GREEK NATIONAL REPORT

under the

CONVENTION ON NUCLEAR SAFETY

Athens, August 2016

GREEK ATOMIC ENERGY COMMISSION

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A. Introduction

Greece has signed the Convention on Nuclear Safety, which entered into force in 1997 by parliamentary ratification. Greece participated in the previous review meetings of the contracting parties.

Greece has no nuclear power plants and no intention to build any in the foreseeable future. A nuclear research reactor exists, licensed for extended shutdown, as well as two sub-critical assemblies, one fully dismantled and one in operation. In Greece, the focus on activities considered by the Convention on Nuclear Safety is on the environmental and health consequences of nuclear accidents in nuclear power plants of neighboring countries. Therefore, the reporting obligations are limited to those of Articles 7, 8 and 16 of the Convention on Nuclear Safety. Information is provided, however, on some other non-power facilities and activities existing in Greece falling under other articles of the Convention. The report follows the Guidelines regarding National Reports under the Convention on Nuclear Safety (INFCIRC/572/Rev.5, IAEA, 16 January 2015). The information provided in the report responds also to the challenges identified by the Special Rapporteur at the 6th Review Meeting, in particular those in relation to peer reviews, regulatory body independence, safety culture, transparency and openness and international cooperation. As concerns harmonized emergency plans and response measures, Greece supports initiatives towards this direction, such as the HERCA-WENRA approach for cross-border emergency preparedness, as well as the extension of such harmonized approaches to cover longer distances and longer term impact and measures.

Greece has established and implemented laws and regulations on nuclear and radiological safety, in conformity with IAEA Safety Standards, the Euratom Treaty and European Directives. Mechanisms and structures are in place in order to face and cope with nuclear/radiological emergency situations resulting from accidents or events within the national territory or abroad.

In view of potential high risks emanating from nuclear installations, the country attaches great importance to international and European efforts towards nuclear safety and security issues. In this respect, Greece has undertaken activities with IAEA (education and training, exchange of information, IRRS mission), as well as with other countries through bilateral agreements on early notification and warning schemes.

B. Summary

Greece has no nuclear power installations and no intention to build any in the foreseeable future. The existing research reactor and two sub-critical assemblies are not defined as nuclear installations by the Convention. So, according to the Guidelines regarding National Report under the Convention on Nuclear Safety, reporting only on Articles 7, 8 and 16 is applicable for Greece. However, similarly with the previous reports, information on other activities is provided by seek of completeness and transparency.

The Greek Atomic Energy Commission (EEAE) is the competent regulatory authority, responsible for radiological protection and nuclear safety.

Greece attaches great importance to nuclear safety and security. This is mainly reflected in EEAE efforts to improve the effectiveness of regulatory actions and its competence in terms of infrastructure, human resources and management system. Moreover, EEAE continues its international and European co-operation in the fields of education and training, radiation protection, nuclear safety and nuclear security.

Developments since the last review meeting could be summarized as follows:

- A new law was issued in 2014, including significant improvements regarding the regulatory role and power of EEAE.
- EEAE action plan for fulfilling the findings of the IRRS mission is an ongoing process. More information on the progress in addressing significant findings of the mission, pertinent to the issues discussed in this report, is provided throughout this report in relevant parts of the text. The full text of the IRRS mission report is publicly available at the EEAE website.
- In 2016 an official request for the follow-up IRRS mission has been made to IAEA. The follow-up mission has been scheduled for the end of 2017 and is under preparation. The Greek research reactor (GRR-1), which was out of the scope of the first mission, will be included within the follow-up mission scope.
- An extended shutdown license for the GRR-1 was issued by EEAE in 2014.
- Actions have been taken for strengthening transparency and openness of the regulatory body, as well as international cooperation.
- EEAE completed a 3-year project for the assessment of the radiation doses to the population from all exposure categories.
- The transposition of the new European Basic Safety Standards (EC Directive 2013/59/Euratom) is in progress, leading to extensive update of the current regulatory and legislative framework.

Regarding the challenges identified in the previous CNS Review Meeting, these are presented below, along with description of the actions taken:

<u>Further promotion of safety culture</u>

EEAE makes a continuous effort to promote and improve safety culture. Since the last review meeting actions were taken to enhance safety culture within EEAE (internal survey, development of procedures and guidelines, policy statement, development of a new internal organizational scheme) or at national level through communication activities.

Compliance of EEAE Integrated Management System with IAEA GS-R-3 Requirements

EEAE implements an integrated management system, certified since December 2013 in accordance with the requirements of ISO 9001:2008 standard, which incorporates all functions and accreditations of EEAE. Compliance with IAEA requirements on management system (IAEA GS-R-3) is a continuous effort, focused during the last years on implementation of a graded approach in the regulatory control of facilities or practices, enhancement of safety culture and management commitment and responsibilities.

