ITALY

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

Second Italian National Report

October 2008

The present report has been drafted, on behalf of the Italian Government, by the Institute for the Environmental Protection and Research (ISPRA) in coordination with other national involved Administrations and Organizations

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Section A. Introduction

A.1. Presentation of the report

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was adopted on 29 September 1997 in the Vienna Diplomatic Conference and entered into force on 18 June 2001. Italy signed the Convention on 26 January 1998 and deposited the instrument of ratification on 8 February 2006.

This is the second national report prepared under the obligations of the Convention. It is based on the first report and provides an updating of the national situation, with particular emphasis on the relevant topics raised during the 2006 review meeting by other contracting parties as well as on significant facts and events having relevance for the improvement of spent fuel and radioactive waste safety, occurred during the last period.

As done in the first report, the fulfilment of the obligations of the Convention is evaluated. The evaluations are mainly based on the Italian legislation and regulations as well as on the safety assessments of Italian radioactive waste and spent fuel management facilities. The assessments on the safety of the NPPs and other nuclear installations cover also the facilities for the management of operational waste and storage of spent fuel located in their sites. The plans for decommissioning of nuclear facilities are also discussed. The management of radioactive waste generated outside the nuclear fuel cycle is discussed, as appropriate.

This report has been compiled according to the Guidelines Regarding the Form and Structure of National Reports, as agreed in the preparatory Meeting of the Convention in December 2001. In Section B, policies and practices of waste management in Italy are summarised as stipulated in Article 32, paragraph 1. In section C, the scope of application taking into account the Italian circumstances is explained, as stipulated in Article 3. Section D provides information on spent fuel and waste management facilities in Italy and on inventories of spent fuel and radioactive waste, as stipulated in article 32, paragraph 2. The implementation of each of the Articles from 4 to 28 of the Convention is evaluated in Sections E to J. Section K deals with further development to improve the safety of spent fuel and radioactive waste management.

A.1.1 Conclusions of the 2006 review meeting

Due to the fact that Italy ratified the Joint Convention only a few months before the 2nd Review Meeting the process of review of the Italian national report by other Countries could not be carried out.
However, within the Country Group at the Review Meeting, many issues of special interest to both spent fuel and radioactive waste management emerged.

At the end of the review meeting the following challenges were identified:

- selection of a site for the construction of a national repository including building public confidence;
- construction of new on site interim storage facilities, including public acceptance;
- establishment of rules and funding provisions for non-power RWM.

Answers to these challenges will be given in the present report.
Good practices identified in the review meeting include the availability of a national inventory for spent fuel, radioactive waste and spent source and the existence of a robust funding system for radioactive waste in nuclear sites, and spent fuel management, including decommissioning.

As a general observation, the Country Group was satisfied with the answers and believes that Italy met the obligations of the Joint Convention.

A.1.2 Most relevant events since the second review meeting

The following main events and activities relevant for the Convention and occurred after the second peer review meeting can be highlighted:

On the legislative and institutional side, establishment of ISPRA (Institute for the Environmental Protection and Research) to which resources, duties and competences of APAT have been transferred, including those related to the Regulatory Authority function in the nuclear field.

On the implementation side

- start of the transport activities of spent fuel to France for reprocessing, in the frame of the agreement between the Italian and the French Government;
- completion of the regulatory review process of the decommissioning plan for the Garigliano NPP and for Bosco Marengo fuel fabrication facility;
- completion of the licensing process of the interim waste storage facilities at the Garigliano and Latina NPPs on the base of a review guideline adopted by ISPRA;
- performance of a remediation campaign of the EUREX facility pool with the removal of the stored spent fuel and of the existing components, tools and internal structures and with the emptying of the pool itself;
- preparation by the licensee of new projects for waste interim storage facilities in the sites of EUREX and Casaccia Center and start of the licensing process;
- completion of the commissioning tests of the new storage facility for liquid waste at the EUREX plant and start of the transfer process of the liquid from the old tanks;
- preparation by the licensee of a project for the treatment and conditioning of U-Th solution at ITREC plant;

With regard to the national storage facility a road map has been defined in relation to the intergovernmental agreement with France. As a first step a Commission established by the Ministry

of Economic Development and having the mandate to define a procedural path to identify the sites candidate for the construction of such a facility, has recently completed its task.

A.2 Executive summary

In Italy, four nuclear power stations (i.e. Garigliano, Latina, Trino and Caorso) were operated until middle of '80s. At present they are, at different stages, in the process of being decommissioned according to a strategy of one step decommissioning, established in late '90s. The spent fuel and the largest part of the radioactive waste to be managed in Italy derive from the operation of the above mentioned NPPs and from a few fuel cycle facilities (see in Figure 1 the location of NPPs and other facilities).

The present Italian regulatory system related to nuclear and radiation safety is the result of an evolution of rules and standards that begun in the early '60s and that took into account the experiences of licensing and operation of NPPs of different types and generations and of other nuclear installations. The system covers also the government of safety of spent fuel and radioactive waste management.

The main regulations are acts of Parliament, Legislative Decrees, governmental or ministerial Decrees binding in law issued by the Government. Technical Positions and Guides issued by the National Nuclear Regulatory Authority (ISPRA – formerly APAT) are also considered.

The legislative and regulatory framework, established since the early '60s, envisages, a system of licensing of nuclear installations and activities as well as regulatory control. This system fully applies to spent fuel and radioactive waste management activities.
The licensing body is the Ministry of Economic Development, based upon the binding technical advice of ISPRA which is entrusted with the role of regulatory authority, performing assessments and inspections in nuclear installations.

Italy is a member state of the European Union. Thus, the directives of the Union are implemented. When necessary, the Italian regulations have been modified to take into account the EU directives (e.g. to radiation protection, transboundary movements of nuclear waste and control of high activity sealed sources and orphan sources).

The main national operator entitled to perform spent fuel, radioactive waste and decommissioning activities is Sogin (Società Gestione Impianti Nucleari), a company whose shareholder is the Ministry of Economy and Finance, while the strategic and operational aims are given by the Ministry of Economic Development.

The national policy on spent fuel management calls for the shipment abroad of the spent fuel still present for reprocessing in foreign facilities. To this aim in November 2006 an agreement between

the Italian and the French Governments regulating the transfer in France of about 235 t of spent fuel was signed. In December 2007, the first shipment from Caorso NPP started.

Figure 1: Location of NPPs and other facilities

As far as the radioactive waste is concerned, almost all the waste generated by the operation of nuclear installations are stored in the sites of origin. Additional amounts of radioactive waste arise from a number of facilities using radioactive sources in medical, research and industrial applications.

Several projects related to the enhancement of the safety level of the radioactive waste (such as treatment and conditioning activities as well as the construction of new storage facilities, also by refurbishing existing buildings or by constructing new buildings) have been implemented or launched.

Also in connection with the commitments taken in the intergovernmental agreement with France in relation to the return of the waste resulting from the reprocessing of the spent fuel, a first activity aimed at defining the procedural path for the identification of a site for the construction of a national storage facility has been recently completed by a Commission established by the Ministry of Economic Development.

In the safe management of spent fuel and radioactive waste, international co-operation is recognized to be fundamental, and the Italian regulatory authorities, nuclear power and waste management operators and research institutes maintain connections with international organisations. In this respect, it is worthwhile to mention the activities of the IAEA and OECD/NEA and the R&D framework programmes of the European Union. ISPRA is also actively participating in the ENSREG and WENRA (Western European Nuclear Regulators Association) initiatives for the harmonization of spent fuel and radioactive waste storage safety requirements.

Based on the evaluation conducted in preparing the present report, the Italian authorities consider that the obligations of the Convention are generally met, taking into account some relevant on-going activities on the nuclear sites to treat, condition and store existing waste as well as to transfer abroad the spent fuel for reprocessing. Nevertheless, the need to improve some aspects of the existing regulations attaining the safe management of spent fuel and of radioactive waste is recognised, together with specific actions connected to the identification of a national site for the construction of a near surface storage facility. Moreover, attention is addressed to the need for increasing the human resources assigned to the different involved Organizations, and in particular to the Regulatory Authority, in the context of a more general reorganization of the nuclear sector.

Section B. Policies and Practices

Article 32 paragraph 1

In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:

(i) spent fuel management policy;

(ii) spent fuel management practices;

(iii) radioactive waste management policy;

(iv) radioactive waste management practices;

(v) criteria used to define and categorize radioactive waste.

B.1. Introduction

In relation to the obligations under article 32, paragraph 1, background information regarding the history of the national nuclear programmes will be provided in advance. In addition, due to the fact that all the Italian nuclear installations were definitively shut down many years ago, with the only exception of a few research reactors still under operation, background information on the decommissioning policy will also be provided, being spent fuel and radioactive waste policies and practices strictly connected to that.

B.2 Background historical information on national nuclear programmes

Commercial utilisation of nuclear power in Italy started in 1962 and within 1981 four nuclear power plants, namely the NPPs of Garigliano (BWR), Latina (Gas Grafite), Trino (PWR) and Caorso (BWR), and a LEU fuel fabrication installation (Fabbicazioni Nucleari S.p.A) had been commissioned.

During that period an extensive R&D programme on the nuclear fuel cycle was developed by the National Committee for Nuclear Energy (CNEN) - now the National Agency for New Technology, Energy and the Environment (ENEA) - with the operation of experimental fuel cycle installations (e.g. ITREC and EUREX).

The three NPPs of Latina, Trino and Caorso continued to be operated until 1987, when they were definitively shut down based on a governmental decision which in such a way interpreted the results of a national referendum called upon after the Chernobyl accident. The NPP of Garigliano had been already shut down in 1978, for technical reasons.

At the time the nuclear programme was cancelled, the Interministerial Committee for the Economical Planning (CIPE) required the National Electricity Company (ENEL) to start the decommissioning of the NPPs. At this aim a *"Safe storage"* (IAEA level 1- 2) option was adopted.

In 1999, in the frame of the privatisation process of ENEL, liabilities and assets connected to nuclear power were assigned to a newly established company, named Sogin (Società Gestione Impianti Nucleari), whose shareholder is the Ministry of Economy and Finance, while the strategic and operational objectives are given by the Ministry of Economic Development. The primary mission of Sogin is the decommissioning of all Italian nuclear installations according to a single step strategy, as well as the safe management of the spent fuel and radioactive waste related to those installations. A special fund allocation for financing all these activities is ensured by means of a specific levy on the price of the electricity.

B.3 Decommissioning Policy

As previously said, a safe storage option was initially selected for the Italian nuclear installations.
In 1999, the Ministry of Industry, Commerce and Crafts, now Ministry of Economic Development, issued a strategic document providing guidelines for the management of liabilities resulting from past national nuclear activities, including the previously mentioned establishment of Sogin.
Another key aspect of this new policy was the adoption of the strategy for a single step decommissioning (IAEA level 3) of all national shutdown nuclear installations, thus abandoning the previous "safe storage" option.

The directive of the Ministry of Economic Development indicated the year 2020 as the reference time to complete the decommissioning activity.

This new policy declaration was followed by the Ministerial Decree of January 26, 2000 which establishes plans and procedures for funding the decommissioning of the nuclear facilities, dismantling and waste conditioning and disposal included.

The strategy identified in the Ministry document of December, 1999 was further detailed in the Ministerial Decree of May 7, 2001, which provided also directives to Sogin for the safe management of spent fuel based on a dry storage strategy.

Later on, the Ministry of Economic Development, with the Ministerial Decree of December 2, 2004, updated the strategic objectives assigned to Sogin, and envisaged the decommissioning of all nuclear power plants and nuclear fuel cycle facilities in a 20 years time frame, provided that an adequate storage capacity of the resulting waste would be available. In the context of the on going authorization process of the NPPs decommissioning plans, the regulatory body ISPRA - at that

time APAT- has in fact taken the position that, before the start up of dismantling activities of the nuclear island, in the case of unavailability of the final national repositories, the licensee has to provide an on-site adequate interim storage capacity to be authorized.

In this new context, on the bases of the governmental decision to move into a decommissioning strategy involving the dismantling of structures and components in the span of 20 years, comprehensive plans have been submitted by Sogin to the Ministry of Economic Development for Garigliano, Caorso, Trino and Latina NPPs in order to obtain the overall decommissioning licenses, to be granted according to the provisions envisaged in the Legislative Decree of March 17, 1995, n. 230.

It is to be noted that the Italian legislation regulates the decommissioning of nuclear installations as a comprehensive set of actions where authorisations can be granted also for subsequent phases leading up to planned and definite intermediate states. Such a possibility, however, is recognised on condition that the proposed subdivision into phases is shown to be part of an overall decommissioning plan leading up to a final site release and defining, inter alia, the destination of resulting radioactive materials.

In addition, the national legislation requires that the decommissioning plans can be authorised only in presence of the results of the environmental impact assessment, which could imply a longer licensing process. On the other hand, the experience resulting from the management of NPPs permanently shutdown since many years clearly indicates some other priorities before starting the bulk of the dismantling activities. In particular, there is the need to remove the spent fuel still present in the pools and to manage (conditioning and storage) the waste already existing on the sites, generated by the past operation. To this aim, as discussed in more details in the following, activities for the management of the spent fuel and several projects aimed at the conditioning of existing waste and at the construction of temporary waste storage facilities on the sites are in progress or have been proposed. The storage facilities are in some cases also intended to accommodate decommissioning waste for the period between the completion of their conditioning process and their transfer to the national repository.

Furthermore law provisions establish the possibility to authorise specific activities related to decommissioning and dismantling before the approval of the overall decommissioning plan, when benefits to safety and radiation protection exist. On this basis, several preliminary decommissioning activities have been therefore conducted on the sites and others are in progress. These activities are mainly related to the treatment and conditioning of existing waste, to the decontamination of some systems and components, to the removal of piping isolation, to the preliminary dismantling of systems, components and structures.

They are however not related to the nuclear island whose dismantling is strictly depending on the authorization of the decommissioning plan. The regulatory review of the decommissioning plans for the four NPPs is expected to be completed by 2009.

As a historical hint, it has to be recalled that in the years from 2003 to 2006, due to the international concern on potential terrorist actions against nuclear installations, Governmental extraordinary provisions were in force to cope with the risk connected to the management of spent fuel and radioactive waste.

In particular, the Italian Prime Minister promulgated a Decree (DPCM February 14, 2003) declaring a so-called *Emergency Status* in those national territories subject to specific risks coming from the presence of radioactive material. The actions required under this status were implemented in force of Ordinances by the Prime Minister. The responsibility for the security of nuclear installations and materials, as well as for the preparation of decommissioning plans, were temporarily assigned to a Commissioner; moreover a *"unique implementer subject"* was identified, namely SOGIN, with the use of the financial resources allocated for the dismantling activities of nuclear installations.

Implementing the directives included in the Ministerial Decrees of May 7, 2001, by means of an Ordinance of the Commissioner, in summer 2003 Sogin took under his responsibility also the facilities of ENEA (Eurex and ITREC fuel reprocessing facilities, OPEC and Plutonium Laboratories at Casaccia site) and Bosco Marengo fuel fabrication facility (former Fabbricazioni Nucleari S.p.A.) with the main objectives to manage the activities related to their spent fuel, radioactive waste and decommissioning.

With regard to these facilities, till now a decommissioning plan has been presented by Sogin only for the Bosco Marengo fuel fabrication plant. The evaluation report has been issued and the final authorization is expected to be granted by the end of 2008. For the other facilities, preliminary activities related to the treatment of existing waste and to the management of the spent fuel have to be conducted. Also for these installations preliminary decommissioning activities are conducted based on specific approvals granted according to the procedure for authorising plant modifications.

B.4 Spent fuel management policy and practices

Since the beginning of its nuclear programmes, Italy had pursued the option to reprocess abroad the spent fuel produced in its NPPs.

After the political decision to stop all nuclear power activities, the policy of reprocessing the spent fuel was abandoned, even though the last shipment took place in 2005 as closure of the service agreements signed in the past.

As far as the spent fuel still present in Italy, the option of adopting an on-site dry storage was initially selected (strategic document of 1999 and Ministerial Decree of May 7, 2001). This strategy however resulted difficult to be implemented, mainly due to the strong opposition of local communities, who considered the presence of the dry stored spent fuel as an obstacle for the

release of the site. This led the Government to reopen the option of reprocessing. In this regard, the Ministerial Decree of December 2, 2004 already included directives to Sogin to perform a feasibility evaluation of the shipping abroad of the spent fuel still existing in NPPs' and in interim storage sites, for its reprocessing with the subsequent re-entry in Italy of the resulting conditioned waste.

In November 2006 an Agreement between the Italian and the French Governments regulating the transfer to France of the spent fuel present in Italy (about 235 t) was signed. On this basis, in April 2007, SOGIN signed a contract with AREVA. In December 2007, the first shipment of spent fuel from Caorso NPP to France took place.

The only fuel that will not be reprocessed is the Uranium/Thorium fuel, some 1.7 tonnes, which is stored in the ITREC experimental reprocessing facility, located in the southern Italy. For this fuel the transfer into dual-purpose dry cask storage is now envisaged.

In the wait of the transfer abroad for reprocessing, the fuel will continue to be stored in the pools as detailed in Sections D and G. Its safe management will continue to be performed according to existing licence conditions and technical specifications.

B.5 Radioactive waste management policy and practices

As previously indicated, the large part of the radioactive waste existing in Italy was produced during the operation of the nuclear installations connected to the national nuclear power programme, definitively closed in 1987. Another significant amount of waste will result from the decommissioning activities, as well as from the re-entry in Italy of the high and intermediate level conditioned waste resulting from the reprocessing.
A minor fraction to be managed is represented by the radioactive waste produced by R&D, medical and industrial uses.

At present, almost all the waste generated by the operation of nuclear installations is stored in the sites of origin.

The Ministerial Decree December 2, 2004 requested Sogin to proceed to the treatment and conditioning into certified form, in a 10 year time frame, of all liquid and solid wastes, ready to be delivered to the national storage facility.

In connection with the national waste storage facility, several preparatory studies have been conducted. It is worth to mention the so called *"Site Task Force"* coordinated by ENEA, which operated in 1999-2000 with the mandate to prepare a list of potentially national qualified sites, and

the work done by a Parliament/Region Commission charged to prepare a document aimed at proposing a possible path to identify a site and to reach the necessary consensus.

The Acts December 24, 2003, n. 368 and August 23, 2004, n. 239 issued provisions for the location of national sites to build repositories for the disposal of low, intermediate and high level waste and of high level waste. Their implementation however met strong difficulties.

It has to be noted that the Act n. 368/2003 also establishes that until the national disposal site will be operative, the local municipalities where the nuclear installations are presently located will receive compensation with an annual fee based on the radiological inventory of the actually stored spent fuel and radioactive waste. This part of the Act has been implemented, contributing in establishing a more positive general attitude of local communities.

In connection with the mentioned Agreement for the reprocessing of the 235 t of spent fuel still stored in Italy, the commitment of the Italian Government to make a national site available in due time has also to be highlighted. In fact the Agreement establishes the milestones of a national road map for enacting all the modifications to existing legislative provisions as necessary to rule the implied matter (i.e. selection of a national site for a waste storage facility) and to execute all the construction works in order to have facilities ready in time to accommodate the re-entry of the high and intermediate level waste as indicated in the agreement.

The main intermediate steps of such a road map are:

- completion of the overall delivery of the spent fuel to Areva Nc in 2012;
- review of national legislation on the matter (e.g. Law no. 368 of 2003 and Law no. 239 of 2004), assignment of duties to the Organisation responsible for the identification of the site for the national storage facility, final decision on the site by the Ministry of Economic Development and the Conference State-Regions on 2012;
- starting of operation of national facility for radioactive waste storage and final time schedule for re-entry in Italy of containers of conditioned waste of 3rd category on 2018,
- re-entry in Italy of waste packages to start on 2020 and to be completed on 2025.

In March 2008, the Ministry of the Economic Development appointed a Committee with representatives of Ministries, Regions, APAT (now ISPRA) and ENEA, having the mandate to define the procedures for identifying suitable areas and for selecting a national site for the storage of radioactive waste. A report from this Committee was issued in September 2008.

Waiting for the availability of the national storage site, the radioactive waste will continue to be stored in the nuclear installations of origin. Plans of interventions are in progress to enhance the safety level of waste by implementing specific treatment and conditioning projects and by refurbishing existing buildings or by constructing new interim storage facilities on the sites. New

facilities will also be used to ensure temporary storage capacity for waste resulting from decommissioning preliminary activities.

B.6 Radioactive waste classification and requirements

B.6.1 Radioactive waste classification

The reference technical regulatory document concerning the radioactive waste management is the Technical Guide n° 26, issued by the Italian Nuclear Regulatory Authority (now ISPRA – Institute for the Environmental Protection and Research), which defines waste classification as well as technical requirements for the waste forms and the waste packages. The complete text of the Technical Guide is reported in Annex D.

Depending on the radioisotopes characteristics and concentrations, and having as principal reference the possible options for final disposal, radioactive waste are classified into three Categories:

Category I: Waste containing radionuclides which decay in a few months to radioactivity level below safety concerns (mainly medical and research waste). *(disposal performed according to toxic waste regulations)*

Category II: Waste containing radionuclides which decay to radioactivity level of some hundreds of Bq/g within few centuries. Activity of several radionuclides shall not exceed given values. *(near surface disposal)*

Category III: Waste with long lived radionuclides, not included in category I and II; high level waste from reprocessing of spent fuel and alpha bearing waste from the fuel cycle and R&D activities. *(deep geological disposal)*

For the Category II waste, the document lists conditioning requirements and specific acceptance criteria for shallow land disposal.

Within Category II waste, two subcategories are defined:

- solid waste whose activities concentration is below established limits, as listed in Tab.1, which can be disposed of without further conditioning process;
- waste with activity concentration above the established limits which need to be conditioned and must fulfil further requirements, as listed in Tables 2 and 3, to be accepted for final disposal.

With respect to the Category III waste (spent fuel, ILW and HLW), ISPRA is planning the revision of the Technical Guide n° 26 and the issuing of specific Safety Criteria and Technical Positions relevant to the management and the interim storage of radioactive waste resulting from the reprocessing.

B.6.2 Radioactive waste operational management

In order to be suitable for disposal and/or interim storage, radioactive waste packages must fulfil a set of requirements concerning their chemical, physical and mechanical characteristics and their radionuclide content.

The requirements to be complied with by the conditioned radioactive waste of Category II, mainly finalized to the final disposal, are shown in Table 2. Furthermore, a record keeping system must be implemented such that each waste package can be uniquely identified in terms of:

- producer;
- dimension and weight;
- beta, alpha and gamma total activity;
- main radionuclides concentration;
- irradiation level at surface;
- removable surface contamination;
- waste package characteristics;
- treatment and/or conditioning process.

The waste producer is responsible for the waste treatment, conditioning and storage and, in compliance with the general requirements defined in the Technical Guide n° 8 "Quality Assurance Criteria", and with the "Qualification and Control Programme for the Conditioning of the Category II waste"(Technical Position n.1/26), must submit to the regulatory authority a complete documentation concerning:

- Quality Assurance Programme;
- Adopted criteria for the waste conditioning facility design, operation and process control;
- Results of product characterization.

The waste producer is also responsible for labelling, tracking and activity inventorying of the radioactive waste.

The quality assurance program specifies the quality control requirements for the solidification and packaging processes, and defines waste recording criteria from waste generation through final disposal. Quality assurance and quality control, as related to waste packages, include all those planned and systematic actions to ensure that the waste acceptance requirements for waste packages are met throughout the waste conditioning, storage, transportation and disposal processes.

Table 1

Limits under which a low-level waste can be disposed without a conditioning process

Radionuclides with $T_{1/2} > 5y$	370 Bq/g	(10 nCi/g)
$^{137}Cs + {}^{90}Sr$	740 Bq/g	(20 nCi/g)
Radionuclides with $T_{1/2} \leq 5y$	18,5 kBq/g	(500 nCi/g)
^{60}Co	18,5 kBq/g	(500 nCi/g)

Table 2 Technical requirements for the IInd Cat. conditioned wastes	
Compressive strength	at least 5 MPa (UNI - Destructive tests for concrete)
Thermal cycling	after 30 thermal cycles [(-40°C) ÷ (+40°C)] compressive strength must be at least 5 MPa
Radiation resistance	after an absorbed dose of 10^8 rads compressive strength must be at least 5 MPa
Fire resistance	incombustible or self-extinguishing according to the ASTM D 635-81 test method
Leaching rate	measurement according to long term leaching test
Free liquids	measurement according to ANSI/ANS 55-1
Biodegradation resistance	compressive strength >5 MPa after biodegradation test ASTM G21 and G22
Immersion resistance	compressive strength >5 MPa after 90 days of water immersion
Radionuclide concentrations	not exceeding values of the Table 3

Table 3 Radionuclide concentrations limits for the IInd Cat. conditioned wastes	
α emitters $T_{1/2}$ > 5 y	370 Bq/g
β/γ emitters $T_{1/2}$ > 100 y	370 Bq/g
β/γ emitters $T_{1/2}$ > 100 y in activated metals	3,7 kBq/g
β/γ emitters 5 y <$T_{1/2}$< 100 y	37 kBq/g
^{137}Cs + ^{90}Sr	3,7 MBq/g
^{60}Co	37 MBq/g
^{3}H	1,85 MBq/g
^{241}Pu	13 kBq/g
^{242}Cm	74 kBq/g
Radionuclides $T_{1/2}$ < 5 y	37 MBq/g

B.6.3 Criteria for solid materials release

A general exemption criterion is in force in Italy, established by Lgs. Drcree 230/1995, regarding both activity concentration and radioactive half life:

- activity concentration $\leq$ 1 Bq/g, and
- half-life $<$ 75 days.

