”</i></p> <p><b>SSR 5 Requirement 6 Understanding of a disposal facility and confidence in safety para 3.33 states that:</b> <i>“Requirements are established in this section for ensuring that there is adequate defence in depth, so that safety is not unduly dependent on a single element of the disposal facility, such as the waste package; or a single control measure, such as verification of the inventory of waste packages; or the fulfilment of a single safety function, such as by containment of radionuclides or retardation of migration; or a single administrative procedure, such as a procedure for site access control or for maintenance of the facility.”</i></p> <p><b>GSR Part 3 Requirement 14 Monitoring for verification and compliance para 3.38 states that:</b> <i>“Registrants and licensees and employers shall ensure that:</i></p> <ul style="list-style-type: none"> <li><i>(a) Monitoring and measurements of parameters are performed as necessary for verification of compliance with the requirements of these Standards;</i></li> <li><i>(b) Suitable equipment is provided and procedures for verification are implemented;</i></li> <li><i>(c) Equipment is properly maintained, tested and calibrated at appropriate intervals with reference to standards traceable to national or international standards;</i></li> <li><i>(d) Records are maintained of the results of monitoring and verification of compliance, as required by the regulatory body, including records of the tests and calibrations carried out in accordance with these Standards;</i></li> <li><i>(e) The results of monitoring and verification of compliance are shared with the regulatory body as required.”</i></li> </ul>
R2	<p><b>Recommendation:</b> ZUOP should provide for an external or internal independent verification of its pre-disposal management activities and disposal of radioactive waste.</p>

#### 4. CONCEPTS, PLANS AND TECHNICAL SOLUTIONS FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT

##### Poland position

Poland currently generates radioactive waste and spent fuel from the use of sealed sources in medical treatments, the use of radioactive materials in industry and the operation of the MARIA test reactor.

At Świerk site, ZUOP has treatment facilities for liquid and solid waste as well as storage facilities for disused sealed sources and spent nuclear fuel. Historically, research reactor fuel has been returned to Russia in the framework of the Global Threat Reduction Initiative (GTRI). The longer-term options for spent fuel from the Maria research reactor currently being considered are deep geological disposal or possible return to the Russian Federation. Poland also has a very limited number of French spent fuel elements. These are currently stored in a special space at Maria reactor site.

The waste treatment processes carried out at Świerk include evaporation, reverse osmosis, compaction, cementation and grouting. There is ongoing research to reduce waste volumes and improve waste treatment. This includes investigation of the use of thermal treatment to reduce waste volumes.

The ARTEMIS team visited the Świerk treatment installation and saw the facilities for evaporation, reverse osmosis, segregation, compaction, grouting and cementing.

There is an existing surface facility at Różan which has been operating since 1961 for the disposal of short-lived low and intermediate level waste and for storage of long-lived waste. ZUOP is operator of this facility that serves at this moment for interim storage of long lived solid historical waste and sealed sources. These historical wastes have to be retrieved, characterized and repackaged at Świerk or Różan site, before closure of Różan. The facility is about 25m above the water table. The clay layer below the facility is 5m thick. Facility 1 has a reception room for waste from Świerk. The legacy wastes are being stored in Vaults 1, 2 and 3. There is a concrete-lined vault (Facility 8) which is a disposal vault. Short-lived, low and intermediate disused sealed sources are disposed in a specific vault (3a). The waste containers are stacked in pits and the waste between them filled with cements. The total volume is almost 4000 cubic metres. The layout of the Różan facility is illustrated in the figure below.



Poland is also planning a programme for nuclear power generation. An open fuel cycle is currently envisaged. The spent fuel and other higher-activity operational and decommissioning waste are proposed to be disposed of in a future deep geological disposal.

Poland is therefore planning two additional disposal facilities for management of radioactive waste:

- A new surface disposal facility for low and intermediate level short-lived waste
- An interim storage followed by a deep geological disposal for all remaining wastes.

The concept for the new surface facility was developed approximately 3 years ago to include designated areas for storage and disposal. There is a waste receipt area where waste can be monitored on arrival from the NPP or Rózan site. The concept of the facility is similar to Centre de L'Aube with a number of disposal installations.

The new surface disposal facility will receive the following wastes: (i) re-packaged lower-activity legacy wastes, which will be retrieved from Rózan, (ii) sealed sources currently being stored at Rózan and not acceptable for disposal at Rózan facility and (iii) operational waste from the planned NPP programme. The selection of a site for the new surface facility is ongoing. Site selection is led by the Ministry of Energy with support from ZUOP on design-related issues and from the Polish Geological survey on geological matters. The regulatory body has no formal role until the submission of a formal application of a licence to construct. However there has been ongoing interaction between the Government body and the regulatory body and this correspondence has been documented.