National Large Scale Project for population collective dose estimation

A national large scale project for population collective dose estimation from artificial and natural sources of radiation was completed at the end of 2015. The average annual dose for the Greek population was estimated to be equal to about 4.5 mSv, with 1.8 mSv and 2.7 mSv from medical and natural radiation exposure, respectively.

Maintain appropriate level of nuclear safety expertise in a non NPP country

Nuclear safety in Greece is relevant in connection with severe nuclear accidents abroad. EEAE follows continuously the progress and developments in nuclear safety at European (e.g. active participation in ENSREG) and international level. EEAE also provides technical opinion on nuclear safety matters in other national authorities, for instance in the frame of environmental impact assessment studies for the international conventions (e.g. ESPOO convention). Moreover, in 2015 a study for assessing the potential radiological impact of hypothetical Fukushima-like accidents in relatively long distances, with interest for Greece, was carried out by EEAE staff.

Significant progress has been made during the last years in further improving the regulatory framework for radiation protection and nuclear safety in the country and in addressing the issues identified by the IRRS mission of 2012. As mentioned previously a follow-up mission has been scheduled for 2017.

C. Reporting article by article

According to the Convention obligations, Greece, as a non-nuclear country, should report for Articles 7, 8 and 16. Therefore, detailed reporting is provided for these Articles. Moreover, as in our previous reports, some information is provided in relation to other Articles of the Convention.

Article 6: Existing nuclear installations

"Each Contracting Party shall take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible. When necessary in the context of this Convention, the Contracting Party shall ensure that all reasonably practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shut-down may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact."

Greece has no nuclear installations as defined in Article 2 of the Convention on Nuclear Safety and has no intention to build any in the near future. Nuclear energy is not included in electricity production programme for the foreseeable future.

Information on the research reactor and other non-nuclear-power activities is provided for completeness in the followings.

Greek Research Reactor (GRR-1)

The GRR-1 is situated on the premises of the National Centre for Scientific Research (NCSR) "Demokritos". The reactor is out of operation. All used HEU fuel elements were returned to the USA in 2005, following the terms of fuel purchase agreement between the U.S. Department of Energy and the Greek Government. The remaining irradiated fuel (LEU) has been removed from the reactor core and is under safe wet storage in the fuel pool inside the reactor building. The cooling system is partly dismantled. GRR-1 was granted an extended shutdown license by EEAE in 2014.

Sub critical assemblies

- The subcritical assembly at the National Technical University of Athens is dismantled (fuel is under secure in-situ storage). Shipment of the fuel abroad is under consideration;
- A subcritical assembly exists at the Aristotle University of Thessaloniki, which is used for educational purposes.

Ionizing radiation installations

Other ionizing radiation activities in Greece include:

- medical applications, such as teletherapy, brachytherapy, diagnostic radiology and nuclear medicine laboratories;
- research laboratories, such as laboratories in research centers and University departments, including an 11MeV Tandem accelerator;
- industrial laboratories using ionizing radiation devices and radiation sources. Among them, one private irradiation facility for sterilization of medical equipment exist;

- a radioactive waste storage facility.

Article 7: Legislative and regulatory framework

Article 7.1: "Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations."

Considerable effort has been devoted during the last years in extending and improving the legislative and regulatory framework. This effort has led to important update of the legislative system, including a number of new legislation pieces for radioactive waste management and for the regulatory body and its role, structure, responsibilities and powers. Moreover, at present the radiation protection regulations are under extensive update for the transposition of the new European Safety Standards EC Directive 2013/59/Euratom.

The Greek legislation for nuclear safety and radiation protection is listed below.

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 not to implement a nuclear power programme to generate nuclear electricity. 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 P/112/305/2012, Basic requirements – principles of nuclear safety and regulatory supervision of nuclear research reactors, Government Gazette Folio No. 2877/B/26.10.2012.

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 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.

Radiological protection

- 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;

- Law No. 181/1974, Protection against ionizing radiation, Government Gazette Folio No 347/A/20.11.1974;
- 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.

The legislation on radiation protection is currently under extensive update in the context of the new European Basic Standards Directive 2013/59/Euratom transposition.

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 *(Significant update is in progress at present, including the resolution of issues identified by the IRRS mission of 2012 (see Article 8 Regulatory body bellow)).*

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 (see Article 16).

- Ministerial Decision 2739/1994, Regulation for public information in the event of a radiological emergency, Government Gazette Folio No.165/B/15.03.1994;
- 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;
- 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, Government Gazette Folio No. 147/A/03.09.2010;
- 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.

Radioactive waste

- 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;
- Ministerial Decision 131207/Ι3/20.08.2015, National policy on the management of spent fuel and radioactive waste, Government Gazette Folio No. 1858/B/27.08.2015;
- 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.

