ITALY

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

Fourth Italian National Report

October 2014

The present report has been prepared, 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 in the Vienna Diplomatic Conference on 29 September 1997 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 fourth national report prepared under the obligations of the Convention. It is based on the previous reports and provides an updating of the national situation, with particular emphasis on the relevant topics raised during the 2012 review meeting by other contracting parties as well as on significant facts and events, having relevance for the improvement of the safety of spent fuel and radioactive waste management, occurred during the last period.

As done in the previous reports, 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 continuous safety assessment of Italian radioactive waste and spent fuel management facilities and activities. 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, when appropriate.

This report has been compiled according to the Guidelines Regarding the Form and Structure of National Reports, as adopted in the preparatory Meeting of the Convention in December 2001, and with the latest modification in the Second Extraordinary Meeting of the Contracting Parties held in May 2014.

In Section B, policies and practices of waste and spent fuel 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 2012 review meeting

Within the Country Group at the 4th 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:

- Development of a comprehensive national RW and SF management strategy in line with Directive 70/2011/Euratom, replacing current ministerial decrees from 2004 and 2010

- Ambitious timing of the siting of the national LLW disposal facility and ILW/HLW long-term store
- Conditioning of liquid and solid RW from reprocessing research facilities and NPPs
- Increased need for human resources especially for the ISPRA.

Answers to these challenges will be provided in the present report.
Good practices identified in the 4th Review Meeting include the foreseen site selection process for national disposal facility with visible milestones and requirements for public consultation, 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 fourth review meeting

The following main events and activities relevant for the Convention and occurred after the third review meeting can be highlighted.

In March 2014 the legislative decree n, 45/2014 was issued to transpose into the national legislation the EU directive 2011/70/EURATOM establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste. One of the main provision of the legislative decree establishes a new regulatory body, named National Inspectorate for Nuclear Safety and radiation protection (ISIN), built upon current resources and structures of ISPRA but with enhanced independence from the Government as well as human and financial resources.

Until this new Inspectorate will be set up, the Nuclear Department of ISPRA will continue its work as nuclear safety authority.

With reference to the activities related to the siting of the National Repository for radioactive waste the national strategy envisages the construction on near surface disposal facility for LLW/ ILW[1] (herein after referred as disposal facility) and a facility for the interim long term storage of ILW[2] /HLW (here in after long term storage facility), in June 2014 ISPRA issued the Technical Guide No.29 on the siting criteria for the identification of areas potentially suitable for the siting of national repository [3].

As far as the spent fuel reprocessing program is concerned, in 2012 the transfer of the spent fuel stored in the Avogadro AFR storage facility and Trino NPP resumed after a period of suspension due to the strong local oppositions in Val di Susa (Piemonte). The completion of the spent fuel

[1] ILW suitable for being disposed off in a near surface disposal facility
[2] ILW not suitable to be disposed off in a near surface disposal facility
[3] http://www.isprambiente.gov.it/files/nucleare/TechnicalGuiden_29onsitingnearsurfaceWeb.pdf

transport to France is foreseen by 2015, but the programme is currently interrupted due to a few aspects of the agreement in place with France to be rediscussed.

On the licensing side it should be mentioned the issue of the Decommissioning licensees for Trino and Garigliano NPPs in 2012, for the Caorso NPP in February 2014 and several “ad hoc” authorization to perform specific decommissioning activities in difference sites.

On the implementation side the commissioning and the advanced construction of interim storage facilities in several sides can be highlighted.

A.1.2 Overview matrix of Italy

Type of Liability	Long-term management policy	Funding of Liabilities	Current practice / Facilities	Planned facilities
Spent fuel	Reprocessing abroad. Remaining SF, long term interim storage	Activities of SOGIN financed through levy on electricity tariff.	Shipments completed by 2015 Only exception: Elk River SF from ITREC site.	For Elk River SF On site dry cask storage envisaged.
Nuclear fuel cycle wastes	National LLW near surface facility and Interim ILW/HLW storage facility.	Existing funds for NPP waste, and, since 2000, levy on electricity tariff – for nuclear fuel cycle waste.	Stored in NPPs where generated. Its treatment / conditioning is on going. Responsibility: SOGIN.	National LLW near surface facility and Interim ILW/HLW storage facility.
Non-power wastes	Central interim storage.	Producer pays	Transfer to ENEA Casaccia treatment, conditioning and storage facility operated by NUCLECO.	National LLW near surface facility.
Decommissioning liabilities	Decommissioning of all nuclear facilities. Strategy selected: one step decommissioning	Activities of SOGIN financed through levy on electricity tariff.	Total decom pending on availability of on site storage. Decommissioning for fuel fabrication in progress	On site waste treatment and interim storage facilities.
Disused Sealed Sources	Temporary storage.	Owner pays	- Return to suppliers - Transfer to by NUCLECO	Centralized storage.

Figure 1: Overview matrix of Italy

A.2 Executive summary

In Italy, four nuclear power plants (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. 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 authority is the Ministry of Economic Development, which grants authorizations bounded by the technical advice of ISPRA.

ISPRA is entrusted with the role of national authority for technical regulation, control and supervision of the nuclear installations.

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

The main national operator entitled to perform spent fuel management, radioactive waste management 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 in Italy 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. At present about 30 tHM of spent fuel still remain to be shipped to France from Avogadro AFR storage pool and from Trino NPP.

As far as research reactors is concerned, the national policy is to return the fuel to the country of origin. The last shipment abroad of the spent fuel was in July 1999 when 140 fuel elements from TRIGA RC-1 have been shipped to the Department of Energy in the United States of America in the frame of the USA policy of withdrawal of spent fuel of American production.

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 between Italy and France in relation to the return of the waste resulting from the reprocessing of the spent fuel, the Legislative Decree n° 31 issued in 2010, as subsequently amended, establishes all the steps and timeframes, including public consultation, for the siting procedure of the National Repository consisting of a LLW/ILW disposal facility and an ILW-HLW long term storage. The same Decree assigns to SOGIN the role of the Implementer responsible for the siting, construction and operation of the national repository.

With reference to the activities related to the siting of the National Repository, in June 2014 ISPRA issued the Technical Guide No.29 on siting criteria for the identification of potential suitable area. According to the time schedule foreseen by Legislative Decree n° 31/2010, in January 2015 SOGIN should present a list of potential suitable area, called the National Chart. After a preliminary validation of the proposed Chart by the Regulatory Body, a national debate will start with the aim to identify, on the basis of declaration of interest from the Regions involved, one or more sites on which to perform detailed investigations in order to select the final site.

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 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 for treating, conditioning and storage of the existing waste as well as to transfer abroad the spent fuel for reprocessing. Nevertheless, the need to accelerate in the on-going process for conditioning existing waste and 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 Body.

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.

It has to be noted that as result of the transposition of the EU Directive 2011/70 a national programme will have to be established and transmitted to the EU Commission by August 2015. It is envisaged that in this framework the current policy for spent fuel and waste management as well as decommissioning will be updated.

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 Graphite), Trino (PWR) and Caorso (BWR), and a LEU fuel fabrication installation (Fabbricazioni 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 Technologies, Energy and the Sustainable Economic Development (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 December 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 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 ongoing 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 repository, the licensee has to provide an adequate 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 unconditional release of the sites 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.

The decommissioning licences for Trino and Garigliano NPPs has been issued in 2012, and for the Caorso NPP in February 2014.

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 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 unconditional 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.
Furthermore, the experience resulting from the management of nuclear installations permanently shut down 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, to the construction of new interim storage facilities in the sites, also by the refurbishment of existing buildings.

They are however not related to the nuclear island whose dismantling is strictly depending on the authorization of the decommissioning plan.

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 the 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, the licensing process for Bosco Marengo LEU fabrication facility was completed in November 2008.
For other facilities, 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 December 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 Italian and 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 June 2010, the shipment of spent fuel from Caorso NPP to France was completed and transfer of the spent fuel stored at the Avogadro AFR storage pool and at the Trino NPP is planned to be completed by 2015, even if a new negotiation of some terms of the pertaining agreement with French authorities is in progress.

The only fuel that will not be reprocessed is the 1,7 tHM of Uranium/Thorium fuel, 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.

Pending the completion of the transfer abroad for reprocessing, the spent 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.

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

A minor fraction to be managed is represented by the radioactive waste produced by R&D, medical and industrial uses.

The Ministerial Decree December 2nd, 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. There is some delays in the implementation of this programme, Specific projects for most relevant waste streams are however on-going.

In connection with the national repository, several preparatory studies have been conducted in the past. 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. Their implementation however met strong difficulties.

It has to be noted that the Act n° 368/2003 also establishes that until the National Repository 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 radioactive waste long term 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.

In March 2008, the Ministry of the Economic Development appointed a Committee with representatives of Ministries, Regions, 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.

Also in connection with the mentioned road map associated to the Agreement for the reprocessing of the 235 t of spent fuel, the Legislative Decree n° 31/2010 and subsequent amendments establishes the new procedure for the siting and the construction of a National Repository, to be realized in the context of a Technological Park, and assigns to SOGIN the role of the Implementer, responsible for the construction and operation of repository itself.

Legislative Decree n° 31/2010 also assigns to SOGIN the responsibility to propose areas suitable for the siting of the installations based upon criteria established by the IAEA and the national regulatory authority. The steps to be made in order to realize a national storage facility are described below, together with the timeframes to perform each of them.

At first, a list of suitable areas is proposed by the Implementer (SOGIN S.p.A.) taking into account the criteria established with Regulatory Body and IAEA and subsequently validated by the Regulatory Body itself (ISPRA).

After this preliminary selection (9 months), a period for a public consultation is foreseen. A public presentation through a seminar by inviting the central and local interested administrations and other stakeholders will be organized by SOGIN in this period.

Once the Chart of potential suitable sites will be approved by the Regulatory Body, SOGIN will invite the involved Regions to declare their potential interest within 60 days. Once one (or more) Region shows interest, SOGIN performs its extensive investigations on the site (15 months) and

submits a request for authorization to the Regulatory Body, which expresses its judgement within 6 months. A one step licence is envisaged (i.e. the authorization is given for construction and operation). For closure, a specific licensing procedure is defined.

In the case of lack of interest, SOGIN will submit to the Ministry of Economic Development the list of the candidate areas indicating the first three more suitable sites, and within 30 days an inter-institutional Committee will be created, with the participation of representatives from different Ministries and Regions, with the task to reach an agreement with one of the Regions.

With reference to activities related to the siting of the National Repository, on June 2014 ISPRA issued the Technical Guide n. 29 related to the siting criteria for near surface disposal facility for low and intermediate level waste. This Guide has been issued following a review performed by IAEA and a consultation process with other interested technical bodies in Italy.

According to the time schedule foreseen by Legislative Decree n° 31/2010, in January 2015 SOGIN should be ready to present a chart of potentially suitable areas, called the National Chart. After that, following a review performed by the Regulatory Body, the chart will be published and a national debate will start with the aim to find an agreement with the Regions involved,.

Waiting for the availability of the National repository, the radioactive waste will continue to be stored in the nuclear installations of origin. 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 near surface 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 specific Safety Criteria and Technical Positions relevant to the management and the interim storage of radioactive waste resulting from the reprocessing.

According to the Legislative Decree n. 45/2014, within 2014 a new classification system, more in line with the international recommendations, should be implemented in Italy, trough a Joint Decree of the Ministry of the Environment and of the Ministry of the Economic Development based on a proposal of ISPRA.