If even one condition above is not complied with, a specific authorisation is required for the unconditional release of the materials.

The authorisation is given on a case-by-case basis provided the compliance with the basic 'below regulatory concern' criteria, fixed in the European union directives:

a) effective dose $\leq$ 10 μSv/year, and

b) either effective collective dose $\leq$ 1 man·Sv/year or demonstration that clearance is the optimised.

In order to demonstrate the compliance to the above criteria, a general reference is made to the European Commission Radiation Protection recommendations.

An example of application of the above criteria for solid materials is reported in Table B.6.1. It is referred to the conditions attached to the authorization granted by the Ministry of Economic Development (Decree of August 2000), for the undertaking of some preliminary decommissioning activities at the Caorso NPP

Table B.6.1.

Clearance levels for solid materials at Caorso authorized by the DM 4/8/2000

Nuclide	Metal scraps		Building rubble		Other materials
	Bq/g	Bq/cm^2	Bq/g	Bq/cm^2	Bq/g
^{3}H	1	10000	1	10000	0.1
^{14}C	1	1000	1	1000	0.1
^{54}Mn	1	10	0.1	1	0.1
^{55}Fe	1	1000	1	10000	0.1
^{60}Co	1	1	0.1	1	0.1
^{59}Ni	1	1000	1	10000	0.1
^{63}Ni	1	1000	1	10000	0.1
^{90}Sr	1	1	1	100	0.1
^{125}Sb	1	10	1	1	0.1
^{134}Cs	0.1	1	0.1	1	0.1
^{137}Cs	1	10	1	1	0.1
^{152}Eu	1	1	0.1	1	0.1
^{154}Eu	1	1	0.1	1	0.1
α emitters	0.1	0.1	0.1	0.1	0.01
^{241}Pu	1	1	1	10	0.1

Section C. Scope of Application

Article 3

i) This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.

ii) This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.

iii) This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.

i) The Convention applies to the safety of spent fuel, originated from civilian power reactors which operated in Italy until 1987, currently present in the Italian territory, as well as to the spent fuel still stored in experimental reprocessing facilities whose operation terminated several years ago. All the installations are in the process of being decommissioned. The Convention also applies to the spent fuel originated from research reactors.

ii) This Convention applies to the radioactive wastes arising from the past operation of nuclear fuel cycle installations and to the waste derived from the application of radioisotopes in industry, agriculture, research and medicine or arising as a result of past activities, incidents and accidents involving radioactive materials.

The Convention also applies to the radioactive wastes resulting from the spent fuel reprocessing activities performed abroad which will be returned to Italy.

iii) Italy, which is party to the Treaty on Non-Proliferation of Nuclear Weapons, does not have any radioactive waste or spent fuel from military or defence programmes, subject to the Convention.

Section D. Inventories and Lists

Article 32, paragraph 2

This report shall also include:

(i) a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

(ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

(iii) a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

(iv) an inventory of radioactive waste that is subject to this Convention that:

(a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;

(b) has been disposed of; or

(c) has resulted from past practices.

This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

(v) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

D.1 Spent fuel management facilities

The spent fuel originated from the operation of the commercial reactors, not yet transferred abroad for reprocessing, as well as that of research reactors and the spent fuel used in experimental reprocessing facilities, is currently stored in the pools of the installations described in following paragraphs.

D.1.1 Spent fuel pool of Caorso NPP

The Caorso power station, a BWR unit (882 MWe), sited in northern Italy, started its commercial operations in the year 1981, was shut down in 1986, just after the 4th refuelling, and was no more restarted due to the decision of nuclear energy relinquishment. Caorso NPP is equipped with two spent fuel pools: one (inner) close to the vessel cavity, and another (outer), connected to the previous one on the other side of the vessel cavity.

Storing capacity is as follows:

- Internal pool: 820 fuel assemblies (plus 26 defective assemblies and control rods),
- Outer pool: 1360 fuel assemblies.

with an overall capacity of 2180 normal positions.

As already mentioned in Section B.4, all the spent fuel currently stored will reprocessed abroad. In December 2007 the first shipment of spent fuel to France for reprocessing started. The total number of spent fuel assemblies stored at December, 31, 2007 was 998. All the spent fuel will be transferred abroad by the end December 2009.

D.1.2 Spent fuel pool of Trino NPP

The Trino NPP**,** a 270 MWe PWR plant, sited in northern Italy, was operated by ENEL from 1965 to 1987. A limited amount of spent fuel is still present in the spent fuel pool, a steel lined concrete structure (14,7x 10,3 x 11 m). Spent fuel racks are located inside with enough room for 162 fuel assemblies and 150 control rods or other in core components.

At present, in the pool, there are 47 spent fuel assemblies (8 MOX and 39 UO2).

D.1.3 AVOGADRO AFR Facility

AVOGADRO is a spent fuel storage facility away from reactors placed at Saluggia, sited in northern Italy.

It was set up in the period 1977-1982 from a general structural reset of a previous research reactor of the MTR kind called “AVOGADRO RS-1“.

AVOGADRO began storage operation on January, 1st 1984.

The AVOGADRO site includes a central storage building and four auxiliary service buildings.

The storage building is focused on its storage pool, where the spent fuel lays in several racks. During stationary storage, the fuel is shielded by a height of water of 6 m, which reduces to a minimum of 3 m during fuel handling operations for shipment.

The fuel temporary storage service is presently supplied to SOGIN, the owner of the spent fuel unloaded from Trino and Garigliano power plants.

Large part of the spent fuel was transferred to UK for reprocessing in the period 2003-2005 (see Figure 2). The spent fuel remaining in the pool was to 49 Trino NPPs elements and 63 MOX Garigliano NPP elements.

During 2007, the spent fuel stored at the EUREX fuel pool, i.e. 52 special (cross shaped) Trino NPP spent fuel assemblies and limited amount of Garigliano NPP (48 pins) and research reactors spent fuel (10 pins of MTR Petten and one rod from European JRC), was transferred to the Avogadro facility.

Figure 2: Spent fuel transportation from Avogadro AFR for reprocessing abroad

D.1.4 Spent fuel pool of the ITREC facility

ITREC**,** a pilot reprocessing facility located in the Southern part of Italy, was operated by ENEA in the '70 (uranium-thorium cycle fuels from the US Elk River reactor). After having reprocessed 20 Elk River spent fuel elements, during the commissioning tests, the operation was stopped. 64 spent fuel assemblies are stored in the pool (10,7m x 3m x 7m). The pool has a steel liner and a water cleanup system, to maintain the required chemical, physical and radiological conditions.

Fuel elements come from the ELK RIVER US reactor, where they were burned before 1967. Each fuel assembly is stored in leak tight stainless steel bottles, located along the pool walls.

D.1.5 Spent Fuel in research reactors

Italy operates also research reactors and the only ones which store spent fuel on site are the two TRIGA reactors of ENEA Casaccia Research Centre (Rome) and the LENA Reactor operated by the University of Pavia.

D.2 Spent Fuel Inventory

D.2.1 Spent Fuel currently present in Italy

Total inventory of the spent fuel stored in Italy on December, 31, 2007amounts to a total of about 230 tHM, as detailed in Table D.1

Table D.1 - Total inventory of the spent fuel stored in Italy				
Facility	**Fuel Type**	**N° of fuel elements**	**Mass (tHM)**	**Activity (TBq)**
AVOGADRO AFR Facility	PWR - TRINO UO_2	49	15,03	115.000
	BWR-GARIGLIANO MOX	63	12,88	56.700
	PWR - TRINO cross UO_2	52	2,02	15.800
	BWR-GARIGLIANO UO_2	48 pins	0,07	117
	MTR Petten	10 leaves	$9\ 10^{-5}$	4,01
	European JRC	1 rod		0,33
CAORSO	BWR-CAORSO UO_2	998 (+6)	184,22	1.240.000
TRINO	PWR - TRINO UO_2	39	12,05	48.600
	PWR - TRINO MOX	8	2,46	36.100
ITREC	ELK RIVER U-Th	64	1,68	4.690
OPEC-1		566 pins	0,12	4
RR Casaccia	Triga	12	0,002	
RR LENA	Triga	7	0,001	4,6
TOTAL		**-**	**230,5**	**1.517.020**

D.2.2 Spent fuel already sent abroad for reprocessing

Since the beginning of nuclear activities, Italy has pursued the reprocessing option using foreign reprocessing facilities. In this connection “service agreements” contracts were stipulated by ENEL.

After the political decision to stop all nuclear power activities, no new reprocessing agreements were established.

Up to 2005, the following amounts of spent fuel had been transferred abroad for reprocessing:

- 963,2 tHM before 1978. In this case, the radioactive waste resulting from reprocessing will not return to Italy;
- 678 tHM after 1978 until 2005. In relation to this amount, it is envisaged the return to Italy of radioactive waste resulting from reprocessing.

As already mentioned, In April 2007 SOGIN signed a contract with AREVA for reprocessing of the spent fuel still present in Italy (about 235 tHM), with the only exception of the Elk river spent fuel present in the ITREC facility. In December 2007, the first shipment of spent fuel from Caorso NPP to France started.

The transfer of the spent fuel abroad is expected to be completed by 2012.

D.3 Radioactive waste management facilities.

As already mentioned in Section B, all the radioactive waste originated from the operation of NPPs and experimental fuel cycle facilities are generally stored in the installations of origin, which were shut down several years ago and which are currently in the process of being decommissioned. Radwaste from medicine, industry and research activities are collected for temporary storage by NUCLECO and other private operators.

The installations were Radioactive Waste is currently stored are discussed in the following paragraphs.

D.3.1 Nuclear Power Plants

At present in the **Caorso** NPP the radioactive waste (about 2300 m^3, 1900 m^3 of which is still to be conditioned) is stored in the three storage facilities of the NPP site (see Figure 3). 1250 m^3 of operational radioactive waste (resins and sludge) have been treated in the past with urea-formaldehyde but, due to the presence of significant amount of free (corrosive) liquids and due to a compressive strength significantly lower than the required limit of 5 MPa, a new conditioning campaign has to be performed, as requested by the Regulatory Authority. An international tender for the supply of a system for the thermal treatment and conditioning of operational radioactive waste is under way.

Figure 3: Caorso – ERSBA 2 storage facility

In **Trino** NPP, the radioactive waste (about 1000 m^3, 280 m^3 of which is still to be conditioned) is at present stored in the two storage facilities of the NPP site. Some semi-liquid radioactive waste (resins and sludges) have still to be conditioned.

The **Garigliano** 150 MWe BWR, sited in Southern Italy, was operated by ENEL from 1963 to 1978. All spent fuel has been removed from the plant. At present the radioactive waste (2625 m^3, 1100

m^3 of which is still to be conditioned) is stored in different buildings of the NPP site. The refurbishment of the building dedicated to the Emergency Diesel is in progress to adapt the building as an interim storage facility

The construction of a new interim storage facility is also in progress and is expected to be completed in two years. These facilities will host large part of the waste existing in the site. in improved safety conditions, also including the waste currently embedded in ditches realised in the '60, when this practise was accepted.

The 153 MWe GCR of **Latina**, located in the Central Italy, was operated by ENEL since 1962 until 1987. All spent fuel has been removed from the plant; the primary circuit has been filled with dry air, and blowers and portions of the primary circuit outside the reactor building have been dismantled. (see Figure 4).

At present, the radioactive waste (about 1220 m^3, 900 m^3 of which is still to be conditioned) is stored in different facilities of the NPP site.

A new waste storage facility is under construction. It is expected to host the waste resulting from a project for the extraction and conditioning of the resins and sludges already licensed and from a project for the extraction and conditioning of the Magnox residues (splitters) currently under regulatory evaluation.

Figure 4: Latina NPP – Preliminary dismantling activity of the primary circuit

D.3.2 Fuel Cycle facilities

AVOGADRO

In the facility there are about 50 m^3 of operational radioactive waste to be conditioned.

Bosco Marengo

Bosco Marengo (formerly Fabbricazioni Nucleari), an industrial scale plant for LWR fuel fabrication located at Bosco Marengo (AL), was operated by FN from 1973 to 1995. Most of the nuclear material has been sold out and the operational dry radioactive wastes have been super compacted. The authorisation of the decommissioning plan by the Authority is going to be granted.
In the facility there are also about 290 m^3 of technological radioactive waste (60 m^3 of which still to be treated).

EUREX

The main current task of EUREX facility, located in the Northern part of Italy, is to treat and condition liquid wastes produced for the reprocessing of MTR and CANDU fuel (some 120 m^3 ILW and some 100 m^3 LLW). This waste is expected to be conditioned by cementation. Qualification of the cementation matrix and licensing process of the cementation facility (called CEMEX), as well as of the storage facility to accommodate the resulting conditioned waste, are in progress. In the meanwhile, in order to enhance the safety conditions of the liquid waste storage, the construction and commissioning of new storage tanks (see figure 5) system was completed in 2007. The transfer of the liquid waste to the new tanks is underway.
On the site there are also some 1500 m^3 of 2^{nd} and 3^{rd} Category solid waste (of which 1300 m^3 is still to be conditioned). A new storage facility to accommodate these waste is expected to be licensed in a few months.

Figure 5: EUREX – One of the tanks of the new storage facility for High level Liquid Waste during the construction

ITREC

The radioactive waste present on the site originates from the experimental reprocessing activities performed on the plant in the 70's, as described in previous section.

All the liquid waste (LLW, ILW and HLW) produced by the operation has been cemented by the so called SIRTE campaigns (see Section H) and the present task is to solidify the 3,3 m^3 of U-Th solution final product, to manage the historical waste and to transfer into dry storage the 64 spent fuel elements still stored in the pool.

On the site, also some 3500 m^3 of 2^{nd} and 3^{rd} Category solid waste (of which 2200 m^3 of VLLW and 620 m^3 of L-ILW is still to be conditioned) is stored.

The construction of a new storage building (authorization granted on 2003 – see Figure 6) to allocate the final packages produced by the SIRTE campaigns is completed.

An extensive review of the existing licensing situation of the installation was recently carried out and an updated set of licensing conditions for regulating activities preliminary to decommissioning has been issued.

Figure 6: ITREC – The new storage facility

PLUTONIUM pilot MOX fuel fabrication facility, located at Casaccia Research Centre, was operated by ENEA from 1968 to 1974 (process development) and from 1977 to early eighties (MOX fuel fabrication experimental campaigns). In the near future, the treatment of many radioactive waste streams (1 m^3 of plutonium bearing liquids) will be carried out.

OPEC 1, a post-irradiation examination facility, also located in the Casaccia Research Centre, was operated by ENEA from 1962 to 1990. Activities were carried out on metal uranium and uranium oxide in a series of hot cells. From 1992 to 1998 activities on spent fuel scraps encapsulation and hot cell decontamination have been carried out. The main decommissioning issue is the repackaging of spent fuel scraps. Moreover, an activity is under regulatory assessment for the dismantling of three tanks that were used for the collection of the liquid waste of the facility. Such tanks were located in underground concrete structures.

D.3.3 Other facilities

European Joint Research Centre

A full description of the different facilities in the JRC Ispra is expected to be provided in the EURATOM report under the Joint Convention.

The Joint Research Centre of Ispra is currently undertaking a global Decommissioning and Waste Management Programme aimed to dismantle the nuclear installation that operated in the Centre as well as to perform a complete characterization and conditioning of the radioactive waste produced in the past activities. An interim storage on the site is also envisaged and its design is in progress.

NUCLECO (Nuclear Ecology)

Nucleco company, owned by ENI (60%) and ENEA (40%), was created in 1980 with the mission to operate the waste facilities sited in the Casaccia centre. In September 2004 the ENI part was transferred to SOGIN.

In addition to the management of the waste produced in the Research Centre, today Nucleco is the Italian operator for collection, transportation, storage, treatment (mainly by supercompaction) and conditioning of 2nd Category waste produced by the industrial, medical and research processes in the context of the Integrated Service coordinated by ENEA.

The Integrated Service is a special technical service that ENEA offers to small producers of radioactive waste (medicine, industry, agriculture, research and education). ENEA has entrusted NUCLECO with the operative and commercial task, and offered to NUCLECO the access to use specific Casaccia facilities and infrastructures. The two parties drew up a special agreement describing mutual duties and responsibilities.

Integrated Service has also collected disused sealed radioactive sources with Cs-137 and Co-60 and small quantities of Ra-226, no longer used in medical therapy. Except this last type of waste, ENEA becomes owner of the radwaste collected, and will take care of the final disposal.

Operators in the industrial and medical sector

In Italy there are also other operators for collection and storage of limited quantities of industrial and medical wastes (e.g. Protex, Campoverde and Sicurad).

D.4 Radioactive waste inventories.

The overall national inventory of the radioactive waste, spent sources and spent fuel presently stored in the Italian Nuclear Installations in Italy is continuously updated by ISPRA. The Data Base is able to present the data in terms of volumes, mass, activity and physical status.

The inventory of the radioactive waste currently present in Italy is as follows: about 26.000 m^3 of Ist and IInd Category waste (4.000 m^3 of VLLW and 22.000 m^3 of LLW-SL), and 1400 m^3 of IIIrd Category waste (LLW-LL and HLW). This inventory includes the wastes of European Joint Research Centre. Details are presented in Table D.2

To this amount it should be added some 30.000 m^3 of L-ILW foreseen from decommissioning activities and the radioactive waste expected to return in the future to Italy as resulting from the reprocessing of spent fuel.

Table D.2 - Inventory of the radioactive waste and spent sources stored in Italy					
Facility	I & II cat. (VLLW - LLW)		III cat. (ILW – HLW)		Spent sources
	Volume (m^3)	Activity (GBq)	Volume (m^3)	Activity (GBq)	Activity (GBq)
Caorso	2.419 (82)*	1.728			0,025
Garigliano	2.840 (43)	425.040			
Latina	1.295 (80)	18.390	12,6 (100)	7.130	
Trino	1.067 (33)	6.337	23,5 (100)	7.720	
Eurex	1.923 (91)	46.202	359 (95)	4.544.852	115
Itrec	3.160 (74)	251.671	13,5 (100)	110.655	22
OPEC 1	10 (100)	n.a.			1.768
Impianto Plutonio			83,7 (100)	20.913	
Boscomarengo	309 (25)	32			
Avogadro	64 (100)	567			
Nucleco	6.573 (31)	4.107			682.620
European JRCC	1.797 (100)	9.590	762 (100)	43.500	130.000
Others **	4.519	6.578	159	8.816	423.465
Total	**25.985**	**770.242**	**1.413**	**4.743.586**	**1.237.990**

* % of unconditioned waste
** includes operators in medical and industrial waste as well as research organizations.

D.5 Nuclear facilities in the process of being decommissioned

As already said in section B3, all the Italian NPP's were definitely shut down several years ago and Decommissioning Plans have been submitted for authorisation. The authorisation processes, including the Environmental Impact Assessment, are in progress. Preliminary or partial decommissioning activities have already been performed or are underway on the basis of specific permissions.

As far as the fuel cycle facilities are concerned, they were also shut down several years ago. At present their main activities are addressed to the safe management of spent fuel and radioactive waste present on the sites. For EUREX, ITREC, PLUTONIUM and OPEC 1 the decommissioning is in the planning phase, for Bosco Marengo the authorisation is expected to be granted soon.

Section E. Legislative and Regulatory System

Article 18. Implementing measures

Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

The Government, the Ministry of Economic Development, the Ministry of Environment, together with other relevant Institutes and Ministries, according to their respective competencies and duties, with the technical assistance of the Institute for the Environmental Protection and Research – ISPRA (formerly APAT), continue to develop, as in the past, legal, regulatory and administrative provisions related to the safe management of radioactive waste and spent fuel, taking into account contributions from national stakeholders.

Based upon the existing legislative framework, as described under article 19, the licensing procedures allow to apply the international experience and practices as codified in the IAEA standards, which are always considered in the authorization and regulatory supervision of any activity related to spent fuel and radioactive waste management.

Furthermore, ISPRA, as a fundamental task of its mission, is continuously performing reviews and inspections in the nuclear installations where spent fuel and radioactive waste are stored and/or managed. This activity will further increase in the future, when decommissioning and waste conditioning activities will be extensively performed in all nuclear facilities.
The construction of interim storage facilities in the different site is authorised on the bases of a comprehensive regulatory review aimed at ensuring a substantial improvement of waste storage safety conditions for the coming years, until the national storage facility will be into operation. In the context of the mentioned regulatory review the compliance with up-to-date safety principle and criteria for waste storage is verified.
ISPRA is also implementing a plan to update existing technical guides, related to the management of radioactive waste and to issue new guides on waste storage facilities.

18.1 Assessment of compliance

The current national legal framework related to safety and radiation protection at nuclear installations can be considered at present adequate. Nevertheless, a proper integration of the legal and regulatory framework is foreseen in the near future, in particular as far as the final phase of the waste management is concerned, together with an updating of the pertaining Technical Guides.

Article 19. Legislative and regulatory framework

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.
2. This legislative and regulatory framework shall provide for:
   (i) the establishment of applicable national safety requirements and regulations for radiation safety;
   (ii) a system of licensing of spent fuel and radioactive waste management activities;
   (iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;
   (iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;
   (v) the enforcement of applicable regulations and of the terms of the licences;
   (vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.
3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

19.1 Legislative and Regulatory Framework

The present Italian legislative and regulatory framework related to nuclear and radiation safety is the result of an evolution of rules and standards that begun in the early 60^{ties} and that took into account the experience of licensing and operation of NPPs of different types and generations and of other nuclear installations. The system therefore covers also the government of safety of spent fuel and radioactive waste management.

The Italian regulatory system is made up of three types of rules of different legal force depending on their origin:

- legislation proper and governmental or ministerial decrees;
- technical guides;
- technical standards.

a) Legislation and ministerial decrees.

In the Italian system the source of legally binding rules must be either an act of Parliament (statute) or a Legislative Decree; the Government can issue governmental or ministerial decrees binding in law. The practice of laying down numerical limits and minute regulations in decrees issued by the Executive is very frequent in particular areas relative to Radiation Protection. An important feature of legally binding rules concerning Safety and Radiation

Protection in Italy is that contravention to obligations by operators and/or users constitutes a misdemeanour and entails a penal sanction; compliance can be enforced by means of criminal proceedings after due process of law.

The main corpus making up, inter alias, the Italian system are itemised below, as regards Statutes and Legislative acts:

- Act no. 1860 of 31 December 1962 published in the Italian Republic's Official Journal no. 27 of 30 January 1963, as amended by the President's Decree no. 1704 of 30 December 1965 (Italian Republic's Official Journal no. 112 of 9 May 1966) and by the President's Decree no. 519 of 10 May 1975 (Italian Republic's Official Journal no. 294 of 6 November 1975).
- Presidential Decree no. 185 of 1964: *"Safety of plants and protection of workers and general public against the risk of ionising radiation associated to the peaceful use of nuclear energy"*, implementing the first EURATOM Directives and replaced by the Legislative Decree no. 230/1995, described below.
- Legislative Decree no. 230 of 17 March 1995 published in the Supplement to Italian Republic's Official Journal no. 136 of 13 June 1995, which has been in force in Italy since January 1st 1996. Legislative Decree no. 230 implements six EURATOM Directives on radiation protection (EURATOM 80/836, 84/467, 84/466, 89/618, 90/641 and 92/3) and refers for detailed regulations and quantitative values to a series of Government and Ministerial Decrees. Decree No. 230/95 regulates radioactive waste disposal in a more precise manner than DPR No. 185/64. In general, Article 102, establishes that waste must be managed in accordance with the rules of good practice and the instructions set out in the disposal licence; also, any person producing, treating, handling, using, dealing in or storing radioactive substances must conduct a whole series of assessments concerning the disposal of solid, liquid or gaseous radioactive waste in order to ensure that the limits and the other conditions governing disposal into the environment are observed [Article 103]. Waste storage facilities included in nuclear installations are licensed together with the installations themselves. In the other cases, radioactive waste storage facilities must be licensed by the authorities identified by regional legislation, or by the Minister for the Economic Development made in consultation with the Minister for the Environment, the Ministers for Labour, Health & Social Affairs, on the basis of technical views of the ISPRA, according to size.

  Decree No. 230 has also incorporated Euratom Directive 92/3 concerning the transfer of waste. In particular, Article 32 requires prior authorisation of transfer, import, export and transit of radioactive waste, in compliance with the Directive. This authorisation is the responsibility of the authorities who have jurisdiction over the activities with which the wastes are involved. The relevant procedure is laid down in a Decree of the Minister for Economic Development. The Article 32 and related ministerial decree are

going to be amended in order to implement the Directive 2006/117/Euratom in the Italian legislation.