Legislation in progress

- The transposition of the new European Basic Safety Standards Directive 2013/59/Euratom is underway, in the phase of drafting the legislative documents;
- Presidential Decree for the internal organization of EEAE (in the process of governmental approval);
- Presidential Decree on "the establishment of the national legislative, regulatory and organizational framework for the responsible and safe management of spent fuel and radioactive waste and amending PD 122/2013" (in the stage of issuance);

Article 7.2: "The legislative and regulatory framework shall provide for:

i. the establishment of applicable national safety requirements and regulations;

ii. a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a license;

iii. a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licenses;

iv. the enforcement of applicable regulations and of the terms of licenses, including suspension, modification or revocation."

The Presidential Decree (PD) No 60 (see Article 7.1) provides for the general legislative, regulatory and organizational framework for nuclear safety of nuclear installations, allocates generic responsibilities to the regulatory body (EEAE) and the license holder and defines generic nuclear safety principles. Following Presidential Decree 60, the Ministerial Decision (MD) Π/112/305 was issued to provide for more specific nuclear safety requirements and principles and regulatory control for research reactors in compliance with the IAEA NS-R-4 "Safety of Research Reactors: safety requirements", Vienna, IAEA, 2005. Safety requirements are specified in chapter 2 of the Ministerial Decision for all life stages of research reactors and in relation to:

- license holder responsibility
- safety management
- evaluation and verification of safety
- radiation protection (with reference to the Greek Radiation Protection Regulations)
- siting evaluation
- design and construction
- commissioning, operation
- maintenance modification and utilization
- extended shutdown
- decommissioning
- waste management

In Article 4.1a of PD 60 it is provided that EEAE is responsible for the implementation of the licensing systems for nuclear installations and for the prohibition of operation without a license. The licensing procedure for research reactors is described in chapter 3, Articles 14 through 21 of the MD Π/112/305, following the different life stages of a research reactor (construction, commissioning, operation, decommissioning, modifications, extended shutdown). Construction and decommissioning licenses are issued by the Minister after the agreement of EEAE. Commissioning, operation and extended shutdown licenses are issued by EEAE. The existing GRR-1 is covered by transitional provisions in chapter 4, Article 24, according to which the reactor is considered to be in extended shutdown. After an application by the owner, EEAE granted an extended shutdown license for the GRR-1 in 2014, according to the requirements of Article 17.1 of MD Π/112/305. In case the owner decides the re-activation of the refurbishment project and the re-operation of the reactor, a licensing procedure similar to that of construction of a reactor shall be followed (Articles 24.3 and 17.2 of MD Π/112/305), including assessment of all nuclear safety aspects and approval of the works for the refurbishment. Fuel loading in the reactor core is allowed only after the refurbishment or reconstruction works licensing and approval of the commissioning program.

Inspections by EEAE can be performed on a regular or irregular basis, announced or unannounced, and the findings must be documented. In case of non-compliance with safety requirements or the terms of the license, EEAE has the authority to proceed to modification, suspension or revocation of the license. The new Law no. 4310/2014 provides for reinforced inspection and enforcement power, including imposing administrative and penal sanctions. In

the current state of extended shutdown the supervision of GRR-1 by EEAE has a frequency of 1-2 inspections per year.

General radiation protection requirements, including dose limits for the public and the workers are provided in the radiation protection regulations according to European legislation. Currently, as already mentioned, the radiation protection legislative framework is under extensive update for the transposition of the new European Basic Safety Standards EC Directive 2013/59/Euratom.

Article 8: Regulatory Body

"1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.

2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy."

EEAE was initially established by an Act in 1954. The organization has been re-established with a different scheme in 1987. One of the most important developments in the regulatory field during the last years concerned the regulatory authority itself. In 2014, in 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). With these provisions the obsolete framework (Law 1733/1987, Legislative Decree 184/1974) is replaced by a new operation framework of EEAE. The basic improvements that the new framework brings are summarized as follows:

- EEAE is explicitly designated as Regulatory Authority for the control, the regulation and the supervision of the sector of nuclear energy, nuclear technology, radiological and nuclear safety and radiation protection, and its competences are codified in a consolidated text, by completing, extending and clarifying the older provisions;
- EEAE acquires complete administrative and financial independence, keeps its scientific character and is given the form of public entity;
- EEAE as regulatory authority is henceforth the licensing administrative authority;
- inspection procedures and inspectors role are reinforced significantly;
- law enforcement means are provided to EEAE, by specifying administrative and penal sanctions;
- EEAE is provided with the power to conduct hearings and public consultations, and to issue a number of regulations;
- provisions for transparency enhancement, accountability and avoidance of conflict of interests are included;
- provisions ensuring organization's resources and sustainable financial independence are foreseen;
- EEAE can cooperate with research/academic institutions on educational matters.

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 functions also include:

- Operation of the personnel dosimetry service in the country;

- environmental radioactivity monitoring, including operation of the telemetric environmental radioactivity monitoring network and laboratory radioactivity measurements;
- participation in emergency preparedness and response;
- calibration of ionizing radiation instruments;
- non-ionizing radiation inspections.

