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GREEK ATOMIC ENERGY COMMISSION

**2nd NATIONAL REPORT OF GREECE
ON COMPLIANCE WITH THE
COUNCIL DIRECTIVE 2011/70/EURATOM
OF 19 JULY 2011**

**“Establishing a Community framework for
the responsible and safe management of
spent fuel and radioactive waste”**

**September
2018**

2nd NATIONAL REPORT OF GREECE

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Abbreviations

EEAE: Greek Atomic Energy Commission

EEAE-194/2018: EEAE decision No Π/112/4364/2018, Government Gazette Folio No. 194/YOΔΔ/05.04.2018, "Appointment, composition and functioning of the National Committee for Radioactive Waste Management", 2018.

EEDRA: National Committee for Radioactive Waste Management

EPPADRA: The national facility for the interim storage and management of RW

ELKE: Special Account for Research Grants

ILW: Intermediate Level Waste

JMD-1858/2015: Ministerial Decision 131207/I3/20.08.2015, National policy on the management of spent fuel and radioactive waste, Government Gazette Folio No. 1858/B/27.08.2015;

JMD-2941/2015: Ministerial Decision Π/112/214196/30.12.2015, National programme of spent fuel and radioactive waste management, Government Gazette Folio No. 2941/B/31.12.2015;

JMD-Auth: Draft of the Joint Ministerial Decision on "Procedures and requirements for the licensing of radioactive waste management facilities"

LLW: Low Level Waste

Minister: the competent Minister for EEAE (currently, the Minister of Education, Research and Religious Affairs).

NatPro: National Program on the SF & RW management

NCSR D: National Centre for Scientific Research "Demokritos"

NRWIS: The centralized interim storage facility for RW operated by the Institute of Nuclear and Radiological Sciences & Technology, Energy & Safety (INRASTES) of NCSR "D".

PD-122/2013: Presidential Decree 122/2013, Transposition to Greek legislation of 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, Government Gazette Folio No. 177/A/12.08.2013.

PD-91/2017: Presidential Decree 91/2017, Legislative, regulatory and organizational framework for the responsible and safe management of spent fuel and radioactive waste and amendment of the Presidential Decree. 122/2013, Government Gazette Folio No. 130/A/01.09.2017;

RM: Radioactive Material

RPR: Radiation Protection Regulations. In this report they referred to the Joint Ministerial Decision No 1014(ΦOP)94, Government Gazette Folio No 216 B/06.03.2001.

RS: Radioactive Source

RW: Radioactive Waste

SF: Spent Fuel

VLLW: Very Low Level Waste

VSLW: Very Short Lived Waste

A: Introduction

Greece has transposed the Council Directive 2011/70/Euratom of 19 July 2011 “Establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste” into the Greek legislation through Presidential Decrees, Joint Ministerial Decisions and EEAE decisions. This legislation, together with the Radiation Protection Regulations, which are being amended according to EC Directive 59/2013, constitute the regulatory framework for SF and RW management in Greece. The framework includes the “National Program” (NatPro), provides general safety requirements for RW management covering the whole lifetime of a management facility, stipulates general safety requirements for disposal, outlines various authorization steps, specifies the stakeholders and describes their roles and responsibilities, including financial aspects.

Greece has signed the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management on 5 September 1997. The Convention has been ratified by the Parliament in 2000 (Law 2824/2000). In addition, Greece implements the IAEA Code of Conduct for the safety and the security of radioactive sources (RS) and its Supplementary Guidance on the Import and Export of Radiation Sources.

In terms of reporting, Greek Atomic Energy Commission (EEAE) has the responsibility to submit to the EC the “national report” under Directive 2011/70/Euratom.

The present report is the 2nd national report of Greece under Article 14.1 of Council Directive 2011/70/Euratom. It provides basic information on the management of SF and RW and summarizes the developments and achievements within the reporting period of the last three years. The report has been prepared by EEAE in accordance with the guidelines provided to the Member States by the European Nuclear Safety Regulators Group (ENSREG) in the document of ENSREG Working Group2, Guidelines for Member States reporting on Article 14.1 of Council Directive 2011/70/Euratom, January 2018.

The information given in this report is consistent with the national report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (publicly available at EEAE website www.eeae.gr).

The national report has been notified to the National Committee for Radioactive Waste Management (EEDRA) for comments, consultation and endorsement.

Spent fuel and radioactive waste in Greece

Greece has no nuclear power plants. SF management is therefore relevant only with respect to the operation of the research reactor (GRR-1) at the National Centre for Scientific Research “Demokritos” (NCSR-D). GRR-1 is currently licensed for extended shutdown; the existing irradiated fuel stored in the reactor building is covered by an agreement with the US Department of Energy for shipment back to the USA until May 2019. The procedures for the repatriation of the spent fuel has already been initiated and are in progress.

RW in Greece originates from medicine, research and industry. RW have also been produced from the past operation of GRR-1 and other activities of the NCSR-D. Today radioactive waste inventory includes RW from the past of operation of the reactor (e.g. resins), disused sources, equipment and consumer products containing radioactive materials (RM, e.g. smoke detectors, lighting rods), and NORM. Short lived liquid or solid RW from the operation of medical and research laboratories are managed by decay and clearance. More details are provided in Section C in this report.

Regulatory bodies and implementing organizations

The principal organizations / bodies involved in SF and RW management are:

Regulatory body – Greek Atomic Energy Commission (EEAE)

EEAE is the competent regulatory authority for the control, regulation and supervision in the fields of nuclear energy, nuclear technology, radiological and nuclear safety and radiation protection. EEAE is operating as a public entity and enjoying full administrative and financial independence in relation to its duties. It operates under and is supervised by the Minister of Education, Research and Religious Affairs.

In 2014, with the Law 4310 (Government Gazette Folio No. 258/A/08.12.2014) titled “Research, Technological Development and Innovation and other provisions”, a separate chapter, chapter E, titled “Nuclear Energy, Technology and Radiation Protection - Greek Atomic Energy Commission” is included (articles 39 - 46, article 90). The obsolete framework (Law 1733/1987, Legislative Decree 181/1974) is replaced by a new operation framework of EEAE. The new framework brings important improvements, regarding, inter alia, EEAE independence, enforcement means, inspectors role and inspection procedures, licensing authority and transparency enhancement. More details are provided in Section F in this report.

National Committee for Radioactive Waste Management

The National Committee for Radioactive Waste Management (EEDRA) has been recently established (05.04.2018) by EEAE-194/2018 act, following PD-91/2017 provision.

EEDRA is a 9-member collegiate body with advisory and supportive role towards the Minister on the implementation of the practical aspects of the national policy and national framework and on the coordination of the bodies involved in RW management. With the establishment of EEDRA the collaboration between the organizations/bodies involved in RW management and the coordination of actions is ensured.

The first meeting of EEDRA took place on 15.06.2018, where, among others, practical aspects of the NatPro was addressed and specific actions were assigned to working groups.

More details are provided in Section E in this report.

National Centre for Scientific Research “Demokritos” (NCSR) – Storage facility

The NCSR is a self-administered governmental legal entity, under the supervision of the General Secretariat of Research and Technology of the Ministry of Education, Research and Religious Affairs.

NCSR consists of five Institutes. Among those, the Institute of Nuclear and Radiological Sciences & Technology, Energy & Safety (INRASTES) operates a centralized facility for interim storage of RW, RS and RM. The license of the facility has been recently renewed by EEAE, for the interim storage of RW and disused RS, low activity RS dismantling (category 3-5), characterization of RW, overpackaging of old drums, re-sorting/ segregation of RW and clearance of materials. The legislative basis for the licensing of the facility is the Radiation Protection Regulations (RPR), PD-122/2013 and PD-91/2017. In this storage facility RW from the research reactor, historical waste and other RS and RW from research and industrial applications are temporarily stored.

Besides the interim storage facility, waste are stored also in other facilities of NCSR. The following is a brief summary of the main types of RW presently stored in facilities at NCSR: sources including Pu-Be sources, contaminated or activated objects from the GRR-1 at the reactor building ; sludge in liquid waste tanks; regeneration bed resins in drums, waste in concrete, Pu contaminated soil, disused sealed radioactive sources in gauges and other industrial sources, lightning rods; contaminated/activated metal objects, smoke detectors; neutron sources, industrial radioactive sealed sources of low activity, at the centralized interim storage facility of NCSR makeweight, shielding jaws etc.

Disposal facility

Greece does not have a RW disposal facility. Current plans and progress since the 1st report are provided in this report.

Major elements of the national policy and the national program

The national policy, through PD-122/2013, PD-91/2017, JMD-1858/2015 and JMD-2941/2015, provides that:

- The irradiated fuel from the past operation of the GRR-1 is stored on site until the return shipment to the USA. Interim wet storage of the GRR-1 fuel takes place in the fuel storage pool inside the reactor building. The procedures for the repatriation of the spent fuel until May 2019 has already been initiated and are in progress.
- Shipment of SF, RS, RM and RW follows transport and safeguards legislation. The nuclear material existing in Greece is subject to the control and regular inspection of IAEA and EURATOM Safeguards.
- RW produced in Greece shall be disposed within the national territory, unless an agreement is in place for export of the waste abroad, in line with European Union legislative requirements. Until the establishment of a national disposal facility, RW generated within the Greek territory shall be stored safely and securely in authorized storage facilities (centralized or at RW producers' facilities). The storage of RW, RS and RM does not constitute a final management solution. The import of RW within the country's borders for management, including disposal, is prohibited.
- For RS, repatriation is the preferred management option (back-end solution).
- For the VSLW originating from nuclear medicine laboratories the decay and clearance options are applied.
- On a 10-year periodic basis, if necessary, withdrawal projects are carried out to export RS and RM to foreign authorized recycling facilities.

Other relevant information is provided in Section D in this report.

Responsibilities

The Minister has the ultimate responsibility for the management of SF and RW, as well as to supplement, extend, maintain and implement the existing "national framework" and "national policy".

EEDRA is responsible to specify and propose to the Minister in relation to issues of the practical implementation of the NatPro, including definition of the technical solutions for the management of RW including final disposal.

The licensee has the prime responsibility for safety, security and radiation protection and for compliance with the safety principles and radiation protection regulations, according to the national and European legislation and the applicable IAEA safety standards.

The producer of research reactor spent fuel has the prime responsibility for SF management until its final return to country that supplied/ manufactured the fuel.

The producer of RW has the prime responsibility for managing them either until their physical decay to the statutory clearance levels, based on current RPR, or for the transfer of them to an authorized RW management facility. Management cost is borne by the SF and RW producer. SF and RW producers are obliged to keep the binding principles of the national policy and the relevant national guidelines and international standards, as well as to have, according to the graded approach principle, the necessary financial resources, infrastructure and skilled workforce required to ensure safety.

RW management principles

The protection of workers, public and environment is ensured by the application of radiation protection principles and the relevant provisions of the RPR, PD-122/2013, PD-91/2017, JMD-1858/2015 and JMD-2941/2015.

Each practice, work or activity related to the SF and RW management, before approval for the first time must be justified on the basis of socio-economic or other advantages granted in connection with possible health risks. Ongoing or existing SF and RW management practices can be reviewed by EEAE in the light of new and important evidence about their effectiveness. Unjustified SF and RW management practices are prohibited.

