



GREEK ATOMIC ENERGY COMMISSION

**NATIONAL REPORT OF GREECE**  
under the  
**“CONVENTION ON NUCLEAR SAFETY”**  
**2010**

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# A. Introduction

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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. Consequently, excluding the non-power nuclear activities in the country (research reactor, sub-critical assemblies, radiological installations), 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 applications existing in Greece falling under other articles of the Convention.

Greece has established and implemented laws and regulations on nuclear and radiological safety, in conformity with IAEA Basic Safety Standards, the Euratom Treaty and all 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 utmost importance to international efforts towards nuclear safety and security issues. In this respect, Greece has undertaken activities with IAEA (mainly in education and training and exchange of information), the European Commission, as well as with other countries through bilateral agreements on early notification and warning schemes.

Greece attributes great importance to the Convention on Nuclear Safety and tries to fully address its related obligations, as well as learn lessons from the review process.

## B. Summary

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Greece has no nuclear power installations and no intention to build any in the near future (the research reactor and two sub-critical assemblies not being defined as nuclear installations by the Convention). So, according to the Guidelines regarding National Report under the Convention on Nuclear Safety, reporting on Articles 7, 8 and 16 is considered applicable for Greece. However, similarly with the previous reports, information on non power nuclear installations and applications is provided, since this practice was considered as a good one in the previous review meeting.

The Greek legislation is in accordance to article 7 of the Convention on Nuclear Safety.

The Greek Atomic Energy Commission (GAEC) with adequate financial and human resources and infrastructure is responsible for introducing regulations and monitoring their implementation and for introducing and implementing radiological protection measures.

Radiological emergency preparedness, regulations, plans and organization and an extensive monitoring network covering the national territory have been established.

Greece continues the efforts towards the improvement of nuclear safety and security. These efforts are mainly reflected by the effort of GAEC in both directions: by improving its capabilities (infrastructure, human resources, quality management programmes) and by assisting and supporting the operators. GAEC continues its activities and collaborations with IAEA in the fields of education and training, radiation protection-nuclear safety and nuclear security. It is worthwhile to mention that in 2009, GAEC applied for an IAEA Integrated Regulatory Review Mission (IRRS) of radiation and nuclear safety.

As it concerns the Research Reactor, in 2006 an additional budget for the upgrading and renovation of the GRR-1 has been approved; the work is still in progress.

# C. Reporting article by article

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## Article 6 Existing nuclear installations

Greece is a country where there are no nuclear installations as defined in Article 2 of the Convention on Nuclear Safety. In the Government's electricity production programme, nuclear energy is not included for the foreseeable future.

As noted earlier, information on non power nuclear installations and applications is provided here for completeness.

### Greek Research Reactor GRR-1

The Greek Research Reactor (GRR-1) is situated on the premises of the National Centre for Scientific Research (NCSR) "Demokritos". GRR-1 is an open-pool type light water moderated and cooled reactor, operating at a thermal power of 5MW. It uses beryllium reflectors at the two sides of the core and is fueled by Material Test Reactor (MTR) type fuel elements. During the period 2005-2010, the reactor was shutdown for maintenance and preparation of the core conversion to Low Enrichment Uranium (LEU). The operator of GRR-1 schedules to restart the reactor in 2011 after completion of the extensive refurbishment and modernization program and using exclusively LEU fuel. These major changes entitle a licensing process which is underway. All used HEU fuel elements were returned to the USA, following the terms of fuel purchase agreement between the USA Department of Energy and the Greek Government.

### Sub critical assemblies

- The subcritical assembly at the National Technical University of Athens is fully decommissioned (currently under secure in-situ storage).
- A sub critical assembly exists at the Aristotelian University of Thessaloniki.

### Ionizing radiation installations

In the following, information concerning the fields of applications of the ionizing radiation in the country is provided. The existing installations are:

- medical applications: 26 radiotherapy laboratories (36 linear accelerators, 10 Co-60 systems, 7 High Dose Rate (HDR) and 2 Low Dose Rate (LDR) brachytherapy systems and 4 radiotherapy X-ray systems (2 not in operation)) and 8 I-125 brachytherapy laboratories (plus 1 to be in operation in the near future), 1189 diagnostic radiology laboratories (357 CT scanners, 1438 X-ray conventional systems, 560 mammography systems, 521 DEXA and 106 interventional diagnostic radiology systems), 138 nuclear medicine laboratories (151 gamma cameras, 5 PET/CT, 19 wards for the accommodation of patients administered with therapeutic doses of radioisotopes) and 46 RIA laboratories,
- radiation research laboratories: 223 laboratories in research centers and University departments. An 11MeV Tandem accelerator is located at the NCSR "Demokritos",

- industrial laboratories: 240 industrial laboratories using ionizing radiation devices and radiation sources. Among them, one private irradiation facility for sterilization of medical equipment,
- other applications related to education, agriculture, etc.

## **Article 7 Legislative and regulatory framework**

### Licensing of nuclear installations

A legislative framework establishing a system of licensing with regard to nuclear installations exists since 1971:

- Law No 854, Official Gazette of the Greek Government No 54/A/18.03.1971  
“Terms to establish and operate nuclear installations”,
- Presidential Decree No 610, Official Gazette of the Greek Government No 130/A/23.08.1978  
“Establishing terms and procedures in licensing Public Power Corporation to construct a nuclear power plant on a specific site” (the Public Power Corporation, is the Greek national utility)”.

### Implementation of the Convention on Nuclear Safety obligations

Greece has ratified the international conventions related to nuclear safety and radioactive waste management, with the following laws:

- Law No 2480, Official Gazette of the Greek Government No 70/A/14.03.1997  
“Ratification of the Nuclear Safety Convention”,
- Law No 1758, Official Gazette of the Greek Government No 44/A/10.03.1988  
“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”,
- Law No 1937, Official Gazette of the Greek Government No 35/A/13.03.1991  
“Ratification of the International Convention in case of a Nuclear Accident or Radiological Emergencies”,
- Law No 1938, Official Gazette of the Greek Government No 36/A/13.03.1991  
“Ratification of the International Treaty on Early Notification in case of a Nuclear Accident”,
- Law No 2824, Official Gazette of the Greek Government No 90/A/16.03.2000  
“Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management”.

