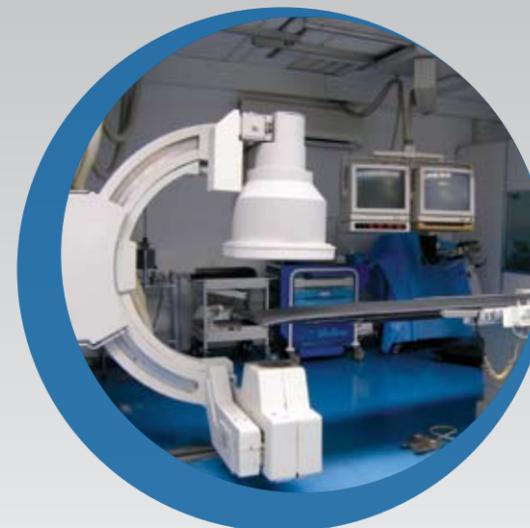


GREEK ATOMIC ENERGY COMMISSION

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Greek Atomic Energy Commission
ANNUAL REPORT 2008

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It is my great pleasure to preface GAEC's annual report for the year 2008, a series of reports published on a regular basis as part of our public information policy.

Year 2008 was a year of continuation and completion of initiatives which reinforced the main competences of GAEC. The following accomplishments are characteristic examples:

- Agreement between GAEC and the Competent Authority of the Republic of Cyprus for scientific and technical cooperation in the fields of radiation protection and nuclear safety.
- Agreement between GAEC and the Ministry of Economy for the technical support of the radiation detection systems installed at the country's entrance points (customs).
- Positive assessment by the International Atomic Energy Agency (IAEA) of GAEC's education and training services, which will enable GAEC to operate as International Regional Centre for Education and Training.

At the functional and operational level, GAEC's ability to respond to needs and challenges was improved. For example, during 2008 the on-site controls of the electric and magnetic fields were intensified throughout the country. At the same time, direct access of citizens to the results of the controls via GAEC's website enhances credibility and transparency.

The extensive use of various kinds of radiation in several aspects of our daily life renders GAEC's institutional role increasingly important. Under this perspective, our goal is to maintain the strong foundations upon which GAEC is building the system for radiation protection of the workers, the public and the environment in Greece: sense of responsibility towards society, scientific integrity, transparency and serving of public interest will continue to be the elements dictating GAEC's actions. Moreover, recognizing the current trends at European and international level, GAEC is exceedingly careful in taking all necessary provisions, as required for an independent radiation protection and nuclear safety competent authority.

Dr. Christos Housiadas
President of GAEC

During 2008 the Greek Atomic Energy Commission accomplished successfully its tasks in the field of radiation applications licensing, inspections and in situ measurements throughout the country. At the same time, GAEC broadened its activities in terms of development, research and education.

A limited number of radiological cases requiring GAEC's intervention was recorded, mainly concerned with the detection of increased levels of radioactivity in scrap metals. At national level, there were no radiological emergency situations. At European level during 2008 the alarm of the early notification system of the European Commission, ECURIE, was activated twice and for first time in its history. The events did not have any radiological implication for Greece.

The debate on nuclear energy renaissance, a current issue of interest, was extensively covered by the media, given the plans of neighboring countries to construct nuclear power plants. GAEC, in the context of its information policy, expressed several times its views, providing information on the advantages and disadvantages of nuclear energy and explaining international experience. It is worthwhile to mention our participation in the working group "Nuclear energy and energy needs in Greece", formed under the Energy Commission of the Academy of Athens.

At organizational level, a new Board was appointed in October 2008, following a successful completion of the term of the previous Board.

The current report of activities is published for first time both in Greek and English language and is available electronically at the website <http://www.gaec.gr>.

The Greek Atomic Energy Commission (GAEC) is the competent national authority, responsible for radiation protection and nuclear safety issues. Its primary mission is the protection of the public, workers and the environment from ionising and artificially produced non-ionising radiation.

GAEC was founded in 1954 and from 1987 operates as an independent public service, supervised by the General Secretariat of Research and Technology under the Ministry of Development.

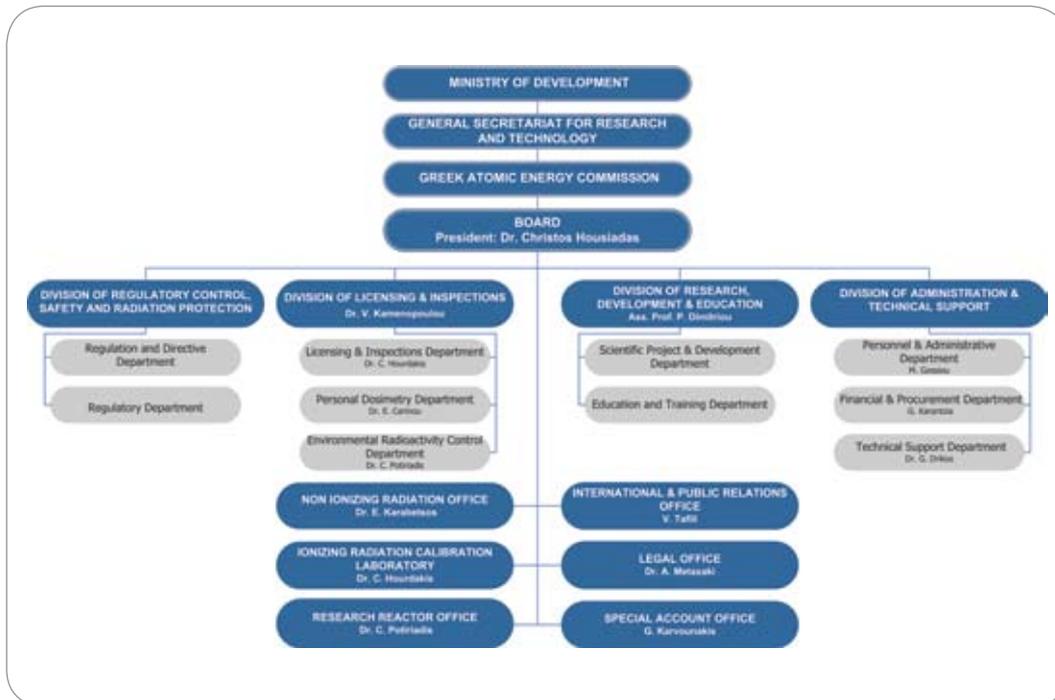
The role of GAEC is mainly accomplished by:

- radiation protection inspections in medical and other laboratories, issuing of certificates of compliance or/and licensing
- individual monitoring of all workers occupationally exposed to ionising radiation
- operation of the national ionising radiation calibration laboratory
- coordination of the national environmental radioactivity monitoring programme, telemetric network operation and laboratory measurements
- preparedness and response to radiological or nuclear emergencies
- response to illicit trafficking of radioactive materials
- measurements of electric and magnetic fields in all kinds of facilities emitting low or high frequency electromagnetic radiation. Expert opinion on the technical reports on electromagnetic emissions during the licensing process of antenna stations
- education and training of workers in the fields of radiation protection and nuclear security. European Regional Training Centre of the International Atomic Energy Agency (IAEA) in the English language on radiation protection and safety of radiation sources
- legislative activities
- representations in national, European and international organizations and committees
- participation in research and development programmes
- implementation of public information actions.

Organization – Administration

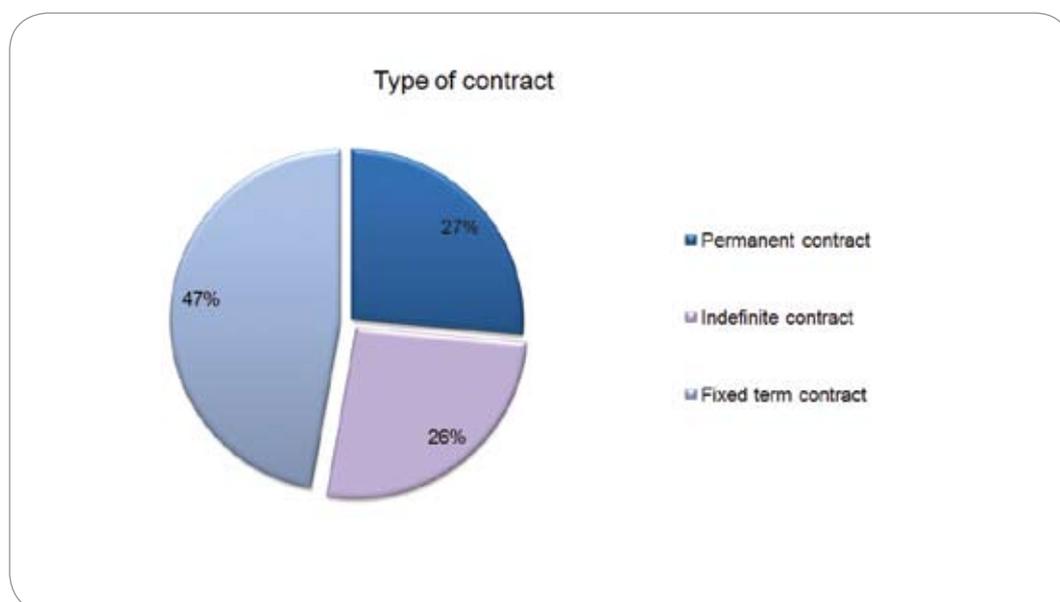
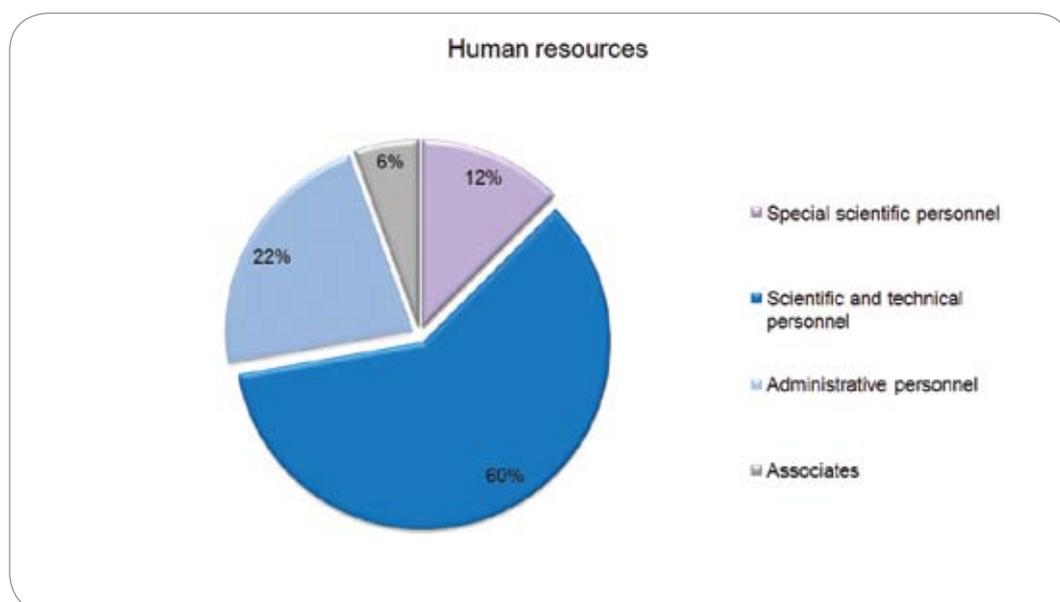
Board

President	Dr. C. Housiadas, Research Director at NCSR «Demokritos»
Vice-president	S. Simopoulos, Professor at the National Technical University of Athens
Members	<p>Th. Matikas, Professor at the University of Ioannina</p> <p>K. Strigaris, Associate Professor at the National and Kapodistrian University of Athens</p> <p>G. Nicolaou, Assistant Professor at Democritus University of Thrace</p> <p>E. Georgiou, Professor at the National and Kapodistrian University of Athens</p> <p>Dr. G. Amanatidis, European Parliament, DG IPOL - Directorate A</p>

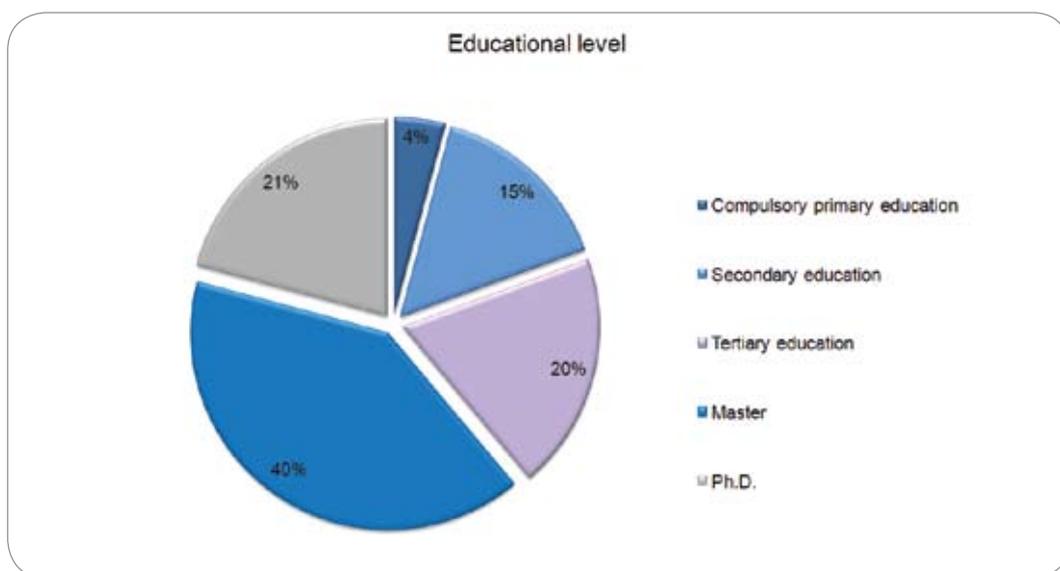


GAEC is currently employing 70 persons. The recruitment process has been accelerated during the last few years due to the increased workload mainly in the field of electromagnetic fields and environmental studies audits.

