GREEK NATIONAL REPORT

under the

JOINT CONVENTION

ON THE SAFETY OF SPENT FUEL

AND ON THE SAFETY OF

RADIOACTIVE WASTE MANAGEMENT

October 2008

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SECTION A. INTRODUCTION

Greece has signed the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management on 5 September 1997. The Convention entered into force on 16 March 2000.

The present report is the National Report of Greece for the Third Review Meeting to the Convention, which will take place in 2009 at the IAEA in Vienna. The report has been prepared in accordance with the Guidelines regarding the Form and Structure of National Reports (IINFCIRC/604, 1 July 2002), established by the Contracting Parties under Article 29 of the Convention. There are no major changes or developments to report here in relation to the October 2005 National Report.

Greece has no nuclear power plants. Spent fuel management is therefore relevant only in connection with the operation of the unique research reactor GRR-1 at the National Centre of Scientific Research (NCSR) "Demokritos" and of two small subcritical assemblies. The policy and practice for spent fuel management for GRR-1 is to temporary store the fuel elements in dedicated storage facilities after irradiation, awaiting transfer to USA jurisdiction by May 2014 the latest, according to an agreement with the US Department of Energy. Since 2004, GRR-1 is not operational and no spent fuel (only with a burn up %) is presently stored on the site.

Radioactive waste in Greece originates from medicine, research and industry; waste with Naturally Occurring Radioactive Materials (NORM) results from some industrial activities as well. The management of radioactive waste is carried out on the site of origin. The national policy for the radioactive waste produced in research and medical applications is on-site storage, decay and/or discharge. As it concerns the sealed sources, and since there is no national production, the back-end solution is imposed.

The Joint Ministerial Order 1014 (ΦΟΡ) 94, Official Gazette No 216/B/6-03-2001 "Radiation Protection Regulations" (RPR), published in 2001, is the national legislation concerning the civilian applications of ionizing radiation and implementing the IAEA BSS and Euratom Directives 96/29 and 97/43. In relation to the particular radioactive wastes issue, since 1990, according to Greek legislation, the import license for radioactive sealed sources is granted by the regulatory authority, the Greek Atomic Energy Commission (GAEC), under the condition that the foreign supplier certifies to take back the source when it is used. Moreover, Greece has implemented the European Council Directive 2003/122 on the control of the high activity sealed radioactive sources and orphan sources (HASS) by issuing a Ministerial Order. GAEC started in 2003 a programme, with the scope to return all the unused and orphan sealed sources to a foreign waste management facility for recycling; under this program, a project that dealt with all the old "historical" sources has been completed in September 2005.

Greece attaches the highest importance to international efforts to harmonise and increase all aspects of nuclear safety. In this respect Greece has initiated projects and bilateral agreements with other countries and tries to participate and contribute to all relevant international and European activities, including of course the Joint Convention on the Safety of the Spent Fuel Management and on the Safety of Radioactive Waste Management.

SECTION B. POLICIES AND PRACTICES

Article 32 (Reporting), paragraph 1

(a) Spent fuel management policy

According to an existing contract, spent fuel from the GRR-1 research reactor of the NCSR "Demokritos" has been returned and will be returned in the future to the United States Department of Energy until 2014. This means that Greece has no obligations regarding the final disposal of spent fuel (with the minor exception for the fuel of the two sub-critical assemblies).

(b) Spent fuel management practices

Spent fuel from the research reactor is stored on site until the return shipment to the United States. Shipment follows applicable transport and safeguards legislation.

Interim wet storage of spent fuel of GRR-1 takes place in the reactor pool and in a separate pool inside the reactor building. Spent fuel from the reactor has been returned to the United States in 1996 and 2005. The burn-up of the spent fuel is about 35%.

The spent fuel of the decommissioned sub-critical assembly of the National Technical University of Athens (NTUA) is under dry interim storage in NTUA premises, under the control and supervision of the Nuclear Technology Laboratory of NTUA.

There is no spent fuel from the sub-critical assembly of the Aristotle University of Thessaloniki, as the facility is still used as a zero power assembly.

Storage of spent fuel follows applicable radiation protection and safeguards legislation. Regular inspections are performed by the regulatory authority and by Euratom and IAEA inspectors.

