

# **EXPERIENCE FROM ITALY**

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Imagines by Sogin



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**Decommissioning is part of that.....** 

# "We did not inherit earth from our parents but rented it from our children"

Indian proverb

2



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#### SAFETY OBJECTIVE

The fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation.



**Principle 7: Protection of present and future generations** 

People and the environment, present and future, must be protected against radiation risks.



### **Historical background**

In the past four NPPs were commissioned and operated (Latina Gas Graphite - 1962, Garigliano BWR - 1963, Trino PWR - 1964, and Caorso BWR - 1977) together with some research facilities connected to the fuel cycle.







INTERNATIONAL GENERAL ELECTRIC OPERATIONS, S. A. FOR SOCIETA' ELETTRONUCLEARE NAZIONALE (SENN) CENTRALE ELETTRONUCLEARE DEL GARIGLIANO 150 000 KW (E) INSTALLATION



DECEMBER 27, 1962 No. 119









# More than 50 years of changes and improvements

All NPPs were definitively shut down in 1987

A safety conservation strategy was initially adopted

Strategy was changed in 2000 into a single step decommissioning

A lot of preliminary activities have been done and are in progress before addressing dismantling of nuclear island



# Decommissioning as defined in the Italian Legislation.

Technical and management planned actions to be implemented in a nuclear installation after the end of its operation, in compliance with safety requirements and ensuring the protection of workers, people and environment from the radiation risk, until the final dismantling or the unconditional release of the site.



# Main nuclear installations to be decommissioned in Italy







CAORSO NPP BWR – 860 MWe 9







GARIGLIANO NPP BWR – 160 MWe



IPU - CASACCIA MOX Fuel Experim. Fabr.



BOSCO MARENGO LEU Fuel Fabrication

ITREC - ROTONDELLA U-Th Fuel Exp. Repr.



OPEC - CASACCIA Post Irrad. Hot Cells



EUREX - SALUGGIA Experimental Fuel Rep.





Installations at <u>JRC of</u> Ispra

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# ITALY IS THE MOST "NUCLEAR" COUNTRY AMONG THE "NON NUCLEAR" COUNTRIES



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# **Adopted Strategy**



Key Issue: availability of adequate storage capacity of resulting waste while waiting for the National Repository

# **Decommissioning strategy**





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### The implementation function

Main nuclear facilities are managed by a public company, named SO.G.I.N. (Società Gestione Impianti Nucleari)

- Primary mission is the safe management of spent fuel & radioactive waste, the decommissioning of nuclear installations as well as the siting, construction and operation of the national radioactive waste repository.
- SOGIN is a State Company under the Ministry of Economy and Finance. Operates according to directives provided by the Ministry of Economic Development and the finantial control of the Authority for Energy and Gas



# The implementation function (2)

 Decommissioning fund is based on the funds for the decommissioning of installations and treatment and disposal of irradiated fuel accumulated by Enel in the period 1962-1999 and constantly ensured by a levy on electricity price.

Other important decommissioning activities are planned in the EU JRC of Ispra (Va)



#### Legislative and regulatory framework

The present Italian legislative and regulatory framework related to nuclear and radiation safety, including decommissioning, is an evolution of rules and standards that begun in the early 60's.

Act No. 1860/1962, the first Act, still in force, regulating the peaceful use of nuclear energy.

Decree of the President of the Republic No 185/1964 Basic legislative provision for more than 30 years. It was the result of the transposition of EU Directives of 1959

Legislative Decree No. 230/1995 and subsequent amendments (replaced Decree of the President of the Republic No. 185/1964).

The Decree was issued and subsequently amended to transpose EU Directives



Legislative and regulatory framework

Licensing Authority :

### **Ministry of Economic Development**

Other administrations involved in the licensing process: Ministries and Regions

Independent competent regulatory Authority National Centre for Nuclear Safety and Radiation Protection ISPRA



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#### Legislative and regulatory framework (2)

According to Legislative Decree No. 45/2014 a new competent regulatory authority has been established:

(Inspectorate for Nuclear Safety and Radiation Protection –ISIN)

Duties and functions of the competent regulatory authority will continue to be performed by ISPRA until the establishment of the new Inspectorate will be completed.

# Key challenge

There is a need to increase the human resources of the competent regulatory authority, also in relation to the planned decommissioning programme



Key elements of radiological hazard and potential environmental impact during decommissioning

- Irradiated Fuel
- <u>Contaminated/activated materials of</u> <u>structures,systems and components</u>
- <u>Radioactive Waste (To be treated and conditioned)</u>



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# Potential pathways of impact

Normal conditions

Authorized liquid and gaseous discharges Clearance of materials from the sites

Accident conditions

Incidents/accidents during dismantling and waste management activities.