### Safeguards and non-proliferation

The Greek legislative framework related to safeguards and non-proliferation is the following:

- Official Gazette of the Greek Government 49/A/26.02.1970  
“Ratification of the non proliferation treaty signed on the 1 June 1968”,
- Safeguards agreement between Greece and IAEA signed on 17.11.1972,
- Law No 1636, Official Gazette of the Greek Government No 106/A/18.07.1986  
“Ratification of the physical protection of nuclear material treaty”,
- Ministerial Decree No 5408 /E3/2362/ Φ MSG, Official Gazette of the Greek Government No 730/B/21.09.1993  
“Control on transfer of nuclear materials, armament and technologies affecting national Defense and Security”,
- Law No 2805, Official Gazette of the Greek Government 50/A/03.03.2000  
“Ratification of the additional protocol”.

## Radiological protection

The frame law concerning radiation protection came into force in 1974 (Legislative Act No 181, Official Gazette of the Greek Government No 347, 20.10.74, "Protection against ionizing radiation") establishing the framework for the protection of the public and the goods against the dangers from ionizing radiations regardless their origin. According to this decree, any application or practice employing ionizing radiation is subject to prior authorization. It also provides for the issue of radiation protection regulations in the form of Ministerial Decree.

The radiation protection regulations were first issued in 1978, concerning only medical applications. These regulations were revised in 1985 and in 1991. The outcome of the last revision is the regulations into force published in 2001 ("Radiation protection regulations", Ministerial Decree no 1014(FOR) 94, Official Gazette of the Greek Government, No 16B, 06.03.01). These regulations implement the IAEA Basic Safety Standards and the European Directives (96/29/Euratom Council Directive of 13 May 1996 laying down basic safety standards for health protection of the general public and workers against the dangers of ionizing radiation and 97/43/ Euratom Council Directive of 30 June 1997 on health protection of individuals against the dangers of ionizing radiation in relation to medical exposure). They cover practically all practices involving the use of ionizing radiation in medicine, research, industry, education and training, as well as issues concerning NORM activities, management and disposal of radioactive waste and transport of radioactive materials. They also provide quality control and quality assurance measures for all installations producing or detecting ionizing radiation.

The Ministerial Decree No 10828 /EFA(1897), Official Gazette of the Greek Government No. 7859/B/10.07.2006, "Control of high-activity sealed radioactive sources and orphan sources" was issued in order to transpose the Council Directive 2003/122/Euratom.

These regulations before entering into force were approved by the Commission of the European Union according to the Article 33 of the Euratom Treaty.

## Establishment of the regulatory body

- Decree Law No 1733, Official Gazette of the Greek Government No 171, 22.09.87  
"Establishment of the Greek Atomic Energy Commission",
- Presidential Decree No 404, Official Gazette of the Greek Government No 173, 05.10.93  
"Organization of the Greek Atomic Energy Commission".

## Emergency preparedness

In order to cope with emergency situations, Greece has established the General Plan for Civil Protection. A specific Annex "P" is dedicated to emergency situations with radiological/nuclear factor (see Art. 16).

- Ministerial Decree No 2739, Official Gazette of the Greek Government No 165/B/15.03.1994  
"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",
- Ministerial Decree No 2025, Official Gazette of the Greek Government No 12B, 19.01.1998

- “Approval of the General Plan for Civil Protection, under the Code Name Xenokratis”,
- Ministerial Decree No 1299, Official Gazette of the Greek Government No 423B, 10.04.2003  
“Approval of the General Plan for Civil Protection, under the Code Name Xenokratis”,
- Decree Law No 3491, Official Gazette of the Greek Government No 207A, 02.10.06  
“Establishment of the supporting team for Nuclear, Radiological, Biological and Chemical Threats”.

#### Other relevant legislation

- Presidential Decree No 22, Official Gazette of the Greek Government No 20/A/26.02.1997  
“Supervision and control of shipments of radioactive wastes between Greece and the other Member States of the EU and into and out of the EU”,
- Ministerial Decree No 9087, Official Gazette of the Greek Government No 849/13.09.1996  
“Radiation protection of external workers”,
- Law No 3787, Official Gazette of the Greek Government No 140/A/07.07.2009  
“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”.

#### Legislation in progress

- The Presidential Decree for the transposition in the Greek legislation of the Council Directive 2006/117/Euratom on the “Supervision and control of shipments of radioactive waste and spent fuel”, is in the process of final signatures.
- Greece has prepared a draft of a Presidential Decree for the transposition in the national legislation of the European Directive 2009/71/Euratom, establishing a Community framework for the nuclear safety of nuclear installations. The text has been submitted to the European Commission and is currently under examination according to the provisions of the Art. 33 of the Euratom Treaty.
- The preparation of a draft of the Ministerial Decree for the establishment, according to the Euratom Directive 2009/71/Euratom, of an updated legislative framework for the licensing of GRR-1 is currently in progress.

### **Article 8 Regulatory Body**

The Greek Atomic Energy Commission (GAEC) was initially established by an Act in 1954. The organization has been re-established with a different scheme in 1987, according to which GAEC is an independent, decentralized, civil service supervised by the General Secretariat for Research and Technology under the Ministry of Education, Lifelong Learning and Religious Affairs and is responsible for matters of nuclear technology, radiation protection and nuclear safety in the country.

GAEC is governed by a seven member Board of Governors, appointed by the Minister of Education, Lifelong Learning and Religious Affairs. GAEC reports to the Greek Government, the European Commission and IAEA when required or according to the existing arrangements and obligations.



Its responsibilities (regulatory and inspection duties, education and research duties, radiological emergency) cover issues of nuclear energy and nuclear technology, as well as issues related to the protection of the public, workers and environment from ionizing radiation, as well as artificially produced non-ionizing radiation. Moreover, its participation in the “General Civil Protection Plan” entails responsibilities for the prevention, preparedness and response to radiological emergencies. GAEC also participates in the “National Emergency Plan for Nuclear, Radiological, Biological and Chemical Threats” (NRBC).