(c) Radioactive waste management policy

Radioactive waste in Greece originates from medicine, research and industry (including industries generating waste with NORM). Only low-level and intermediate-level waste derives from these sources. For such wastes, the national policy is on-site storage, decay and discharge or disposal. The management of radioactive waste is carried out on the site of origin. The producers of radioactive waste have to bear the full costs of treatment, interim storage and final disposal.

Greece strongly supports the idea that states operating nuclear power plants cooperate closely with non nuclear power countries to develop regional solutions for final disposal of radioactive waste.

(d) Sealed radioactive sources

The case of sealed radioactive sources is discussed under Section J.

(e) Storage facilities

In light of the above described situation and arrangements, there is no need to create a long-term storage or disposal facility. Short-term interim storage of radioactive sources and waste awaiting disposal is provided in interim facilities located at the NCSR "Demokritos."

(f) Regulatory aspects

Radioactive waste management follows the RPR specifications. Announced and unexpected inspections are performed by the regulatory authority (GAEC) at least once every two years, in order to verify compliance with RPR.

Greek national authorities are responsible for the availability of technical infrastructure and equipment related to the treatment of radioactive waste.

(g) Radioactive waste management practices

For the waste produced in NCSR "Demokritos", on-site waste treatment includes a range of operations, such as waste segregation, characterization, conditioning and storage and discharge.

Regarding nuclear medicine and other research laboratories, according to the provisions of the RPR and since the waste concerned is short lived, it is preferable to stored it in an interim storage by the producers until it has decayed and can be released to the environment, to a waste disposal for non radioactive waste, or to a waste treatment facility for infectious waste. Special retention tanks might be required in nuclear medicine laboratories using I-131. GAEC has issued an explanatory circular, complementary to the RPR, defining the methodology and criteria for the need to install retention tanks.

GAEC in collaboration with the NCSR "Demokritos" and the Ministry for the Environment, started in 2003 and completed in 2005 an action aiming at the collection of unused radioactive sources in the country and their export to specialized facilities for recycling. The collection is a continuing effort and this action is going to be repeated when a significant number of non-used sources are collected again. Until their disposal for recycling, the sources remain in the interim storage facility built on the campus of NCSR "Demokritos".

Up to now, the industrial wastes produced by the NORM industries and when their radionuclide concentrations exceed the exemption levels, have been exported to a foreign country for recycling. GAEC has adopted the EC Radiation Protection 122 "Practical use of the concepts of clearance and exemption – Part II) and issued an explanatory circular for this purpose.

Criteria to categorize low and intermediate-level radioactive waste: Low level waste is defined as that delivering a dose rate of less than 100μSv/h at a distance of one meter from the unshielded material. Material producing higher dose rates is considered as intermediate level waste.

SECTION C. SCOPE OF APPLICATION

Article 3 (Scope of Application)

(a) As mentioned before in Section A and Section B, spent fuel management does not occur in Greece because Greece has no nuclear power programme and is operating only one research reactor. All spent fuel has or will be returned to the United States and reprocessing in Greece is not an issue

(b) Greek legislation declares waste that contains NORM as radioactive waste, only if the exposure to the general public exceeds legally binding limits when this material is released to the environment. The regulated activities inducing NORM waste include the agricultural applications of phosphogypsum, the decommissioning activities of abandoned industries, etc. NORM wastes are considered in this report.

(c) Greece has not declared spent fuel or radioactive waste within military or defense programmes as spent fuel or radioactive waste for the purposes of the Convention.

According to Greek legislation, GAEC is the competent authority for the safety of radioactive waste management. Even if GAEC is not responsible for the radioactive waste from the Greek military, it is handled by GAEC in the same way as described in this report, since this waste is covered by the legislative system described in Section E.

SECTION D. INVENTORIES AND LISTS

Article 32 (Reporting), paragraph 2

(a) Spent fuel management facilities

In Greece there are no spent fuel management facilities.

(b) Inventory of spent fuel

GRR-1 is not operating since 2004. All spent fuel produced by that time was exported to the US during 2005. The existing irradiated fuel assemblies are kept at the reactor facility interim storage tank under Euratom safeguard provisions. The inventory of the irradiated assemblies is given in Section L (Table a).