The planning of the geological disposal facility, as well as of the underground research laboratory, is intimately linked to the nuclear power programme. The volumes of waste requiring geological disposal are currently very small and increasing only gradually. The planned new power plant will increase the amount and types of waste to be managed, with a significantly greater proportion requiring geological disposal. The national need for geological disposal facility is much challenging to demonstrate in the absence of the power programme as the volumes of waste to be stored are small and there is sufficient storage capacity already available for some decades into the future. If the NPP plant does not go ahead, there will be additional capacity requirements for storage. A supplementary storage facility is foreseen at the Świerk site to accept the institutional waste from present activities.

### **ARTEMIS observation**

The ARTEMIS team notes that the National Plan provides a comprehensive identification of the various waste streams in Poland and proposes solutions for the long-term management of all of the wastes and spent fuel. The majority of the radioactive wastes will be disposed in existing or future surface disposal facilities. Higher activity wastes and spent fuel are stored awaiting availability of the deep geological disposal facility. The given options provide effective management for the existing waste streams.

At present, the various existing waste streams are effectively managed in the current treatment facilities at Świerk. The waste packages are well identified through the ID form. As mentioned in section 3, the waste database assures the traceability along the treatment chain.

The waste streams from the proposed nuclear programme have been estimated a level of detail commensurate with the current early planning stage of the NPP programme. The estimation method provides a good basis for the update and refinement that will be necessary as decisions are made about the specifics of the NPP programme such as the choice of NPP technology and the anticipated operation period.

## **5. SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES**

### **Poland Position**

Article 4 in the Atomic Law sets out the requirements for a safety case to support licenses for all stages of the radioactive waste and spent fuel management including treatment, transport, storage, disposal operation and closure. The types of document required are also specified in the Act or in secondary legislation.

ZUOP is required to prepare the safety documents and to update them at each step in the lifetime of the facility (construction, operation etc.). Provision for periodic safety review has been added more recently in the Atomic law (2015). For disposal facilities, the time period for periodic safety review is every 15 years. During the discussion, the Polish counterpart mentioned that the current date for the first periodic safety review for the existing facility at Rózan is scheduled for 2029.

ZUOP currently operates one licensed storage and disposal facility at Rózan. The licence for Rózan was issued in 2002 and has no pre-determined time limit. The Rózan facility was the subject of a PHARE (Poland and Hungary Assistance for the Restructuring of the Economy) project which concluded in 2004. Extracts from the report were presented at the meeting. The Atomic Law mentions a new criterion that is 0.1mSv per year. The project evaluated a number of closure options for Rózan and included a safety assessment for the preferred option. A post-closure safety analysis was also performed.

During the discussion, ZUOP presented preliminary conceptual documentation to support its proposed design for a new surface facility. Prior to disposal facility construction, ZUOP can seek informal advice from the regulator.

PAA is currently developing guidance for Waste Acceptance Criteria (WAC) for near surface disposal. The guideline will be published early in 2018 for stakeholder comment. It has not yet been discussed with ZUOP.

The Atomic law assigns responsibility for the WAC policy to the Ministry of Energy. In line with the IAEA requirements, the WAC must be developed on the basis of the safety case by the operator and should be submitted to the Regulatory Body for approval.

The self-assessment document mentions an update, in the near future, of the safety reports on operation, closure and post-closure of Rózan facility.

### **ARTEMIS observation**

At present no guidelines are available with respect to site selection, nor on the content of the safety case for disposal facilities. For site selection Ministry of Energy makes use of IAEA safety standards. The PAA guidelines to be developed will also be applicable for the coming phases of existing facilities such as Rózan (closure and post-closure safety cases). For new disposal facilities, the guidelines would be completely applicable.

At present, no up-to-date safety case as well as formalized WAC exist for storage and disposal. This does not conform to the IAEA safety standards requirements. Recognizing that establishment of WAC depends on having an appropriate safety case and safety assessment; it is recommended that ZUOP undertakes a review of the safety documentation for the Rózan facility. In particular, a formal safety case is necessary in order to verify the continued acceptability of the storage and disposal operations, noting the changes in the regulatory requirements such as reduced dose constraints and limits and to establish appropriate WAC, necessary for assuring interdependencies among treatment steps up to disposal. During discussion, the

ARTEMIS team noted that the Ministry of Energy affirmed its commitment to initiate such assessment in 2019.

ZUOP as operator of the Różan facility has the responsibility to undertake such safety case and safety assessment. ZUOP will have to verify the acceptability of the waste packages already disposed/stored at Różan Facilities. Depending on the results of such verification, some mitigation measures could be considered.

In view of the planned closure of the Różan facility in near future, a safety case including safety assessment, supported by the necessary R&D, will have to be developed by ZUOP for the closure and post-closure phases.