Protection of the public from ionizing and non-ionizing radiation is mainly accomplished by:

- environmental radioactivity monitoring (telemetric network and laboratory measurements),
- individual monitoring of all workers occupationally exposed to ionizing radiation,
- issuing licenses for the import, export, possession, use, transport and disposal of radioactive materials,
- performing radiation protection inspections in laboratories using or producing ionizing radiation,
- carrying out measurements of electric and magnetic fields in all kinds of facilities emitting low or high frequency electromagnetic radiation,
- examining the submitted technical electromagnetic emissions studies and the environmental impact studies,
- training activities,
- participating or coordinating research and development projects.

GAEC’s organizational structure is presented in Annex 2.

GAEC’s staff consists of 70 persons (60% scientific, 15% technician, 25% administrative) and has regulatory and inspection duties, education and research duties, as well as special duties in case of radiological emergencies.

GAEC’s scientific and technical personnel are of a high scientific level (M.Sc. and/or Ph.D.). They participate in several working groups and committees at a national, European or international level. Their contribution in European research projects and scientific networks, as well as their scientific work in GAEC produces a number of publications in international journals and presentations in conferences. These facts prove that GAEC’s personnel are of high scientific level, being always well informed and up to date.

GAEC collaborates in a systematic manner with a lot of institutions in national, European and international level, in all fields of its competency.

GAEC’s laboratories are unique in the country and are equipped with up-to date equipment. All laboratories have been accredited by the Hellenic Council of Accreditation according to the ELOT EN IEC/ISO 17025 standard.

GAEC’s financial resources, adequately covering its needs, come from the public budget as well as from licensing fees and radiation protection services.

## **Article 9 Responsibility of the license holder**

According to the legislation in force, each activity, with radioactive material exceeding the exemption levels or with equipment producing radiation, needs a license. The license holder must fulfill specific requirements, conditions and obligations laid down in connection with the operating license.

In the radiation protection regulations, it is explicitly stated that the prime responsibility for the safety of nuclear installations is assigned to the license holder, who is also responsible for any breach of law towards the authority. As it concerns the nuclear installations, Greece respects the terms of the ratified Convention on the Nuclear Third Party Liability.

The license holder is responsible for the compliance with any relevant requirement of the radiation protection regulations, like the protection of workers from occupational exposure, the workplace supervision, the control of any discharges, etc.

In this respect, the license holder is responsible to arrange the assessment of the occupational exposure of workers, on the basis of individual monitoring where appropriate, and to ensure that adequate arrangements be made with appropriate dosimetry services under an adequate quality assurance programme.

The license holder is responsible to establish, maintain and keep under review a programme for the monitoring of the workplace under the supervision of a qualified expert and a radiation protection officer.

Also the license holder is responsible for the establishment, implementation and maintenance among others of appropriate monitoring equipment and surveillance programmes to assess public exposure and of keeping adequate records. He must determine the characteristics and activity of the material to be discharged, and the potential points and methods of discharge, as well as all significant exposure pathways by which discharged radionuclides can deliver public exposure and to assess the doses to the critical groups due to the planned discharges.

The license holder is responsible to establish and carry out a monitoring programme (and the relevant record keeping) sufficient to ensure that the requirements for discharges of radioactive substances to the environment be satisfied and that the conditions assumed in deriving the authorized discharge limits remain valid and sufficient to enable the exposures to critical groups to be estimated. Finally, the license holder is responsible to establish and maintain a capability to carry out emergency monitoring, in case of unexpected increases in radiation fields or radioactive contamination.

All the above, must be submitted by the license holder in advance to the authority in the form of a radiation protection and hazard report. According to the radiation protection regulations, the regulatory body performs in situ inspections to all license holders in order to assure the compliance with the regulations provisions.

## **Article 10 Priority to safety**

The national legislation gives high priority to nuclear safety, concept which in Greece predominantly applies to radiation protection and security issues.

### Radiation protection

According to the radiation protection regulations, priority is given to the nuclear safety; however, in the absence of nuclear power plants in the country, the concept applies predominantly to radiation protection and security issues. According to the same regulations, each activity with radioactive material exceeding the exemption levels or with equipment producing radiation needs a license. The license holder must fulfill specific requirements, conditions and obligations laid down in connection with the operating license, as already noted above.

The license is issued by the Ministry of Health and Social Solidarity (for the medical applications) or by the GAEC for the other types of applications. The license has a specific duration (radiodiagnostic laboratories: 5 years, nuclear medicine laboratories: 3 years, radiotherapy laboratories: 3 years, research laboratories: 5 years, industrial applications: 2 years) and its renewal requires the same procedure. In all cases a certificate of compliance with radiation protection provisions is required, which is issued by GAEC after examining the submitted documents and in-situ inspections for radiation protection and quality assurance purposes.

According to the radiation protection regulations, GAEC performs in situ inspections to all license holders in order to assure the compliance with the regulations provisions. The license holder must submit in advance the hazard report and the radiation protection report of the establishment. During the inspections, GAEC performs measurements to assure the conformity of the construction, operation and quality of the installations, systems and devices with the specifications and terms defined in radiation protection regulations. Moreover, GAEC performs unannounced inspections to assure the conformity of the different operations and procedures with the relative legislations.

As it concerns the Greek Research Reactor, the regulatory body in addition:

- approves the Safety Analysis Report (SAR) and its amendments,
- licenses the operators and key support personnel,
- bi-annually reviews the safe operation of the nuclear Research Reactor and individual items and identifies and evaluates factors that could limit safe operation during the period between reviews (No. NS-G-4.2, IAEA).

In 2009, GAEC applied for an IAEA Integrated Regulatory Review Mission (IRRS) of radiation and nuclear safety. In this respect, the first part of the IRRS, which is the self-assessment is in progress.

