

The New Policy for Radioactive Waste Management and Site Selection for the National Repository in Italy-11053

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ABSTRACT

In Italy a legal framework allowing the restart of nuclear energy has been set up during 2009 and 2010. The legislation includes the policy and procedures for the site selection for NPPs and for a near-surface repository for LLW. This site will also host a centralized facility for long term storage of conditioned HLW, LILW-LL and un-reprocessed SF. The integrated system will be the **National Repository**. Along with the National Repository, other high tech R&D installations are planned at the same site (the *Technological Park*).

The procedure for siting the national repository is initially based on voluntarism and partnership with the local administrations. Steps of the procedure include development of the conceptual design of the LLW repository and Long Term Storage Systems and a screening of the national territory for identification of potentially suitable areas, based on exclusion criteria. Regions and local Administrations with suitable areas will be invited to a public discussion (the *National Seminar*) along with all involved stakeholders. A negotiation is undertaken with the Administrations having shown interest to the localization of the Repository.

INTRODUCTION

In Italy following a referendum held in 1987, the nuclear energy was phased out. Since then, activities were uniquely directed to the conditioning of radioactive wastes produced during the about thirty years of nuclear operation, and to the decommissioning of the nuclear facilities. Italy had carried out in the past a considerable activity in the field, playing during the sixties and seventies a pioneer role in the development of the nuclear industry, through the construction and operation of 4 NPPs, 2 reprocessing pilot plants, fuel fabrication factories, large research laboratories.

A program for providing the country with a repository for disposal of radioactive LLW was first launched in 1997 by ENEA, the former Nuclear Energy Commission of Italy, which after the referendum became the National Agency for Energy and New Technologies. Starting from 2001, a rearrangement of the national organisation framework directed to expedite the decommissioning activities was progressively implemented. The responsibility for waste management and D&D of the dismissed NPP's, including ownership, was transferred from ENEL, the national board for electricity production, to SOGIN (Società Gestione Impianti Nucleari), a new purposely created stock company fully owned by the Ministry of Economy. From 2003 SOGIN also took over responsibility for the decommissioning of the ENEA pilot

plants and experimental facilities of fuel cycle. ENEA has maintained responsibility for R&D activity on nuclear energy, including fusion.

As unique national operator responsible for waste management, SOGIN in 2004 acquired control of NUCLECO, a stock company providing engineering and field services on radioactive waste, currently jointly owned with ENEA (60% SOGIN, 40% ENEA). NUCLECO is also charged with managing the institutional waste in Italy.

SOGIN was also given responsibility for site selection and disposal program. An attempt to select a site in southern Italy for the repository led in November 2003 to a strong opposition by the local population and the repository project was suspended.

After the general election of 2008, the new government, as anticipated in the election campaign, decided to return to the nuclear energy path. A plan for a new legislation establishing a legal framework for allowing the construction of nuclear power plants was soon announced.

THE NEW LEGISLATION

In July 2009 a framework law was approved by the Parliament covering the whole policy, including the provision of a new dedicated Agency for Nuclear Safety (the nuclear regulatory function was assured by the Agency for Environmental Protection, covering nuclear as well as conventional activities). Furthermore, in February 2010 a Decree of Law was passed implementing key aspects of the policy, in particular dealing with the authorization regime for nuclear installations and site selection for NPPs and for a near-surface repository for LLW.

The established licensing process for NPPs goes through two main steps: 1) an initial application for site (or sites) qualification; 2) an application for a combined Construction and Operating License. Upon site(s) qualification by the Safety Agency, the procedures calls for local partnership with Regions and the local Administrations directed to guarantee information and transparency and aimed at seeking public acceptance and reaching an agreement on the localization. Provisions are also established in the Decree for the management of radioactive waste and funding for nuclear plants decommissioning.

Benefits for communities hosting NPPs are based on a “cash incentive” approach, laid down by the law, hence not subject to negotiation. Starting from the plant construction, the payment is fixed at 3000 €/MW/year for power plant up to 1600 MW. Starting from operation the payment is related to the electricity delivered to the grid, and amounts to 0,4 €/MWh on quarterly basis. Benefits are shared between the hosting community (55%), the neighboring communities (35%), and the Province (10%).