In discussion, it was acknowledged that the R&D required by ZUOP will include optioneering on the backfilling and capping of the disposal facility, for development of the safety case and safety assessment.

Taking into account the necessity of having a new disposal facility operational before closure of the Różan facility (stop of operational activities at Różan foreseen by 2024), and taking into account potentially long timeframes for, and of complexity of such developments, urgent actions should be undertaken by ZUOP. Related to R&D and development of safety cases (closure, post-closure of Różan; new surface disposal facility as well as for the storage planned storage facility at Świerk), ZUOP should develop a detailed multiyear development and implementation plan. It is recognized that in order to achieve this, ZUOP will require additional technical expertise.

The ARTEMIS team strongly encouraged that for these activities ZUOP should work in close cooperation with the regulatory body. Safety case development is very important for the implementer ZUOP, not only for applying for a license but more importantly as a tool to demonstrate application of the prime responsibility for safety, to evaluate the effectiveness of current process, develop more understanding of the safety relevant items, to reduce uncertainties, to derive/update WAC, and to determine gaps in knowledge and as such to determine the type of R&D needed and when it is needed.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *The team observed that for the Rózan facility:*

1. *The current licence is based on safety documentation from 2002.*
2. *The most recent safety documentation dates from the Phare 2004 project.*
3. *Regulator requirements have changed.*
4. *There are no comprehensive waste acceptance criteria.*

(1)

**BASIS: SSR-5 Requirement 20 states that:** *“Waste acceptance in a disposal facility Waste packages and unpackaged waste accepted for emplacement in a disposal facility shall conform to criteria that are fully consistent with, and are derived from, the safety case for the disposal facility in operation and after closure.”*

**SSR-5 Requirement 26 states that:** *“Existing disposal facilities The safety of existing disposal facilities shall be assessed periodically until termination of the license. During this period, the safety shall also be assessed when a safety significant modification is planned or in the event of changes with regard to the conditions of the authorization. In the event that any requirements set down in this Safety Requirements publication are not met, measures shall be put in place to upgrade the safety of the facility, economic and social factors being taken into account.”*

**SSR-5 para 4.11 states that:** *“As site investigations and design studies progress, safety assessment will become increasingly refined and specific to the site. At the end of a site investigation, sufficient data have to be available for a complete assessment. Any significant deficiencies in scientific understanding, data or analysis that might affect the results presented also have to be identified in the safety assessment. Depending on the stage of development of the facility, safety assessment may be used in focusing research, and its results may be used to assess compliance with the safety objective and safety criteria.”*

R3

**Recommendation:** **ZUOP should prepare up to date safety case for the Rózan Facility including a safety assessment and waste acceptance criteria and submit these to the regulator for review.**

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *ZUOP has no formal plan for conducting R&D to support the safety case development and implementation.*

(1)

**BASIS: SSR-5 para 3.13 states that:** *"The operator has to conduct or commission the research and development work necessary to ensure that the planned technical operations can be practically and safely accomplished, and to demonstrate this. The operator likewise has to conduct or commission the research work necessary to investigate, to understand and to support the understanding of the processes on which the safety of the disposal facility depends. The operator also has to carry out all the necessary investigations of sites and of materials and has to assess their suitability and obtain all the data necessary for the purposes of safety assessment."*

R4

**Recommendation:** **On the basis of safety case and safety assessment, ZUOP should establish its own programme of prioritised R&D for the current and planned surface disposal facilities.**

## **6. COST ESTIMATES AND FINANCING OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT**

### **Poland position**

In Poland, both ZUOP and PAA are public bodies and receive an annual budget from the Government for their routine operational costs. Major projects such as the closure at Rózan storage and disposal facility and the construction of new facilities are costed separately.

The Polish National Plan contains high-level estimates of the costs associated with these major projects for the period up to 2025. This time period of a maximum of 10 years is selected because it is considered the maximum time for which reasonable projections can be made based on the current level of understanding. The current estimates are for budgetary planning purposes only. They have been approved by the Minister of Energy, the Minister of Finance and the Council of Ministers. This approval can be considered as a decision of support in principle and details of the various activities within the projects and the associated costs will have to be approved in order to secure the actual funds. The detail of these tasks has yet to be developed.

The cost of waste management associated with nuclear power is planned to be financed through a levy on electricity prices, in line with the 'polluter pays' principle. The levy is underpinned by a detailed estimate of the various contributors to the cost of waste management, which has been benchmarked against similar intentional projects.

ZUOP is authorized to charge fees for the services provided. The fees are reviewed annually and published by the Minister of Energy. This annual review takes account of inflation and increases in operational costs of ZUOP.

### **ARTEMIS observation**

The ARTEMIS team recognized the various mechanisms for funding of waste management activities in Poland, the role of the Government in managing the institutional waste and the proposed levy for wastes from future NPP programme.