Human resources



The 81% of GAEC personnel have completed the two highest levels of education system: the 62% has postgraduate studies and 19% has completed the tertiary education. The covered expertise areas are mainly those of radiation-physics, physics, nuclear physics and electrical engineering.



Information systems

GAEC is equipped with up to date information systems, which plays a supportive role to its activities. One of its most important systems is the National Radiation Protection Database containing information about the laboratories that use or produce radiation. The database includes also the inventory of the radiation sources used in the country. Part of the National Radiation Protection Database is the National Dose Registry Information System, where information related to occupationally exposed workers is kept. Due to the increasing amount of services provided by GAEC, technology and network infrastructure is constantly updated with cutting edge technology. In 2008:

- a new network application was designed, in order to monitor on-line the radiopharmaceuticals transport, taking into account data related to licensing by GAEC, medical laboratories and transport companies
- a new database and respective application were developed, aiming at the registration of the inspections performed in the vicinity of electromagnetic fields emission systems, as well as of the results from in situ measurements. Through GAEC's website, on-line access to in-situ measurements' results is available. This way, the users can be informed in detail about the electric and magnetic fields levels measured in each region, and compare them with the established exposure limits

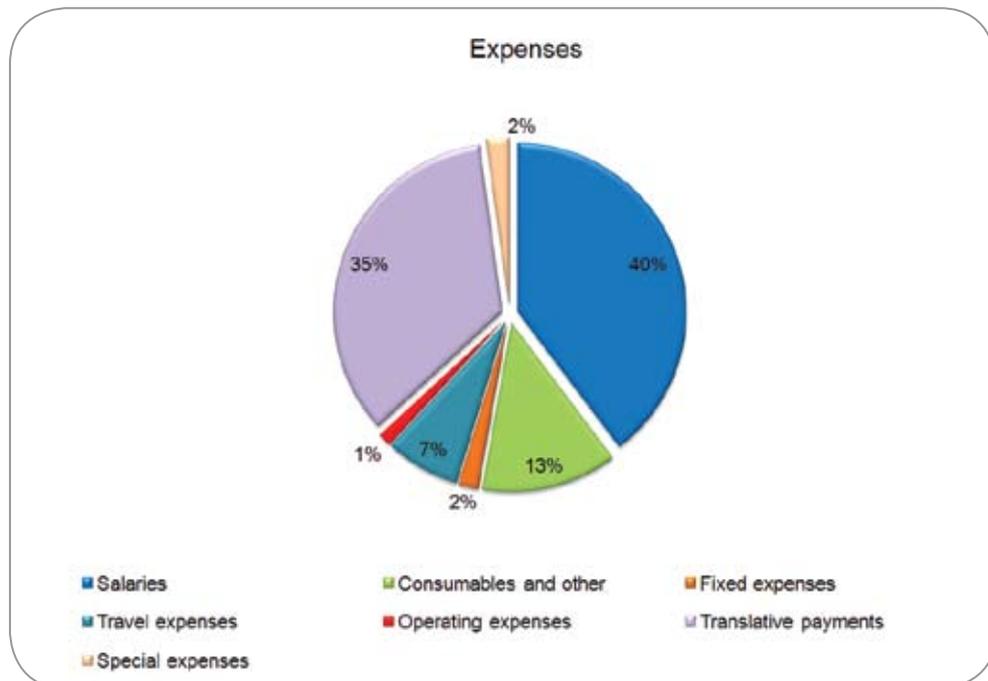
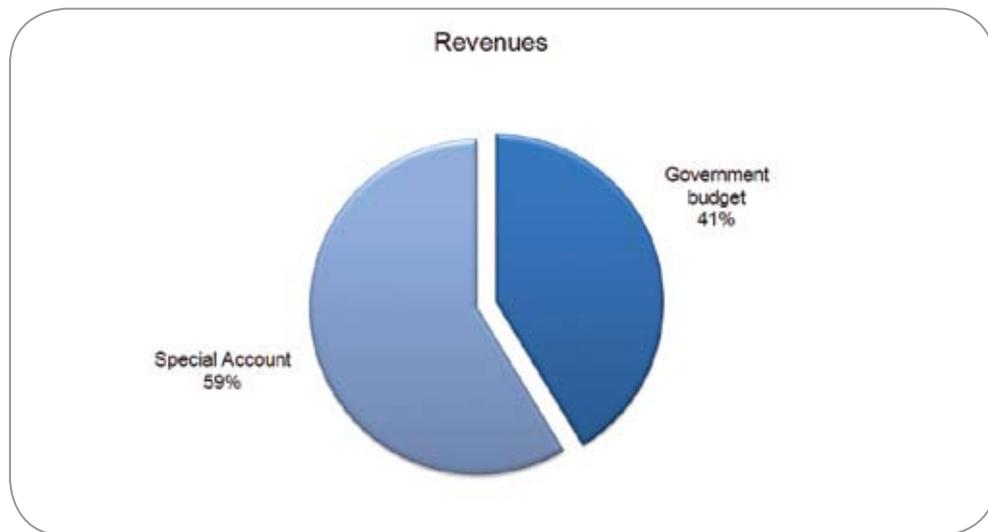


- a know-how transfer project was implemented on GAEC's initiative and in cooperation with the US Department of Energy and the company – provider of the software used by the fixed radiation detection systems, which are installed in customs offices. GAEC has fully undertaken the maintenance of these systems, the on-line access to detection systems, as well as the transfer of registered events to GAEC's main server
- a new system simulating the customs office detection equipment was installed at GAEC premises, allowing the training, as well as the in-situ monitoring of detection reliability
- several databases were upgraded (Oracle 9.2, Ingres R3, MySQL 5.5)
- an internal network of LAN wireless access was installed.



Financial resources

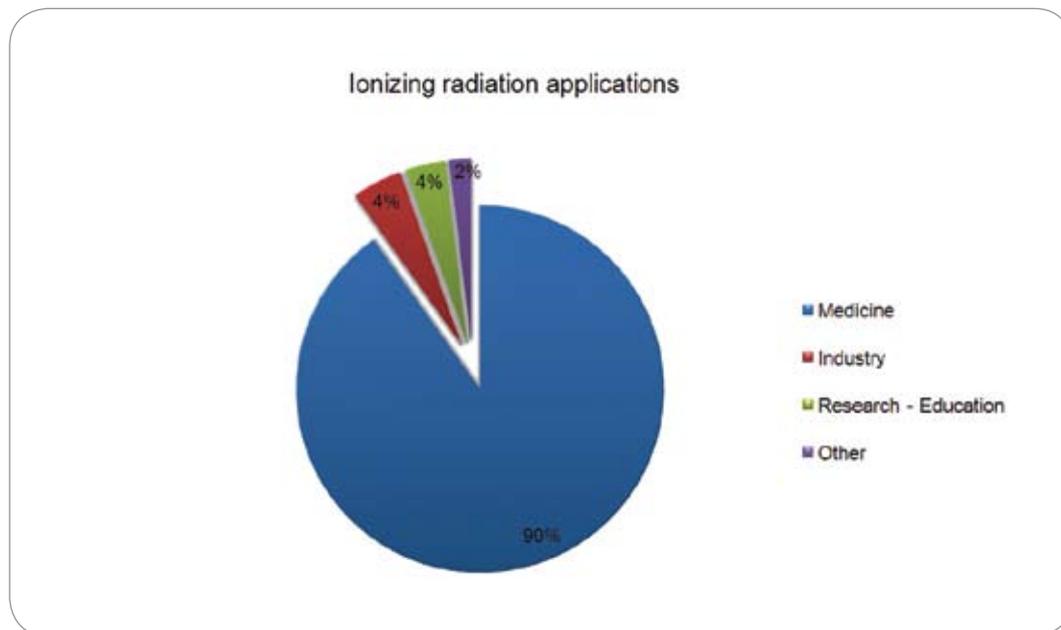
GAEC's income account consists of government funds and revenues from services provision. In 2008, GAEC's revenues (invoices issued) were € 6, 8 million, while the total expenditure was € 4,6 million. The governmental financial support was mainly used to cover translative payments and a small part of salaries and operative costs. Travel expenses, salaries, fixed and consumable expenses were covered by its Special Account.



Ionising radiation is used in health care sector, in industry and in several research-educational centres. In the medical sector, radiation is used in various diagnostic and treatment practices. In Greece, ionising radiation is used for medical purposes by 24 radiotherapy departments, 1171 radiodiagnostic departments and 180 nuclear medicine laboratories.

Radioactive sources as well as radiation production systems are also used by industries. Sterilization products, geological studies, material structure analyses are some of radiation industrial practices. In 2008, 275 industrial applications, including radiography laboratories and industrial radioactive sources operated under GAEC's license.

Research and educational laboratories use radioisotopes, accelerators, subcritical devices and neutron generators. In total, 218 licenses for research or educational radiation use have been issued by GAEC in 2008.



Licensing and inspections of ionising radiation

GAEC performs on-site inspections for radiation protection and quality assurance purposes. GAEC's inspections and radiation measurements aim to assure the compliance of the construction, operation and quality of installations, systems and devices with the specifications and terms defined in radiation protection regulations. Moreover, GAEC is responsible for issuing certificates of compliance and/or licenses for medical, industrial, research and other applications of ionising radiation in Greece. For this reason GAEC inspects regularly the totality of ionising radiation systems.

In 2008:

- the total number of the performed inspections was 740
- unannounced and sudden inspections in ionising radiation laboratories were organized on a more systematic and comprehensive basis, independently from licensing procedures. The aim of these inspections was to identify "good" and "bad" procedures and practices during the day-life operation of a laboratory. However, non-compliance with the regulations leads to recommendations and serious non-conformities may lead to the inhibition of the operation license. A final report with the results of these inspections is communicated to the laboratory responsible persons.