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**Radiation Protection Objectives adopted in Italy** 

Normal Conditions: 10 µSv/year
"below radiological concern criterion"

- Accident conditions: 1 mSv/event



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Key elements of regulatory approach during decommissioning phase

# **Ensure that the Licensee:**

- maintain an high level of safety on the sites
- perform in due time **waste conditioning, final spent fuel management and dismantling activities** relevant to improve safety
- perform any activity in compliance with safety and radiation protection requirements (compliance with radiation protection objectives)
- produce wastes adequately conditioned (suitable for storage, transport and disposal)



Key elements of regulatory approach during decommissioning phase

# **Graded Approach:**

Taking into account the radiological hazard which is obviously below the one of the operational phase



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# **Decommissioning strategy 2**

#### First stage

#### Activities aimed at improving safety conditions:

- removing spent fuel from the pools;
- treatment and conditioning of radioactive waste from past operation ready for disposal or long term storage;
- removing structures and materials implying conventional risks (e.g. asbestos);
- construction of interim waste storage facilities
- preliminary decontamination activities;

#### <u>Activities faciltating subsequent decommissioning</u> <u>operations</u>:

- dismantling parts of the plants not contaminated or at low contamination levels,
- installation/refurbishment of plant systems relevant to decommissioning operations;
- construction of Radioactive Waste Management Facilities





#### TRANSFER OF SPENT FUEL TO FRANCE FOR REPROCESSING



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# Remediation of buried VLLW Garigliano NPP







# Remediation of buried waste at ITREC Fuel Reprocessing Plant



# **Decommissioning strategy 3**

#### Second stage

- decontamination/demolition of buildings,
- dismantlement of the nuclear island,
- completion of waste processing
- clearance of materials/buildings

#### Third stage

- waste transfer to repository
- completion of dismantling(e.g. storage facilities)
- final radiological survey and site release.



# **Decommissioning activities - 1**

Decommissioning license has been granted for Trino (2012), Garigliano (2012) and Caorso (2014) NPPs.

The license for Latina NPP is foreseen to be granted by 2017.





before



after



Latina NPP turbine building



after

### **Garigliano NPP chimney dismatling**



Chimney

Chimney mock up

Scarifing and sampling equipment



#### **MOCK UP**



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# In progress construction of CEMEX Plant for Cementation of I-L Liquid Waste





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# **Decommissioning activities - 2**

Bosco Marengo Fuel Fabrication Plan: authorization granted in November 2008 – Dismantling activities completed

ITREC Reprocessing Facility – Decommissioning Plan submitted in 2011 – Priority assigned to treatment and conditioning of existing waste and SF management

EUREX Reprocessing Facility - Decommissioning Plan submitted in 2014 – Priority assigned to treatment and conditioning of existing waste (priority to liquid)



#### Bosco Marengo - Sintering oven



after

before

#### **Dismantling or reuse for different purposes?**

# Chimney and water tower to be dismantled



Containment "ball" to be unconditionally released in compliance with clearance levels



Containment "ball" to be unconditionally released in compliance with clearance levels

**Garigliano NPP** 

Chimney and water tower to be dismantled

# **Decommissioning Licensing process**

- One step decommissioning to be terminated with the unconditional release of the site.
- In force legislation requires a comprehensive licensing process, based on the filing of Decommissioning Plans (DP) and on the performance of an articulate regulatory assessment. The decommissioning licence is granted also based on an Environmental Impact Assessment (EIA).
- Before decommissioning licence decommissiong operations can be performed based upon "ad hoc" authorizations

# Key aspects of the decommissioning authorization

- elaboration of a comprehensive set of management and technical specifications related to all work phases until unconditional release of the sites,
- technical specification are in particular related to radioactive waste management, clearance of materials, effluents discharge,s systems operability, radiation protection of workers, environmental monitoring,
- approval steps for relevant activities (Decommissioning Projects composed of Detailed Projects and/or Operational Plans),
- full adoption of the WENRA Safety Reference Levels (storage facilities and decommissioning activities),
- the Overall Decomissioning Plan is authorized also on the bases of Environmental Impact Assessment (EIA)