A special section of the Decree of Law is dealing with the provisions for the selection of a site for the construction of an integrated system called the National Repository for Radioactive Materials. This system includes a Near Surface Disposal Repository for the Low Level Waste and a centralized facility for long term storage of conditioned HLW, LILW-LL and un-reprocessed Spent Fuel. Along with the National Repository, other high tech R&D installations are planned in the same site (the *Technological Park*). As established by the law, the Technological Park is intended to become a center of excellence for developing scientific and technological activities on sectors connected with waste disposal (advanced decommissioning technics, waste

conditioning for advanced fuel cycle, etc.), also offering opportunities for researchers, universities and national industry as well.

The organization charged by the law to carry out all the activities directed to the construction of the National Repository and the Technological Park, including site selection and design development, is SOGIN. The procedure established by the law for the site selection is mostly based on the proposals made by a Commission purposely appointed by the previous government in February 2008.

The short term steps of the process are:

- development of the conceptual design of the LLW repository and Long Term Storage Systems;
- screening of the national territory for identification of potentially suitable areas, based on exclusion criteria (fulfilling the IAEA requirements [1]), and preparation of a National Map of potentially suitable areas ;
- the National Map is made public through the most important national media and internet;
- inviting the Regions and local Administrations with potentially suitable areas to a public discussion (a *National Seminar*) for presenting to all the involved stakeholders the proposed National Map along with the structures of the National Repository and the other installations of the Technological Park. The local Administrations are required to present comments, observations and proposals to the identified areas;
- following the National Seminar and its achievements (in particular comments and proposals by the local administrations), SOGIN develops and submits to the Ministry of Economic Development a final version of the National Map of suitable areas, for formal approval. This is finally released upon advice of the Safety Agency.

Upon final approval of the National Map, SOGIN within 30 days invites the Administrations with suitable areas (Regions, Provinces, Municipalities) to communicate their interest in hosting the National Repository, and possibly to volunteer. Showing interest is by no means an anticipation of acceptance. A bilateral negotiation is then undertaken by SOGIN with the Administrations having shown interest, directed to achieve an agreement on the localization. In case of more than one local community enter negotiations, a ranking of suitability is considered in the final choice, according to social and/or geographic factors. The final agreement is laid down as a formal protocol between the Region and the Government.

In the law there are also provisions covering a lack of interest or a failed agreement in the negotiation. These provisions can be shortly summarized as follows:

- a Joint Committee is set up, between central institutions (Ministries of Economy, of Environment and of Infrastructures and local Administrations (Regions and others), charged to achieve an agreement on a site or on a list of sites;
- if an agreement cannot be reached in the Joint Committee, the decision on a site, among those subjected to negotiations, is taken by the government through a Decree of Law submitted to the Parliament.

The above process has to be completed within six months from the recognition of the missed agreement in the previous procedure involving the partnership of the Regions.

THE NATIONAL REPOSITORY

In Italy a considerable amount of radioactive wastes has been produced during the about thirty years of R&D and commercial nuclear activities. A total inventory of around 80.000 cubic meters of LLW conditioned wastes is calculated, mostly coming from dismantling of the power stations. Currently, some 20.000 cubic meters of already conditioned waste of this kind are being stored at the sites.

The total inventory of long lived waste to be placed in interim storage in the National Repository accounts for about 12.000 cubic meters of ILW-LL and about 500 canisters of vitrified and compacted HLW produced in the reprocessing of spent fuel in UK and France. The return of these materials is expected to be completed by 2025.

Fig. 1 shows the eight major sites of Italy with plants and laboratories under decommissioning. Waste produced in the Euratom Joint Research Center of Ispra, northern Italy, will also be disposed in the Italian LLW repository.