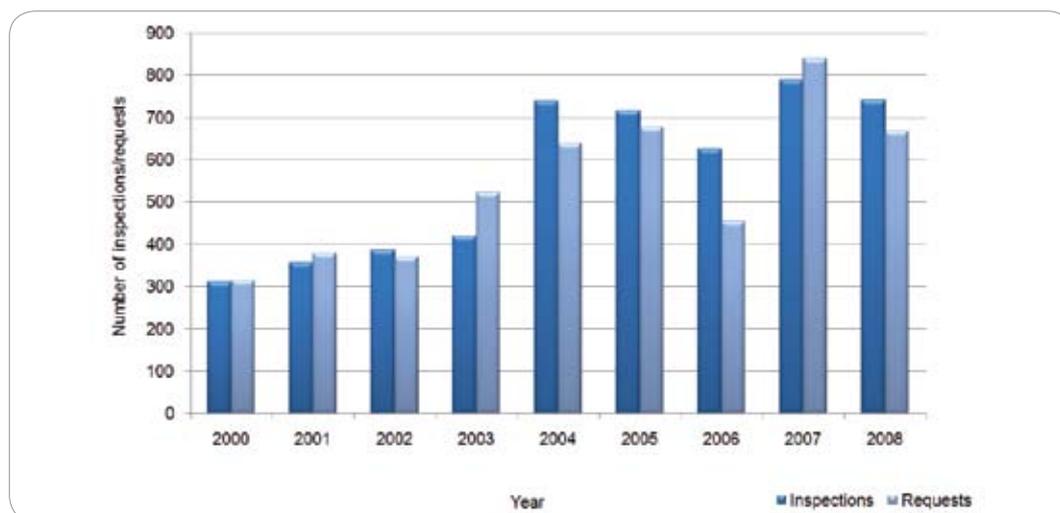
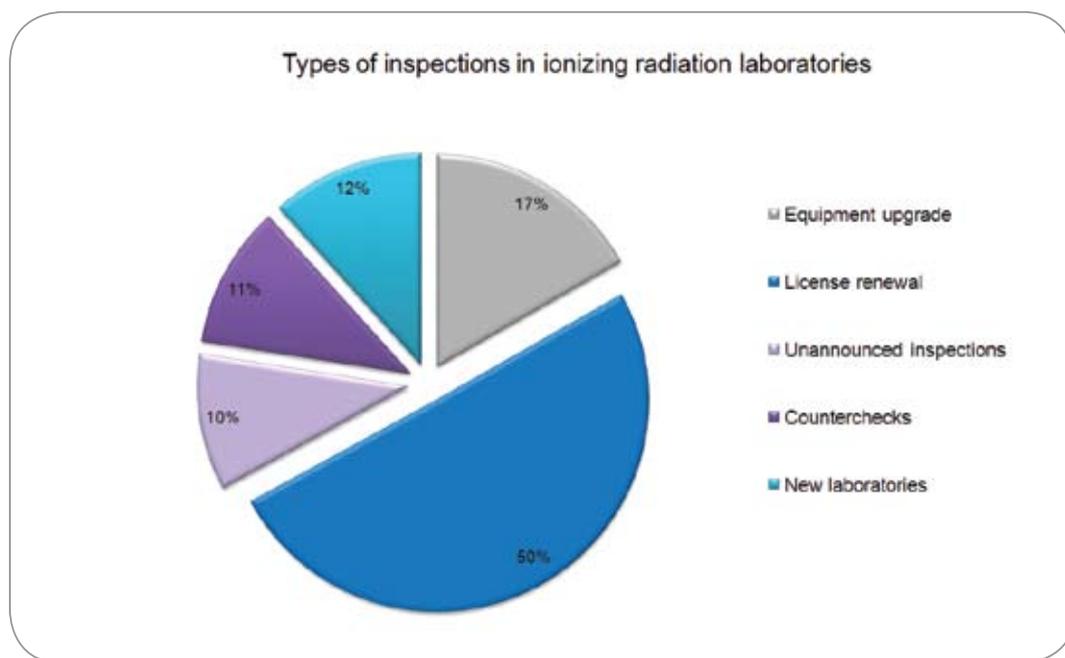


Diagram 1: Progress in time of the applications number and the inspections performed.

- 2621 documents were issued. Compared to previous years, there was a substantial decrease of the number of documents with recommendations for non-compliance appraisal (153 in 2008), while the number of certificates of compliance increased (1186 in 2008)
- 78 pregnant women who were exposed to radiation contacted GAEC, in order to get information about the foetus doses, the probability of deterministic and stochastic effects and to seek advice for further actions



- the following quantities of radioisotopes were used by nuclear medicine and research laboratories: 68.7 TBq Tc-99m, 2.1 TBq Tl-201, 0.4TBq Re-186, 5.8 TBq I-131, 0.3 TBq In-111, 0.15 TBq Ga-67 MBq, 0.16 TBq I-123. The import, export and transport of sealed sources were licensed individually. In 2008, 202 sealed radiation sources were approved for import / export (194 licenses were issued).



Type of facilities/equipment	Number
Linear accelerators	9
Co60 teletherapy units	2
HDR Ir192 brachytherapy sources	2
MDR Cs137 brachytherapy sources	1
I125 brachytherapy sources	1
Radiotherapy simulators	3
X-ray diagnostic units	91
Radiographic units	101
Fluoroscopic units	4
Computer tomographic units	59
Mammography units	105
Angiography systems	17
Bone densitometer units	92
Mobile radiographic unit	57
Mobile fluoroscopic unit	31
Orthopantomograph unit	66
Dental radiodiagnostic units	53
γ camera system	56
PET system	1
β - counters	9
γ - counters	73
Irradiator for sterilization of medical products	1
Industrial applications (sources, X, ...)	449
Industrial radiography Ir192 sources	36
Total	1319

Table 1: Inspections in radiation systems during 2008

1. Quality audit protocols for radiotherapy laboratories

Radiotherapy quality control (QC) and dosimetry protocols were developed and distributed for evaluation to the relevant stakeholders (oncology and radiotherapy association, medical physicist association). The protocols refer to the QC tests and the absolute or relevant dosimetry measurements in medical radiotherapy linear accelerators, teletherapy Co60 units, X-ray simulators and brachytherapy remote afterloading systems. The protocols determined the methods, check points, acceptability criteria and acceptance limits of performance, as well as the frequency of the QC tests and the staff responsibilities.

Other activities

2. New database for radioisotopes and radiopharmaceuticals

A new database for radioisotopes and radiopharmaceuticals was designed and introduced. The new database ensures the continuous monitoring of isotopes distribution and transport on a daily, weekly, monthly and yearly basis, as well as the radiation protection monitoring of workers in transport companies and laboratories.

3. Radioactive material transport regulations

GAEC's personnel was highly involved in the education and training programme of "Dangerous Good – Radioactive Transport Advisors", in radiation protection, safety and security issues. The relevant training seminars were organized and ran by the Greek Ministry of Transport, while GAEC's personnel participated to the relevant examination committees. Furthermore, the Greek transport regulation was amended so that GAEC participates to the "Joined Transport Inspection Groups" of the Ministry of Transport for the inspection of radioactive material transport. This amendment is included in the Law No 3710/08 (Official Gazette No. 216/A/23-10-2008).

Future actions

At this stage, the priorities for improvement and development in the field of licensing and inspections are:

- improvement and extent of the unannounced inspections in radiation laboratories
- minimization of the request response time
- digitalization of the archives
- development of new scientific activities in new technologies and practices
- accreditation according to the terms of ISO 17020 standard
- issuing of informative material for radiation protection of workers in the fields of interventional radiology and computer tomography.

GAEC ensures the individual monitoring of the workers occupationally exposed to ionising radiation in the country. Aim of the individual monitoring is the evaluation of the equivalent dose and the effective dose. The results of the measurements are useful for the reduction of radiation doses to the monitored workers, for the improvement of the practices and the methods used at different sectors, and finally for proving the compliance with the radiation protection system. Moreover, GAEC keeps the National Dose Registry and provides all the relevant data for medical and juristic reasons to the radiation protection officers and the occupationally exposed workers.

During 2008:

- 122.662 dosimeters were distributed; an increase of 6% compared to 2007
- the lowest percentage of the non-returned dosimeters was achieved (2, 5%) which shows that the monitored workers are continuously motivated for improving their individual monitoring programme
- a very small amount of complaints was received, since problems related to the issuing of invoices and packaging, were encountered.

Results from the statistical analysis of the measurements during 2008

For the whole body dosimeters:

- the mean annual dose was 0, 45 mSv which is stable for the last 3 years
- an increase of the mean annual dose is observed in interventional cardiology and radiology sector as well as in the industrial applications of radiation
- a decrease of the mean annual dose is observed in the categories of nuclear medicine, radiotherapy and education.

For the extremities dosimeters (wrist and ring):

- at the interventional cardiology and radiology category an increase of the mean annual dose is observed (~100%), which can be attributed to bad practices of the monitored workers
- in nuclear medicine the doses recorded from the wrist dosimeters is stable, whereas a reduction of 57% is observed in the dose recorded from the ring dosimeters
- in the sector of the production and distribution of radiopharmaceuticals the doses from the extremity dosimeters are stable.

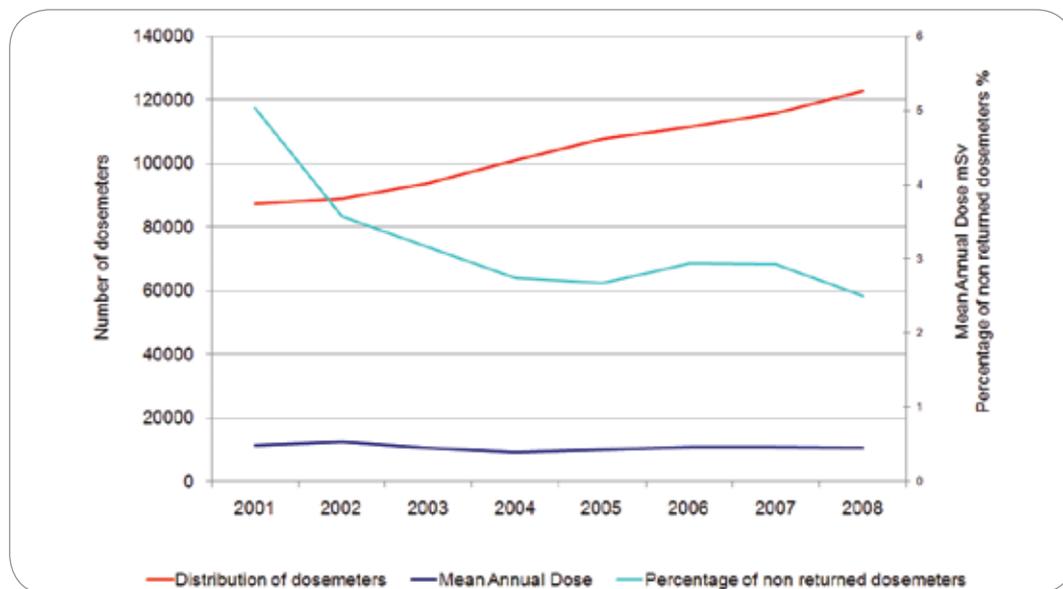


Diagram 2: Progress in time of the mean annual dose, percentage of the non-returned dosimeters and the number of the distributed dosimeters

Other activities

1. Improvements in 2008

- Introduction of the MTS-N material for wrist dosimeters; the material is also used in whole body dosimeters. Calibration and type testing of the new wrist dosimeters was performed.
- Introduction of the new automatic dosimeter reader (Re-2000) to the QA/QC programme.
- Quality control and type testing following the terms of the new standard IEC 61066.
- Calculation of uncertainties following the terms of the new standard IEC/TR 62461.

2. Customer survey

GAEC addressed a "Customer Satisfaction Questionnaire" (January 2008) to dosimeters users in order to evaluate the dosimetry services provided and in particular the QA system applied. The total number of the mailed questionnaires was 1200. The questionnaire included on 11 questions, 9 of which were multiple choice questions. At the multiple choice questions the participants were asked to express their degree of satisfaction following the 5-point Likert-type scale from 1 to 5, where the number 1 corresponds to the expression "very dissatisfied", number 2 "somewhat dissatisfied", number 3 "neither satisfied nor dissatisfied", number 4 "satisfied" and number 5 "very satisfied". The percentage of return of the completed questionnaires was 42% (~500 questionnaires). The analysis of the questionnaires showed the following:

- the degree of customer satisfaction is high especially at the parameters "contact with the laboratory" (information, willingness, kindness), "time" (dosimeter mailing, issued results, handling requests) and the "dosimeter new packaging"



- the 14% of the comments are related to the requests regarding training of the monitored workers

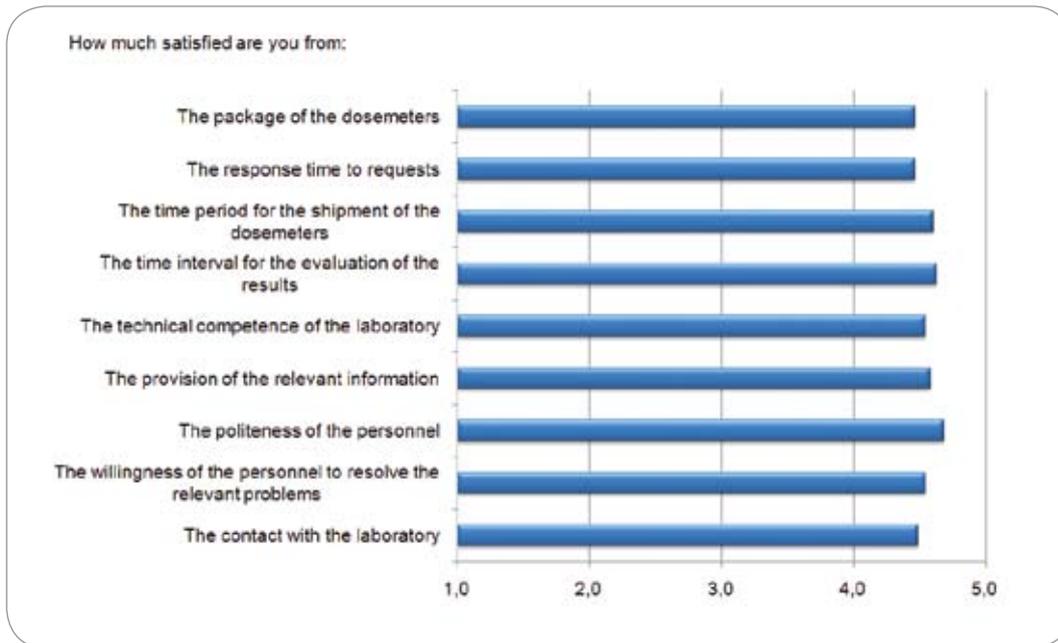


Diagram 3: Questions and answers

- the small number of complaints expressed is mainly related to the time of dosimeter shipment from GAEC to the laboratories, problems related to the non-delivery of the envelopes by mail, claims for receiving more often clips for wearing the dosimeters and finally a lot of complaints related to the invoices format. The complaints will be investigated for further improvement.