Dose constraints are set for the members of the public, as 100 $\mu\text{Sv}/\text{year}$ due to all applied SF and RW management practices, 50 $\mu\text{Sv}/\text{year}$ due to a single SF and RW management practice and 10 $\mu\text{Sv}/\text{year}$ due to discharges of liquids or gases from a particular SF and RW management practice. Dose constraints for radiation workers are set by the licensee and approved by EEAE.

Safety requirements for the RW management and for the disposal of RW are provided in legislation (PD-91/2017, JMD-Auth), including licensee obligations, evaluation and verification of safety, location, design and construction, operation, maintenance, decommissioning etc.

The IAEA waste classification is applied, in general. Characterization and classification of existing waste is in progress. Details on the classification criteria are provided later in this report (Section C).

Sealed RS and other RM, after their useful life, are returned to the manufacturer or to an authorized recycling facility abroad. A legal written declaration from the source manufacturer for accepting back the source is necessary prior to the RS or RM import, as well as a legal written declaration from the RS or RM user for undertaking all financial and administrative provisions to export the RS or RM.

The inventory of RW, RS and RM is maintained by EEAE within the national radiation protection database and includes the necessary basic information, i.e. facility, location, operator, persons in charge, quantities, form, activities, etc. EEAE performs on regular basis on-site inspections to verify the accountability of the RW, RS and RM.

National Program

The initial (first) national program (NatPro) has been prepared by EEAE, pursuant to Article 7 of JMD-1858/2015 and in accordance with the requirements of the Council Directive 2011/70/Euratom. The subsequent editions (review/updates) of the NatPro will be undertaken by EEDRA.

The NatPro was published in the Official Gazette in 2015 as a Joint Ministerial Decree (JMD-2941/2015). The NatPro, among others, includes five (5) specific actions on the management of RS, RM and RW with milestones and timelines, preliminary cost estimation, financing and inventories of SF and RW.

Peer reviews

In November 2017, an IAEA follow-up IRRS mission took place in Greece. Significant progress during the last years was ascertained, as reflected by the fact that all recommendations and suggestions related to RW management but one suggestion (S8) which remains open, were assessed as “closed” or “closed on the basis of progress made and confidence in effective completion”.

B. Recent developments

The main developments and achievements during the last three year reporting period are summarized as follows:

Completion of legislation

1. JMD-2941/2015: In 2015, the Joint Ministerial Decision No Π/112/214196, Government Gazette Folio No. 2941/B/31.12.2015, “NATIONAL PROGRAM for the management of spent fuel and radioactive waste” was published. It refers to the NatPro, the key milestones of which are:

a. Appointment, composition and functioning of the National Committee Radioactive Waste Management (EEDRA);

b. updated and verification of the Inventory and Classification of Radioactive Waste;

c. establishment of the National Temporary Storage and Radioactive Waste Management Facility;

d. project for the identification, collection, and export for recycling of radioactive sealed sources and radioactive materials;

e. decisions on national options for the management and disposal of radioactive waste.

2. PD-91/2017: In 2017, the PD 122/2013, which is the higher level legislative document pertaining directly to the management of radioactive waste, was significantly amended by the PD-91/2017 (Official Gazette A' 130/01.09.2017), including, among others the introduction of the general safety requirements for RW management covering the whole lifetime of a management facility and the definition of the various licensing stages. General safety requirement for disposal are also defined.

3. EEAE-194/2018: In 2018, the National Committee National Committee for the RW management (EEDRA) was appointed and composed by the EEAE decision No Π/112/4364/2018, Government Gazette Folio No. 194/YOΔΔ/05.04.2018, “Appointment, composition and functioning of the National Committee for Radioactive Waste Management”.

The new legislation brings important modifications and additions in relation to applicable safety requirements for predisposal management and disposal, organizations and stakeholders involved in the management of RW, the licensing stages and regulatory supervision system.

Appointment and functioning of the EEDRA

Following the adoption of PD-91/2017 (article 15, paragraph 3), EEDRA was constituted on 05.04.2018 (EEAE-194/2018). EEDRA met for the first time on 15.06.2018, where mainly organizational issues and priorities of the NatPro were discussed. The urgent priority of EEDRA is the revision and update of the 2015 NatPro including the issue of finding a solution for the final management of RW. A road map of EEDRA meetings is scheduled, where, inter alia, the issue of updating the NatPro, in particular Action 5 on the disposal of RW, will be addressed in detail.

Progress on RW disposal options decision making

Since the publication of the NatPro in 2015, more knowledge has been gained and a comprehensive understanding has emerged on the applicable options that can meet the country's needs for disposal of RW.

In particular, the concept of **engineered near surface disposal facility** is considered as the basic technical option (baseline scenario). This option can cover all types of existing and future RW in the country, including radioactive sources that cannot be exported for recycling and RW from the decommissioning of the research reactor GRR-1 of NCSR "D". This solution manages all types of waste in a single installation with a high level of safety and security, which is ensured by properly designed and implemented engineered barriers.

Any difficulties (e.g. public perception) that may arise when selecting a location for the facility are expected to be mitigated by the application of a careful, comprehensible and comprehensive communication and information exchange approach between all stakeholders over the coming years. Furthermore, it should be noted that Article 26 of PD-91/2017 provides for compensatory benefits in the area hosting the disposal facility. Although the exact cost estimate is not available at the moment, the cost of disposal facility construction is manageable.

In case that the aforementioned baseline scenario is not feasible, two alternative options for the RW disposal are considered. The two alternative options, by preference and priority, are the following:

The first alternative to the baseline scenario is the option of a **surface trench** for the disposal of VLLW and possibly LLW. The cost of the surface trench is lower than that of the baseline scenario, however, due to the lower level of safety, it is not possible to dispose of all categories of RW to it, such as disused RS that cannot be exported for recycling and the (extremely small) volume of ILW that is estimated to likely arise from the decommissioning of the GRR-1 research reactor of the NCSR "D". For these radioactive waste, the option of a **borehole** is considered in parallel. This additional option (borehole) is expected to increase the cost of the overall RW management considerably. Indicatively, the estimated cost of the borehole is in the order of 3 M€.

It is pointed out that according to the RW management policy principles, the primary management option for the RS is their return to the manufacturer on the basis of relevant agreements concluded prior to their import into the country.

The second alternative option to the baseline scenario concerns the choice of decommissioned, non-operating **mines**. In this case, the construction costs are small, however, extensive and complex studies are needed to assess safety especially on a long-term basis. For this reason, this solution is of low preference and priority.

It is noted that public perception for both alternatives options is more difficult compared to option of the baseline scenario.

One of the main immediate tasks of EEDRA is the assessment of the appropriateness and the practical implementation of the first basic option (construction of an engineered near surface disposal facility) and the final decision on the type of disposal facility, with a view to formulating a relevant recommendation (PD-91/2017 Article 15 (3)) by the end of 2018. Subsequently, on the basis of the final decision, a more detailed estimate of the cost will be made, in order EEDRA, before the end of 2019, to proceed with the final proposal to the Minister on the revision of the NatPro. The time frame for the selection and construction of disposal facility is an integral part of the NatPro and will, therefore, be specified in the revised version of the program. The steps for selection and siting of the disposal facility are provided in Action 5 of the NatPro implementation, as described in Section K in this report.

Finance of the NatPro implementation

Following the publication of the new legislation acts (PD-91/2017, JMD/2941/2015 and EEAE/194/2018) and the appointment and functioning of the EEDRA (on 05.04.2018), the financing of the NatPro gets rigid. In particular:

- As aforementioned, officials from the economic and financial sectors and the sector of development and competitiveness of the Ministry of Economy and Development participate in EEDRA, having the major role in the preparation of the financing plan and to identify and obtain the relevant financial resources and funds for the implementation of the NatPro.
- According to the PD-91/2017 and JMD-2941/2015 mainly, the Ministry of the Economy, depending on the cost estimates of the NatPro and the action timeframes, registers into the budget of each year the relevant financing needs.
- An independent deposit fund with separate code has been created in EEAE's Special Account for Research Grants (ELKE) to cover financial needs of the NatPro. An amount of one million Euros (1M€) has been transferred to this fund to meet financing needs for the implementation of the first stages of the NatPro. The approval of this transfer has been made by decision of the EEAE Board of Directors in July 2018. The role of the fund, and in particular the actions of the NatPro it finances, are reviewed following the revisions of the NatPro. More details are presented in section I in this report.

Progress on the repatriation of the irradiated fuel

According to Article 4.1c of PD 122/2013, spent fuel shall be returned to a supplier or producer country, according to an agreement which shall be in place before the import of the fuel in Greece. Spent fuel final disposal in Greece is not presently considered as part of the NatPro. The spent fuel of the GRR-1 was returned to the USA in 2005. The irradiated fuel currently stored in GRR-1 is under an agreement with the US DoE for repatriation until May 2019.

During the last two years, significant progress has been made for the repatriation of the GRR-1 irradiated fuel. The operator is anticipated to finalize the procurement and operational arrangements for the shipment shortly, given that the review and assessment of the submitted official quotes has been completed. Consultation with European Supply Agency (ESA) EURATOM and actions in line with the terms and conditions of the aforementioned contract are in progress.

It is expected that the irradiated fuel repatriation will be completed before May 2019. Following this, Greece will not possess spent or irradiated fuel.

Safety issues

1. The centralized interim storage facility for RW operated by the Institute of Nuclear and Radiological Sciences & Technology, Energy & Safety (INRASTES) of NCSR (NRWIS) has been further upgraded regarding the buildings, human resources, working procedures, quality management system and physical protection. The license of the facility was renewed by EEAE for the interim storage of RW and disused RS, low activity sources dismantling, characterization of RW, overpackaging and re-sorting/ segregation of RW and RS and clearance of RW. The legislative bases for the licensing of the facility were the RPR, PD-122/2013, PD-91/2017, JMD-1878/2015 and JMD-2941/2015.
2. The regulatory inspections at the interim storage facility of the NCSR (NRWIS) have been enhanced, in content, frequency and reporting. Indicatively, the number of inspections have been performed at the interim storage facility NRWIS were 4 in 2015 and 2016, 3 in 2017 and 2 in the first semester of 2018. The inspections results have been announced to the facility in details through official inspection reports.
3. EEAE has developed procedures for the review and assessment of the safety assessment report and combined them with the guidance regarding the type, format and content of the documentation that should be submitted by the applicants, in support of the application for authorization. The content of the documented procedures includes the

minimum required information to be provided by the applicant, the acceptance criteria and the review and assessment process for the EEAE reviewers.

4. Improvements, regarding the format and content of the safety documentation of the interim storage facility NRWIS, have been identified during the facility licensing. In particular, a safety analysis, including a qualitative accident analysis and specification of the waste acceptance criteria of the NRWIS, have been requested from the operator during the renewal of the license. One of the most important hazard, due to the location of the facility, had been identified to be an external fire. This hazard has been evaluated and measures have been identified in collaboration with the National Fire Service for the minimization of the impact of a fire on the facility.

International peer reviews

At the request of the Government of Greece, an IAEA Integrated Regulatory Review Service (IRRS) Follow-up mission was conducted in EEAE from 20 to 24 November 2017. The purpose of the IRRS Follow-up mission was to review Greece's progress against the recommendations and suggestions identified in the initial IRRS mission (20 to 30 May 2012).