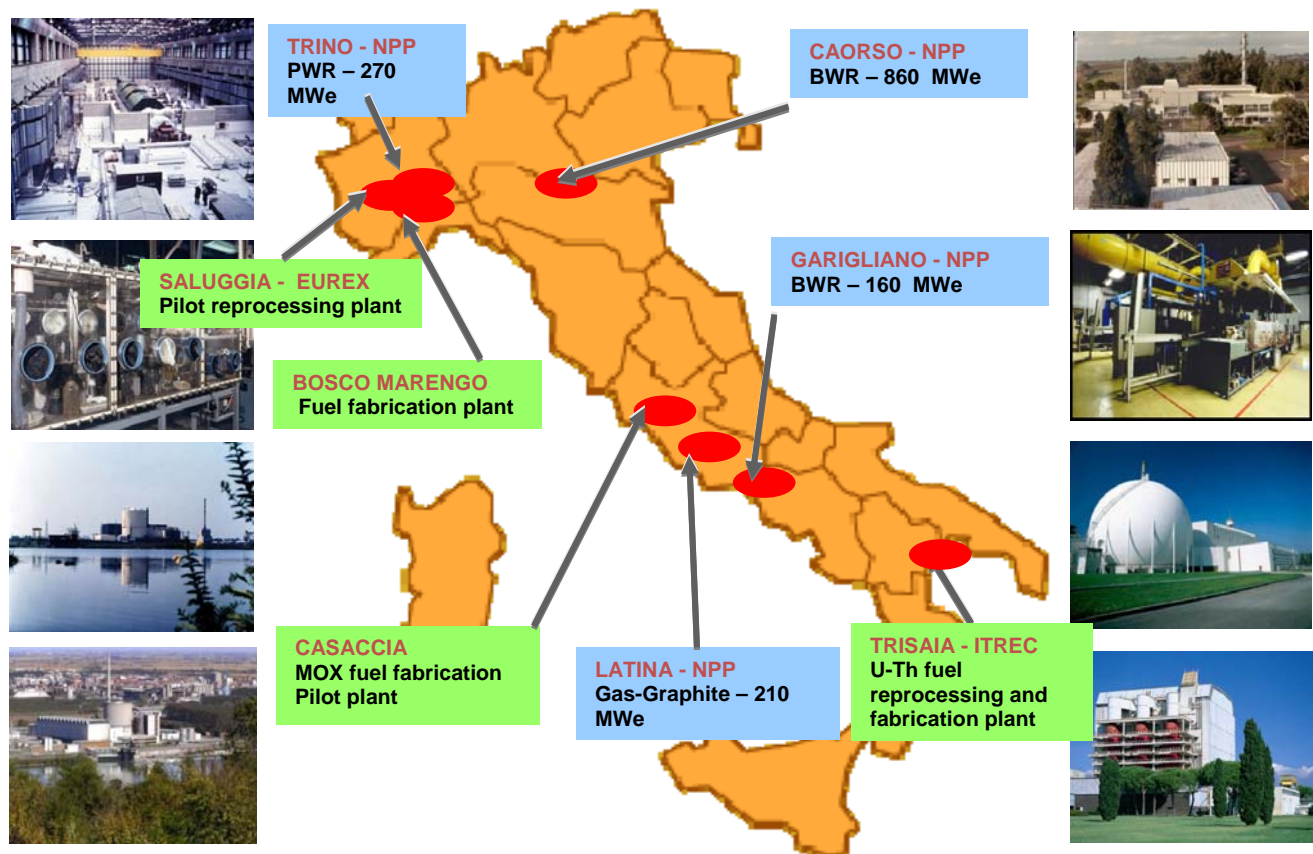


Fig. 1 - Sites of the facilities under decommissioning

LLW Repository

The LLW Repository is based on vault concept, similar to the French and Spanish repositories. The waste packages will be disposed through a concrete container (the "module"), which is a key component of the EBS. A number of vaults able to accommodate all the waste produced in the past (i.e. about 80.0000 cubic meters) is initially planned, while the disposal capacity for the future needs (waste arising from the new NPPs) will be provided by extension of the repository. The site will be selected and qualified for accommodation of a total inventory of LLW that includes a future radioactive waste production due to an installed nuclear power of 10.000 Mw(e). Only conditioned waste will be accepted in the Center.