Education and training (E&T)

EEAE provides education and training on radiation protection since 1960. Nowadays, it has a range of activities, in providing post-graduate and continuing E&T, at national and international level. The educational activities are fully supported by EEAE scientific personnel and the available infrastructure. At national level, a variety of training courses covering issues, such as occupational radiation protection, transport and emergency response, are organized in the framework of a national programme for education and training in radiation, transport and waste safety, which has been established and implemented since 2013. For all its training activities EEAE implements a QMS based on ISO 29990:2010.

At regional and international level, EEAE is the IAEA Regional Training Centre (RTC) in English language in Europe on Radiation, Transport and Waste Safety, as well as on nuclear security. After the successful completion of the IAEA Education and Training Appraisal (EduTA) mission of Greece in 2008, a Long Term Agreement (LTA) between the Government of Greece and the IAEA, to support EEAE as the RTC in Europe for radiation, transport and waste safety was signed in July 2011. The LTA was ratified by the Greek Parliament in October 2012 (Law 4085/2012). In 2015, EEAE requested and received a follow up EduTA mission, which confirmed the progress made the last 8 years and indicated new challenges in education and training that should be faced in the future.

Also, "Practical Arrangements between EEAE and IAEA" was signed in 2010, supporting EEAE as a Regional Training Center in Europe for nuclear security. This cooperation has been extended and validated through "Practical Arrangements between IAEA and the Government of the Hellenic Republic on cooperation in the area of Nuclear Security", signed during the International Conference on Nuclear Security held in Vienna in July 2013.

Since 2003, EEAE hosts, the Postgraduate Educational Course on Radiation Protection and the Safety of Radiation Sources co-organised and co-funded by IAEA.

EEAE participates also in research and development programmes, such as the projects under IAEA Technical Cooperation Programme and the EC Framework Programmes. EEAE personnel present a significant number of publications in scientific journals and conferences.

Public information

EEAE holds the responsibility of providing information to the general public and the media regarding its fields of competence. Public information related activities, such as organization of events, dissemination of information material, are systematically addressed. In case of radiological emergencies, EEAE acts as the channel which provides the available data and information. EEAE website is a useful tool for public information and includes: data from the telemetric monitoring stations; data on medical radiation laboratories, radon concentrations, measurements results and reports, such as annual activity reports, radiological incidents reports, external evaluation reports (e.g. IRRS mission report) and reports submitted to IAEA (CNS, Joint Convention).

EEAE policy regarding information dissemination is based on the principles of transparency and openness both towards interested parties and the general public. EEAE has both formal and informal mechanisms of communication, including meetings, web-based information and public consultation as appropriate. As a public entity, EEAE is obliged to follow official procedures of communication with all authorized parties and the general public. Since the last review meeting,

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;
- research reactor and radioactive waste interim storage facility licenses, including the evaluation reports prepared by EEAE, are available at EEAE website. Inspection reports for the reactor are also available at EEAE website;
- public electronic consultation of the national regulative 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 by EEAE personnel, emphasizing on the access to information and online services;
- EEAE Newsletter. In March 2014, EEAE disseminated its first newsletter (available only in Greek language) with the motto "Let's talk about radiation", with content related both to professional groups and to the general public. Aim of EEAE is to issue the newsletter three times per year;
- information material. In 2014 EEAE produced one corporate video and one information video about radiation protection. Also, information brochures were prepared and disseminated;
- National platform of electronic governance "Diavgeia". Since 2013 administrative acts and decisions are not valid unless published online. EEAE, as government institution, uploads administrative acts and decisions on the Internet at Diavgeia platform, with special attention to issues of national security and sensitive personal data;
- 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.

Organization, human and financial resources, (quality) management systems

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 is in the process of governmental approval for updating the structure of EEAE. The proposed new organization chart is shown in Figure 1. 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 is governed by a seven-member Board.

