Sogin
Development and Technology Innovation

Carlo Vicini

Rome, 12 April 2019

SOGIN GROUP

Sogin has been operating since 2001. It became a Group in 2004 through the acquisition of the majority stake (60%) of Nucleco SpA, the national operator responsible for collecting, treating, conditioning, temporary storage of radioactive waste and nuclear sources from medicine and scientific and technological research activities.

Sogin SpA

100% Italian Ministry of the Economy and Finance

Nucleco SpA

40 % Enea

60 % Sogin Spa

ITALIAN NUCLEAR SITES IN DECOMMISSIONING

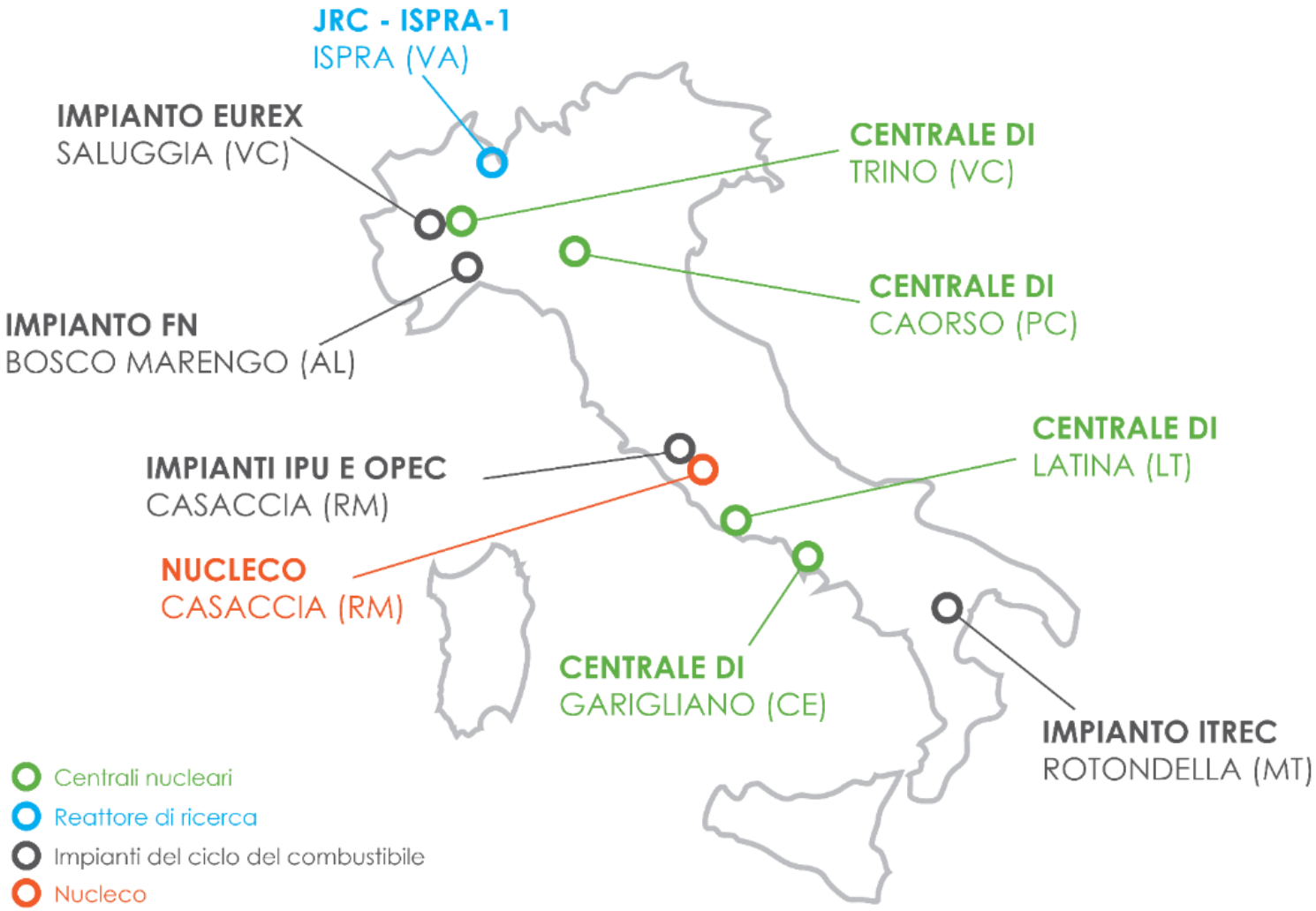
SOGIN AT A GLANCE

Four NPPs

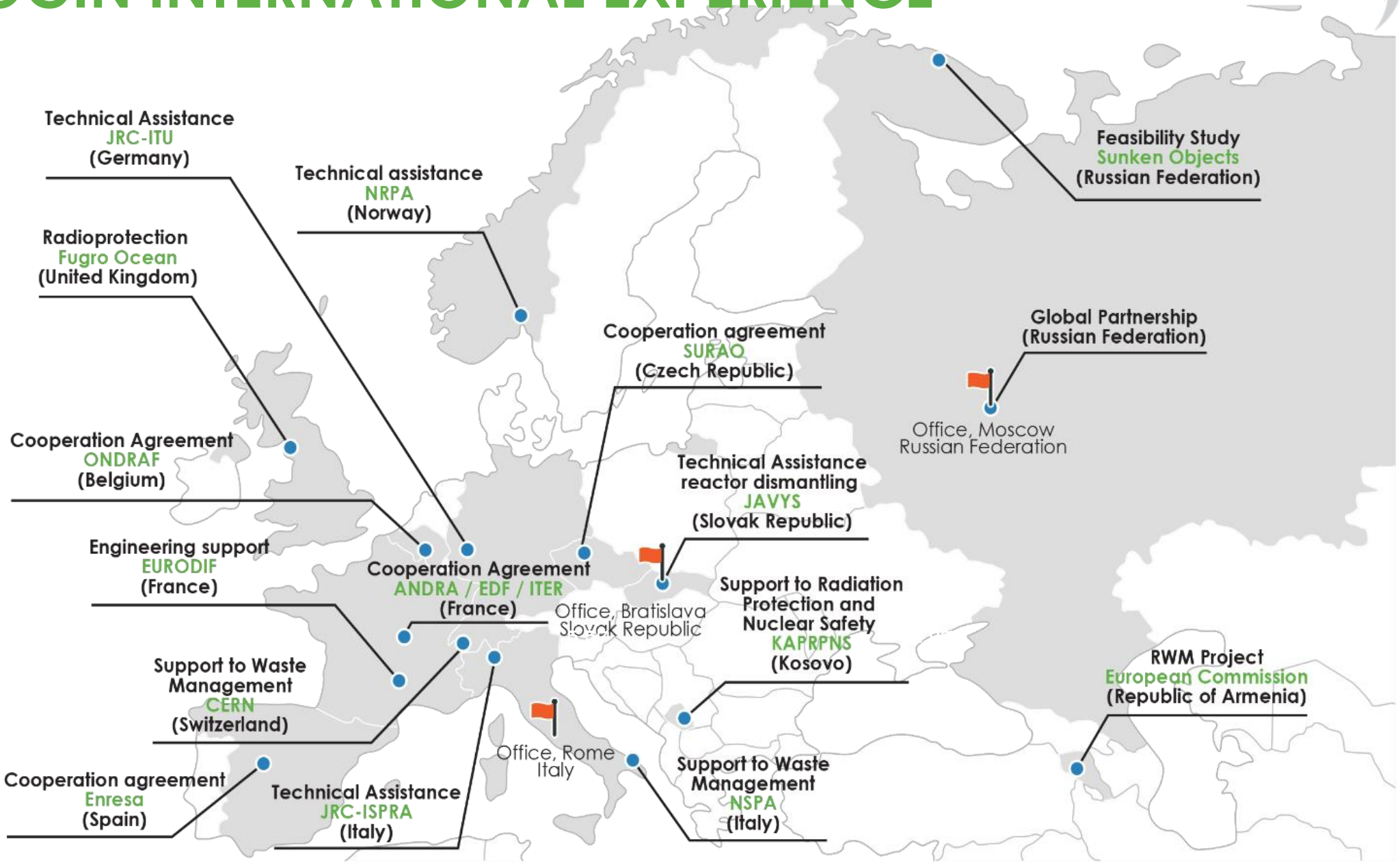
- 210 MW_e GGR (5/63) – **Latina**
- 160 MW_e BWR (4/64) – **Garigliano**
- 270 MW_e PWR (10/64) – **Trino**
- 870 MW_e BWR (12/81) – **Caorso**