Overall, the IRRS team concluded that Greece, through EEAE, has been responsive to each recommendation and suggestion made in 2012, and continues to place appropriate focus on implementing a framework that provides for effective protection of public health and safety. 26 out of 28 recommendations and 9 out of 10 suggestions identified in 2012 have been closed. More details are provided in Section L in this report. The full IRRS report is available in EEAE webpage (www.eeae.gr).

Training, Research and Developments

During the last three year reporting period, important training and R & D have been taken place.

A significant number of scientific and technical staff from EEAE and NCSR, the major key partners in SF and RW management, as well as members from the EEDRA participated in IAEA training activities and programs. Indicatively, in IAEA project activities participated: 3 persons in RER/9/138 project, 3 persons in RER/9/143, 2 persons in RER/9/146, 12 persons in INT/9/182, In addition 7 persons participated in other IAEA workshops and meetings, as CoC, MedNet, etc.

NCSR and EEAE participated or/and developed consortiums for EU and IAEA R & D activities, programs and proposals (e.g. JOPRAD, EJP)

These activities have strengthen the cooperation between Greek scientists, research and technical centers and initiated and broadened the collaboration with EU research centers and IAEA.

C. Scope and inventory (Article 2, Article 12.1 (c), Article 14.2 (b))

Scope

According to the definitions given in legislation (PD122/2013), which is in line with Directive 70/2013, RW means radioactive material in gaseous, liquid or solid form for which no further use is foreseen or considered by the Greek State or by a natural or legal person whose decision is accepted by the Greek state, and which is controlled as RW from EEAE under the legislative and regulatory framework of the Greek state.

Spent fuel management in Greece concerns only the GRR-1. There are no reprocessing facilities in Greece.

RW in Greece originates from medicine, research - including the past operation of the GRR-1 - and industry. The vast majority of them are VLLW or LLW. A very small amount of waste that may be classified as ILW, mainly some parts from the dismantled core of the reactor, also exist. Today RW includes:

- a. Solid and liquid RW (regeneration bed resins, activated and contaminated objects etc), RS originated from the past activities and operation of the research reactor GRR-1. These RW and RS are temporarily stored inside the reactor building, storage spaces in retention tanks and the interim storage facility of NCSR D.
- b. Disused and orphan RS and RM for which, by EEAE decision, there is a clear and urgent need – from the safety, security and radiation protection point of view - for immediate management. This category includes RS and RM detected in scrap metal, illicit trafficking, illicit actions, emergency situations, as well as RS and RM from bankrupt companies. These RS and RM are transferred to the interim storage facility of the NCSR D.
- c. Disused RS and RM, derived from activities of industrial, medical, research or other facilities, which cannot be repatriated or exported to a recycling facility abroad. They are temporarily stored in the premises of their holders, in storage spaces, until their final management. The possession and the temporary storage of such RS and RM are under regulatory control. To this end, specific terms are included in the conditions of the facility operation license, which are subject to EEAE's inspection.
- d. Equipment and consumer products containing RM (e.g. smoke detectors, lighting rods, fluorescent signs, measurement devices, etc.), which completed their useful life and cannot be exported for recycling, for any reason. These materials are temporarily stored either at the holder's premises, or at authorized facilities for radioactive lightning rod / smoke detector management. They may also be transferred to the NRWIS.
- e. Radioactive materials or contaminated objects containing naturally occurring radioactive materials (NORM), which are stored on site, in temporary storage spaces, until their final management. Furthermore, several tens of tones of soil containing very small amounts of NORM (above exemption levels), produced as by-product of phosphoric fertilizer industry, are deposited in land fields.
- f. Liquid and solid RW from the operation of medical and research laboratories, which are managed by decay and clearance. The relevant files and records are kept by the operator and are subjected to EEAE's inspections.

Regarding NORM management, relevant legislation is under development in the context of the transposition of the new European Basic Safety Standards Directive 2013/59/Euratom. At the moment, fertilizer industry phosphogypsum or other industries residuals and other contaminated materials (e.g. metal pipes) are stored on site (e.g. on stacks). From radiation protection perspective, all NORM materials are under monitoring by EEAE.

Classification of existing waste is underway. In general, the IAEA radioactive waste classification is applied. Specific criteria are as follows:

The 100 days and 30 years half-lives apply for distinguishing between very short lived and long lived RW, respectively. Very low level waste (VLLW) contains isotopes with half lives less than 30 y and activities about two orders higher than the exempted values. Waste with radionuclides with higher half times are considered as VLLW too (e.g. ^{226}Ra), if the activity is very low. Examples are objects using ^{226}Ra for luminance, smoke detectors with ^{241}Am , soil with NORM ^{226}Ra at low concentrations, etc. Low level waste (LLW) do not contain long lived (i.e. with $t_{1/2} > 30$ y) radionuclides. Long lived radionuclides (i.e. with $t_{1/2} > 30$ y) could be present in LLW, if the concentration is lower than 400 Bq/g on average for long lived alpha emitting radionuclides, or 10 kBq/gr for long lived beta and/or gamma emitting radionuclides. Although classification is related to the disposal options – which have not been determined yet – and the availability and suitability of the storage procedures and infrastructure, almost all (except very few cases) radioactive waste in Greece are classified as VSLW, VLLW or LLW, due to their activities and form. A very few RW which concern regeneration bed resins and activated or contaminated objects in connection with GRR-1 operation, as well as a few RM found in scrap metal, have not been classified yet.

For very short lived waste (VSLW) ($t_{1/2} < 100$ d) decay and clearance are employed. Generic and conditional clearance levels apply.

Inventory of RW and future RW

EEAE maintains the national radioactive sources inventory including the following information: License holder: Facility / laboratory / organization; Person in charge: Radiation protection officer / advisor or source officer; License: expiration – conditions; Location within the facility; Source device: manufacturer, type, etc Source isotope, type – form, s/n (if available); Source activity and reference date; Other available information from the licensee.

Regarding the future RW, it is noted that the main principles of SF and RW management policy (i.e. return of spent fuel to the supplier or producer country, repatriation of radioactive sources and clearance) are being realized successfully, which is expected to continue. In addition, the research reactor GRR-1 is under extended shutdown, so no SF or other RW will be generated from its operation.

In this respect, it has been assessed that the future RW, additional to the existing, may arise mainly from:

- a. the decommissioning of the research reactor GRR-1. The inventories presented in the NatPro (Annexes) include estimations of the RW that will be generated from the GRR-1 decommissioning.
- b. orphan sources from illicit trafficking and scrap metal shipments
- c. sources from bankrupt facilities that the owner will not be able to manage

Since the aforementioned (a) RW generation route has already been considered to the RW inventories and the (b) and (c) routes are of low probability occurrence, if existing at all, it is expected that the RW quantities, as presented in the NatPro (Annexes) will remain the same in the future. EEAE performs updates of the inventories regularly.

During the last three year reporting period, the RW inventories remain the same. The most recent data for the national inventory of RW and RS in use are provided in Annexes.

D. General principles and policies (Article 4)

Policy for RW management

The national policy is defined in article 4 of PD-122/2013 and specified in JMD-1858/2015. The basic principles are as follows:

According to article 4, paragraph 1 of PD-122/2013 and the terms of PD-91/2017, the Minister has the ultimate responsibility for management of SF and RW generated within the Greek territory, as well as for supplementing, extending, maintaining and implementing the national framework and the national policy.

Disposal of radioactive waste in Greece is only allowed for RW generated within the Greek territory, and shall take place in an authorized disposal facility within the country. The import of SF and RW within the country's borders for management, including disposal, is prohibited.

Until the establishment of a disposal facility the storage of RW generated within the Greek territory is carried out in authorized interim storage facilities (centralized) for a period no longer than 100 years or in authorized storage spaces at RW producers' facilities for a period up to 10 years. In case that RW of Greek origin is shipped from the Greek state for processing in an EU Member State or in a third country, the ultimate responsibility for the safe and responsible disposal of those materials, including any waste generated as by-products remains with the Minister. Supervision of the safe and responsible disposal of these materials is assigned to EEAE.

Research reactor SF returned permanently to a country where research reactor fuels are supplied or manufactured, based on an applicable international agreements concluded compulsorily at the time of import of any nuclear fuel.

For the RS the repatriation is the prioritized (primary) management option. For liquid VSLW originating from nuclear medicine laboratories the decay and clearance options are applied.

On a 10-year periodic basis, if necessary, withdrawal projects are carried out to export RS and RM to foreign authorized recycling facilities.

The storage of RW, RS and RM does not constitute a final management solution. The temporary storage period is specified in the licensing conditions/terms of the facility or practice. Maximum storage periods are specified.

Greece supports the idea of sharing of common activities, practical solutions and R & D programs in the context of agreements between the countries.

Furthermore, according to PD-122/2013, JMD-1858/2015, PD-91/2017

- the licensee of the facility has the prime responsibility for the safety and radiation protection and the compliance with the safety principles and radiation protection regulations, according to the Greek and European legislation and the applicable IAEA safety standards.
- the producer of research reactor SF has the prime responsibility for its management until its final return to the supplying country.
- the RW producer has the prime responsibility for the management of RW either up their physical decay to the statutory clearance levels of the current RPR, or their transport to an authorized RW management facility within or outside the country.
- the producer bears the management costs of the SF and RW.

Shipment of SF and RW

Since now, only RS have been exported for recycling following a national project for identification, collection and export for recycling of RS (2001-2006). During the activities of that project, no RW was generated to the foreign recycling facility that had to be returned to Greece.

According to PD-122/2013, PD-91/2017 and JMD-1858, in case of exporting RW, RS or RM for processing, recycling or other management, these shall be exported to a country whose technical, legislative or administrative facilities are adequate and all necessary bilateral and or international agreements are in place. All relevant points of the acts refer explicitly to an authorized facility. Shipments of RS, RM, RW and SF are ruled by the terms of the Presidential Decree No. 83/2010, "Transposition of Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel into the Greek legislative framework".

Main principles of the RW management policy

a. Article 4, paragraph 3 of PD-122/2013, defines the basic principles of national policy, including minimization of RW, recycling and reuse of materials. According to article 5 of JMD-1858/2015 the producer of RW shall take all necessary, reasonably practicable, measures to minimize the volume and activity of RW. The measures are approved by EEAE, under the authorization of the relevant practice. Furthermore, all stakeholders use RS ensure the reusability of RS from other interested users, where possible, before they become RW. On a periodic basis of decade, if deemed necessary, the Minister proclaims withdrawal programs for the recycling of RS and RM to foreign authorized recycling facilities, so they do not become RW, and ensures the availability of the required funds.

Recycling facilities for RS do not exist in Greece. Treatment basically concerns simple procedures for the dismantling of some consumer products (smoke detectors, lightning rods, etc.) for volume minimization.

