The Management of Medical and industrial Radioactive Solid Waste. The Italian Scenario

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Abstract

It is commonly understood that in the absence of electric energy production from nuclear fission, the activities concerning nuclear sciences are of interest of universities, laboratories or research institutes only. The reality is just the opposite. The variety of the issues concerning industries and health care facilities, with the exchange of nuclear materials, the possibility of discovering orphan sources, imposes sound public and legal infrastructures, since the nuclear sector is designed starting from the management of its wastes. As far as the Italian scenario is concerned, ENEA (The Italian Agency for Energy, Environment and Economic Sustainable Development), manages an “Integrated Services” which includes qualified national operators, verified by ministerial and internal procedures. These operators achieve the licence from Ministry and operate after a release of a proper certificate. ENEA is the owner of a unique nuclear Italian temporary storage facility in which the wastes are treated, conditioned and kept in safe conditions for the interim storage, the operator is NUCLECO, firm of which the Agency has the 40% of the shares.The experience and the experts of the ENEA Agency are recognized as an asset of the Italian scenario. The management of the radioactive sources coming from medical and industrial activities, with all the related legal, legislative and storage implications from the cradle to the grave is one of the most challenging and recognized activities of the international environment.

Key Words

Integrated Service,radioactive wastes, D.Lgs 52/2007, orphan sources, legal framework, conditioning of radioactive wastes, interim storage, EURATOM directives.

Introduction.

Italy, as it is well known, abandoned the production of electric energy from nuclear source from the referendum of 1986, resulting in the only European country which stopped immediately the production of the four small and prototypal NPPs after the Chernobyl accident, this after nearly four decades resulted in a heavy disadvantage for

the whole industrial economical and educational sector, i.e. the energy price in Italy is higher than the other important competitors and affects the general competitiveness of the whole country.

On the contrary, the country stands all the charges of the nuclear technology, i.e. a wide range of radioactive wastes coming from the previous electrical generation and all the issues coming from this burden, which oblige to a countinuos work for the safe and secure conditioning and storage of the radioactive wastes in temporary or furthergeological storage.

The ethical and deeply modern aspect is that the nuclear sector considers as the main process of the whole industrial workmanship the conditioning and the safe and secure storage of the wastes which are produced during the production.

This is speciallytrue also for those wastes which are deriving from the non-energy sectors, i.e, medical and industrial. All the sanitary units, hospitals and industrial facilities offer oncological and radiotherapy treatments, industries needs welding and thickness controls, geological prospections require the use of radioactive sources.

All these various medical and industrial aspects of a modern developed economy need a complicate and robust management system, efficient public bodies such a regulatory authority, international specialized firms and an solid educational framework able to contrast the generational gap deriving from the minor perception of the public.

It is a common understanding among the experts that this system is more challenging and various than the energy production one and needs a more refined and dedicated knowledge.

This reality exists in Italy, it works, operates, improves the quality of the life of the citizens and it is a remarkable asset of the productive system, contributing to the inclusion of the country in the world of the pacific and international uses of the nuclear energy, implementing the EURATOM directives and the IAEA recommendations.

Methods

The Integrated Service

To go back to this long and valuable tradition, the ENEA (The Italian National Agency for New technologies, Energy and Sustainable Economic Development) Board of Directors, with a resolution of 4 June 1986 Doc. ENEA, (86) n. 33/CA Rev.1 approved the establishment of an «Integrated Service» for the management of low and medium radioactive wastes generated by external operators and defined that such a Service were undertaken partly directly by ENEA and partly entrusted to NUCLECO. The relations between the parties, to apply such a resolution are regulated through a

specific Conventionof 15 June 1989, registered at n. C/46007 at the Registration Office of private acts in Rome on 27 September 1989.

The legal framework in which the Agency acts and supervises the operators which are in the business, includes two main legislative decrees: the 230/95, the general Italian act on the nuclear activities and mainly D.Lgs. 52/2007 [1].

