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The Italian National Repository and Technology Park

A. MARIANI and D. MARTA
Sogin S.p.A. - Via Marsala 51c, Rome, Italy

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Summary. — Italy has produced electricity from nuclear source for several years starting from the first half of the 1960s, with 4 Nuclear Power Plants (NPPs) based on 4 different technologies. These plants phased out for a political decision after a referendum held in 1987. After an initial indecision on how to find the best solutions for decommissioning and disposals, between the end of the 90s and the early 2000s Italy adopted an institutional framework for these tasks, with the strategies of immediate dismantling and realisation of a near-surface repository for Very Low Level Waste (VLLW) and Low and Intermediate Level Waste (LILW). In 2010, a law was approved (Legislative Decree 31/2010) which foresees a decision-making process with a mixed-mode approach, based on expressions of interest within a map of suitable areas, and the decision to realise the National Repository together with a Technological Park. The latter is intended to host activities necessary for both the Repository and the complementary ones. These procedures, which confirm a general European evolution to favour shared decisions and projects that foster added value for concerned territories, represent an opportunity both in involving a wide range of stakeholders and in promoting development of technological research. Indeed, the Technology Park will be able to attract public and private investments, with the aim of developing activities with a high and innovative technological content, able of creating a centre of national excellence in this field, open to international cooperation.

1. – Italy overview

In Italy, 4 nuclear power plants (Trino Vercellese, Caorso, Latina and Garigliano) and 4 fuel-cycle plants (Saluggia, Bosco Marengo, Casaccia and Trisaia) are currently being decommissioned by Sogin (see fig. 1 for heir location). The waste generated by the previous operation of these plants and by running decommissioning activities will constitute approximately 60% of VLLW and LLW waste, and almost all of ILW and HLW and spent fuel. Both of these waste categories require a disposal solution.

The Italian disposal strategy (see figs. 2 and 3 for schematic illustration), confirmed in the National Programme that Italy has published pursuant to Euratom Directive

Fig. 1. – The Map of the temporary storages in Italy.

2011/70, is based upon the realisation of a near-surface National Repository for the disposal of VLLW and LLW, and for long-term interim storage of Intermediate Level Waste (ILW) and High Level Waste (HLW).

These solutions are in line with the disposal guidelines recommended by the IAEA and with international best practices, and Sogin, entrusted by Law No. 31 of 2010, is currently acting as Project's implementer, having the task of designing, siting, constructing and operating the National Repository.

The National Repository will be realised together with a Technology Park, which will host both facilities for the best performance of the operational phase and for the development of research and technological activities. The realisation of a Geological Disposal Facility for HLW and spent fuel is not yet planned, as Italy would like to take advantage of the opportunity to join a regional project together with other European countries that have also declared interest to join in their own National Programmes. [1]. The National Repository will collect about 95.000 m^3 of radioactive waste over time: 60% of the waste resulting from the decommissioning of nuclear energy plants and installations and the other 40% originating from scientific research, medical applications and industrial activities.