3. Participation in EURADOS intercomparison for the whole body dosimeters

The dosimetry department took part at the intercomparison exercise that was organized by the European network EURADOS (Working Group 2) and it concerned whole body dosimeters in photon beams for the evaluation of Hp(10) and Hp(0.07). 26 dosimeters were used for the intercomparison exercise. The results are shown in the diagrams 4 and 5 using the so called "trumpet curves" according the EUR 14852 technical recommendations. The vertical axis shows the ratio of the measured value to the reference one given by the secondary standard laboratory where the dosimeters were irradiated.

The results of the intercomparison are considered satisfactory, since in all cases the ratio of the measured to the reference value is within the acceptable limits. The results that have 30% deviation from the reference value are observed in N-60 beam type and 60° angle irradiation, which is expected, as TLDs appear to have over-response at the specific energies.



In addition, the energy dependence algorithm cannot be implemented correctly at the irradiation at large angles and in mixed fields. Regarding the results of the Hp(0.07) values, there is a systematic underestimation of the dose, due to the change of the calibration process from S-Cs to N-80 according to the standard IEC 61066.

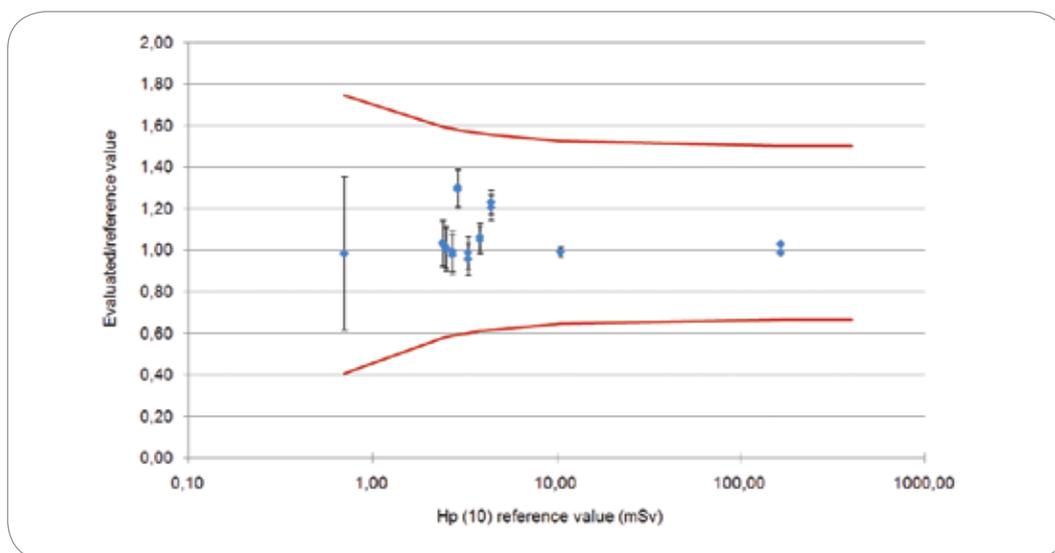


Diagram 4: Results of the intercomparison for Hp(10) based to trumpet curves ($H_0=0.17$ mSv)

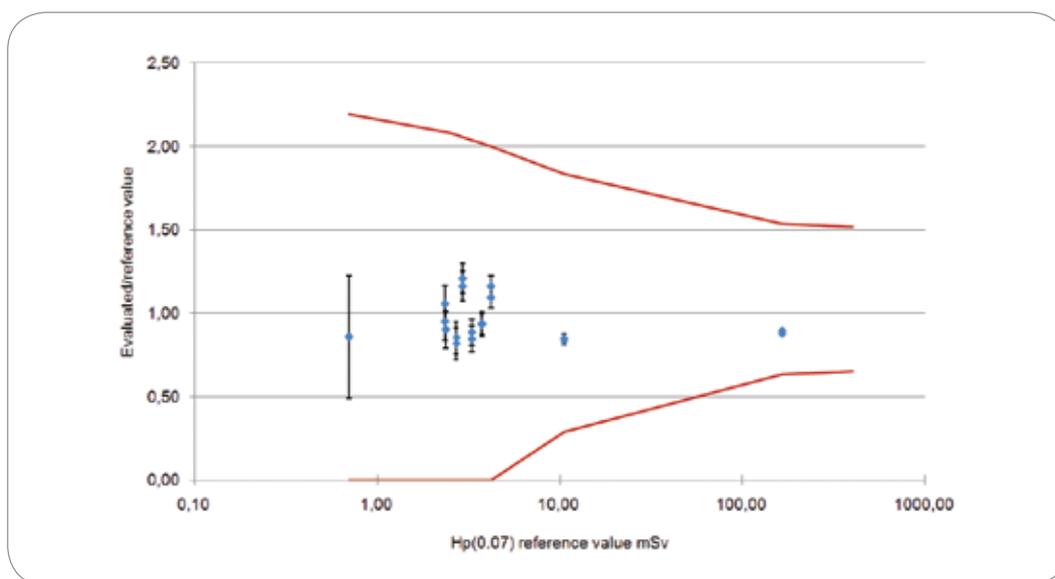


Diagram 5: Results of the intercomparison for Hp(0.07) based to trumpet curves ($H_0= 4.2$ mSv)



At this stage, the priorities for improvement and development in the field of individual monitoring are:

- use of a bar code reader for the dosimeters' order confirmation before dispatching them
- use of microcubes and powder consisted of TLD 700 material, for the quality audit of radiotherapy units. Construction of appropriate phantoms
- corrective actions for the use of finger dosimeters in beta radiation beams. Use of new dosimeter
- continuation of the ORAMED research project. It involves measurements and simulations for the estimation of doses at extremities and eyes of the staff involved in interventional procedures. The results should be compared and analyzed.

Future actions

GAEC is monitoring the radioactivity levels throughout Greece, activates the national emergency system in case of increased levels of radioactivity following a radiological or nuclear accident and keeps the national database. The environmental radioactivity monitoring programme is based on the operation of the telemetric environmental radioactivity monitoring network, as well on the the performance of laboratory measurements in soil samples, food, drinking water samples, air filters etc.

The telemetric environmental radioactivity monitoring network consists of 24 gamma air monitoring stations, 4 river water monitoring stations in Northern Greece and 3 aerosol monitoring stations. These stations collect data for natural alpha radiation, beta and gamma radiation (^{137}Cs , ^{131}I), which are stored every ten minutes in a database connected with GAEC website, where the mean daily values are published, as well as with the European Radiological Data Exchange Platform (EURDEP). A project of upgrading the water sampling systems located at rivers is in progress.

**Telemetric
environmental
radioactivity
monitoring
network**

The laboratory measurements are performed:

- in soil samples, food, drinking water samples, air filters through alpha and gamma spectroscopic analysis and total α/β spectroscopic analysis
- in imported products and materials belonging to the Green Catalogue of Waste
- in places with increased levels of natural radioactivity (radon, phosphogypsum).

In 2008, α spectroscopic analyses were performed in 194 samples in order to detect mainly uranium and its isotopes, Ra-226, plutonium, americium, curium, thorium and polonium. The total α/β spectroscopic analyses were applied in 97 samples.

**Laboratory
measurements**

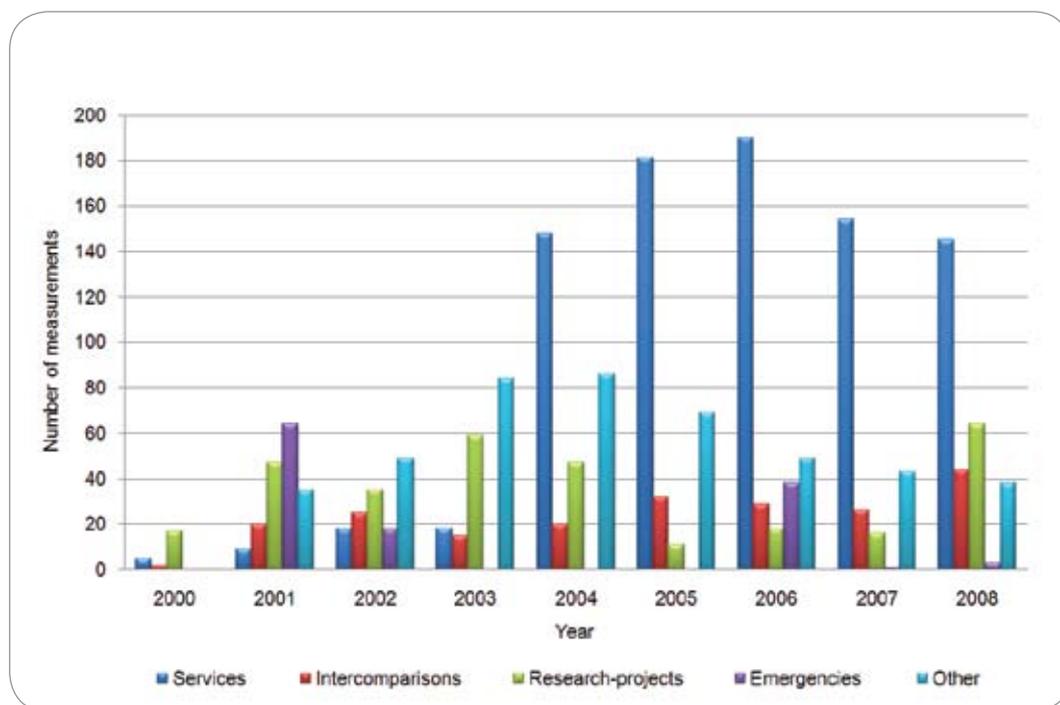


Diagram 6: a-spectroscopy measurements during the years 2000-2008

Analyses were performed for the detection of:

- uranium and total α/β radiation in water samples coming from water towers/tanks, lakes and drills of EYDAP (Athens Water Supply and Sewerage Company) and in water samples from Axios, Nestos, Strymon and Ardas rivers
- uranium and Radium-226 in surface and underground water coming from the phosphogypsum disposal area of a phosphoric fertilizer industry (Kavala)
- uranium and Radium-226 in water samples coming from springs in order to characterize them as therapeutic springs
- uranium and total α/β radiation in drinking water
- uranium in water samples from the island of Nisyros and Ikaria
- uranium and thorium in engines of the Greek aviation industry
- uranium in smear test and in cooling water coming from NCSR "Demokritos" research reactor
- uranium in hair and urine samples from monks living in a monastery in Northern Greece
- uranium in water samples coming from the Amvrakikos Gulf (IAEA, RER/7/003 "Marine Environmental Assessment of the Mediterranean Sea")
- Th, U, Pu, Am, Cm, Ra-226 and Po-210 in urine and feces samples for internal dosimetry



intercomparison reasons (Procorad)

- uranium and Radium-226 in potable water for EC intercomparison reasons.

The γ -spectroscopic analysis (germanium detectors) was used for performing 386 measurements during 2008, which are the following:

- measurements of artificial radionuclides in water samples coming from water towers/tanks, lakes and drills of EYDAP
- measurements in Naturally Occurring Radioactivity Materials (NORM)
- air filter measurements
- measurements in building materials and building material components
- measurements in exported and imported food
- measurements in environmental samples coming from the island of Ikaria
- measurements in materials with increased natural radioactivity detected in the entrance of recycling industries
- measurements of leakage from radioactive sources.