- Act no. 393 (1975), which contains Administrative rules on the selection of the sites for NPPs.
- Presidential Decree no. 1450, which contains requirements and procedure for the acquisition of the operational personnel licences (1970).
- Legislative Decree no. 241 of 26th May 2000, which has transposed directive 96/29/Euratom laying down basic safety standards for the radiation protection of workers and the public; the standards laid down in the directive incorporate the 1990 Recommendations of the International Commission on Radiation Protection (ICRP) into EU radiation protection legislation. Decree no. 241 has modified and integrated Legislative Decree no. 230 of 1995; the latter constitutes, as described above, the main piece of legislation laying down radiation protection requirements for workers and the public.
- Besides, Legislative Decree no. 257 of 9th May 2001 was promulgated in order to modify certain details in Legislative Decree no. 241 of 2000 concerning requirements for notification and authorisation of non nuclear installations where ionising radiation sources are used for industrial, research and medical purposes.

Legislative Decree no. 230 of 1995, as modified as specified above, now contains thirteen Technical Annexes which make almost all of the provisions applicable as of 1st January 2001, although some ministerial decrees enacting some of the provisions of the Legislative Decree have still to be published.

The main functions of the Regulatory Body, as better identified under article 20, were in the past entrusted to the Directorate for Nuclear Safety and Health Protection (DISP), originally part of the National Committee for Nuclear Energy (CNEN) changed in ENEA (Agency for new technologies, energy and environment) in 1982. In 1994 the functions of DISP, together with its staff, technical structures, equipment and financial resources, were transferred to ANPA, a new Agency for the protection of the environment. That transfer definitively resolved the problem of the independency and separation of the Regulatory Body from any function of research, development and promotion of nuclear energy, which were performed by other units of ENEA. Moreover, ANPA was under the administrative surveillance of the Ministry of the Environment and no longer under the Ministry of Industry, now Ministry for the Economic Development, which gives the strategic address and surveillance over the public utility.

In 2002 ANPA was merged in a new Agency, APAT, with the governmental Technical Services competent for geology, hydrology and seismology.

Finally, in 2008, the Institute for the Environmental Protection and Research (ISPRA) has been established through the merging of APAT and two other minor institutes, working in the areas of marine research and wildlife.

The Acts of legislative force on the institution and subsequent re-organisations of the Regulatory Body are listed below:

- **Act no. 933 (1960)**

  On Establishment of the National Committee for Nuclear Energy (CNEN)

- **Act no. 84 (1982)**

  Establishment of the State Agency for new technologies, energy and environment (ENEA)

- **Act no. 85 (1982)**

  With specific provisions to ensure independency of DISP in the frame of ENEA

- **Act no. 61 (1994)**

  Establishment of the National Agency for the Environmental Protection (ANPA).

- **Legislative Decree n° 300 of 1999 and President of the Republic Decree n°207 of 2002**

  Establishing APAT, by merging ANPA with other national technical services.

- **Act no. 133 (2008)**

  Establishment of the Institute for the Environmental Protection and Research (ISPRA).

b) Technical guides

The issuing of technical guides, previously carried out by the Directorate for Nuclear Safety and Health Protection (ENEA-DISP), is now assigned in Law to the ISPRA by Article 153 of the Legislative Decree no. 230/1995.

Technical guides contain recommendations and are a tool to implement rules of good practice. Some thirty technical guides have been issued on Safety and Radiation Protection matters ranging from procedural to detailed technical guidance.

In addition, the existing wealth of international recommendations, such as IAEA (International Atomic Energy Agency) and ICRP (International Committee on Radiological Protection) publications, has been largely used in the Italian system.

The list of the most important Technical Guides is reported in Annex B. It is worthwhile pointing out that one of the Technical Guides (TG N° 26) is related to safe management of radioactive waste reflecting the fact that, since 1987, when it was issued, the importance of defining specific requirements to be fulfilled in this area by licensees was recognized. An updating of this guide, taking into account the experience and the lessons learned in the recent times, is in progress. A first issue will be related to storage requirements.

c) Technical standards

Technical standards are mainly issued by UNI (Ente Nazionale Italiano di Unificazione) the Italian National Standards Body. Selected standards related to decommissioning and to waste management are listed in Annex B.

Other standards often used were those published by CEI (Comitato Elettrotecnico Italiano) and by ISO (International Standards Organisation).

Standards documents are developed within expert groups and approved by the Technical Committees.

Moreover, in the design, construction and operation of nuclear installations and radioactive waste facilities, other rules apply, such as those concerning fire fighting, pressure components integrity, labour health.

Some wider description of the Italian legislative and regulatory framework relevant to the Convention is given in Annex C. In the following the main outlines are presented.

19.2.1 National safety requirements and regulations for radiation safety

Information under article 19.1 and in Annexes B & C provide a comprehensive picture of the national safety requirements and regulation for radiation safety.

19.2.2/3 Authorization System of nuclear installations

Article 6 of Act n. 1860/1962 establishes that the operation of nuclear installations has to be authorized by the Ministry of Industry (now Ministry of Economic Development). Authorization is granted according to provisions established in Chapter VII of the Legislative Decree n. 230 of 1995, based upon the technical advice of ISPRA, to be considered binding, which is formulated as result of the assessment of the safety case filed by the applicant.

With regard to the licensing of spent fuel and radioactive waste related activities, the following different cases can be pointed out as existing in the national facilities, together with the specific applicable legislative provision:

a) Storage of spent fuel in the pools of the nuclear installation where it was generated or used for reprocessing purposes;
b) Storage of spent fuel in facilities specifically devoted to the purpose;
c) Treatment and storage of radioactive waste in the facilities where it was generated;
d) Treatment and storage of radioactive waste in facilities under decommissioning;
e) Storage of radioactive waste in facilities specifically devoted to the purpose.

In the case of spent fuel stored in the pools of the nuclear installation where it was generated, or used for reprocessing purposes, its safe management is regulated by specific conditions attached to the licence and by the technical specifications defined for the nuclear installation.

Facilities specifically devoted to the temporary storage of spent fuel need to be authorised according to the provisions of Article 52 of Legislative Decree n.230/1995, which requires a specific authorization to be granted by the Ministry of Economic Development, based upon the technical advice of ISPRA.

Activities connected with the treatment and the storage of radioactive waste in the facilities where it was generated are regulated by specific conditions attached to the licence and by the technical specification of the facilities. In the case of new and relevant waste management activities to be performed on the site (for example the construction of a temporary storage facility) they are authorised following the legislative procedure established for the authorization of plant modifications of nuclear installations, as defined by Article 6 of Act n. 1860/1962 and detailed in the ISPRA Technical Guide n° 2 *"Authorization procedure for nuclear installations modifications".*

Any management and storage activity of radioactive waste generated during decommissioning requires a specific approval by the Regulatory Authority in the frame of the overall authorization of the decommissioning plan which is granted in compliance with the procedure defined in Articles 55-56 of the Legislative Decree n. 230/1995.

For radioactive waste storage facilities, different from nuclear installations, a specific authorization is also required. In particular, in the case of installations for temporary storage or for disposal of radioactive wastes their authorization is required under Article 33 of Legislative Decree n° 230/1995. The authorization is granted by the Ministry of Economic Development, in agreement with other involved Ministries, regional administrations and based upon the technical advice of ISPRA. For minor facilities, authorization is granted by local authorities established by each Region.

The most important requirements for storage facilities are identified in Technical Guide n. 26, issued by the Regulatory Body. As already mentioned, an updating of this guide is in progress taking into account lessons learned and recent regulatory experiences.
A first issue related to storage requirements is expected in the next months and takes into account IAEA safety guides requirements and WENRA harmonised "reference levels"

As far as the radioactive waste management associated with decommissioning activities are concerned, Articles 55-56 of Chapter VII of the Legislative Decree n. 230 of 1995 establish that a decommissioning plan of nuclear installations has to be approved taking into account the proper management of the radioactive wastes already existing on the sites and of all the wastes which will result from the dismantling activities. The approval is granted by the Ministry of Economic Development based upon the technical advice of ISPRA and taking into account observations expressed by different involved Ministries as well as relevant Regional authorities. A separate Environmental Impact Assessment procedure is performed under the coordination of the Ministry of Environment. Furthermore, any specific management and storage activity of the radioactive waste

which will be generated during decommissioning will require, on the bases of specific decommissioning licence conditions, the approval by the Regulatory Authority.
In addition to the above mentioned basic legislative provisions regulating the licensing process applicable to spent fuel and radioactive waste management activities, in early 2003, in order to enhance the level of protection of the radioactive materials present in the national installations in view of the increased risk of terrorist actions the Italian Government established some extraordinary provisions.
In particular, as already indicated under Section B of this report, the Italian Prime Minister issued a Decree (DPCM February 14, 2003) declaring a so called *emergency status* in those national territories subject to specific risks coming from the presence of radioactive materials. The actions required under this status are implemented in force of Ordinances by the Prime Minister. Among the relevant decisions taken in this frame, the transfer of the licenses of all the interested installation to a unique "Implementer" subject (i.e. SOGIN) has to be highlighted.
Main objectives of the Prime Minister Ordinances were to ensure the adoption of provisions aimed at enhancing the level of protection of most vulnerable installations, as well as to further improve the safety of radioactive waste storage facilities with prompt and homogeneous interventions.

The main tools to effectively reach those objectives were identified in the centralization of the decision making process and in the simplification of authorization procedures. For such a purpose, the Prime Minister delegated his own power to a Commissioner who, under the control of a Scientific Committee, was charged to issue specific Ordinances requesting the Implementer to perform the necessary actions, primarily in the area of security. The subsequent Ordinances identified plans of interventions establishing urgent provisions for enhancing both the physical protection of the installations, with particular regard to the spent fuel and the radioactive waste.

The above provisions remained in force up to the end of 2006.

19.2.4 Institutional Control and Regulatory Inspection

With regard to the system of institutional control and regulatory inspection the Legislative Decree n. 230 of 1995 establishes that regulatory inspection activity on the general compliance with the provisions established by the Decree is performed by APAT (now ISPRA) Inspectors. On the bases of its institutive Act, ISPRA is entitled to perform any supervision activity which deems necessary and relevant to the nuclear safety and the radiation protection of the workers and the population.

19.2.5 Enforcement and sanctions system

Enforcement of applicable regulations and of licence conditions is ensured on the basis of Article 10 of Legislative Decree n° 230 of 1995 and taking into account the sanction system, as established in Chapter V of the Act n. 1860 and in Chapter XI of Legislative Decree 230/1995, give to ISPRA Inspectors the authority to request any information they deem relevant to ascertain the compliance of the activities performed at the nuclear installations with the requirements established

in the Legislative Decree and in the licence conditions. Inspectors are entitled to report any violation to the public attorney of the jurisdiction the nuclear installation belongs to.

Moreover, Article 58 of Legislative Decree n. 230/1995 establishes the procedure according to which, in case of non compliance with the conditions attached to the licence, the Ministry of Economic Development can suspend or revoke the licence or the authorization.

19.2.6 Assignment of responsibilities

Section B of this report, related to policies and practices, describes the responsibilities assigned to SOGIN S.p.A. as implementer for activities in particular related to:

- Treatment and conditioning into certified form of all liquid and solid wastes, ready to be delivered to the national repository.
- Perform all the actions needed for managing spent fuel.
- Contribute to the decommissioning of all nuclear facilities owned by other licensees.
- Implement the single phase decommissioning strategy in all nuclear installations, reactors and fuel cycle facilities in a 20 years time frame, pending the realization in due time of the temporary and final repository of radioactive waste.

Responsibilities assigned by the law to the Ministry of Economic Development, ISPRA and to other governmental bodies have been described in the previous paragraphs of this section.

19.2.7 Assessment of Compliance

On the bases of the information included in the previous paragraphs of this section of the report and under the following article 20, it is concluded that Italy has an adequate legislative and regulatory framework to ensure the safe management of spent fuel and radioactive waste.

Article 20. Regulatory Body

1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.
2. Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation.

20.1 Authorities responsible for the application of the legislative framework

The key regulatory functions (rulemaking, licensing, assessment, inspection and enforcement) related to nuclear safety and radiation protection matters, including also the safe management of spent fuel and radioactive waste, and decommissioning, are mainly exploited in Italy by the following bodies:

a) The Ministry of Economic Development, in this report defined as the Licensing Body, is the authority which grants the licence/authorization for nuclear activities (from the design and construction to the decommissioning and waste disposal) and for major practices involving the use of ionising radiations. Authorizations are granted on the bases of the technical advice, to be considered binding, provided by the Regulatory Authority ISPRA – Institute for the Environmental Protection and Research (former APAT – National Agency for Environmental Protection and Technical Services). For specified activities, the authorisation shall take also into account environmental assessment provided by the Ministry of the Environment. Also the advice by the Ministries for the Interior, Labour, Health and Social Affairs and by the Region where the installation is located shall be required shall be required.

b) ISPRA (formerly APAT), in this report defined as the Regulatory Body, is the Governmental Institute entrusted with the role of regulatory authority responsible for the assessment and the inspection activities on nuclear installations, as well as for approving detailed designs or activities related to the construction of nuclear facilities, which are part of the general construction licence granted by the Ministry of Economic Development. ISPRA operates under the aegis the Ministry of Environment. Any licence/authorization issued by the Ministry of Economic Development is based on the technical advice and specifications formulated by ISPRA, which supervises, throughout its inspection activity, the compliance with the requirements established in the law, with the technical specifications issued in the Ministerial authorization an decrees and with the conditions attached to its approvals. ISPRA inspectors are entitled by the law with the proper authority to request the licensee any information deemed necessary to ascertain compliance with legal requirements and licence conditions.

In case of infringements, ISPRA inspectors report to the Public Attorney of the jurisdiction the installation belongs to and have the authority to establish specifications in order to interrupt any violations in place. ISPRA is also the competent body for giving support to the Governmental rule-making function in the field of nuclear safety and radiation protection and it is also entitled to issue technical guides pertaining the different operational aspects of the regulatory process.

A "Technical Commission on Nuclear Safety and Radiation Protection" is in place to formulate an independent technical advice to ISPRA in the course of the process for assessing license applications. The Technical Commission is composed of experts designated by various Ministries (Interior, Health, Environment, Territory and Sea, Economic Development, Labour, Health and Social Affairs and Infrastructure), by ISPRA, by ENEA and by the Regions where the nuclear activities are exploited. For matters under the competences of other Public Scientific Organizations (e.g. Italian National Institute of Health, National Research Council), the chairman of the Technical Commission can appoint and invite to seat in the Commission experts designated by the respective Organization.

The Regulatory Body functions in ISPRA are performed by a specific Nuclear Department to which the Institute assigns, with high priority, human and financial resources. The recruitment of new personnel to ensure the continuity and the effectiveness of regulatory functions in the future is an issue expected to be addressed in the frame of the reorganisation of the nuclear sector in Italy.

20.2 Independence of the regulatory function

The main national nuclear Operator involved in the decommissioning and in the spent fuel and radioactive waste management is SOGIN whose sole shareholder is the Ministry of Economy and Finance, while the strategic and operational aims are given by the Ministry of Economic Development.

SOGIN S.p.A. has the responsibility for

- the management of the nuclear spent fuel, treatment and conditioning of radioactive waste stored at Italian nuclear facilities;
- the decommissioning of Italian nuclear facilities,

As indicated under art.19 of the Convention authorisations are granted and can be revoked by the Ministry of Economic Development on the basis of the independent, binding technical advice of ISPRA. The other regulatory functions, such as the assessment activity during the licensing process and the inspection activity to supervise the compliance with law and the authorization conditions, are performed by ISPRA itself, which also grants directly the approval for the detailed designs and plans.

ISPRA is a Governmental Institution endowed with a full autonomy under the administrative aegis of the Ministry of Environment completely separate from other body or organization concerned with the promotion or utilization of nuclear energy, as well as with the radioactive waste and spent fuel management activities. Licensees have no voice in ISPRA internal organisation, finance matters, policy and in the decision making process of the Institute; moreover the Institute's budget is mainly funded by the State.

20.3 Assessment of Compliance

On the bases of what is reported in this section it may be concluded that Italy has sufficient provisions to fulfil its obligations under Art. 20 of the Convention.

Section F. Other General Safety Provisions

Article 21. Responsibility of the licence holder

1. Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

2. If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.

21.1 Responsibility of the licence holder

According to the Act no. 1860/1962 and the Presidential Decree no. 519/1975, the primary responsibility for safety is assigned to the operating organisation; in the quoted legislation it is specified that such a responsibility is extended from the nuclear facility to the nuclear fuel.
Therefore the operating organisation is fully responsible of all the activities performed during design, construction, commissioning and operation having direct influence on safety.

Furthermore, all the activities involving the management of the spent fuel and radioactive waste require an authorization.
The regulatory system in place also ensures that appropriate supervision activity is exploited to verify that the license holders meet their responsibility.

The system of controls provided for in the Italian rules is based upon the following three pillars :

1. the independent verification of the safety reports and other relevant documents, the analysis on the results of tests and measurements, the performance of additional tests,
2. the inspection system, in order to verify compliance with applicable rules and technical specifications, at all stages from design to operation,
3. the sanction system, in case of non compliance, either with provisions of the Law or with conditions and technical specifications attached to the licence. The system envisages penal and administrative measures. The former can entail deprivation of freedom and fines, the latter consists in suspensions or, in worst cases, revocation of the licences. The penal sanctions are applied by Courts following trial proceedings initiated by reports from ISPRA inspectors. The administrative measures are applied by the Ministry of Economic Development. Before applying the administrative measures, the Ministry can issue and injunction to comply with applicable regulations and prescriptions.

21.2 The national legislation ensures that in case of lack of the licensee holder state administrations will take care of spent fuel and radioactive waste.

21.3 Assessment of compliance

On the basis of what discussed about, it is considered that there are adequate provisions in the Italian legislative system to comply with the obligations of this article of the Convention.

Article 22. Human and financial resources

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

(i) qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;

(ii) adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;

(iii) financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility

22.1 Staff qualification

Current regulation establishes specific qualification requirements for the staff involved in the operation of the NPPs, Research Reactors, Fuel Reprocessing Facilities etc. These requirements are also applicable to radioactive waste and spent fuel management facilities which, as already said, are operated under the licensing conditions of the main nuclear installation they belong to. Additionally, staff qualification for the performance of any safety-related activity is among the relevant aspects assessed during the licensing process. Moreover, technical and operating staff undertakes training regarding technical and legal issues, according to the specific company policy of Sogin.

In the Italian nuclear installation (NPP and fuel cycle facilities) the rules governing the organization and the roles of the technical and operating staff to ensure a safe management of the facility, both during ordinary and emergency conditions, are stated in a specific document (named *"Regolamento di esercizio")* as required by the Italian law. This document rules also the activities related to waste management and dismantling operations. According to that document only licensed personnel can operate in spent fuel management facilities.
In other installations staff qualification requirements are established on a case by case basis.

22.2 Financial resources

When the nuclear power plants were still in operation, ENEL, on the basis of autonomous decision, started to set aside funds for the decommissioning. The early shut down of these plants prevented the possibility to sum up all the necessary financial resources. As far as concern, for ENEA research facilities no funds were set aside for decommissioning.

According to the decommissioning strategy initially identified (SAFE STORE), ENEL calculated the amount of funds on the basis of the estimated costs to bring the NPPs in the Safe Enclosure condition, maintaining them for 40 years before dismantling. In 1998 an additional fund has been set aside for the closure of the Creys-Malville NPP fuel cycle, after the decision taken by ENEL to give up its share in the NERSA Company.
As result of the change in the decommissioning strategy (DECON), the cost re-evaluations performed by Sogin shown higher costs for dismantling, larger than those initially estimated for the SAFE STORE strategy, mainly due to the wider use of costly techniques (for example, remote operation) and due to the additional expenses for the earlier need of the financial resources. All those factors arise the amount of the necessary funds even if only partially compensated by the elimination of the expenses to maintain the NPPs in the Safe Enclosure condition for 40 years.

For those reasons, in order to finance the additional decommissioning cost, the Ministry of Productive Activities (now Ministry of Economic Development) issued the Decree of 26th January 2000, which established the related instrument with a levy on the price of the electricity.
The funds have been transferred to Sogin which, as stated in Section B, is responsible for performing decommissioning and waste treatment activities for all nuclear installations (including ENEA ones). For this purpose, Sogin has been also charged to perform plans and cost estimations. The cost estimation is done as a best estimate. However, it includes a contingency depending on the specific activity and on the time of expenditure, together with the management costs of the new Company.

The same decree quoted above states that every year Sogin has to submit to the National Authority for the Electricity and Gas an updated report on technical and economic plan of the global decommissioning project. The yearly reports have also to contain an update of the decommissioning plan and cost estimate. The levy on kWh, paid from the final users, is adjusted regularly on the basis of the contents of the yearly reports. In this way, possible additional costs due to changes of strategies and the activities needed for safety reasons, need to be endorsed by the National Authority for Electricity and Gas. Efficiency criteria related to the program management and to the progress of activities are taken into account in performing such adjustments.

The latest cost assessment indicates an amount of about 5200 M€ for the total decommissioning of the four NPPs, for the decommissioning of the Nuclear Fuel Cycle Facilities (constant money 2007, including spent fuel reprocessing, waste management costs and disposal to the final repository). The main components of the total decommissioning costs are the spent fuel reprocessing and glass waste final disposal (counting for about 1200 M€) together with the waste management and disposal cost, which strongly depends on the fees that are required for the disposal in the final repository. Due to the uncertainties currently existing in this regard an assumption of about 10 k€/m^3 for LLW and ILW and 50 k€/m^3 for HLW has been made.

The following activities were taken into account in the decommissioning scope:

- on-site storage of fuel;
- spent fuel reprocessing;
- decontamination for conditional, unconditional recycle, re-use or release;
- volume reduction (e.g. compaction) for radioactive waste materials;
- packaging of historic/operational waste, e.g. sludge, ion-exchange resins;
- removal of reactor/fuel cycle facility building;
- removal of conventional plant buildings, e.g. turbine hall;
- disposal of radioactive waste;
- disposal or recycling of non-radioactive waste material;
- final site surveys;
- de-licensing of the site.

It has to be underlined that the operators are also liable for the cost of managing any radioactivity discovered after the de-licensing process has been completed if they continue to be the owners of the site, otherwise it depends on conditions stipulated in the transfer of site ownership.

Regarding the waste treatment capabilities, the adaptation of the already existing waste treatment and storage facilities to the new needs are taken into account.

22.3 Institutional control

Costs for appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility have not been evaluated yet. They will be taken into account in the framework of the national strategy that currently envisages the construction of a near surface reversible facility.

22.4 Assessment of compliance

(i) Staff qualification is regulated on specific facilities' basis. Specific requirements will be included in the updating of applicable technical guides.

(ii) Financial resources are available for the foreseen activities. The same mechanisms will be used for the long term needs.

(iii) Detailed components of costs related to the closure phase of disposal faciity have not been allocated yet. They will be considered as far as practicable in the frame of the current national strategy which envisages the construction of a near surface reversible storage facility.

On those bases, it can be concluded that no further measures have to be implemented to fulfil the obligation of this article of the Convention.

Article 23. Quality assurance

Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.

23.1 Undertaken steps associated to QA programmes

Although the legislative system does not contain specific provisions regarding quality assurance in nuclear installations, QA requirements are detailed in specific Technical Guides issued by the Regulatory Authority in the middle of 70's and at the beginning of 80's, in the frame of a more general programme of development of technical guides to support the regulation of installations of the national nuclear programme. Technical guides are normally used as key references regulatory tools during the Licensing process. They do not have a mandatory character but, in case of non compliance, the licensee is requested to demonstrate that the safety case fulfils alternative equivalent requirements. On the bases of the requirements established in the technical guides, licensees developed proper QA General Programmes for conduct of operation and/or Quality Procedures Guidelines/Instructions under the supervision of the Regulatory Authority.

General QA requirements as defined in Technical guides related to plant operation are therefore applicable also to the safe management of the spent fuel and radioactive waste.

With regard to new facilities connected to the treatment and the storage of radioactive waste to be realized as preliminary activities for decommissioning, QA requirements (as defined in the Technical Guide n° 4 related to the standard content of applications for detailed design of relevant parts of nuclear installations) are applied. In particular, an adequate demonstration with regard to quality assurance related aspects is requested to be provided by the licensee in the specific safety case filed to support the authorization.

For installations which have submitted the request of licence for the decommissioning plan, conditions attached to the licence will establish the requirement for the licensee to perform the decommissioning activities according to a QA programme to be submitted and approved by the Regulatory Authority.

With reference to the current implementation level it is to be mentioned that the QA system of Sogin as the main national licensee involved in the management of spent fuel and radioactive waste, is documented through three levels of documentation applicable for all projects - *Quality Manual* related to the main organization, *Quality Assurance Programme* related to the dismantling activities and operation of each site, *Quality procedures/Guidelines Instructions* - and a third level of specific documentation for each project, such as a *Quality Plan and purchase technical specifications*.

For the approval of activities related to waste treatment, conditioning and storage as well as to spent fuel management and decommissioning a specific quality plan is requested.

23.2 Assessment of compliance

Based on information reported above it may be concluded that Italy meets the requirements of this Article of the Convention.