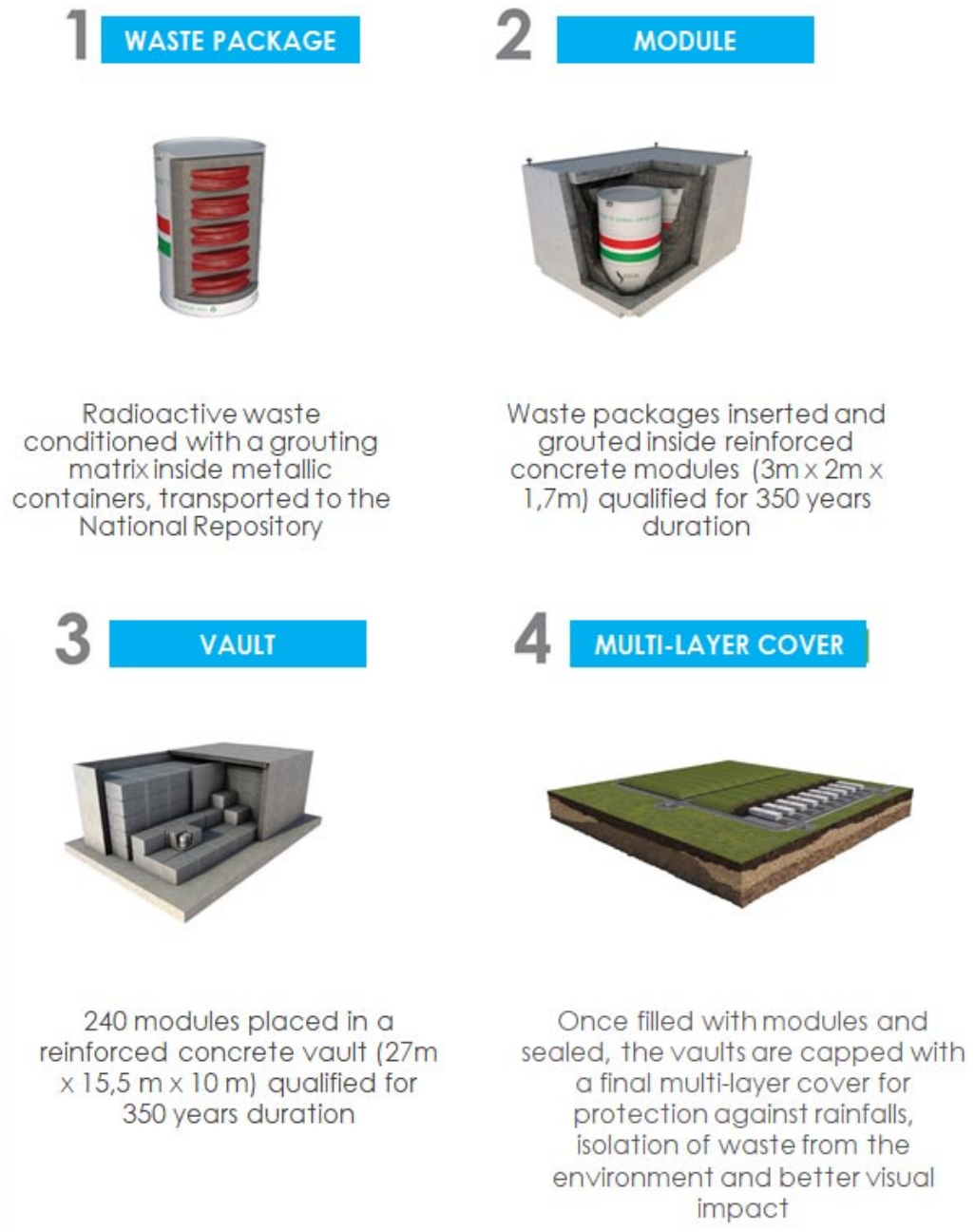

Fig. 2. – Schematic illustrationn of the multibarrier concept.

2. – Siting process

The siting programme for the National Repository is based on a mixed-mode approach, which includes technical and engineering criteria, together with environmental,

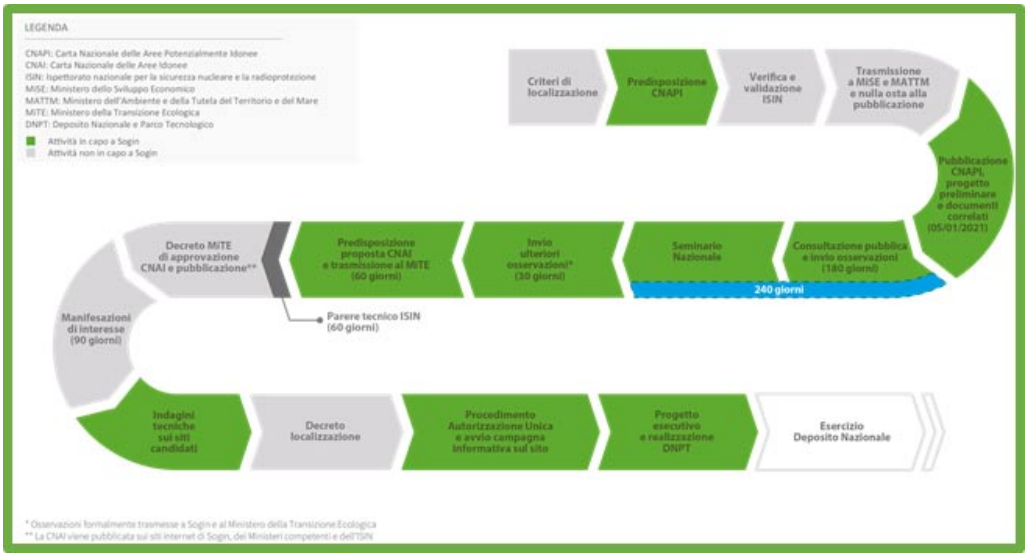

Fig. 3. – Illustration of the steps for the siting process according to the law decree 31/2010.

socio-economic and demographic aspects, to exclude unsuitable areas (*i.e.*, most of the national territory), and subsequent expressions of interest by the local communities of the suitable areas to host the National Repository.

The CNAPI (Carta Nazionale delle Aree Potenzialmente Idonee, National Map of Potentially Suitable Areas) was published, after the green-light from the concerned Ministries, at the beginning of 2021, together with the Preliminary Design of the Repository. A Public Consultation was held throughout the year to allow all institutions and people to provide their observations and technical proposals on both CNAPI and Preliminary Design . The dialogue with the interested communities continued with the National Workshop, which took place in Autumn 2021 with a series of sessions dedicated both to a general part and to the in-depth study of each Region included in the CNAPI.

Thanks to the collection of contributions provided during the Public Consultation and the subsequent National Workshop, Sogin has elaborated the proposal for the new National Map, CNAI (Carta Nazionale delle Aree Idonee, National Map of Suitable Areas). The Map was submitted for technical review to the Regulatory Authority (ISIN, Ispettorato Nazionale per la Sicurezza Nucleare e la Radioprotezione, National Inspectorate for Nuclear Safety and Radiation Protection) which requested some changes and additions. The revised version of the CNAI is presently being prepared by Sogin. At the end of this procedure the Ministry of Environment and Energetic Safety in agreement with the Ministry of Infrastructures and Transports will allow the publications of the CNAI.

