



Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

Radioactive waste management Italian context

EURAD Lunch & Learn session - News on the siting process in Italy – 27 October 2021

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ITALIAN NATIONAL AGENCY FOR NEW TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

R&D activities: energy efficiency, renewable energy sources, climate and environment, safety and health, new technologies, electrical system research, **nuclear energy**.

Nuclear energy - Fission:

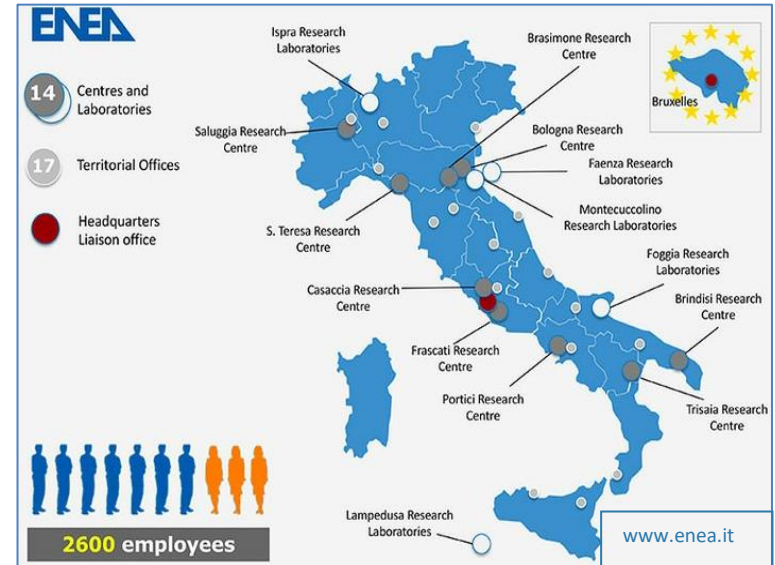
- advanced nuclear systems for innovative production plants and for medium-term, long-term problem solving related to both the availability of fuel resources and reducing long-life radioactive waste;
- qualification of nuclear components and systems;
- ionizing radiation metrology;
- radiation protection.

Nuclear energy - Fusion:

future radioactive waste management, physics, plasmas, technology, engineering system.

Up to 2003: ownership and management of 3 plants related to nuclear fuel cycle.

Today: public supervisor of the **Integrated Service** (radioactive waste management).



Nuclear power in Italy

The use of nuclear energy in Italy started in early 60's (4 NPPs, managed by ENEL).

- 60's – Construction of **Latina** (MAGNOX, 200 MWe; 1963), **Garigliano** (BWR, 160 Mwe; 1964), **Trino-Enrico Fermi** (PWR, 260 MWe; 1964) NPPs .
- 70's - Construction of LEU, HEU fuel fabrication plants in North-West of Italy (**Fabbricazioni Nucleari, ENEA-IFEC**).

Activities of Garigliano NPP stopped in 1978 (permanent shut down in 1982).

R&D about nuclear fuel cycle (ENEA, INFN, Universities, ...); two experimental fuel cycle facilities: **ITREC, EUREX**.

- 80's – Construction of **Caorso** NPP (BWR, 860 MWe; 1981).
In 1987: **cancellation of nuclear program** by government (as result of a national referendum following the Chernobyl accident).
ENEA closes down the nuclear fuel cycle facilities : IFEC, EUREX (Saluggia Research Centre), ITREC (Trisaia Research Centre) and the IPU Plutonium Plant (Casaccia Research Centre).

Nuclear power in Italy

- 90's - In 1999, NPPs and **radioactive waste management assigned to SOGIN** (*Società Gestione Impianti Nucleari*), a newly established company (the Italian WMO).
Mission: decommissioning of all Italian nuclear plants and safe management of spent fuel and radioactive waste.
- 2000's - In 2003, the responsibility to manage ENEA and Fabbricazioni Nucleari nuclear plants
 - EUREX and ITREC fuel reprocessing plants,
 - OPEC and IPU at the Casaccia site,
 - Bosco Marengo fuel fabrication facility,assigned to SOGIN.

In 2009, proposal for a **new commercial nuclear option**; after the results of a new referendum in 2011 (Fukushima accident), the Government decided to stop the program.

In December 2019, the National Program for the implementation of the policy for the management of spent fuel and radioactive waste has been adopted by the two Ministries of Environment and of Economic Development (Council Directive 2011/70/Euratom).

Waste management and decommissioning: competent ministry

Waste management and decommissioning, *who does what*:

- Licensing authority,
- Waste Management Organization,
- Safety authority,
- ENEA, Nucleco.

Licensing Authorities – The Ministry for Ecological Transition (MITE) has the main role in licensing activities in nuclear sector, in cooperation with other competent ministries and the binding technical advice of safety authority (ISIN).

MITE is also the authority responsible for determining the environmental compatibility of nuclear projects, including decommissioning of nuclear power stations and other reactors.

Waste management and decommissioning: Nuclear Safety

National Inspectorate for Nuclear Safety and Radiation Protection (ISIN): independent regulatory authority, competent and responsible in the field of nuclear safety and radiation protection.

Legislative Decree 4 march 2014 n. 45: ISIN has been fully established, replacing the previous Nuclear, Technological and Industrial Risk Department of ISPRA (ISIN absorbs all the functions concerning nuclear safety and radiation protection).

At the beginning, structures and resources by the nuclear department of ISPRA and by the ENEA.