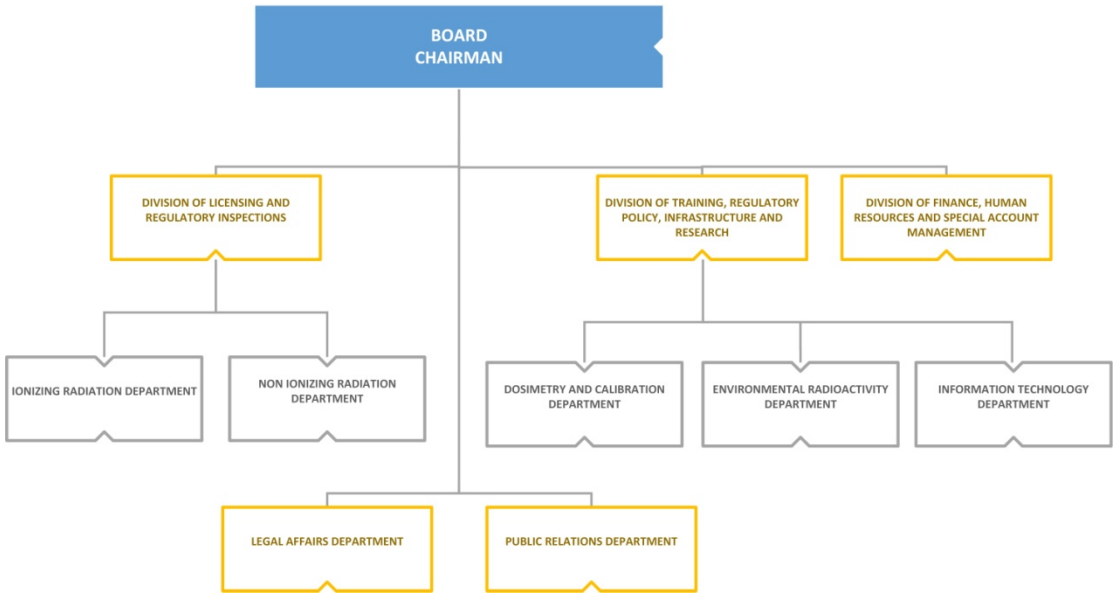

Figure 1. Organizational chart of EEAE

EEAE employs a sufficient number of qualified and competent staff (75) to carry out its tasks. Most of EEAE personnel hold a degree of high level education and dispose specialized scientific expertise (M.Sc. and/or Ph.D.). They participate in several working groups and committees at national, European or international level. The outcome of their participation in European research projects and scientific networks, as well as their scientific work in EEAE is a number of publications in international journals and presentations in conferences. Their continuous training, the participation in EEAE E&T activities and the participation in scientific networks 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, as well as 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. 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, as follows:

Graded approach: EEAE inspection system has been modified to incorporate a graded approach. Drafting of the new radiation protection regulations, in the context of the new European BSS Directive transposition, is based on a graded approach in authorization and inspection of facilities and practices.

Safety culture: EEAE makes a continuous effort to promote and improve safety culture. Since the last review meeting, among others:

- a survey based on questionnaire was performed among EEAE staff, in order to assess the situation internally and the findings were used for proposing to the management areas, where enhancement of the safety culture within the organization is possible. The follow-up of this survey is under development;
- the EEAE integrated management system lies on the priority of safety. The procedures and guidelines developed for EEAE management system promote safety culture. Commitment of the top management to safety is clearly declared in EEAE policy statement;

- promotion of safety culture is considered as a pillar of EEAE internal and external communication activities (e.g. a "safety culture" part is included in the annual report; the internal meetings among management and personnel always include safety culture as agenda topic; enhancement of the bottom-up flow of information through for instance internal meetings at all hierarchy levels and encouragement of reporting attitude; drafting of EEAE internal code of conduct etc);
- promotion of safety culture has been explicitly included as EEAE task in the proposal of a new internal organizational scheme for EEAE (legally binding document), which is in the process of governmental approval.

Management commitment and responsibility: the management has adopted the above aspects through a policy statement document communicated to the personnel along with the EEAE values and mission. EEAE has also developed a specific process within the integrated management system for the management of organizational changes.

Article 9: Responsibility of the license holder

"Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant license and shall take the appropriate steps to ensure that each such license holder meets its responsibility."

For nuclear installations and research reactors, the prime responsibility is assigned explicitly to the license holder in the Presidential Decree No 60 (Article 6.1).

Article 6.2 of PD 60 requires that license holders, under the supervision of EEAE, assess and verify regularly, and continuously improve the nuclear safety or their installations, in a systematic and verifiable manner. More specific requirements in relation to research reactors are provided in article 5 of MD Π/112/305, according to which, the license holders are obliged to assess the safety of the reactor in a systematic way before the construction and commissioning and also before significant modifications or changes in utilization. The assessment shall be documented appropriately in safety documents and shall include all stages of the reactor lifetime. License holders shall verify the safety of the reactor by safety analysis, surveillance and inspections. The required safety documents must be submitted to and reviewed by EEAE, as part of the licensing procedure. EEAE performs inspections to assure the compliance with the regulation provisions.

For the current stage of extended shutdown it is provided that (article 11 of MD Π/112/305) the license holder shall implement an adequate program to maintain the safety of the reactor and the physical protection of the facility and the safety of the nuclear fuel and other radioactive materials.

For any other radiation involving activity in Greece, specific responsibilities of the license holder are provided in the Radiation Protection Regulations.

Article 10: Priority to safety

"Each Contracting Party shall take the appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety."

The national legislation gives due priority to safety in relation to radiation involving activities, including research reactors, and nuclear security issues.

Research reactor

For the research reactor, relevant requirements are explicitly provided in the Ministerial Decision P/112/305. More specifically, the following are applicable in all stages of the research reactor lifetime:

- policy for the management of research reactors that gives to safety high priority and promotes safety culture, through the appropriate organizational structure;
- quality management system;
- internal safety committee, independent from the reactor manager;
- lifelong learning of the reactor staff with duties connected to safety;
- due consideration of human factors;
- defense in depth concept applied to the design of the research reactor;
- systematic operator safety self-assessment.