After the publication of the CNAI, local communities will be asked to formulate, through their elected officials, a formal expression of interest to host the National Repository and Technology Park. Such interest will be developed and formulated inside a formal mutual agreement with Sogin, enabling the search for a suitable site inside the area.

Fig. 4. – The Map of the potentially suitable areas (CNAPI).

3. – The Technology Park

The role of the Technology Park (whose schematic drawing is illustrated in fig. 4) is twofold: on the one hand, that of strengthening the activities carried out in the National Repository, with the presence of services common to both areas, environmental analysis laboratories, training centres for the personnel employed in the infrastructure, research laboratories to improve radiation protection techniques, and so on. On the other hand, the Technology Park will make it possible to develop further research activities, which will be agreed with the local communities who will host the National Repository, also taking into account the specific features of the territory from a socio-economic and environmental perspective. Such activities will be developed with a financial system that will attract investments from both public and private sectors, thanks to the profitable situation guaranteed by the presence of the infrastructure itself.

This mechanism of shared choice of activities to be carried out in the Technology Park is one of the most important pillars in the benefit package associated to the realisation of the infrastructure. In fact, it is a well-established element both in the guidelines and in best practices, to guarantee, through a benefit package, the long-term sustainable development of the territory that hosts an infrastructure such as a radioactive waste repository, in consideration of both the long timescale with a significant portion of the territory occupied, and the fact that the communities that accept to host this infrastructure make a decisive contribution to solving a problem of the whole country. [2]

Furthermore, the opportunity of sharing, with the local communities interested in the project, a series of elements opens to decisions that can be more easily agreed upon. In addition this sharing process helps to rebalance the overall discussion [3] and to find a common ground and it also reduces the risk that a strong polarization may arise, absorbing the whole public debate and making solutions much more difficult [4].

Fig. 5. – The Technology Park: a sketch of a possible realization of the infrastructure.

The benefit package includes, in addition to the activities that will be implemented in the Technology Park, the benefits in terms of direct and indirect job opportunities, the improvement of infrastructures (bridges, roads, other services) and one or more forms of direct benefits to the resident populations. Moreover, the recent debate about local benefits has gradually exploited the importance of the added value for the territory, intended not only as an additional level of acknowledgment in an objective perspective, but also as something deriving from the presence itself of an infrastructure capable of improving the social opportunities of the territory, even in a symbolic dimension [5]. Examples of this evolution have been already implemented in many European countries (Belgium, France, the Netherlands), including site visits, temporary exhibitions, public meetings and so on, and will be further implemented in the years to come.

Another way of guaranteeing more involvement of local communities and more benefit for the territory they are living in, is to implement activities that will reflect the general quality of environment. In the Technology Park will be developed an environmental laboratory, where will be carried out analyses on liquid environmental samples and solids (air, drinking water, vegetables, milk, etc.) both inside and outside the site, in order to confirm the absence of contamination. Therefore an environmental laboratory is directly related to the operation of the National Repository and to the general premises about safety. Moreover, it will provide another opportunity of showing transparency in involving people and in sharing data about the territory. Indeed the results of the analyses carried out by the laboratory will be made available to local communities and will allow, as well as it happens in other countries, continuous monitoring of any source of pollution, even outside the repository area.

The Technology Park will host also several training activities, provided in a first phase to personnel assigned to National Repository, on issues such as radiation protection, radioactive waste management, safety and environmental protection, in accordance with the provisions of the national legislation. In addition, to foster opportunities for young residents in the area hosting the National Repository, specific post-graduate courses will

be organised. All this is to make the Technology Park a unique centre of education and training at national level.

As a concluding remark I like to underline that in the Technology Park research demonstration and development (RD&D) activities in the decommissioning and radioactive waste management sectors will be carried out. Such activities are needed because, although Nuclear Power Plants (NPPs) have been dismantled in many countries, some specific activities related to the treatment of 'problematic' types of waste, or decommissioning of certain types of reactors (*e.g.*, reactors of type Magnox, moderate to graphite) have challenges and aspects still unsolved in an optimal way. Research, development and demonstration activities therefore aim to develop new technologies, or to adapt technologies to reduce dismantling times and therefore the associated costs and doses for operators, as well as minimizing waste volumes. These issues are especially important to be addressed in a strong market development that will see hundreds of reactors to reach their phase-out in the coming decades.

Some of the possible areas of interest for the research activities are:

- New characterization systems for radioactive waste;
- New treatment and conditioning solutions for special waste (*e.g.*, graphite);
- New monitoring systems for environment and workers;
- Research activities on the Italian geological disposal
- Use of nuclear science to solve problems on the conventional field
- Modification of conventional solutions to be applied in nuclear field
- New solutions for renewable energy production
- New solutions on the medical field
- New technologies (artificial intelligence, robotics, ...)

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