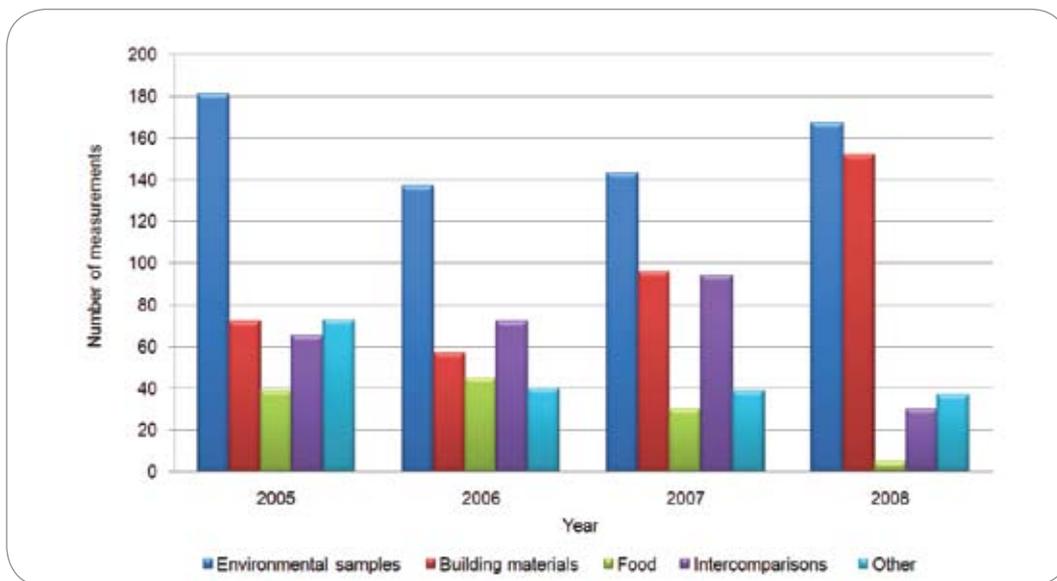


Diagram 7: γ -spectroscopy measurements during the years 2005-2008

Radon measurements

In 2008 more than 420 requests were submitted to GAEC for radon measurements in dwellings and workplaces. 340 measurements were performed and additionally 80 dwellings and 6 workplaces were inspected.

A special project was implemented in cooperation with the island of Ikaria for performing radon measurements in schools. The high – level concentration in a school located in the area of Rahes was investigated using passive detectors, as well as by in situ inspections. After the adoption of GAEC's guidelines in June 2008, the radon concentration has been reduced by more than 50%.

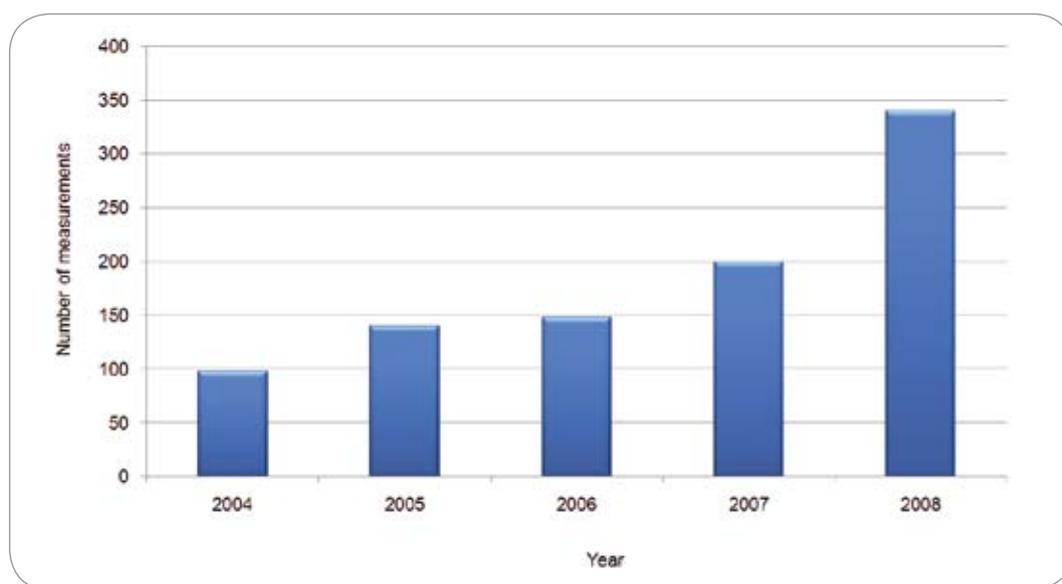


Diagram 8: Radon measurements during the years 2004-2008

Whole body measurements

In the context of radiation protection monitoring of GAEC's personnel involved in emergency plans, 17 members were submitted to whole body measurements.

Furthermore, radiation protection advice and equipment was provided to four journalists traveling to Kazakhstan. After their return to Greece, they were also submitted to whole body measurements.

In situ inspections

In 2008 25 in situ inspections were performed, five of them were total γ radiation measurements in dwellings and the other twenty concerned imported scrap metal measurements necessary for issuing radioactivity certificate. The number of in situ measurements in scrap metals in Northern Greece was 35. The total number of radioactivity certificates for imported scrap metals issued during 2008 by GAEC was 455. The fixed radiation detection systems' alarms were activated twenty times during 2008; 14 of them concerned portals installed in steel factories in the area of Athens and the other 6 in steel factories of northern Greece. The shipments that activated the alarms came from abroad, as well as from the local market. Isotopes, such as Ra-226, Th232 and Eu-152 were detected in pipes, airplane and helicopter motors etc. These alarms were reported to the IAEA illicit trafficking database.



For the prevention of illicit trafficking of radioactive materials, the country's entrance points have been equipped with radioactivity detectors. In detail, fixed systems of radioactivity detection are installed at six customs offices and portable radioactivity detectors have been distributed to 26 custom offices. GAEC monitors all radiological incidents in cooperation with customs authorities; in case of emergency activates its response plans and updates respectively the IAEA Illicit Trafficking Database. Since November 2008, according to an official agreement with the Ministry of Economy, GAEC has undertaken the maintenance and calibration of the radiation detection systems located at customs offices.

Combat against illicit trafficking of radioactive materials

1. Intercomparisons

a-spectroscopy measurements

- Procorad (Association pour la Promotion du Controle de Qualite des Analyses de Biologie Medicinale en Radiotoxicologie): Detection of Th, U, Pu, Am, Cm, Ra-226 and Po-210 isotopes in urine and faeces samples.
- E.U. Institute for Reference Materials and Measurements. Detection of uranium isotopes and Ra-226 in potable water.

γ – spectroscopy measurements

- Procorad (Assosiation pour la Promotion du Controle de Qualite des Analyses de Biologie Medicinale en Radiotoxicologie): Detection of isotopes in urine samples.
- BfS - Bundesamt für Strahlenschutz, "Bestimmung des Radionuklidehaltes im wasser": Results are acceptable according to criteria BfS.
- IAEA-CU-2008-02 "Proficiency test on determination of radionuclides in air filters": Results are acceptable according to the established criteria.
- National Physical Laboratory "Environmental radioactivity Proficiency test exercise 2008": Results are acceptable according to NPL criteria. GAEC's laboratory was one of the 12 laboratories (out of 78 in total) whose results were 100% acceptable.

Other activities

2. Equipment upgrade

In 2008 GAEC's equipment was upgraded with new detectors suitable for radon measurements in air (electrets) and in water. Moreover, a microwave digestion system was acquired in order to be used for sample preparation.

At this stage, the priorities for improvement and development in the field of environmental radioactivity monitoring are:

- accreditation of a-spectroscopy measurements according to the terms of ISO 17025 standard
- development of measurement method for α and β radiation using low background liquid scintillation counter (Quantulus)
- installation of microwave digestion system
- development of a radon measurement method in water using electrets.

Future actions

GAEC, as the competent authority for responding to radiological or nuclear emergencies, participates in the General Plan for Civil Protection "Xenokratris", as well as in the National Emergency Plan for Nuclear, Radiological, Biological and Chemical (NRBC) threats. Furthermore, GAEC is connected with the early notification systems ECURIE and ENATOM of the European Commission and the IAEA respectively.

An internal emergency plan has been designed and implemented in GAEC, according to which in cases of radiological emergencies, special teams for intervention and support are formed by GAEC's specialized staff. GAEC's personnel participate in European Commission working groups entitled to draft a European emergency plan.

At national level, during 2008 GAEC performed radiological inspection in the area of Kimi (Evoia), after the crash of an AH-64A Apache helicopter of Army aviation. The in situ inspection and the results of the measurements (γ radiation dose rate, total β radiation, γ -spectroscopy) were completely normal. No artificial radioisotopes or hot spots were detected.

At European level, during 2008 the alarm of ECURIE system was activated twice and for first time in its history. The first time, on June 4th, the alarm concerned a technical problem at Krsko nuclear power plant (Slovenia). The second time, on 29th August, the alarm was related to a release of radioactive iodine at Fleurus Institute of Radioactive Elements (Belgium). None of these events had any radiological implication for Greece.

Aiming at personnel training, as well as at the enhancement of communication channels and cooperation networks, GAEC participates in international exercises, such as the ConvEx-3 that was organized by the IAEA on 9 and 10 of July 2008. According to the exercise scenario, the participating countries should respond to an emergency situation caused by an accident at Laguna Verde nuclear plant (Mexico). The exercise aimed at testing and evaluating the response system applied by the 75 participating countries and the 10 international organizations in cases of radiological accidents, as well as the international emergency response system.

The Ionising Radiation Calibration Laboratory (IRCL) is a secondary standard dosimetry laboratory that has developed and maintains the national standards of Gy, Sv, Cb/kg (for γ , X and β radiation). IRCL provides calibrations in terms of Air Kerma, Absorbed Dose in water, Personnel Equivalent Dose Hp(10) and Hp(0,07), Ambient Dose Equivalent H*(10) in the fields of radiotherapy, diagnostic radiology and radiation protection. IRCL is the national metrology laboratory and has an official partnership with the National Metrology Institute.

In 2008:

- IRCL provided calibration services in radiotherapy, brachytherapy, diagnostic radiology, radiation protection, individual monitoring. In total, 287 certificates were issued

Fields	Number of instruments
Radiotherapy ionization chambers -electrometers	9
Brachytherapy ionization chambers – well type (Ir192 & Cs137)	4
Diagnostic radiology dosimeters	25
Non invasive kVp meters, timers and multimeters used in diagnostic radiology	19
KAP meters – calibrations at IRCL or on site	3
Survey meters	74
TLD irradiations	1650
Pencil type dosimeters – APD	1250
Fixed radioactivity detection systems (in situ inspections)	4

Table 2: Number of calibrations

- ICRL has participated in two IAEA intercomparison projects: “IAEA TLD audit in radiotherapy” and “IAEA TLD audit in radiation protection”. The results of EURAMET 738 intercomparison in the field of individual dose monitoring were also announced. The results of all projects were satisfactory as presented in the following table:

Organization	Date	Field	Results	Limits
EA	10/2000	Personal Dosimetry	Not announced	-
IAEA	3/2000	Radiation Protection	0,97	0,965-1,035
IAEA	5/2000	Radiotherapy	-0,6%	±3,5%
IAEA	3/2000	Radiotherapy	Nk: 0,992	0,985-1,015
			Nw: 0,998	0,985-1,015
EURAMET	6/2001	Mammography	-0,2%	±1%
EA	1/2001	Radiation Protection	En= 0,06(+)	±En+ <1
			En= 0,49(+)	
			En= 0,91(+)	
STUK-IAEA	5/2001	Diagnostic Radiology	RQR: -2.1%	±3,0 %
			RQM: 0.9%	±3,0 %
IAEA	6/2001	Radiotherapy	-1.2%	±3,5%
IAEA	7/2002	Radiotherapy	-1.2%	±3,5%
IAEA	1/2003	Radiation Protection	0,99	0,95-1,05
EURAMET	2003	Radiation Protection project 738	+0.5%	±5%
IAEA	10/2004	Radiotherapy	Co60 : 0,3 % Linac : 0,0 %	±3,5%
IAEA	06/2005	Radiotherapy	Co60 : 1,3 % Linac : 0,3 %	±3,5%
EURAMET	4/2005	Radiotherapy Project 813, Hp(10)	≅ 1% from diagram	--
IAEA	05/2006	Radiotherapy	Co60 : 0.3 %	±3,5%
EURAMET	4/2006	Radiotherapy, project 736	Not available yet	--
IAEA	05/2007	Radiotherapy	Co60 : -1.5 %	±3,5%
IAEA	05/2007	Radiation Protection	Cs137 : 0.99	0.93-1.07
IAEA	05/2008	Radiotherapy	Co60 : -0.1 %	±3,5%
IAEA	09/2008	Radiation Protection	0.99 και 0.94	0.93-1.07

Table 3: Participation in intercomparisons

- during the quality control and quality assurance program of the IRCL, more than 500 check points were measured and compared to the baselines. Only 8 deviations were recorded, which were corrected and followed up.