Nuclear Security

In 2004, EEAE in collaboration with the IAEA and the U.S. Department of Energy upgraded the physical protection systems of selected radiological facilities in the country. These installations include:

- the nuclear research reactor GRR-1;
- medical clinics and hospital installations – radiotherapy units and blood irradiators;
- sensitive industrial installations.

For the prevention of illicit trafficking of radioactive or nuclear materials, EEAE, in collaboration with IAEA, the U.S. Department of Energy and the Greek Customs Department, equipped the country's entrance points with radioactivity detectors. In particular, fixed systems for radioactivity detection are installed at the major customs offices and portable radioactivity detectors have been distributed to the custom offices in the country.

In the same context, radioactivity detectors – pagers and portable spectrometers have been distributed to border police and Coast Guard.

The customs local detection systems have been networked; the central server includes a database that includes the alarms triggered on any custom alarm system.

Article 11: Financial and human resources

"1. Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.

2. Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life."

The requirement regarding the responsibility of license holders of nuclear installations to maintain adequate human and financial resources is provided in Article 6.5 of PD 60. This requirement is further addressed in MD Π/112/305 for research reactors, where it is required that adequate number of trained and competent personnel shall be ensured at all stages of the reactor lifetime (Article 4.3). In Article 4.4, it is provided that adequate financial resources shall also be provided for the lifetime of the reactor. Information regarding the staff and the arrangements for ensuring the required financial resources shall be included in a license application for all stages of a reactor lifetime, as provided in MD Π/112/305. The staff of GRR-1 has somewhat decreased since the period of operation, though, the current staff is adequate for the surveillance and maintenance of the facility, in its current state.

As far as other activities are concerned, the Radiation Protection Regulations provide for the requirement of properly trained and/or licensed staff within the license holder organization. The certification of the personnel competency in radiation protection, when necessary, is performed by EEAE.

Article 12: Human Factors

"Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation."

In the Radiation Protection Regulations it is clearly stated that only persons with recognized specialty can be involved in radiation practices. Also, the Regulations give provisions for the specialties and the relative curricula required (radiation protection officer, medical physicist, radiologist, etc). Education and training on radiation protection is also required, the adequacy of which is recognized by EEAE. The continuous training of the workers is strongly encouraged.

Consideration of human factors is a safety requirement provided in the legislation for research reactors. Although human factors is an aspect applicable mostly in the design phase, though, there are cases in the extended shutdown phase where human factors could also be considered, as for example in terms of personnel qualification and training, physical and health conditions, shifts and also regarding some works in the facility.

Article 13: Quality Assurance

"Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation."

EEAE, through the Radiation Protection Regulations, fully supports and encourages the activities related with Quality Assurance/Quality Control programs for the radiological installations. EEAE laboratories have been accredited by the Hellenic Accreditation Council according to ELOT EN IEC/ISO 17025 standard since 2003; in 2011 the Department of Licensing and Inspections has been accredited, according to ELOT EN IEC/ISO 17020 standard.

In 2013, the education department of EEAE was certified for the design, the development and the provision of non-formal education and training in radiation protection and nuclear safety, according to the ISO 29990:2010. 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 (see also reporting under Article 8).

Quality assurance is included in the safety requirements for research reactor in the pertinent legislation. In the last extended shutdown licensing of the GRR-1, quality assurance program was not included in the documentation requested by EEAE. However, some aspects of it, in particular in relation to record keeping, clarifications on referenced documents, signing of maintenance and surveillance check lists by the responsible staff were taken into account during licensing and subsequent inspection by EEAE. Written prior assessment and approval of radiological protection, in case of works with radiological significance, were also requested.

Article 14: Assessment and verification of safety

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

i. *comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;*
ii. *verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions."*

According to Article 3 of MD Π/112/305 license holders of research reactor have the prime responsibility, throughout the lifetime of the reactor for ensuring, implementing and complying with the safety requirements, in line with the national and European legislation and the applicable IAEA safety standards. In addition, Article 5.3 provides that the license holders shall verify the safety of the reactor through analysis, surveillance and inspections, in order to maintain compliance with the design, the safety analysis, the operating limits and conditions and the safety requirements. The application for the licensing of a research reactor, in all stages of its lifetime, shall include an appropriate, applicable safety analysis report, through which, as provided in Article 19.1, the license holder shall demonstrate the safety of the installation, in line with the safety requirements. The content of the safety analysis report is based on IAEA safety standards for research reactors and is defined in Article 19.2 and shall commensurate with the actual hazards posed in the particular state of the reactor.

EEAE, as stated in Article 23.1 of MD Π/112/305, is the competent authority for assessing the safety of research reactors. Whenever EEAE deems, it has the authority to require any information and clarification, including information concerning contractors. No restriction is allowed regarding the provision of information to EEAE (Article 23.4). In addition, EEAE has the authority to require from the license holder improvements, modifications or to take measures, in case of incompliance with the safety requirements or the terms of the license (Article 23.5).