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;
- non-fixed 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.

It should be noticed that in the framework of recent licensing processes relevant to the conditioning of radioactive waste, ISPRA required some additional criteria. In particular, it is worth to mentioning the set of requirements, showed in Table 4, for the ILW packages that will be produced from the conditioning process of the liquid waste at the ITREC reprocessing facility, approved in 2010.

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)] at 90% of relative humidity, compressive strength must be at least 5 MPa
Radiation resistance	after an absorbed dose of 10^6 gray of gamma radiation,

	compressive strength must be at least 5 MPa
Fire resistance	incombustible or self-extinguishing according to the ASTM D 635-81
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	No bulges and 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	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 + ^{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

Table 4 **Technical requirements for the IIIrd Cat. conditioned wastes**	
Compressive strength	at least 20 MPa (UNI - Destructive tests for concrete)
Thermal cycling	after 30 thermal cycles [(-40°C) ÷ (+40°C)] at 90% of relative humidity, compressive strength must be at least 20 MPa
Radiation resistance	after an absorbed dose of 10^6 gray of gamma radiation, compressive strength must be at least 20 MPa
Fire resistance	incombustible or self-extinguishing according to the ASTM D 635-81
Leaching rate	measurement according to long term leaching test Li>7
Free liquids	measurement according to ANSI/ANS 55-1
Water permeability	Water penetration <20 mm
Immersion resistance	No bulges and compressive strength >20 MPa after 90 days of water immersion

Dimensional stability	Shrinkage <2000 µm/m
Gas Permeability	only qualitative
Thermal Conductivity	k ≥ 0,5 W/(m*K)

B.6.3 Criteria for solid materials release

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

- activity concentration ≤ 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 directive n° 96/29:

a) effective dose ≤ 10 μSv/year, and

b) either effective collective dose ≤ 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.

Specific clearance levels for conditional and unconditional releases have been issued with the decommissioning licence of Trino, Garigliano and Caorso NPPs. For Latina NPP, Eurex and Itrec reprocessing plants clearance levels have been granted in the framework of the existing operational license. Clearance levels have been established taking into account European Union directives and recommendations.

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

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.

Large part of the spent fuel was transferred to UK for reprocessing in the period 2003-2005 and to France in the period 2011-2013 (see Figure 2).

At the end of 2012 ten fuel plates from a dismantled MTR element from Petten (NL) were transferred from Avogadro to USA under the Global Threat Reduction Initiative (GTRI) ;

At December 2013, the spent fuel remaining in the pool was 1 Trino NPPs element and 63 MOX Garigliano NPP elements.

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

D.1.3 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 ‘70ies (uranium-thorium cycle fuels from the US Elk River reactor) until 2003, when it was taken under SOGIN responsibility.

After having reprocessed 20 Elk River spent fuel elements, during the commissioning tests (1975-78), the operation was stopped. 64 U-Th spent fuel assemblies are still 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.1.4 Spent Fuel in research reactors

Italy also operates five research reactors. The only ones which store spent fuel on site are the TRIGA Mark II, site at L.E.N.A. (Laboratory of Applied Nuclear Energy) of the Pavia University, and the TRIGA RC-1, site at C.R. Casaccia of ENEA.

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 31st, 2013 amounts to a total of about 30 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	1	0,31	2.020
	BWR-GARIGLIANO MOX	63	12,88	47.100
TRINO	PWR - TRINO UO_2	39	12,05	41.300
	PWR - TRINO MOX	8	2,46	29.500
ITREC	ELK RIVER U-Th	64	1,68	3.310
OPEC-1		566 (**)	0,12	3
JRC Ispra		-	0,658	3.689
TRIGA Mark II		9	0,0017	n.a.
TRIGA RC-1		12	0,0023	n.a.
TOTAL		**-**	**30,162**	**126.922**

(**) N° of rods, some partially dismantled

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 June 2010 the shipments of 190,4 tHM of spent fuel from Caorso NPP was completed.
Transfer of the spent fuel stored in the Avogadro AFR storage pool and in the Trino NPP should be completed by 2015.

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. Radioactive waste from medicine, industry and research activities are collected for temporary storage by NUCLECO and other private operators.

The installations where 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 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, a new conditioning campaign has to be performed in the near future in a defined timeframe as established by the licensing conditions, as requested by the Regulatory Authority. An international tender for the thermal treatment and conditioning of operational radioactive waste is under way.

Figure 3: Caorso NPP – ERSBA 2 storage facility

The residual heat removal cooling towers were dismantled in 2008 after some works of modification of the electrical distribution.
The dismantling of the off-gas building started in 2009, was completed in 2013. From 2010, the removed radioactive charcoal has been treated by incineration at Studsvik facility, and the conditioned waste have returned at Caorso in 2013.

In the **Trino** NPP, the radioactive waste is at present stored in the two storage facilities of the NPP site. Some semi-liquid radioactive waste is still to be conditioned.
The detailed project for the conditioning of resins and sludges is now under licence approval by ISPRA.
The Trino Nuclear Power Plant obtained the decommissioning licence on August 2012. According to the decommissioning program the existing waste storage facilities will have to be refurbished, also in order to accommodate waste packages that will derive from dismantling activities .

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 since many years, the radioactive waste is stored in different buildings of the NPP site. The Emergency Diesel building was refurbished to adapt the building itself as an interim storage facility. This new facility started its operation in 2013.
A new interim storage facility (named D1) has been realized and started its operation in 2014 as well.
These facilities will host a large part of the waste existing in the site in improved safety conditions, also including the very low level waste currently embedded in trenches realised in the ’60.
The principal activity now on-going is the remediation of the mentioned trenches and the radiometric characterization of the waste before its storage in the interim facilities.

Two main dismantling activities to be started are the chimney demolition, whose regulatory approval was granted in 2009 and the water tower demolition.
Auxiliary systems installation (cranes, electrical power system, ventilation etc.) is undergoing. A supercompaction campaign of radioactive asbestos is in progress.

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 5).
At present, the radioactive waste is stored in different facilities of the NPP site.
The construction of a new waste storage facility is completed and commissioning test will start soon. It is expected to host the waste resulting from a project for the extraction and conditioning of the sludges already licensed and from a project for the extraction and conditioning of the Magnox residues (splitters) currently under regulatory evaluation.
In 2012, the Turbine building has been dismantled, and other activities have been authorized:

- Dismantling of the blowers casings;
- Spent fuel pools decontamination
- Construction of the waste management facility “Cutting Facility”.

Figure 5: Latina NPP – Preliminary dismantling activity of the primary circuit

D.3.2 Fuel Cycle facilities

AVOGADRO

All the radioactive waste generated from the operation of the facility is stored in the facility itself.

Bosco Marengo

Bosco Marengo (former 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 removed from the site and the operational dry radioactive wastes have been super compacted. The decommissioning license was granted in November 2008.

The dismantling plan was divided into 2 phases: the first step included the dismantling of the fuel assembly fabrication equipment and its accessories, and the auxiliary systems such as ventilation, decontamination systems and liquid waste treatment plants; the second phase includes the shipment of the waste to the National Repository and the free release of the site.

The first phase began in December 2008 and in June 2014 the work had reached 90%.

On March 11, 2011, operations for the dismantling of the auxiliary systems, were approved by the Regulatory Body. Works started at the beginning of September 2011 with the dismantling of the first sections of the ventilation pipes.

In September 2011, refurbishment activities to convert one site building (Bld11) into a buffer storage activities were completed.

In 2012, 611 overpacks were treated and placed in the provisional local buffer Bld11 with other incombustible waste.

During 2013 the decommissioning activities of the ventilation system were completed.

First phase will be completed by the end of 2015.

It is estimated that from the dismantling of the plant, about 270 tons of materials will be released and about 500 drums (220 liters each) of radioactive waste will be produced.

EUREX

The main activities in progress at 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 at an advanced stage. In the meanwhile, the liquid waste has been transferred in the new system of storage tanks.

A new storage facility was licensed in 2012. Activities for the construction of civil structures was completed, installation of internal system are in progress (see figure 6).

Figure 6: On-going construction of D2 storage facilities

ITREC

The radioactive waste present on the site originates from the experimental reprocessing activities performed on the plant in the 70'ies, 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).

An extensive review of the existing authorization of the installation was carried out and an updated set of licensing conditions to regulate activities preliminary to decommissioning was issued in 2006. These in particular includes the removal of a solid waste underground pit, the conditioning of U-Th final product solution and the implementation of a dry storage configuration for the remaining 64 irradiated fuel elements

Detailed design for the remediation of the underground pit, containing radioactive waste drums immobilized in a block of concrete (6 x 6 x 1.5 m) set, built during the former operation, has been completed. Digging works around the block of concrete started in November 2013 in order to investigate on the best technical solution to intervene for the removal of the concrete block.

The conditioning process for the 3,3 m^3 of U-Th solution final product has been approved by ISPRA in 2010.

An additional important task is to manage the historical waste and to transfer the 64 spent fuel elements still stored in the pool into dual purpose casks for dry storage.

Construction activities started with the waste storage building. Process building for the cementation of the radioactive liquid solution named "Prodotto Finito" will start after the removal of the underground pit.

For the implementation of dry storage strategy related to the spent fuel the related project is under regulatory review.

In the frame of the SIRIS project (Settlement of Solid Radioactive Waste), characterization and treatment activities by grouting and super-compaction of metal wastes generated in the former operation are undergoing.

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).
At the end of 2010 the first glove box (SaG) of the plutonium plant (IPU) was dismantled, as a hot test of the dismantling project of the remaining 55 SaG's, started in 2012. The SaG's were used in the past operation for manipulating uranium and plutonium during the manufacture of MOX fuel.
In the period 2013-2014 some amount of fresh plutonium and enriched uranium has been transferred to USA, under the Global Threat Reduction Initiative (GTRI).
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 the tanks that were used for the collection of the liquid waste of the facility. Such tanks were located in underground concrete structures.
In 2013 some amount enriched uranium has been transferred to USA, under the Global Threat Reduction Initiative (GTRI).

D.3.3 Other facilities

European Joint Research Centre Ispra

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 installations that operated in the Centre as well as to perform a complete characterization and conditioning of the radioactive waste produced in the past activities. Licensing and supervision activities are conducted by the Italian authorities according to the in force agreement between the Italian Republic and the Euratom Community signed in 1960.

The construction of an interim storage facility on the site has been recently completed.

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 an Italian operator for collection, transportation, storage, treatment (mainly by supercompaction) and conditioning of Category II 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 radioactive waste collected, also in view of 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 sealed 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, at December 31st 2013, as follows: about 28.240 m^3 of Ist and IInd Category waste (5.300 m^3 of VLLW and 22.900 m^3 of LLW-SL), and 1780 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 20 m^3 of vitrified HLW arising from reprocessing of spent fuel that will be returned from Sellafield in the UK. Similar amount of radioactive waste will have to return in Italy from the reprocessing of the 235 t of spent fuel in France. In addition, some 30.000 m^3 of L-ILW from decommissioning of nuclear facilities.