Article 24. Operational radiation protection

1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:
   (i) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;
   (ii) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and
   (iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.
2. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:
   (i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and
   (ii) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.
3. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

24.1 Undertaken steps

The Legislative Decree 230/95 clearly states that the Operator of a nuclear installation or a facility making use of radioactive materials, must implement all the safety and protection measures suitable to keep the exposures of workers and population as low as reasonably achievable. The implementation of the optimisation principle by the Operator must be demonstrated firstly at the

design stage and subsequently during the plant operation and decommissioning. The compliance with the implementation of the optimisation principle is ensured by specific rules.
The Legislative Decree 230/95 states limits of effective dose and of equivalent dose for specific organs and tissues respectively addressed to members of the public, exposed workers, as well as apprentices and students. Such limits and the criteria for the exposures assessment comply with the indications of the Directive 96/29 Euratom issued by the European Union on the basis of the ICRP recommendations since the Publication No. 60. The compliance with the provisions on the dose limits is ensured by specific rules

With specific regard to any activity subject to licensing approval, including spent fuel, waste and decommissioning activities, a dose estimation for workers has to be submitted to show compliance with dose limits and ALARA principle.

With regard to members of the public compliance of estimated doses with below regulatory concern criterion has also to be demonstrated for routine releases.

The same legislative decree states that, in installations subject to authorisation, the release of waste and of any other material containing radioactivity aimed at the disposal or addressed to locations, installations or anyhow to activity not subject to the clauses of the Legislative Decree, must be subject to technical specifications to be included in the authorisation provisions. The clearance levels to be specified in the technical specifications shall comply with the basic *"below regulatory concern"* criterion for practices – also established in the European Directive 96/29/Euratom – and, to this aim, shall take into account directives, recommendations and technical positions provided by the European Union. At present, specific clearance levels are defined for all the installations that envisage to release material as result of their activities.

As far as situations having the potential to imply unplanned or uncontrolled releases of radioactive material into the environment are concerned, the authorisation procedure - in force in Italy since 1964 – requires that the applicant provides an analysis of possible scenarios and the assessment of the relevant consequences in terms of radiological impact on critical groups of people concerned, with the aim of establishing ad hoc emergency plans. Following the transposition of the Directive 96/29/Euratom in the Legislative Decree 230/95, an analogous provision was introduced also for facilities making use of radioactive materials.

Design basis accident conditions associated to waste, spent fuel and decommissioning management activities have to be demonstrated to comply with 1 mSv/event reference dose objective.

24.2 Assessment of compliance

On the basis of what stated above it is considered that Italy has adequate provisions to fulfil obligations under this article.

Article 25. Emergency preparedness

1. Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.
2. Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

25.1 On-site and off-site emergency plans

Emergency planning at nuclear installations is regulated by the provisions reported in Articles 115 to 135 of the Legislative Decree n° 230/1995 and subsequent amendments. In addition, the general legislation governing emergency preparedness and response provisions in all cases of accidental events and disasters, as reported in the Act n° 225/1992, is applicable.

With regard to *on-site emergency planning* above provisions are complemented with those reported in Articles 47 and 49 respectively related to the Manual for the Conduct of Plant Operation and to the role of the Plant safety Committee which include, among other duties, the preparation of the on-site emergency plan. Technical specifications attached to the license regulate the performance of periodic emergency drills. As a normal practice these drills are attended also by representatives of the regulatory authority.

As far as .off-site emergency preparedness response concerns its organization differs depending on extension and type of the consequences of the postulated events (namely events which could affect a local area or a larger part of the national territory).

If the potential consequences of postulated reference events result to be manageable at local level, the *off-site emergency* plan is prepared under the authority of the Prefect of the province where the installation is located, as stated in Articles 118, 119 and 120 of the Legislative Decree n° 230/1995. According to article 117 of the same legislative decree , the technical basis for the plan are established by the Licensee and revised by the Regulatory Authority. The plan is prepared taking into account the indications reported in the Law n° 225/92.
At present, NPPs which still have spent fuel storage on the site, have maintained the emergency plan in force during the operation phase. Emergency preparedness provisions are therefore sized to ensure a level of protection to the public and the environment beyond the current level of risk of the installation .In other cases, a re-evaluation of the technical bases has been performed and the plan consequently updated.

An updating is in any case performed following the authorization of the decommissioning plan.

It is the case to mention, that in relation to the transport activity of spent fuel abroad for reprocessing specific emergency plans have been prepared, on the bases of a specific regulation issued by the Government as envisaged by Art. 125 of Legislative Decree 230/1995.

For cases in which potential consequences of postulated reference events could invest larger parts of the national territory, provisions of Article 121 of the Legislative Decree n° 230/1995, related to National Plan on Radiological Emergencies, apply, as discussed in the following point.

25.2 National Plan against Radiological Emergency

Provisions of Article 121 of the Legislative Decree n° 230/1995 require the preparation of a General National Plan of Protective Measures for Radiological Emergencies under the authority of the Department of Civil Protection. Such a plan is aimed at protecting general public and environment in case of accidents occurring at an Italian installation or at an installation located in a neighbouring country, as well as for emergency situations of undetermined location in the territory. The current plan is in force since 1997. With particular reference to events taking place in nuclear installations located in the vicinity of the national territory emergency preparedness provisions envisaged in such a plan have been determined on technical bases which assumes, as reference events, severe accidents potentially occurring at NPPs under operation. It is therefore believed that these provisions properly bound conditions potentially related to events occurring to radioactive waste and spent fuel installations in the vicinity of the national territory.

On the basis of the identified accidental scenarios and the technical competences of different administrations, the national Plan determines the ruling structures (competent Authorities) as well as the technical and the operative bodies, both at national and at local levels.

The ruling structure is the Prime Minister (or a delegate) with the support of the Operative Committee of Civil Protection, with representatives of all related national administrative bodies (Department of Civil Protection, Ministry of Interior, Ministry of Health, Ministry of Defence and others).

In case of a national emergency the technical structure is the Centre for Data Elaboration and Evaluation (CEVaD), as stated at art. 123 of Law n° 230/1995, which includes representatives of ISPRA (as coordinator), the National institute of Health (ISS), National Prevention and Workers safety Institute (ISPESL), National Fire Brigades Department (VV.F), National meteorological service and representatives of regional laboratories.
ISPRA is also charged to provide also technical and logistic support for CEVaD.
The Centre is entitled to follow the evolution of the radiological consequences of the event in order to provide the Civil Protection Department with the proper recommendations in relation to the protective actions to be undertaken where required.

The Centre is operating according to established procedures contained in an Operative Manual which have been recently updated. The Centre also makes use of important technical support features, such as the Control Centres of two radiation monitoring networks and a computational system, named ARIES, with validated models to estimate the medium and long range dispersion of radioactive contaminants released into the atmosphere from a specific installation located in Europe. Italy regularly participates together with all major organizations involved in the implementation of National Plan, in emergency exercise organized at international level by EU, IAEA and OECD/NEA. National exercises have been also undertaken in the past.
It is finally to be mentioned that, at international level, Italy has ratified the Convention on Early Notification of a Nuclear Accident (1986) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1987). Italy has also established the proper provisions to fulfill the requirements of European Union Council Decision n° 87/600/Euratom regarding the urgent exchange of information in case of radiological emergency.

The definition of specific agreements with the Safety Authorities of neighbouring countries is in progress.

25.3 Assessment of compliance

Based on information reported above it may be concluded that Italy meets the requirements of this Article of the Convention.

Article 26. Decommissioning

Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

(i) qualified staff and adequate financial resources are available;

(ii) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;

(iii) the provisions of Article 25 with respect to emergency preparedness are applied; and

(iv) records of information important to decommissioning are kept.

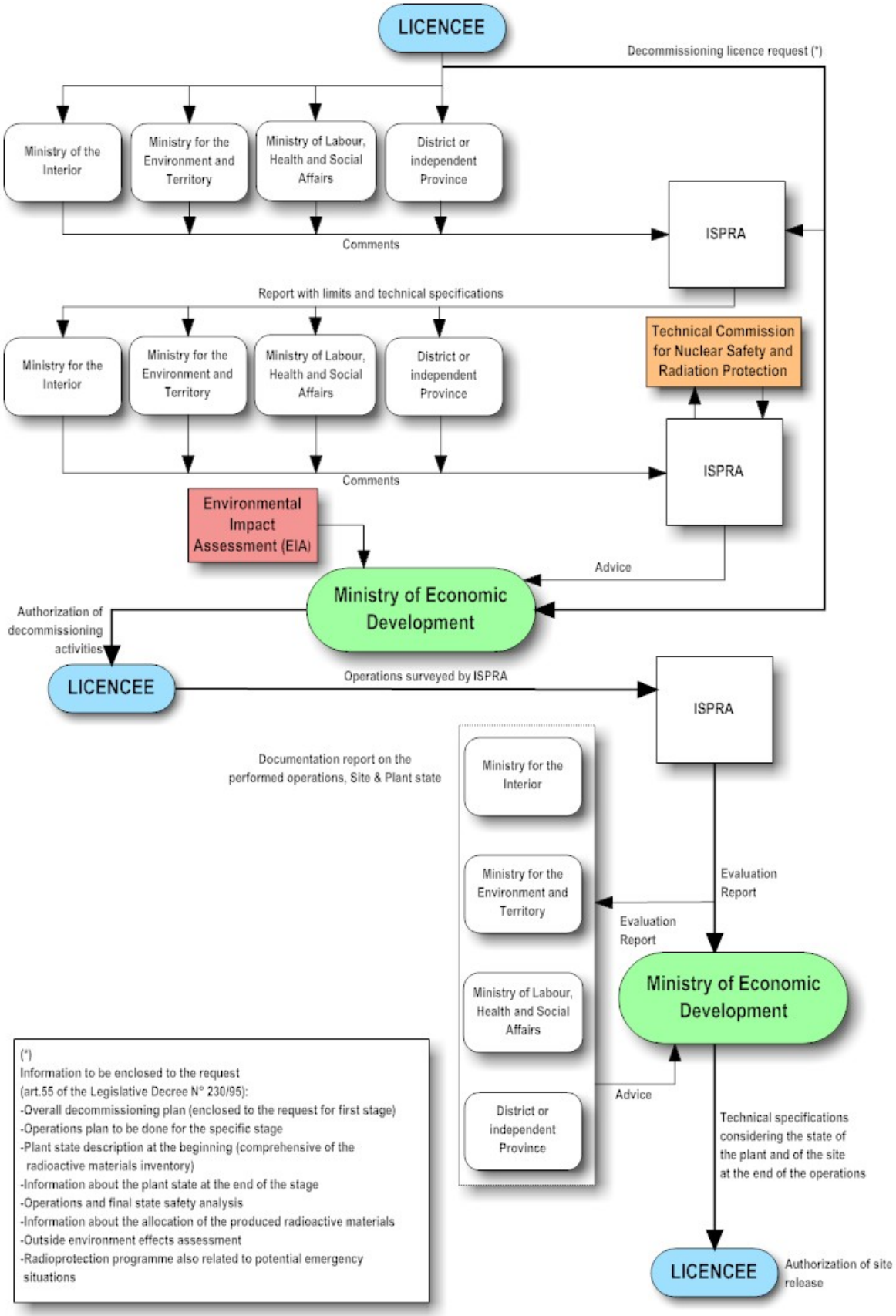
26.1 Undertaken steps

The relevant regulation related to decommissioning can be found in the Legislative Decree 230/95 and, in particular, in Articles from 55 to 57.

Regarding the procedure for granting the decommissioning licence the applicant has to submit several documents, including a Global Decommissioning Plan, describing the whole decommissioning process. These documents have to contain all the required safety data and analyses to demonstrate the safety and constitute the main basis for granting the license. During subsequent stages of dismantling, detailed design reports shall be submitted for the approval of specific activities. The activities must be authorised by the Ministry of Economic Development (MSE), based upon the advise of ISPRA who gathers the view of the Ministries of the Environment, Internal Affairs, Labour, Health and Social Affairs, together with the interested Regional Administration. The main license may be granted for single or multiple phases, providing that an overall plan is submitted.

The overall procedure is presented in the following diagram.

LICENCING PROCESS SCHEME FOR EACH DECOMMISSIONING STAGE ACCORDING TO THE LEGISLATIVE DECREE N° 230/95



It is planned that in the decommissioning licence specific conditions will be established to define the authorization procedure to be applied to specific activities. In particular, it is envisaged that most relevant activities will have to be approved by ISPRA on the basis of the submission of a Detailed Design, or, in case of a dismantling activity, of an *Operating Plan.*

(i) Regarding staff qualification, it has to be underlined that relevant documents coming from the operational phase of the plant maintain their role also during decommissioning; they are subject to some adjustments, following however the same principles applied to the operational phase.

There are several articles of the Italian applicable Laws and several technical guides issued by Italian Regulatory Authority, dealing with requirements addressed to the Operating Organisation and to the plant staff. More in particular, the following Italian regulations may be quoted:

- Law 1860 (1962) on the *"Pacific Use of Nuclear Energy",*
- Legislative Decree 230 (1995), implementing also six EURATOM Directives on radiation protection (EURATOM 80/836, 84/467, 84/466, 89/618, 90/641 and 92/3), replacing Presidential Decree no. 185 of 1964: *"Safety of plants and protection of workers and general public against the risk of ionising radiation associated to the peaceful use of Nuclear Energy"* replaced in 1996 by the Legislative Decree no. 230/1995
- Technical Guide n. 8 *"General criteria of Quality Assurance for NPPs"*,
- Technical Guide n. 20 *"Q.A. Documents to be produced for the operation of NPP",*
- Technical Guide n. 21 *" Content of the Operating Rules (Regolamento d'Esercizio",*
- Guide on *"General Design Criteria for Light Water Pressurised Nuclear Power Plants"* 1987.

In particular, the Operating Rules (Regolamento d'Esercizio) and the Quality Assurance Programmes identify the qualification of the staff in key positions.

Regarding financial resources, considerations developed under Article 22 are applicable.

(ii) All the provisions described under article 24 entirely apply to decommissioning activities. Regarding criteria for solid materials release see Section B. ALARA principles are implemented during decommissioning activities. Design objectives in terms of Maximum Dose to the public for each plant condition are defined. In particular, for accidents conditions, the objective of 1 mSv/event to the most exposed member of the critical group of the public has been defined.

(iii) All the provisions described under article 25 entirely apply to decommissioning activities.

(iv) Relevant records related to design, operation and decommissioning are required to be kept on the basis of specific requirements in the Quality Assurance Programmes. The principles that are at the basis of record keeping for materials during decommissioning are described below.

Identification and traceability of materials present in the plant

Sogin recognizes that the dismantling of a complex structure, such as a nuclear installation, requires the orderly and organised management of substantial amounts of information, whose availability and proper use is essential for safe management of the dismantled material, radioprotection and characterisation of originated waste, according to final repository requirements.

In the light of managing consistent quantities of materials and consequentially a substantial amount of data, detailed Procedures/Instructions are established to keep the inventory of removed materials and progress report updated at all times.

In order to document the various operations to which each element[1] is subjected during the dismantling phases, IAEA criteria are followed.

Preparation and upkeep of a database to ensure controlled material management

For the management of dismantled materials, the following phases have been identified:

a) dismantling phase;
b) radiological control phase, aimed at identifying the destination of the element (not-clearable, clearable after decontamination, clearable in current state);
c) treatment phase (including any decontamination to reduce the doses to the personnel working on subsequent operations and/or to reduce the radioactivity content below the authorised clearance levels, etc);
d) conditioning phase, in order to produce final packages complying with the requirements for storage, transportation and disposal in the final repository);
e) storage phase in the site's temporary deposits;
f) clearance and release from the site phase (disposal or transfer), subjected to the required radiometric tests.

The cutting of a contaminated component in several pieces is an activity that can take place in every phase after dismantling.

This situation, whilst imposing information management with a Quality System that makes management reliable, requires a computerised management and integration.

26.2 Assessment of compliance

On the basis of discussion reported in the above sections can be concluded that adequate provisions are in place in Italy to fulfil the obligation of the present article of the Convention.

[1] The term "element" is used to indicate any "object" that one wishes to trace, intending a spool of piping, a valve, a pump, an electric panel, a drum containing waste or any other object, on the condition that it is univocally identifiable.

Section G. Safety of Spent Fuel Management

Article 4. General safety requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;

(ii) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;

(iii) take into account interdependencies among the different steps in spent fuel management;

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(v) take into account the biological, chemical and other hazards that may be associated with spent fuel management;

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(vii) aim to avoid imposing undue burdens on future generations.

4.1 Measures to ensure protection against radiological hazards

As indicated in Section E, the Italian legislative and regulatory framework, applicable to spent fuel management activities, define the main principles related to radiation protection and to licensing procedures. Specific requirements to be met in any phase of the fuel cycle are than established in the context of specific technical licensing process.

Spent Fuel management activities that continue to be performed in Italy are the storage in pools and the transportation to reprocessing facilities located abroad. As indicated in Section D, the spent fuel still present on the national territory is stored in the pools of the individual facilities and partly in a specifically devoted wet storage facility. It is expected that by 2012 all the existing fuel, with the exception of the Elk River spent fuel will be transferred abroad.

With regard to the provisions established under this article the following can be highlighted:

(i) criticality prevention and residual heat removal were addressed in all the existing Italian fuel storage facilities during the licensing and supervision process. Details are provided under the following Art. 5; the issue is also addressed by the transportation regulations;

(ii) all spent fuels produced in Italy have been or will be reprocessed in European industrial reprocessing plants, with the only exception of the spent fuel stored at the ITREC facility. These plants guarantee that the production of radioactive waste coming from spent fuel

reprocessing will be kept to the minimum practicable. The waste production in Italy is mainly related to the wet storage (systems for cleaning and decontamination of the pool water), and also will be kept to the minimum practicable;

(iii) The interdependencies among the different steps in spent fuel management, connected to the residual activities, are limited and are taken into account. In fact, in Italy no nuclear power is produced and no domestic reprocessing capabilities are available, the spent fuel management approach only entails the following main steps: wet storage, transport to foreign European plants for reprocessing, return to Italy of corresponding nuclear material and conditioned radioactive waste;

(iv) protection measures of individuals and members of population are specified in the Legislative Decree n° 230/1995, as progressively modified to take the applicable European Union Directives into account;

(v) no biological, chemical and other hazards have been identified to be associated with the specific spent fuel management activities that take place in Italy;

(vii) at the moment, all the licensed activities related to spent fuel have a quite limited perspective time horizon and therefore regulation or technical guides do not explicitly consider future generations; existing regulations do not identify any limitation in the time periods for which the principles related to practices have to be applied; moreover, licensing activities, which take international standards into account , consider also the long term perspectives. With regard to radioactive waste management, Technical Guide N° 26 specifically addresses the principle that the potential impact on future generation of radioactive waste management activities should be taken into account.

4.2 Assessment of compliance

From what it has been said in each of the previous sections, taking also into account the envisaged transfer abroad of the largest part of the spent fuel for the reprocessing, it may be stated that Italy fulfil the obligations under this article.

Article 5. Existing facilities

Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.

5.1 Status of safety assessment at existing facilities

Spent fuel management in the storage pools is regulated by the technical specifications of the facility. Regulatory supervision is performed on regular bases. Near future plans are mainly addressed to the delivery of the remaining fuel to reprocessing facilities abroad. The spent fuel management facilities will be decommissioned.

In the following additional information are provided on the facilities still having spent fuel in their storage pools. Some general information on the spent fuel stored at sites is provided in Table D.1.

Caorso NPP

Preliminary activities for the decommissioning are underway. The regulatory review process for the decommissioning license is in progress. Spent fuel is stored in the site pool and the transfer abroad is underway since December 2007 to be completed by the end of 2009.

Caorso NPP	
Name:	Caorso
Location	Caorso (Piacenza)
Category (e.g. commercial, prototype, research facility, other nuclear installation):	Commercial
Type:	BWR
Type of process systems to be decommissioned:	Nuclear Island and connected systems
Number of units on the site:	1
Capacity on the site (MWe net)	860 MWe
Date of commissioning:	May 1978
Date of shutdown:	November 1986
Expected date of decommissioning strategy end point:	2017

Fuel assemblies in CAORSO site before the beginning of transfer	
Nominal initial U mass kg (average)	186.6 (560 FAs) - 182.1 (472 FAs)
Fuel type	BWR
Fuel element layout	8 x 8
Number of fuel elements per assembly	63 + 1 water rod (560 FAs) - 62 + 2 water rods (472 FAs)
Cladding material	Zr 2
Fuel material	UO_2
Fuel initial enrichment (average)	2.43 % (560 FAs) - 2.84 % (320 FAs) - 2.99 % (152 FAs)

Essential feature of the storage	Storage in pool
	Total: 1032 fuel assemblies + 6 fuel pins

Spent fuel pool

Caorso NPP is equipped with two spent fuel pools: one (internal) close to the vessel cavity, and another (outer), connected to the previous one on the other side of the vessel cavity. High density (i.e. poisoned with borated panels – Boraflex type) fuel racks are installed together with special racks dedicated to failed fuel elements and additional ones for spent control rods. Pool walls and bottom are lined by 6 mm and 8 mm stainless steel sheets respectively. Pool penetrations are located over the fuel top. The area in the pool where spent fuel transport cask is leaned, has an additional 25 mm thick liner.

Storing capacity is as follows:

- *Internal pool*: 820 fuel assemblies (26 defective assemblies + control rods can also be stored in the same pools),
- *Outer pool*: 1360 fuel assemblies,

with an overall capacity of 2180 assemblies normal positions.

In 2007 the storage need amounted to a total of 1032 spent fuel assemblies.

The required subcriticality in the high density racks is ensured by boraflex sheets (< 0,95 keff, without burnup credit).

Due to the large room available, i.e. the limited number of fuel elements to be stored (1032) with respect to the design capability, it is presently required to distribute the assemblies in such a configuration that subcriticality is ensured only by geometrical factors; moreover, it is still required to regularly survey Boraflex panels effectiveness, although no credit to the poison is needed to assure subcriticality of the overall storage configuration.

Although there is no need to remove the heat due to very small residual power, heat removal systems are still available.

The quality of the spent fuel pool water is regularly controlled, also with the purpose to minimize the build up of corrosion products and the consequent increase of wastes generation.

Normal ventilation is available, which sucks air from the pool surface, especially during fuel elements movement. Emergency ventilation systems are available in case of abnormal radiation signals in the fuel pool area.

The transport operations begun at the end of 2007 after a systematic revision of procedures, upgrading of cranes, certification of transport cask and improvement of the safety features dedicated to the fuel and cask movement (see figure 7).

Figure 7: Caorso NPP – A phase of spent fuel transport casks handling inside the reactor containment with a special shock absorber structure

Trino NPP

Preliminary activities for the decommissioning are underway. The regulatory review process for the decommissioning license is in progress. Some spent fuel is stored in the site pool and is going to be removed according to the mentioned program for transportation abroad.

Trino NPP	
Name:	Trino
Location	Trino (Vercelli)
Category (e.g. commercial, prototype, research facility, other nuclear installation):	Commercial
Type (e.g. PWR, BWR, LMR, Fuel Cycle Facility, Hot-lab, Conditioning Facility, etc):	PWR
Type of reactor pressure vessel (e.g. steel, concrete, pressure tube, etc):	Steel
Number of units on the site:	1
Capacity on the site (MWe net)	260 MWe
Date of commissioning:	October 1964
Date of shutdown:	March 1987
Expected date of decommission. strategy end point:	2016

Fuel assemblies in TRINO site	
	39 FAs
Nominal U mass kg (average)	309
Fuel type	PWR
Fuel element layout	15 x 15
Number of fuel elements per assembly	208 (29 FAs) - 207 (10 FAs) + 1 rod position vacant
Cladding material	AISI 304
Fuel material	UO_2
Fuel initial enrichment (average)	4,47%
Essential feature of the storage	Storage in pool
	8 FAs
Nominal HM mass kg (average)	307,9
Fuel type	PWR
Fuel element layout	15 x 15
Number of fuel elements per assembly	208
Cladding material	AISI 304
Fuel material	MOX
Fuel initial enrichment in fissile isotopes (average)	4,50%
Essential feature of the storage	Storage in pool

Spent fuel pool

The spent fuel pool is a steel lined concrete structure (14,7x 10,3 x 11 m), containing about 1470 m^3 of water. Spent fuel stainless steel racks are located inside, with enough room for 162 fuel assemblies and 144 control rods or other in core components.

At present, in the pool, there are 47 spent fuel assemblies (8 MOX and 39 UO2). In the same pool there are 29 absorbers of control rods, 53 dummy cross elements, a bottle with heterogeneous pieces, 30 sectors of the former in vessel thermal shield pieces, two boxes containing shavings from cutting activities.

The prevention of criticality is ensured by geometry (distance), assuming that demineralised water is present.

The residual power is very limited and there is no need for heat removal. Nevertheless, the original heat removal system is still available, capable to remove the decay heat from the full core discharged 60 hours after the shutdown.

The quality of the spent fuel pool water is regularly controlled, also with the purpose to minimize the build up of corrosion products and the consequent increase of wastes generation.

ITREC

The facility has recently received a new license specifically addressed to the safe management of the installation and the performance of preliminary decommissioning activities (mainly waste treatment and conditioning etc.) to be performed before the decommissioning plan is submitted. Some spent fuel is stored on site, as specified below.

