GREEK ATOMIC ENERGY COMMISSION

Convention on Nuclear Safety

Seventh Review Meeting

(27 March – 4 April 2017)

Answers to the Questions of Contracting Parties on the National Report submitted by Greece

Q.No	Country	Article	Ref. in National Report
1	Norway	General	p. 5

Question/ Comment: The EEAE has a staff of 75 people, how many of these are dedicated to nuclear safety? Do you publish IAEA Mission Reports?

Answer: There is one person dedicated to nuclear safety. Two more persons have also relevant knowledge and work partly on issues related to nuclear safety.

Q.No	Country	Article	Ref. in National Report
2	Norway	General	p. 4

Question/ Comment: How many people work at the GRR-1 reactor?

Answer: Twelve people work at the reactor, at the moment.

Q.No	Country	Article	Ref. in National Report
3	Norway	General	p. 4

Question/ Comment: The GRR-1 reactor is in permanent shutdown. What are the future plans for this reactor?

Answer: The reactor is licensed for extended shutdown. The current license expires in 2019. There are no definite plans for the future of the reactor. Licensing for decommissioning or re-operation of the reactor include both a Ministerial Decision. NCSR “Demokritos”, the owner and operator of the reactor, is exploring the feasibility and possibility for re-operation of the reactor. Relevant project proposals have been made to the government, with no decision yet.

Q.No	Country	Article	Ref. in National Report
4	Norway	General	p. 4

Question/ Comment: What is the license period for the GRR-1 reactor and the two sub-critical assemblies?

Answer: The current extended shutdown license of the reactor is valid for 3 years, until October 2019. The sub-critical assembly of the National Technical University is dismantled and the fuel is safely stored. There is no special license for the fuel, which is included in the license for the possession of other radioactive sources used by the owner. This license expires in Dec. 2017. The operation license of the sub-critical assembly of the University of Thessaloniki is under renewal, in the context of which, some measures are to be taken by the operator regarding the improvement of the safety of the fuel. Both licenses period is equal to 5 years.

Q.No	Country	Article	Ref. in National Report
5	Germany	6	p. 6

Question/ Comment: In the application for the extended shutdown license, the operator reserves the possibility to reactivate the modernization and refurbishment project. Are there any updates to place the reactor back into operation?

Answer: The reactor is licensed for extended shutdown. The current license expires in 2019. There are no definite plans for the future of the reactor. Licensing for decommissioning or re-operation of the reactor include both a Ministerial Decision. NCSR "Demokritos", the owner and operator of the reactor, is exploring the feasibility and possibility for re-operation of the reactor. Relevant project proposals have been made to the government, with no decision yet.

The extended shutdown license does not cover any modernization or refurbishment work for reactor re-operation. Such works shall be reviewed and licensed following the requirements and procedure provided in the legislation for the construction and operation of a research reactor. Such a procedure, as mentioned before, includes a relevant decision by the Minister.

Q.No	Country	Article	Ref. in National Report
6	Norway	6	p. 6

Question/ Comment: In the report it says that fuel in the subcritical assembly at the National Technical University of Athens is in storage, and that you are considering to ship it abroad. To where are you planning to ship the spent fuel?

Answer: The fuel is natural uranium. It is not considered as spent fuel, but as fresh. The financial and administrative implications of the export of the fuel are investigated. There are no definite plans yet.

Q.No	Country	Article	Ref. in National Report
7	Germany	7.2.1	p. 10

Question/ Comment: It is said that the Greece legislative and regulatory framework is partly based on the IAEA safety standards. The updated version of the Safety Requirements on Safety of Research Reactors is currently in the process of publication. Are there any plans to update the framework, taking into account the updated Safety Standards?