(c) Radioactive waste management facilities

The radioactive waste management facility at NCSR "Demokritos" includes:

1. Central retention tanks for aqueous waste
2. Sorting box for the segregation of solid waste
3. High force compactor
4. Equipment for cementation
5. Facilities for interim storage

A second interim storage facility for sealed sources and other radioactive waste operates in the campus of NCSR "Demokritos", as already mentioned.

Before wastes disposal, the following are taken into account:

1. The composition and the activity of the wastes, provided by the users.
2. Independent measurements performed by the waste management personnel. In particular, the dose rate on the surface of the waste should be equal to the background dose rate, and the spectrum after a 30 min measurement with a portable NaI detector (Exploranium device) on contact should be identical with the 30 min background spectrum. Contamination measurements (inside the segregation box) are done with a surface contamination detector to verify that there is not contamination anywhere inside the box.

The radioactive waste management provisions for the research and medical sectors, included in Part 6 of the Radiation Protection Regulations, are:

1. Sealed sources after their useful life are returned to their manufacturer abroad.
2. Radioactive waste produced by the use of unsealed sources in solid and/or liquid form:
    - Solid waste is stored in dedicated shielded storage containers for decay, until they reach the unconditional clearance levels provided by the Radiation Protection Regulations, which are in accordance with the Radiation Protection Report 122-Part 1 of the European Union.
    - Liquid waste is disposed through the laboratory's dedicated and properly labelled pipelines to the national sewage system, in accordance to the specific clearance levels provided by the Radiation Protection Regulations.

(d) Inventory of radioactive waste

Excluding the spent and disused sealed sources, the most significant production of radioactive waste takes place in NCSR "Demokritos". From 2006 to 2008, 6 m^3 of solid waste and 10 m^3 of liquid waste have been produced. For this period, there was not any need for treatment and conditioning of solid waste before keeping it in interim storage. The solid waste and the liquid waste are disposed after up to 2 years storage. This practice is used mainly for short-lived radionuclides.

Table (b) in Section L shows the annual average use of radionuclides at the NCSR "Demokritos". These eventually show up as waste.

Table (c) in Section L shows the radionuclides used in nuclear medicine laboratories all over the country that result in the production of radioactive waste.

SECTION E. LEGISLATIVE AND REGULATORY SYSTEM

Article 18 (Implementing measures)

Greece has fully implemented the Joint Convention on the Safety of Spent Fuel and on the Safety of Radioactive Waste Management.

Article 19 (Legislative and Regulatory Framework)

The laws and regulations relevant to this Convention are given below.

(a) Greece has no nuclear power programme. The legislative framework establishing a system of licensing with regard to nuclear installations exists since 1971:

- Decree Law No 854, Official Gazette No 54/A/18-03-1971
  "Terms to Establish and Operate Nuclear Installations"
- Presidential Decree No 610, Official Gazette No 130/A/23-08-1978
  "Establishing Terms and Procedures in Licensing P.P.C. to Construct a Nuclear Power Plant on a Specific Site or change of the Site."

(b) According to the existing legislation, the Greek Atomic Energy Commission is the regulatory body responsible for the implementation of the nuclear safety and radiation protection regulations.

- Decree Law No 1733 (Article 28), Official Gazette No 171/A/22-09-1987
  "Establishing the Greek Atomic Energy Commission"
- Law No 181, Official Gazette No 347/A/20-11-1974
  "Protection Against Ionizing Radiation"
- Joint Ministerial Order 1014 (ΦΟΡ) 94, Official Gazette No 216/B/6-03-2001
  "Radiation Protection Regulations"
- Ministerial Order No 2739, Official Gazette 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 No 20/A/26-02-1997
  "Supervision and Control of Shipments of Radioactive Waste between Greece and the other Member States of the EU and Into and Out of the EU"
- Organization of Civil Protection, Ministerial Order No 2344, Official Gazette No 212/A/11-10-1995.

(c) The Greek legislative framework related to safeguards and non-proliferation is the following.