### Nuclear Security

GAEC in collaboration with the IAEA and the USA Department of Energy, upgraded the physical protection systems of selected radiological facilities in the country. These installations are:

- the nuclear Research Reactor GRR-1 and the subcritical installations,
- medical clinics and hospital installations – radiotherapy units and blood irradiators,
- sensitive industrial installations.

For the prevention of illicit trafficking of radioactive or nuclear material, the GAEC, in collaboration with IAEA, the USA 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 456 portable radioactivity detectors (300 pagers, 98 plastic scintillators, 68 portable spectrometers) have been distributed to all custom offices in the country.

In the same context, 181 radioactivity detectors – pagers and 32 portable spectrometers have been distributed to the police and the fire brigades.

Since previous CNS review meeting, the customs local detection systems have been networked. The central server includes a unified database with the alarms generated on local alarm systems. Additionally, in 2008 GAEC has been contracted by the customs to undertake the maintenance and calibration of the detection systems at the country points (ports, airports, borders).

## Education and Training

GAEC is responsible for providing education, training and continuing training in radiation protection matters. It organizes seminars on a regular basis, addressed to the scientific and technical personnel of medical, industrial and research laboratories where ionizing radiation is used. It also provides education and training for the personnel of other organizations and services involved in the national emergency response plan, as well as on-the-job training for future regulators and inspectors.

Some of the recent activities in this field are:

- GAEC operates a 3 semesters course for Physicists in Medical Radiation Physics in collaboration with the relevant Inter-University Post Graduate Course, where five Greek Universities are involved (Universities of Athens, Ioannina, Thessaloniki, Thrace and Crete). This jointly operating course leads to a M.Sc. degree in Medical and Radiation Physics and optionally to a Ph.D. degree. The acquirement of the M.Sc. degree plus one year of practical training, are prerequisites for a candidate to get the professional license on radiation physics, issued by the Ministry of Health and Social Solidarity after successful examinations. This license is necessary for the employment of a physicist in medical radiation laboratories, where he has a key role in the implementation of radiation protection. The employment of a medical physicist in these laboratories is compulsory by the law,
- GAEC is an IAEA's Regional Training Center for Radiation Protection and Nuclear Security. Within this frame, it operates the Post-Graduate Educational Course on "Radiation Protection and the Safety of Radiation Sources", organized in collaboration with NCSR "Demokritos", the University of Athens, the National Technical University of Athens and the University of Ioannina. The duration of the course is 18 weeks and is held in GAEC premises in Athens. It is attended by about 20 scientists from 15-20 countries. Within the same framework, several seminars of smaller duration concerning nuclear security issues are organized as well,
- an IAEA EduTA mission was organized in November 2008 by an expert team of IAEA regarding issues concerning the provision of education and training in radiation protection. Among the parameters evaluated was the legislative framework concerning matters of education and training in radiation protection, the national training programme, the accredited training courses, the facilities used for educational and training programmes, the available human resource and the national lecturers,
- the successful cooperation between IAEA and GAEC in the field of education and training is expected to be reflected in a Long Term Agreement, establishing the terms of reference for GAEC to act as a Regional Training Center in Europe for nuclear, radiation, transport and waste safety. A long term agreement between GAEC and IAEA is in the final process of formal establishment.

### **Article 11 Financial and human resources**

A graded approach for the adoption of IAEA document NS-G-4.5, on "The operating organization and the recruitment, training and qualification of personnel for research reactor safety guide", for the Research Reactor GRR-1 has been initiated.

According to the mandatory regulations of the Research Reactor GRR-1:

- the training programs for all reactor personnel are submitted for approval to GAEC,
- all reactor personnel attend yearly a radiation protection seminar focusing on practical radiation protection issues,

- reactor operators attend yearly a seminar on nuclear reactor theory and practical reactor systems operation (IAEA document NS-G-4.5, IAEA-TECDOC-1170),
- the reactor operators and radiation protection personnel are licensed by GAEC after examinations. The license is valid for two years,
- the competences and qualifications of the rest of the technical support personnel is certified according to specialty by procedures approved by the Reactor Safety Committee,
- the external users of the research facilities, before access to the facility is granted, are trained in radiation protection and other safety areas by an appointed member of the research reactor radiation protection group.

The financial resources needed for the operation of the Research Reactor GRR-1, come from the regular budget of the Greek Government.

In 2006 an additional budget for the upgrading and renovation of the GRR-1 has been approved. The works include renovation of the reactor building and replacement of the reactor primary cooling system and associated safety systems.

## **Article 12 Human Factors**

The issue of Human Factors is applied to radiation protection issues and the safety of research reactors, both outside the scope of the Convention on Nuclear Safety.

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 (e.g. radiation protection officer, medical physicist, radiologist, etc). Education and training on radiation protection is also required, the adequacy of which is recognized by GAEC. The continuous training of the workers is strongly encouraged.

Additionally in relation to the Research Reactor GRR-1 the following apply:

- according to the mandatory safety regulations of the Research Reactor GRR-1, its personnel must be trained each year on radiation protection rules and procedures. Following this, the personnel take written examinations.  
The operators are trained each year on radiation protection, nuclear reactor theory and practical reactor system operation. For all these, there are written procedures and lecture notes. Every two years the operators take written and practical examinations by GAEC. Their licenses, based on these examinations, are renewed by the GAEC every two years.  
It is noted that training of the reactor personnel was characterized by the Integrated Safety Assessment of Research Reactors (INSARR) mission (2001) as “good practice”,
- according to the safety regulations of the Research Reactor GRR-1, there are written procedures for the analysis and reporting of incidents,
- according to the same regulations there is a hierarchy of internal and external committees for evaluation of each analysis.

## **Article 13 Quality Assurance**

The issue of Quality Assurance is applied to radiation protection issues and the safety of research reactors, both outside the scope of the Convention on Nuclear Safety.

GAEC, through the radiation protection regulations, fully supports and encourages the activities related with Quality Assurance / Quality Control programs for all radiological installations. For example, GAEC laboratories have all been accredited by the Hellenic Accreditation Council according to ELOT EN IEC/ISO17025 standard.