Answer: Use of IAEA standards is provided in PD 60/2012. IAEA NS-R-4 has been used as a basis for the preparation of the national legislation for the nuclear safety of research reactors and is explicitly specified in the current legislation, in particular in MD P/112/305/2012. In this context, safety requirements of NS-R-4 have been used complementary to MD P/112/305/2012 for the licensing and inspection activities for the GRR-1. The updated IAEA safety requirements for research reactor will be considered, as well, during the ongoing updating of the national framework for the transposition of the amended European Nuclear Safety Directive.

Q.No	Country	Article	Ref. in National Report
8	United States of America	8	Section 8 p. 14-15

Question/ Comment: The national report describes improving and enhancing the safety culture. What specific activities or practices have been most and least successful?

Answer: The last years, EEAE initiated a systematic effort towards the improvement of safety culture among its personnel. Activities or practices that can be characterized as efficient are the following:

- the internal survey, because it helped us to establish an internal dialogue on safety culture, as well as to identify the areas that further enhancement was required;
- the training seminars, especially those addressed to inspectors;
- the induction presentation for new employees was enriched with a safety culture section;
- actions taken to improve EEAE as a safe workplace;

We believe that the above mentioned activities have contributed to the engagement of personnel and of the management to the continuous effort for enhancing safety culture.

The connection of the safety culture with the implementation of the integrated management system was least successful, because this link caused confusion.

Q.No	Country	Article	Ref. in National Report
9	Norway	10	p. 16

Question/ Comment: In the report it says that fixed and portable radioactivity detectors have been distributed at the country's entrance points and customs offices, border police and coast guard. Have you given any training in the use of radioactivity detectors? And if so, how have you trained the users?

Answer: Initial training was provided by EEAE when fixed or portable detectors were installed or distributed. For the fixed detectors, training is provided by EEAE at the customs where the detectors are installed. Training includes both a theoretical part on radiation protection, source security and illicit trafficking and a practice part on the operation and use of detectors. In addition to the initial one, training has been repeated by EEAE when was needed (e.g. replacement of competent staff). Since 2004 when the fixed detectors were installed, three training activities have been carried out.

For portable detectors, EEAE provides training by using the train-the-trainers approach, by providing training only to assigned staff of the customs, police and coast guard.

Q.No	Country	Article	Ref. in National Report
10	South Africa	10	Section 10.1

Question/ Comment: Please list any of the NRPA regulatory requirements and guidance documents to be applied for the research reactor.

Answer: Although, possibly, this question is not addressed to Greece, is, however, applicable due to the existence of research reactor in Greece, as well.
In Greece, the legislation and regulations applicable to the research reactor are the PD 60/2012, the MD P/112/305/2012 and the National Radiation Protection Regulations (see p. 7-8 in our Report). IAEA NS-R-4 is also adopted and provided explicitly, as applicable standard, for the safety of the reactor. Internally in EEAE, a document providing some general guidance to the EEAE staff in relation to the review and safety evaluation of the reactor submissions and on inspections has also been issued.

Q.No	Country	Article	Ref. in National Report
11	Hungary	15	p. 19

Question/ Comment: "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." What kind of methodology is used for the estimation of medical exposure?

Answer: The Greek Atomic Energy Commission (EEAE) developed a methodology to assess the annual collective effective dose and per caput dose to the Greek population from x-ray and nuclear medicine procedures in the framework of a research project conduced in the period 2013-2015 (project PRISMA, funded by the KRIPIS national program and co-funded by the European Regional Development Fund, National Strategic Reference Framework, 2007- 2013).
The methodology applied was according to the European Commission Radiation Protection No 154/2008 “European Guidance on estimating population doses from medical x-ray procedures” and European Commission Radiation Protection No 180/2014 “Medical radiation exposure of the European population”.
More specifically, the estimation of the annual collective effective dose, S, (person-Sv) and per caput dose, Eper-caput, (mSv/caput) requires information on the frequency (i.e. annual number of procedures) and the mean patient effective dose, Epat, (mSv) for each type of diagnostic and interventional procedures.
The frequency was assessed by a nationwide survey conducted in all radiology and nuclear medicine departments with the use of properly prepared questionnaires. Frequency data were collected for 11 plain radiography procedures, 22 computed tomography procedures, 5 interventional cardiology procedures, 13 interventional radiology procedures, mammography and 19 nuclear medicine procedures.
The Epat for x-ray procedures was evaluated from the obtained dosimetric quantities, i.e. Air Kerma (free in air), CTDIvol & DLP, KAP, measured in a representative sample of health care providers and by using appropriate conversion factors or software. For nuclear medicine procedures, the Epat was derived from the