- Decree Law No 437, Official Gazette 49/A/26-02-1970
  "Ratification of the Non Proliferation Treaty Signed on the 1 July 1968"
- Safeguards Agreement between Greece and IEAE signed on 17-11-1972
- Law No 1636, Official Gazette No 106/A/18-07-1986
  "Ratification of the Physical Protection of Nuclear Material Treaty"

- Ministerial Order No 5408 /E3/2362/ Φ. NSG, Official Gazette No 730/B/21-09-1993 "Control on Transfer of Nuclear Materials, Armament and Technologies Affecting National Defence and Security"
- Law No 2805, Official Gazette 50/A/3-3-2000, "Ratification of the Additional Protocol."

(d) Greece has implemented the European Council Directive 2003/122 on the control of the high activity sealed radioactive sources and orphan sources (HASS) by issuing the Ministerial Order No 10828 / EFA(1897), Official Gazette No 859/B/10-07-2006 "Control of the high activity sealed radioactive sources and orphan sources".

Greece is in the process of implementing the European Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel. A ministerial Order has been prepared, approved by the EC and is in the process of signature by the Ministers concerned.

(e) GAEC Circulars:
- "Clearance levels for NORM", 03.08.2006.
- "Release of patient excreta following nuclear medicine therapy", 30.11.2006

Article 20 (Regulatory Body)

The Greek Atomic Energy Commission (GAEC) was first established in 1958 as the authority responsible for planning, application and supervision of radiation protection measures, and as the competent authority for nuclear energy & technology and radiation protection.

The GAEC was re-established in 1987 as an independent civil service under the Minister of Development, and is the competent authority for nuclear energy & technology and radiation protection of workers, the general public and the environment against the dangers of ionizing and non ionizing radiation. In order to accomplish its duties, GAEC has specialized staff and accredited laboratories with state of the art equipment. GAEC has evolved over the past years by increasing its personnel, upgrading its infrastructure, improving the services provided, and by establishing regular education and training programmes.

The main responsibilities of GAEC in the field of radiation protection are the introduction of regulations and the monitoring of their implementation, as well as the introduction and implementation of radiation protection measures. The main functions of GAEC related to ionizing radiation, are:
- Licensing (import, export, transport, storage, use, disposal of radioactive and fissionable materials, research and training applications, import and use of radiation producing equipment, non-medical applications)
- Safety evaluation and inspections for all installations using or producing radiation
- Individual monitoring (external and internal) for all occupationally exposed workers in the country
- Secondary standard dosimetry
- National radiation protection data base

- Environmental radioactivity monitoring (telemetric network) and laboratory measurements of environmental samples (air filters, water, soil, food, etc)
- Emergency planning and response
- Education and training in radiation protection

GAEC's personnel is composed of 69 persons: 44 scientists, 9 technicians and 16 administrative staff. Among the scientists there are 21 with M.Sc. degree and 14 with Ph.D.

SECTION F. OTHER GENERAL SAFETY PROVISIONS

Article 21 (Responsibility of the license holder)

According to the RPR every practice with ionizing radiation is subjected to license. The RPR describe extensively and clearly the responsibilities of the license holder who is primarily responsible for the safe use, handling, storage, etc. of radioactive materials, radiation protection of workers and the environment, quality assurance, reporting, etc, as well as of any other person involved in the radiation protection of the practice.

The waste management concept and all relevant actions undertaken by a facility are always evaluated before the licensing of a practice which involves waste. The licensee has to implement all RPR in respect to waste management and to perform quality assurance and regular quality controls on these matters. Furthermore, the competent authority inspects at a regular basis the facility's waste management programme as well as the licensee responsibilities.

Article 22 (Human and financial resources)

The RPR describes the human resources of the licensee which are part of the licensing requirements. The verification of the adequacy and the training of the personnel is a part of the licensing process.

For the import of sealed radioactive sources, the licensing imposes that full financial provisions are made by the licensee for waste management and the return of the sealed sources to their manufacturers. In case the collected funds are insufficient for the real costs of final disposal, the government will cover the difference.

The GRR-1 research reactor is owned and operated by NCSR "Demokritos", a governmental institution. The government assures the responsibility to cover any cost of its future decommissioning.