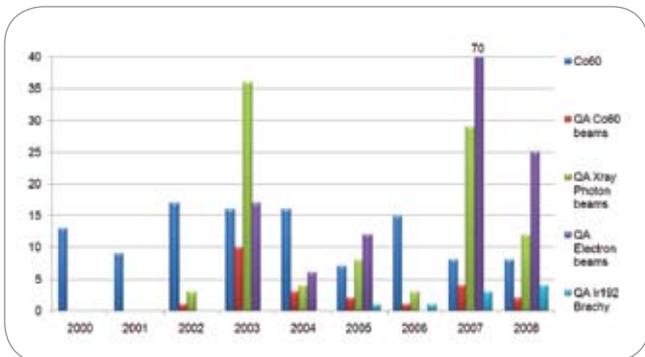


Diagram 9: Radiation therapy

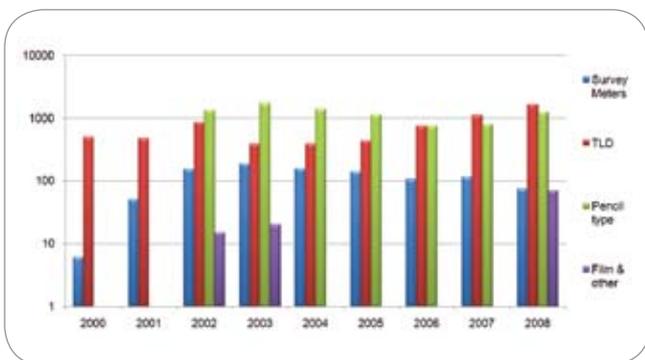


Diagram 10: Radiation protection

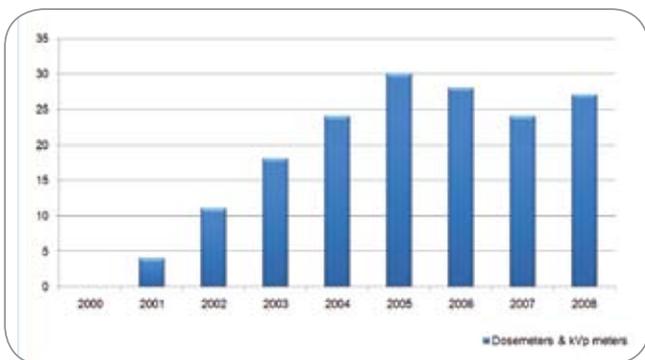


Diagram 11: Diagnostic radiology

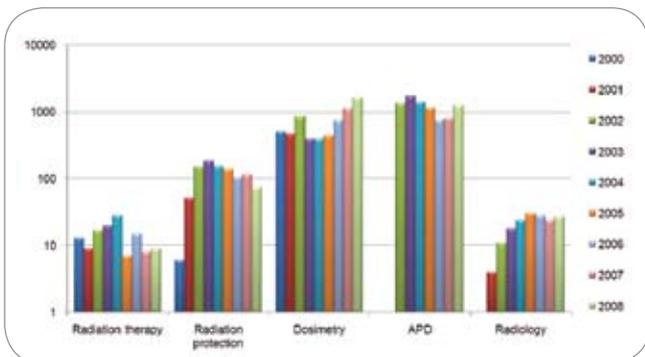


Diagram 12: Calibrations during the years 2000-2008

Other activities

1. Action plan for national laboratory of nuclear metrology establishment

The Hellenic Institute of Metrology (EIM), the Greek competent authority in metrology issues, in cooperation with GAEC, implemented a project concerning the establishment of the national nuclear metrology laboratory. The project was under the «Competitiveness and Entrepreneurship» (EPAN) program of the Greek Ministry of Development. The project budget was € 380.000 and covered the development of new IRCL activities and equipment upgrade. In particular, a brachytherapy dosimeter (electrometer and well type ionization chamber), an extrapolation counter for radiation β , β emission sources, an XRF system, a liquid scintillation counter and a TLD reader were purchased. The project was finalized in 2008 with fund absorption rate at 66%. The project failed to purchase a diagnostic radiology X-ray system 150 kVp and a dosimeter chamber for radiation protection level applications.

2. EURADOS intercomparison programme

The European Radiation Dosimetry Group (EURADOS) organized an intercomparison exercise for whole body dosimeters. Among the participating European laboratories, IRCL was chosen as the standard irradiation laboratory. During summer 2008, 1240 personal dosimeters from 62 European individual monitoring systems were irradiated at 14 beam types at various doses and irradiation conditions, while 62 irradiation certificates were issued.

3. Dosimetry quality audit in radiotherapy laboratories

The first cycle of the dosimetry audit at all Greek radiotherapy centers was completed. The audit was performed at high energy photon beams from linear accelerators and Co60 teletherapy systems. A relevant scientific paper has been published at "Radiotherapy and Oncology" journal.

4. Training of fellows

Two IAEA fellowships were conducted at ICRL, which concerned the 3 months on-the-job training of 2 Kenyan colleagues on metrology and accreditation issues. (December 2007 – March 2008). Furthermore, several Cypriot colleagues were participated in seminars relevant to radiation measurement, standards and calibrations.

Future actions

At this stage, the priorities for improvement and development in the field of calibration of ionising radiation instruments are:

- development and establishment of new fields (beta radiation beams, brachytherapy, etc)
- replacement of the cobalt source
- organization of an intercomparison exercise on diagnostic radiology
- development of new X - ray beams in radiation protection and mammography
- accreditation for in situ calibrations under the terms of ISO 17025 standard.

Non ionising radiation

Non-ionising radiation is the electromagnetic radiation of lower energy, which is unable to cause biological effect, as ionization result. However, it is capable to affect the cells electrically, chemically and thermally, either with beneficial or harmful consequences.

The static electric and magnetic fields, as those encountered in the natural environment, the low frequency electric and magnetic fields arising in the vicinity of electric power installations, the radiowaves and the microwave frequency fields emitted by antenna stations (e.g. radio and television antennas, mobile phones base stations, radar systems) as well as the infrared, the visible and the ultraviolet radiation are characterized as non ionising radiation. The low frequency electric and magnetic fields interact with the human body by inducing fields and currents inside it, while the radiowaves and microwaves by heating the cells and tissues.

According to the current national legislation, non ionising radiation systems audited by GAEC are:

- all types of lines and substations of the national power grid (e.g. power lines, high voltage substations), industrial and domestic electrical installations, machines & devices and other low frequency electric and magnetic field emission systems
- radio and television antennas
- mobile phone base stations, LMDS base stations and other antenna stations providing telecommunication services
- radar systems and satellite earth stations.

Electromagnetic field measurements

GAEC is responsible for the protection of the general public and the environment from artificially produced non-ionising radiation (electromagnetic fields) and provides relevant information to everyone interested. GAEC's control activities include high frequency electromagnetic fields as well as low frequency electric and magnetic fields.

GAEC participates in telecommunications base stations licensing procedure, by examining the submitted technical electromagnetic emissions studies and the environmental studies. Furthermore, performs in situ inspections and measurements in places close to base stations in order to certify their compliance with the general public exposure safety limits. Specifically:

In 2008, 2996 new electromagnetic emissions studies were submitted to GAEC. After their examination 2584 expert opinion certificates were issued. The following table presents the studies and the certificates allocation per company/provider.

High frequency electromagnetic fields

Electromagnetic emission studies issuing of expert opinion certificates

Company / Provider	Submitted studies	Certificates
COSMOTE	858	1050
CRAIG	5	5
FORTHNET	4	4
EDISY	45	45
OTE	331	143
ANTENNA	6	6
TIM	927	725
VODAFONE	796	593
RADIO/TV/RADAR	21	10
UNIMAST	3	3
Total	2996	2584

Table 4: Number of electromagnetic emission studies and expert opinion certificates per company/provider

Environmental impact studies

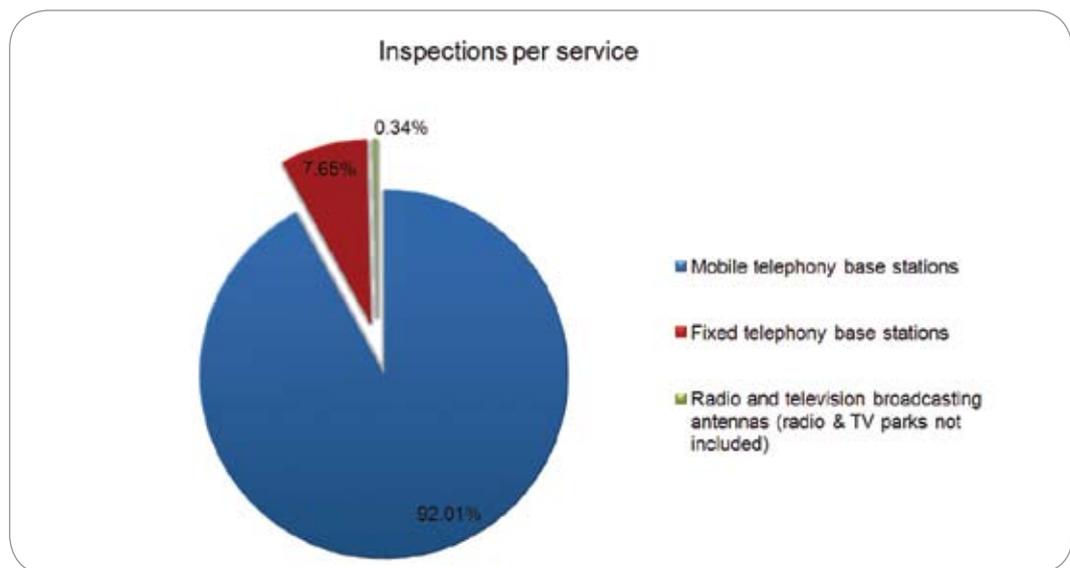
In 2008 the Regions' General Secretariats submitted to GAEC 1159 environmental impact studies. GAEC approved 954, while 31 were characterized as insufficient.

In situ inspections and measurements

GAEC performs in situ inspections and measurements in emission systems, in order to certify their compliance with the general public exposure safety limits. Measurement requests are processed within a twenty working days period, starting from the payment date.

In 2008:

- the vast majority of high frequency measurements was performed in the vicinity of mobile phone base stations (92,01%)
- the ex officio inspections were almost the 57% of the total number of inspections performed close to antenna stations. As far as mobile phone base stations are concerned, GAEC is obliged to inspect ex officio, on a yearly basis at least the 20% of the licensed antennas in urban areas



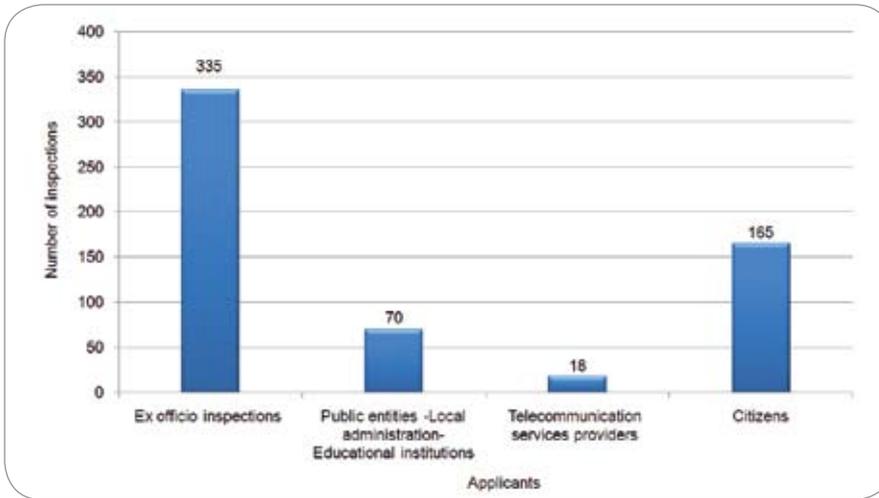
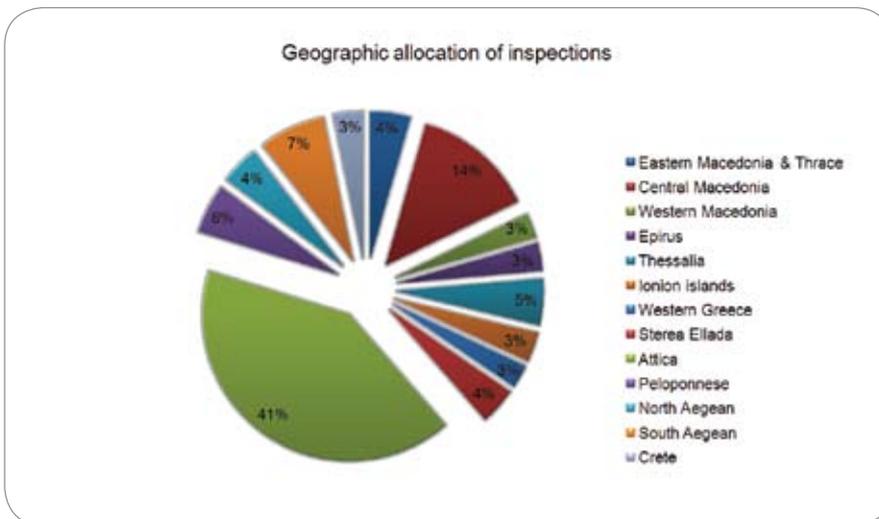


Diagram 13: Requests for inspections

- the 41,16% of measurements were performed close to antenna stations located in the Prefecture of Attica. Measurements have been performed in every Prefecture of the country. The total number of measurements does not include the radio and television antennas, located in antennas parks across the country, as well as radars
- GAEC's scientists performed inspections in antenna stations, following court orders.