average administered activities of radiopharmaceutical (MBq) per procedure and the use of ICRP published conversion factors, based on data collected from all nuclear medicine departments (nationwide).

Q.No	Country	Article	Ref. in National Report
12	South Africa	15	General

Question/ Comment: It is stated: "Currently, the radiation protection legislative framework is under extensive update for the transposition of the new European BSS Directive 2013/59/Euratom."
What is the anticipated duration of the update process and when will it be completed?
Is the requirements of IAEA GSR Part 3 considered?
When and how will it be implemented?

Answer: For the update of the radiation protection legislative framework the IAEA requirements, the recommendations and suggestions from the IRRS mission in Greece in 2012 and the operational experience are taken into account.
The main part of the European directive will be transposed into the Greek legislative framework in the form of Presidential Decree (PD). The draft PD has already been prepared. The first phase of the consultation process with the stakeholders has taken place. We aim the deadline provided in the Directive, which is in Feb. 2018.

Q.No	Country	Article	Ref. in National Report
13	South Africa	15	General

Question/ Comment: Is the latest ICRP requirements on dose to the lens of the eye considered? How and when is it implemented?

Answer: The latest recommendations about the lens of the eye have been considered in the framework of the transposition of the Greek legislation to the European BSS Directive 2013/59/Euratom.

Therefore, according to the draft presidential degree:
- for the occupational exposure the limit on the equivalent dose for the lens of the eye is set to 20 mSv in a single year or 100 mSv in any five consecutive years subject to a maximum dose of 50 mSv in a single year;
- for apprentices aged 18 years or over and students aged 18 years or over who, in the course of their studies, are obliged to work with radiation sources the limit on the equivalent dose for the lens of the eye is set to 15 mSv in a year
- for the public exposure the limit on the equivalent dose for the lens of the eye is set to 15 mSv in a year.

Meanwhile, a pilot study has been performed since 2014 by measuring the eye lens doses of the most critical group which is the one of the interventional staff. Dedicated eye lens dosemeters were used on monthly basis. The eye lens dosemeter were worn on the right or left eye of the temple. The working habits, the workload

(expressed in terms of Kerma Area Product), the personal or collective protective equipment were recorded. The results were communicated to the staff at the beginning of each monitoring period. Moreover, a methodology has been developed in order to estimate the eye lens doses using the measurements of the whole body dosemeters worn above the radiation protective apron and conversion coefficients published in the literature or calculated by Monte Carlo techniques. The results showed that the mean annual dose sometimes exceeded the proposed limit of 20 mSv for the eye lens. This was observed in cases where the workload was high or no appropriate radiation protection measures were taken. However, the most latest measurements showed that the eye lens dose levels have been decreased after the continuous communication of the eye lens results to the pilot group and the information about the use of the radiation protective equipment for the eye lens.

Q.No	Country	Article	Ref. in National Report
14	South Africa	15	General

Question/ Comment: Are there requirements on reporting, investigation and intervention levels on occupational and public exposures and how are these requirements met by the license holders?
Does the regulator ensure the availability of analytical capabilities on dosimetry and how is the quality ensured?
Are there training courses for radiation workers, radiation professionals and emergency workers?
Are these courses accredited? Who is responsible for the accreditation?

Answer: The reporting level for the occupational exposure is set to 0.1 mSv following the Technical Recommendations for Monitoring Individuals Occupationally Exposed to External Radiation (RP 160 European Commission, Luxembourg 2009). This reporting level is met by the dosimetry service, which sends the certificates with the results of the occupationally exposed personnel to the facilities on a monthly basis.