Medical and research laboratories using liquid or solid RM apply the decay and clearance method, by storing the short-lived radioactive waste at their premises. The conditions for storage are included in the terms of the operation license and are subjected to EEAE inspections.

b. According to Article 4.3 of PD-122 the interdependencies between all steps in SF and RW generation and management shall be taken into account; in particular, for the existing RW storage facility at NCSR (NRWIS), all RW management activities are performed so as to ensure the retrievability of the waste, until the final disposal option and the corresponding acceptance criteria are determined.

c. According to article 6, paragraph 1 of PD-91/2017, passive safety measures are specified in the disposal of RW; the evaluation of location, design, construction, operation and closure of a disposal facility must be undertaken in such a way as to achieve safety by passive means to the fullest and to minimize the need for measures and actions after the closure of the facility. Appropriate radiation protection supervision and control for the preservation of passive safety features should be applied, in order to comply with the provisions of the safety analysis report.

d. According to article 5, paragraph 15 of JMD-1858/2015, the requirements, decisions taken, the proposed solutions and regulatory inspections and audits, relating to the safe management of RW follow a graded approach, i.e. reflect in a proportionate manner the relative risk. An example is the requirements for storage, decay and clearance, as applied in nuclear medicine laboratories and in the NRWIS.

e. According to article 5, paragraph 2 of JMD-1858/2015 and article 7, paragraph 5 of PD-91/2017, the producer of RW has the sole responsibility of their management and

bears the associated costs. The SF and RW producer is required, with graded approach, to have all the necessary financial resources to ensure the infrastructure and skilled workforce required for the safe processing, conditioning, transport, storage or clearance.

f. According to RPR and PD-91/2017 (section 3, article 10) each practice, work or activity related to the management of RW requires a license in accordance with the current legislation, taking into account the graded approach. In the various stages of a RW management facility lifetime, in addition to other requirements provided by law, the following authorizations are required: a. Feasibility License; b. Establishment License in a specific site; c. Design approval; d. Operation License; e. Decommissioning License; f. Approval for site release from regulatory control. In case of significant changes in terms of radiation protection and safety, or important modifications of the activities carried out there, a license amendment is required.

E. National framework (Article 5)

Main legislation

In 2017, the PD 122/2013, which is the higher level legislative document pertaining directly to the management of radioactive waste was amended by the PD 91/2017. The amended legislation brings important modifications and additions in relation to applicable safety requirements for predisposal management and disposal, organizations and stakeholders involved in the management of radioactive waste, the licensing stages and regulatory supervision system.

In 2015, the NatPro has been published as a joint ministerial decree (JMD-2941/2015).

In 2018, the National Committee National Committee for the RW management (EEDRA) was appointed and composed by the EEAE decision (EEAE-194/2018).

A list of the laws and regulations relevant to RW management are given below.

Radioactive waste

- Presidential Decree 122/2013, Transposition to Greek legislation of 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, Government Gazette Folio No. 177/A/12.08.2013.
- Presidential Decree 91/2017, Legislative, regulatory and organizational framework for the responsible and safe management of spent fuel and radioactive waste and amendment of the Presidential Decree. 122/2013, Government Gazette Folio No. 130/A/01.09.2017;
- Presidential Decree No. 83, Government Gazette Folio No. 147/A/03.09.2010, "Transposition of Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel into the Greek legislative framework".
- Ministerial Decision 131207/13/20.08.2015, National policy on the management of spent fuel and radioactive waste, Government Gazette Folio No. 1858/B/27.08.2015;
- Ministerial Decision Π/112/214196/30.12.2015, NatPro of spent fuel and radioactive waste management, Government Gazette Folio No. 2941/B/31.12.2015;
- EEAE-194/2018: EEAE decision No Π/112/4364/2018, Government Gazette Folio No. 194/YOΔΔ/05.04.2018, "Appointment, composition and functioning of the National

Committee for Radioactive Waste Management”, 2018, as amended by the 7β/254, Government Gazette Folio No. 325/YOΔΔ/07.06.2018 (EEAE-325/2018).

- EEAE Decision No. 2/214, Government Gazette Folio No. 1958/B/18.07.2014, “Specification of procedures for the release/acceptance of contaminated objects and radioactive waste from medical applications”;
- EEAE Decision No. 2.1/218/06.02.2015, Government Gazette Folio No. 948/B/26.05.2015, “Patients excreta release after nuclear medicine treatments (therapies)”;

Radiological protection

The legislation on radiation protection is currently under extensive update in the context of the new European Basic Standards Directive 2013/59/Euratom transposition. The main act is a Presidential Decree (PD-BSS), which has been approved by the State Council and is in the final stage of publishing. The current legislation in force, some of which, however, will be amended by the PD-BSS soon, are:

- Law No. 4310/2014, Research, Technological Development and Innovation and other provisions (Chapter E' - Nuclear Energy, Technology and Radiation Protection – Greek Atomic Energy Commission (EEAE), Government Gazette Folio No. 258/A/08.12.2014;
- Ministerial Decision No. 1014/(FOR)94/2001, Approval of Radiation Protection Regulations, Government Gazette Folio No. 216/B/06.03.2001;
- Ministerial Decision No. 10828/(EFA)1897/2006, Control of high-activity sealed radioactive sources and orphan sources (transposition the Council Directive 2003/122/Euratom), Government Gazette Folio No. 859/B/10.07.2006;
- Ministerial Decision No. 9087(FOR)1004/1996, Operational protection of outside workers exposed to the risk of ionizing radiation during their activities in controlled areas, Government Gazette Folio No. 849/B/13.09.1996.

Nuclear installations

The legislative framework with regard to nuclear installations is as follows:

- Act No. 854/1971, On the terms regarding the establishment and operation of nuclear facilities, Government Gazette Folio No. 54/A/18.03.1971;
- Presidential Decree No. 610, Establishing terms and procedures in licensing Public Power Corporation to construct a nuclear power plant on a specific site, Government Gazette Folio No. 130/A/23.08.1978;
- In early 1980s, a decision was made to exclude nuclear power electricity generation. Therefore, the above two pieces of legislation have never been used and can be considered as archival pieces of legislation.
- Presidential Decree No. 60/2012, Establishing a National framework for the nuclear safety of nuclear installations (transposition of the Council Directive 2009/71/Euratom of 25 June 2009), Government Gazette Folio No. 111/A/03.05.2012.

Nuclear research reactors

- Ministerial Decision 91175/31.05.2017, Amendment of the Decision no. P/112/305/2012 (B' 2877/26.10.2012) “Basic requirements – principles of nuclear safety and regulatory control of research reactors” (transposition of the Directive 2014/87/Euratom) Government Gazette Folio No. 1991/B/09.06.2017;

- Ministerial Decision P/112/305/2012, Basic requirements – principles of nuclear safety and regulatory control of nuclear research reactors, Government Gazette Folio No. 2877/B/26.10.2012.

Establishment of the regulatory body

- Law No. 1733/1987, Transfer of Technology, inventions, technological innovation and establishment of the Greek Atomic Energy Commission, Government Gazette, Folio No. 171/A/22.09.1987;
- Presidential Decree No. 404/1993, Organization of the Greek Atomic Energy Commission, Government Gazette Folio No. 173/A/05.10.1993;
- Law No. 4310/2014, Research, Technological Development and Innovation and other provisions (Chapter E' - Nuclear Energy, Technology and Radiation Protection – Greek Atomic Energy Commission (EEAE), Government Gazette Folio No. 258/A/08.12.2014;
- The organization of EEAE is currently under update (see below in legislation in progress).

Implementation of the International obligations

- Law No. 2480/1997, Ratification of the Nuclear Safety Convention, Government Gazette Folio No. 70/A/14.05.1997;
- Law No. 1636/1986, Ratification of the Convention on the physical protection of nuclear material, Government Gazette Folio No. 106/A/18.07.1986;
- Law No. 1758/1988, Ratification of the Protocol Amending the Convention on Third Party Liability on the Field of Nuclear Energy of 29 July 1960, as it was modified by the Additional Protocol of the 28 January 1964, Government Gazette Folio No. 44/A/10.03/1988;
- Law No. 1937/1991, Ratification of the International Convention in case of a Nuclear Accident or Radiological Emergencies, Government Gazette Folio No. 35/A/13.03/1991;
- Law No. 1938/1991, Ratification of the International Treaty on Early Notification in case of a Nuclear Accident, Government Gazette Folio No. 36/A/13.03.1991;
- Law No. 2824/2000, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Government Gazette Folio No. 90/A/16.03.2000;
- Law No. 3990/2011, Amendment of the Convention of Physical Protection of Nuclear Materials, Government Gazette Folio No. 159/A/13.07.2011.

Safeguards and non-proliferation

- Law No. 437/1970, Ratification of the non-proliferation treaty signed on the 1 June 1968, Government Gazette Folio No. 49/A/26.02.1970;
- Safeguards agreement between Greece and IAEA signed on 17.11.1972;
- Ministerial Decision No. 5408/E3/2362, Control on transfer of nuclear materials, armament and technologies affecting national Defense and Security, Government Gazette Folio No. 730/B/21.09.1993;
- Law No. 2805/2000, Ratification of the additional protocol, Government Gazette Folio No. 50/A/03.03.2000.

Emergency preparedness

In order to cope with emergency situations, Greece has established the General Plan for Civil Protection. Annex "R" of this Plan is dedicated to radiological/nuclear emergencies

- Ministerial Decision 2739/1994, Regulation for public information in the event of a radiological emergency, Government Gazette Folio No.165/B/15.03.1994;
- Law no. 3013/2002, Enhancement of civil protection and other provisions, Government Gazette Folio No. 102/A/01.05.2002;
- Ministerial Decision No. 1299/2003, Approval of the General Plan for Civil Protection, under the Code Name Xenokratis, Government Gazette Folio No. 423/B/10.04.2003;
- Law No. 3491/2006, Establishment of the supporting team for Nuclear, Radiological, Biological and Chemical Threats, Government Gazette Folio No. 207/A/10.10.2006;
- Decision of the General Secretary for Civil Protection National Plan on CBRN threats, November 2011.

Emergency preparedness and response system and plans are under update as part of the new European Basic Safety Standards Directive 2013/59/Euratom transposition.

Other relevant legislation

- Law No. 3787/2009, Ratification of the Protocol amending the Convention on Third Party Liability in the field of nuclear energy of 29 July 1960, as amended by the additional protocol of 28 January 1964 and by the Protocol of 16 November 1982, Government Gazette Folio No. 140/A/07.08.2009;
- Ministerial Decision Π/112/1057/2016/01.02.2016, Establishment of requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption, in compliance with the Council Directive 2013/51/Euratom of 22th of October 2013, Government Gazette Folio No. 241/B/09.02.2016.

Legislation in progress

- Joint Ministerial Decision on "Procedures and requirements for the licensing of radioactive waste management facilities" (JMD-Auth).
- Transposition of the new European Basic Safety Standards Directive 2013/59/Euratom and update of the RPR is underway (approved by the State Council and in the final stage of publishing);
- Presidential Decree for the internal organization of EEAE (approved by the government and in the final stage of publishing);

Bodies in charge for RW management

According to PD-91/2017 and PD-122/2013 the main bodies in charge for RW management are:

a. The Minister

The responsible for EEAE Minister (currently the Minister of Education, Research and Religious Affairs) has ultimate responsibility for the management of SF & RW and for the approval and implementation of the NatPro, as well as to supplement, extend, maintain and apply the existing "national framework" and implementation of the "national policy".

The Minister issues SF & RW management facility licenses and enforces measures according to EEAE recommendations and ensures the development and implementation of the financial plan for the SF & RW management, including the disposal of RW (Article 5.1 PD- 122/2013).

b. Greek Atomic Energy Commission (EEAE)

EEAE is the competent authority - Regulatory Body. Details on EEAE duties and responsibilities are provided in other sections in this report.

c. National Committee for Radioactive Waste Management (EEDRA).