ITREC	
Name:	ITREC
Location	Trisaia (Matera)
Category (e.g. commercial, prototype, research facility, other nuclear installation):	Research facility
Type (e.g. PWR, BWR, LMR, Fuel Cycle Facility, Hot-lab, Conditioning Facility, etc):	Pilot reprocessing facility
Type of reactor pressure vessel (e.g. steel, concrete, pressure tube, etc):	N.A.
Capacity on the site (MWe net)	N.A.
Number of employees during operation:	
Date of commissioning:	1962
Date of shutdown (termination of activities):	1978
Expected date of decommissioning strategy end point:	2016

ELK RIVER Fuel assemblies in TRISAIA site	
	64 FAs
Nominal HM mass kg (max)	28
Fuel type	ThO_2 - UO_2
Fuel element layout	5 x 5
Number of fuel elements per assembly	max 25[2]
Cladding material	Stainless Steel
Fuel material	ThO_2 - UO_2
Fuel initial enrichment (average)	25.5 kg ^{232}Th, 1.2 kg ^{235} U
Essential feature of the storage	Storage in pool

Spent fuel pool

64 spent fuel assemblies are stored in a pool (m 10,7 x 3 x 7). The pool has a steel liner (AISI 304L) and a water cleanup system, to maintain the required chemical, physical and radiological conditions (e.g. normal water activity concentration of 37 Bq/l from ^{137}Cs against a maximum allowed by technical specifications about 10^3 times that value). A 5 m water height over the fuel is ensured. Dynamic containment is provided in the pool area by active ventilation systems.

Spent fuel elements stored in the pool come from ELK RIVER US reactor where they were burned before 1967.

16 fuel assemblies have been disassembled into fuel elements. Each fuel assembly is stored in leak tight stainless steel bottles, located along the pool walls.

Subcriticality is ensured by geometry and by the administrative norms applicable to the fuel movement.

In the pool bottom there is an additional well (m 2,5 x 2,5 x 4,5) for temporary housing the transportation cask during fuel transfer.

[2] 2 FAs were dismantled: 1 FA remained with 11 rods and 1 FA with 23 rods

The criticality safety is ensured by geometry: two rows of fuel elements are disposed at a distance of 34 cm that was calculated to be subcritical with adequate margins even in case of infinite rows at such distance.
The residual power is very limited, the number of stored elements is very low therefore there is no need for heat removal.
The quality of the spent fuel pool water is regularly controlled, also with the purpose to minimize the build up of corrosion products and the consequent increase of wastes generation.
In particular, the pool is equipped with a “cleaner” for cleaning the walls and the bottom, together with a clean-up system for the water, that includes an ion exchanger and a particulates filters. The activity concentration is kept very low (the maximum permitted value from technical specifications being 3700 Bq/l), due also to the fact that each spent fuel element is enveloped by a metallic leak tight box.
Some activities are going to be performed before the transfer of the fuel assemblies to the dry casks such as the cleaning of the thin sludge layer present in the pool bottom area.

Avogadro AFR facility –Saluggia (VC)

AVOGADRO is a spent fuel wet storage facilities away from reactors, described in section D.1.3.
The storage building is focused on its storage pool, where the spent fuel lays in several racks. During stationary storage the fuel is shielded by an height of water of 6 m, which reduces to a minimum of 3 m during fuel handling operations for shipment.
Auxiliary systems of the storage building include:

- a decontamination bay for service and clean-up of transport casks;
- a gantry crane (60 t) for casks handling, a polar crane (15 t) for building service and a bridge crane (1 t) for fuel handling inside the pool.

The four peripheral auxiliary buildings are dedicated to general management services. All the principal auxiliary systems of AVOGADRO are located inside one of them. They include in details:

- control room and general radioactivity monitoring systems
- primary and secondary decay heat removal systems
- pool water decontamination system (based upon ion exchange resins)
- raw water supply system (industrial water from wells)
- buildings general ventilation system (equipped with absolute filtering devices)
- liquid radioactive wastes collection and storage system
- liquid radioactive wastes release system.

The fuel temporary storage service is presently supplied to SOGIN S.p.A., the owner of the spent fuel unloaded from Trino and Garigliano power plants.
AVOGADRO storage operation is licensed by the Ministry of Economic Development.
Professional assistance to operations is supplied by the so called “Qualified Expert“ in terms of physical surveillance of protection from ionising radiations.

This facility is going to be emptied, according to the new strategy of reprocessing abroad, in the next three years.

Criticality is prevented by the design of "high density" storage racks (limits to the reactivity – K_{eff} < 0,95 - accounting for the general nuclear features of the spent fuel - burn up and initial maximum enrichment).The decay heat removal during the spent fuel storage is assured by a largely oversized cooling system. It was designed to remove the whole thermal output of the previous research reactor "AVOGADRO RS-1", varying from 1 to 7 MW, while the maximum decay thermal power due to the stored fuel has always been well under 100 kW.
The cooling system includes:

- a closed-loop primary system, circulating the storage pool contaminated water through an heat exchanger;
- an open-loop secondary system, circulating uncontaminated raw water from a storage reservoir to the liquid release system;
- a raw water supply system, equipped with submerged pumps placed in wells.

The quality of the spent fuel pool water is regularly controlled, also with the purpose to minimize the build up of corrosion products and the consequent increase of waste generation.
To prevent chemical corrosion of the structural materials of the fuel storage racks and of the bottles containing Garigliano fuel elements, the storage pool is filled with demineralised water. Periodical controls of the chemical composition of pool water are imposed by the operative technical requirements for AVOGADRO.
Surveillance monitoring for corrosion is provided by a qualified Supplier (CESI Institute), and yearly reports on the subject are sent to the Italian Regulatory Authority.

The radioactive contamination of pool water is systematically controlled by measurements on samples. The water specific activity level determined by the operative technical requirements for AVOGADRO is provided by a decontamination system using a batch of ion exchanging resins.
The following fuel assemblies are currently stored in Avogadro facility pool. In 2007 fuel assemblies stored at the Eurex facility pool were transferred in the Avogadro pool as part of a program for the remediation of the Eurex pool and in view of the transfer abroad for reprocessing.

GARIGLIANO Fuel assemblies in DEPOSITO AVOGADRO site	
Nominal HM mass kg (average)	204,5
Fuel type	BWR
Fuel element layout	8 x 8
Number of fuel elements per assembly	64[3]
Cladding material	Zr 2
Fuel material	1 modified BWR[4], 54 UO_2 + MOX[5], 8 MOX
Fuel initial enrichment in fissile isotopes (average)	2,85%
Essential feature of the storage	Storage in pool

[3] some FAs were modified during irradiation: 2 FAs remained without 1 fuel pin, 3 FAs without 2 fuel pins
[4] after last irradiation cycle in the FA were inserted 4 MOX and 2 UO_2 non irradiated fuel pins segments
[5] in 4 FAs only the spacer capture rod is a UO_2 pin

TRINO Fuel assemblies in DEPOSITO AVOGADRO site	
	39 FAs
Nominal U mass kg (average)	306,8
Fuel type	PWR
Fuel element layout	15 X 15
Number of fuel elements per assembly	208 (30 FAs) - 207 (19 FAs) + 1 rod position vacant
Cladding material	AISI 304
Fuel material	UO_2
Fuel initial enrichment (average)	4,02%
Essential feature of the storage	Storage in pool

TRINO Fuel assemblies transferred in 2007 from EUREX site	
	52 FAs
Nominal U mass kg (average)	38,9
Fuel type	PWR
Fuel element layout	Cruciform
Number of fuel elements per assembly	26 + 2 empty centre rods
Cladding material	AISI 304
Fuel material	UO_2
Fuel initial enrichment (average)	2,72%
Essential feature of the storage	Storage in pool

GARIGLIANO Fuel half pins transferred in 2007 from EUREX site	
	48 half pins from 9 x 9 FA
Nominal 48 half pins U mass kg	66
Fuel type	BWR
Fuel element layout	--
Number of fuel elements per assembly	--
Cladding material	Zr 2
Fuel material	UO_2
Fuel initial enrichment (average)	2%
	48 half pins from 9 x 9 FA

Spent fuel pool of Triga Research Reactor (ENEA Research Centre – Casaccia)

TRIGA RC-1 is a Mark II open tank reactor operating at a power of 1-MW. The core is cooled by light-water with an annular graphite reflector. The core has a cylindrical configuration and is placed at the bottom of an open tank. On the inner edges of the reactor tank, there are racks where partially burned fuel assemblies can be stored in a largely sub critical configuration; at present there are twelve partially burned fuel assemblies located in the racks, no spent fuel is stored in the plant.

Spent fuel pool of LENA Research Reactor (University of Pavia)

LENA is a Triga type research reactor. The spent fuel is stored in special wells in the reactor building. There are 5 wells, two of them respectively contain 6 and 1 spent fuel assemblies. Moreover, on the edges of the reactor pool, there are fuel racks where partially burned fuel assemblies, to be possibly inserted in the reactor, are stored.

5.2 Assessment of compliance

In summary, it can be underlined that the existing spent fuel storage facilities contain a limited amount of fuel assemblies and have limited residual operation period. Taking into account what has been said in the previous section, further measures are not planned to be implemented as a result of the ratification of the Convention.

Article 6. Siting of proposed facilities

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:
   - (i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;
   - (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment;
   - (iii) to make information on the safety of such a facility available to members of the public;
   - (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.
2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

6.1 Undertaken Steps

As indicated in Section B the current national spent fuel management strategy envisages the transfer of the remaining spent fuel abroad for reprocessing with the subsequent return to Italy of the resulting radioactive waste. The construction of new spent fuel storage facilities is therefore not envisaged. The only exception is represented by an on site facility for the interim dry storage of the

spent fuel in the ITREC experimental reprocessing facility. Due to the difficulties for reprocessing the particular fuel (U-Th), it is in fact currently envisaged that the very small amount of spent fuel at ITREC plant (64 elements) will be temporary in situ dry stored (1 or 2 metallic casks) waiting for further developments.

In the licensing procedure for the construction of spent fuel dry storage facility all pertaining safety assessment evaluations will be performed, including site related factors potentially affecting the new facility. Interested members of the public are informed in the context of periodic meetings taken with the local administrations.

Being constructed in the same site where the spent fuel is already stored in the pool of the ITREC facility, it is not expected that the new dry storage facility will affect other Contracting Parties.

6.2 Assessment of compliance

No new fuel management facility is foreseen to be constructed in the near future, with the only exception of a dry storage facility for the spent fuel located in the ITREC plant, for which the application for a license is going to be submitted. In that frame, all site related evaluations are going to be confirmed. Regular consultation with the local authorities, already taking place since long time, will provide the proper spread of information.
On those bases, the existing measures are considered sufficient to fulfil the requirements under this article of the Convention.

Article 7. Design and construction of facilities

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

(i) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;

(iii) the technologies incorporated in the design and construction of a spent fuel management facility is supported by experience, testing or analysis.

7.1 Undertaken steps

As indicated in Section B, the current national spent fuel management strategy envisages the transfer of the remaining spent fuel abroad for reprocessing with the subsequent return to Italy of the resulting radioactive waste. The construction of spent fuel storage facilities is therefore not envisaged, with the only exception indicated in article 6.1 (dry storage on the site of the limited amount of ITREC spent fuel).

Being strictly connected to the site, the new installation for spent fuel dry storage at ITREC facility will be licensed following the procedure for major modifications (Art. 6 of Act 1860/1962). A condition in the licence granted by the Ministry of Economic Development exists establishing that the facility has to be constructed and operated on the bases of a design approved by ISPRA.

The technical review process will take into account the general principle of reducing exposures to the lowest practicable value (Legislative Decree 230/95 art. 2, the need to facilitate future decommissioning activities and the suitability of the technology as required, either by specific technical guides issued by the Regulatory Authority or by making reference to international standards.

It has also to be taken into account that a specific, detailed technical position related to the design of dry spent fuel facilities has been already issued by the Regulatory Authority when the dry storage of spent fuel on the sites was selected as the strategy to be applied, specifying the acceptable requirements for the most important features of such facilities.

7.2 Assessment of compliance

New fuel management facilities are not foreseen to be constructed in the near future, with the only exception mention in article 6.1. In the frame of the related licensing procedures for the dry storage facility at the ITREC installation, all measures to limit possible radiological impacts on individuals, society and the environment will be taken into consideration in the safety case to be prepared.
Limited impact to decommissioning aspects can be singled out for such dry storage facility. Specific guidance on decommissioning will be however provided in a technical guide related to general decommissioning aspects under preparation.

On the above bases Italy considers that the existing measures comply with the requirements of article 7 of the Convention.

Article 8. Assessment of safety of facilities

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

(i) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(ii) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

8.1 Undertaken steps

As already said, the spent fuel dry storage facility to be constructed on the ITREC plant site, which is the only one to be realized in Italy in the near future to manage the existing spent fuel - will be licensed according to the procedure for major plant modifications. In this context a comprehensive and systematic safety assessment covering radiological impact of the installation to the public and to the environment has to be filed by the applicant. Technical Guides issued by the Regulatory Authority specify more in detail licensing requirements to be applied.

If a new facility should be constructed in a location different from a nuclear site, a specific licensing process should be followed according to the procedures envisaged in the Legislative Decree n° 230/1995 and an Environmental impact Assessment should be performed.

8.2 Assessment of compliance

On the bases of what reported above the existing measures can be considered in compliance with the requirements of article 8 of the Convention.

Article 9. Operation of facilities

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

(i) the licence to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility;

(v) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

(vi) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

(vii) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.

9.1 Undertaken steps

As already illustrated above Nuclear Power Plants and other nuclear Facilities in the process of being decommissioned have their own licenses, procedures, limits and conditions, which are based on part VII of the Legislative Decree 230/95 which include also the spent fuel management facilities existing on the site.

Specific requirements are addressed in Chapter VII of the Legislative Decree n° 230/95 and in relevant technical guides as following:

(i) the relevant documents to be produced, which include the safety report, are covered in Articles 36 and 44,

(ii), (iii) the requirement to issue an Operating Manual and Technical Specifications containing operating limits and conditions [OLC] is given in article 44; the contents of such documents are better specified in Article 7. In particular, the fist issue of the OLC is required before the performance of the nuclear tests (Article 44), the final issue has to

be attached to the operating license (Article 50). At the moment no regulation addresses to regularly revise OLCs on the basis of the operating experience. Also the Operating Manual is required to be issued before the performance of the nuclear tests (Article 44); it has to incorporate all the procedures related to the operation, maintenance, and also in view of accident or emergency conditions.

(iv) Articles 44 and 46 require for issuing the so called “Regolamento d’Esercizio”, according to its definition under article 7. Technical Guide n. 21, as complemented by other relevant guides related to Quality Assurance, issued by the Regulatory Authority, specifies the requirement for technical support.

(v) Technical Guide n. 11, which is related to notification reports, specifies the data to be provided to the Regulatory Authority, in case of incidents or failures.

(vi) current regulations do not require to regularly collect and revise data on the operating experience, although some technical guides ask for taking into account such data (e.g. for setting up maintenance programmes).

(vii) decommissioning plans are required by articles from 55 to 57, which require also the description of the plant state as results from the previous operations as well as the review by the Regulatory Authority.

9.2 Assessment of Compliance

Taking the existing legislative provisions into account and considering the limited residual life of the spent fuel management facilities currently into operation, it can be concluded that the existing measures comply with the requirements of article 9 of the Convention.

Article 10. Disposal of spent fuel

If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.

10.1 Disposal of spent fuel

At present the National strategy does not envisage the disposal of spent fuel because it will be reprocessed abroad. As already mentioned, only for the very limited amount of spent fuel of one installation (namely ITREC plant) the dry interim storage on the site is currently envisaged.

Section H. Safety of Radioactive Waste Management

Article 11. General safety requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;

(ii) ensure that the generation of radioactive waste is kept to the minimum practicable;

(iii) take into account interdependencies among the different steps in radioactive waste management;

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(v) take into account the biological, chemical and other hazards that may be associated with radioactive waste management;

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(vii) aim to avoid imposing undue burdens on future generations.

11.1 Undertaken Steps

The protection of individuals, society and the environment against radiological and other hazards is covered by the legislative and regulatory framework for nuclear activities, as detailed in Section E.2, and by the general legislation on environmental protection.

(i) regarding the maintenance of conditions of sub-criticality and heat removal during radioactive waste management it is duly addressed in the safety case preparation and in the regulatory assessment, taking into account international standards and practices. Addressing this issue is, however, not considered a priority taking into consideration that radioactive wastes presently stored in Italy, as well as those produced during D&D operations, are such that problems of criticality or heat removal will never arise;

(ii) As far as measures adopted to ensure that the generation of radioactive waste is kept at the lowest possible level, specific requirements are set out in the Technical Guide n. 26 on Radioactive waste management, in terms of waste mass, activity and volume minimization and optimisation of treatment and conditioning processes. In the specific national situation, according to which all nuclear installations are in the process of being decommissioned, the principle of waste minimization is applied during the licensing process of waste treatment and conditioning activities, as well as of dismantling and decontamination activities;

(iii) Regarding measures adopted to take into account interdependencies between the different stages of radioactive waste management, key related aspects are covered by the requirements established in the Technical Guide n° 26 previously mentioned. In particular, all technical, operational and administrative aspects which affect or might affect the quantity of radioactive wastes produced and their volume reduction and concerning different phases such as plant design and operation, services and processes selection, shall be optimised;

(iv) With reference to measures to ensure effective protection of persons, society and environment see article 4, paragraph (iv);

(v) In relation to measures for consideration of biological, chemical and other risks potentially associated with radioactive waste management related to decommissioning projects it is the case to mention that a specific environmental impact assessment has to be produced by the Licensee and evaluated by a Commission established under the Ministry of Environment;

(vi) As far as measures to avoid impacts on future generations are concerned, no specific provisions addressed to the control of radiological risk are currently envisaged in the longer term in the national legislation. However, the principle of considering in the radioactive waste management activities the potential impact on future generations is addressed in the Technical Guide n. 26;

(vii) Although no specific legislative provisions address prevention of undue burden to future generations the present strategy as defined in section B is however intended in perspective to fulfil this objective, throughout the planning of the different steps to be performed before disposal.

Regarding above points vi and vii, the management of radioactive waste is and will be carried out in Italy adopting well known and proved technologies, among the best today available worldwide; in this connection, the impact on future generations as well as the avoiding of undue burdens is properly taken into account.

Compliance with the legal requirements regarding nuclear safety and radiation protection is verified and enforced by regulatory bodies. The compliance is verified by reviewing safety analysis reports during the licensing steps and by supervising construction and operation, particularly through inspections.

11.2 Assessment of compliance

On the basis of the above discussion it can be concluded that Italy has sufficient provisions to fulfil its obligations under the Art. 11 of the Convention. There is however room for some improvements to cover some specific requirements in the regulations.

Article 12. Existing facilities and past practices

Each Contracting Party shall in due course take the appropriate steps to review:

(i) the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

(ii) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

12.1 Undertaken steps

As already explained in Section D, the only radioactive waste management facilities in Italy are the storage facilities present in the existing nuclear installations (NPPs, fuel cycle facilities and research centres). For the management of industrial, medical and research L-ILW there are a few authorised operators. Among them NUCLECO has also on site capabilities for treatment, volume reduction, conditioning and storage of RW.

In this framework the safe management of existing radioactive waste is regulated under the operating license conditions of the facilities where wastes are stored.

As reported in section E, in most nuclear installations new temporary storage facilities have been constructed or are under design or construction. In some cases the refurbishing of existing buildings has been considered. The construction of new storage facilities has been recently authorised for the Garigliano and Latina NPPs. These facilities will allow to improve the safety condition of the radioactive waste already existing on the sites. Their construction will also allow to start some important waste treatment and conditioning process, also including the removal of waste from trenches, where they were buried in the ‘60s and early ‘70s, according to a practice common at that time. New storage facilities are under authorization also for the waste existing in the EUREX and Plutonium installations.

For the authorization of new storage facilities the licensee has to provide a specific safety case which is revised under the regulatory assessment process. A comprehensive review of the storage facilities characteristics and capabilities in the Italian nuclear installations is foreseen in the framework of the decommissioning licensing process of such installations.

In addition to the construction of new storage facilities in almost all the installations specific treatment and conditioning programmes are in progress or are planned for the coming years. In this regard it is worthwhile to mention:

- the cementation of the liquid waste at the Eurex plant (at present that waste is in the process of being transferred in a new containment system);
- the removal and conditioning of the waste at the ITREC plant, located in the ‘70s in a cemented ditch;
- the treatment and conditioning programmes of existing wastes in most installations.

In the past there were some experiences of on site radioactive waste management facilities for the treatment of a specific radioactive waste stream. Main experiences on radioactive waste conditioning activities performed in the recent times are described in Annex E; in Annex F a significant recent experience for emptying and remediation of the Eurex pool is described.
More details on the measures under implementation in the different sites are reported in Section K.

12.2 Assessment of compliance

On the basis of the above discussion it can be concluded that Italy has sufficient provisions to fulfil its obligations under the Art. 12 of the Convention.

Article 13. Siting of proposed facilities

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:
   (i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;
   (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;
   (iii) to make information on the safety of such a facility available to members of the public;
   (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.
2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

13.1 Undertaken Steps

(i) Up to now waste management facilities, including waste storage buildings, are located in nuclear installations that have already a license, and siting considerations are widely discussed under the Safety Analysis Report of the installation themselves. For the new interim storage facilities as well as for other waste management facilities to be constructed on the nuclear sites main site related aspects (e.g. demography, hydrology, geology, seismology) are reviewed in the licensing process and an evaluation is included in the safety documentation submitted to the Regulatory Authority;

(ii) Radiation protection of the public has to be considered in the license application under the requirements of Legislative Decree 230/95; For new facilities to be constructed in new sites, as in the case of the national storage facility, environmental protection will be addressed also by the Environmental Impact Evaluation required by the specific law in force;

(iii) information to the public on new facilities to be constructed in the nuclear sites is provided in the context of information meetings periodically arranged with local authorities;

(iv) The construction of waste interim storage facilities on the nuclear sites is not expected to affect other Contracting Parties, mainly due to the fact that they are aimed at improving the safety conditions of wastes already existing in he sites. In the case of the national storage facility it is expected that consultation of other Contracting Parties will takes place if required or under article 37 of the Euratom Treaty.

13.2 Assessment of compliance

On the basis of the above discussion it can be concluded that Italy has sufficient provisions to fulfil its obligations under the Art. 13 of the Convention. There is however room for some improvements to cover some specific requirements in the regulations.

Article 14. Design and construction of facilities

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

(i) the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;

(iii) at the design stage, technical provisions for the closure of a disposal facility are prepared;

(iv) the technologies incorporated in the design and construction of a radioactive waste management facility is supported by experience, testing or analysis.

14.1 Undertaken Steps

The construction of waste management facilities (treatment, conditioning, storage) in the site of an existing nuclear installation has to follow the same licensing procedure, established by the Law 1860/1962 and by Chapter VII of the Legislative Decree n° 230/1995 for nuclear installations. In particular the procedure for the approval of major plant modifications is followed, with an authorisation granted by the Ministry of Economic Development and an approval of the design by ISPRA.

For new wastes long term storage facilities to be realised in sites different from those of the existing installations, licensing procedures are currently specified in the Legislative Decree n° 230/95.

(i),(ii) The applicant has to submit to the Ministry of Economic Development and to ISPRA a detailed design showing compliance with safety and radiation protection objectives as stated in the Legislative Decree n° 230/1995. In particular as far as the protection of general public is concerned, the facility shall be so designed that the radiological consequences for the defined plant conditions do not exceed pre determined values.

The relative annual probability limits for each plant condition are referred to each single event, meant as an individual event or a discrete sequence of individual events. Any deviation found shall be justified for each individual case, in the light of design alternatives and/or other available solutions, also taking the collective dose into account. In the frame of the detailed design, provisions related to decommissioning are addressed.

(iii) As already said in Section B the current national strategy envisages the construction of an national near surface storage facility. Detailed design requirements are still to be set out, including those related to the institutional control during the design life. Such requirements are those on which most of regulatory efforts will have to be addressed to in the future. Technical provision related to the closure phase of such a facility will be established in that context, as far as applicable.

(iv) In the frame of the above mentioned detailed design the applicant is requested to demonstrate that the adopted technologies are adequately supported by experience, testing and analysis. As already detailed in section B.6.2, for facilities whose purposes is to treat a specific waste stream (for instance a cementation facility), the applicant submit also the *"Qualification and Control Programme"* aimed to demonstrate the compliance of the final waste package characteristics with the TG 26 requirements. In the framework of the Qualification Program, a series of test are carried out by the applicant, under the ISPRA surveillance, on samples reproducing the composition of the final waste matrix and/or on the final container. The test results will also be used to define a set of criteria and parameters for the waste conditioning facility design, operation and process control. As far as interim storage facility is concerned, some of the most significant general design criteria or requirements are listed below:

a) direct or indirect waste inspectionability;
b) package protection from weathering;
c) package protection from external events (e.g. tornado, earthquake);
d) floor drainage systems equipped for collection and sampling of drained liquids;
e) fire detection and suppression systems commensurate with fire loads;
f) inaccessibility by non authorized personnel;
g) administrative procedures (labeling, waste registration systems, etc.) shall enable the waste control.

14.2 Assessment of compliance

On the basis of the above discussion it can be concluded that Italy has sufficient provisions to fulfil its obligations under the Art. 14 of the Convention.