In addition, the Department of Licensing and Inspections has applied in 2010 to the Hellenic Accreditation Council for accreditation according to ELOT EN IEC/ISO17020 standard. The accreditation process is currently in its final stage.

Last year GAEC applied for an IAEA Integrated Regulatory Review Mission (IRRS) of radiation and nuclear safety. In this respect, GAEC actually operates the first part of the IRRS, which is the self-assessment.

There are plans for the establishment of Quality Assurance Programme for the Research Reactor according to the IAEA standards. For this purpose and although a complete system of written procedures on reactor operation, practices, maintenance and radiation protection exists, the assistance of IAEA has been requested for the establishment of a quality assurance program according to IAEA standards.

#### **Article 14 Assessment and verification of safety**

The issue of assessment and verification of safety is applied by extension to the safety of the Research Reactor and all other radiation facilities.

According to the radiation protection regulations, the regulatory body for radiation protection in the country (GAEC) carries out regular and not-announced inspections of the facilities in order to verify the compliance with the radiation protection provisions in the frame of the issuing or renewing their license. Since the previous review meeting, more scientists and new equipment have been added and new inspection procedures are applied. The number of unexpected inspections is increasing. The department has applied for an accreditation according to the EN/EC/ISO 17020 standard.

The Research Reactor's operation is evaluated through monitoring of radioactive releases, inspections and evaluation of the Safety Analysis Report (SAR). Any planned practice that may be safety related is examined, with respect to safety, by an internal safety committee.

Within the framework of the Technical Co-operation Program RER/9/058 an Integrated Safety Assessment of Research Reactors (INSARR) mission was conducted in the Greek Research Reactor GRR-1, in 2001. A follow-up mission was conducted from 23 to 25 June 2004. The main conclusion reached by the team of experts was that "the experimental nuclear reactor operates with safety, by knowledgeable and well informed personnel". Furthermore, a high level of safety know-how was observed. The activities of "personnel training", "dosimetry" and "development of probabilistic safety assessment of the reactor" were characterized as good practices.

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

#### **Article 15 Radiation Protection**

The national legislation on radiation protection implements the European Directives 96/29 and 97/43 Euratom, which are based among others on the ALARA concept. In this respect, the legislation provides the requirement and the

guidelines for implementing radiation protection programmes in radiation facilities. GAEC, as the regulatory body, during its inspections verifies the compliance with the requirements.

In particular, as it concerns the Research Reactor GRR-1, a radiation protection programme has been established and approved by GAEC.

The ionizing radiation installations where radiation protection programmes are implemented are described under Article 6. Relevant information on the radiation protection legislative framework can be found under Article 7; radiation protection in relation to priority on safety is discussed in Article 10.

## **Article 16 Emergency Preparedness**

Greece can be affected in the event of a radiological emergency at a nuclear installation (in the sense of the Convention on Nuclear Safety) only outside of its borders. In order to be ready and cope with such situations, Greece has established radiological emergency preparedness regulations, plans, and an organizational scheme, as well as an extensive environmental radioactivity monitoring network covering the national territory.

### The national emergency plans

- a) The General Civil Protection (Emergency) Plan (GCPP) under the code name “Xenokratis” concerns any emergency situation in the Greek territory (Ministerial Decree No 2025, Official Gazette of the Greek Government No 12B, 19.01.98, “Approval of the General Plan for Civil Protection, under the Code Name Xenokratis”). 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 Official Gazette in 2003 (Ministerial Decree No 1299, Official Gazette of the Greek Government No 423B, 10.04.03, “Approval of the General Plan for Civil Protection, under the Code Name Xenokratis”). In particular Annex “P” (Greek letter rho) of the GCPP concerns the response to an emergency situation from important and extensive radioactivity contamination due to radiological or nuclear accidents taking place inside or outside Greece and is designed to provide response to accidents involving the release or potential release of radioactive substances.

GAEC is the authority responsible for activating the GCPP Annex “P”, 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 President of the GAEC and supported by a properly staffed Information Group,
- the Scientific Committee (SC): a seven-member committee chaired by the President of GAEC, 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,
- the Ministerial Coordinator Board: is convened in emergency cases according to the provisions of the general emergency plan, and is chaired by the Minister of Education, Lifelong Learning and Religious Affairs.

According to the emergency plan, the emergency situations arising from a wide spread radioactive contamination of the Greek territory, are classified as follows:

- normal level - level A,

- alert level - level B which is characterized by increased environmental radiation or radioactivity levels or when information is received for a nuclear accident through the ENATOM or ECURIE systems or through the countries with which Greece has signed bilateral agreement on early notification,
  - alarm level - level C. In this level the emergency plan is fully activated and all governmental and other national authorities are ready to perform their duties according to the plan.
- b) 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. GAEC 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).

#### GAEC's role and preparation for the emergency situations

GAEC plays the major role in implementing the emergency plans as it concerns nuclear or radiological components. In addition to what has been already mentioned, GAEC is responsible for emergency preparedness and advises the Government on the measures and interventions necessary to protect the public. GAEC is the contact point for receiving and communicating information to the IAEA, ENATOM and ECURIE emergency-response systems. GAEC also performs relevant national exercises and participates in international ones.

Several governmental departments and other national authorities are involved in the emergency plan including, the General Secretariat for Civil Protection, the Ministries of Interior, Health and Social Solidarity, Rural Development and Food, Education - Lifelong Learning and Religious Affairs, Defence, Infrastructure, Transport and Networks, and the National Meteorological Service. The cooperation with the Police, the Fire Brigade, the Coast Guard, the Ministry of Defence, the General Chemical State Laboratory, the Ministry of Health and Social Solidarity and other civil services and institutes has been significantly strengthened.