The National Committee for Radioactive Waste Management (EEDRA) has been recently established by EEAE-194/2018 act and its amendment EEAE-325/2018, following PD-91/2017 provision. EEDRA is a collegiate body with advisory and supportive role towards the Minister on the implementation of the practical aspects of the national policy and national framework and on the coordination of the bodies involved in RW management. EEDRA is a 9-member committee nominated upon an EEAE act and consists of the EEAE Chairman (EEDRA President) and the EEAE Vice Chairman (EEDRA Alternate President), a representative of the ministry responsible for EEAE (currently, Ministry of Education, Research and Religious Affairs), representatives of the Ministry of Environment, Ministry of Finance, Ministry of Development and Ministry of Health, a representative of the General Secretariat of Waste Management Coordination, a representative of EEAE and a representative of NCSR. With the establishment of EEDRA the collaboration between the organizations/bodies involved in RW management and the coordination of actions are ensured.

As Greece is having a very small nuclear program, the establishment of a separate Waste Management Organization (WMO) is not justifiable. EEDRA can be interpreted as having a WMO-like role in the country by being independent from the waste producers, maintaining its autonomy in relation to the regulatory authorities due to its diverse composition, and having a flexible, optimal and effective form.

The role and work of EEDRA is:

- a) To update the NatPro of RW management from production to disposal in accordance with Articles 11 and 12 of PD-122, taking into account the needs of the country and the national policy.
- b) The preparation of financial plan and proposing funding sources for the implementation of the NatPro for RW management.
- c) The presentation to the Government of studies or calls of tender for the implementation of actions under the NatPro .
- d) The monitoring and evaluation of the process and progress of the implementation of the actions undertaken under (c) above.

d. License holder

The license holder operates a SF & RW management facility or conduct practices and activities with SF & RW management. It holds a license pursuant to Article 7 of PD-122/2013. The licensee has the prime responsibility for the safety, radiation protection and the compliance with the basic safety principles and radiation protection requirements during whole lifetime of a management facility, according to the Greek and European legislation and the applicable IAEA safety standards. The license holder of a RW disposal facility shall belong to the public sector.

e. **Producer of RW**

The RW producer possesses a license of a practice or activity that generates RW. The SF and the RW producer prime responsibilities and financial obligations are presented in previous parts in this report. The producer, also, has the obligation and responsibility to follow the binding principles of the National Policy and the relevant national guidelines and international standards.

f. **The national facility for the interim storage and management of RW (EEPADRA)**

EEPADRA is a national facility for the interim storage and management of RW. It is defined and approved by the Minister, with the assent of EEAE. The EEPADRA is responsible for the storage and the proper management - until a disposal solution is applied - of all orphan RS and RM which pose radiation risks to the public and environment and therefore, their safe and secure management is mandatory.

EEPADRA has not been defined, yet. EEDRA has initiated the procedures for setting the criteria for the appointment and approval of the EEPADRA.

Coordination of the Bodies in charge

The Minister has the ultimate responsibility for the management of SF & RW in the country and the approval and implementation of the NatPro. The Minister also approves the appointment and establishment of EEPADRA and issues the licenses of the facilities involved in SF & RW management.

EEAE is the competent authority for authorization and licensing of SF & RW management facilities and practices and proposes to the Minister for the license issue. EEAE performs regulatory inspections to all RW management facilities ("License Holder") and to facilities that produce RW from the applied practices ("Producers of RW").

EEDRA, being a collegiate body coordinates the activities of the ministries in charge in respect to SF & RW management. EEDRA also have an important role to the appointment and establishment of EEPADRA.

Safety Requirements and Responsibilities

a. Responsibility of the license holder

Article 7.1 of PD 122/2013 and articles 15.4 and 15.5 of PD-91/2017 explicitly assign the prime responsibility for safety of SF & RW management facilities or activities to the license holder and the producer. SF & RW management actions of a facility are assessed by EEAE during the authorization process.

b. Authorization

According to RPR and PD-91/2017 (chapter 4, article 16) each practice, work or activity related to the RW management requires a license in accordance with the current legislation, taking into account a graded approach. In the various stages of a RW management facility lifetime the following authorizations are required: (a). Feasibility License; (b) Establishment License in a specific site; (c) Design approval; (d) Operation License; (e) Decommissioning License; (f) Approval for site release from regulatory control.

EEAE has developed procedures for the review and assessment of the safety assessment report and combined them with the guidance regarding the type, format and content of the

documentation that should be submitted by the applicants, in support of the application for authorization. The content of the documented procedures includes the minimum required information to be provided by the applicant, the acceptance criteria and the review and assessment process for the EEAE reviewers.

EEAE, as responsible for assessing the safety of SF and RW management facilities in the country, if appropriate, seeks the assistance of other agencies with appropriate expertise in the country or abroad. In order to assess specific aspects of the safety of SF and RW facilities, which are not within the responsibilities of EEAE, opinion of the competent national bodies is required.

In the process of licensing, the findings of EEAE from inspections, audits and safety assessments of the SF and RW management facilities are recorded and documented.

c. Inspections

EEAE performs regular and ad hoc inspections and safe operation verifications, which may be pre-announced or extraordinary, to ensure compliance with the regulatory requirements. The findings of audits and inspections, including any recommendations or requirements for improving the safety of the SF and RW facilities, are recorded in inspection reports, notified to the licensee and to all interested parties with a legitimate interest. Indicatively, the number of inspections have been performed at the interim storage facility NRWIS, the main RW management facility in the country, were 4 in 2015 and 2016, 3 in 2017 and 2 in the first semester of 2018. The inspections results have been announced to the facility in details through official inspection reports.

During the inspection, the licensee is required to allow and facilitate unrestricted access for inspectors at any point of the facility, access to documents or other sources of information concerning the safety of SF and RW management and allow communication with any member staff. In the event that the licensee refuses or impairs the conduct of the inspection, EEAE may request the assistance of the police authority.

In the case the inspection findings are related to discrepancies with the requirements of legislation or the conditions of a permit or approval, to proceed to an amendment, suspension or revocation of the license.

EEAE may require measures or improvements and / or changes in the facility or safety documents, when necessary, to maintain a high level of safety, especially if deviations from the terms of the license or the essential safety requirements of SF and RW management facilities are observed.

In case of failure by a licensee to the requirements of EEAE, EEAE may withdraw or suspend the license or the approval issued or EEAE may propose the suspension or revocation of the license and may recommend or impose sanctions in accordance with applicable laws and provisions.

d. Integrated Management Systems

According to PD 122/2013 (Article 7.4), license holders shall implement management system, including a Quality Assurance (QA) program. In addition, according to the RPR, the end-user, which is the RW producer in certain cases (e.g. industrial applications, nuclear medicine or research laboratories), should implement QA program, which are subjected to regulatory inspection.

Indicatively, the QA program of NRWIS, which is the main RW management facility in the country, currently, is based on

1. Document Standardization and Codification.
2. Handling of Incoming and Outgoing Documentation.

3. Organization and Responsibilities of the personnel.

The most important elements of the QA include Records and Document Control System, Radioactive Waste Management Review, Personnel Meetings, Surveillance and Maintenance of Instrumentation, Sampling Quality Control, Handling, Storage and Shipping, Quality Assurance Records and Training Program.

e. Human and financial resources

The RPR and the PD-122/2013 provide general requirements for human and financial resources of the licensee. Information for the available human and financial resources of the NRWIS storage facility were provided in the application for the operation license and found adequate in the regulatory review for the current activities in the facility.

For the import of RS and RM, licensing imposes that full financial provisions are made by the licensee for waste management and the return of the RS and RM to the manufacturers.

f. Public information and perception

The information and public participation in the decision-making process for the management of RW is set by the provisions of article 10 of PD-122/2013 on transparency. In addition article 15.7 of PD-91/2017 states that the bodies in charge (i.e. the Minister, EEAE, EEDRA, the license holder, the RW producer and the EEPADRA) are required to provide the public with the necessary information and the possibility to participate effectively in the decision-making process concerning the management of SF & RW in accordance with national law and international obligations, provided this does not jeopardize security.

Furthermore, the forthcoming Joint Ministerial decision for the authorization (JMD-Auth) involves public at all stages of authorization/licensing of RW management facilities through open public consultation procedures. Such open consultation has been conducted, by means of the Government website www.opengov.gr, during the development of legislation acts (PD-91/2017 and JMD-1858/2015) and the comments received were considered to revise the drafts.

g. Financing

According to the article 15.5 of PD-91/2017 and the article 4.3 of PD122/2013, the SF and RW producer bears all costs for the management of the SF and RW produced.

The plan for the NatPro financing is elaborated by EEDRA. The Minister shall ensure the implementation of the financing plan, which will not necessarily draw on the state budget but will be oriented in raising resources through, as indicative, projects, structural funds, recovery of the deposit fund, etc.

An independent deposit fund with separate code has been created in EEAE Special Account for Research Grants (ELKE) for the financial security of the management of RW, RS and RM. More details are presented in section I in this report.

h. Other elements to improve the national framework

A number of means have been deployed in order for the Greek regime to be responsive to changes in technology, international best practice/standards and lessons learned from international operating experience. Such means are outlined below.

Greece participates effectively to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management since 2000 as well as to other international treaties/conventions and bilateral agreements in the area of radiation

safety and implements the Code of Conduct on the Safety and Security of RS and its supplement for import – export – transport of RS.

In the context of continuous improvement, Greek scientific and technical staff members participate actively to relevant IAEA and EU projects and to several international workshops and seminars in this field.

- At the request of the Government of Greece, an IAEA Integrated Regulatory Review Service (IRRS) Follow-up mission was conducted in EEAE from 20 to 24 November 2017. Overall, the IRRS team concluded that Greece has been responsive to each recommendation and suggestion made in 2012, and continues to place appropriate focus on implementing a framework that provides for effective protection of public health and safety. More information regarding the IRRS mission is available in Section L in this report. The full IRRS report is publicly available in EEAE webpage (www.eeae.gr)

F. Competent regulatory authority (Article 6)

EEAE was initially established by an Act in 1954. The organization has been re-established with a different scheme in 1987. In 2014, with the Law 4310 (Government Gazette Folio No. 258/A/08.12.2014) titled “Research, Technological Development and Innovation and other provisions”, in which a separate chapter, chapter E, titled “Nuclear Energy, Technology and Radiation Protection - Greek Atomic Energy Commission” is included (articles 39 - 46, article 90), the obsolete framework (Law 1733/1987, Legislative Decree 181/1974) is replaced by a new operation framework of EEAE. The new framework brings important improvements, regarding, inter alia, EEAE independence, enforcement means, inspectors role and inspection procedures, licensing authority and transparency enhancement. The recently established new legal framework (Law 4310/2014) provides terms on impediments and incompatibilities in the appointment of the Board members (Article 44 on management). This ensures the avoidance of conflicts of interests that could unduly influence regulatory decision making. EEAE is governed by a 7 member Board.

The effective independence of EEAE in the decision making process is ensured by the fact that the Board makes autonomous decisions on safety matters, without political or other interference. These decisions, as well as the minutes of the Board meetings are made open to the public through the EEAE’s web site. Moreover, EEAE staff members are not allowed to have other job positions in the private or public sector.

The new EEAE operation regime is in line with the international and European requirements for radiation protection and nuclear safety regulatory authorities, enhances the independent and effective regulation of this field and addresses some of the IRRS mission findings.