Article 15. Assessment of safety of facilities

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

(i) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(ii) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;

(iii) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

15.1 Undertaken steps

(i)(iii) The licensing process related to the construction of waste management facilities (treatment/conditioning and interim storage) on the nuclear sites envisages the submittal of a systematic safety and environmental assessment. The configuration of the installation before operation is verified in front of the performed assessment, and technical specifications are defined to regulate the operational phase. For radioactive waste management facilities, including the national storage facility, to be constructed in new sites, as for other nuclear installations, two main licensing steps are envisaged in the current regulation, the first one for construction permit and the second for operating licence. A safety assessment is included in the documentation submitted by the applicant for each of these steps. It is than subject to the regulatory review process with an independent assessment performed by the Regulatory authority to support the authorizations. In a similar manner an environmental impact assessment is performed by the licensee. It is than independently reviewed by a Commission established under the Ministry of Environment and Territory.

(ii) As said in other sections the closure and post closure phases will be considered in the context of the licensing of the national storage facility. The related requirement are under definition.

15.2 Assessment of compliance

On the basis of the above discussion it can be concluded that Italy has sufficient provisions to fulfil its obligations under the Art. 15 of the Convention.

Article 16. Operation of facilities

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

(i) the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;

(v) procedures for characterization and segregation of radioactive waste are applied;

(vi) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

(vii) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

(viii) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;

(ix) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

16.1 Undertaken steps

(i) with regard to the safety assessment and commissioning programme assumed as reference for the licence of a radioactive waste management facility they are clearly regulated under Chapter VII of the Legislative Decree n° 230/1995. In particular, as indicated under Art. 15 of this report, a safety case has to be presented by the Licensee to support the application and a commissioning programme, approved and supervised by the Regulatory Authority, has to be conducted.

(ii) operational limits and conditions as specified in Art.15 are defined in the Technical Specification document attached to the licence; definition and general content of the

technical specification document is reported in Article 7 of Chapter VII of Legislative Decree n. 230/1995.

(iv) with regard to maintenance, monitoring, testing etc related procedures are reported in the Conduct of operation manual which has to be prepared for the facility according to requirements established in the same Article of the Legislative Decree identified above.

(v) with reference to engineering and technical support in safety related fields, although a specific requirement is not present in the in force regulations, its availability in the licensee organization is evaluated and requested in the licensing process.

(vi) characterization and segregation of radioactive waste is performed according to general guidelines issued by SOGIN and approved by ISPRA. Implementation is subject to regulatory authority supervision.

(vii) As far as reporting of incidents important to safety is concerned, Article 122 of Chapter X of Legislative Decree n.230/1995 establishes that the manager of the nuclear installation is responsible to notify any event relevant to safety to the Regulatory Authority and to other Administrations involved in the management of a potential emergency. Moreover further guidance on the information to be provided to the Authority Regulatory. Collection and analysis of operating experience is usually envisaged in specific QA procedures.

(viii) With reference to the decommissioning plan, although specific requirements are not envisaged in the present regulations, the proper consideration of decommissioning aspects is requested during the licensing process of the facility design. Furthermore, specific guidelines issued by SOGIN S.p.A. require that the final radiological characterization of the facility has to take into account its operating history

(ix) See Art.17.

16.2 Assessment of compliance

On the basis of the above discussion it can be concluded that Italy has sufficient provisions to fulfil its obligations under the Art. 11 of the Convention.

Article 17. Institutional measures after closure

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

(i) records of the location, design and inventory of that facility required by the regulatory body are preserved;

(ii) active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and

(iii) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

17.1 Institutional measures after closure

As said in other sections the current national strategy envisages the construction of a near surface national storage facility. The closure and post closure phases will be considered in the context of the licensing process of that facility. The related requirement are under definition.

Section I. Transboundary Movement

Article 27.Transboundary movement

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments.

   In so doing:

   (i) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

   (ii) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

   (iii) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

   (iv) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement;

   (v) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

2. A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees south for storage or disposal.

3. Nothing in this Convention prejudices or affects:

   (i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

   (ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

   (iii) the right of a Contracting Party to export its spent fuel for reprocessing;

   (iv) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

27.1 Regulatory requirements

Trans-boundary movement of spent fuel and radioactive waste is regulated into the national regulatory framework by the requirements stated in:

- Law on peaceful use of nuclear energy (Law 31 December 1962, n° 1860 as modified);
- Radiation Protection Act (Legislative Decree 17 March 1995, n°230 as modified);
- Council Regulation (EC) n° 1334/2000;
- The Act on authorization of export of dual-use products and technical assistance (Legislative Decree 9 April 2003, n°96);

In summary, according with the national regulations, to export spent fuel or radioactive waste from Italy a licence cannot be granted if:

- the destination is south of latitude 60° south;
- a State party to the Fourth ACP-EEC Convention which is not member of the European Union;
- a State which, in the opinion of the Italian competent authority, does not have the technical, legal or administrative resources to manage the spent fuel or the radioactive waste safely.

The international regulations for transport of dangerous goods, including class 7 (radioactive material) are applied for trans-boundary movement of spent fuel and radioactive waste to protect persons, property and the environment from the effects of radiation during their transport. Those materials are not categorized as such by the international Regulations but on the basis of their radioactive and fissile properties. Therefore all the requirements stated in the modal regulations (ADR, RID, IMDG Code, ICAO TI), that are based on the IAEA Regulations for the Safe Transport of Radioactive Material, are applied for the shipments of spent fuel and radioactive waste.

27.2 Administrative requirements

For trans-boundary movement of radioactive waste Italy follows the administrative procedures set forth in the European Union Directive 92/3/Euratom implemented into the national regulatory framework by the Radiation Protection Act.

The Directive establishes a set of requirements in order to ensure that the State of destination and the States of transit have the right to give their prior consent and to prescribe additional conditions and to be notified as is stated in the Directive. The Italian competent authority to grant the licence for export, import or transit of radioactive waste is the Ministry of Economic Development. The implementation of the EU Directive 2006/117, establishing new rules replacing the above mentioned directive 92/3 Euratom is in progress. The new Directive, besides introducing other administrative amendments, extends the scope of the rules to the spent fuel trans boundary movement.

For export of spent fuel in non EU countries the Council Regulation (EC) n° 1334/2000, setting up a Community regime for the control of exports of dual-use items and technology, is applied. In that case an authorization for export is issued by the Italian competent authority (Ministry of Economic

Development – International Department) on the basis of a declaration of the consignee endorsed by the State of destination.

27.3 Experience of trans-boundary movements

National experience of trans-boundary movements of spent fuel ad radioactive waste are related to the reprocessing of spent fuel and the treatment of radioactive waste arising from nuclear fuel cycle and from medical or industrial activities. The radioactive waste exported to UE countries are re-imported after their treatment. Also in those cases the procedures stated in the Directive 92/3/Euratom, quoted above, area applies.

27.4 Assessment of compliance

On the bases of information provided above Italy comply with article 27 for such radioactive waste and spent fuel as defined by the Directive 92/3/Euratom.

Section J. Disused sealed sources

Article 28.Disused sealed sources

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.
2. A Contracting Party shall allow for re-entry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

28.1 Sealed Sources Regulation in Italy

In accordance with the provisions of the Italian legislation, a practice with radiation sources is subject to radiation protection regulatory system if specified thresholds of activity and concentration are exceeded. However, for certain practices, such as medical use of radiation, deliberately adding radioactivity to consumer goods, importing and exporting such goods, discharges, reuse or recycle of radioactive materials from installations, the Italian legislation's requirements apply for any radioactivity contents, without thresholds.

From an administrative viewpoint, practices can be subject to the mutually exclusive requirements either of notification or of authorisation, in accordance with the provisions of Legislative Decree no. 230/1995.

A practice is subject to notification requirements if both defined thresholds in total activity and activity concentration of radioactive materials are exceeded. A holder of sources is required to notify local authorities on his intention to carry out the practice at least 30 days before the start of the practice itself. Moreover, detailed requirements for notification apply, which closely mirror those provided for in case of authorisation.

For installations using ionising radiation sources for medical, industrial and research purposes, the Italian authorisation system is based on a two tiered structure: authorisation of the most important installations is the competence of the Ministry of Economic Development; the Ministry issues authorisations acting in accordance with other relevant Ministries; the advice of ISPRA is sought under law in order to determine technical specifications applicable to the installation.

For smaller industrial and research installations the Prefect of the province has administrative competence to issue authorisations after seeking the advice of regional technical bodies and of the Fire Corps; the authorisation required for small medical installations is issued by the Regions, which are responsible for health in the Italian system.

Specific provisions apply to closing down practices subject to notification or authorisation; in particular, users are required to submit in advance a report to competent authorities on close-down operations as well as the meant for the destinations of radioactive sources and waste.

Import and export of, and trade in, activities of radioactive materials, products, apparatus and any other devices containing radioactive materials, pursuant to the Act no. 1860/1962, are subjected to

prior authorisation from the Ministry of Economic Development. Moreover, pursuant to Legislative Decree no. 230/1995, the licensees are required to comply with the following obligations:

(iii) the import activity shall be notified by the licensee in advance at least 60 days before; the notification shall be addressed to a few Ministries and to ISPRA;

(iv) every source placed on the market shall be accompanied by written information on technical precautions to be taken to prevent any undue exposure and on the procedures to follow when such sources are disposed of or cease to be in possession of the holder;

(v) a record of all commercial transactions relating to such radioactive materials shall be kept, contracting parties and activity of the sources shall be indicated in the records, in the lines given by a ministerial decree of 1964.

An authorisation by the Ministry of Economic Development for transport of the radioactive materials is required as well, pursuant to Act no. 1860/1962. Carriers shall transmit to ISPRA, within 15 days of the end of each calendar quarter, a summing up of records concerning transport operations carried out, in accordance with a Decree of the Ministry of Economic Development.

Ad hoc provisions of the new Legislative Decree no. 52/2007 establish that the holder of high-activity sealed radioactive sources shall integrate the licence or request a prior authorisation for such sources (granted in accordance with the Act no. 1860/1962 and the Legislative Decree no. 230/1995) with the demonstration that adequate arrangements have been made to ensure the safe management of sources, including when they become disused; such arrangements shall include, in particular, obligation for the transfer of sources to the manufacturer or supplier, or their placement in a recognised installation or financial security for the safe management of sources when they become disused.

Legislative Decree no. 52/2007 establishes specific provisions in order to identify the duties of two subjects which may take the charge of the disused sources management:

(vi) National Operator responsible, in particular, for the long term storage (50 years) of spent sources;

(vii) Integrated Service which may grant all the phases of the spent sources management.

Legislative Decree no. 52/2007 states specific provisions for the import and export of IAEA Categories 1 and 2 sealed sources; pursuant to Legislative Decree importation and exportation activities are subject to prior authorisation by the Ministry of Economic Development and the Ministry of Environment, with the advice of ISPRA. Such provisions are established on the basis of the essential requirements of the IAEA Code of Conduct and supplementary Guidance.

ISPRA plays a central role in the regulatory system. Apart from nuclear installations, which are always subject to ISPRA review, ISPRA is required by law to express advice and lay down technical specifications for installations which are authorised by the Ministry of Economic Development; moreover ISPRA has general inspection powers for every kind of radiation source and installation falling under the provisions of the Act and the Decrees. In the fulfilment of their duties ISPRA inspectors are vested with police powers, that is, they even have power of seizure on

sources or installations inspectors deem to be non compliant with relevant provisions laid down in law.

Apart from ordinary powers given to police, other authorities such as Labour Inspectorate, local Health bodies and regional Agencies for the Protection of the Environment are vested with competence in the field and entrusted to their surveillance.

28.2 Spent Sources Management

Responsibility is placed on the organisation receiving the sources to ensure that it complies with its authorisation to store radioactive material.

It should be noted that sealed sources are not manufactured or recycled in Italy; all sources are imported.

As far as the disused sealed sources management is concerned, one of these options can be adopted:

- transfer to the manufacturer or to the supplier (i.e. outside Italy).
- transfer to the waste processing and storage facility at the ENEA Research Centre of Casaccia.
- transfer to one of the companies which provide regional services for the collection of sources for subsequent disposal to ENEA (at present 3 companies are licensed).

In Italy there is no central repository for disused sources yet; Italian Government is at present committed to establish the procedures for the selection among suitable sites, in consultation with Regional Authorities. In the meanwhile, every user either has his own storage facility, which is regulated by ad hoc provisions in the license, or makes use of medium or small size interim waste storage facilities. For instance, in a medium interim storage facility for radioactive wastes, many disused sources may be stored today after dismantling of equipment containing sources.

There is a storage facility for radioactive wastes at the Casaccia Research Centre near Rome. It is owned by ENEA and operated by Nucleco S.p.A. Nucleco is a commercial company jointly owned by ENEA (40%) and SOGIN (60%). Its services include the collection of radioactive sources, the dismantling of equipment containing sources, processing of sources and the transfer of the processed material to the interim storage.

Waste is generally processed for storage at NUCLECO by supercompacting individual drums and placing compacted drums into a 400 litre overpack which is then backfilled with cement. Each overpack must comply with international transport requirements and the activity content is therefore restricted to limits for a Type A container.

28.3 Assessment of compliance

From what is stated above, the existing measures comply with the requirements of article 28 of the Convention. Some actions are required in the medium/long term in order to enlarge the storage capacity, available at national level, to safely manage spent sources and in view of final disposal.

Section K. Planned Activities to Improve Safety

K.1 Planned activities to improve safety

Several activities are in progress at regulatory and implementation level to ensure a continuous enhancement of spent fuel and radioactive waste safe management.

The process is taking in due consideration international references and practices, also through measures of international cooperation. In particular, it is worthwhile to mention that ISPRA is actively participating in the activities of OECD/NEA, IAEA and EU. In addition, . the Institute is also involved in the activities of the ENSREG and of the Western European Nuclear Regulators Association (WENRA) aimed at pursuing a continuous enhancement of the safety of reactors operation as well as of spent fuel and radioactive waste management and decommissioning, by promoting an harmonization process toward “reference levels”, either on legal and implementation side. An high level of attention is devoted by ISPRA to this process which is regarded as capable to providing up-to-date basis, aligned to the best European practices, for updating current national regulations.

On the legislative side, it is worthwhile to mention that the Decree of the Ministry of Productive Activities (now Economic Development), issued in March 2006, provides clear guidelines to the unique implementer subject (Sogin.) in order to implement the strategy for reprocessing abroad of the spent fuel still stored in the nuclear installations. In particular, on this basis, since December 2007 the transfer of spent fuel abroad for reprocessing is in progress, starting from the spent fuel of Caorso NPP. This requires the availability for the future of a suitable facility for the allocation of the resulting waste.

Clear directives have been also provided in relation to the treatment and conditioning of wastes currently stored on the nuclear sites, with a target to complete the treatment and conditioning programme by 2014.A specific priority is assigned by SOGIN S.p.A. to these activities.

Existing legislation has to be updated in relation to the construction of the national storage facility, whose completion is connected to the intergovernmental agreement with France for the return of the high level waste resulting from reprocessing. A commission established by the Ministry of Economic Development and having the mandate to define a procedural path to identify the sites candidate for the construction of such a facility, has recently completed its task.

On the implementation side, several projects related to the enhancement of the safety level of the radioactive waste (such as treatment and conditioning activities as well as by realizing new storage facilities, either by refurbishing existing buildings or by constructing new buildings) have been launched and/or planned.
In particular, priority has been assigned to the following activities to be performed on the sites:

- treatment and conditioning by cementation of the reprocessing liquid wastes stored at the EUREX facility as well as the realization of the storage facility for the final packages; in view

of the completion of these projects the liquid waste are transferred in a completely new storage station, from were they will be moved to the cementation facility

- treatment and conditioning by cementation of the reprocessing U-Th solution stored at the ITREC facility as well as the construction of the related storage facility for the final packages; A detail design has been submitted to the Regulatory Authority;
- realization of an interim dry cask storage facility for the Elk River spent fuel at the ITREC site;
- realization of new radioactive waste storage facilities at the NPPs of Garigliano and Latina (see figure 8), recently licensed;
- conditioning of the intermediate and high level waste at the Latina NPP;
- remediation of on site radioactive waste storage/disposal facilities at the Garigliano NPP, ITREC facility (wells and trenches) to bring them in line with present safety requirements; figure 9 shows an historical picture of the radioactive waste disposal in pits at the ITREC facility in the years ‘70s.
- preliminary decommissioning activities having relevance to radiation protection and safety (e.g. dismantling of Caorso NPP Off Gas system and of Garigliano NPP chimney showed in figure 10);
- completion of the envisage steps related to the spent fuel management strategy outlined in the report as well as to the treatment and the conditioning of the waste;

Most of the above activities are already in an advanced phase of design or licensing.

On the regulatory site the following improvements are envisaged:

- identification of the main requirements to be addressed in relation to design, construction, operation and closure of the above facility;
- updating of Technical Guides pertaining decommissioning and radioactive waste treatment and conditioning .

On the organizational side

- increase of the human resources assigned to the different involved Organizations, and in particular to the Regulatory Authority, in the context of an in progress reorganization of the nuclear sector.

Figure 8: Project of the Latina NPP recently licensed new interim storage facility

Figure 9: Historical picture of burial of radioactive waste in pits at the ITREC facility in the years ‘70s.

Figure 9: The chimney of the Garigliano NPP (on the left) and the Off-gas system of the Caorso NPP (on the right) to be dismantled in the near future

Section L. Annexes

Annex A List of Abbreviations and Acronyms

AFR	Away From Reactor
ALARA	As Low As Reasonably Achievable
ARPA	Regional Agency for the Environmental Protection
APAT	National Agency for Environment Protection and Technical Services
BWR	Boiling Water Reactor
CEVaD	Centre for Data Elaboration and Evaluation
CIPE	Interministerial Committee for Economic Planning
DISP	Nuclear Safety and Health Protection Directorate
DPCM	Decree of Prime Minister
ENEA	Agency for New Technology, Energy and Environment
ENEL	National Electricity Company
FSAR	Final Safety Analysis Report
GCR	Gas Cooled Reactor
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ISPESL	National Prevention and Workers Safety Institute
ISPRA	Institute for the Environmental Protection and Research
ISS	Italian National Institute of Health
LEU	Low Enriched Uranium
LWR	Light Water Reactor
NEA	Nuclear Energy Agency of OECD
OECD	Organisation for Economic Co-operation and Development
OPCM	Ordinance of Prime Minister
PSAR	Preliminary Safety Analysis Report
PWR	Pressurised Water Reactor
QA	Quality Assurance
RESN	Radiological Environmental Surveillance Network
SOGIN	Company for the Nuclear Installations Management
TS	Technical Specification
US NRC	United States Nuclear Regulatory Commission
WENRA	West European Nuclear Regulators Association

Annex B List of legislation, regulations, guides and standards

a) Statutes and Legislative acts

Law n° 1860 of 31st December 1962 published in the Italian Republic's Official Journal no. 27 of 30 January 1963, as amended by the President's Decree no. 1704 of 30 December 1965 (Italian Republic's Official Journal no. 112 of 9 May 1966) and by the President's Decree no. 519 of 10 May 1975 (Italian Republic's Official Journal no. 294 of 6 November 1975).

Law n° 225 of 24th February 1992, as modified by Legislative Decree 393 of 26th July 1996 promulgated in order to create National Service for the Civil Protection.

Legislative Decree n° 230 of 17th March 1995 published in the Supplement to Italian Republic's Official Journal no. 136 of 13 June 1995, implementing six EURATOM Directives on radiation protection (EURATOM 80/836, 84/467, 84/466, 89/618, 90/641 and 92/3).The Decree replaced the previous DPR n°185 issued in 1964 and establishes radiation protection requirements for workers, public and environment.

Legislative Decree n° 241 of 26th May 2000 transposing EU (European Union) directive 96/29/Euratom laying down basic safety standards for the radiation protection of workers and the public; the standards laid down in the directive incorporate the 1990 Recommendations of the International Commission on Radiation Protection (ICRP) into EU radiation protection legislation. Decree no. 241 has modified and integrated Legislative Decree no. 230 of 1995.

Legislative Decree n° 257 of 9th May 2001 promulgated in order to modify certain details in Legislative Decree no. 241 of 2000 concerning requirements for notification and authorisation of non nuclear installations where ionising radiation is used for industrial, research and medical purposes.

Prime Minister Decree of 14th February 2003 declaring the emergency status in relation to the decommissioning and radioactive waste management activities in those regions involved.

Ordinance of the Prime Minister n° 3267 of 7th March 2003 establishes the measures for the implementation of provisions aimed at enhancing the level of protection of Nuclear Installations.

Law n° 368 of 24th December 2003 establishing the procedures for the site selection of a national repository for HLW.

Law n° 239 of 23rd August 2004 promulgated for the rearrangement of the energy sector extends the procedures established by the Law n°368 of 2003 also for the site selection of a national repository of LLW.

Decree of 2nd December 2004 of the Ministry of Productive Activities (now Economic Development) provides directives to SOGIN for the implementation of decommissioning and radioactive waste management activities. The Decree also charges SOGIN to explore the feasibility of sending all the spent fuel currently stored in ITALY to abroad for reprocessing.

Law n° 282 of 16th December 2005 promulgated for the ratification of Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

b) Technical guides - Selected ISPRA TG addressed to Nuclear Installations' licensing

Doc. DISP (87) 10	"General Design Criteria for PWR NPPs"
Doc. DISP (87) 11	"Design Requirements for the limitation of the worker exposure for the PWR NPPs"
T.G. no.1	"Content of the Preliminary Safety Analysis Report for NPPs, pursuant to article no.36 of the Legislative Decree no. 2301995 "
T.G. no.2	"Procedure for the Authorisation of Changes in NPPs"
T.G. no.4	"Implementation of the article no.41 of the Legislative Decree no.230/1995 --Detailed Construction Designs"
T.G. no.8	"Quality Assurance Criteria for NPPs"
T.G. no.9	"Quality Assurance Description of the documentation required for design and construction phases prior to carry out nuclear tests"
T.G. no.11	"Criteria for the compilation of information reports on the operation of NPPs to be sent to DISP"
T.G. no.20	"Quality Assurance Description of the documentation required for operation phase of NPPs"
T.G. no.21	"Content of Operating Rules"
T.G. no.22	"Quality Assurance. Guide for collection, storage, preservation, and safekeeping of quality assurance records for NPPs"
T.G. no.23	"Quality Assurance. Guide for procurement of Items and Services for NPPs"
T.G. no.24	"Quality Assurance. Guide for Auditing on QA Programmes for NPPs"
T. G. no.25	"Quality Assurance. Guide for Applying on design activities for NPPs"
T.G. no.26	"Radioactive Waste Management"

c) Technical Standards

UNI standards related to decommissioning

The Standards applicable to the decommissioning of Italian installations are set out in a single document issued by the national standards organisation (UNI): UNI 9498.
That standard contains eight sections covering different topics. The contents of the individual sections of the document are summarised below.
In general the present standard pertains explicitly to the following type of installations:

- nuclear reactors
- nuclear subcritical units
- nuclear power plants
- nuclear research plants
- nuclear plants for spent fuel reprocessing
- plants for preparation and fabrication of special fissile materials and of nuclear fuel
- storage of special fissile materials and of nuclear fuel
- Installations for reprocessing, conditioning or temporary storage of radioactive wastes.

The standard is not applicable to:

- uranium mines
- storage of final disposal of radioactive wastes
- plant where during the operation, no radioactivity has been produced
- plants which have been converted to a new nuclear related use.

UNI 9498/1 - General criteria
This standard gives a general picture that includes principles and factors which have to be considered for the decommissioning of a nuclear plant. It includes the general requirement that all the procedures, either of a management, accounting and administrative type, or of a technical type, must be planned and done in a controlled and documented way.
The standard is addressed to the operator of nuclear plants to be decommissioned and to persons responsible for the planning and execution of decommissioning operations; it provides to indications and recommendations about the methods and the technical options which are convenient in order to maintain an adequate health protection for workers, public and environment, and finally to minimise the radiological risk associated to the plant.
The scope of the standard begins at the decision of the owner/operator to permanently shut down the plant, and terminates when a situation without radiological constraints is reached. The status of the plant taken as a reference in the present standard is the configuration existing at the moment the decision is made to permanently shut down. The radioactive substances considered are those associated with the normal operation

of the plant itself. The standard does not deal with decommissioning activities following severe accidents.

The aspects related to processing, conditioning, transportation and disposal of radioactive wastes are not included in the scope of the standard. The numerical definition of radioactivity limits for materials free from radiological constraints are also not included. Nor the management, accounting and administrative aspects. The standard does not exempt the user from observing the rules and authorising procedures in force.

UNI 9498/2 - Decontamination techniques

The section describes the principles and the methodologies which have to be considered for the planning and execution of decontamination activities at a nuclear plant being decommissioned, for the case of either immediate or deferred dismantling. It provides technical information and recommendations necessary to the owner/operator of the plant and to people responsible for the planning and execution of all the decontamination procedures which are useful in improving the conditions of radiological protection at the plant as well as in achieving the optimum management of wastes.

It is not applicable to plants which, following an accident, show a generalised contamination of components, structures and buildings and of the site itself. In this case specific decontamination techniques will be have to set up, and they are allowed to be different to those described in the present standard.