In 2008, 60 measurements of extremely low frequency fields were performed, either on request or ex officio.

In total, in 2008, 296 response letters were sent to citizens, municipalities, police stations etc.

**Extremely Low
frequency
electric and
magnetic fields**

Other activities

1. Contribution to the completion of electromagnetic fields measurements' legislation framework

Following GAEC's proposal, a Joint Ministerial Order (Official Gazette 346/B/3-3-2008) defining the measurements techniques, in order to ensure the compliance of every kind of antenna station with exposure limits of the general public, was issued.

2. Equipment upgrade

Acquisition of measurement devices of personal exposure to extremely low and high frequency electromagnetic fields, which have been already used for evaluating workers' exposure to EMF's (e.g. physiatrists, hospitals' staff). These devices will contribute to the implementation of a large scale project aiming at the assessment of general publics' exposure to extremely low and high frequency electric and magnetic fields.

3. Authorization of technical staff to perform EMF measurements

GAEC, following the respective legislation framework, made arrangements, in order to be able to assign part of the in situ inspections to the technical staff of other entities by the end of 2009.

4. Contracts with companies/public entities for the performance of a large number of measurements

- High frequency electromagnetic field measurements in 22 antenna stations in the Prefecture of Kos.
- High frequency electromagnetic field measurements in antenna stations located at the Olympic Athletic Center of Athens (OAKA).
- High frequency electromagnetic field measurements in parking control systems used by the Athens Municipal Police.
- High and extremely low frequency electromagnetic field measurements in school facilities (in progress).
- Extremely low frequency electromagnetic field measurements in hybrid cars.

5. Participation in working groups

Participation in the International Advisory Committee of the International EMF Project of the World Health Organization, as well as in International Committee on Electromagnetic Safety of I.E.E.E. At national level, participation in two ELOT committees regarding the protection of people from exposure to electromagnetic fields and the maintenance and development of ELOT 1422 standard.



At this stage, the priorities for improvement and development in the field of electromagnetic fields inspections are:

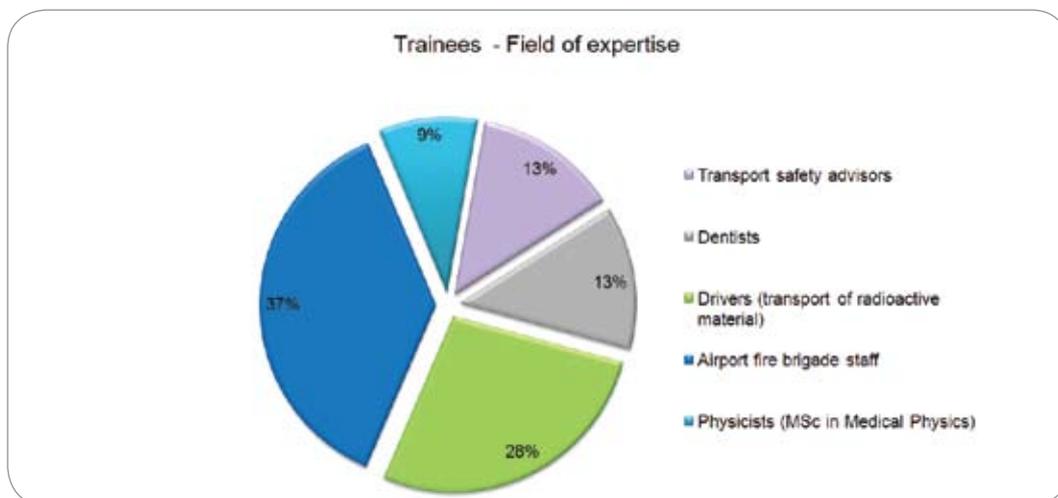
- completion of the authorization process of technical staff to perform EMF measurements
- national observatory for electromagnetic fields (national telemetric network for the measurement of EMF levels)
- organization of interlaboratory comparison measurements of high frequency electromagnetic fields
- further reduction of the time required for environmental impact studies examination
- equipment upgrade
- personnel number increase.

Future actions

The Greek Atomic Energy Commission provides education and training to radiation workers in the field of radiation protection. The educational activities are fully supported by the experienced scientific personnel and the state of the art technical infrastructure. In detail:

1. Provision of education and training courses to radiation workers in the fields of medical, industrial and research applications of ionising radiation, to people involved in emergency response plans, to customs offices and airports workers, where audits for illicit trafficking of radioactive sources are performed, as well as to workers in radioactive material transport. In 2008 were organized the following seminars:

- training seminar for personnel involved in radioactive material transport (January 8, March 7, 2008)
- training seminar for safety advisors in the safe transport of dangerous goods, class 7 (January 23, February 22, May 26, October 15 2008)
- training seminar for dentists on dental radiology and radiation protection (February 15, 2008)
- training seminar for fire workers involved in fire extinguishment after airplane accidents (March 3, April 7, 2008)
- training seminar for medical staff on interventional radiology and radiation protection (July 10, 2008).



2. Participation to the Inter-University Postgraduate Course in Medical-Radiation Physics.

GAEC operates the Hospital Physicists' post graduate School since 1960. Since 1994 the Hospital Physicists' Institute operates in a legislated cooperation with the Inter – University Postgraduate Course in Medical - Radiation Physics (IPCMRP) of the Universities of Athens, Ioannina, Thessalonica, Crete and Thrace and the NCSR "Demokritos", aiming at specialized training of Physicists in Medical - Radiation Physics. The Course duration is five semesters and is attended by about 10 to 15 physicists. The successful completion of all educational stages leads to a Master's Degree in Medical Radiation Physics.

3. As the European Regional Training Centre of the International Atomic Energy Agency (IAEA) in the field of radiation protection and safety of radiation sources:

- hosting of the Postgraduate Educational Course on Radiation Protection and the Safety of Radiation Sources, co-organized and co-funded by IAEA. The Course provides education and training to young scientists pursuing to acquire a sound basis in radiation protection and knowledge of related safety fundamentals in order to become, in the course of time, qualified experts in their countries. The third cycle of Postgraduate Educational Course on Radiation Protection and the Safety of Radiation Sources started on October 2007 and finished on March 2008. The Course was attended by 18 young scientists, lasted for 22 weeks and was conducted primarily in GAEC premises, as well as in collaborative research and educational centers
- organization of international seminars in specialized fields of radiation protection, as well as in radiation sources safety and nuclear security. In 2008 the «International Training Course on Data Networking, Remote Monitoring and Sustainability of Border Radiation Detection Equipment for Front Line Officers and Mobile Expert Support Teams» were organized (June 23 – 27, September 22 – 26). The objective of the seminar was the training of the participants in matters concerning the networking of the remote radiation detection systems with headquarters of relevant responsible authorities and the maintenance and calibration of the radiation detection equipment. The seminar that took place in the premises of GAEC, in collaboration with the IAEA and the funding from the European Union, was attended by 36 customs officers and experts from 10 European and African countries.

4. Offers on the job training to scientists chosen by IAEA, in the fields of radiation protection, regulations, personal dosimetry, ionising radiation calibration and environmental radioactivity control. In 2008 2 scientists were trained for a period of three months in radiation protection calibration and accreditation matters.

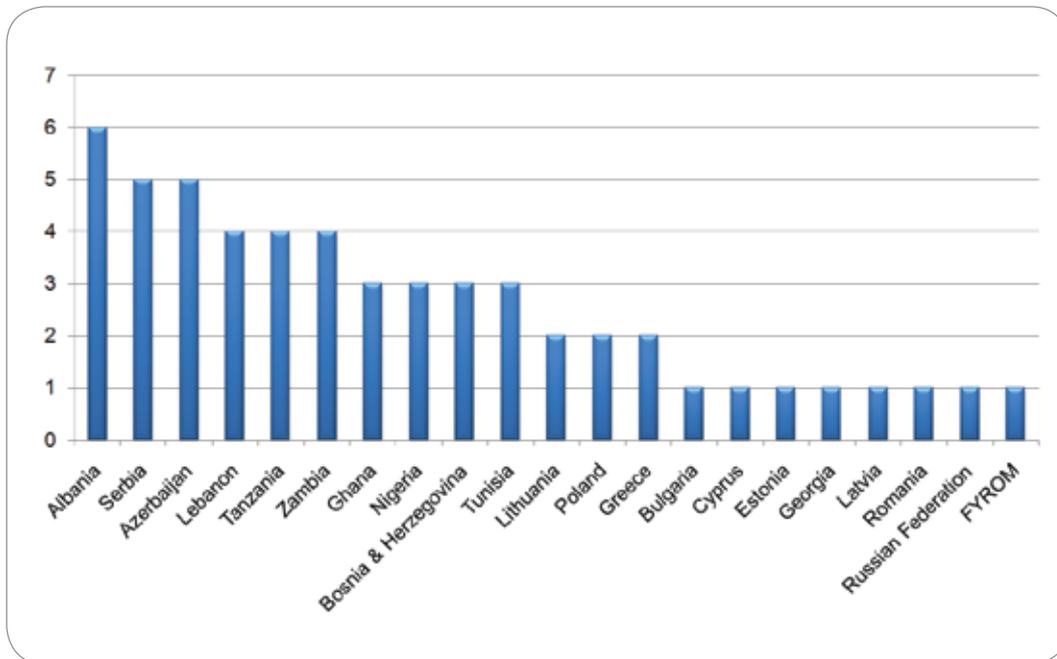


Diagram 14: Trainees' countries of origin

1. Education and Training Appraisal Mission of IAEA, November 17-21, 2008 (EduTA)

GAEC as Training Centre of the International Atomic Energy Agency was evaluated in November 2008 by an expert team of IAEA regarding issues of 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 program in radiation protection, the accredited training courses, the facilities used for educational and training programmes, the available human resource and the national lecturers.

The report of the appraisal team was positive, which underlines the high level of scientific sufficiency and the experience of GAEC in the rendering of education and training services in the field of radiation protection. As a result, GAEC fulfills the requirements for the signing of a long-term educational agreement that will enable GAEC to operate as international regional centre for education and training.

2. On the job training of students from the University of Piraeus

Completion of the 4-months on the job training of seven students from the University of Piraeus that has been started in the late 2007 and concerned all departments of GAEC.

Other activities



Future actions **At this stage, the priorities for improvement and development in the field of education are:**

- implementation of the action plan
- training of all individuals with specialisation in ionising radiation
- update of the training syllabus
- development of an e-learning platform
- strengthening of the safety culture.

GAEC participates in research programmes, taking advantage of European financial sources (e.g. 7th Framework Programme) and opportunities of cooperation within European scientific networks. The current research activities focus on radiation protection of medical staff and on the development of state of the art equipment for the detection of radioactivity.

Research programmes

- **Continuation of the programme “Establishment of European Technical Recommendations for Monitoring Individuals Exposed to External Radiation” (EU-Trimer), European Commission, DG-TREN**

The EU -Trimer programme began on April 2007. Its outcome will be a textbook including European technical recommendations about occupationally exposed monitoring. Furthermore, this textbook will include criteria for dosimeters and individual monitoring systems, aiming at the harmonization of individual monitoring methodologies and the establishment of European and international standards.

- **Completion of the programme “Strengthening the Capacity of the Radiation Protection and Nuclear Safety Regulatory Authority of Cyprus”, 2007-2008**

The programme “Strengthening the Capacity of the Radiation Protection and Nuclear Safety Regulatory Authority of Cyprus” began on September 2007 and finished on December 2008. Goal of the programme was the improvement of the efficiency of the current Radiation Protection, Nuclear Safety and Radioactive Waste Management system in Cyprus and its harmonization with EURATOM and IAEA standards. The programme was implemented in three stages: the first one was focused on the radiation protection and nuclear safety regulatory framework, including inspections and licensing procedures. The second one was related to technical aspects of radiation protection system, such as the medical applications, the environmental radioactivity, the emergency situations, the waste management, the radiological safety and the illicit trafficking of radioactive materials. The third stage concerned educational activities recommended during the previous stages and the drafting of equipment specifications. In total seven training seminars were organized. The four of them were about ionising radiation medical applications, while the other three about the illicit trafficking combat, the response to radiological accidents and dispersion codes (Hysplit, Hotspot).