EEAE organizational structure was published in the form of a Presidential Decree in 1993. At present, a new Presidential Decree on the internal organization of EEAE has been approved by the government and is in the final stage of issuance. Following IRRS mission findings, the new internal organization of EEAE provides for the operational separation between its regulatory functions and scientific and technical services.

EEAE employs a sufficient number of about 75 qualified and competent staff to carry out its tasks. Most of EEAE personnel holds a degree of high level education and dispose specialized scientific expertise (M.Sc. and/or Ph.D.). Their continuous training, the participation in EEAE E&T activities and the participation in scientific networks and international fora and activities is encouraged in order to gain the knowledge and experience required for the fulfillment of their tasks.

EEAE financial resources come from the public budget and from licensing fees and radiation protection services. The accounts and fiscal reports of the EEAE are subject to the control of the Audit Council. These data and fiscal reports are published on the EEAE

website and submitted to the President of the Hellenic Parliament and the relevant Minister alongside the yearly report and the budget for the coming year.

EEAE implements an integrated management system; in 2013 it was certified in accordance with the requirements of ISO 9001:2008 standard, which incorporates all functions and accreditations of EEAE. In December 2016, the IMS was updated, fulfilling the requirements of the revised ISO 9001:2015. Specific aspects were further identified to be embedded in the integrated management system to respond to the IRRS findings, in line with IAEA safety requirements. An IRRS follow-up mission was conducted in November 2017, as presented in other parts of the report.

G. License holders (Article 7)

General safety requirements

General Safety Requirements, pertaining in particular to radioactive waste management, are provided in Article 7 of PD 122/2013. These requirements define the responsibilities of the license holders regarding:

- The periodic safety assessment of the facility and activity.
- The demonstration of the safety of the facility, covering all stages of the facility lifetime (development, operation, decommissioning, closure), including normal conditions and events or accidents considered in the facility design.
- Measures for accident prevention and mitigation of their consequences, including the verification of the safety barriers and of the organizational procedures, in order to avoid significant exposure of the workers and the public.
- Management systems and quality assurance.
- Adequate human and financial resources.

The PD-91/2017 provides additional safety requirements for both predisposal management and disposal of radioactive waste, throughout the different stages of a facility lifetime, including siting, design and construction, operation, maintenance, modification and utilization, and decommissioning or closure of facilities.

Safety assessments

Articles 13.2, 15.4 and 15.5 of PD-91/2017 and article 5.1.f of PD-122/2013 set to the license holder and the RW producer the prime responsibility for the safe management of SF & RW, including financing aspects and the compliance with the safety principles and radiation protection regulations. Licensees are required to implement a policy for SF and RW management that sets high priority on safety and promotes the safety culture, by appropriate administrative structure, with clear allocation of responsibilities and fixed communication lines. Furthermore, licensees are required to establish and implement an appropriate quality assurance program and appropriate quality management system, a nuclear security program and a program of lifelong education and training for those employees engaged in tasks related to safety, radiation protection and emergency response.

According to article 13.2 of PD-91/2017, the license holder is required to assess the safety of the installation in a systematic manner. The assessment of safety and security is documented in safety analysis documents and covers all stages of facility lifetime, taking into account the implications of ageing. The assessment of safety and security analysis reports should be updated periodically, and whenever appropriate, taking into account operating experience, changes or new knowledge, with respect to the particular characteristics of the site and the facility, international experience and developments in research and technology. The facility's safety and security level is verified through analysis,

monitoring, audits and inspections to ensure that it remains at all stages of life in accordance with the design, safety requirements and operating conditions limits.

Regarding the main RW management facility in the country, NRWIS interim storage facility, the operation license of the existing NRWIS interim storage facility was last renewed in 2016 with a validity period of 2 years (until end 2018) when it has to be renewed. Authorization is granted for the following practices: interim storage of RW and disused RS; low activity sources dismantling; characterization of RW; over-packaging of waste drums and RS as well as re-sorting/ segregation of RW; clearance of RW.

Improvements, regarding the format and content of the safety documentation of the interim storage facility NRWIS, have been identified during the facility licensing. Respective EEAE recommendations and timeframes were officially delivered to NRWIS in order to take appropriate measures. Several EEAE follow up inspections have taken place to assess the implementations of measures taken. The EEAE safety evaluation reports / inspection reports to NRWIS have been made publicly available (posted to EEAE's web site).

As concerns the overall safety of the facility, areas, where further improvements shall be made, have been identified and included in the current license as additional terms. Among them, the radiological hazards to the public, although are considered to be limited, it has been requested to be further assessed quantitatively in the context of a safety analysis, taking into account the guidance provided in IAEA safety standard WS-G-6.1, Storage of Radioactive Waste, IAEA, 2006.

Other facilities that produce VSLW from their practices (e.g. nuclear medicine, research laboratories) submit radiation protection reports every 3 years (for the renewal of the license), where, among others, RW management is addressed.

Accident prevention and mitigation of consequences

According to the legislation, in each facility there is an internal emergency preparedness plan in case of a radiological accident or event, which is subjected to regulatory review. Moreover, in PD-122/2013 (Article 7.3) and article 13.1 of PD-91/2017 is provided that license holders shall implement measures for the prevention of accidents and for the mitigation of their consequences, in order to protect the workers and the public from significant exposures to radiation.

The emergency plan for the NRWIS facility is based on the assessment of the possible hazards that might arise: (i) during the RW management activities; (ii) in case of fire; (iii) in case of larceny. The assessment consists of tracking and recording the dangers and risks that threaten the safety and health of the personnel, the general public and the environment.

In particular, a safety analysis, including a qualitative accident analysis and specification of the waste acceptance criteria of the NRWIS, have been conducted by the operator. One of the most important hazard, due to the location of the facility, has been identified to be an external fire. This hazard has been evaluated and measures have been identified in collaboration with the National Fire Service for the minimization of the impact of a fire on the facility.

PD-91/2017 sets the safety requirements for the management (article 5) and the disposal (article 6) of RW. JMD-Auth substantiates these requirements by detailing the requirements for the above licenses. In particular, Article 7 of JMD-Auth sets the contents of the Safety Analysis Report (SAR).

The legislation mentioned before (PD-91/2017 and JMD-Auth) provides terms on decommissioning, closure and post-closure and sets the respective requirements for safety and authorization. Yet, decommissioning plans for the GRR-1 research reactor and the centralized interim storage facility of NCSR have not been submitted. The submitted SARs

for these facilities do not include, for the time being, decommissioning, closure and post-closure plans.

IMS and QA programs

According to article 7.4 of PD-122/2013 and article 13.1 and 13.2 of PD-91/2017, the license holders are required to establish and implement management systems, including quality assurance (QA), which give due priority to safety in SF and RW management. The purpose of the management systems and QA is to ensure that all planned and systematic actions necessary for the satisfactory operation of structures, systems, components or procedures related to the SF and RW management are carried out. EEAE is responsible to assess these systems. The QA program is subjected to review and assessment by EEAE.

The centralized interim storage facility of NCSR D has a quality assurance program in place, which has been submitted to EEAE and is regularly inspected by EEAE. The management system is under development.

According to RPR, all medical laboratories, including radiotherapy and nuclear medicine laboratories (potential RW producers) are required to have quality assurance programs, the content of which is approved and regularly inspected by EEAE.

Financial and human resources

According to article 7.5 of PD-122/2013 and article 13.1 of PD-91/2017, the licensee is required to ensure adequate financial resources and scientific and technical support needed for safe and secure SF and RW management, as well as sufficient number of suitably qualified and trained staff. Furthermore, the licensee is required to establish and implement a program of lifelong education and training for the employees engaged in tasks related to safety, radiation protection and emergency response.

Article 15.5 of the PD-91/2017 provides that the SF and RW producer bears the associated management costs. The SF and RW producer, with graded approach, is required to have all the necessary financial resources and skilled workforce required for the safe processing, conditioning, transport, storage or clearance.

For the sustainability of the NatPro, a deposit fund operates under the EEAE for the financial security of the management of RW, RS and RM. More details are presented in section I in this report.

H. Expertise and skills (Article 8)

PD-122/2013 and PD-91/2017 provide requirements and arrangements for the education and training for staff involved in SF and RW management.

Scientific and technical staff of organizations involved in RW management participates in actions of the International Atomic Energy Agency (IAEA) and EU research & development projects on the management of RW and RM. It is particularly encouraged the participation in programs aimed at exploring common waste management solutions (shared regional solutions).

In the current period, the ongoing programs are:

- RER/9/138 "Enhancing Capacities in the Member States for Management of Decommissioning Projects" (IAEA Technical Cooperation program, TC)
- RER/9/143 "Enhancing Radioactive Waste Management Capabilities" (IAEA Technical Cooperation program, TC)

- RER/9/146 "Enhancing Capacities in Member States for the Planning and Implementation of Decommissioning Projects" (IAEA Technical Cooperation program, TC)
- INT/9/182 "Sustaining Cradle-to-Grave Control of Radioactive Sources" (IAEA Technical Cooperation program, TC)
- INT/9/183 "Regional Practical Training Course on Planning and Implementation of Nuclear Facility Decommissioning and Remediation of Radioactively" (IAEA Technical Cooperation program, TC)
- JOPRAD «Joint Program on Radioactive Waste Disposal» (Coordination and Support Action of the H2020 Euratom program)
- EJP European Joint Research Programme in the management and disposal of radioactive waste. Participation in consortium for a research project proposal (2018).

I. Financial resources (Article 9)

According to article 9 of PD-122/2013 all bodies, competent or engaged in activities related to SF and RW management, ensure the availability of sufficient financial resources, as needed for the implementation of the NatPro.

The Minister ensures the development and implementation of the financial plan for the SF and RW management, including disposal (article 7, par. 1 of the PD-91/2017).

One of EEDRA duties is the preparation of financial plan and proposing funding sources for the implementation of the NatPro for SF and RW management.

The Minister shall ensure the implementation of the financing plan, which will not necessarily draw on the state budget but will be oriented in raising resources through, as indicative, projects, structural funds, recovery of the deposit fund, etc.

The SF and RW producers bears the associated management costs.

An independent deposit fund with separate code has been created in EEAE Special Account for Research Grants (ELKE) to cover financial needs of the NatPro. The deposit fund operates under EEAE, in accordance with Article 10 of Ministerial Decision No. 10828/(EFA)1897, Government Gazette Folio No. 859/B/10.07.2006, "Control of high-activity sealed radioactive sources and orphan sources" (transposition the Council Directive 2003/122/Euratom). The deposit fund receives financial contributions from the owner of RS and RM or the RW producer, and from the Ministry of Finance, upon reasoned opinion by EEDRA, or from other involved entities.

In July 2018, an amount of one million Euros (1M€) has been transferred to this fund to meet financing needs for the implementation of the first stages of the NatPro. The approval of this transfer has been made by decision of the EEAE Board in July 2018. The role of the fund, and in particular, the actions of the NatPro it finances, are reviewed following the revisions of the NatPro.

The deposit fund is used exclusively to finance the following:

- recovery of orphan sources and safe temporary storage of such sources;
- management of RW, RS and RM for which EEAE considers that there is immediate need for management for reasons of radiation protection and nuclear security, when the holder is unable to take action.
- export of RS or RM, which are under the jurisdiction of the Greek State (e.g. legacy items) or the holder has ceased to exist or is unable to deal with (e.g. due to bankruptcy), for recycling or management.