- D.Lgs. 52/2007 Implementation of the Directive 2003/122/CE EURATOM on the control of the HASS (High Activity Sealed radioactive Sources) and orphan sources.

- Art. 2 paragraph 1 letter m). «Integrated Service» technical operative tool able to take charge of all the phases of the management cycle of the disused source.

- Art. 12 The ENEA Agency with no further charges to the government spending, is required to organize and manage training courses for the personnel who are operating in those installations in which orphan sources are likely to be found, i.e. customs, metal industries, the great scrap metal repositories, the intermodal shipping nodes, to achieve their updated knowledge and competence.

- Art. 17 paragraph 3, The Integrated Service guarantees all the phases of the management cycle of the disused sources like the preparation for shipment, the transport, eventually the conditioning and the temporary storage. All the plants and operators which undertake collection activities and eventual temporary storage of disused sources are allowed to join the Service. (They must be in possession of the relevant authorizations issued by the Ministry of Economic Development as per 230/95 act.

Underthis act of the Italian parliament issued in May 2007, ENEA is responsible for providing an Integrated Service able to manage the collection and the storage of low and medium activity radioactive materials, including disused radioactive sources.

The wastes which are of interest are specified in the document “GuidaTecnica n.26” [2], issued by ISPRA, the body currently having regulatory functions and supervised by the Ministry of the Environment.

This regulation is the Italian classification of the radioactive wastes, it was issued in 1986 and in some parts needs updating and revision to comply with the last and modern classification recommended by IAEA. This process is ongoing, our Institute submitted its proposals at the beginning of the current year and is waiting for the final version which is espected this year, issued by the Italian regulator.

It can be imagined that the international legislative outline is in rapid evolution through a more deep harmonization among the European Union, encouraged by means of the IAEA guidelines. Italy is following this process, since all the legislative acts of the

government and parliament are complying with the recommendations of the Agency and the EURATOM directives.