UNI 9498/3 - Storage and surveillance

This section identifies the fundamental activities which are necessary to be done on a nuclear plant at the end of operation, to leave it in a safe condition for an adequate period of time. It is concerned in particular with plants where the existing radioactivity, after the complete removal of all fissile materials, is due primarily to radioisotopes which have decay times which justify placing the plant in a conservation and maintenance (C&M) state for appropriate period, in order to allow the plant to be completely dismantled with a greatly reduced level of radioactivity.

UNI 9498/4 - Dismantling of structures and components

This section describes the principles and the factors which have to be taken into account for the dismantling and removal of structures and components which have become contaminated and/or activated during the operation of the plant.

UNI 9498/5 - Radioactive inventory

This section specifies the methodologies to be followed in the evaluation of the remaining radioactivity and of the associated radiation fields in order to carry out the radiological characterisation of the nuclear plants to be decommissioned. Such

methodologies must be programmed and performed in a checked and documented way.

UNI 9498/6 - Radiological characterisation and classification of materials

This section deals with the factors which have to be taken into account to characterise and classify the materials produced during the decommissioning of nuclear plants. It provides the criteria against which the most appropriate methodology for characterisation and classification of materials as a function of their type is to be chosen, as well as provides guidance for the choice of measurement instrumentation appropriate to define the radiological state of the materials.

UNI 9498/7 - Criteria for partial release of a nuclear plant and/or site

This section deals with those nuclear plants to be decommissioned for which a decision has been made to delay final dismantling for a sufficiently long period of time, such that they will have to be placed in a C&M state.

The decision of putting a part of a nuclear plant in a C&M state depends on the requirement to release some zone where other activities of a non nuclear type can continue to be performed.

Usually the part of the plant that will be put in a C&M state will be that part where the radioactivity cannot be easily removed but can be confined for long periods of time in well defined and sealed zones. Usually these are areas where the major part of the radioactivity is coming from neutron activation.

UNI 9498/8 - Requirements for the temporary storage of radioactive wastes and materials

This section gives the criteria to be followed in the design of a temporary store for the radioactive wastes resulting from the operation and dismantling of the nuclear plants. It also provides the general technical requirements which have to be fulfilled either in the design and management of the new temporary store, or in the modification of already existing facilities.

Furthermore it provides the criteria for environment protection against pollution resulting from management of radioactive wastes, in order to minimise the individual and collective doses of population and workers, and to preserve the quality of the environment for the present and future uses of the site.

The radioactive wastes mentioned above include those arising from reprocessing and/or conditioning activities, which are solid and satisfy the radioactivity concentration limits according to present standards for temporary storage or for disposal at an appropriate site.

UNI standards related to radioactive waste management

In the framework of the National Standardization Organisation (UNI) activities, the following standards aiming to the standardisation of the procedures for radioactive waste management have been developed:

UNI 10621 (2004) "Radioactive waste packages characterization"

UNI 10704 (2004) "Radioactive waste classification"

UNI 10755 (2004) "Recording and labelling of RW packages"

UNICEN 189 (2001)* "Solid materials from nuclear plants - Radiological methods and procedures for the clearance"

UNI 11196 (2006) "Qualification of conditioning processes for cat. 2 packages", that sets out the general requirements for the conditioning process qualification and the specific test to which the waste form and/or packages should be verified (mechanical and physical/chemical properties for homogeneous and heterogeneous waste form and for High Integrity Containers)

UNI 11194 (2006) "Radiological characterization of Cat.2 packages", that establishes methods and requirements for radiological characterization of radioactive waste packages before their disposal (i.e. measurement system performances, typical radionuclides relevant for disposal to be measured, sampling preparation, correlation factors).

UNI 11195 (2006) "Information management system for the disposal of Cat. 2 packages", that sets out the requirements and the methodologies for the management of the Surface Disposal Information Management System (i.e. data acquisition, waste reception plan, inspection and monitoring data base, long term management of the information system)

UNI 11196 (2006) "Containers for the final repository of Cat. 2 packages" That defines the requirements (dimension, mechanical characteristics) of the identified containers for LLW packages and qualification process.

UNI 11197 (2006) "Identification procedure and traceability of information for Cat.2 Packages", that defines the requirements for building a suitable Data Base and for organising the information needed to appropriately manage radioactive waste packages at a near surface disposal facility.

UNICEN 214-1 (2003)* "Category 2 Radioactive Waste Engineered Repository", that is structured as follows:

- Part 1: Basic Design Criteria

- Part 2: Basic Qualification Criteria for Engineered Barriers
- Part 3: Surveillance and Monitoring basic criteria

***** Waiting **for the final approval**

Annex C Additional information on Safety & Radiation Protection rules

As specified in section E, the main body of the applicable Italian rules is contained in the Nuclear Act 31.12.1962, no. 1860, and Legislative Decree no. 230/1995.
The statute and the decree provide for the most important aspects concerning both safety and radiation protection, as regards not only nuclear installations but also other aspects of the uses of radiation, so as to make up a comprehensive corpus of rules at the highest level.
The legislative provisions apply to every aspect of activities relevant to radiation protection, such as:

- Construction, operation, decommissioning of nuclear installations; provisions for decommissioning are a new feature of this Legislative Decree that were not included in the previous rules.
- Production, importation, export, handling, holding, processing, use, marketing, storage, transport, termination of holding, collection and disposal of nuclear radioactive substances.
- Work with radiation generating devices.
- Mining activities.
- Exposure to natural sources of radiation as well as any other activity or situation involving a significant risk, such types of exposures are to be laid down by governmental decrees.

It must be recalled here that the Countries members of the European Union share common directives and regulations that have been inspiring more and more many relevant aspects of the national regulatory system, above all in the field of radiation protection. Even in the Rome Treaty, signed in 1957, directives were included regarding radiation safety fundamental rules; procurement, treatment, controls and property of special fissile material. The quoted Treaty requires (art. 37) also the notification to the member States about the construction of any kind of plant that may discharge radioactive wastes. The aim of the notification is to give the possibility to verify whether any possible discharge can lead to contamination of water, ground or air of any member state.

Protection of workers

As provided by the 230/95 Legislative Decree, responsibility for the radiation protection of workers lies with the Ministry of Labour and Social Affairs (acting through the Labour Inspectorate), with ISPRA and with the local authorities of the National Health Service.

Any persons, including the State, the Regions, the Provinces, the Communes, public bodies, educational establishments and research laboratories, who, in the course of their work. expose workers to the hazards arising from ionising radiation must comply with the provisions of the 230/95 Legislative Decree.

The general standards for the radiation protection of workers are based upon the Euratom basic standards. These are embodied notably in the provisions for the adoption of the dose limits mentioned above. As to the present dose limits it must be emphasised that those ones in

Legislative Decree no. 230 of 1995 anticipated the limits subsequently prescribed by Euratom Directive 96/29.

The Legislative Decree of 1995 also regulates work in mines where radioactive substances are present and, in particular, defines the obligations of employers in relation to the radiation protection of workers in the mining industry. The conditions in which these provisions are applied are laid down by a Decree of the Minister for Industry. who is also responsible for inspection activities to ensure protection against radiation risks.

In particular, special provisions regard the protection of foreign workers covered by Euratom Directive no. 90/641. This involves, inter alias, the establishment for each worker of a personal radiation log book with which he must be provided in compliance with the above Directive.

Finally, another very important feature is the explicit inclusion of provisions allowing the ALARA principle to be applied to the employer's activities even though the justification and ALARA principles were long in use in the Italian regulatory system before they were formally legislated into the Legislative Decree no. 230.

Protection of the public

The Legislative Decree no. 230/95 contains provisions on the protection of the public against ionising radiation. The Ministry of Health is responsible for such protection and must, in particular, control all sources of ionising radiation to avoid any contamination of the public and of the general environment. Regional and provincial Commissions were set up under Presidential Decree no. 185 to give their advice on the radiation protection and associated problems. Under the Legislative Decree no. 230 advisory bodies must now be set up in accordance with the provisions of regional laws.

In pursuance of Article 96 of the same Decree under the procedure mentioned above, dose limits and maximum permissible concentrations are laid down for the public in compliance with the Community Directives.

Other provisions concern the protection of patients undergoing radiology and nuclear medicine, in compliance with Euratom Directive no. 466/84. These provisions concern the qualification of staff, the criteria for and methods of using radiation in medicine, the inventory of radiological equipment, quality controls measures, and so forth.

Protection of the environment

The most important provisions, relating expressly to the environment, are contained in Legislative Decree no. 230, namely Articles 100 and 104.

Article 100 provides that in the event of an operational accident involving radioactive substances and affecting the environment, the operator must intervene to prevent the risk of subsequent

contamination or injury to persons. The Prefect of the Province and the local authorities of the National Health Service must be immediately informed.

Article 104 provides that the Ministry of the Environment is responsible for monitoring environment radioactivity, while the monitoring of foodstuffs and drinks is entrusted to the Ministry of Health, with overall technical co-ordination by the ISPRA. All monitoring is carried out by national and regional networks, the latter acting under directives issued by the abovementioned ministries.

The activities of the ISPRA are also governed by relevant directives from these ministries, and by Article 35 of the Euratom Treaty. Its functions include the co-ordination and standardisation of measurements, the introduction of new measuring stations, etc.

The situation described above is one result of the referendum held 18 April 1993 which abolished the powers of Local Health Units as regards the environment, entrusting these powers to the National Environmental Protection Agency and to other relevant departments and organisations concerned.

Radioactive Waste Management

Legislative Decree no. 230 of 1995 regulates radioactive waste management and disposal in a more precise manner than Presidential Decree no. 185 of 1964. In general, Article 102, establishes that these wastes must be managed in accordance with the rules of good practice and the instructions set out in the disposal licence; also, any person producing, treating, handling, using, dealing in or storing radioactive substances must conduct a whole series of assessments concerning the disposal of solid, liquid or gaseous radioactive waste in order to ensure that the limits and the other conditions governing disposal into the environment are observed [Article 103]. Radioactive waste discharges must be licensed, as a rule, by the authorities responsible for licensing the installations where the waste is produced and discharged; in other words the licence for the installation also cover waste discharges from that installation.

That is so with nuclear installations as well as installations for use of radioisotopes. Where no licence is necessary for the installation, authorisation for waste disposal is given by authorities identified by regional legislation, while a decree of the Minister for the Environment, made in consultation with the Ministers of Labour, Health and Social Affairs and of Economic Development and taking into account the views of the ISPRA, determines the upper limits beyond which a licence is required. Article 33 also requires a prior licence to be obtained from the Ministry of Economic Development to build and operate installations for the storage or disposal or radioactive wastes.

Legislative Decree no. 230 has also incorporated Euratom Directive 92/3 concerning the transfer of waste. A Circular of the Ministry of Industry (no. 236 of 28 October 1994) adopted in order to implement this Directive into Italian legislation, pending Legislative Decree no. 230, was essentially embodied in this Decree. Article 32 requires prior authorisation of transfer, import, export and

transit of radioactive waste, in compliance with the Directive. This authorisation is the responsibility of the authorities who have jurisdiction over the activities with which the wastes are involved. The relevant procedure is laid down in a Decree of the Minister for Industry.

Other technical and administrative obligations are prescribed in the event of any serious contamination of the environment in connection with the use and disposal of radioactive substances. To be more precise, the Prefect, other competent authorities in the region and the ISPRA must be informed of the occurrence of a dangerous incident and there is an obligation to take all the measures required to restrict contamination in non controlled areas and to prevent any risk to individuals and the public [Article 101]. A Decree made by the Ministers for the Environment and Health, incorporating the opinion of the ISPRA, lays down the levels of serious contamination and other conditions governing the application of this section.

Most recent modifications in the regulations

It must be said beforehand that the text of Legislative Decree no. 230 of 1995 was drafted keeping in mind the drafting in Brussels of the new directive 96/29/Euratom; indeed, the Decree no. 230 was drafted with a view to anticipating the new Euratom requirements as much as legal constraints made it possible. As a consequence, the transpose of the directive did not made it necessary to completely revise Italian radiation protection legislation, although Decree no. 230, as modified by Legislative Decree no. 241 of 2000, does contain new important features deriving from the transpose of Directive 96/29/Euratom into Italian law.

One of the most far reaching new provisions in Decree no. 230 is the distinction between practices and intervention, as defined in EU directive 96/29/Euratom in accordance with the Recommendations of ICRP Publication 60: the basic principles of justification and optimisation (the latter being also called ALARA, i.e. requiring doses to be kept as low as reasonably achievable) apply both to practices and to intervention although the wording is somewhat different. In cases of intervention on the contrary the third principle of dose limitation does not apply, intervention levels being used in its stead.

Practices

In accordance with the new provisions introduced into Decree no. 230 of 1995 by Legislative Decree no. 241 of 2000, a practice is subject to radiation protection requirements if certain thresholds of activity and concentration are exceeded: the scope is determined by overall thresholds of:

- 1 Bq/g in activity concentration for all radionuclides, and
- relevant activity values for each radionuclide from Euratom directives 84/467 and 96/29, whichever the lesser.

However, for certain practices, such as medical use of radiation, deliberately adding radioactivity to consumer goods, importing and exporting such goods, discharges, reuse or recycle of radioactive materials from installations, the Decree's requirements apply even below the thresholds.

As before, safety and radiation protection requirements for protection of workers, the public and the environment apply if a practice meets the appropriate conditions.

The concept of triviality in individual and in collective doses as well as provisions for unrestricted release of radioactive materials from installations have also been formally introduced into Italian legislation according to the following basic 'below regulatory concern' criterion, both conditions of which must be met:

a) Effective dose $\leq$ 10 μSv/year, and
b) either collective Effective dose committed in one year of performance of the practice not greater than about 1 man·Sv/year or the relevant analysis demonstrates that exemption is the optimum option.

From an administrative viewpoint, practices can be subject to the mutually exclusive requirements either of notification or of authorisation. In accordance with the new provisions a practice is subject to notification requirements starting from certain thresholds in activity and activity concentration as far as radioactive materials are concerned; the relevant thresholds established for notification in an Annex of the Decree are those laid down in Annex I of EU directive 96/29/Euratom. A holder of sources is required to notify local authorities of his intention to carry out the practice at least 30 days before the start of the practice. Besides, detailed requirements for notification apply which closely mirror those provided for in case of authorisation.

The Decree's provisions state that a practice is subject to notification insofar as requirements for authorisation do not apply. In particular, nuclear installations do not require notification since they continue being subject to the ad hoc authorisation requirements laid down in Decree no. 230 of 1995, which have not been modified by the transpose of EU directive 96/29/Euratom.
For other installations using ionising radiation for medical, industrial and research purposes the Italian authorisation system is based, as in the past, on a two tiered structure: authorisation of the most important installations is the competence of the Ministry of Industry; the Ministry of Industry issues authorisations acting in accordance with other relevant Ministries; the advice of ISPRA is sought under law in order to determine technical specifications applicable to the installation.

For industrial and research installations of a less important character the Prefect of the province has administrative competence to issue authorisations after seeking the advice of regional technical bodies and of the Fire Corps; the authorisation required for installations where ionising radiation is used for medical purposes is issued by the Regions, which are responsible for health in the Italian system.

A Technical Annexe to Legislative Decree no. 241/2000 lays down thresholds in order to determine which installations are authorised by the Ministry of Industry and which ones by local authorities; thresholds are set in terms of values of activity, activity concentration and neutron yield for radioactive sources, and of energy and neutron yield for accelerators. The same Annexe also lays

down the technical features of the radiation sources and of the installation which must be specified in the application.

A general criterion is in force in Italy for unrestricted release from any installation subject to either notification or authorisation requirements. Radioactive materials from such practices can be unconditionally released from regulatory control if the radionuclides concerned comply with conditions regarding both activity concentration and radioactive half life:

- activity concentration $\leq$ 1 Bq/g, and
- half-life $<$ 75 days.

If conditions above are not complied with, an authorisation is required for release, reuse and recycle of radioactive materials from the installation concerned and specifications to that effect are established in the licence. The authorisation is given on the basis of a case-by-case analysis which has to demonstrate compliance with the basic 'below regulatory concern' criterion stated above. In the case where the practice is not subject per se to authorisation requirements, as for instance in the case where notification applies, a special authorisation for release is provided for.

The transposing of the EU directive 96/29/Euratom has also led to establishing a new dose limit for exposed workers of 20 mSv in a calendar year. Instead of Annual Limits on Intake (ALI), age dependent coefficients relating a unit of intake of a radionuclide to committed effective dose for workers and members of the public are now in use in accordance with the EU directive mentioned above.

Natural Radiation Sources

Some of the most important provisions introduced in the Italian regulatory system by the transposal of EU directive 96/29/Euratom concern work activities which involve the presence of natural radiation sources, such as radon, ores and cosmic rays, leading to a significant increase in exposure of workers or members of the public; given the impact of the changes introduced into the regulatory system a gradual implementation has been provided for.

As regards natural radiation sources a new Title (III-bis) was introduced into Legislative Decree no. 230 of 1995 by the transposal of EU directive 96/29/Euratom. In the transposal of the directive the relevant European Commission's recommendations & guidance (Radiation Protection (RP) 88, RP 95 and RP 107) were followed, action levels being provided for concerning e.g. the following work activities:

- 500 Bq/m3 or 3 mSv/year effective dose for radon;
- 1 mSv/y effective dose for workers or 0,3 mSv/y effective dose for members of the public in work activities with radioactive substances of a natural origin;
- 1 mSv/y effective dose for air crews.

Work activities with natural radioactive substances identified as worthy of concern in an Annex to Legislative Decree no. 241/2000 are, broadly, the ones listed in RP 95.

Operators are under a legal obligation to carry out relevant measurements and to have Qualified

Experts estimate doses to workers and, where appropriate, to reference groups of the public; if an action level for workers or the public is reached and the operator does not succeed in keeping exposures below the action level then the ordinary provisions for the protection of workers and, if appropriate, for the public apply, i.e. the work activity in question is considered for all practical purposes as a practice as far as radiation protection of workers and, where appropriate, members of reference groups of the public is concerned.
An ad hoc Section of a Technical Commission which sits at ISPRA is also provided for in order to give technical advice and further good practice in work activities in radon prone areas, with naturally occurring radioactive materials and cosmic rays.

Intervention

As regards intervention in cases of emergency, it must be stated beforehand that requirements for detailed emergency plans providing for intervention in case of accidents in nuclear installations had been in force in Italy since Presidential Decree no. 185 of 1964 was promulgated. Further requirements to that effect have been introduced in Legislative Decree no. 230 by transposing EU directive 96/29/Euratom providing for intervention in cases of radiological emergencies in non nuclear installations and for exposure resulting from the after effects of a radiological emergency or of a past or old practice or work activity, which were not regulated in previous radiation protection legislation.

Since the promulgation in 1964 of the first Radiation Protection Decree it had been a practice in the authorisation procedures to request of the applicant an analysis of possible accident scenarios and of their radiological consequences, together with appropriate measures to be implemented with a view to preventing and controlling accident conditions, and mitigating their consequences; even then, separate provisions laid down in Decree no. 185/1964 applied to nuclear installations.

Given that nuclear installations proper continue to be subject to a special, separate regime as in the past, ad hoc provisions introduced into Legislative Decree no. 230 of 1995 by Legislative Decree no. 241 of 2000 require for each non nuclear installation subject to authorisation by the Ministry of Industry that evaluations of potential exposures should be made by the applicant seeking an authorisation for radioactive sources and submitted to licensing authorities so that an intervention plan can be prepared by emergency preparedness and management authorities.

For those non nuclear installations which require authorisation by the Prefect or by the Regions, licensing authorities will review evaluations of potential exposures made by the applicant and will decide whether such potential exposures are likely to exceed 1 mSv of effective dose; in this case an intervention plan must be prepared by emergency preparedness and management authorities as well. No new installation can start operations before approval of an intervention plan if the former is required under the new rules.

A Technical Annex in Legislative Decree no. 230, also introduced by Legislative Decree no. 241 of 2000, lays down indicative intervention levels in terms of effective, equivalent and absorbed doses

for purposes of planning and intervention in case of emergency; broadly, the levels established are in accordance with the European Commission's guidelines (Radiation Protection 87 "Radiological protection principles for urgent countermeasures to protect the public in the event of accidental releases of radioactive material") and with criteria in IAEA Safety Series no. 109 ("Intervention criteria in a Nuclear or Radiological Emergency").

Annex D Technical Guide n° 26 on Radioactive waste management

I INTRODUCTION

I.1 Foreword

Radioactive waste management shall refer to the basic principles of workers and population health protection and protection of the environment, taking also into account the impact on the future generations.

Radioactive wastes produced in the peaceful use of nuclear energy are different in form, activity content, half-lives, and emitted radiations are of different nature (α, β, γ and n) and energy; such differences require differentiated waste management strategies.

This management, that includes the collection, selection, treatment, conditioning, interim storage, transportation and disposal, results tightly connected also with process selection and with plant design, because they can considerably influence the nature and the amount of produced wastes.

I.2 Scope

This Technical Guide (T.G.) is aimed to establish criteria for the radioactive waste management.

In the T.G. the wastes are classified into three categories to which correspond different confinement times and management strategies.

Specific guidances are provided for the first two categories, while only general guidelines are given for the third one which concerns those wastes requiring confinement times of hundreds of thousand years.

This T.G. applies to wastes generated in those activities regulated by the in force laws on the peaceful use of nuclear energy, and does not consider gaseous and liquid wastes released into the environment as effluents.

I.3 Definitions

The following definitions apply:

Radioactive waste: material, produced or used in the peaceful use of nuclear energy, containing radioactive substances, and which no further use is foreseen for; exception is made for radioisotopes of U and Th series naturally present in the materials, which need not to be considered, provided their concentrations are below the values established in the art. 197 of the Treaty of European Atomic Energy Community; also spent fuel elements are not considered as radioactive wastes.

Conditioning: process carried out by means of a solidifying agent within a container in order to obtain a package (conditioned radioactive waste + container) in which radionuclides are embedded in a solid matrix to restrict their potential mobility.

Confinement: segregation of radionuclides from the biosphere in order to limit their release below acceptable quantities and concentrations.

Disposal repository: natural and/or artificial structure used for the emplacement of radioactive wastes for disposal purposes.

Embedding: conditioning of solid radioactive wastes resulting in the production of a heterogeneous solid matrix.

Solidification: conditioning of liquid or semiliquid radioactive wastes resulting in the production of a homogeneous solid matrix.

Treatment: set of physical and/or chemical processes which modify the radioactive waste physical form and/or chemical composition, the main objective being to reduce the volumes and/or to make wastes more suitable to the subsequent conditioning process.

II CRITERIA

II.1 Radiological and environmental protection

Individual and collective doses to the public and workers from the radioactive waste management shall be kept as low as reasonable achievable, social and economic factors and impact on future generations being taken into account.

Impact to the environment shall also be minimized, taking into consideration, besides the radiological aspects, also the other aspects which are or might be important for the preservation of the environmental quality and for the present and future land use.

II.2 Reduction of waste production and volume reduction

Provisions shall be made in order to:

a) reduce the radioactive waste production at the origin, in terms of mass, volume and activity;

b) reduce the volume of the waste through specific treatments, taking also into account the envisaged disposal solutions.

All technical, operational and administrative aspects which affect or might affect the quantity of radioactive wastes produced and their volume reduction and concerning different phases such as plant design and operation, services and processes selection, shall be optimised.

II.3 Classification of radioactive wastes

Radioactive wastes are classified into three categories in accordance with the radioisotopes characteristics and concentrations.

For each category, different management methods and specific disposal solutions are identified.

II.3.1 First category

Radioactive wastes are classified into first category when, within a few months or, as a maximum, within a few years, decay to a radioactivity concentration lower than values defined in the Italian law (art. 6, point 2, paragraphs b) and c) of the DM July 14, 1970)[(1)].

The presence of long half-life radioisotopes in the wastes is permitted, provided their concentration is lower than the above mentioned values.

First category wastes are mainly produced in medical and research activities, where the radionuclides involved (apart from few exceptions such as ^{3}H and ^{14}C) are short lived ones with half-lives lower than 1 year and, in most cases, lower than 2 months.

(1) For solid wastes, referred values are as follow:
a) 10^{-5} μCi/g for nuclides with very high radiotoxicity
b) 10^{-4} μCi/g for nuclides with high radiotoxicity
c) 10^{-3} μCi/g for nuclides with moderate radiotoxicity
d) 10^{-2} μCi/g for nuclides with low radiotoxicity

II.3.2 Second category

Radioactive wastes are classified into second category when, in time periods varying from a few decades to a few centuries, decay to radioactivity concentrations in the order of some hundreds of Bq/g; the presence of very long half-life radioisotopes in the wastes is permitted provided their initial concentrations is of this order of magnitude.

Second category wastes are in particular characterized by a radioactivity concentration that, following possible treatment and conditioning processes, shall not exceed at disposal the values listed in tab. I.

Second category wastes are mainly generated in nuclear facilities (primarily in nuclear power plants) and in a few specific medical, industrial and research activities. This category also includes some parts or components arising from the decommissioning of nuclear facilities.

II.3.3 Third category

Third category wastes are radioactive wastes which do not belong to the previous ones.

To this category belong wastes which need thousands or more years to decay to radioactivity concentrations of some hundreds of Bq/g.