Regarding the practical aspects of financing, as already mentioned in other parts of the report, the first revision of the NatPro is expected by the end of 2019, including the final

technical choice for the type of disposal facility. As a baseline scenario, the option of an engineered near surface disposal facility is considered. For the next step of the selection of candidate sites for the disposal facility, studies (geological, environmental etc.) are required, which are, however, expected to be awarded to public universities - research centers and other government bodies, minimizing the relevant costs. The costs for project implementation (e.g. use of equipment, geological and hydrological studies and measurements, labor costs) will be assessed in details in the first review of the NatPro. The Ministry of the Economy, depending on the estimated costs and the timeframes of the actions, will transfer to the annual state budget the relevant financing needs. As already mentioned, officials from the economic and financial sectors and the sector of development and competitiveness of the Ministry of Economy and Development participate in EEDRA, having the major role in the preparation of the financing plan and to identify and obtain the relevant financial resources and funds for the implementation of the NatPro.

J. Transparency (Article 10)

According to article 10.1 of PD-122/2013 the Minister and, as applicable, other competent Ministers take the necessary steps in order the necessary information on the management of SF and RW to be available to workers and the general public.

Article 15.7 of PD-91/2017 states that the bodies in charge (i.e. the Minister, EEAE, EEDRA, the license holder, the RW producer and the EEPADRA) are required to provide the public with the necessary information and the possibility to participate effectively in the decision-making process concerning the management of SF & RW in accordance with national law and international obligations, provided this does not endanger public security.

Pursuant to Law 4310/2014, one of EEAE's competencies is to provide sufficient information to the general public and workers regarding its areas of responsibility [article 43, par. 4(g)].

Furthermore, the forthcoming Joint Ministerial decision for the authorization (JMD-Auth) involves public at all stages of authorization/licensing of RW management facilities through open public consultation procedures. Such open consultation has been conducted, by means of the Government website www.opengov.gr, during the development of legislation acts (PD-91/2017 and JMD-1858/2015) and the comments received were considered to revise the drafts.

In addition, the EEAE inspection reports, the EEAE Safety Evaluation Reports (SER) and the licenses for the GRR-1 research reactor and the interim storage facility of NCSR D are made publicly available via the EEAE web site.

Actions have been taken to improve communication with the public and transparency including, inter alia:

- Stakeholders and information meetings on the new European Regulatory Framework (BSS, nuclear safety and radioactive waste directives);
- promotion of safety culture through sharing lessons learned from radiological events: EEAE systematically disseminates findings and lessons learned from radiological incidents/accidents by posting them at EEAE website;
- public electronic consultation of the national regulatory framework for the safe management of spent fuel and radioactive waste;
- design and development of a new website, www.eeae.gr. The new web profile of EEAE is an information portal on radiation, covering issues of interest for all visitors. It was developed in house, emphasizing on the access to information and online services;

- open data policy. By applying Law no. 4305/2014 (Government Gazette Folio no 237/A/2014), providing for the public disposition and further use of public documents, information and data, within the framework of integrating the provisions of European Directive 2013/37/EU, EEAE recorded all documents and data at its disposal and issued a related decision.

K. Implementation of the national program (Articles 11 and 12)

General on NatPro progress

The initial (first) NatPro has been prepared by EEAE, pursuant to Article 7 of JMD-1858/2015 and in accordance with the requirements of the Council Directive 2011/70/Euratom. The subsequent editions (review/updates) of the NatPro will be undertaken by EEDRA.

The NatPro was published in the Official Gazette in 2015 as a Joint Ministerial Decree (JMD-2941/2015). The NatPro, among others, includes five (5) specific actions on the management of RS, RM and RW with milestones and timelines, cost estimation, financing and inventories of SF and RW. Each action consists of activities. The actions are:

- Action 1: Appointment, composition and functioning of the National Committee for Radioactive Waste Management (EEDRA).
- Action 2: Inventory and Classification of Radioactive Waste
- Action 3: Establishment of national facility for the interim storage and management of Radioactive Waste (EEPADRA)
- Action 4: Withdrawal project of radioactive sealed sources and radioactive materials for recycling and / or management
- Action 5: Decisions on national options for the management and disposal of radioactive waste

According to article 5.1 of PD-122/2013, the starting point for the implementation of the NatPro is the publication date of the PD-91/2017 (i.e. **01.09.2017**), since several important aspects had to be foreseen in advance, the most important being: the appointment of the National Committee for Radioactive Waste Management (EEDRA); the establishment of the national facility for the interim storage and management of RW (EEPADRA); specification of safety requirements for RW management and RW disposal; obligations and duties of the RW management facility licensees and RW producer; financing; authorization and regulatory inspections; enforcement.

The publication of PD-91/2017, initially foreseen in 2015, was delayed due to political developments at that time (e.g. two electoral processes for the emergence of a government in 2015). As a result, the whole NatPro was delayed, including the appointment of EEDRA.

Nevertheless, the overall progress of NatPro implementation, and in particular the investigation of the disposal options, remain within the timeframes of the NatPro. The progress made of the specific NatPro actions within the last three year of the reporting period is briefly presented in the sections below.

Key performance indicators (KPI) that demonstrate the implementation of the NatPro has been determined in EEAE-194/2018 presented in the following table. The respective up-to-day achievements are reported in the last column of the table, as well. EEDRA will revise the KPI to better match with the activities and indicate the progress of the NatPro implementation more coherently.

Table: Key performance indicators (KPI) of the NatPro implementation			
Act	Target / Objective	Goal	Achievement
1	Adherence to schedules and milestones:		
	Establishment and Operation of the National Committee for Radioactive Waste Management (EEDRA)	Deviation <3 months / field	Completed with 1 month delay
	Defining national facility for the interim storage and management of Radioactive Waste (EEPADRA)	Deviation <3 months / field	Within timeframes
	Exporting for recycling and management of RS and RM	Deviation <3 months / field	1 st sub-action has delayed for 6 months. The rest within timeframes.
	Decisions on national options for the RW management and disposal	Deviation <1 year / field	Within timeframes
2	Number of inspections EEAE existing RW management facilities	> 10 / year	3-4 (depending on year) inspections performed per year to the only one existing RW management facility. Goal is considered to be achieved.
3	Number of meetings of EEDRA	> 2 year	The 2 nd meeting is scheduled in September 2018. Goal achieved.
4	Disbursement of funds	> 75% of the requested	No funds is requested yet. 1 M€ has tranfered in EEAE fund for the NatPro activities.
5	Number of disused RS and RM stored on site at owners' premises over a	Zeroing in 5-years	--
6	Number of research & development projects relevant to RW management, involving Greek bodies / organizations	> 2	5 projects involved. Goal achieved.
7	Number of posts on the internet for public information on RW management plans and decision-making	> 5 / year	The national reports (e.g. JC, CoC, RW) and the EEAE Board decisions (e.g. fund for RW management) are posted.
8	Number of safety reports and evaluation reports of existing facilities & organizations	1 / year / facility	About 3-4 (depending on year) inspections performed per year to the only one existing RW management facility. Goal is considered to be achieved.

Action 1

Due to the delayed publication of PD 91/2017, initially foreseen in 2015, for the reasons mentioned above, there was a delay in the appointment of EEDRA,

EEDRA was established on 05.04.2018, following the EEAE decision that provided in PD-91/2017, which had to be published in the Official Gazette (EEAE EEAE-194/2018).

The first meeting of EEDRA took place on 15.06.2018, where, among others, practical aspects of the NatPro was addressed and specific actions were assigned to working groups. After this, EEDRA is functioning.

Action 1 has been completed successfully. A deviation from the KPI goal of about 1 month has been recorded.

Action 2

Since 2015, EEAE has proceeded with the initial inventory of the RW, existing and future. The inventory is continuously updated. However, the inventory is still incomplete for some RW in respect to activity concentration and, in a limited cases of historical waste, isotope characterization.

In September 2018, EEAE has initiated a survey with questionnaires distributed to all facilities countrywide to amend their RS, RM and RW registry, as appeared to national database of EEAE.

On a regular base, EEAE performs on-site inspections at facilities having RS, RM and RW, during which the inventories are assessed and updated accordingly.

The procedure for the final determination of the RW streams and the disposal option(s) has been addressed by EEDRA and a working group has started working on this.

The action is being implemented according to the procedures and the timeframes of the NatPro.

Action 3

A working group (WG) was set by EEDRA to set the criteria to define the national facility for the interim storage and management of Radioactive Waste (EEDPADRA). The criteria are based on the SF & RW inventory, the location, the national policy and the methods and techniques of temporary storing and management solutions (excluding disposal) of SF & RW. The WG is expected to finalize the criteria in autumn 2018, in order the procedures for the selection and the appointment of EEDPADRA to be finalized in the first semester of 2019.

EEDPADRA plays an important role to the RW framework; it could accept RS, RM and RW for management, including characterization, conditioning/packaging and temporarily store.

The action is being implemented according to the procedures and the timeframes of the NatPro.

Action 4

The 1st activity of this action, i.e. the approval by the Minister of project for the export of RS and RM for recycling, has not implemented, yet, due to the late appointment of EEDRA.

However, EEDRA and EEAE has started the preparation of the project. All facilities having radioactive material or may produce RW, countrywide, are contacting, in order to inform about any RS or RM they possess that could be included in the project.

The funding of this action has been partially foreseen, by transferring 1 M€ to EEAE deposit fund.

Action 5

Since the publication of the NatPro in 2015, more knowledge has been gained and a comprehensive understanding has emerged on the applicable options that can meet the country's needs for disposal of RW. The road map on the preferable RW disposal option has become clearer and more specific. In particular, the engineered near surface disposal facility is considered as a basic technical option (baseline scenario). Two alternative options, by preference and priority, are (a) a surface trench and a borehole option and (b) decommissioned, non-operating mines. A few details on the baseline scenario and the alternative options are given in section B of this report.

One of the main immediate tasks of EEDRA is the assessment of the appropriateness and the practical implementation of the first basic option (construction of an engineered near surface disposal facility) and the final decision on the type of disposal facility, with a view to formulating a relevant recommendation (PD-91/2017 Article 15 (3)) by the end of 2018. Subsequently, on the basis of the final decision, a more detailed estimate of the cost will be made, in order EEDRA, before the end of 2019, to proceed with the final proposal to the Minister on the revision of the Natpro. The time frame for the selection and construction of disposal facility is an integral part of the NatPro and will, therefore, be specified in the revised version of the program.

In the short and med term, and in line with the decision on the type of disposal facility, the time frames is expected to take place in accordance with the following steps:

- EEAE will specify the relevant detailed and specialized requirements and safety criteria for all life-time stages of the disposal facility. It is noted that the general, high level of safety requirements for the RW disposal are already foreseen in article 14 of PD- 91/2017.
- The stakeholders (EEDRA and EEAE, mainly) will initiate the process for selecting candidate locations in the country to build the disposal facility. Specific safety criteria are not expected to be set before the end of 2021 and therefore the initiation of the selection process for the candidate sites is foreseen after 2021. Although unforeseeable and / or unknown (at this phase) delays cannot be excluded, there is a significant time margin, until the 2030, to implement the milestone of the NatPro relevant to the selection of the final candidate sites to host the disposal facility. It should be stressed that the selection of candidate sites requires long preparation, as it involves the verification of the suitability of the candidate sites on the basis of extensive technical studies and assessments, including social and political aspects. In the review of the NatPro by EEDRA (as noted, planned in 2019) it is expected to redefine the milestones for the selection of the candidate sites as well as the final site where the disposal facility will be constructed. At the same time, EEDRA is expected to have finalized the cost estimate and the financing needs and resources, which will be included in the revision of the NatPro, as well.