Article 23 (Quality assurance)

The RPR include the concept of Quality Assurance (QA) in all practices. The existence of a QA programme is obligatory for every facility and is subjected to the competent authority inspection and evaluation.
As an example, GAEC's specialised laboratories have been accredited by the National Accreditation Council according to the ISO 17025 requirements.

Article 24 (Operational radiation protection)

All activities with ionizing radiation in the country are performed in accordance with the RPR, which implement the IAEA BSS and Euratom Directives 96/29 and 97/43, where the radiation protection demands for each practice are described in detail. All radiation protection measures

for the public, the occupationally exposed workers, the medical patients and the environment, are subjected to competent authority inspection, control and evaluation.

For the activities and the relevant laboratories covered by the Joint Convention (e.g. waste management facilities, interim storage, environmental radioactivity laboratory, etc), NCSR "Demokritos" and the GRR-1 apply their own radiation protection programme assured by the Health Physics Service, that is controlled by GAEC on a regular basis within the framework of the licensing procedure of the laboratories concerned.

GAEC provides the individual monitoring of all occupationally exposed workers and keeps the national records. The workers take part in a medical surveillance programme.

The liquid or air discharges are monitored by the licensee holders and surveyed by GAEC. Moreover, GAEC performs intercomparison and intercalibration exercises with the environmental monitoring, waste and research reactor measurement laboratories of the NCSR "Demokritos". As already mentioned in the previous 2005 National Report, the most recent (September 2005) inspection performed under the Euratom Article 35, has concluded that Greece is in full compliance with article 35 of the Euratom Treaty.

Article 25 (Emergency preparedness)

According to RPR, in each facility there is an internal emergency preparedness plan in case of a radiological or nuclear accident or event, which is subjected to the competent authority inspection and evaluation.

According to its statutory role, GAEC is responsible for the coordination of the national environmental radioactivity monitoring programme. In this respect:

- GAEC coordinates a network of 10 collaborating research and University laboratories providing environmental radioactivity measurements, performs intercomparison exercises and harmonises the measurement procedures.
- GAEC operates a national telemetric network containing 24 stations for total gamma dose rate measurements, 4 stations for the radioactivity measurements in the water of the main rivers and 3 stations for aerosol measurements.
- GAEC and NCSR "Demokritos" perform air filter measurements from different locations in the country.
- GAEC and NCSR "Demokritos" perform measurements in soil, water and food samples.

The water reservoirs of the Greek capital are monitored on a monthly basis by GAEC.

According to its statutory role, GAEC is responsible for emergency preparedness, advises the Government on the measures and interventions necessary to protect the public and acts as contact point for receiving and communicating information to the emergency response systems.

Since its establishment, GAEC participates in the National Emergency Plan for Civil Protection "Xenokratis". This plan includes accidents in Nuclear Power Plants of a neighboring country. GAEC is responsible for activating Annex R of the Plan, related to radioactivity issues. Additionally, since 2004, GAEC participates in the national plan for Nuclear Radiological Biological Chemical (NRBC) threats. In order to cope with the above, GAEC's emergency

response system has been significantly upgraded with a new internal emergency plan, the necessary personnel and appropriate infrastructure.

GAEC's relevant infrastructure contains measuring and detection systems (detectors, surveys, dosimeters, contamination monitors, portable spectrometers, pagers, etc), protective equipment, an independent communication system, a mobile laboratory fully equipped with a series of detectors, spectrometers, protective equipment and a radiochemical laboratory, a specialized vehicle for collecting radioactive sources, a scientific library containing all recent publications relevant to the nuclear and radiological safety and security, radiological emergency computer codes (Lasair, Hotspot, Hysplit, etc) and detailed, step by step documentation for all the procedures to be followed in case of an emergency.

In addition to the above, all GEAC specialized laboratories (environmental radioactivity laboratory, telemetric network, individual monitoring laboratories, etc.) and the network of the collaborating accredited laboratories already mentioned assist in case of an emergency.

Staff training, emergency exercises, intercalibration and intercomparison exercises are performed on a regular basis.

GAEC participates in Emergency Response Systems and Data Bases (ECURIE, IAEA Illicit trafficking data base, ENATOM, etc).