Table D.2 - Inventory of the radioactive waste and spent sources stored in Italy (December 2013)					
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	2.483 (78)*	2.434			0,023
Garigliano	3.214 (47)	385.177			
Latina	1.640 (82)	15.936	12,6 (100)	5.972	
Trino	1.190 (31)	1.180	61,6 (100)	10.987	
Eurex	2.505 (93)	27.181	342 (93)	2.102.237	115,4
Itrec	3.176 (65)	236.691	63,8 (100)	55.800	0,02
OPEC 1	2 (100)	10,4	7,2 (100)	3833	1.402
Impianto Plutonio			110 (100)	17.623	
Bosco Marengo	410 (38)	32,7			
Avogadro	77 (100)	477			
Nucleco	6.595 (40)	9.524	12 (100)	39	1.128.502
JRC Ispra	2.909 (100)	31.340	1009 (30)	100.060	261
Others **	4.046 (100)	6.205	160 (100)	8.818	15.184
Total	**28.247**	**716.188**	**1.778**	**2.305.369**	**1.145.464**

* % 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 (Caorso, Garigliano, Latina and Trino) were definitely shut down several years ago. For all but one (Latina) the decommissioning license has been granted. For Latina NPP, regulatory review for the decommissioning license is in progress.

For each NPP an environmental impact assessment related to decommissioning activities has been conducted. Preliminary and partial decommissioning activities have already been performed or are underway on the basis of specific authorization.

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 Bosco Marengo the decommissioning authorisation has been

granted in November 2008. For ITREC the decommissioning plan has been submitted for authorization in July 2011. For EUREX, PLUTONIUM and OPEC 1, decommissioning application will be filed in the near future. Preliminary dismantling activities are however performed on the basis of “ad hoc” authorization.

As far as research reactors is concerned, the Decommissioning licensees for RB-3 research reactor was granted on 2010, Following that, the Radiological characterization plan for the removal of materials from the plant was approved in April 2013.

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 Ministries and authorities, according to their respective competencies and duties, with the technical advice 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.

Italy, as member of the European Union, have transposed the EU Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste with the legislative decree n, 45/2014. According to this decree a National Programme will be prepared by the end of the 2014.

Based upon the existing legislative framework, as described under article 19, the licensing procedures in place 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 disposal 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. A guide on siting criteria of a disposal facility for low and intermediate level radioactive waste has been recently issued. Other guides on waste storage facilities and decommissioning will be issued for consultation in the next months.

18.1 Assessment of compliance

The current national legal framework related to nuclear safety and radiation protection at nuclear installations can be considered adequate. 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 current Italian legislative and regulatory framework related to nuclear and radiation safety is the result of an evolution of rules and provisions 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, that is Acts and legislative decrees, and governmental or ministerial decrees;
- technical guides;
- technical standards.

a) Legislation and ministerial decrees.

In the Italian regulatory system the source of legally binding rules must be either an act of Parliament (statute) or a Legislative Decree issued by the Government thus empowered by Parliament. The Government can also 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 regulatory system are itemised below, as regards Statutes and Legislative acts:

- Act n° 1860/1962 published in the Italian Republic's Official Journal n° 27 of 30 January 1963, as amended by the President's Decree n° 1704 of 30 December 1965 and by the President's Decree n° 519 of 10 May 1975.
- Presidential Decree n° 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 n° 230/1995, described below.
- Act n° 393/1975, which contains Administrative rules on the selection of the sites for NPPs.
- Presidential Decree n° 1450/1971, which contains requirements and procedure for the acquisition of the operational personnel licences.
- Legislative Decree n° 230/1995, which has been in force in Italy since January 1st 1996, replaces the Presidential Decree n° 185/1964 and implements six EURATOM Directives on radiation protection (EURATOM 80/836, 84/467, 84/466, 89/618, 90/641, and 92/03) and refers for detailed regulations and quantitative values to a series of Government and Ministerial Decrees. Legislative Decree n° 230/1995 regulates radioactive waste disposal in a more precise manner than Presidential Decree n° 185/64. In particular, waste storage facilities included in nuclear installations are licensed together with the installations themselves. In the other cases, for radioactive waste storage facilities, in relation to their size, authorisation shall be granted by the Ministry of Economic Development together with the Ministries of Environment, of Labour, of Health and of Social Affairs, and the region concerned, on the basis of technical advice of ISPRA or by the Prefect. 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].
- Legislative Decree n° 241/2000, 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. Legislative Decree n° 241/2000 has modified and integrated Legislative Decree n° 230/1995; the latter constitutes, as described above, the main piece of legislation laying down radiation protection requirements for workers and the public.

- Legislative Decree n° 257/2001 was promulgated in order to modify certain details in Legislative Decree n° 241/2000 concerning requirements for notification and authorisation of non nuclear installations where ionising radiation sources are used for industrial, research and medical purposes.
- Legislative Decree n. 52/2007 which transposes EU directive 2003/122/Euratom on the control of high-activity sealed radioactive sources and orphan sources; Legislative Decree n. 52/2007 integrates the licence or request a prior authorisation for such sources granted in accordance with the Act n° 1860/1962 and the Legislative Decree n° 230/1995.
- Legislative Decree n° 23/2009: which transposes EU directive 2006/117/Euratom on the supervision and control of shipments of radioactive waste and spent fuel; Legislative Decree n° 23/2009 has modified pertinent administrative provisions previously contained in Legislative Decree n° 230/1995 concerning the trans-boundary shipments of radioactive waste.
- Legislative Decree n. 100/2011 which modifies the provisions of article 157 of Legislative Decree n° 230/1995 concerning the radiometric surveillance of metal scraps.
- Legislative Decree n° 185/2011 which transposes the EU Council Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations.
- Act n° 27/2012 on the economic development, through the Art. 24, establishes a new procedures to reduce the timing of the licensing phases for decommissioning activities with a strong involvement of local administrations.

A series of Governmental and ministerial decrees have also been made in implementation of the Act n° 1860/1962 and the Legislative Decree n° 230/1995.

In 2009 the Italian Government, with the aim to restart a new nuclear programme, promulgated a new Act (Act 99/2009) establishing the necessary legislative provisions. Other Legislative Decrees have been issued or were in preparation, but a public debate brought to a popular referendum on June 2011, the result of which definitely sanctioned the abandon of the nuclear programme in Italy.

- Act n° 99/2009, related to the process to start a new nuclear programme, in Article 29, establishes a new Nuclear Safety Agency with the role of Regulatory Body. The Agency will be made by the resources of the Nuclear Department of ISPRA and by resources from the Agency for New technologies, Energy and Sustainable Economic

Development (ENEA). This new Safety Authority has, however, been cancelled in 2011 before becoming operative.

- Legislative Decree n° 31/2010 related to the future nuclear development in Italy, provides criteria for the site selection procedure with the involvement of local administration, for the approval and for the compensation of the local municipality. The Legislative Decree includes also provisions for the site selection procedure of the national site for radioactive waste disposal giving the responsibility to SOGIN.
- Legislative Decree n° 41/2011 amended the Legislative Decree n° 31/2010 with reference to the future nuclear development in Italy.
- Act n°75/2011, that modifies all the provisions given in the Act n°99/2009 and in the Legislative Decree n° 31/2010, as amended by the Legislative Decree n°41/2011, relevant to the development of new NPP in Italy, relinquishing the nuclear development in Italy. The provisions for the development of the national site for LLW disposal and ILW-HLW interim storage has however been confirmed. Furthermore, by abrogating the Articles 8 and 9 of the Legislative Decree n° 230 of 1995, this Act slightly modifies the regulatory process by cancelling of the "Technical Commission on Nuclear safety and Radiation Protection", as described in Art.20 of this report.
- Legislative Decree n° 185/2011 which transposes the EU Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations. Legislative Decree n° 185/2011 has modified and integrated Legislative Decree n° 230/1995.
- Act n° 214/2011 that abrogates the Nuclear Safety Agency (created with the Act n° 99/2009, but never applied) and the functions have been temporary assigned to ISPRA (that in fact continue its work as nuclear authority) waiting for a definitive asset of the regulatory organization.
- Act n° 27/2012 on the economic development, through the Art. 24, establishes a new procedures to reduce the timing of the licensing phases for decommissioning activities with a strong involvement of local administrations.
- Legislative Decree n° 45/2014 which transposes the EU Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste. This Legislative Decree included also provisions for the establishment of a new competent Regulatory Authority (Inspectorate for Nuclear Safety and Radiation Protection, ISIN) fully dedicated to the regulation and control in the nuclear field with strengthened independence and human and financial resources and based on the current ISPRA organization. The enactment of further legislative provisions is required for the full and formal establishment of the new Regulatory Authority.

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 sustainable economic development). 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 institutes working in the areas of marine research and wildlife.

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

- **Act n° 933/1960** on establishment of the National Committee for Nuclear Energy (CNEN)
- **Act n° 84/1982** on establishment of the State Agency for new technologies, energy and environment (ENEA).
- **Act n° 85/1982**with specific provisions to ensure independency of DISP in the frame of ENEA.
- **Act n° 61/1994** on establishment of the National Agency for the Environmental Protection (ANPA).
- **Legislative Decree n° 300/1999 and Presidential Decree n°207/2002** on establishment of the APAT, by merging ANPA with other national technical services.
- **Act n° 133/2008 on** establishment of the Institute for the Environmental Protection and Research (ISPRA).
- **Legislative Decree n° 45/2014**
  Establishment of the Inspectorate for Nuclear Safety and Radiation Protection (ISIN)

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 to ISPRA by Article 153 of the Legislative Decree n° 230/1995.

Technical guides, issued by ISPRA pursuant to art. 153 of the legislative decree n. 230 of 17 March 1995 and subsequent amendments are regulatory documents with which ISPRA discloses best practices on operational and technical measures to implement legislative

previsions in the field of nuclear safety and radiation protection, as well as criteria and methodology of its control activity.

Compliance with Technical guides is verified by the regulatory body during the licensing process based upon assessment and demonstrations provided by the operator. 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, i.e. the T.G. 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. At the beginning of 2014 the Technical Guide n. 29 was issued in which the siting criteria of a near surface disposal facility for low and intermediate level radioactive waste are established. With reference to the procedure laid down in the Title III of the Legislative Decree n. 31/2010, for the siting, construction and operation of the national disposal facility within a Technology Park, the criteria established in the Technical Guide n. 29 are also applied in the siting process of the aforementioned disposal facility from the definition of the proposed National Chart of potentially eligible sites until the selection of the suitable site.

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.

19.1.1 National safety requirements and regulations for radiation safety

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

19.1.2/3 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. 230/1995, 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 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.

As far as the radioactive waste management associated with decommissioning activities are concerned, Articles 55-56 of Chapter VII of the Legislative Decree n° 230/1995 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.

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 Articles 27, 28 and 29 and 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 Prefect.

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 under preparation and takes into account IAEA safety guides requirements and WENRA harmonised “reference levels”. Above criteria are however already adopted in the safety assessment related to the licensing of new radioactive waste storage facilities.

19.1.4 Institutional Control and Regulatory Inspection

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

19.1.5 Enforcement and sanctions system

Enforcement of applicable regulations and of licence conditions is ensured on the basis of the sanction system, as established in Chapter V of the Act n° 1860/1962 and in Chapter XI of Legislative Decree n° 230/95, taking into account that Article 10 of Legislative Decree n° 230/1995 gives 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. ISPRA 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.

19.1.6 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 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 assigned in Italy to the following main 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. 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 and Social Affairs, and Health and by the Region where the installation is located shall be required.

b) ISPRA is the Governmental body 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, or to the implementation of a plant modification. ISPRA operates under the aegis of the Ministry for the 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 as 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.