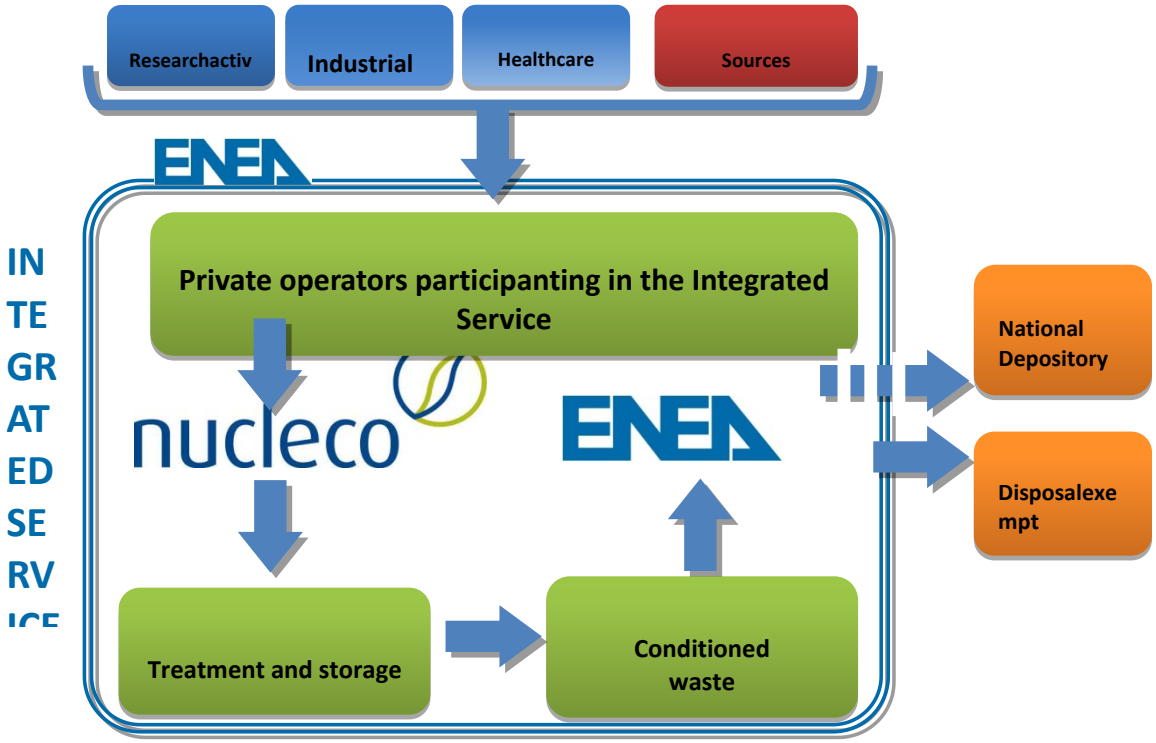

Fig. 1 Scheme of the integrated Service

As it is not so well known, depending to their characteristics, radioactive materials are used in a variety of further applications apart from energy production purposes, e.g.:

- Diagnosis and medical therapy (radiotherapy, diagnosis of osteoporosis, scintigraphy, blood sterilization of surgery instruments, radiography, CAT).
- Irradiation of non-medical devices (e.g., food preservation).
- Diagnostics, industrial measures, and material analysis (i.e. thickness, density measurements, inspection and non-destructive testing of weldings in the joints of the pipelines).

Even if the management of the radioactive sources is regulated by laws to which the owners have to strictly comply, the national Authorities have to consider the case when the sealed sources are discovered in unguarded places with potential hazard to population and environment.

The problem of the Orphan Sources

In this context, the Integrated Service is responsible, under the directive of the above mentioned act, to carry in safe conditions sources occasionally discovered (the so-called orphan sources,[3] or high activity sealed ones).These events can occur 1) when the owner is unknown or 2) in the case in which some industry goes bankrupt, or 3) for citing a real case, if a radiologist passes away and the heirs have access to the legacy which includes the building of the hospital, the technological systems and the sections of the oncological therapy equipped with previously regularly authorized radioactive sources.The final destiny of the sources, who is the owner, the holder and who is going to stand all the economic implications, is left to a long legal debate with a decision of the courts which is far from the common understanding of the technicians involved.

We have to point out that the case in which entire hospitals, health care facilities are run by subcontracts, moved or dismissed is very delicate, since the presence of long life radioactive sources for the medical radiotherapies implies as well correct procedures that the owner and the holder have to undertake for a safe and secure final storage of the sealed sources.

Legal implications i.e. who is going to support the expenses of final disposal of such devices is often a matter of discussions which, as in the case mentioned above, result in law suits, the entity of the financial turnover is high due to the specialized people and companies which have to manage the decommissioning of these radioactive devices.

ENEA, due to the long experience and technical capability, being the supervisor State body of thesmall but technologically advanced constellation of firms which are administratively qualified for these purposes and works, is now able to give the correct legal advice and consultancy andto give support also to the State Institutions which should require advice.

If nobody takes action, we can reach the stage in which serious accidents due to thefts, misuse, illicit detention or abandoning are unfortunately recorded. IAEA (The International Atomic Energy Agency of the United Nations) records in the last decades at least ten significant accidents in which orphan sources were involved due to poor quality of supervision and management. The results were casualties, wounded people and tons of soil to be removed and considered as radioactive waste.

The 2007act, which takes in the European Directive 2003/122/CE Euratom, now obliges those who require the authorization for operation of these devices to stipulate one of three kinds of agreements: with banks, or public bodies, or return to the manufacturer, to constitute a fund for management and final disposal. The situation now is far better than before, but old sources may appear and have to be managed one by one.