The plan for the waste management costs associated with possible future nuclear power appears sound and appears to be well underpinned by benchmarking against similar projects internationally. The ARTEMIS team commended the early establishment of financial provisions for the future nuclear power.

Whilst the ARTEMIS team recognised the efforts to determine the future cost for institutional waste management, it was recognised that these estimates provide cost projections to the year 2025 and do not reflect the full lifetime cost for the associated activities. Significant cost items such as the capping of Rózan, will only occur after this time period. Furthermore, there is very little detail to support the current high-level estimates, giving rise to a risk that they will not be insufficient to finance the activities required. The ARTEMIS team consider that it is important for ZUOP to develop an itemized costing for the activities needed to manage institutional waste through to disposal, in the same manner and to level of detail that has been used for the waste costs from possible new nuclear power in Poland. This will enable ZUOP to give realistic figures to the Ministry to be included in future budget provision.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *The current cost estimates for institutional waste have been projected up to 2025 and the radioactive waste management activities extend beyond this time.*

<b>(1)</b>	<p><b>BASIS:</b> GSR Part 1 Requirement 10, para. 1.33 (X) states that “<i>Appropriate financial provision shall be made for:</i></p> <p><i>(a) Decommissioning of facilities;</i></p> <p><i>(b) Management of radioactive waste, including its storage and disposal;</i></p> <p><i>(c) Management of disused radioactive sources and radiation generators;</i></p> <p><i>(d) Management of spent fuel.”</i></p>
<b>R5</b>	<p><b>Recommendation:</b> ZUOP should develop a comprehensive estimate of the life-time cost for the management of institutional waste including disposal.</p>
<b>R6</b>	<p><b>Recommendation:</b> The Government should undertake a review of the life-time cost estimate and ensure that funding to cover the required activities is made available to ZUOP in a timely manner.</p>

## **7. CAPACITY BUILDING FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT – EXPERTISE, TRAINING AND SKILLS**

### **Poland position**

The Atomic Law assigns the overall responsibility for resources and skills in nuclear technologies, which includes waste management, to the Ministry of Energy. The Ministry carried out a national analysis of future human resource needs in the nuclear sector in 2013. The analysis identified a need to increase human resources in the Ministry of Energy, PAA and ZUOP. The individual institutions developed separate human resource plans.

The Ministry of Energy reported that capacity in the areas of geoscience is not currently included in their plan as this technical area falls within the responsibility of the Ministry of Environment.

ZUOP currently has 48 employees, with around 40 technical staff divided almost equally between professional engineers and scientists and skilled technicians. ZUOP has an ambitious human resource expansion plan, which involves increasing the size of the organisation to a peak of around 150 at the opening of the new surface disposal facility. This will be achieved by increasing the workforce by approximately five employees per year each year until 2025, and a sharp increase thereafter recruit the less-specialized skills such as guards at the new facilities. The plan recognises that in addition to the need to expand the workforce, ZUOP will lose a number of highly experienced staff through retirement over the coming years. Knowledge transfer between these staff and new recruits is achieved by having an overlap in succession appointments.

The importance of training of new staff has been recognized by ZUOP. New recruits receive an extensive training programme over the first four years or so of their employment. This training includes education, practical training and overseas collaboration. It was further noted that ZUOP plans to recruit additional safety specialists in the short term.

PAA has, over the recent years, increased its staff complement in preparation for the introduction of nuclear power programme. The ARTEMIS team noted that in particular additional staff had been recruited in the area of radioactive waste management and spent nuclear fuel. PAA has carried out a comprehensive skills audit using an approach developed by the IAEA and planned strategic activities to improve competence over a period of the next three years.

Further, to aid in creating a pipeline of new staff, Government encouraged the introduction of a number of new tertiary and secondary level courses. The Government has also conducted a SWOT analysis and identified potential challenges to the success of these initiatives including limited interest by students, lack of political will, and a lack of funds.

In January 2016, the Ministry adopted a framework plan for human resource development in nuclear. This represents a high level plan and does not contain details of the specific skills required or the timing when they will be needed as these factors are seen to be strongly linked to the final choice of nuclear technology and the contracting mechanism.

The main organization with responsibility for delivering research on nuclear matters in Poland is the Institute of Nuclear Chemistry and Technology. This is a large institute with around 200 staff and modern, well-equipped facilities for a range of techniques. It carries out research on a wide range of technologies, including future reactor designs, nuclear reprocessing and waste treatment and disposal. The institute has good international standing, collaborates with a number of Polish organizations and is a member of Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP). It receives

approximately one third of its funding from central Polish Government sources and needs to seek the remaining funds through collaborative projects and commercial contracts.