As provided by the Act n° 214/2011, the new Nuclear Safety Agency (established by the Act n° 99/2009 in connection to a new nuclear program subsequently cancelled as result of the referendum taken in 2011) has been abrogated and its functions and duties have been “temporary” assigned to ISPRA, that in fact has continued its work as nuclear Regulatory Authority, waiting for a definitive asset of its regulatory organization.

As introduced under the previous Article 19, a recent legislative and regulatory relevant development was represented by the enacting of the Legislative Decree n° 45/2014 which transposes the EU Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste. This Decree included in fact provisions for the establishment of a new competent Regulatory Authority (Inspectorate for Nuclear Safety and Radiation Protection, ISIN) fully dedicated to the regulation and control in the nuclear field with strengthened independence and human and financial resources and based on the current ISPRA organization.
It has to be underlined that the full and formal establishment of this new Regulatory Authority will require the enactment of further legislative provisions.

Until the full and formal establishment of the new Authority (ISIN), ISPRA is continuing to act as national nuclear Regulatory Authority.

The Regulatory Authority functions in ISPRA are carried out by a specific Nuclear Department to which the Institute assigns human and financial resources. It has also to be considered that responsibilities and duties assigned to ISPRA include supervision activities on safeguards and physical protection, the execution of a technical support function in the field of emergency preparedness and of a control function in the field of environmental radioactivity. The recruitment of new personnel to ensure the continuity and the effectiveness of regulatory functions in the next future is an issue to be addressed. This also to cope with the personnel retirements and the expected significant increase of regulatory activity at national level on spent fuel and radioactive waste management and decommissioning, including to the siting and construction of a National Repository, as well as to nuclear safety related activities required by a new regional and international context followed to the Fukushima accident and to the strengthening of regulatory control on radiation sources.
In this regard, it has to be considered that the above reported needs on the ISPRA’s human and financial resources should be definitely met by the establishment of the new Regulatory Authority,

ISIN, which, as required by the Legislative Decree n° 45/2014 referred under the Article 19, will be largely based on a targeted reorganization of the ISPRA's Nuclear Department.

20.2 Independence of the regulatory function

The main national 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 and of the treatment and conditioning of radioactive waste stored at the Italian nuclear facilities;
- the decommissioning of the Italian nuclear facilities;
- the construction and operation of the national waste repository.

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 n° 1860/1962 and the Presidential Decree n° 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.
The operating organisation is therefore fully responsible of all the activities performed during design, construction, commissioning and operation having direct influence on safety. The principle of prime responsibility for safety of the license holder is clearly stated in article 58-bis of Legislative Decree n. 230/1995 and subsequent amendments.

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 pillars :

1. the authorization process in place for activities related to spent fuel and radioactive waste management,
2. 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,
3. the inspection system, in order to verify compliance with applicable rules and technical specifications, at all stages from design to operation,
4. 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 an injunction to comply with applicable regulations and prescriptions.

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

21.2 Assessment of compliance

On the basis of what discussed above, 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, SOGIN technical and operating staff (840 units at the end of 2013) undertakes training regarding technical and legal issues, according to the specific company policy of SOGIN, which has created in Caorso a dedicated School where SOGIN personnel and operators of qualified companies selected to work in the decommissioning activities are trained.
In total, more than 44.400 hours of training have been given in 2013.

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 NPPs and other facilities having spent fuel on site. In other installations precise staff qualification requirements are established.
In order to promote qualification and quality, SOGIN has enhanced its own organization creating, within the Division for Waste Management and Decommissioning, new Units: one dedicated on radioprotection of workers, people and population, one to investigations on new technologies, one related to Safety & Management System.

22.2 Financial resources

The current Italian decommissioning strategy foresees a deferred decommissioning until the unconditional release of the sites. In order to finance the decommissioning cost, the Ministry of Productive Activities (now Ministry of Economic Development) issued the Legislative Decree of 26th January 2000, which established the related instrument with a levy on the price of the electricity.
The funds are transferred yearly to SOGIN which, as stated in Section B, is responsible for performing decommissioning and waste treatment activities for all Italian nuclear installations. For this purpose, SOGIN has been also charged to prepare dismantling 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.

The same decree quoted above states that every year SOGIN has to submit to the National Authority for the Electricity and Gas (AEEG) an updated report on technical and economic plan of the global decommissioning project. The yearly reports shall contain an update of the decommissioning plan and cost estimate. The levy on the price of electricity, 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 referred to August 2014 indicates an amount of about € 7,4 billion for the complete decommissioning of the four NPPs and of the Nuclear Fuel Cycle Facilities. The mentioned amount comprises all the costs until today sustained. The main components of overall costs are the dismantling and waste management costs (about € 2,1 billion), the spent fuel reprocessing and nuclear material management related costs (about € 1,7 billion), the costs related to personnel (about € 1,6 billion), the general costs related to safety and security (about € 1,1 billion) the final disposal costs (about € 0,9 billion). The latter has been evaluated assuming disposal unit cost of 10 k€/m^3 for LLW and ILW and 50 k€/m^3 for temporary repositories (e.g. 50 years) of HLW / long life waste.

The increase of overall costs is due to several factors, among those the main are the following:

- delay in the realization of National Repository has made necessary the construction of new facilities on the site for interim storage ;

- the evolution of safety criteria requires improvements in waste management technologies, with related cost increase;
- additional costs for re-treatment of waste already conditioned in the past in a way not acceptable today according with new requirements.

The following activities were taken into account in the overall costs evaluation:

- on-site storage of fuel;
- spent fuel reprocessing;
- decontamination for conditional, unconditional recycle, re-use or release;
- selection of appropriate treatment and conditioning technologies for volume reduction of radioactive waste materials;
- packaging of historic/operational waste, e.g. sludge, ion-exchange resins;
- dismantling of reactor/fuel cycle facility building;
- dismantling of conventional plant buildings, e.g. turbine hall;
- disposal of radioactive waste;
- disposal or recycling of non-radioactive waste material;
- final site surveys and release without radiological constrains (de-licencing)

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.

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 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 facility 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 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 being decommissioned, conditions attached to the licence establishes 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 n° 230/1995 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 and “ad hoc” demonstrations have to be provided in this regard in the documentation submitted by operators for the authorization process of spent fuel and waste management, as well as decommissioning activities.

The Legislative Decree n° 230/1995 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 n° 96/29/Euratom issued by the European Union on the basis of the ICRP recommendations since the Publication n° 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.

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.

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

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 accident scenarios involving unplanned or uncontrolled releases 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 n° 230/1995, 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 of the Legislative Decree n° 230/1995 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*, as required by the Articles 116 of the Legislative Decree n° 230/1995, is prepared under the authority of the Prefect of the province where the installation is located, following provisions stated in Articles 118, 119 and 120 of the same legislative decree.

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 Act n° 225/1992 which establishes the National Service

of Civil Protection and is the general legislation governing emergency preparedness and response management following accidental events and disasters of any nature.

Off-site emergency plans are in force for the non operational NPPs and nuclear fuel cycle facilities, for research reactors and for radioactive waste management facilities.

Off-site emergency plans are in place also for the nuclear installation in decommissioning, fulfilling the same emergency functional requirements as those for operational plants but, of course, providing for a different size of both the emergency response and of the necessary emergency infrastructures.

For the nuclear installation under the decommissioning process, the off-site emergency plan shall be periodically reviewed and resized with reference to the progress of the different phases of the decommissioning process until its final withdrawal.

A first updating of the off-site emergency plan is performed in the initial phase of the decommissioning process, following the authorization of the decommissioning plan, and in any case, following the remove of spent fuel from the site. This updating is based on safety analysis of the accident scenarios postulated for all the activities provided for the authorized whole decommissioning process.

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 rationale behind the updating of the nuclear national planning, the postulated reference scenario and the assessment of the accident consequences, as well as the main features of the revised plan and the emergency response organization provided for were described in the previous Third National Report – October 2011.
Italian organisations involved in the implementation of national plan, regularly participate in emergency exercises organized at international level by EU, IAEA and OECD/NEA. National exercises have been also undertaken in the past and a new exercise series, aimed to test the

current revision of the plan, will be organised under the coordination of the Department of Civil Protection.

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 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.

Bilateral Cooperation

A plan to establish bilateral cooperation on nuclear and radiological emergencies with neighboring countries having NPPs was launched on late 2009 and concluded in 2010-11 as reported in the following paragraphs.

The implementation activity of such a cooperation expedited in the aftermath of the Fukushima Daiichi NPP accident.

Agreement with Switzerland

An Agreement between the Swiss Federal Council and the Government of the Italian Republic on the rapid exchange of information in case of nuclear accidents was signed on 15th December 1989 and entered into force on 26th February 1990. On this basis regular communication drills take place between the respective national contact points.

Parties are committed to notify each other immediately about emergency situations that could have radiological consequences, as well as abnormal levels of radioactivity on their territory, which have arisen as a result of any kind of activity. Information about the emergency has to be promptly forwarded by the interested Party and to cover date, time and place of the event, its nature and the measures planned or taken on own territory and any further available information relevant to minimize the radiological consequences on the population of the other Party.

In order to complement the above State level Agreement, a cooperation Arrangement between the Swiss Federal Nuclear Safety Inspectorate (ENSI) and ISPRA on nuclear safety matters was concluded on June 2011.

On November 2012 an Italian-Swiss Commission for the cooperation on emergency preparedness and response and on matter of nuclear safety was established with the task to coordinate the overall cooperation activity.

In this context also the national emergency Organizations (Civil Protection Department of the Presidency of the Council of Ministers for Italy and the National Emergency Operations Centre of the Federal Office for Civil Protection of Swiss Confederation) attend the regular meetings scheduled under the cooperation Agreement.

Agreement between ASN (France) and ISPRA

A cooperation agreement between the French and Italian nuclear safety Authorities (ASN and ISPRA) was signed on April 2010. The agreement envisages the early exchange of information in the event of a radiological emergency and for the co-operation in the field of the nuclear safety.

In case of an event that could endanger the population of the other country, the Party will notify to the other one the event, its nature, the time and location of its occurrence and any further available information relevant to minimize the radiological consequences on the population of the other country.

The arrangement provides for setting up a joint expert group which will provide a common identification of the set of specific data to be transmitted both at onset of the event and during the evolution of the accident, and the transmission method. The points of contact of the Parties will be available on 24h/7d bases and will be put periodically under test.

As far as the co-operation on nuclear safety matters, the Arrangement provides for the information exchange and cooperation in many areas of the nuclear safety regulatory matters, for example,

- legislation, regulation, safety guides and technical criteria regarding siting, design, construction, operation, decommissioning and waste management,
- licensing, inspection and enforcement procedures;
- regulatory procedure and assessment methodologies related to nuclear safety, radiation protection, quality assurance, emergency planning, environmental impact evaluation, waste management and transportation;
- major public information activities;
- information concerning research and development programs.

Agreement between SNSA (Slovenia) and ISPRA

Likewise the aforementioned French agreement, a second arrangement was ratified on May 2010 by the ISPRA and the Nuclear Safety Administration (SNSA) of the Republic of Slovenia, for the early exchange of information in the event of a radiological emergency and for the co-operation in nuclear safety matters. This Agreement will apply to the notification and provision of information for emergency response in case of the radiological emergencies which include accidents involving facilities or activities referred to in Article 1 of the Convention on Early Notification of a Nuclear Accident and also to exchange of information and cooperation for emergency preparedness and other nuclear and radiological safety matters. Also in the case of events not specified in the mentioned Article 1 but which are of potential interest, the Party may request information about the nature of the event, its consequences and on the undertaken countermeasures.