In order to cope with its statutory duties in the field of emergency planning and response, GAEC has established an internal emergency plan, the general lines of which are as follows:

1. personnel: The majority of GAEC personnel participate in emergency situations. Special teams (intervention team, support team ...) have been formed, the members of which have specific duties,
2. equipment: GAEC equipment devoted to emergency planning includes:
  - a mobile laboratory fully equipped with a series of portable equipment such as detectors, spectrometers and protective equipment. This vehicle contains additionally a radiochemical lab, a HpGe spectrometer, and a plastic detector of high volume placed on its roof and connected to a laptop computer,
  - measuring and detection systems: a series of instruments for rapid detection (plastic scintillators with audio signals and pagers), dosimeters for dose assessment (survey meters, contamination monitors for alpha, beta, gamma) and portable spectrometers (NaI and HpGe) for radionuclide identification,
  - protective equipment of different types, like uniforms, gloves, masks, shoes, casks, respiratory devices, etc.,



- independent communication systems, in order to permit the staff to communicate independently of the general communication network, if needed,
- specialized vehicle with the possibility of carrying and stabilizing shielded radioactive sources (with shielding of different types, like Pb boxes, sheets of Pb, Pb bricks and pellets),
- dispersion calculation codes, in case of a nuclear accident or any radiological release, and calculation codes for radiological dispersion devices. In particular, in order to cover an explosion in a nuclear power plant, the Hysplit calculation code is used for a quick estimation of the situation, before running more sophisticated codes. Under the National Emergency Plan, a special team dealing with calculation of the dispersion and contamination after a nuclear accident has been established. This team is composed of Greek experts in the field. The codes actually used are the Hysplit and Rodos. An on-line connection with the National Meteorological Service assures the receipt on real time of the meteorological data, necessary for any dispersion calculation.

Apart from the infrastructure devoted to emergency response purposes, all GAEC 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.

3. A critical component of the nuclear accident emergency plan is the network of monitoring stations covering the national territory. The GAEC telemetric network consists of 24 stations with total-gamma dose-rate detectors (ionization chambers, equipped with data loggers for storing data and releasing alarms), and three aerosol telemetric stations (pips detectors with NaI and a proportional chamber). All these stations are connected to the public dial-up network via a modem. NCSR "Demokritos" in cooperation with GAEC operates a complementary network consisting of 12 aerosol samplers, six surface water sampling places and five fall-out sampling positions for radioactivity measurements in air, water and soil samples.
4. Collaboration with national, European and international organizations (eg emergency response systems, databases, networks ...). In order to cover the whole country in case of an emergency, GAEC has established a network of "collaborating laboratories" belonging in a number of Universities and Research Centers throughout the country. Specialized equipment and training has been provided to these laboratories. GAEC performs periodic inter-calibration exercises to ensure the validity of the results provided by these laboratories.
5. Documentation: all procedures to be followed in case of an emergency are documented. This document contains the responsibilities of the GAEC teams, administrative information, concerning the premises and vehicles and the supporting or back-up infrastructure used for the purpose, step-by-step analytical procedures of the actions to be performed the first moments after receiving the alarm for each team involved, technical procedures to be followed based on possible scenarios, technical fiches to complete, list of the equipment, quality control procedures, basic description of each piece of equipment, list of useful bibliography, phone numbers and address of the personnel involved.

### GRR-1 emergency plan

Within the framework of the GRR-1 Research Reactor radiation protection program, an internal emergency response plan has been prepared. This plan takes into consideration emergencies arising from radioactivity contamination and increased radiation levels due to abnormal operations at the reactor facility. The plan provides appropriate communication channels between reactor operator and the GAEC in case of an emergency condition at the reactor facility. However, the plan will be revised during the process of reactor licensing after completion of the reactor refurbishment program that is currently underway.

### Information of the public

The provisions about the information of the public in case of radiological or nuclear emergencies are described in the Ministerial Decree No 2739, Official Gazette of the Greek Government No 165/B/15.03.94, "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". The information of the public is a duty of GAEC.

In summary, there is a National Information Committee responsible for public information, presided by the President of GAEC, with members representing the relevant specialties, such as radiation protection, radiobiology, nuclear technology, public health, etc. The Committee sits in the GAEC premises. This Committee disseminates the information via national media and public offices and ministries, in agreement with the relevant Ministry and the President of the GAEC.

GAEC has issued special information leaflets for the emergency situations, which have been largely distributed to the Prefectures, Police, Fire Brigade, Public Services, Schools, etc. They are also available in the GAEC's web-site. In case of an emergency, a special "window" opens in GAEC's web-site, where information is provided constantly.

The telemetric network for the monitoring of the environmental radioactivity covering the country indicates in real time any elevated level of radioactivity. These results are always available in the GAEC web page. A link to EURDEP is also provided.

### Reporting

In the radiation protection regulation, it is clearly stated that the license holders have to report to their administration and to the GAEC any event, incident or accident relevant to radiation protection. Moreover, the license holders have to submit to the GAEC a detailed report describing the incident/accident and the countermeasures taken.

As it concerns the Research Reactor GRR-1, according to its safety regulation, there are written procedures for the analysis and reporting of incidents. According to the same regulation, there is a hierarchy of internal and external committees for evaluation of each analysis.

As it concerns the reporting towards other countries or organizations, GAEC respects the ECURIE and ENATOM demands and follows the INES scale. Moreover, GAEC participates in the IAEA "Incident reporting system for research reactors" and the "Illicit trafficking database". In addition to the above, GAEC respects the provisions of the bilateral agreements for early notification with Bulgaria and Romania.

## D. Activities, achievements and concerns regarding the improvement of safety – Since CNS Review Conference 2007

The Greek Atomic Energy Commission continues its efforts towards the improvement of nuclear safety and security, in both directions: by improving its own capabilities (infrastructure, human resources, quality management programmes) and by assisting and supporting the operators.

In particular:

- in the field of inspections and licensing, more scientists and new equipment have been added and new inspection procedures are applied. The number of unexpected inspections is increasing. The department has applied for an accreditation according to the EN/EC/ISO 17020 standard,
- in nuclear security, the customs local detection systems have been networked. The central server includes a unified database with the alarms generated on local alarm systems. In 2008 GAEC has been contracted by the customs to undertake the maintenance and calibration of the detection systems at the country points (ports, airports, borders),
- prior of signing a Long Term Agreement between IAEA and GAEC, an IAEA EduTA mission was organized in November 2008 by an expert team of IAEA regarding issues concerning the provision of education and training in radiation protection,
- in 2009, GAEC applied for an IAEA Integrated Regulatory Review Mission (IRRS) on radiation and nuclear safety,
- transposition of the European Directive 2009/71/Euratom, establishing a Community framework for the nuclear safety of nuclear installations, in the national legislation.