Ministero dello Sviluppo Economico Diparimento per l'Energia Soutura Di-ENRE			
RECISTRO UPFICIALE Prol. n. 0002642 - 10/02/2014 - USCITA			
Ministers della Gidappo Economica			
DESCRIPTION OF A DESCRI			
Divisione V - Gestione di materiali e rifiuti nucleari			
IL DIRIGENTE			
VISTA la legge 14 ottobre 1957, n. 1203, concernente la ratifica ed esecuzione del Trattato istitutivo della Comunità Europea dell'Energia Atomica, fatto a Roma il 25 marzo 1957;			
VISTA la legge 31 dicembre 1962, n. 1860 e s.m.i. "Impiego pacifico dell'energia nucleare";			
VISTA la legge 24 aprile 1975, n. 131, che autorizza la ratifica e l'esceuzione del Trattato contro la proliferazione delle armi nucleari, firmato a Londra, Mosca e Washington il 1º luglio 1968;			
VISTA la legge 7 agosto 1982, n. 704, di ratifica ed esecuzione della Convenzione sulla protezione fisica dei materiali nucleari, aperta alla firma a Vienna e a New York il 3 marzo 1980;			
VISTA la lagge 3 laglio 1986, n. 340 e s.m.; "triinciene del Ministero dell'ambiente r norme in materia di danno ambientale", e in particolare l'art. 6, comai di a 19, obe prevede, per determinate categorie di opere, la promunci adi compatibilità ambientale da parte del Ministro dell'ambiente (orn Ministro dell'ambiente e della totta del territorio e del mare), di concerto con il Ministro per l'enci culonali e ambienti dor Ministro per l'enci e la dività caturali);			
VISTA la legge 23 agosto 1988, n. 400 e s.m.i., recante "Disciplina dell'attività di Governo e ordinamento della Presidenza del Consiglio dei Ministri";			
VISTA la legge 7 agosto 1990, n. 241 c s.m.i., recente "Nuove norme in materia di procedimento amministrativo e di diritto accesso ai doctacementi amministrativo", in particolare l'art. 2, comma l e gli art. 14, 14bii, 14ter e 14quater;			
VISTO il decreto legidativo 17 marzo 1995, n. 230 e s.m.i. "Attractore delle direttrive 896/18/karatom, 2064/Lieuratom, 96/20/karatom, 2060/11//karatom imateria di raditasioni ionizzanti e 2009/71/karatom, in materia di sicurezza nucleare degli impianti nucleari <sup>4</sup> (en leguito: D12, n. 23095);			
VISTA la legge 19 gennaio 1998, u. 10, concernente la ratifica ed esecuzione della Convenzione sulla sicurezza nucleare, fatta a Vienna il 20 settembre 1994;			
VISTI l'art. 38 del decreto legislativo 30 luglio 1999, n. 300, di istituzione dell'Agenzia per la protezione dell'ambiente o per i servizi tecnici (APAT), nonchi il decreto del Presidente della Respublica 8 agosto 2002, n. 2017 Regulamento reconte approvatione dello Statuto dell'Igenzia per la protezione dell'ambiente a per i servizi tecnici, a norma dell'articolo 8, comma 4, del decreto legislatto 30 luglio 1999, n. 300°;			
VISTO il decreto legislativo 30 marzo 2001, n. 165 e s.m.i. "Norme generali sull'ordinamento del lavoro alle dipendenze delle Annninistrazioni Pubbliche";			
1.9			

# **Licensing documents**

Decommissioning license Overall Decommissioning Plan

> Review & Assessment



#### **Decommissioning Projects (PDD) approved within the granted license**

**Detailed Projects – DP** (construction/refurbishment of structures and systems) **Plans of Operation – PO** (dismantling activities)

approved by ISPRA

PDD	Documents topics	DP/PO
Waste management	Operational waste treatment and conditioning	РО
	Waste treatment and buffer area	DP
Storage facilities	Commissioning of a storage facility	DP
	Building refurbishment for storage	DP
Turbine building	Dismantling of thermal cycle components	РО
	Refurbishment of turbine building for storage	DP



Verification of safety on Overall Decommissioning Plans

- Comprehensive strategy until site unconditional release
- Radiological characterization of structures and components
- Detailed safety case for dismanling, waste treatment/conditioning and storage
- <u>Proven</u> decontamination & dismantling <u>technologies</u>
- Site safety management with special attention to contractors activities
- Availability of adequate wastes storage capacity for the full implementation of the decommissioning plan
- Fire protection programme and risk analysis (High level of fire protection)
- Proper residual materials management
- Legally binding clearance levels and verification methodology



Verification of safety on DP/OP in relation to the Overall Decommissioning Plan attains to:

- radioprotection objectives: for normal operation they are established in the legislation and referred to the *"below radiological concern criteria"*; for accident conditions they are proposed by the licensee on the basis of its safety analysis;
- detailed radiological characterization of SSCs: focused on the completeness of the historical operational data and on the adequacy of the measurement campaign planned to obtain a complete characterization of the installations and as well as on the correct selection of the international standards assumed as reference; (*The Radiometric Characterization Plan shall be submitted by the licensee for approval*)
- radioactive waste management strategy for processing: The review of the strategy for the management of radioactive waste will assess its timely feasibility, the operative experience of the proposed treatment/conditioning process and the availability of adequate temporary storage facilities on the site;
- design and operational status of SSCs useful for decommissioning: the review of design and the operational status of SSCs useful for decommissioning is performed in order to define the necessary upgrades. Such systems modifications will be object of dedicated projects to be submitted for approval.