### **ARTEMIS observation**

It is clear that Poland has invested significant effort in the development of nuclear competence over recent years and has made significant progress. The clear allocation of overall responsibility to the Minister of Energy, who has the authority to introduce change, e.g. to introduce relevant training courses at degree level and technician level in Polish institutions is commended. There is a system for measuring success of these initiatives and progress is monitored and reported annually. However, the ARTEMIS team noted that capacity and capability in waste management is not currently identified separately in the plans and therefore this important area may not receive sufficient priority in the overall nuclear provision.

Within ZUOP, there is a high-level growth plan. The level of ambition in this area looks to be at the limit of what is achievable in an organization of this size and recognizes the considerable effort that will be required in the training of new recruits. However, the plan does not provide detail on the prioritizing of the new recruits. Further, it may be necessary to provide more focus to the training programmes so that staff is equipped with the skills to operate fully in their roles within around six months of recruitment.

The ARTEMIS team noted that there is insufficient capacity in the area of disposal facility design and safety case development and evaluation within ZUOP to lead the future needs in design and safety case development, even with contractor support. The recruitment of additional resource in this area should be progressed as a high priority.

The ARTEMIS team noted that the current PAA staff complement of four specialists for radioactive waste management and spent fuel would require the assistance of external technical support in order to deliver on the required safety evaluation of the submissions from ZUOP for the existing facilities at Świerk and Różan as well as the proposed new surface disposal facility.

Competence and capacity within the research institute (Institute of Nuclear Chemistry and Technology) is good. However, the funding model drives the strategic priorities within this organisation towards international sources of grant funding. As a consequence, it is less focussed on delivering the national strategic priorities and there is a risk that the R&D needed to support the implementation of Poland's National Plan may not be delivered in a timely manner.

Whilst the team recognized that capacity in the areas of geoscience falls within the responsibility of the Ministry of Environment, it is recommended that arrangements are put in place to ensure access to sufficient resource to meet the needs of the nuclear programme, particularly to provide geoscience expertise to support site selection for the new surface facility and, in the longer term to support site characterization for geological disposal.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *Whilst the government and ZUOP have developed human resources framework plans, these plans do not provide clear identification of the priority recruitment needs related to management of radioactive waste and spent nuclear fuel.*

(1)	<p><b>BASIS:</b> SF-1 in para 3.24. states that: <i>“The resources devoted to safety by the licensee, and the scope and stringency of regulations and their application, have to be commensurate with the magnitude of the radiation risks and their amenability to control.”</i></p> <p><b>SF-1 para 3.6. states that:</b> <i>“The licensee is responsible for:</i></p> <ul style="list-style-type: none"> <li>—Establishing and maintaining the necessary competences;</li> <li>—Providing adequate training and information;</li> <li>—Establishing procedures and arrangements to maintain safety under all conditions; ...”</li> </ul> <p><b>GSR Part 1 Requirement 11 states that:</b> <i>“The government shall make provision for building and maintaining the competence of all parties having responsibilities in relation to the safety of facilities and activities.”</i></p>
S3	<p><b>Suggestion:</b> For the effective implementation of the National Plan, the Government should consider further developing its human resource framework plan to ensure that the specific needs for the management of radioactive waste and spent nuclear fuel are explicitly identified and prioritised.</p>
R7	<p><b>Recommendation:</b> ZUOP should update its human resource plan to provide further detail on the specific expertise needed and the recruitment timeframe and in particular to prioritize the recruiting of the additional specialists needed for the safety demonstration of the current and future facilities at Różan and Świerk as well as of the planned new repository.</p>

## APPENDIX 1: TERMS OF REFERENCE

# ARTEMIS Review of National Radioactive Waste and Spent Nuclear Fuel Management Plan of Republic of Poland

## Terms of Reference

### 1. Introduction

On 24th March 2016, the Minister of Energy of Republic of Poland requested the IAEA to organize and carry out, in the second quarter of 2017, an ARTEMIS Review of **National Radioactive Waste and Spent Nuclear Fuel Management Plan** of Republic of Poland, as required under Article 14.3 of the European Council Directive 2011/70/EURATOM of 19 July 2011, *establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste*.

### 2. Objective

The ARTEMIS review will provide an independent international evaluation of Polish radioactive waste and spent fuel management plan, recognizing the elements required by the EC Directive 2011/70/EURATOM.

The review, organized in the IAEA by the Department of Nuclear Safety and Security and the Department of Nuclear Energy, will be performed on the basis of the relevant IAEA Safety Standards and proven international practice and experiences, with the combined expertise of the international peer review team selected by the IAEA.

### 3. Scope

The given ARTEMIS review will evaluate the National Radioactive Waste and Spent Nuclear Fuel Management Plan of Republic of Poland and the national framework for executing country's obligations for safe and sustainable radioactive waste and spent fuel management.