Article 26 (Decommissioning)

Decommissioning of the GRR-1 is not considered for the foreseeable future. However, a plan for the decommissioning of the GRR-1 primary cooling system for refurbishment purposes and a study of the research reactor's decommissioning is in progress. The GRR-1 has the qualified staff for this task. Since the GRR-1 research reactor is owned by a governmental institution, the government assures the responsibility to cover the cost of its future decommissioning.

Decommissioning of the waste management facility and the interim storage facility of the NCSR "Demokritos" is not foreseen for the near future. The preparation of such plans is in progress. NCSR "Demokritos" has the appropriate staff for this purpose.

SECTION G. SAFETY OF SPENT FUEL MANAGEMENT

Article 4 (General safety requirements)

As explained in Section B, Greece has only one research reactor (GRR-1) and has no plans for a nuclear power programme nor for additional research reactors.

All spent fuel from the research reactor has already been returned to the U.S. Department of Energy. Any new spent fuel will be returned by May 2014. Therefore Greece has only to take care of the on-site interim storage. The GRR-1 license and safety regulations cover the safety of the interim storage in the reactor pools.

Article 5 (Existing facilities)

NCSR "Demokritos" operates GRR-1, since July 1961. GRR-1 is an open-pool, light water moderated and cooled reactor, with a nominal power of 5MW (thermal). GRR-1 uses materials-testing reactor, MTR, plate-type fuel elements. Until the beginning of July 2004, GRR-1 used a mixed core including high (HEU 93%) and low (LEU 19.75%) enriched fuel elements. GRR-1 has been fully converted to LEU in 2006, whilst the existing 46 HEU spent fuel assemblies have been shipped to the USA (Savannah River Site) at the end of 2005. GRR-1 has a spent fuel interim wet storage pool with capacity of 57 assemblies inside the reactor building. Another 48 spent fuel assemblies may be stored inside the reactor pool. GRR-1 has not yet started operating under its new configuration as it is undergoing refurbishing.

Article 6-8 (Siting of proposed facilities, Design and construction of facilities, Assessment of safety of facilities)

It is not foreseen to design or construct new facilities.

Article 9 (Operation of facilities)

The interim fuel storage facility is within the GRR-1 building and operates under the responsibility of GRR-1 and NCSR "Demokritos" and under the supervision of GAEC. This is an underground stainless-steel, 1.6m x 2.6m and 4m deep tank, offering 57 storage positions arranged in five groups. Cadmium sheets are properly positioned between storage positions to make any undue criticality impossible. The tank is filled with demineralised water. Recirculation of the water through a resin-type mixed-bed ion exchanger (4.5 m^3/h capacity) via installed piping, keeps it in appropriate pH and conductivity levels, eliminating any corrosion hazard for the stored fuel elements. Two steel covers secure the tank. Removal of the covers is possible only by means of a fork-lift-truck.

Article 10 (Disposal of spent fuel)

All spent fuel from GRR-1 is to be transferred to USA jurisdiction by May 2014, according to an agreement with the US Department of Energy

SECTION H. SAFETY OF RADIOACTIVE WASTE MANAGEMENT

Article 11 (General safety requirements)

Criticality and removal of residual heat is not a concern for the LILW waste in the interim storage of NCSR "Demokritos".

The management of radioactive waste is covered by the RPR and is based on the following general principles:

- Avoid the generation of radioactive waste or limit the waste generated to short half-life radionuclides.
- Provide for effective protection of individuals, society and the environment, taking into account the biological, chemical and other hazards.
- Take into account interdependencies between stages of radioactive waste management.

Article 12 (Existing facilities and past practices)

(a) Wastes at NCSR "Demokritos"

The only category of radioactive wastes that were solidified in Greece are sludge and evaporation concentrates. In the past, aqueous waste from the radionuclide production plant in NCSR "Demokritos", was either released after monitoring or transferred to the waste treatment plant for concentration by evaporation, then solidified by addition of Portland cement and vermiculite in steel drums. The evaporator was of steam-heated type. The solidified waste drums are stored in the storage facility at NCSR "Demokritos". Since the radioactive inventories at the time of solidification are known, the acceptability for disposal in a future repository can be assessed. This practice is no longer used today.
Radioistope production has been discontinued. Presently, aqueous waste is collected in retention tanks, located close to the place where it is produced, then released after decay and monitoring. The installation has been recently renewed and licensed.