- safety analysis: safety analysis assessment is related to the considered event classification and completeness, to the failure analysis and to the evaluations of the consequences based on national and international standards and independent analysis.
- fire prevention & protection: fire prevention and protection assessment is performed in order to verify the compliance with the defense in depth criteria.
- safety classification and design criteria of SSCs: a direct consequence of the safety analysis performed by the operator and assessed by ISPRA. The quality class with the associated standards for the systems and components are based on international guidelines, while the loads associated to the seismic classification for SSCs are derived for the national standards with additional conservative margins.
- radioprotection of people and workers: Radiation protection of people and workers is assured by independent assessment of radiation protection objectives, workers exposure on the basis of ALARA principle with regard to exposition time, shielding or remote tools used, personal protection dispositive,

- Quality Assurance Program: Quality Assurance Program is assessed taking particular attention on the control of contractors and suppliers, the internal audits, the experience feedback, personnel training program, etc..
- Technical specifications technical specifications are established taking into account the SSCs to be used during decommissioning operations, according to a graded approach criteria. Dedicated specifications regulate effluents discharges and environmental monitoring.
- Emergency plan: during decommissioning activities also emergency plans are reviewed and updated on the basis of the hazard analysis.



# The Importance of the National Repository

An infrastructure necessary to protect current and future generations

Allows long term safe management of radioactive waste

Allows unconditional release of nuclear sites

Allows to comply with international obligations



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# What is the National Repository?

The long term strategy for waste management envisages a National Repository made up of:

- A near surface disposal facility for low and intermediate level waste
- A long term storage facility for intermediate and high level waste



# The National Repository for L-ILW disposal and I-HLW long term storage - 1

Legislative Decree n. 31/2010 assignes responsibilities for siting, construction and operation to SO.G.I.N..

In particular, Art 27 assign to SO.G.I.N. the task to perform the siting selection according to the technical criteria given by IAEA and by ISPRA.

The site will be selected based upon a National chart of potentially eligible areas, a national debate in which all involved stakeholders will be invited to formulate observations and proposals, declaration of interest by involved communities.



# The National Repository for LLW disposal and ILW-HLW storage - 2

Main site requirements for the near surface disposal facility

- confinement of radioactive waste through natural barriers offered by the hydrogeological characteristics and chemical properties of the soil;
- isolation of the facility from anthropic infrastructures and human activities, taking into account the mutual arising from the presence of the facility and from the transport of waste;
- geological, geomorphological and hydrogeological stability of the area;
- compatibility of the disposal system with regulatory constraints of land protection and conservation of natural and cultural heritage;
- isolation of the disposal facility from underground natural resources;
- protection of the disposal facility against extreme weather conditions.

# **The National Repository** for LLW disposal and ILW-HLW storage - 3

Siting criteria for National Repository published by ISPRA with Technical Guide n. 29 are grouped in two categories defined as follow:

Exclusion criteria: defined to exclude those areas of the national territory, whose characteristics do not ensure the full compliance with the safety requirements

Investigation criteria: defined to allow the evaluation of the areas identified with application of the exclusion criteria National repository siting criteria.

The siting criteria addresses the following thematic areas:

- Geology, hydrogeology, geochemistry
- Natural
- Anthropic





A siting procedure based upon trasparency, participation and consensus

#### **First Phase**

Selection of a number of potentially suitable areas starting from the entire national territory and taking into account geological, naturalistic and antropic characteristics of the territory.

#### Second phase

Identify potentially suitable areas on the bases of a consesus process following a public debate

Third phase Conduct of detailed investigation and site selection



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# **Transparency and Participation**

Authorizations decrees request to implement specific specific information programmes

Public hearings with participation of the implementer, the competent regulatory authority are organized at local level on a periodic basis (Transparency Tables)

**Extensive use of web based information** 



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# **KEY CHALLENGES**

**Complete the siting process of the National Repository** 

Ensure continuity to dismantling and waste management activities in many different sites. Conditioning of legacy waste is a priority.

Increase the human resources of the competent regulatory authority



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# Thank you for your kind attention

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