There is also an investigation level, set to 6 mSv. When the effective dose of the workers exceeds this level, the radiation protection officer of the facility is responsible to investigate the situation and send a report to the regulatory authority. In case that this is not done in time, EEAE (who is also responsible for keeping the national dose registry) checks for the cases with doses higher than the investigation level and sends a questionnaire to the radiation protection officer asking her /him to investigate the situation and send a report back to EEAE. At the end of the year an analysis for all the investigated case is performed by EEAE. This analysis is published in the annual report available at our website.

License holders are obliged to report if radioactivity discharges to the environment exceeds their license limits, which are based on a general dose constraint of 10μSv/year for the public from any practice.

There are no specific obligations for analytical dosimetry capabilities. License holders apply their own dosimetry programs and/or radioactivity measurements.

For the research reactor these programs are reviewed-as part of the radiation protection program required by the regulation and submitted- during licensing and inspections. The needs for radiation monitoring and measurement equipment are reduced in the current state of the reactor. For other practices, for example medical applications, the National Radiation Protection Regulations do not require licensees to have monitoring programmes. However, this need is implicitly covered by the requirement for the implementation of adequate quality assurance programmes in the facilities. The instrumentation used for monitoring should be appropriately calibrated and the related results should be available to EEAE for evaluation. Furthermore, the availability of the monitoring capabilities is confirmed during the on-site inspections performed by EEAE to the facilities as part of the authorization procedure.

According to the L. 4310/2014 the Greek Atomic Energy Commission has the responsibility to provide education, expertise and training on radiation protection to scientists and technicians and to the personnel of special groups dealing with emergencies. EEAE has also the mandate to issue certificates of competence and skills for those working on the issue of radiation protection and to recognize relevant educational courses.
Within this framework, EEAE provides education and training on radiation protection which is addressed to specific groups of occupationally exposed personnel.

Response to radiation emergencies
EEAE provides education and training to people involved in the national emergency response plans against nuclear and radiological threats. On the occasion of Athens 2004 Olympic Games organization, EEAE provided training on radiation protection, prevention, detection, emergency preparedness and response to more than 3000 persons working for numerous national organizations involved in the national emergency plan (military forces, police, coast guards, fire brigade, first line officers, etc.) and still continues to organize on regular basis seminars addressed to the personnel of these organizations, in order to ensure the sustainability of national operational capability on preparedness and response. In the case of custom officers, training courses and refresher training courses on illicit trafficking have been conducted at custom offices all over the country in order to maintain and strengthen the skills and knowledge of customs officers on detection equipment and relevant procedures.

Radiation protection
Different education and training courses have been developed for the following groups:

1. Taking into account the non-medical personnel related to medical exposures, EEAE organized and accomplished a nationwide extensive education and training project, dealing with several cycles of three day courses on radiation protection in medicine, addressed to medical technologists, which was implemented in

collaboration with academic institutions and locally with the Medical Physics Departments of Universities and major General Hospitals. In total, 2425 medical technologists attended these courses, succeeded in the exams and received a certificate of competence in radiation protection.
2. The industrial applications account for about 10% (in terms of occupationally exposed personnel) of the applications of ionizing radiation in the country. EEAE through its training activities aims at developing a safety culture in this area as well. To this end, EEAE has designed and conducted a series of two-day seminars on radiation protection in industrial radiography. The seminars were conducted in 3 different cities and were attended by more than 100 radiographers and assistant radiographers.
3. Since 2007, EEAE systematically provides training on the safe transport of radioactive materials with the aim to inform and educate stakeholders in radiation protection. The attendance to the 1-day seminars is a prerequisite for the participation in the examinations organized by the Ministry of Infrastructure, Transport and Networks for the advisors for the safe transport of dangerous goods. In this respect, seminars are organized 3-4 times per year.