Fig. 2 Orphan Sources from medical facilities

The Industrial Process

Apart from this,a normal flow of low activity wastes coming from hospitals and other medical organizations is present in Italy. These are managed for the final treatment and conditioning through ENEA's operator NUCLECO (ENEA owning the 40% of its shares),

NUCLECO runs all the conditioning plants and storage facilities of which ENEA is the owner, and has legal responsibility for the collection and the management of medium and low activity radioactive wastes. The company has a license issued by the Ministry of Economic Development which defines types, quantities, and volumes of solid and liquid wastes to be processed and finally stored. In the facility of Casaccia near Rome

two techonologically advanced plants are operating for the conditioning of solid and liquid wastes (fig.3).

The various steps concerning the evolution of the property of the radioactive wastes and of the responsibilities are written in contracts and agreements which are the frame of the activity.

The facilities, the personnel and all the documents concerning the activity of the interim storage are opened to the periodical inspections of IAEA, EURATOM and ISPRA, which is actually the Italian regulatory body.

In total, the non-nuclear power wastes which are stored in this temporary facility located in CasacciaResearchCenter are about 4.500 m^3 and the annual rate coming from the Integrated Service is about 200 m^3.

Other companies which have authorizations issued by the Ministry are allowed to apply to join the Integrated Service. All of these qualified and authorized firms may undertake their work under ENEA supervision, which coordinates and supervises the various phases.

Cooperation with other bodies is undertaken, especially with customs, police departments, and fire fighters, to comply with the Safeguard Agreements which are the practical enforcement of the Non Proliferation Treaty. It is also done to disseminate know-how, prevent the illicit trafficking of nuclear materials and provide technical support to the Ministry to revise the export applications of the national industries, to prevent the risk of penalties in case firms decide to export those materials, i.e. lasers, package units, motors and other devices which are suitable for dual-use.

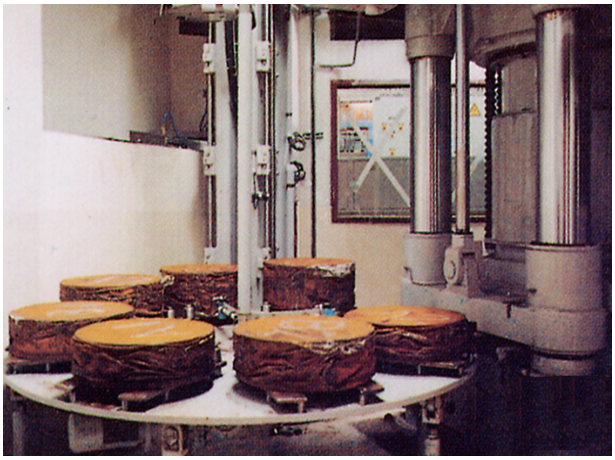

Fig 3. Conditioning process of solid radioactive medium and low activity wastes.

CONCLUSIONS

- Italy, as it is well known, has no electric energy production from the nuclear source, since this one was abandoned further to the Chernobyl accident, at that time the fleet included four NPPs and various other facilities.
- Nuclear activity is still remarkable for industrial and medical purposes. Heavy industries and hospitals commonly undertake nuclear practices for which nuclear materials must be conveniently and efficiently managed.

- This technologically advanced sector acts in the framework of a robust legal and procedural environment, under the recommendations of IAEA and the EURATOM directives which are promptly transponded in the national legislation.
- The implementation of an efficient regulatory body is peculiar. The nuclear sector needs the supervision of state-owned bodies which are able to carry on inspections and regulation function.
- The Council Directive of 19 July 2011 “Establishing a Community Framework for the Responsible and Safe Management of Radioactive Waste”, obliges to set up in the EU within August 2015 roadmaps and national plans for the future management of the nuclear inventories of the various countries. This enforces the concept that nuclear is the human activity which is designed and run to take care of its waste management.
- Generational gap must be avoided. Knoweledge and experienced people in nuclear energy are an asset of any developed country representing the thrust to robotics, instrumentation, material, environmental sciences. When financially viable fission nuclear is the most powerful mean to tackle the greenhouse gas emission and is a remarkable share of the European energy mix.

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