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.

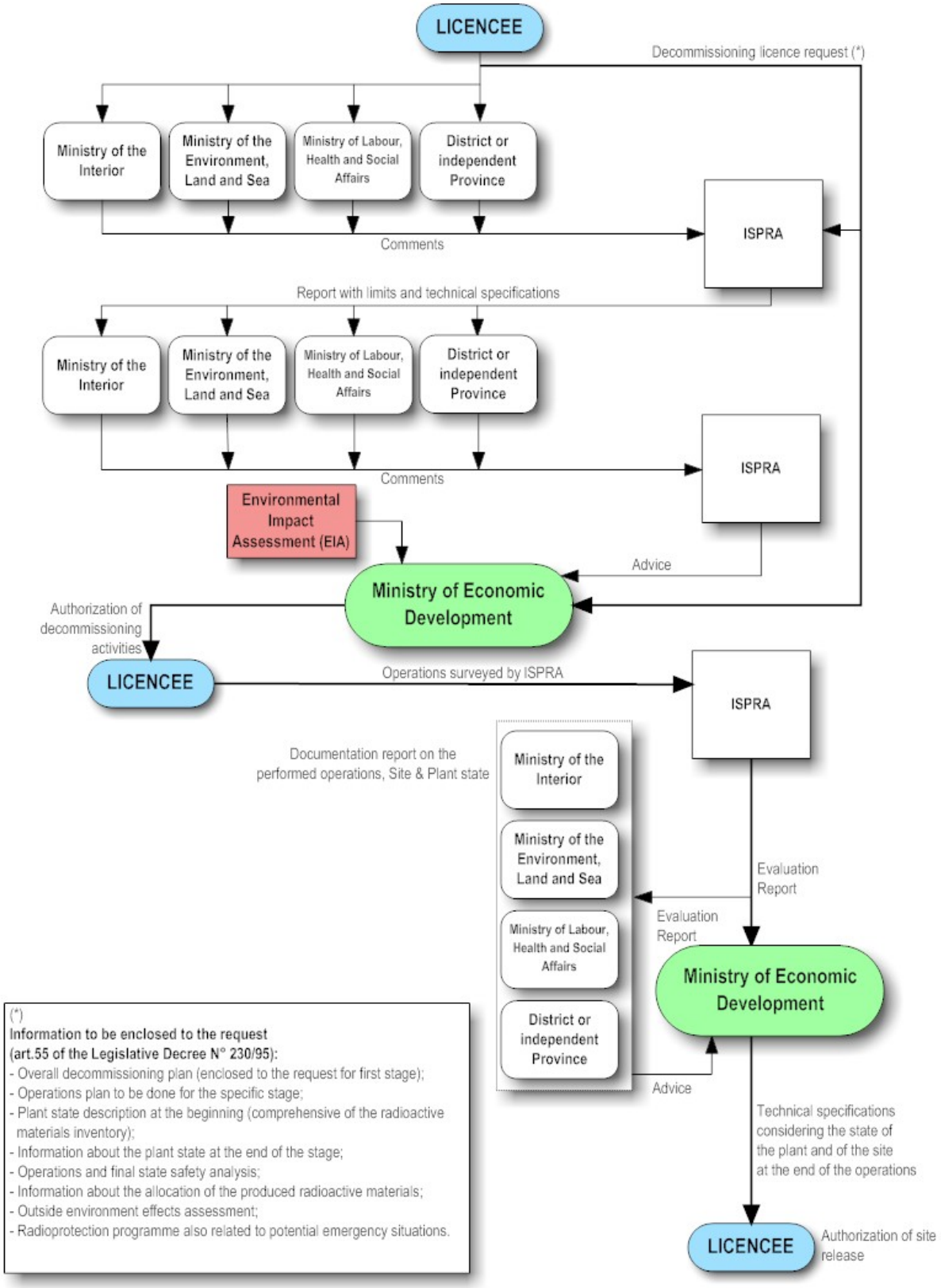
26.1 Undertaken steps

The relevant regulation related to decommissioning can be found in the Legislative Decree 230/1995 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 decommissioning plan 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 and Social Affairs and Health, 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



In the decommissioning licence specific conditions are 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:

- Act n° 1860 (1962) on the *"Pacific Use of Nuclear Energy",*
- Legislative Decree n° 230/1995, implementing six EURATOM Directives on radiation protection (EURATOM 80/836, 84/467, 84/466, 89/618, 90/641 and 2006/117), replacing Presidential Decree n° 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"*
- 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 di Esercizio)",*

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

Regarding financial resources, the related funding system is described under Article 22.

(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. Specific limits for routine discharges complying with the *"below regulatory concern"* criterion are setup. Design dose objectives for members of the public are defined for each plant condition. 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

It is recognized 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[4] 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.

[4] 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, defines the main principles related to nuclear safety and radiation protection and to applicable 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 2015 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, since 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;

(vi) (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 fulfils 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 spent 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.

In line with international practice of periodic safety review ISPRA requested an extraordinary assessment on the status of structures, systems and components related to spent fuel pool to ascertain existing margins for the fuel safe storage until the complete removal of the fuel from the pools to be sent to reprocessing or to dry storage.

Trino NPP

As said the decommissioning licence as been granted in 2012. Some spent fuel is stored in the site pool and is going to be removed according to the already mentioned program of transport abroad for reprocessing.

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

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 UO_2). 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.

With the regard to the extraordinary review requested by the regulatory body in 2014 the following can be highlighted.

The spent fuel pool of Trino nuclear power plant is located inside the "Auxiliary Building", which was interested in the period 1985 ÷ 1988 by some seismic upgrading activities.

In view of the upcoming emptying of the fuel pool, several investigations have been performed to ascertain the condition of the concrete of the building and calculate the stresses that the loading of the cask can determine in the structures. The investigation focused in particular on the fuel pool and the space below it.
In addition, a study was carried out to assess the efficiency of the civil structures, where it is noted that the efficiency of the structures of the fuel pool was evaluated according to the criteria of durability and functionality specified by law and by the most recent international recommendations, both in terms of operation and under seismic conditions. The earthquake assumed as basis design event has a return period of 500 years. All inspections in this regard led to a positive result.
In the past, improvements have been made on the pool liner to prevent leakage due to the age of the structure. In the last years, tests to check for a leak rate of the pool water through the liner have been made several times. The tests have shown that any decreases in the pool level are determined by evaporation of water. Any significant time variation of the state of the hydraulic integrity of the spent fuel pool is kept under control by verifying the replenishment level of the pool.
According to the result of the performed review the current conservation status of the spent fuel pool facilities has been deemed capable to support the safe storage of the fuel elements for the coming years and the safe handling procedures in the frame of the upcoming spent fuel shipment activities for reprocessing.

ITREC

The facility received a new licence in 2006 specifically addressed to the safe management of the installation and to the performance of preliminary decommissioning activities (mainly waste treatment and conditioning etc.) for the period until the decommissioning authorization will be granted. 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

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[5]
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 (10,7 x 3 x 7 m). 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 (2,5 x 2,5 x 4,5 m) for temporary housing the transportation cask during fuel transfer.

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.

[5] 2 FAs were dismantled: 1 FA remained with 11 rods and 1 FA with 23 rods

With regard to the extraordinary review recently conducted, a numerical analysis have been performed to calculate tensional and deformational status of the structure. Two different load conditions have been considered: the first accounting for the static loads (mass of the structures, permanent overloads, hydrostatic pressure, geostatic pressure); the second accounting for a seismic input given by a reference heart-quake with 500 years return time, which equals to consider, from a seismic point of view, an operational residual lifetime of the structure of 25 years.
The performance parameters evaluated, considering the above mentioned loads, are the damage limitation state and the ultimate limit state. In both cases the calculations give positive results. Particularly, referring to the static load conditions the calculations show a large margin in respect of the cracking and leakages. This considering, it has been judged not necessary to proceed with further numerical verifications.
Fuel pool integrity is periodical verified trough visual control of dedicated sumps.

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.
Several transports have been arranged in recent years to transfer the fuel assemblies to UK and to France for reprocessing. At present only 63 fuel elements remain to be transferred to France in the framework of the in place agreement.

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.
In particular 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 NPP Fuel assemblies in DEPOSITO AVOGADRO site	
	63 FAs
Nominal HM mass kg (average)	204,5
Fuel type	BWR
Fuel element layout	8 x 8
Number of fuel elements per assembly	64[6]
Cladding material	Zr 2
Fuel material	1 modified BWR[7], 54 UO_2 + MOX[8], 8 MOX
Fuel initial enrichment in fissile isotopes	2,85%

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

(average)	
Essential feature of the storage	Storage in pool

TRINO NPP Fuel assemblies in DEPOSITO AVOGADRO site	
	1 FA
Nominal U mass kg	310
Fuel type	PWR
Fuel element layout	15 X 15
Number of fuel elements per assembly	208 + 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

With regard to the extraordinary safety assessment of structures, systems and components of the plant requested by the regulatory body, according to international practice, the guidelines set out in IAEA Specific Safety Guide No. SSG-25 "Periodic Safety Review for Nuclear Power Plants" have been followed according to a graded approach.
From the analysis the following conclusions have been drawn:
1) The structural conformity of the pool and the containment building has been demonstrated, according to current Italian regulation (NTC 2008)
2) The primary cooling system is to be considered fully adequate to its scope, both from a design and construction point of view.
3) Plant engineering works and periodic structural checks ensure the efficiency of the plant in case of flooding events.
4) There have not been any substantial changes made in the operating logic of the plant and the constant maintenance over the years has increased the reliability of the systems.
5) What was described in 1978 CNEN Safety Analysis is still valid and up-to-date and therefore it is possible to state that the plant is suitable to continue with the storage of spent fuel elements in the coming years. Due to its old design, the installation remains however not suitable for a long term storage and the plan to remove the fuel in the context of the in place agreement for reprocessing remains firm.

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 some partially burned fuel assemblies located in the racks. Spent fuel is stored in dedicated pits.

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

LENA is a Triga type research reactor. The spent fuel is stored in special pits in the reactor building. There are 5 pits, two of them respectively contain 9 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.

For Italian Research reactors a periodic review is foreseen 5 years but is addressed mainly on monitoring with case by case analyses; as application of the Code of Conduct for RR, a wider extension is in progress by means of a graded approach. ISPRA has prescribed to the operators to submit an updated evaluation of safety which takes into account the recommendation of the Code of Conduct. The regulatory review of the submitted document is in progress.

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, according to the spent fuel management strategy (transfer abroad for reprocessing, dry storage), have a short residual operation period. A specific safety review of operating spent fuel pools has been recently conducted. 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 abroad for reprocessing of the limited amount of spent fuel remaining in the national installation 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. The licensing in process of the dry storage facility is in progress. 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 licensing process is on going. In that frame, all site related evaluations are going to be confirmed. Regular consultation with the local authorities and stakeholders already taking place for the ITREC plant will provide the proper level of information to the members of the public.
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 n° 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 related project has been submitted by the operator SOGIN and it is under regulatory review.

The technical review process will take into account the general principle of reducing exposures to the lowest practicable value (Legislative Decree n° 230/1995 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 n° 230/1995 which include also the spent fuel management facilities existing on the site.