In particular for the current state (extended shutdown) of GRR-1, an applicable safety analysis is required to be submitted to EEAE (Article 17 of MD Π/112/305). NCSR "Demokritos", after a request by EEAE, submitted important chapters of the safety analysis report of the reactor, updated to the present state. The submission by GRR-1 included the chapters "Radiation Protection" and "Conduct of operation", as well as the current surveillance and maintenance program and the physical protection program.

Inspections are also carried out to the reactor by IAEA and Euratom inspectors within the framework of safeguards and in compliance with Articles 35, 36 of the Euratom Treaty.

For any other radiation involving activity, according to the Radiation Protection Regulations, EEAE carries out on-site inspections of the radiation facilities, in order to verify the compliance with the radiation protection requirements, when issuing or renewing their license. Radiation protection and hazard reports are submitted to EEAE for revision and evaluation during the licensing process.

Article 15: Radiation Protection

"Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits."

The current national legislation on radiation protection implements the European Directives 96/29 and 97/43/Euratom. General radiation protection requirements, including dose limits for the public and the workers are provided in the radiation protection regulations according to European legislation. Currently, the radiation protection legislative framework is under extensive update for the transposition of the new European BSS Directive 2013/59/Euratom.

At present the applicable dose limits in Greece in terms of effective dose are 1 mSv/year for the public and 20 mSv/year for the occupational exposure (or 100 mSv in five consecutive years). More stringent effective dose limits are provided for specific groups (e.g. pregnant women). Equivalent dose limits for specific organs are provided in the regulations, as well. As mentioned earlier, EEAE keeps the national dose registry. The average collective dose for occupational exposure in Greece in years 2013, 2014 and 2015 has been estimated to be equal to 7.75 personSv.

At the end of 2015, a 3-year national large scale project for population collective dose assessment from artificial and natural sources of radiation was completed. The project, named "Holistic

assessment of the radiation doses and development of national information system related to radiation" (PRISMA), was co-funded by the European Regional Development Fund (National Strategic Reference Framework, 2007-2013). The average annual dose for the Greek population was estimated to be equal to about 4.5 mSv, with 1.8 mSv from medical exposure and 2.7 mSv from natural radiation. Within the frame of the project a web-platform was developed for communication with the public and information and data collection and provision. The web-based services for public information and communication (access to workers dose data, data provision from medical applications etc) were also further improved and modernized as part of the project.

Article 16: Emergency Preparedness

"1. Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency.

For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.

2. Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.

3. Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency."

According to the legislation, for any radiation involving activity, including GRR-1, is explicitly provided that the license holder shall have in place an emergency plan and shall report to EEAE any abnormal event immediately. EEAE has requested from GRR-1 to submit an updated emergency plan for the current extended shutdown phase.

Greece can be affected in the event of a radiological emergency at a nuclear installation of a third country (in the sense of the CNS). Such situations are covered by Annex "R" of the National Plan for Civil Protection "Xenokratis" (more information is provided below). According to the plan, EEAE is responsible for information collection, activation of the plan, assessment of the situation and proposal of measures to higher levels of the plan hierarchy, namely the General Secretariat for Civil Protection. EEAE activates and coordinates the measurement campaign around the country in which various laboratories countrywide also participate in case of an emergency. EEAE also is the contact point for receiving and communicating information to the IAEA, ENATOM and ECURIE emergency-response systems, organizes national emergency response exercises and participates in international exercises. EEAE participates in the IAEA "Incident reporting system for research reactors" and the "Incidents and trafficking database" (ITDB). In addition, EEAE has concluded provisions on a bilateral basis for early notification with Bulgaria and Romania.

Recently, EEAE performed an assessment of the potential radiological impact of a hypothetical severe, Fukushima-like nuclear accident abroad at relatively long distances (around 300 km) (having in mind that such accidental releases in Europe is highly unlikely). The results showed that in such case (i.e. provided releases of the order of Fukushima Daiichi accident) longer term consequences, cannot be totally ruled out depending on the prevailing meteorological conditions, even at distances more than 300km.

In the following, more information is provided on the current national emergency plans and infrastructure. As mentioned earlier, the emergency plan and system are currently under significant update following the transposition of the new European BSS Directive 2013/59/Euratom.

Current national emergency plans

The General Civil Protection (Emergency) Plan (GCPP) under the code name "Xenokratis" concerns any emergency situation in the Greek territory (Ministerial Decision No. 2025, Approval of the General Plan for Civil Protection, under the Code Name Xenokratis, Government Gazette Folio No. 12/B/19.01.1998,). It has been revised and re-approved in 2000, after the legislative restructuring of the responsibilities related to facing national disasters of all kinds and the establishment of the General Secretariat for Civil Protection. After governmental approval, it was published in the Government Gazette in 2003 (Ministerial Decision No. 1299, Approval of the General Plan for Civil Protection, under the Code Name Xenokratis, Government Gazette Folio No. 423/B/10.04.2003). In particular, Annex "R" of the GCPP concerns the response to an emergency situation from important and extensive radioactivity contamination due to nuclear accidents taking place outside Greece and is designed to provide response to accidents involving the release or potential release of radioactive substances.