### 4. Basis for the review

The ARTEMIS review will be based on the relevant IAEA safety standards and proven international practice and experience, following the draft guidelines of the ARTEMIS review service. The review will take the requirements laid on the EU Member States by the EC 2011/70/Directive.

### 5. Reference material

The review will cover all documentation submitted by National Counterpart for the considered scope of the review, with a focus on National Radioactive Waste and Spent Nuclear Fuel Management Plan, as well as the results of self-assessment, which should be based on the provided questionnaire.

All documents for the purpose of the ARTEMIS review will have to be submitted in English.

### 6. Modus operandi

The working language of the mission will be English.

- Self-assessment: available to Poland as of 2016
- Preparatory Meeting: 10th – 11th January 2017, Warsaw, Poland (2 days)
- Reception of English documents: at the latest 2 months before mission (including results of self-assessment)
- Peer review mission: October 2017 - 5 Days
- The National Counterpart is the Ministry of Energy of Republic of Poland, Department of Nuclear Energy.
  - The National Coordinator for the given review is Mr. Andrzej Chwas;
  - Deputy National Coordinator is Mr. Paweł Pytlarczyk.

## **7. International peer review team**

The IAEA will convene a team of international experts to perform the ARTEMIS review according to the agreed Terms of Reference. The team will comprise of:

- 5 qualified and recognized international experts from government authorities, regulatory bodies, waste management organizations, and technical support organizations with experience in the safe management of radioactive waste and spent fuel;
- 2 IAEA staff, respectively from the Waste and Environmental Safety Section (Department of Nuclear Safety And Security) and the Waste Technology Section (Department of Nuclear Energy) to coordinate the mission. The Coordinator of the considered ARTEMIS review is Mr. Gerard Bruno, Waste and Environmental Safety Section;
- 1 IAEA staff for administrative support.

The peer review team will be led by a Team Leader, assisted by a Deputy Team Leader, comprising from the review team as defined in the ARTEMIS draft guidelines. The IAEA will formally inform the National Counterpart regarding the composition of the proposed review team prior to submission of reference material. The review mission may include presence of Observers, what will be agreed with the National Counterpart in advance of the preparatory meeting or the mission.

## **8. Reporting**

The findings of the peer review will be documented in a final report that will contain proceedings, the recommendations, suggestions and if applicable, good practices. The report will reflect the collective views of the team members and not necessarily those of their respective organization or Member State or the IAEA.

Prior to its finalization, the ARTEMIS Review Report will be delivered to the National Counterpart for fact-checking, being the Ministry of Energy.

## **9. Funding of the peer review**

The peer review will be funded by Republic of Poland through funds of its respective national Technical Cooperation Project with the IAEA, to the amount budgeted under the project. The costs for the services will be limited to the travel costs and per diem of the peer review team (external experts and IAEA staff).

The cost of the peer review is currently conservatively estimated to the amount of xxxx EUR. Poland is aware that the review cost includes 7% programme support costs.

Poland agrees with these Terms of Reference by accepting necessary arrangements, including release of funds from TC, for holding of the ARTEMIS preparatory meeting on January 10th – 11th 2017, to the responsible TC budget Officer of the IAEA.

## APPENDIX 2: MISSION PROGRAMME

Sunday, 1st October 2017		
<i>Meeting room (Wilanowska&amp;Belwederska) in Hotel Mercure Warszawa Grand</i>		
<i>17:00 – 18:00</i>	Team meeting	<i>Artemis Team and Mr A. Chwas (MoE)</i>

Monday, 2nd October 2017		
<i>Meeting room 26, Ministry of Energy, ul. Krucza 36/Wspolna 36</i>		
<i>10:00 – 12:00</i>	Opening	<i>Mr Jussi Heinonen Artemis Team Leader</i>  <i>Introduction of Artemis team members</i>  <i>Introduction of Director Mr J. Sobolewski and Director Mr Z. Kubacki (MoE)</i>
	General presentation	<i>Mr A. Chwas (MoE) and Mr K. Madaj (RWMP)</i>
<i>12:00 – 13:00</i>	<b><i>LUNCH BREAK</i></b>	
<i>13:00 – 17:00</i>	Policy, strategy and framework	<i>Presentation by Mr A. Chwas (MoE) and Mr R. Truszkowski (NAEA)</i>  <i>Discussions (experts and counterparts)</i>
<i>Meeting room (Wilanowska&amp;Belwederska) in Hotel Mercure Warszawa Grand</i>		
<i>17:00– 18:00</i>	Team meeting	<i>Artemis Team</i>

Tuesday, 3rd October 2017		
<i>Meeting room 26, Ministry of Energy, ul. Krucza 36/Wspolna 36</i>		
<i>09:00 – 12:00</i>	Inventory WAS/WAC Concepts, plans and technical solutions	<i>Presentation by Mr A. Grzegorzółka and Mr M. Banach (RWMP)</i>