Specific requirements are addressed in Chapter VII of the Legislative Decree n° 230/1995 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 di 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. New storage facilities have been authorised for the Garigliano, Latina NPPs, Eurex plant, JRC of Ispra, Casaccia research centre (Rome) The Garigliano and JRC storage facilities have already entered into operation. 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.

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 is foreseen in the framework of the decommissioning licensing process of each 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 Eurex plant;
- 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.
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 n° 230/1995; For new facilities to be constructed in new sites, as in the case of the national storage facility, environmental protection will be also addressed 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 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 storage facilities the authorizations is garanted also taking into account the advice of Ministries of Environment of Health.
In the case of an installations operating under a decommissioning licence, the design of new storage facilities on the site as to be approved by the regulatory body (ISPRA).

For new long term waste storage facilities to be realised in sites different from those of the existing installations, licensing procedures are currently specified in the Legislative Decree n° 230/1995. Licensing procedure for the construction of a national , near surface repository is reported in the new Legislative Decree n. 31/2010 as subsequently amended.

(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 defined dose objectives. 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 a national near surface disposal facility for low. 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. Legislative Degree N. 45/2014, with which the EU directive N. 2011/70/Euratom has been transposed into the national legislations establish the licensing procedure to regulate the closure of the facility.

(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 are 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 n° 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, flooding);
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.

Safety assessment performed in the frame of the licensing process of new interim storage facilities takes fully into account IAEA applicable safety standards and WENRA safety reference levels as stated in document “Waste and Spent Fuel Storage Safety Reference Level Report – Version 2.1 – February 2011”

It is also to be mentioned that potential radiological impact of low probability events, like an airplane crash, are evaluated according to a “What if” methodology. In the case of radiological consequences exceeding a few mSv adequate protection of the waste is requested.

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 to be constructed in new sites as specific authorization is requested.. A safety assessment is included in the documentation submitted by the applicant.. It is than subject to the regulatory review process with an independent assessment performed by the Regulatory body 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 Land and Sea. Before the operations waste management facilities, including storage facility, an updated version of the safety assessment has to be provided before the facility operation.

(ii) As said in other sections the closure and post closure phases will be considered in the context of the licensing of the national disposal facility. The related requirement are under definition. As reported in the previous section the pertaining licensing procedures is established in Legislative Degree n. 45/ 2014 recently issued.

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. 16 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 national near surface disposal 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

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

- Act on peaceful use of nuclear energy (Act 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 administrative and technical capacity and regulatory structure, to manage the spent fuel or radioactive waste safely.

The international regulations for transport of dangerous goods, including class 7 (radioactive material) are applied for transboundary 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, ADN, 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 transboundary movement of radioactive waste and spent fuel Italy follows the administrative procedures set forth in the European Union Directive 2006/117/Euratom implemented into the national regulatory framework by the Radiation Protection Act (Legislative Decree 17 March 1995, n°230 as modified).

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 and spent fuel is the Ministry of Economic Development.

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 transboundary movements of spent fuel and 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 2006/117/Euratom, quoted above, are applied.

27.4 Assessment of compliance

On the bases of information provided above Italy comply with article 27 of the Convention for such radioactive waste and spent fuel as defined by the Directive 2006/117/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 n° 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 authorities identified by regional legislation.

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 n° 1860/1962, are subjected to

prior authorisation from the Ministry of Economic Development. Moreover, pursuant to Legislative Decree n° 230/1995, the licensees are required to comply with the following obligations:

- 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;
- 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;
- 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 n° 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 n° 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 n° 1860/1962 and the Legislative Decree n° 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 n° 52/2007 establishes specific provisions in order to identify the duties of two subjects which may take the charge of the disused sources management:

- National Operator responsible, in particular, for the long term storage (50 years) of spent sources;
- Integrated Service which may grant all the phases of the spent sources management.

Legislative Decree n° 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 Italian facilities (e.g. NUCLECO 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 (at present 3 companies are licensed).

In Italy there is no central repository for disused sources yet. 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.

At the Casaccia Research Centre there is a storage facility for radioactive wastes operated by Nucleco S.p.A., 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.

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. General Efforts to Improve Safety

K.1 General efforts 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.

Also in connection with the commitments taken in the intergovernmental agreement between Italy and France related to the return of the waste resulting from the reprocessing of the spent fuel, the Legislative Decree n° 31 issued in 2010, as subsequently amended, establishes all the steps and timeframes, including public consultation, for the siting procedure of the National Repository. The same Decree assigns to SOGIN the role of the Implementer responsible for the siting, construction and operation of the facility. In connection with the National Repository, ISPRA recently issued a Technical Guide setting up technical criteria for its siting. It is expected that SOGIN will submit the proposal of a National Chart of suitable sites in the coming months.

It has to be mentioned that, as member of the European Union, Italy has transposed the EU Directive 70/2011/Euratom (Legislative Decree n. 45/2014).

In relation with the Directive transposal, a National Programme for spent fuel and radioactive waste management from generation to disposal will have to be prepared.

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 realized, under implementation or planned.
In particular, priority has been assigned to the following activities to be performed in the near future at 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 have been transferred in a completely new storage station;

- 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; the detailed design has been approved by the Regulatory Authority in 2010;
- realization of an interim dry cask storage facility for the Elk River spent fuel at the ITREC site;
- commissioning and operation of radioactive waste storage facilities at Latina NPP, EUREX Plant ;
- commissioning and operation of the conditioning process for f the intermediate level waste at the Latina NPP;
- remediation of the on site radioactive waste storage/disposal facilities at the Garigliano NPP, ITREC facility (wells and trenches) to bring them in line with current safety requirements; figure 7 shows an historical picture of the radioactive waste disposal in pits at the ITREC facility in the years '70s;
- implementation of decommissioning activities at Garigliano, Trino and Caorso NPPs;
- completion of the transport campaign of the remaining spent fuel from Trino NPP and Avogadro AFR facility to France.

A specific priority has continuously to be assigned by SOGIN to accelerate the implementation of above activities, in particular of those related to the conditioning of existing waste.

On the regulatory side the following improvements are envisaged:

- definition of the main requirements to be addressed in relation to design, construction, operation and closure of the national repository process has to be developed;
- the updating of Technical Guides pertaining decommissioning and radioactive waste storage is in an advanced stage.

On the organizational side:

- increase of the human resources assigned to the Regulatory Body.

Figure 7: Historical picture of burial of radioactive waste in pits at the ITREC facility in the years ‘70s.

Figure 8: The chimney of the Garigliano NPP 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 Sustainable Economic Development
ENEL	National Electricity Company
GCR	Gas Cooled Reactor
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
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
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

Act n° 1860/1962 published in the Italian Republic's Official Journal n° 27 of 30 January 1963, as amended by the President's Decree n° 1704 of 30 December 1965 and by the President's Decree n° 519 of 10 May 1975.

Presidential Decree n° 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 n° 230/1995, described below.
Act n° 393/1975, which contains Administrative rules on the selection of the sites for NPPs.

Presidential Decree n° 1450/1971, which contains requirements and procedure for the acquisition of the operational personnel licences.

Act 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° 230/1995 implementing six EURATOM Directives on radiation protection (EURATOM 80/836, 84/467, 84/466, 89/618, 90/641 and 2006/117).The Decree replaced the previous DPR n°185 issued in 1964 and establishes radiation protection requirements for workers, public and environment.

Legislative Decree n° 241/2000 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 n° 241 has modified and integrated Legislative Decree n° 230/1995.

Legislative Decree n° 257/2001 promulgated in order to modify certain details in Legislative Decree n° 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.

Act n° 368/2003 establishing the procedures for the site selection of a national repository for HLW.

Act n° 239 of 23rd August 2004 promulgated for the rearrangement of the energy sector extends the procedures established by the Act 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.

Act n° 282/2005 promulgated for the ratification of Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Legislative Decree n. 52/2007 which transposes EU directive 2003/122/Euratom on the control of high-activity sealed radioactive sources and orphan sources.

Legislative Decree n° 23/2009 related to the transposal of EU Directive 2006/117/Euratom, on the supervision and control of shipments of radioactive waste and spent fuel

Act n° 99/2009, related to the process to start a new nuclear programme, in Article 29, establishes a new Nuclear Safety Agency with the role of Regulatory Body. As already mentioned, the Agency will be made by the resources of the Nuclear Department of ISPRA and by resources from the Agency for New technologies, Energy and sustainable development (ENEA). The full establishment of this new Safety Authority has, however, still to be completed.

Legislative Decree n° 31/2010 related to the future nuclear development in Italy, provides criteria for the site selection procedure with the involvement of local administration, for the approval and for the compensation of the local municipality. The Decree includes also provisions for the site selection procedure of the national site for radioactive waste disposal giving the responsibility to SOGIN.

Legislative Decree n° 41/2011 amended the Legislative Decree 31/2010 with reference to the future nuclear development in Italy.

Act n°75/2011, that modifies all the provisions given in the Act n°99/2009 and in the Legislative Decree n° 31/2010, as amended by the Legislative Decree n°41/2011, relevant to the development of new NPP in Italy, relinquishing the nuclear development in Italy. The provisions for the development of the national site for LLW disposal and ILW-HLW interim storage has been confirmed. Furthermore, by abrogating the Articles 8 and 9 of the Legislative Decree n° 230/1995, the Act n° 75/2011 slightly modifies the regulatory process by cancelling of the “Technical Commission on Nuclear Safety and Radiation Protection”.

Legislative Decree n. 100/2011 which modifies the provisions of article 157 of Legislative Decree n° 230/1995 concerning the radiometric surveillance of metal scraps.

Legislative Decree n° 185/2011 which transposes the EU Council Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations.

Act n° 214/2011 that abrogates the Nuclear Safety Agency (created with the Act n° 99/2009, but never applied) and the functions have been temporary assigned to ISPRA (that in fact continue its work as nuclear authority) waiting for a definitive asset of the regulatory organization.

Act n° 27/2012 on the economic development, through the Art. 24, establishes a new procedures to reduce the timing of the licensing phases for decommissioning activities with a strong involvement of local administrations.

Legislative Decree n° 45/2014 which transposes the EU Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste. This Legislative Decree included also provisions for the establishment of a new competent Regulatory Authority (Inspectorate for Nuclear Safety and Radiation Protection, ISIN) fully dedicated to the regulation and control in the nuclear field with strengthened independence and human and financial resources and based on the current ISPRA organization. The enactment of further legislative provisions is required for the full and formal establishment of the new Regulatory Authority.

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. n°1	"Content of the Preliminary Safety Analysis Report for NPPs, pursuant to article n°36 of the Legislative Decree n° 2301995 "
T.G. n°2	"Procedure for the Authorisation of Changes in NPPs"
T.G. n°4	"Implementation of the article n°41 of the Legislative Decree n°230/1995 --Detailed Construction Designs"
T.G. n°8	"Quality Assurance Criteria for NPPs"
T.G. n°9	"Quality Assurance Description of the documentation required for design and construction phases prior to carry out nuclear tests"
T.G. n°11	"Criteria for the compilation of information reports on the operation of NPPs to be sent to DISP"
T.G. n°20	"Quality Assurance Description of the documentation required for operation phase of NPPs"
T.G. n°21	"Content of Operating Rules"
T.G. n°22	"Quality Assurance. Guide for collection, storage, preservation, and safekeeping of quality assurance records for NPPs"

T.G. n°23	"Quality Assurance. Guide for procurement of Items and Services for NPPs"
T.G. n°24	"Quality Assurance. Guide for Auditing on QA Programmes for NPPs"
T.G. n°25	"Quality Assurance. Guide for Applying on design activities for NPPs"
T.G. n°26	"Radioactive Waste Management"
T.G. n°29	"Siting criteria for a near surface disposal facility for low and intermediate level radioactive waste"

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, n° 1860, and Legislative Decree n° 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.