As it concerns the Research Reactor GRR-1, in 2006 an additional budget for its upgrade and renovation has been approved and the work is in progress. The operator plans the work to be completed in 2011. The reactor will restart operating under a new license.

# E. Annexes

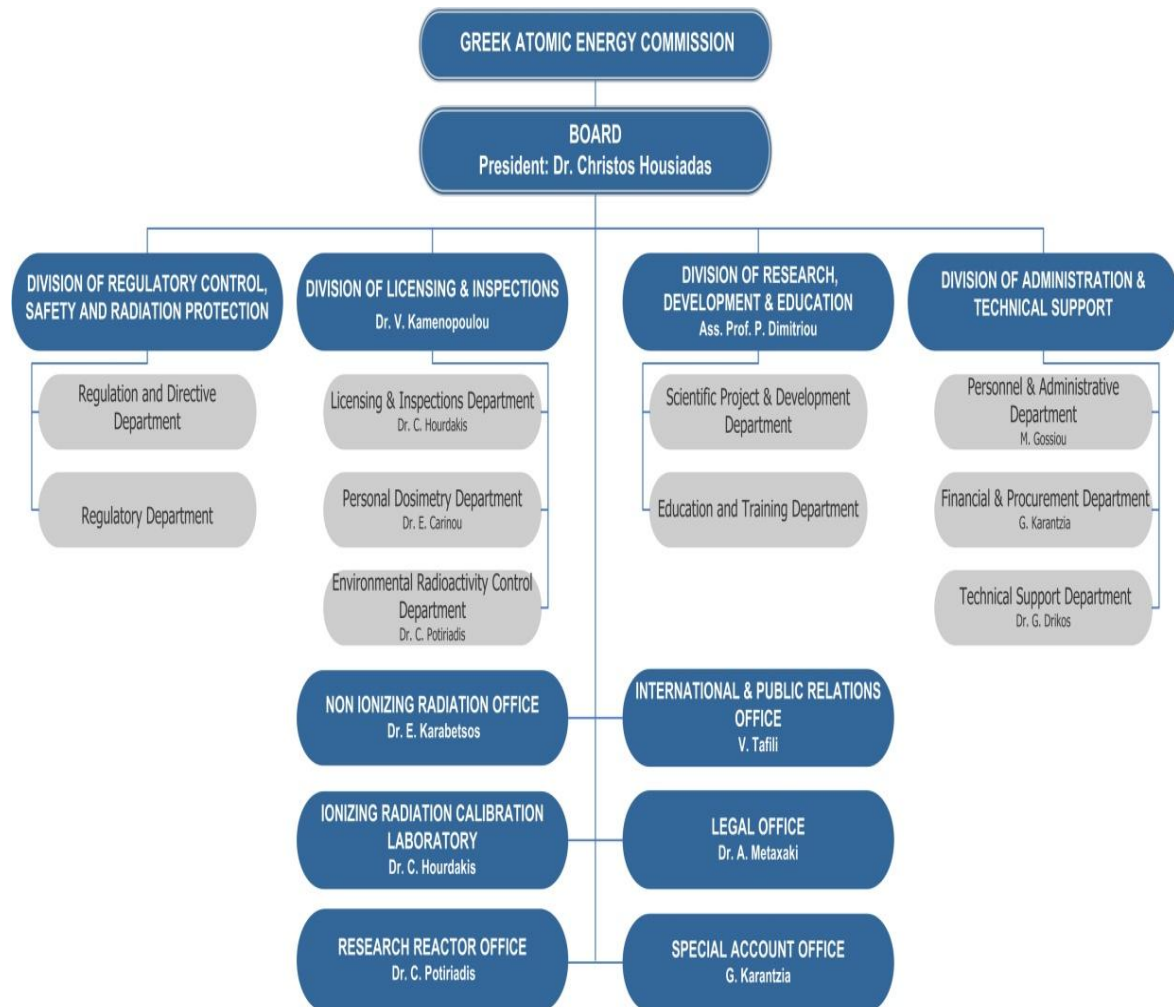
## ANNEX 1: List of Relevant National Legislation