In the current NCSR "Demokritos" waste management plant, there is a sorting box equipped with a ventilation system providing segregation of the solid waste. Also, there is a high force compactor and a cementation device.

The segregation and characterization of radioactive waste enables selection of suitable treatment and conditioning techniques as well as disposal methods. The segregation and characterization of radioactive wastes in NCSR "Demokritos" are performed taking into consideration:

a. activity and radionuclides present;
b. half-life of radionuclides present;
c. physical and chemical form of the waste, such as:
   - solid (compactible, non-compactible);
   - liquid (aqueous and organic);
   - homogeneous or non-homogeneous (contain sludge or suspended solids);
d. non-radiological hazards (toxic, pathogenic, infectious, genotoxic, biological or pharmaceutical properties);
e. required storage activities.

This segregation and characterization approach has been sufficient for the relatively simple and straightforward cases dealt with in the past. The global effects from all steps are considered,

taking into account any local and/or global optimization options and giving preference to solutions that do not foreclose future options if reasonable.

The concentrated and solidified aqueous waste is kept in the interim storage facility of NCSR "Demokritos" under monitoring and control.

(b) Wastes from medical applications and sealed sources

Since 1991, Greece has a well-established regulatory system for controlling waste from nuclear medicine labs, so that disposing such solid or liquid waste does no harm to the environment. The RPR, contain the following provisions:

Liquid:

- The disposal of liquid radioactive waste to the public drainage is permitted only if the maximum concentration in any part of it is less than 1GBq/m^3.
- Under no circumstances the daily disposed quantity should exceed 18 MBq for in vitro labs, 37 MBq for in vivo diagnostic labs, and 110 MBq for in vivo diagnostic and therapeutic labs.
- H-3 and C-14 used as organic solvents in liquid scintillators can be disposed in quantities of less than 3 GBq and 0.3 GBq per day, respectively.

Solid:

- Solid radioactive waste is permitted to be disposed as ordinary waste if it does not contain reusable objects and its concentration is below the clearance levels for each radionuclide.
- Short-lived (half-life < 60 days) solid waste that cannot be disposed according to the regulations is stored in vaults inside the labs until its radioactivity falls below the limits. All the other solid waste such as used sealed sources is returned to its supplier abroad for recycling.

Article 13 -15 (Siting of proposed facilities, Design and construction of facilities, Assessment of safety of facilities)

It is not foreseen to design or construct new facilities.

Article 16 (Operation of facilities)

The facilities operate under the responsibility of NCSR "Demokritos" and the supervision of GAEC. The operation of the facilities is subjected to the radiation protection requirements of RPR and the control of the effluents of the facilities is subjected to the Euratom Treaty Article 35 and 36 requirements.

Article 17 (Institutional measures after closure)

There are currently no plans for closure of the existing facilities.

SECTION I. TRANSBOUNDARY MOVEMENT

Article 27 (Transboundary movement)

The transboundary movement of the spent fuel shipped to the US is covered under the provisions of the agreement with the US Department of Energy.

The transboundary movement of radioactive waste is covered by the Greek RPR, which takes into account the Council Directive 93/3/Euratom/3.2.1992 "On the supervision and Control of Shipment of Radioactive Waste between Member States and into and out of the Community". Also all other safety series and guidelines (e.g. IAEA etc) are taken into account.

On the occasion of the Olympic Games Athens 2004, and to prevent that radioactive materials are smuggled into the country, GAEC in collaboration with the IAEA and the Greek Customs Office and under the US Second Line of Defense Programme, implemented state-of-the-art technology at borders to detect illicit trafficking of radioactive or nuclear materials. Specifically, 57 portal monitors and 456 pieces of handheld equipment were provided in 32 cargo and passenger entry points of the country, covering 7 airports, 12 seaports, and 13 land-borders. The fixed systems contain gamma and neutrons detectors. The hand held equipment is used for the secondary control when fixed systems are installed, or for the primary control in the smaller entry points. These sets of equipment are composed by radiation pagers indicating the presence of radiation, by gamma detectors in order to determine the radioactive source location and intensity and spectrometers specifying additionally the radionuclide.