One of the most relevant provisions in Legislative Decree no. 230/1995 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 optimization (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. As far as the third principle of dose limitation is concerned, in cases of intervention on the contrary such principle does not apply, intervention levels being used in its stead.
The Legislative Decree 230/1995 clearly state that the operator of a nuclear installation or non nuclear installations or facilities 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, social and economic considerations being kept into account. The implementation of the optimization principle by the operator must be demonstrated firstly at the

design stage and subsequently along the plant operation and decommissioning.

As far as situations concerning unplanned or uncontrolled releases of radioactive material into the environment are concerned, it has been a practice in the authorisation procedure - in force in Italy since 1964 – to request to the applicant an analysis of possible scenarios and the assessment of the consequences (in terms of radiological impact on critical groups of the public), together with appropriate measures implemented with a view of preventing and controlling accident conditions, and mitigating their consequences, with the aim of establishing ad hoc emergency plans. Following the transposition of the Directive 96/29/Euratom in the Legislative Decree 230/1995, an analogous provision was introduced also for non nuclear installations.

Practices

In accordance with the provisions of Legislative Decree no. 230/1995, a practice is subject to radiation protection requirements if certain thresholds of activity and concentration are exceeded:

- 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 Italian legislation’s requirements apply for any radioactivity contents, without thresholds.

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 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 of Legislative Decree no. 230/1995.a practice is subject to notification requirements starting from defined thresholds in activity and activity concentration as far as radioactive materials are concerned; the relevant thresholds 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 Legislative 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 Legislative Decree no. 230/1995, which have not been modified by the transposition of EU directive 96/29/Euratom.

For non nuclear 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 more important installations is the competence of the of Ministry of Economic Development which issues authorisations in accordance with other relevant Ministries; the advice of APAT 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.

A Technical Annexe to Legislative Decree no. 230/1995 lays down thresholds in order to determine which installations are authorised by the Ministry of Economic Development 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 clearance levels to be specified in the prescriptions, must comply with the basic below regulatory concern criterion for practices – also established in the European Directive 96/29/Euratom – and, to this aim, must take into account directives, recommendations and technical positions provided by the European Union. The contravention to prescriptions included in the authorisation acts is opposed by ad hoc sanctions.

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. 230/1995 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.

As previously said, 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.

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 Economic Development that evaluations of potential exposures should be made by the applicant seeking an authorisation 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 can 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. 230/1995, 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").

Dose limits

The transposing of the EU directive 96/29/Euratom in Legislative Decree no. 230 of 1995 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.

A) WORKERS

The following limits shall not be exceeded for exposed workers:

- an effective dose of 20 mSv in any single (calendar) year;

- a dose equivalent of 150 mSv per year to the lenses of the eyes;
- a dose equivalent of 500 mSv per year to skin, forearms, hands, feet and ankles.

However, in exceptional circumstances, recourse can be made to specially authorised exposures for medically fit category A workers (as hereinbelow defined) if exceeding dose limits cannot be avoided; such exposures can be incurred only by voluntary workers and must not exceed twice the yearly limits laid down for exposed workers. In particular, no women of reproductive capacity can undergo such exposures; the same rule applies to male workers having exceeded dose limits in the twelve months before.

Special provisions ensure that workers having exceeded the effective dose limit of 20 mSv for any reason whatever must not be exposed in excess of 10 mSv per calendar year as long as their yearly averaged exposures are no more than 20 mSv.

WORKER CLASSIFICATION CRITERIA

An individual, in relation to his work activity, can be classified:

a) non-exposed worker, if he is not likely to receive, because of his work, doses exceeding the following limits in a (calendar) year:
   - an effective dose of 1 mSv, or
   - an equivalent dose of 15 mSv to the lenses of the eye, or
   - an equivalent dose of 50 mSv to skin, forearms, hands, feet and ankles;

   (the above limits are numerically equal to those laid down for members of the public).

b) exposed worker, if in relation to his work activity he has a likelihood to receive doses exceeding the limits indicated in a).

Exposed workers can be classified in two categories for monitoring and surveillance purposes: Category A and Category B workers.

Category A workers: Exposed workers are classified in such category when they have a likelihood to receive in a calendar year doses exceeding:

- an effective dose of 6 mSv, or
- an equivalent dose to the lenses of the eye of 45 mSv, or
- an equivalent dose to skin, forearms, hands, feet and ankles of 150 mSv.

Category A workers must be individually monitored, both for external and internal exposures while for category B workers area monitoring is used, as a rule, in order to assess doses and to verify compliance with ALARA constraints and, of course, with dose limits.

Category B workers: occupational exposure of any worker shall be so controlled through area monitoring that the previous dose levels for purposes of classification are not exceeded.

Other special provisions are laid down in Legislative Decree no. 230 of 1995 with a view to protecting: apprentices and students of age $\geq$18 years (who are training for employment involving exposure to radiation), the worker classification criteria shall be applied; apprentices and students

of age between 16 and 18 years (who are training for employment involving exposure to radiation); apprentices and students of age 16 years or less; pregnant and nursing women.
Moreover, delineation of work areas (i.e. supervised and controlled areas) based upon by reference to an assessment of the expected annual doses and the probability and magnitude of potential exposures, thus distinguishing work areas at risk in controlled and surveyed areas.
According to EURATOM directive no. 90/641, special provisions were established in the Legislative Decree no. 230/1995 for outside workers and in particular the use of a radiation "passport", logging doses incurred during their working activities.

B) MEMBERS OF THE PUBLIC

The following limits shall not be exceeded for members of the public:

- an effective dose of 1 mSv per year;
- a equivalent dose to the lenses of the eye of 15 mSv per year;
- a equivalent dose to skin of 50 mSv per year.

Radiological safety objectives and Authorised Limits

The Italian Regulatory Practice has always made intensive use of radiological safety objectives and authorised limits for ensuring that, during normal operating conditions, doses to workers and reference groups of the population are well below primary dose limits.
As regards transient and accident conditions, radiological criteria applicable to each kind of installation are identified, seeking to differentiate between various types of transient and accidental conditions in terms of maximum dose levels not to be exceeded to the relevant reference groups of the populations.

Surveillance

For the implementation of provisions regarding radiation protection of workers and public, the Italian regulatory system identifies a particular person, the qualified experts, whose technical qualification is recognised through State examinations. Those professionals have been playing an advisory role and bearing technical responsibility, as far as radiation protection is concerned; their role consists in carrying out both preventive and periodical radiation protection evaluations and measurements, in particular regarding dose assessments both for workers and members of the public. Moreover qualified experts bear technical responsibility in that they must give operators all technical advice relevant to ensuring effective radiation protection of workers and public at the design stage, at the operational level and at the decommissioning stage.
An important instrument for the radiation protection of exposed workers is medical surveillance carried out by specialised physicians whose capacity to act as approved medical practitioners is recognised by means of State examinations. Every member of the work force must be recognised as fit prior to being exposed to radiation as a category A or B worker and is also subject to periodic reviews of health.

All considerations, evaluations, measurements and technical advice by qualified experts must be recorded, in particular as regards dose assessment records for which a strict regime of filing is provided for; the same requirement for filing holds for records concerning medical surveillance of exposed workers.

Radiation Protection Inspections and enforcement

Verification of compliance with radiation protection requirements laid down in law and in licensing prescriptions is the responsibility of various independent bodies. ISPRA inspectors are vested with authority over the whole domain of radiation protection requirements as both workers and public are concerned, Labour Inspectorates are concerned with requirements pertaining to workers' protection while Inspectors with regional bodies are mainly concerned with radiation protection requirements for the public. It must be remembered that Inspectors are vested with police powers in the Italian system.

The Italian compliance and inspection system is based upon the fact that legislation provides for penal sanctions in cases of non compliance; penalties are meted out by the Courts at the instigation of the Office of Public Prosecution to which inspectors are required under law to communicate every case of non compliance. Particular measures are laid down in legislation in order to prompt and/or force swift compliance, especially for non compliance concerning provisions for radiation protection of workers; in these cases inspectors are bound to evaluate if the user could avoid undergoing a trial by complying with *ad hoc* specifications established by inspectors and paying a fine.

The ALARA Principle

The principle that doses incurred in relevant exposures are to be kept as low as reasonably achievable, social and economic considerations being kept into account, is laid down in article 2 of Legislative Decree no. 230 of 1995, together with the principles of justification and of dose limitation. It must be remembered that the optimisation principle, together with the justification principle, had been implemented in Italian regulatory philosophy and practices long before it was legislated into the Legislative Decree no. 230/1995.

The implementation of the ALARA principle in the Italian system of regulatory control is ensured by means of two regulatory tools:

- provisions in the Legislative Decree no. 230/1995;
- administrative prescriptions.

The Legislative Decree has distinct provisions for doses to workers and public to be kept ALARA by operators: the provisions state, essentially, that rules of good practice are to be obeyed at every stage. Rules of good practice are not an exclusive means to ensure optimisation as ALARA is also called: other means may be used to that end provided that results are the same.

The second regulatory tool, largely employed in the Italian system for the purpose of implementing ALARA, is the use of administrative prescriptions at every stage of the licensing process. It must be pointed out that such prescriptions are enforceable by means of criminal penalties.

From an operational viewpoint the whole of the regulatory instruments available, that is:

- the careful planning at the design stage, through the laying down of the radiological safety objectives;
- the consequent safety assessment and all ensuing reviews;
- the safety and radiation protection culture fostered among all Italian organisations involved,
- the good independent prevention role played by qualified experts;
- the support role by the NPP Council of Delegates;
- the system for verification of compliance.

all have conspired so that a more than satisfactory radiation protection level from the ALARA viewpoint was ensured for all stages of the installation life.

Incident reporting

The most important provisions are contained in Legislative Decree no. 230/1995, namely Articles 92 and 100.

In case of accidents, or incidents that could result in an exposure to workers above dose limits, according to article 92 of the Legislative Decree no. 230/1995, the operator is requested for notification as soon as possible, but not later than 3 days after, to the following Institutions:

- The Regulatory Body (ISPRA);
- Local Labour Inspectorate (Province);
- Local Offices of the National Health Services.

In case of unexpected radioactive contamination inside the plant boundaries or an accidental occurrence implying a significant increase of the risk of exposure to the workers, the Operator has to implement all suitable measures aiming at avoiding any risk increase (article 100 of the Legislative Decree no. 230/1995). Moreover, when significant contamination of air, water or land outside the plant boundary, or exposure to the public, at the occurrence of accidental events, the operator is required to immediately notify to:

- Local Government Representative (Prefect);
- Local Fire Brigade;
- Local Offices of the National Health Services;
- The Regulatory Body (ISPRA).

Furthermore, the operator has to take all the measures suitable to reduce the radioactive contamination in the areas outside the boundary of the plant, so to limit the risk to the public.

Radioactive Waste Management

Legislative Decree n° 230/1995 contains more precise provisions regarding radioactive waste management. Article 102, establishes that radioactive waste must be managed in accordance with the rules of good practice and the instructions set out in authorization documents; also, any person producing, treating, handling, using, dealing in or storing radioactive substances has to conduct 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.