12:00 – 13:00	<b>LUNCH BREAK</b>	
13:00 – 17:00	Discussions	<i>Discussions (experts and counterparts)</i>
<b>Meeting room (Wilanowska&amp;Belwederska) in Hotel Mercure Warszawa Grand</b>		
17:00– 18:00	Team meeting	<i>Artemis Team</i>

<b>Wednesday, 4th October 2017</b>		
<b>Meeting room 26, Ministry of Energy, ul. Krucza 36/Wspolna 36</b>		
09:00 – 12:00	Safety case and safety assessment	<i>Presentation by Mr R. Truszkowski (NAEA)</i>  <i>Discussions (experts and counterparts)</i>
12:00 – 13:00	<b>LUNCH BREAK</b>	
13:00 – 17:00	Site visit	
<b>Meeting room (Wilanowska&amp;Belwederska) in Hotel Mercure Warszawa Grand</b>		
17:00– 18:00	Team meeting	<i>Artemis Team</i>

<b>Thursday, 5th October 2017</b>		
<b>Meeting room 26, Ministry of Energy, ul. Krucza 36/Wspolna 36</b>		
09:00 – 12:00	Cost estimates and financing	<i>Presentation by Mr A. Chwas (MoE)</i>  <i>Discussions (experts and counterparts)</i>
12:00 – 13:00	<b>LUNCH BREAK</b>	
13:00 – 17:00	Capacity building	<i>Presentation by Mr A. Kordas (MoE), Mr R. Truszkowski (NAEA) and Ms A. Korczyk (RWMP)</i>  <i>Discussions (experts and counterparts)</i>
<b>Meeting room (Wilanowska&amp;Belwederska) in Hotel Mercure Warszawa Grand</b>		

17:00– 18:00	Team meeting	<i>Artemis Team</i>
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<b>Friday, 6th October 2017</b>		
<i>Meeting room 26, Ministry of Energy, ul. Krucza 36/Wspolna 36</i>		
09:00 – 12:00	Reservation for further discussions	<i>All participants</i>
12:00 – 13:00	<b>LUNCH BREAK</b>	
13:00 – 17:00	Discussion with the Counterparts on draft recommendations, suggestions and good practices	<i>All participants</i>
<i>Meeting room (Mokotowska) in Hotel Mercure Warszawa Grand</i>		
17:00 – 19:00	Drafting of the report	<i>Artemis Team</i>

<b>Saturday, 7th October 2017</b>		
<i>Meeting room (Wilanowska&amp;Belwederska) in Hotel Mercure Warszawa Grand</i>		
09:00 – 12:00	Internal report review	<i>Artemis Team</i>
12:00 – 13:00	<b>LUNCH BREAK</b>	
13:00 – 17:00	Team meeting	<i>Artemis Team</i>

<b>Sunday, 8th October 2017</b>		
<i>Meeting room (Wilanowska&amp;Belwederska) in Hotel Mercure Warszawa Grand</i>		
09:00 – 12:00	Draft report finalization and submission to Polish Counterparts	<i>Artemis Team</i>
	Review of draft report by Polish Counterparts	

<b>Monday, 9th October 2017</b>		
<i>Meeting room 26, Ministry of Energy, ul. Krucza 36/Wspolna 36</i>		
09:00 – 12:00	Meeting with the Counterparts	<i>All participants</i>
12:00 – 13:00	<b>LUNCH BREAK</b>	
13:00 – 17:00	Finalization of draft report and presentation	<i>All participants</i>

Tuesday, 10th October 2017

*Meeting room 26, Ministry of Energy, ul. Krucza 36/Wspolna 36*

<i>09:00 – 12:00</i>	Closure meeting	<i>Mr Andrzej Piotrowski Undersecretary of State (MoE)</i>  <i>Mr Juan Carlos Lentijo (DDG-NS, IAEA)</i>  <i>All Participants</i>
<i>12:00 – 12:30</i>	Meeting of Mr Andrzej Piotrowski, Undersecretary of State (MoE) and Mr Juan Carlos Lentijo (DDG-NS, IAEA)	

### APPENDIX 3: RECOMMENDATIONS AND SUGGESTIONS

Area	R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
<b>1.</b>	<b>NATIONAL POLICY AND FRAMEWORK FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT</b>	S1
		The Government should consider enhancing the transparency of the site selection process for the new surface facility by making publicly available the description of the process for involving the public and potential host municipality at the various stages of site selection.
<b>2.</b>	<b>NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT</b>	R1
		The Government should ensure that a programme is established for the R&D activities to be undertaken in Poland to support the implementation of the National Plan. The programme should establish priorities with clear timeframes and the associated resources for its timely execution.
		S2
		During the coming update of the National Plan the Government should consider providing measurable indicators with clearly identified timeframes and indication of dependencies, so that progress in the implementation of the National Plan can be monitored effectively.
<b>3.</b>	<b>INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE</b>	R2
		ZUOP should provide for an external or internal independent verification of its pre-disposal management activities and disposal of radioactive waste.
<b>5.</b>	<b>SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES</b>	R3
		ZUOP should prepare up to date safety case for the Rózan Facility including a safety assessment and waste acceptance criteria and submit these to the regulator for review.
		R4
		On the basis of safety case and safety assessment, ZUOP should establish its own programme of prioritised R&D for the current and planned surface disposal facilities.