HLW and Intermediate Long Lived Waste Storage System

The following installations are planned for the centralized interim storage of all categories of radioactive waste, not suitable for disposal in the LLW repository, produced in Italy:

- Storage building for heat-generating conditioned waste (vitrified HLW and compacted hulls). Storage in vertical shafts or in dual purpose casks is currently being evaluated. A decision on the system is expected to be taken by mid-2011.
- Storage building for medium level conditioned waste without or with negligible heat generation;
- Storage building for casks with spent fuel assemblies. This facility is planned essentially for future needs: most of the old spent fuel has been shipped to reprocessing plants in UK and lately in France.
- The centralized interim storage system for long lived waste is intended to provide an intermediate solution to ensure the safe storage of radioactive waste pending the availability of a long-term disposal option.

The current inventory of long lived waste in Italy and the perspective of a future production due to the new planned NPPs do not allow to indefinitely postpone the launch of disposal program for these materials. During 2011 a decision on that subject is expected. At present, for the centralized storage facilities a lifetime of more than 50 years is considered.

THE SITE SELECTION

As required by the law, a systematic screening of the national territory for identification of potentially suitable areas has been performed in the first half of 2010. The suitability has been driven by the requirements for a LLW near-surface disposal repository. A set of exclusion criteria based on technical and socio-economic factors, implementing the well-known requirements established by the IAEA, have been established. The first step of the process, laid down by the law, is the elaboration of a proposed National Map of Suitable Areas to be submitted to the attention of the Regions and the all national stakeholders and discussed in National Seminar, now expected to be held in the first half of 2011.

As mentioned above, in the law there is a provision for the creation of a dedicated Nuclear Safety Agency. The law also requires the formal endorsement by the Safety Agency of the selected exclusion criteria, along with the establishment of the general safety criteria. The Chairman and the four Commissioners have been appointed in November 2010 by the government, and the Agency should be in operation in the beginning of 2011. The proposed National Map will be made public following the formal accomplishment of the procedure.

In this paper we can anticipate some results of the geographic screening. Table I shows the used exclusion criteria, against which the national territory has been examined.

Tab. I - Applied Exclusion Criteria for the National Map of Potentially Suitable Areas

<i>Theme</i>	<i>Criterion</i>
Geography	Exclusion of islands
Geology	Exclusion of areas with geological substratum largely inhomogeneous or highly fractured or soluble.
Hydrogeology	Exclusion of areas where there is a potential for direct release pathways to a regional aquifer or to a locally important aquifer.
Geochemistry	Exclusion of areas where there is a gaseous or hydrothermal groundwater circulations.
Tectonics and seismicity	Exclusion of: active volcanic areas; areas in correspondence of active seismic structures and if peak ground acceleration (PGA) exceeds 0.3 g, for a return period of 2475 years.
Surface processes	Exclusion of: areas covered by Holocene sediments; areas at <5 km from the coastline and at altitudes <20 m a.s.l.; sloping areas (slope > 15%); areas affected by soil instability; mountain areas > 600 m a.s.l.
Antropization	Exclusion of: urbanized and surrounding areas (within a distance from the perimeter of the villages/towns 3 times the mean radius of their extension); areas of exploitation of mineral resources (oil, gas, geothermal energy and deep storage of CO ₂); areas around the hazardous industrial plants and within 25 km from HUB airports and 8 km from other major civil and military airports; areas at distance of 0.5 km from major highways, roads and railways.
Land uses	Exclusion of: areas with intensive farming, areas with valuable cultural heritage and landscape, National Parks.

The islands have been excluded because public concern regarding the sea transport of waste might be expected, also taking in mind that the location on the site of the interim storage system for long lived waste will require a further displacement of such materials. The first step of the screening has been carried out using an advanced GIS (Geographic Informative System) methodology for implementing all the selected exclusion criteria, except the land use.

GIS is a computing environment that enables the territorial data storage and processing. Topological, mathematical, statistical and logical elaboration can be done as well as mapping of any given element of the territory or result of data elaboration.