SECTION J. DISUSED SEALED SOURCES

Article 28 (Disused Sealed Sources)

According to national legislation enacted in 1990, in order to import a sealed radioactive source, the foreign supplier must make the commitment to take back the source when it is decommissioned. Therefore, when the supplier makes an offer, the cost of taking the source back in a few years' time has to be considered. This is also provided by the implementation of the European Council Euratom Directive 2003/122 on the control of the high-activity sealed radioactive sources and orphan sources (HASS). In case the source user or the supplier bankrupts, the government will cover the additional funds needed for disposing of the source.

In Greece there are no manufacturers of sealed sources; all sealed sources are imported.

A programme exists for collecting all spent and disused sources, imported into the country before 1990. Up to now, all the old "legacy" sources have been collected and exported to a foreign country for recycling according to a programme started by the GAEC in 2003.
This action will be repeated when a significant number of non-used sources is collected again. In the mean time, the collected sources (bankrupt source user, scrap yards, foundries, etc) are waiting for exportation in the upgraded interim storage facility located in the campus of NCSR "Demokritos".

In addition to the provisions taken to prevent the smuggling of radioactive sources or nuclear material into the country (section J, art. 27), radioactivity detectors (portals) have been installed in the scrap yards and foundries to monitor the scrap entering these facilities and detect any hidden sealed sources. In case of a finding, the persons in charge communicate immediately with GAEC, so as to perform a secondary control and collect the object, if needed.

SECTION K. PLANNED ACTIVITIES TO IMPROVE SAFETY

There are no new major actions planned. The programmes presently implemented are continuously upgraded and improved.

SECTION L. TABLES

(a) Inventory of irradiated fuel assemblies in interim storage at the reactor building

Assembly no.	U-235 (gr)	Burn-up (%)
601	200,67	9,50
602	188,62	14,92
603	218,81	1,37
604	187,63	15,45
605	192,69	13,14
606	188,36	15,02
607	195,29	11,96
608	193,74	12,68
609	197,39	11,04
610	197,95	10,73
611	194,33	12,40
612	199,52	10,03
613	198,58	10,41
614	206,23	6,98
615	208,14	6,09
616	209,82	5,34
617	218,51	1,41
618	219,04	1,22
6C01	89,23	34,02
6C02	105,14	18,03
6C03	108,33	14,86
6C04	113,10	10,09

(b) Radionuclides used in the National Centre of Scientific Research (NCSR) "Demokritos" that eventually become wastes

Radionuclides used	Radioactivity/ y in solid waste (MBq)	Radioactivity/ y in liquid waste (MBq)	Activity
Eu-152, Ag110m, Mn-54, Zn-65, Co-60	1.2	200	The Research Reactor is out of operation since 2004
H-3	30	300	Biology and Radio-pharmacy and in vitro radio-diagnostic
C14	30	300	Biology Radio-pharmacy and in vitro radio-diagnostic
P-32	300	30	Biology and Radio-pharmacy and in vitro radio-diagnostic
I-125	450	260	Radio-pharmacy and in vitro radio-diagnostic
S-35	18	180	Biology and Radio-pharmacy and in vitro radio-diagnostic

(c) Radionuclides used in nuclear medicine that result in wastes for the year 2007

Radioinuclide	Radioactivity/Year (GBq)	Use
Mo/Tc-99m	68024	Diagnosis in vivo
Tl-201	3217	Diagnosis in vivo
In-111	595	Diagnosis (in vivo) & Therapy
I-123	263	Diagnosis in vivo
I-131	7751	Diagnosis (in vivo) & Therapy
I-125	10.2	In vitro
Y-90	65	Therapy
Ga-67	250	Diagnosis in vivo
Re-186	727	Therapy
Sm-153	280	Therapy
Sr-89	15.7	Therapy
H-3	5.4	In vitro
C-14	0.08	In vitro
P-32	8.5	In vitro
P-33	0.037	In vitro
S-35	3.55	In vitro
Cr-51	7.4	In vitro
Co-57	0.012	In vitro
Er-169	0.925	Therapy