National warning point in case of a nuclear accident and on assistance in the event of a radiological emergency (in accordance with the international conventions).

Waste management and decommissioning: WMO

SOGIN is responsible for the decommissioning of Italian nuclear plants and the management of all the radioactive waste.

SOGIN Group includes Nucleco S.p.a. (stakeholders: SOGIN, 60%; ENEA, 40%):

- management of radioactive waste and sources;
- decommissioning of nuclear installations;
- decontamination of industrial sites.

Sogin, ENEA, ISIN: participates, with world experts, in the most important international forums and in numerous working groups and initiatives within the main international organizations in the nuclear sector (IAEA, OECD-NEA, UE).

Waste management and decommissioning: Integrated Service

The **Integrated Service** ensures the management of the radioactive waste produced in the medical, industrial and scientific activities. The system includes a group of authorized operators.

The Integrated Service does not deal with waste generated by NPPs (Chapter VII, Legislative Decree 17 March 1995 n. 230).

Integrated Service is extended to the management of the dismissed High Activity Sealed radioactive Sources (HASS) and of the orphan sources (Legislative Decree 6 February 2007 n. 52, about the implementation of the Directive 2003/122/CE EURATOM).

ENEA: public supervisor of the Integrated Service by law, performing the direction and control of the whole management cycle, including transport, characterization, storage, treatment and conditioning.

Waste management and decommissioning: Integrated Service

Integrated Service: how it works.

ENEA gets ownership of the radioactive waste and takes charge of their final disposal.

NUCLECO is in charge for the conditioning and the temporary storage of waste at the ENEA Casaccia Research Center, nearby Rome.

ENEA and NUCLECO has signed an agreement defining rates, procedures for the management and ownership transfer of the radioactive waste.

NUCLECO signs contracts for the conditioning of the waste, collected throughout the country by the private operators, which have joined the Integrated Service.

In the NUCLECO plants are temporary stored:

- 4400 m³ solid radioactive waste;
- 500 m³ liquid radioactive waste.

Generally ~20 m³ radioactive waste per year come from the Integrated Service activities.

Waste management and decommissioning

Radioactive waste origin: from past operations of nuclear plants, from the current and future dismantling. Other waste from medicine, industry and research activities.

Nuclear plants decommissioning and radioactive waste management financed by a fee included in the electrical energy cost.

Strategy for the **Spent Fuel management:** guidelines by the Italian Government (Ministerial Decree 2 December 2004). Dry storage option at the plants has been replaced with **reprocessing abroad**. Exception: “Elk River fuel” from the uranium-thorium cycle; dry storage in dual purpose cask at the Rotondella site.

Actually, about the 99% of the irradiated fuel related to NPPs has been sent abroad:

- Eurochemic plant (Belgium);
- La Hague plant (France);
- Sellafield plant (UK).

Conditioned waste (resulting from the reprocessing) will be returned to Italy.

NPPs decommissioning

Decommissioning of Italian NPPs is at **different stages** among the plants.

Same objective: site releasing without radiological constraints (*green field*).

Decommissioning license for NPPs granted:

- Enrico Fermi Trino - Ministerial Decree 02 August 2012 (decommissioning end 2031);
- Garigliano - Ministerial Decree 28 September 2012 (decommissioning end 2028);
- Caorso - Ministerial Decree 12 February 2014 (decommissioning end 2031);
- Latina - Ministerial Decree 20 May 2020 (1st phase decommissioning end 2027). Two phases:
 - safety enhancement of all existing and future radioactive waste, six boiler and auxiliary facilities dismantling, etc.;
 - dismantling of reactor and of all the remaining plant structures (only after the siting and construction of the National Repository; 2nd specific authorization).

National repository

Italian radioactive waste: actually stored in ~20 temporary sites (not suitable as final repositories).

Safety level enhancement: treatment and conditioning of radioactive waste, construction of new storage facilities, refurbishing existing ones, etc.

Legislative Decree 15 February 2010 n. 31: **National near surface repository** and technology park, to dispose and store all radioactive waste.

Siting, design, construction and operation of the infrastructure are entrusted to Sogin.

Radioactive waste from fusion

ENEA is involved in **research about fusion energy**: radiological characterization of waste from fusion (Casaccia Research Centre) and DTT project (Frascati Research Centre).

Why? To prevent the problems related to the future production of waste from fusion.

Fusion energy production: considerable amount of energy, but also production of radioactive waste and materials because of:

- neutron-induced radioactivity,
- contamination with tritium.

Type of waste:

- ILW, components direct facing the plasma;
- LLW, components and materials outside the vessel, material from maintenance;
- VLLW, decommissioning material in and outside the biological shield.

Characterization, decontamination and recycling is needed.

Radioactive waste from fusion

Management of fusion waste is considered easier than management of waste from fission fuel cycle:

- lower radiotoxicity than in fission waste;
- fusion waste mostly solid: it does not require processes (vitrification, cementation) in extensive way;
- low radiotoxicity and solid form simplify its eventual final disposal;
- nuclear fusion reactors produce **no high activity, long-lived** nuclear waste (no transuranic);
- no necessity of fuel storage facility.

But the **amount of activated material** (originating from the fusion reactor) is considerably larger than that from the fission.

Obviously, no decision about the destination of future radioactive waste from fusion in Italy (too early!).

R&D activities are necessary to prevent the problems that have been faced with radioactive waste management from fission.

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