<b>Area</b>		<b>R: Recommendations S: Suggestions G: Good Practices</b>	<b>Recommendations, Suggestions or Good Practices</b>
<b>6.</b>	<b>COST ESTIMATES AND FINANCING OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT</b>	R5	ZUOP should develop a comprehensive estimate of the life-time cost for the management of institutional waste including disposal.
		R6	The Government should undertake a review of the life-time cost estimate and ensure that funding to cover the required activities is made available to ZUOP in a timely manner.
<b>7.</b>	<b>CAPACITY BUILDING FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT – EXPERTISE, TRAINING AND SKILLS</b>	S3	For the effective implementation of the National Plan, the Government should consider further developing its human resource framework plan to ensure that the specific needs for the management of radioactive waste and spent nuclear fuel are explicitly identified and prioritised.
		R7	ZUOP should update its human resource plan to provide further detail on the specific expertise needed and the recruitment timeframe and in particular to prioritize the recruiting of the additional specialists needed for the safety demonstration of the current and future facilities at Różan and Świerk as well as of the planned new repository.

## **APPENDIX 4: IAEA REFERENCE MATERIAL USED FOR THE REVIEW**

- [1] INTERNATIONAL ATOMIC ENERGY AGENCY, Fundamental Safety Principles, Safety Fundamentals No. SF-1, Vienna (2006).
- [2] INTERNATIONAL ATOMIC ENERGY AGENCY, Governmental, Legal and Regulatory Framework for Safety, General Safety Requirements No. GSR Part 1 (Rev. 1), Vienna (2016).
- [3] INTERNATIONAL ATOMIC ENERGY AGENCY, Leadership and Management for Safety, General Safety Requirements No. GSR Part 2, IAEA, Vienna (2016).
- [4] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna (2014).
- [5] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for Facilities and Activities, IAEA Safety Standards Series No. GSR Part 4, IAEA, Vienna (2009).
- [6] INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Radioactive Waste, IAEA Safety Standards Series No. GSR Part 5, IAEA, Vienna (2009).
- [7] INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Facilities, IAEA Safety Standards Series No. GSR Part 6, IAEA, Vienna (2014).
- [8] INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Facilities, IAEA Safety Standards Series No. GSR Part 6, IAEA, Vienna (2014).
- [9] INTERNATIONAL ATOMIC ENERGY AGENCY, Disposal of Radioactive Waste, IAEA Safety Standards Series No. SSR 5, IAEA, Vienna (2011).
- [10] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Fuel Cycle Facilities, IAEA Safety Standards Series No. NS-R-5 Rev. 1, IAEA, Vienna (2014).
- [11] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Energy Basic Principles, Nuclear Energy Series, NE-BP, Vienna (2008).
- [12] INTERNATIONAL ATOMIC ENERGY AGENCY, Radioactive Waste Management and Decommissioning Objectives, Nuclear Energy Series, NW-O, Vienna (2011).
- [13] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Fuel Cycle Objectives, Nuclear Energy Series, NF-O, Vienna (2013).
- [14] INTERNATIONAL ATOMIC ENERGY AGENCY, Policies and Strategies for Radioactive Waste Management, IAEA Nuclear Energy Series No. NW-G-1.1, IAEA, Vienna (2009).
- [15] INTERNATIONAL ATOMIC ENERGY AGENCY, Policies and Strategies for the Decommissioning of Nuclear and Radiological Facilities, IAEA Nuclear Energy Series No. NW-G-2.1, IAEA, Vienna (2012).
- [16] INTERNATIONAL ATOMIC ENERGY AGENCY, Policy and Strategies for Environmental Remediation, IAEA Nuclear Energy Series No. NW-G-3.1, IAEA, Vienna (2015).

[17] INTERNATIONAL ATOMIC ENERGY AGENCY, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, IAEA International Law Series No. 1, IAEA, Vienna (2006).

[18] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Glossary – Terminology used in Nuclear Safety and Radiological Protection, IAEA, Vienna (2007).

[19] Official Journal of the European Union No. L 199/48 from 2nd Aug 2011, COUNCIL DIRECTIVE 2011/70/EURATOM of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste, Brussels (2011).