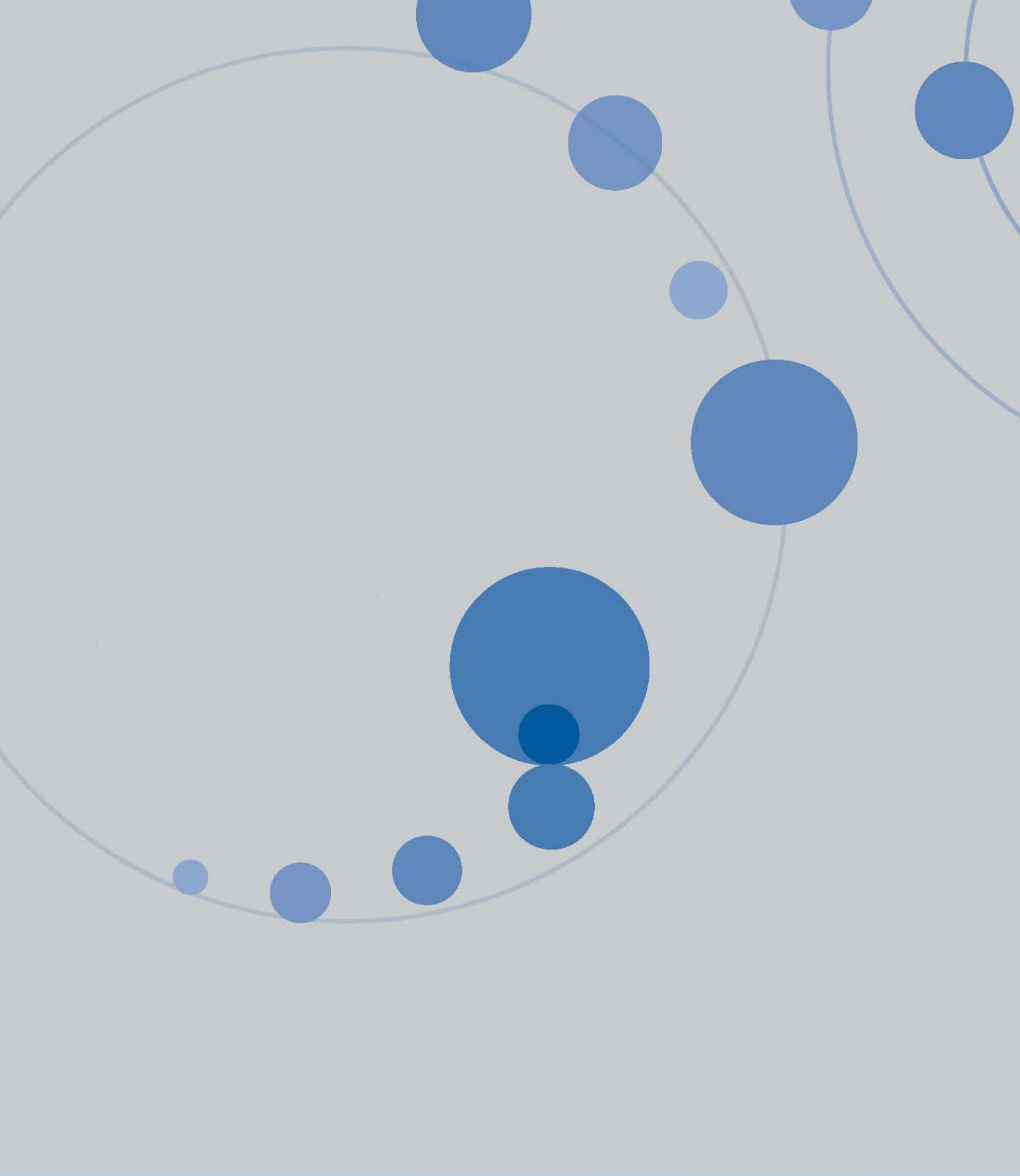
- Law No 2480, Official Gazette of the Greek Government No 70/A/14.03.1997  
“Ratification of the Nuclear Safety Convention”,
- Law No 1758, Official Gazette of the Greek Government No 44/A/10.03.1988  
“Ratification of the Protocol Amending the Convention on Third Party Liability on the Field of Nuclear Energy of 29 July 1960, as it was modified by the Additional Protocol of the 28 January 1964”,
- Law No 1937, Official Gazette of the Greek Government No 35/A/13.03.1991  
“Ratification of the International Convention in case of a Nuclear Accident or Radiological Emergencies”,
- Law No 1938, Official Gazette of the Greek Government No 36/A/13.03.1991  
“Ratification of the International Treaty on Early Notification in case of a Nuclear Accident”,
- Law No 2824, Official Gazette of the Greek Government No 90/A/16.03.2000  
“Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management”,
- Law No 854, Official Gazette of the Greek Government No 54/A/18.03.1971  
“Terms to establish and operate nuclear installations”,
- Presidential Decree No 610, Official Gazette of the Greek Government No 130/A/23.08.1978  
“Establishing terms and procedures in licensing Public Power Corporation to construct a nuclear power plan on a specific site”,
- Official Gazette of the Greek Government No 49/A/26.02.1970  
“Ratification of the non proliferation treaty signed on the 1 June 1968”,
- Safeguards agreement between Greece and IAEA signed on 17.11.1972,
- Law No 1636, Official Gazette of the Greek Government No 106/A/18.07.1986  
“Ratification of the physical protection of nuclear material treaty”,
- Ministerial Decree No 5408 /E3/2362/ Φ MSG, Official Gazette of the Greek Government No 730/B/21.09.1993  
“Control on transfer of nuclear materials, armament and technologies affecting national Defense and Security”,
- Law No 2805, Official Gazette of the Greek Government No 50/A/03.03.2000  
“Ratification of the additional protocol”,
- Law No 3787, Official Gazette of the Greek Government No 140/A/07.07.2009

“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”.

- Ministerial Decree No 1014(FOR) 94, Official Gazette of the Greek Government, No. 16B, 06.03.2001  
“Radiation protection regulations”,
- Ministerial Decree No 10828 /EFA(1897), Official Gazette of the Greek Government No. 7859/B/10.07.2006  
“Control of high-activity sealed radioactive sources and orphan sources”,
- Decree Law No 1733, Official Gazette of the Greek Government No 171, 22.09.1987  
“Establishment of the Greek Atomic Energy Commission”,
- Presidential Decree No 404, Official Gazette of the Greek Government No 173, 05.10.1993  
“Organization of the Greek Atomic Energy Commission”,
- Ministerial Decree No 2739, Official Gazette of the Greek Government No 165/B/15.03.1994  
“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”,
- Presidential Decree No 22, Official Gazette of the Greek Government No 20/A/26.02.1997  
“Supervision and control of shipments of radioactive wastes between Greece and the other Member States of the EU and into and out of the EU”,
- Ministerial Decree No 9087, Official Gazette of the Greek Government No 849/13.09.1996  
“Radiation protection of external workers”,
- Ministerial Decree No 2025, Official Gazette of the Greek Government No 12B, 19.01.1998  
“Approval of the General Plan for Civil Protection, under the Code Name Xenokratis”,
- Ministerial Decree No 1299, Official Gazette of the Greek Government No 423B, 10.04.2003  
“Approval of the General Plan for Civil Protection, under the Code Name Xenokratis”,
- Decree Law No 3491, Official Gazette of the Greek Government No 207A, 02.10.2006  
“Establishment of the supporting team for Nuclear, Radiological, Biological and Chemical Threats”.

## ANNEX 2: GAEC Organizational Structure





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