The first revision of the NatPro, which, as mentioned above, is to be made on the basis of the relevant EEDRA recommendation by the end of 2019, will include the final decisions on disposal option with the required clarity and detail at technical level.

L. Peer reviews and self-assessments (Article 14.3)

IRRS mission

At the request of the Government of Greece, an IAEA Integrated Regulatory Review Service (IRRS) Follow-up mission was conducted in EEAE from 20 to 24 November 2017. The purpose of the IRRS Follow-up mission was to review Greece's progress against the recommendations and suggestions identified in the initial IRRS mission (20 to 30 May 2012).

Overall, the IRRS team concluded that Greece, through EEAE, has been responsive to each recommendation and suggestion made in 2012, and continues to place appropriate focus on implementing a framework that provides for effective protection of public health and safety. 26 out of 28 recommendations and 9 out of 10 suggestions identified in 2012 have been closed. More specifically, in the areas relevant to the RW management, the IRRS team deduced that since 2012, EEAE has taken positive steps to:

- Update its legal and regulatory framework to bring into compliance with the latest IAEA safety standard;
- Develop and implement an integrated management system and foster safety culture;
- Clearly assign responsibility for radiation safety including for the safe management of spent fuel and radioactive waste; and setting out the obligations and responsibilities of the license holder and the prime responsibility for safety;
- Develop its compliance assurance program for transport of radioactive material and strengthen its capacity for review and approval of package design by validation of the original certificate;
- Enhance the national regulatory framework for the management of radioactive waste and decommissioning.

Conversely, the IRRS team concluded that even if the IAEA classification scheme is generally applied in regulatory oversight, EEAE has not incorporated it into its regulatory system. Therefore the IRRS team considered that the relevant suggestion made in 2012 is still open.

EEAE quality management systems

The EEAE's quality management systems described elsewhere in this report.

The latest reviews and assessments conducted by external review bodies/organizations:

- December 2017: ISO 9001:2015, by DQS GmbH
- December 2017: ISO/IEC 17020, by Hellenic Accreditation System (ESYD)
- February 2018: ISO 29990:2010, by TUV Hellas
- May 2018: ISO/IEC 17025, by Hellenic Accreditation System (ESYD)

All reviews concluded on the successful implementation of the relevant standards and the accreditation or certifications requirements

ANNEXES : INVENTORY of Radioactive Waste / Sources / Material

TABLE 1 : Resins in drums

Location: Interim storage facility of NCSR "Demokritos"

Form Resins

Origin: Past activities of GRR-1, NCSR "Demokritos"

Properties: Radiological, Physical, chemical

Status: In drums

Processing options: Characterization in progress. Disposal option has not been decided

Update: June 2018

Characterization completed

Waste classif.	Storage room	Type	# Drums	Volume, L/drum	Weight, kg/drum	Total Weight, kg	Total activity, MBq	Nuclides (main)	Maximum C _A / drum, Bq/g	Total MBq
VLLW & LLW	A & B (*)	Resins	158	200	100	15800	245	Ag-108m	4,8	15
								Cs-137	160	213
								Eu-152	2	4
								Co-60	6,2	13

(*) : LLW are stored in building A (56 drums) & VLLW in building B (102 drums). Reference date for activities 2011.

TABLE 2 : Radioactive waste produced from GRR-1

Location: NCSR "Demokritos"

Type: Sediment, liquid and activated/contaminated objects

Origin: Past activities of GRR-1, NCSR "Demokritos"

Properties: Radiological, Physical, chemical

Status:

Processing options: Characterization in progress. Disposal option has not been decided, yet

Update: July 2018

Solid Waste

Waste classif.	Storage room	Form	# Drums	Volume, L	Total activity, kBq	Nuclides (main)	Total Activity kBq
LLW	NCSR "D"	Sediment	1	2	300	Ag-108m	50
						Cs-137	
						Eu-152	30
						Co-60	220

Reference date for activities 2011

Solid Waste

Waste classif.	Storage room	Form	# Drums	Volume	Dose rate at 5 cm	Nuclides (main)	Total Activity kBq	Remarks
ILW	B	Metal parts from GRR-1	1 (cement shielding)	< 0.01 m ³	~ mSv/h	Co-60	(*)	Metal objects (e.g. screws) from GRR-1
LLW	A	Objects in drums	53	10 m ³	< 4 μSv/h	Co-60, Cs-137, Ag-108m, Eu-152	(*)	From GRR-1
Historical Waste	B	Objects in drums	100	20 m ³	< 50 μSv/h	(*)	(*)	From GRR-1 and connected facilities
Historical Waste	B	cemented sludge	50	10 m ³	~ 100 nSv/h	Cs-137	(*)	From GRR-1 and connected facilities
Historical Waste	NCSR "D"	Objects in drums	50	10 m ³	~ 100 nSv/h	(*)	(*)	From GRR-1 and connected facilities

(*) to be defined

Table 2 cont'd

TABLE 2 : continued

Liquid waste

Waste classif.	Storage room	Form	# Tanks	Volume, L	Total activity, MBq	Nuclides (main)	Total Activity kBq
VLLW	Liquid waste storage tanks	Water	15	8944	5,70E+05	H-3	5,70E+05
						Cs-137	47
						Co-60	51

Reference date for activities 2011

TABLE 3 : Expected decommissioning radioactive waste from GRR-1

Location: GRR-1 of NCSR "Demokritos"

Type: Activated /contaminated objects

Origin: Decommissioning of GRR-1. Additional RW may be produced during decommissioning activities.

Properties: Radiological, Physical, chemical

Status:

Processing options: Characterization in progress. Disposal option has not been decided, yet

Update: July 2018

Solid Waste

Waste classif.	Location	Form	# Items	Mass (tons)	Dose rate at 5 cm	Nuclides (main)	Total Activity kBq	Remarks
EW	GRR-1	Metal parts	(*)	30	(*)	Co-60, Cs-137, Ag-108m, Eu-152	(*)	Aluminium, Steel and Stainless Steel
VLLW	GRR-1	Metal parts	(*)	28	(*)	Co-60, Cs-137, Ag-108m, Eu-152	(*)	Aluminium, Steel and Stainless Steel
VLLW (mixed)	GRR-1	Lead	(*)	5	(*)	(*)	(*)	Lead (at the thermal column)
LLW	GRR-1	Metal parts	(*)	0.6	(*)	Co-60, Cs-137, Ag-108m, Eu-152	(*)	Aluminium, Stainless Steel
LLW (mixed)	GRR-1	Lead	(*)	1.8	(*)	(*)	(*)	Lead inside the experimental tubes
ILW	GRR-1	Metal parts	(*)	0.3	(*)	Fe-55, Ni-63, Co-60	(*)	Aluminum, Staintless Steel (support structure of the core and parts of the control rods)
ILW (mixed)	GRR-1	Be blocks and part of the control rods	(*)	0.2	(*)	Fe-55, Ni-63, Co-60, Ag-110m, Ag-108m, Cd-109, H-3	(*)	Be and Ag-Cd-In
(*)	GRR-1	Graphite	(*)	15	(*)	(*)	(*)	Partitioning will be done in the future
(*)	GRR-1 store room	Contaminated objects	(*)	< 1 m ³	tens μSv/h	(*)	(*)	Objects from maintenance, house-keeping, etc

(*) to be defined

TABLE 4 : Disused sources

Location: see table

Type: Disused sources stored at NCSR "D" and at user's facilities (on site)

Origin: Past -current activities of operator

Properties: Radiological

Status: Raw material

Processing options: Awaiting for recycling. Activity verification or determination is still pending

Update: July 2018

Location	Source Category	# sources	Total activity, MBq	Nuclides
Interim Storage NCSR "D, Building A	1			
	2	1	2,18E+04	Co-60
	3	56	4,78E+05	Cs-137, Am-241/Be, Sr-90, Co-60
	4	15	2,53E+04	Co-60, Kr-85, Cs-137
	5	312	2,98E+04	Co-60, Cs-137, Ir-192, Sr-90, Mn-54, Ra-226, Am-241, C-14, Pm-147
On site (facilities countrywide and in GRR-1 storage room)	1	3	5,22E+08	Co-60
	2			
	3	4	5,92E+05	Am-241, Pu-239/Be
	4	57	6,07E+05	Cs-137, Am-241, Ra-226, Th-232, Eu-152
	5	210	2,03E+05	Ra-226, Ni-63, Co-60, Cs-134, Cs-137, Sr-90, Kr-85, Pb-210, U-238, Am-241, Hg-203, Mn-54, Ba-133, Na-22, Co-57
Total		658	5,24E+08	

TABLE 5 : Radioactive material

Location: Interim Storage NCSR "D and on-site at other facilities (storage)

Type: Consumer products, Instruments, contaminated objects

Origin: Past activities of operator, illicit trafficking

Properties: Radiological

Status: Raw material

Processing options: Characterization in progress. Disposal option has not been decided, yet

Update: July 2018

Location	Type	Origin	# items / quantity	Activity	Nuclides
Interim Storage NCSR "D	Lighting rods	Collected from sites	154	~ 50 MBq/item	Am-241, Ra-226
	Smoke detectors	Collected from sites	13475	~ 0.03 MBq/item	Am-241
	Consumer products, instruments, objects	Vehicle instruments, lamps, depU blocks	2298	various (*)	Ra-226, Am-241, Th-232, Sr-90, depU
	Contaminated soil, objects	Illegal actions, illicit trafficking	3 drums	(*)	Pu-238, Pu-239, Pu-240, Pu-241
	Metal plates with evaporated Pu-238	Illegal actions, illicit trafficking	250	(*)	Pu-238, Pu-239, Pu-240, Pu-241. Evaporation on metal plates
On-site (in facilities, countrywide)	Lightning rods	Activities of user	535	50 MBq/item	Am-241, Ra-226
	Consumer products, instruments, objects	Vehicle instruments, lamps	10 drums	(*)	Ra-226
	Insineration Ash	Scrap metal industry	50-100 m ³	(*)	Cs-137
	Contaminated objects with NORM	Excavation industry	100 m ³	Max activity concentration, C _A =5E3 Bq/g	Ra-226

(*) unknown at the moment, to be defined

TABLE 6 : Orphan sources**Location:** On site**Type:** Orphan sources stored on site, where they detected (metal industries, scrap metal facilities, customs)**Origin:** Scrap Metal**Properties:** Radiological**Status:** Raw material**Processing options:** Characterization in progress. Disposal option has not been decided, yet**Update:** July 2018

Location	Source Category	# sources / devices	Form	Total activity, MBq	Nuclides
On site, at locations / facilities	1				
	2	1	Sealed source	1,85E+07	Cs-137
	3				
	4				
	5	160	objects		Ra-226, Am-241, Th-232, Sr-90, depU
Total		161		1,85E+07	

(*) unknown at the moment, to be defined