Medical Physicists
The professional license of Medical Physicists constitutes an essential condition for their employment. This license is issued by the Ministry of Health after succeeding in written examinations. Within this framework, EEAE has been organizing the Medical Radiation Physics Course at Post-Graduate level, on a regular basis, since 1961. In 1993, this course was upgraded to an Inter-University Post-Graduate Course (IPCMRP) established by law and was re-organized in its present form, in 1998. Apart from EEAE, the course is organized by the Universities of Athens, Ioannina, Thessaloniki, Crete and Thrace in collaboration with the National Centre for Scientific Research (NCSR) Demokritos".

For the purposes of these courses, special educational material has been developed (textbook and presentations files). Modern methods of training (e.g. e-learning classes), following technological developments and contemporary learning needs have been also adopted. It should be also mentioned that all training provided by EEAE is certified according to the ISO 29990:2010.

Q.No	Country	Article	Ref. in National Report
15	South Africa	15	General

Question/ Comment
Are there any discharges to the environment?
What is the criteria for control of exposures to the public from these discharges?
What is the basis for this criteria?
How was it derived?
How is licensees informed of the criteria?
How is the licensee compliance assured?
Is there formal and accredited training for the regulator and the licensees on this topic?

Answer Discharges in Greece come mainly from medical and research activities or practices. In general, a dose constraint equal to 10μSv/year to the public from radioactive discharges is provided in the National Radiation Protection Regulations. For liquid discharges to conventional sewage system, discharge limits have been specified in the Greek Radiation Protection Regulations in terms of daily discharges of radioactivity (Bq). For other discharges specific discharge limits are determined on the basis of the 10μSv/y dose constraint on a case-specific basis.

At the moment there are no discharges to the environment from the research reactor. The relevant technical specification of the reactor for the previous state of operation is not valid in the current extended shutdown state. There are no specific requirements imposed to the research reactor for environmental discharges for the extended shutdown phase. In the current phase, the dose levels of 10μSv/y applies also to the reactor. The GRR-1 Health Physics group is responsible, according to the existing license for the evaluation of the discharges to the environment. The reactor Safety Committee has also responsibility for reviewing discharges to the environment.

The licensee is responsible for the control and monitoring of the discharges to the environment and to ensure that the necessary means are in place. Compliance with the legislation and the license terms is ensured through inspections, which may include records review, facility inspections and walkthroughs, interviews, as well as radioactivity measurements. There are penalties provided in the current legislation for non-compliance with radiation protection regulations.

There is no accredited training of the licensees or regulators dedicated to discharges to the environment. As far as the regulator is concerned, inspection by EEAE is accredited according to ISO 17020, including the training of the inspectors on issues pertaining to their duties. EEAE has a dedicated department (Department of Environmental Radioactivity Control) with specialized scientific and technical staff and adequate state of the art laboratory infrastructure. Within the implemented integrated management system there are provisions for the training of the staff of the department, based on the identified training needs.

Continuous training of the staff on radiation practices is responsibility of the licensee. Qualification, including education and training of the staff is reviewed within the licensing process.

Q.No	Country	Article	Ref. in National Report
16	Germany	16	p. 20

Question/ Comment Greece reports on the EEAE role in establishing and implementing of an internal emergency plan. Are emergency situations exercised regularly? What is the role of EEAE during trainings for emergency preparedness?

Answer EEAE participates in ECURIE and EMERCON exercises. Additionally EEAE organizes and participates in field and table top exercises for emergency situations in

cooperation with first responders at least once per year. Within this framework, in 2016, a field exercise was organized in cooperation with the firefighters, simulating a car accident during the transportation of radiopharmaceuticals and an internal table top exercise for the evaluation of EEAE preparedness.
The role of EEAE during training is to train first responders, in order to:
• recognize a radioactive source and a radiological or nuclear threat
• understand the principles of radiation protection
• understand the effects of radiation
• use the available detectors and understand the basic principles of detection
• understand some of the operational implications between the different teams of first responders
• understand the decontamination options in a radiological or nuclear event.