EEAE is the authority responsible for activating the GCPP Annex "R", while the overall management of the emergency response rests with increasing level of responsibility with the following three managing Committees:

- the Staff Office (SO): a three-member committee chaired by the Chairman of EEAE and supported by a properly staffed Information Group;
- the Scientific Committee (SC): a seven-member committee chaired by the Chairman of EEAE, having as main task the assessment of the proposals submitted by the SO and the suggestion to the Ministerial Coordination Board the proper actions and counter measures for the situation in hand;
- inter-Ministerial Coordination Board: is convened in emergency cases according to the provisions of the general emergency plan.

On the occasion of the Athens 2004 Olympic Games, the Athens 2004 Olympic Games Security Division developed the National Emergency Plan for Nuclear, Radiological, Biological and Chemical Threats. Nowadays this plan runs under the coordination of the General Secretariat for Civil Protection. EEAE was deeply involved in drafting and implementing the Nuclear/Radiological part of this plan and acts as the major counterpart of the General Secretariat for Civil Protection for those two factors (N/R).

EEAE role and preparation for the emergency situations

EEAE plays a key role in implementing the plans regarding nuclear or radiological emergencies. In order to cope with its statutory duties in the field of emergency planning and response, EEAE has established an internal emergency plan. The majority of EEAE personnel participate in emergency situations. Special teams (intervention team, support team …) have been formed, the members of which have specific duties.

EEAE has adequate equipment devoted to emergency planning including, a mobile laboratory, measuring and detection systems, protective equipment, independent communication systems, specialized vehicle with the possibility of carrying and stabilizing shielded radioactive sources, computer codes for atmospheric dispersion and transport of radioactivity (US NOAA HYSPLIT, JRODOS, HOTSPOT) and a network of monitoring stations covering the national territory.

Apart from the infrastructure devoted to emergency response purposes, EEAE specialized laboratories and their personnel are prepared to participate in emergency response, if needed. These laboratories are: the environmental radioactivity laboratory for performing measurements of environmental samples, the telemetric network for monitoring of the environmental radioactivity all over the country, the individual monitoring laboratory for external and internal radiation. EEAE coordinates a network of collaborating laboratories belonging to Universities and Research Centers throughout the country and collaborates with national, European and international organizations (e.g. emergency response systems, databases, networks).

Information activities in case of an emergency

EEAE is responsible to provide information through appropriate channels to the public during a radiation emergency. The provisions about the information of the public in case of radiological or nuclear emergencies are described in the Ministerial Decision No 2739, Regulation on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency, Government Gazette Folio No.165/B/15.03.1994, as well as in the Annex "R" of the General Civil Protection Plan "Xenokratis".

Depending on the demand for information from the public, EEAE adopts a range of tools to ensure broad dissemination and transparency. These include press releases and individual responses to media, press conferences and interviews. Real time environmental radioactivity monitoring data (telemetric network) are available through EEAE website during emergencies. A link to EURDEP is also provided.

D. Activities, achievements and concerns regarding the improvement of safety since last meeting

Since the last review meeting the effort for further compliance with IAEA standards were intensified, taking into consideration the findings of the IRRS mission.

The important developments since the last review meeting can be summarized as follows:

- A new law was issued in 2014, which modernizes the overall framework, including significant improvements regarding the regulatory role and power of EEAE and so, responding to important recommendations made by the IRRS mission in Greece in 2012. Enforcement power was legally conferred to EEAE. Inspectors' role was also reinforced.
- New legislation for updating the internal organization of the EEAE, which takes into consideration the findings of the IRRS mission, is in advanced progress.
- A number of legislation documents were issued or were drafted and are being currently in the process of governmental approval pertaining to radioactive waste management regime. Implementation of the National Program for radioactive waste management is considered as a challenge.
- The transposition of the new European Basic Safety Standards (EC Directive 2013/59/Euratom) is in progress, leading to extensive update of the present regulatory and legislative framework.
- Further actions were taken to improve transparency and communication with the public.
- Actions were taken to achieve compliance of EEAE integrated management system with IAEA GS-R-3 standards and to further promote safety culture.
- In 2015 a follow-up EduTA mission was completed.
- In 2016 an official request for the follow-up IRRS mission has been made to IAEA. The follow-up mission has been scheduled for 2017 and is under preparation. The Greek research reactor (GRR-1), which was out of the scope of the first mission, is included within the follow-up mission scope.
- An extended shutdown license for the GRR-1 was issued by EEAE in 2014.
- A project was completed by EEAE for assessing the dose to Greek population from all exposure categories.
- A study for the assessment of potential radiological impact of a hypothetical severe nuclear accident at relatively long distance was performed.

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