However, approaching the land use evaluation we had to consider that a reliable investigation and interpretation of land uses for exclusion can be hardly performed by an informative procedure. Italy is in fact a country rather densely populated, without arid or remote areas and with many “untouchable” areas of special interest spread out all over the country (e.g. archeology, tourism and landscape as an example). The land uses scrutiny, which is a key factor in the Italian context, has been consequently carried out through a direct observation of the areas not excluded by the previous GIS analysis. Techniques connected with aerial and satellite photography have been extensively used.

By the first stage of the screening around 200 potentially suitable areas (about 320.000 hectares), representing about 1% of the national territory, have been identified.

The further direct screening for characterization and exclusion of land uses performed on the above areas led to a final identification of a short list of suitable areas, located in seven Regions of Italy. Those data will be made public in Italy after the endorsement by the new Agency for Nuclear Safety, as mentioned above.

In SOGIN’s view, a safe repository able to meet regulatory safety standards could be built at any of these locations, by a suitable combination of design, engineering and operating practice, which will vary depending on the environment at each site.

As mentioned above, the applied exclusion criteria have to be endorsed by the newly created Agency for Nuclear Safety. Afterwards, the areas will be submitted for discussion and comments to the involved Administrations and to the national stakeholders, according the process described above.

THE PROBLEM OF SOCIAL ACCEPTANCE IN ITALY

Radioactive waste management is one of the most controversial issues facing Society today. The public perception of risk and safety associated with the siting of storage and disposal facilities, which has led to the well-known NIMBY syndrome, might be particularly acute in Italy. The aftermaths of the referendum, held one year after the Chernobyl accident, have been particularly heavy on the political and cultural side. Since then and for longtime even the word nuclear was considered in Italy even *politically incorrect*, especially, but not exclusively, on the left side of the politics which includes the Green Party. Furthermore, the failed attempt to select a site in 2003 by a kind of *Decide and Defend* procedure did not help in building the confidence of the public.

It is true that nowadays the widespread perception of the problems arising from the large use of fossil resources (global warming, dependence from foreign countries, etc.) contributed to a more favorable attitude towards nuclear energy in many countries, and in Italy this led to some rehabilitation of the nuclear energy.

Table II shows one of the several Eurobarometer surveys [2] conducted by the European Commission on the public opinion issues linked to the use of the nuclear energy, where a positive trend can be observed for Italy.

On the other hand, additional surveys, also conducted at national level, show that Italy is among those countries where consensus in the population in developing nuclear power would be rather difficult as long as the issue of managing radioactive waste is unresolved. This is why the new established policy implemented by the recent legislation gives special emphasis on the issue of solving the problem of radioactive waste, with a major effort being made to implement a procedure direct to gain acceptance by the local Administrations in selecting the disposal site.

Tab. II - Euro barometer 2008: Acceptance of nuclear in EU.

Question: Are you totally in favour, fairly in favour, fairly opposed or totally opposed to energy production by nuclear power stations?

	Winter(**) 2005	Winter(**) 2008	Difference 2008 - 2005		Winter(**) 2005	Winter(**) 2008	Difference 2008 - 2005
EU27	37%	44%	+7	CZ(*)	61%	64%	+3
IT	30%	43%	+13	LU	31%	34%	+3
PL	26%	39%	+13	NL(*)	52%	55%	+3
IE	13%	24%	+11	FI(*)	58%	61%	+3
EL	9%	18%	+9	PT	21%	23%	+2
DE(*)	38%	46%	+8	EE	40%	41%	+1
ES(*)	16%	24%	+8	BE(*)	50%	50%	0
DK	29%	36%	+7	FR(*)	52%	52%	0
SI(*)	44%	51%	+7	HU(*)	65%	63%	-2
AT	8%	14%	+6	MT	17%	15%	-2
UK(*)	44%	50%	+6	SE(*)	64%	62%	-2
LT(*)	60%	64%	+4	CY	10%	7%	-3
SK(*)	56%	60%	+4	LV	39%	35%	-4

(*)Country with operational NPP('s)

(**) Total "in favour"

REFERENCES

[1] IAEA, Safety Standards Series, WS-R-1, Near Surface Disposal of Radioactive Waste

[2] Attitudes towards Radioactive Waste, Special Eurobarometer 297, European Commission, June 2008