- **Beginning of the programme “Optimization of Radiation Protection of Medical Staff” (ORAMED), European Commission, FP7 - EURATOM (<http://www.ored-fp7.eu>)**

The European research programme “Optimization of Radiation Protection of Medical Staff” (ORAMED), FP7 – EURATOM, EC (2008-2011) began on February 2008. GAEC participates to this project among 12 European partners, specialized in radiation protection and dosimetry fields. The programme aims at developing a methodology for measuring eye lens dose and designing a prototype eye dosimeter. It includes five work packages and entails data collection of extremity doses of personnel involved in interventional radiology and nuclear medicine examinations, emphasizing on eye lens doses in combination with

respective radiation protection measures. A number of simulations will be performed to study the main parameters that influence the extremity and eye lens doses, as well as the effectiveness of the radiation protection measures. Moreover, one work package is dedicated to the use of APDs at real conditions in interventional radiology departments and to design a prototype without the current response problems.

- **Beginning of the programme “Cooperation across Europe for Cd(Zn)Te based security” (COCAE), European Commission, FP7 – Security**

The European research programme “Cooperation across Europe for Cd(Zn)Te based security instruments” began on October 2008. GAEC participates to this programme among nine European partners. The project aims at the development of a portable spectroscopic system based on Cd(Zn)Te crystals. This system will be capable of performing more efficient spectroscopic analyses in comparison with NaI detectors, providing information about the spatial distribution of radioactive contamination. The new portable detector will be extremely useful during the secondary inspection performed in imported freights at customs, given the fact that it will provide useful information about the source type, the activity and the shielding.

- **Continuation of the IAEA Coordinated Research Project (CRP) for the application of the «International Code of Practice on Dosimetry» in Diagnostic Radiology (SSDL’s and hospitals)**

IAEA issued in 2007 a protocol as Technical Report (TRS) entitled «International Code of Practice on Dosimetry in Diagnostic Radiology TRS 457» (CoP). The CoP describes the standards and the methods that should be followed in diagnostic radiology dosimetry, including guidelines, forms and practical examples. The CoP concerns the instruments calibrations in SSDL’s as well as the patients’ dose measurements in hospitals. The CoP refers to all procedures/practices applied in diagnostic radiology (e.g. radiography, fluoroscopy, mammography, computed tomography, interventional radiology). Before issuing the CoP, IAEA launched a three-year research programme (2006-2008) aiming at investigating the compatibility of CoP with the “International metrology - dosimetry system”, eventual problems during its application in metrology laboratories, as well as eventual problems in clinical practice. Eleven countries participate in the CRP among which Greece.

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G. Filippopoulos and E. Karabetsos, “A quick and easy method for checking compliance of multi-frequency magnetic fields with ICNIRP’s guidelines”, *Health Physics*, Volume 95, Number 2, August 2008, p. 245-254.

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E. Carinou, L. Donadille, M. Ginjaume, J. Jankowski, A. Rimpler, M. Sans Merce, F. Vanhavere, M. Denoziere, J. Daures, J. M. Bordy, C. Itie, P. Covens "Intercomparison on measurements of the quantity personal dose equivalent, Hp(0.07), by extremity ring dosimeters in medical fields", *Radiation Measurements*, 43 (2008), p. 565-570.

L. Donadille, E. Carinou, M. Ginjaume, J. Jankowski, A. Rimpler, M. Sans Merce and F. Vanhavere, "Extremity dosimetry in medical application within Europe: An overview of doses and monitoring practices", 12th International Congress of the International Radiation Protection Association, Buenos Aires -Argentina, 19-24 October 2008.

M. Ginjaume, E. Carinou, L. Donadille, J. Jankowski, A. Rimpler, M. Sans Merce, F. Vanhavere, M. Denoziere, J. Daures, J.M. Bordy, C. Itie and P. Covens, "Intercomparison of extremity dosimeters in beta, photon and medical realistic fields", 12th International Congress of the International Radiation Protection Association, Buenos Aires -Argentina, 19-24 October 2008.

P. Tritakis, E. Papadomarkaki, S. Economides, E. Carinou, P. Askounis, C.Hourdakias, V. Kamenopoulou and P. Dimitriou, "Occupational exposure in Greek industrial radiography laboratories (2004-2007) and comparison of doses with other industrial applications", 7th International topical meeting on industrial radiation and radioisotope measurement application, Prague, Czech Republic, 22-27 June 2008, Book of Abstracts, p.72.

P. Dimitriou, C.Pafilis, S. Economides and V. Kamenopoulou, "Required qualifications and duties of the personnel involved in a Radiation Protection Programme", 2nd EUTERP Platform Workshop "Definitions, Qualifications and Requirements for Radiation Protection Experts, Radiation Protection Officers and Radiation Workers", Vilnius, Lithuania, 23-25 April 2008 (oral presentation).

S. Vogiatzi, E. Carinou, C. Potiriadis, C.J.Hourdakias, P. Dimitriou, V. Kamenopoulou, "Doses to sewage workers due to I-131 waste from therapeutic purposes", 11th European ALARA Network Workshop, Athens, Greece, 9-11 April 2008 (oral presentation).

**Conference
oral/poster
presentations**



V. Koukoulidou, C. Potiriadis, V. Kamenopoulou, "γ- Spectrometry intercomparison exercise for GAEC's collaborating laboratories network", Nuclear Physics Congress, Ioannina, April 2008.

V. Koukoulidou, K. Kehagia, K. Potiriadis, "Naturally occurring radioactive material releases from a phosphogypsum disposal area in Greece", Nuclear Physics Congress, Ioannina, April 2008.

1. Overexposure of workers to ionising radiation

In 2008, 142 workers exceeded the annual dose limit of occupational exposure. Due to this, 116 documents were sent to their employers, radiation protection advisors and themselves, in order to investigate the reasons for the overexposure. In most of the cases the overexposure is due to the fact that the personal dosimeter is worn above the lead apron in interventional radiology departments.

2. Information requests on behalf of Parliament members

During 2008 GAEC expressed its opinion related to 26 information requests submitted in the context of parliamentary audit. The majority of these requests concerned the performed electromagnetic fields audits, as well as the nuclear power plants of neighboring countries.

3. Bilateral scientific and technical cooperation agreement with the Department of Labour Inspection of the Ministry of Labour and Social Insurance of the Republic of Cyprus

GAEC signed in Nicosia on December 13, 2008 an official bilateral agreement for scientific and technical cooperation in the fields of radiation protection and nuclear security with the corresponding organization of the Republic of Cyprus, the Department of Labour Inspection of the Ministry of Labour and Social Insurance. Goal of the signed agreement, which is supported by the governments of Greece and Cyprus, is to ensure the safe use of radiation and the efficient radiation protection of the workers, the public and the environment. The mutual exchange of experts, the training of the personnel and the information exchange in the fields of research and development, of ionising and non ionising radiation applications, of emergency response and of environmental radioactivity monitoring are part of this agreement. The agreement is the outcome of the cooperation of two organizations under the programme "Strengthening the Capacity of the Radiation Protection and Nuclear Safety Regulatory Authority of Cyprus" implemented by GAEC the period 2007-2008.

4. Agreement with the Ministry of Economy

On November 10, 2008 an agreement was signed between GAEC and the Ministry of Economy regarding the maintenance and calibration of the radiation detection systems located at customs offices. These systems have been installed at entrance points in order to combat the radioactive and nuclear materials illicit trafficking. The undertaking of this extremely complex and specialized project on behalf of GAEC confirms the gained know-how and the expertise of its personnel. Furthermore, it will improve even more the radiological "shielding" of the country.

5. Participation in the working group “Nuclear energy and Greece energy needs” under the Energy Commission of the Academy of Athens

6. Renewal of services accreditation

The major part of the services offered by GAEC has been accredited by the National Accreditation System, according to ELOT EN ISO/IEC 17025 standards. During 2008 the accreditation for measurements performed in the non ionising radiation facilities, in the field of individual monitoring (body and wrist dosimeters), in γ -spectroscopy and in the field of calibration in radiotherapy, diagnostic radiology, radiation protection and individual monitoring was renewed.

7. Preparation and submission of the National Report regarding the Joint Convention on Radioactive Waste Management and Spent Fuel Management

8. Presentation of National Report at the 4th Review meeting of IAEA Convention on Nuclear Safety

9. “Individual Monitoring of Ionising Radiation conference”: organization assignment

GAEC, as a member of the European Dosimetry Group (EURADOS), undertook the organization of the next European Conference on Individual Monitoring of Ionising Radiation. The conference will be held in Athens, at Megaron Athens International Conference Centre, from 8 to 12 March 2010. The IM 2010 conference is organized under the auspices of the European Commission and in cooperation of the IAEA and the EURADOS.

The Individual Monitoring of Ionising Radiation Conference aims to bring together scientists from regulatory authorities, individual monitoring services, research bodies, European networks and companies, for the purpose of facilitating the dissemination of knowledge, exchanging experiences and promoting new ideas in the field of individual monitoring. Among the main thematic topics there will be the recommendations of the EU-Trimer project, as well as the results of the intercomparison exercises.

Website: <http://www.gaec.gr/im2010>

10. 11th EAN Workshop “ALARA in radioactive waste management”, Athens, 9-11 April 2008

GAEC, as a member of the European ALARA Network (EAN), organized in Athens from 9 to 11 April, 2008 the 11th EAN Workshop. The aim of the workshop was to discuss the implementation of the ALARA principle (As Low as Reasonably Achievable) with regard to occupational and public exposures arising from the management of radioactive waste. This includes waste from the nuclear fuel cycle, medical, NORM, industrial, educational and research sectors. Half of the programme time was devoted to 20 oral presentations, and half to Working Group discussions and their findings. There were 62 participants from 15 different European countries representing these different sectors.



11. Honor event organization for Professor D. Glaros

GAEC, in cooperation with the Inter-university postgraduate course in Medical Radiation Physics, organized an event in order to honor Professor D. Glaros, member of the GAEC's Board of Directors since its establishment on 29 May 2008.

12. Sponsorships

During 2008 GAEC supported financially (α) the NCSR "Demokritos" Summer School (7-18 July) and (β) the "Regional Workshop on Harmonization Procedures related to Nuclear Analytical Techniques" organized by the NCSR "Demokritos" Institute of Nuclear Physics (13-17 October). Moreover, a three-day symposium on nuclear medicine was organized under the auspices of GAEC (Volos, 12-14 September).

GAEC represents Greece:

- to 26 European Union committees. Suggestively: European High Level Group on Nuclear Safety and Waste Management, EURDEP - European Radiological Data Exchange Platform, ECURIE - European Community Urgent Radiological Information Exchange, EURATOM Scientific and Technical Committee, EURATOM Treaty Art. 31, 35, 36, 37
- to 21 IAEA committees. Suggestively: Technical Cooperation Group of Experts, Joint Convention on Waste Management, Steering Committee for Educational Training, Early Notification and Assistance Convention
- to 12 committees of Nuclear Energy Agency and OECD. Suggestively: Steering Committee for Nuclear Energy, Committee on the Safety of Nuclear Installations, Committee on Radiation Protection & Public Health
- to 7 international mixed committees
- to European scientific networks. Suggestively: European ALARA Network, European Radiation Dosimetry Group (EURADOS).

Moreover, GAEC is the National Contact Point for EURATOM special programme of EC 7th Framework Programme.

GAEC pursues the establishment of communication channels with citizens, by providing information regarding all types of radiation and their use. In this context:

- **issues press releases about its activities and incidents of radiation concern.** In 2008 five press releases were issued
- **disseminates its informative material.** In 2008 the leaflets "Learning for radiation" and "Radiation protection and nuclear security in Greece – education and training aspects" were published
- **updates its website (<http://www.gaec.gr>).** In 2008 the number of visits at GAEC's website was increased and exceeded 165.000
- **organizes lectures.** In 2008 were organized two lectures. The first of them, entitled "2007 Recommendations of the ICRP", was given by the invited speaker Dr. Jack Valentin, Scientific Secretary of International Commission of Radiological Protection (ICRP). The second one, entitled "Nuclear energy in USA: the present and the future", was given by the invited speaker Dr. G.E. Apostolakis, Professor of Nuclear Technology (MIT) and member of Advisory Committee on Reactor Safeguards in USA
- **participates in large scale information events.** In 2008, GAEC participated in the Research and Technology Festival 2008, organized by the General Secretariat of Research and Technology at Zappeion Megaro, from 27 November to 4 December 2008. In this festival results of basic and applied research were presented from universities, research centers and technological bodies.