Legislative Decree n° 230/1995 has also incorporated Directive 2006/117/Euratom on the supervision and control of shipments of radioactive waste and spent fuel. In particular, Article 32 requires prior authorisation of transfer, import, export and transit of radioactive waste, in compliance with the Directive.

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. In that case, the Prefect, other competent bodies in the region and ISPRA must be informed of the occurrence of any incident and there is an obligation for the authorized party to take all the measures required to restrict contamination and to prevent any risk to individuals and the public [Article 100].

Legislative Decree n° 31/2010 establishes the procedures for the siting, construction and operation of the National Repository.

The Legislative Decree n° 45/2014, which transposes the EU Directive 2011/70/Euratom, establishes some amendments to Legislative Decree n° 230/1995 related for example to definitions, transboundary movements of spent fuel and radioactive waste and authorization procedures for temporary storage facilities. The Legislative Decree n° 45/2014 establishes amendments also to Legislative Decree n° 31/2010 in relation to the National Repository siting procedure and licensing procedures for the closure of the related disposal facility.

The Decree also establishes provisions for the updating of the waste classification system, taking into account the international standards, and the development of the National Programme for spent fuel and radioactive waste management from generation to disposal.

Natural Radiation Sources

Some of the most important provisions introduced in the Italian regulatory system by the transposal of 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 n°

230/1995 by the transposition of Directive 96/29/Euratom. In the transposition of the directive the relevant European Commission's recommendations and 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/m^3 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 n° 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.

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 guidance 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.

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.

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) non-fixed 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 geomorphologic 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 activities at facilities under decommissioning

CAORSO NPP

The dismantling of the turbine and BOP started in 2009 and ended in 2012. More than 6500 tons of metallic materials were dismantled, about 700 tons were decontaminated and 5500 released. The dismantling of components of the off-gas system ended in 2010. The building was completely dismantled in 2013.

Caorso - Off-gas building dismantling

With regard to waste treatment 600 drums of technological wastes were supercompacted by Nucleco in the years 2008 and 2009. In the years 2011-2013 about 350 tons of low level waste (oil, charcoal, polymer, carbon steel, technological waste) were treated by Studsvik in Sweden, producing 208 drums of final packages.

A project for the re-conditioning of resins and sludge that have been treated in the past with urea-formaldehyde has to be performed in the near future in a defined timeframe as established by the licensing conditions.

In February 2014 the decommissioning licence has been granted.

TRINO NPP

The spent fuel which is still on site (47 fuel assemblies) will be shipped to reprocessing plants in France in the 2015. The decommissioning license for dismantling has been granted in August 2012.

A program of supercompaction of solid low- level radioactive waste began in 2013 and continued in the first months of 2014. The number of drums processed was 1487 and the volume reduction factor was 2,86 . The activity was carried out by Nucleco, which is 60% owned by SOGIN, through a supercompaction system operating at 2000 tons.

During 2013 the removal of contaminated components was completed in the radioactive waste disposal building in order to install a system of treatment of spent ion-exchange space resins by wet oxidation technology. The total quantity produced was 61 tons of carbon steel and 45 tons of stainless steel.

The detailed project for the conditioning of resins and sludges is now under licence approval by ISPRA.

The design for dismantling Primary cooling systems (Reactor Vessel not included) has been completed in June 2013.

GARIGLIANO NPP

The decommissioning license has been issued in September 2012.

A new radioactive waste interim storage building (about 10,000 m^3) named D1 entered into operation on 31/01/2014.

Building storage D1

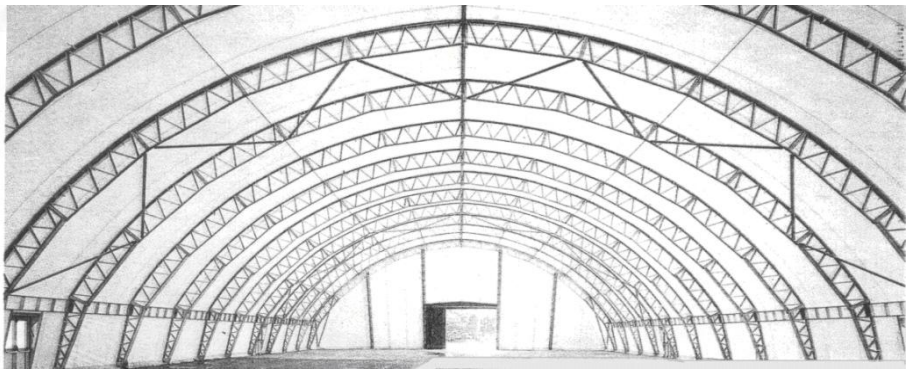
The adaptation of the emergency diesel building, as an interim waste storage facility, was completed. The current state is fully loaded.

Building storage ex-diesel

The internal area for the demolition of the plant stack (90 m), after radiological characterization and scarifying, has been opened up. The work will be carried out according to two principles: containment static and dynamic.

Garigliano's plant stack

Activities for the realization of a containment of the "trenches", for the subsequent extraction and treatment of radioactive wastes coming from former operation and currently stored underground, was completed. Activities for the remediation have started.



Containment building trenches 2 and 3

Trenches remediation activities

Reactor building

LATINA NPP

The decommissioning licensing application is under regulatory review. Due to the presence of about 2000 tons of irradiated graphite and the current unavailability of the National Repository the decommissioning strategy by SOGIN is based on two phases:

- Step 1: Plant footprint reduction and safestore: activity steps are: dismantling of the six boilers, reactor sealing inside the biological shield, lowering of reactor building roof to the "secondary floor" and pool decontamination. Radioactive wastes generated at this stage will be conditioned and stored on site in existing buildings and new buildings whilst waiting for the availability of the National Repository.
- Step 2: Dismantlement of the nuclear island and auxiliary buildings

The last stage of the reactor and internal dismantling will be subjected to the availability of the National Repository.

Some activities related to decommissioning are in progress or planned on the bases of ad hoc authorizations. A new radioactive wastes interim storage building (20,000 m^3), in which also the sludge resulting from the past operation of the plant will be stored after cementation, has been completed. A plant for the extraction and conditioning of such wastes is under construction.

The design of CO_2 ducts dismantling was completed and the tender procedure for the dismantlement of the blower's casings was launched.

In the frame of the demolition of conventional structures, the dismantlement of the concrete structure of the pier and the building (about 100,000 m^3) that housed the turbines and other components of the BOP has been finalized. The tender procedure for the construction of a waste management facility, called "Cutting Faciity" is in progress. The Operational Plan necessary for the spent fuel pool emptying and decontamination has been recently approved by to the Regulatory Authority.

Latina new storage building

EUREX PLANT (SALUGGIA SITE)

The EUREX reprocessing plant dismantling was postponed after the conditioning of liquid waste and other activities which were planned in order to ensure a safe storage of waste and an extensive knowledge of the plant radiological state.

For this reason, major activities were run in order to prepare the site for further decommissioning; they are as follows:

- The licensing process of the CEMEX Cementation plant in near to be completed
- Characterization of wastes, especially those arising from past decommissioning of the IFEC fuel fabrication plant in Saluggia. They undergo a service of volume reduction and conditioning off site and the final waste forms, suitable for final disposal, are returned to Saluggia for temporary storage
- The conditioning of slurries and resins coming from the storage pool remediation is in the design phase
- A comprehensive plant characterization has been completed, with destructive and non-destructive analyses, in order to improve waste amount estimation and radiological risk for future decommissioning
- All the fissile material has been removed from the Site in the frame of the Global Threat Reduction Initiative
- One Waste Pond went under remediation, and an application form for revamping all of them was submitted
- Main maintenances to maintain major plant services in shape until the end of decommissioning, have been planned or implemented.
- Construction of the interim waste storage building D2 and the new electrical power switchboard (NCE)
- The design of a Waste Management Facility is in progress
- An application for a phase 1 decommissioning will be submitted by the end of 2014

Eurex – D-2 and NCE buildings

ITREC (TRISAIA SITE)

In July 2011 the Decommissioning license, the "Overall Decommissioning Plan", the "Plant status" and the "Activities Plan were presented to the Ministry of Economic Development and other Authorities.

The detailed design regarding the reconditioning of underground Pit 7.1, containing radioactive waste drums immobilized in a block of concrete (6 x 6 x 1.5 m) built during the former operation, has been completed.

In June 2012 the excavation works began around the block of concrete. In December 2013 the construction of the containment building was completed. This building forbids any form of radioactive impact to the environment. To guaranty perfect isolation safety auxiliary systems (fans, monitoring) were installed and tested, inside the building. Until now excavations, works are still going on and have reached half way to underground Pit 7.1 block. The support beams were installed.

In July 2011 the tender for cementation facility construction, radioactive liquid solution ("Prodotto Finito") and the for the cemented products/Casks interim storage building was launched and contract assigned in 2013. Activities for the construction of the storage building are have started. :

In the SIRIS (Settlement of Solid Waste) project framework, characterization, treatment activities, grouting and super-compaction of metal wastes generated in the former operation are in progress.

Itrec - Overpack preparation

BOSCO MARENGO SITE

The decommissioning licence was granted in 2008.

The dismantling plan was divided into 2 phases: the first step included the dismantling of the fuel assembly fabrication equipment and its accessories, and the auxiliary systems such as ventilation,

decontamination systems and liquid waste treatment plants; the second phase includes the shipment of the waste to the National Repository and the free release of the site.
The first phase began in December 2008 and in June 2014 the work had reached 90%.
On March 11, 2011 ISPRA authorized SOGIN to proceed with the dismantling of the auxiliary systems. Works started at the beginning of September 2011 with the dismantling of the first sections of the ventilation pipes.

Before dismantling

After dismantling

In 2012, 611 overpacks were treated and placed in the provisional local buffer Bld11 with other incombustible waste.
During 2013 the decommissioning activities of the ventilation system were completed.
First phase will be completed by the end of 2015.
It is estimated that, from the dismantling of the plant, about 270 tons of materials will be released and about 500 drums (220 liters each) of radioactive waste will be produced.

Bld 11

Decommissioning activities

CASACCIA SITE

The decommissioning project of 55 obsolete Glove Boxes (GB's) from the Plutonium Plant, used in past for MOX fuel fabrication, begun in December 2010; dismantling of a first group of 12 level-1 GB's ended in 2013 and level-2 GB's (total of 8) has been started and is in progress.

Treatment and conditioning of operational radioactive wastes from OPEC and Plutonium plants are in progress. Characterization and stabilization of nuclear materials (HEU and MOX) have been performed in 2013-14, with installation of 3 new GB's in the Plutonium plant.

In the near future, the removal and dismantling of the OPEC-1 underground tanks (4.7 m3 + 22 m3) of the radioactive liquid waste collection system, is planned to start.

In 2010, an authorization has been granted to modify the structure of OPEC-2 facility (originally designed as post irradiation examination facility but never entered in operation) as temporary storage building for plutonium contaminated solid wastes. OPEC-2 civil works and system installations are in progress; the facility is expected to enter into operation by 2015.

Maintenance activities were also performed in 2013-14 on electrical supply systems and HVAC control systems.

Figure 1 – Waste A&B dismantling facility at OPEC-1 plant

Figure 2 – Glove box dismantling at Plutonium plant

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