In particular this category includes:

- high specific activity liquid wastes arising from the first cycle of reprocessing facilities (or other equivalent liquids) and the solids to which these liquids may be converted;
- wastes containing alpha and neutron emitters mainly arising from research laboratories, medical and industrial activities, mixed oxide fuel element fabrication and reprocessing facilities.

II.4 First category waste management

First category wastes shall be kept into a suitable storage for a time period sufficient to attain a radioactivity concentration lower than the values referred in the previous paragraph II.3.1.

If radionuclides with different half-lives are present, they should be collected separately in the production area in order to optimize the storage time. When such provisions are not practicable, the storage time is determined by the radionuclides with longest half-life.

Wastes shall be stored in containers able to guarantee their containment, taking also into account chemical-physical interaction processes between waste and container.
When the re-utilization of the container is foreseen, wastes should be collected inside a further containing system (e.g. plastic bags), in order to minimize possible contaminations of the container.
External irradiation and surface contamination levels, with reference to the containers and the storage area, shall be consistent with the adopted classification of the area and workers.
Transportation of the wastes, when provided, shall comply with regulations for off-site transportation, as far as the activities and the containers are concerned.
A recording system shall be established, and the following information shall be registered for each container: radionuclides which are present, their activity and concentration, date of last filling, their origin and time foreseen for the disposal.
Same information, or at least a clear reference, shall be reported on the containers. Indirect method for the evaluation of the concentration may be adopted, provided their reliability is demonstrated.
The storage facility shall guarantee:

a) weathering and flooding protection;
b) suitable fire protection;
c) inaccessibility by non-authorized personnel.

When the radioactivity concentrations have fallen below the values referred in paragraph II.3.1, the wastes may be disposed in compliance with the Italian law concerning hazardous wastes (DPR September 10, 1982 n. 915).

II.5 Second category waste management

The following criteria apply to sea-dumping or to shallow land-burial, above or below ground surface; however most of them may also apply to other methods of land disposal such as in abandoned mines or in natural cavities.

II.5.1 Radiological and environmental protection criteria

Land disposal of the radioactive wastes shall comply with the objectives established in chapter II.1.
In particular the present and future exposure of the population reference group shall not exceed the level established as design objective for the other nuclear facilities. Such a level, which corresponds to an effective dose equivalent of 0.1 mSv/y, represents a small fraction of the mean level of exposure from natural background radiation.
These objectives shall be pursed through the selection of adequate technical requirements for wastes, storage facility and disposal site, as well as through administrative provisions to be taken at the disposal repository design phase and at the waste management procedures planning phase.

II.5.2 Waste requirements for disposal

Second category wastes, with the exception referred in paragraph II.5.3, shall be subjected to specific conditioning processes after a possible treatment; such processes entail solidification of liquid or semi-liquid wastes and embedding of solid wastes.

In defining the conditioning systems (design and operation), besides the compliance with the radioprotection requirements and the criterion related to the volume reduction referred at the point II.2.b), each one of the following shall be considered:

a) the radioactive waste conditioning shall be performed in a time period as close to the production phase as possible;
b) the techniques based on mixing of different waste streams and which allow a volume reduction of conditioned wastes, shall be implemented as far as reasonably possible.

Radionuclide concentrations in conditioned wastes shall not exceed the values listed in tab. 1.
The compliance of such limits is temporally referred to the disposal phase but, as far as possible, it is required the same limits shall be complied with also by the final products at the end of the conditioning process. On this regard, in the frame of a general balancing with the volume reduction requirement, it is allowed that, in some instance, the radioactive concentration in the final products at the end of the conditioning process exceed the above mentioned limits. In such specific cases a clear demonstration, in term of capacity and characteristics (see point II.5.9) of the foreseen interim storage shall be provided to support the proposed storage period; in any case the storage period assumed for the evaluation of the radioactive concentration shall not exceed 10 years.
The values listed in tab. 1, which do not exceed the concentration limits set down by NEA regulation for sea-dumping, refer to the whole monolithic volume in which the radioactive material is distributed; materials used for purpose other than solidification of embedding, such as shielding, should not be considered in the computation of total weight. Similarly, in case of embedding of solid wastes with considerable size, the compliance with the values listed in tab. 1 of the specific activities calculated shall be referred to the solid waste mass and not to the whole mass of the final product.
If different radionuclides are present in the waste, the limits of tab. 1 are met if the sum of fractions obtained dividing each nuclide’s concentration by the appropriate limit referred in tab. 1, is not greater than 1.
The methods used to determine radionuclide concentration in the final products may be direct or indirect; however they shall be such as to permit the verification of compliance with the limits of tab. 1.

Table 1 CONCENTRATION LIMITS FOR SECOND CATEGORY CONDITIONED WASTES	
Radionuclides	**Concentration**
α emitters $T_{1/2}$ > 5 y	* 370 Bq/g (10 nCi/g)
β/γ emitters $T_{1/2}$ > 100 y	* 370 Bq/g (10 nCi/g)
β/γ emitters $T_{1/2}$ > 100 y in activated metals	3.7 KBq/g (100 nCi/g)
β/γ emitters 5 y <$T_{1/2}$≤ 100 y	37 KBq/g (1 μCi/g)
^{137}Cs and ^{90}Sr	3.7 MBq/g (100 μCi/g)
^{60}Co	37 MBq/g (1 μCi/g)
^{3}H	1.85 MBq/g (50 μCi/g)
^{241}Pu	13 KBq/g (350 nCi/g)
^{242}Cm	74 KBq/g (2 μCi/g)
Radionuclides $T_{1/2}$ ≤ 5 y	37 MBq/g (1 mCi/g)

* values must be intended as average values referred to the whole of the wastes contained in the disposal repository, taking into account that the limit value for each package cannot exceed 3.7 KBq/g (100 nCi/g)

II.5.3 Second category wastes which do not need conditioning for disposal

Dry solid wastes which, even following a volume reduction process, present radioactivity concentrations lower than the values listed in tab. 2, and which therefore require times of few decades to decay to levels of some hundreds of Bq/g, may be land disposed, in compliance with radiological and environmental protection objectives, without any preventive conditioning.

These wastes are generally contaminated or lightly activated materials such as rags, paper, clothing, tools and other different objects.

The possibility of the land disposal such waste depends also on the physical and chemical nature of the wastes, the treatment processes, the packaging techniques adopted, the absence of free liquids in the package wastes.

Direct or indirect methods may be used to determine radionuclide concentrations, but their accuracy shall be such as to permit the verification of compliance with the limits referred in tab. 2.

Such wastes shall be packaged into containers and, at the disposal repository, segregated from the second category conditioned wastes.

Table 2 CONCENTRATION LIMITS FOR SECOND CATEGORY NOT CONDITIONED WASTES	
Radionuclides	**Concentration**
Radionuclides with $T_{1/2} > 5y$	370 Bq/g (10 nCi/g)
$^{137}Cs + {}^{90}Sr$	740 Bq/g (20 nCi/g)
Radionuclides with $T_{1/2} \leq 5y$	18,5 kBq/g (500 nCi/g)
^{60}Co	18,5 kBq/g (500 nCi/g)

II.5.4 Radioactive waste conditioning

Conditioned wastes shall present mechanical, physical and chemical characteristics that make them suitable for land disposal. The final products shall, in any case, comply with the packaging requirements established by the NEA regulation for sea dumping (Guidelines for sea dumping packages of radioactive waste, NEA, April 1979).

In the conditioning process, the requirements established by present regulations for domestic and international transportation of radioactive materials shall be taken into account, in particular when bulk transportation is foreseen; package by itself, or with additional shielding components, shall comply with such regulations.

The external radiation level of the package, without additional and removable shielding components, shall not exceed, on production, 10 mSv/h at any point of external surface.

The conditioned wastes shall comply with the minimum requirements listed below, where in some cases reference is made to national or foreign standards for specific requirements or test methodologies; the listed standard may be replaced by other equivalent standards or procedures.

a) Compressive strength

The compressive strength shall be at least 500 N/cm^2. For materials with elasto-plastic characteristics, the compressive strength shall be evaluated under load condition corresponding to a 5% in the compressive strain (tests may be performed in accordance with UNI standards for the destructive tests on concrete).

b) Thermal cycling

Following not less than 30 thermal cycles of 24 hours, from –40 °C +40 °C with 90% relative humidity, the compressive strength shall keep over the above mentioned limit, and cracks shall not be observe.

c) Radiation Resistance

The compressive strength shall keep over the above mentioned limit even following an exposure to 10^6 Gy from γ radiation.

d) Fire resistance

Conditioned wastes shall be incombustible or, at least, self extinguishing in accordance with ASTM D 635-81.

e) Leaching rate

Conditioned wastes shall present a high resistance to leaching; leaching rate tests shall be performed in accordance with long term methods.

f) Free liquids

Conditioned wastes shall be exempt from free liquids in accordance with ANSI/ANS 55-1.

g) Biodegradation resistance

Conditioned wastes shall present suitable biodegradation resistance, keeping the compressive strength over the above mentioned limit.

h) Immersion resistance

Immersion in fresh water for 90 days shall cause neither bulkings nor decreases of the compressive strength under the above mentioned limit.

The required tests shall be performed within a documented program for qualification and control of the conditioning system, that includes a set of characterization tests on laboratory specimens or conditioned waste prototypes in suitable scale. Such program shall be developed in accordance to the applicable Quality Assurance criteria set down in ENEA/DISP T.G. n. 8.

The program shall also concern the methods for the evaluation of the radioactivity concentration in the packages and the design and operation criteria for the conditioning plant. In case that characterization tests are carried out on laboratory specimens, their characteristics shall be correlated with the actual size conditioned wastes.

II.5.5 Waste containers

Radioactive waste containers shall guarantee the following functions:

a) constitute an effective barrier for radioactive materials during filling, handling and possible interim storage;
b) constitute a radiation shielding, if needed;
c) guarantee, for transportation purpose, leak tightness in accordance with international standard tests (such as those established by ONU).

Container material shall have good quality and be consistent with the waste and the selected conditioning process. Mechanical characteristics shall be such as to guarantee an adequate resistance against the collision or dropping occurring at the plant during handling and transportation. Container surfaces shall be easily decontaminable, if needed. The outside surface of the container shall provide an adequate corrosion resistance and the inside surface shall be consistent with the conditioning process. The shape of the container shall be such as to facilitate the handling operations.

To optimize spaces and handling equipments, standard containers shall be used when possible, consistently with points a) and b) mentioned above.

II.5.6 Recording and labelling

A recording system shall be established which provides, for each container addressed to the disposal, the following information:

a) manufacturer of the package;
b) package and container description: mass, dimensions, density;
c) waste characteristics (e.g. solidified resins, laboratory glasses, etc.) and chemical composition (e.g. calcium fluoride, toluene, etc.);
d) solidification agent (e.g. cement, polymer, etc.);
e) α, β, γ and n activity content (Bq);
f) main radionuclides present in the waste;
g) radioactivity concentrations for each radionuclide group referred in tab. I (Bq/g);
h) maximum dose rate at the surface (mSv/h);
i) transferable surface contamination level (Bq/m^2);
j) packaging date;
k) container identification marking.

The identification marking shall be indelibly reported on the container.

II.5.7 General characteristics of the disposal site on the land

Site hydrogeological characteristics shall be such as to minimize the waste leaching by the groundwater and the return of contaminated waters to the surface or the biosphere.

Climatic, geographical and geomorphological characteristics of the site shall exclude significant erosion processes, in particular by meteoric and surface water, as well as land-sliding and flooding possibility.

Similarly, areas shall be avoided where significant tectonic processes, seismic activity or volcanism could reduce the waste confinement capability.

The disposal site shall have geological and hydrogeological characteristics sufficiently homogeneous and such that surveys and analyses are representative of the site.

In site selection, consideration shall be given to land use, to the presence of dangerous activities or of man made facilities, whose failure could have adverse impact on the site characteristic.

To meet the radiological and environmental protection objectives, the disposal site and/or the disposal facility shall be provided with engineering features, able to prevent or delay a direct contact between wastes and the environment, with a consequent possible radioactivity release.

The design of these features shall, as far as possible, avoid maintenance operations.

II.5.8 Surveillance

An environmental monitoring system shall be provided at the disposal site.

Environmental surveillance shall be maintained even after the disposal capacity to receive the radioactive wastes is over.

II.5.9 Interim storage

Conditioned wastes and wastes which do not need conditioning for disposal (par. II.5.3) may be collected in an interim storage facility prior to final disposal.

Interim storage characteristics shall be such as to guarantee:

a) direct or indirect waste inspectionability;
b) waste protection from weathering
c) waste protection from external events (e.g. tornado, earthquake);
d) floor drainage systems equipped for collection and sampling of drained liquids;
e) fire detection and suppression systems commensurate with fire loads;
f) Inaccessibility by non-authorized personnel.

Administrative procedures (labelling, waste registration systems, etc.) shall enable the waste control.

II.6 Third category waste management

The management of the third category wastes shall be based on case by case analyses. In the following a few general guidance's are given, considering in particular:

- high-level liquid or solidified wastes, containing β / γ emitters, arising from fuel reprocessing;
- wastes containing α and n emitters, arising from fuel cycle and research laboratories;
- radiation sources, containing α and n emitters, such as lightning rods and smoke detectors;
- β / γ sources not falling into the second category wastes.

II.6.1 High-level β / γ wastes

Liquid wastes shall be solidified within a proper time period, by a vitrification process or other process proven adequate.

Pending the definition of appropriate disposal solutions, solidified wastes shall be stored in engineering storage facilities in which heat removal is provided by suitable water on air cooling systems.

II.6.2 Wastes with α and n emitters from fuel cycle and scientific research laboratories

The following are considered in particular:

1) liquid wastes with α – emitters;
2) materials contaminated by α – emitters;
3) cladding hulls and fuel hardware from fuel reprocessing.

Wastes 1) and 3) shall be processed by specific treatment and conditioning processes, whose nature and technical features, shall be evaluated on a case by case base, as well as the conditioned waste characteristics and all other aspects, including disposal.

Wastes 2), which include materials having different nature and dimensions, shall be stored in containers, having adequate leak tightness and mechanical and corrosion resistance. Prior storage, a selection should be performed according to plutonium or other radionuclides with

equivalent radiotoxicity content and/or leaching and combustibility characteristics, etc.; if necessary, volume reduction process shall be applied.
The interim storage facilities shall meet the requirements of par. II.5.9.

II.6.3 Radiation sources with α and n emitters

Waste constituted of radiation sources containing α and n emitters, such as Ra-226 sources used in radioactive lightning rods and Am-241 sources used in smoke detectors, shall be embedded in cement, in compliance with radioactivity limits and other requirements established by NEA regulation for sea dumping.
The conditioning process shall be validated in relation of each specific case.
For these waste, the disposal in geologic structures or sea dumping can be envisaged.
Ra-226 sources arising from therapeutic uses, for which the retrieval is foreseen, shall be stored in shielded metallic containers.

II.6.4 Sources with β / γ emitters not included into the second category waste

Such sources shall be embedded in cement (the conditioning process shall be validated in relation of each specific case) in compliance with radioactivity limits and other requirements established by NEA regulation for sea dumping.
Even for these wastes, the disposal in geologic structures or sea dumping can be envisaged.

Annex E Recent experiences in waste treatment and conditioning

LLW and HLW Liquid waste conditioning at the ITREC facility

At the beginning of the 90's, at the Trisaia Centre, a facility was built to transfer the liquid reprocessing waste of the ITREC pilot reprocessing plant for being treated in a cementation facility (MOWA). The facility, called SIRTE (Integrated system for transfer and treatment of effluents), started operation in 1995 and 81 m^3 of liquid LLW (2^{nd} Category waste) have been conditioned (433 drums produced). The formula for cement matrix, determined in ENEA's laboratories after several qualification test under the ISPRA supervision, is based on a pozzolan cement with a microsiliceous additive to improve the quality of the final product.

On the basis of the gained experience it was decided to optimise the SIRTE facility by improving the shielding and the dynamic containment of the system, in order to allow also the treatment of 3 m^3 of HLW derived from the reprocessing of U-Th fuel. The produced drums (337) are shielded with steel and lead shells in order to meet the surface dose rate of LLW drums.

All the aspects relevant to safety, accurately considered in the licensing process, that was performed according to the Art.6 of Law 1860 – regulating plant modifications, were:

- dynamic containment of MOWA head,
- shielded containers,
- emergency pump to transfer the waste from SIRTE facility to the tank storage of the plant,
- drum's sealing,
- cleaning of MOWA head,
- on line activity measurement system.

Extraction and conditioning of the operational radioactive waste of the Garigliano NPP

A conditioning campaign of the Garigliano NPP operational waste (360 m^3 of resins, sludges, concentrates etc...) has been carried from in 1994 in an on site facility called GECO (Garigliano Extraction and Conditioning of the Operational waste).

The design was approved by APAT (now ISPRA) on 1990 after a safety evaluation of the project (structural design, mechanical, ventilation, control and monitoring, health protection, environmental impact, handling and transportation and waste management). In a preliminary phase of the licensing process the conditioning process was qualified. The first objective was to validate the formula to be adopted for the cementation of the three different type of waste: spent ion exchange resins, filtering sludge and evaporator concentrates. Therefore, for each formula, 400 l drums incorporating inactive simulated waste and cement were prepared.

All tests concerning the matrix were performed according to the requirements of Technical Guide 26. Test on final packages were performed in accordance to transportation requirements given in the IAEA SS n.6.

During the construction, ISPRA undertook many actions of control, inspection and surveillance in order to verify the full conformance. Particular attention was devoted to the following activities:

- erection of a building to accommodate the process, having the function of static and dynamic containment of the operational process and for containing safety related components and systems of GECO;
- qualification program of the special equipment designed for stirring and extracting radioactive waste from the underground storage tanks and for feeding the solidification system MOWA;
- pre-operational and functional test of the safety related system addressed also to set operational procedures
- additional laboratory test required by ISPRA for actual matrix composition in order to demonstrate full conformance to TG 26 requirements;
- temporary storage of final packages in adequate facilities with seismic resistance;
- extraction of radioactive bottoms of the storage tanks;
- storage tanks decontamination.

In order to satisfy the project objectives, the GECO facility was designed with the following features:

- operational area with static and dynamic confinement;
- filtration, control and monitoring of all the liquid and radioactive effluents by means of the station effluent treatment system;
- adoption of incombustible and self extinguishing structural material in order to minimize the fire risk;
- feeding circuit of radioactive waste, connecting the underground tanks to the MOWA, made by shielded pipes equipped with a detection system and with a double containment system;
- adoption of baritic concrete containers for the shielding of final packages containing sludges and resins.

A total of 1671 drums were produced with a total occupational dose of 160 man mSv.

Annex F EUREX Spent Fuel Pool Remediation Project

INTRODUCTION

The EUREX (Enriched Uranium Extraction) reprocessing plant operated between 1970 and 1983, and was prepared for decommissioning in the following period. In 2004 a leak was detected originating from the plant Spent Fuel Pool (SFP).

Described in this paper are the operations to facilitate and complete draining of the SFP within spring 2008, following the successful out of water loading of spent fuel that occurred in the first half of 2007.

THE EUREX PILOT PLANT

The EUREX pilot reprocessing plant, designed to reprocess Material Testing Reactor (MTR) spent fuel, was built in Saluggia (north-west Italy) in the 1960's, in order to complete the R&D program of Italian Committee for Nuclear Energy (CNEN), providing design data for a future industrial reprocessing plant. Operations started in October 1970 with MTR fuel reprocessing until 1977 and replicated, after major plant modifications, in 1980-83 on irradiated CANDU fuel bundles.

Initial programs were developed to reprocess also commercial fuel; consequently, until 1972, PWR, AGR and BWR spent fuel was received and stored in the pool. When reprocessing programs were definitely cancelled after the Italian nuclear phase-out, 54 spent fuel elements from the Trino PWR, 48 pins from an irradiated Garigliano BWR fuel element and 10 fuel plates from a dismantled MTR element from Petten (NL) were present in the SFP.

Some 500 spent Latina AGR fuel elements, which were also present at the moment, were sent abroad at the end of 80's and their recovery for the transport after 20 years of storage produced a huge amount of sludge in the pool, a part of which was removed just after such operation.

EUREX SPENT FUEL POOL DESCRIPTION

The EUREX SFP is a 675 m^3 concrete basin, whose planar dimensions were 5.5 m to 7.5 m, divided into three sections of different depths, the deepest one devoted to fuel cask loading and unloading. The peripheral part of the pool is surrounded by a 65-70 cm wide trough extending 3.5 m above the floor of the enclosure building. The pool floor and walls are constructed of concrete, having just paint as a liner. The structure was built in the 60's and received its first irradiated fuel in 1968.

EUREX SPENT FUEL POOL SITUATION

Decommissioning Program Main Steps

The sizing based on light and small MTR fuel and related transport casks, the characteristics of a pilot – rather than industrial – reprocessing facility and the relatively aged design of the EUREX SFP, which was built and went into operation 5 years before the rest of the plant, when nuclear

regulatory laws were not yet in full force in Italy, presented unique challenges for the SFP decommissioning.

The SFP decommissioning project outlined the main issues to solve:

1. To modify pool handling devices (crane and fuel bridge) in order to meet updated safety standards,
2. To procure (design, licensing and construction) a cask dimensionally suitable for the pool,
3. To remove the remaining spent fuel,
4. To remove obsolete equipment present in the pool,
5. To remove the sludge from the bottom.

Loss of Containment

At the beginning of 2004, phases 1 and 2 were in progress when a leak, occurring from the pool, was detected in the trough and later in the surface water table. 35 m^3 of water were recovered from the trough in the year.

This event gave a further thrust to the program; alternatives to cask procurement and spent fuel management programs, which envisaged the transportation abroad for reprocessing after 2010, were studied.

A new program was set up, directed to complete the pool emptying and draining in only three years.

Water Contamination Issue

Due to the presence of a thin sludge layer on the pool bottom, which was highly alpha contaminated and easily resuspended, any operation involving underwater equipment movement and/or extraction had to be performed with adequate protective clothes (double overcoat, full face mask with filter) and with a dedicated protective clothing change point.

This issue made every operation delicate, heavy duty and time consuming, requiring a detailed and daily updated scheduling of works.

OBSOLETE EQUIPMENT REMOVAL

Between 2006 and 2007, some 80 tons of mainly metallic equipment, used in past activities of storage and handling of spent fuel, were removed from the pool. Some very large equipment (height over 2 meters, weight over 2 tons – Fig. 1) removal required special handling tools and devices, in order to perform operations safely, limiting as far as possible any airborne contamination.

Fig. 1. Metal basin 5 m long during extraction from EUREX SFP.

Three special shielded containers (500 – 1000 ℓ volume) have been designed, fabricated and used in order to evacuate highly irradiating items (Fig.2): such as some 1300 MTR fuel elements terminals with Aluminum parts having high activation, and eleven 5 ℓ bottles containing radioactive slurries from past pool cleaning.

Fig.2. Two shielded containers for activated MTR terminals.

SPENT FUEL EVACUATION

An accelerated program to remove the irradiated fuel from the EUREX SFP (52 Trino PWR elements, 48 Garigliano BWR pins, 10 Petten MTR plates) was established according to these main strategic guidelines:

1. reuse, with an internal basket modification, an AGN-1 transport cask (50 tons), Sogin's property, to load 6 Trino elements, all the Garigliano and Petten fuel,
2. load the cask outside the water, designing a shielded shuttle to move the fuel from the pool to the cask,
3. transfer the fuel to the nearby Avogadro wet storage facility, where some 20 tons of Sogin spent fuel were already stored. The small distance (less than 1 km) between EUREX and Avogadro reduced the transport licensing duties

From May to July 2007 ten fuel transfers have been performed, removing all the irradiated fuel from EUREX SFP.

POOL CLEANING AND DRAINING

Sludge Removal

In order to remove the contaminated sludge at the EUREX SFP bottom, an underwater cleaning system has been used (NUKEM / Energy Solutions Wall & Floor Washer™, Fig.3).

Fig.3. Sludge collection vessel.

The system recovered about 50 GBq of fission products and transuranic sludge, facilitating pool operations and subsequent water treatment and draining.

Water Treatment And Draining

After the removal of obsolete equipment, irradiated fuel and bottom sludge, the last step, started in march 2008, was the water treatment and the pool draining. 675 m^3 of treated water were produced and released, with a special authorization, within the licensed operational discharge limits.

The water treatment was performed using an electro coagulation process coupled with ultra filtration and final polishing with ionic exchange resins (Fig. 4).

Fig. 4. Electro coagulation cells.

FINAL STEPS

Final state of EUREX SFP is empty and with walls and bottom painted in order to fix surface contamination.

Further investigations about the radiological conditions of the trough filling material and of the building will be performed, giving the basic data for further decommissioning steps (building structure demolition).

CONCLUSIONS

In a short timeframe after the SFP leak was detected, the EUREX SFP remediation project has been put in place and almost completed.

Obsolete equipment, irradiated fuel, contaminated sludge have been safely removed and properly stored, waiting for final treatment and conditioning.

Like few others experiences in the world, some two tons of irradiated commercial fuel has been removed from the pool and loaded into transport cask out of the water.

675 m^3 of contaminated water have been purified to the extent to meet the appropriate criteria for being released to the environment.

Very limited dose uptake by workers and the population has been achieved on this challenging project.