Fuel cycle plants and research reactors

- **EUREX** (U-Pu) fuel reprocessing and **IFEC** fuel fabrication plants – Saluggia
- **Bosco Marengo** LEU fuel fabrication plant
- **Plutonium** fuel fabrication plant and **OPEC** spent fuel testing facility – Casaccia
- **ITREC** (U-Th) reprocessing plant at Trisaia.
- **Ispra-1, Research Reactor**



SOGIN INTERNATIONAL EXPERIENCE



SLOVAKIA: PMU for the decommissioning of V1 Nuclear Power Plant in Bohunice (VVER type)

Engineering

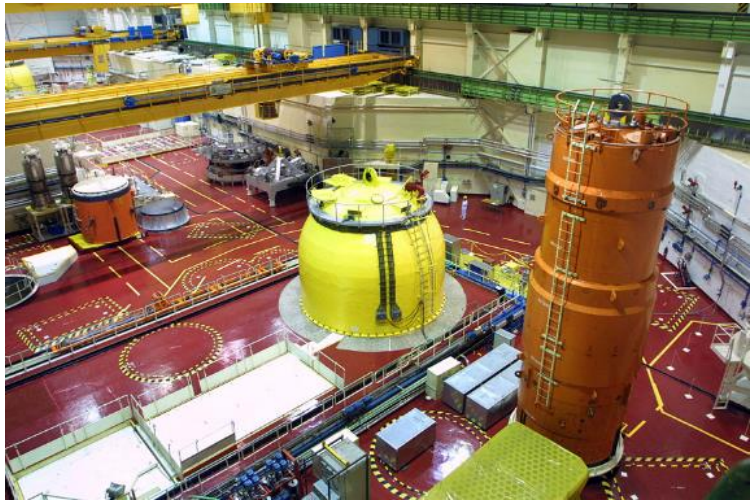
- Review of the technical documentation
- Development of technical studies
- Decommissioning Cost assessment

Management

- Contracts management during project implementation
- Review of contractors' deliverables including design documentation
- Support JAVYS during project implementation
- Control and update the schedule of the decommissioning activities
- Propose measures necessary for mitigation of risks

Procurement

- Review of procurement documentation
- Participation at the Evaluation Committees and support to negotiation with the contractors



PROJECT MANAGEMENT UNIT IN RUSSIA

Global Partnership and Bilateral cooperation between Italy and Russia

- Technical Management of the whole life cycle activities
- Administrative Management of the Programme (approx. 360 M€)
- Implementation scheme: dedicated Italian Russian management unit based in Moscow (10 engineers/experts)

Main achievements:

- Dismantlement of 6 **nuclear submarines** (e.g., Oscar type 15.000 t)
- Construction of the vessel “Rossita” for the transportation of nuclear fuel
- Construction of the pontoon "Itarus“ for the management of parts of dismantled submarines
- Andreeva Bay: design and construction of treatment and conditioning facilities for radioactive waste
- Construction of ten special steel containers for the storage of highly enriched irradiated fuel

PROJECT IMPLEMENTATION ASSISTANCE TO EC IN THE DECOMMISSIONING OF NUCLEAR FACILITIES

An 8 years Framework Contract with European Commission on Project Implementation Assistance **Services for the Decommissioning and Waste Management**.

On demand technical consultancy services

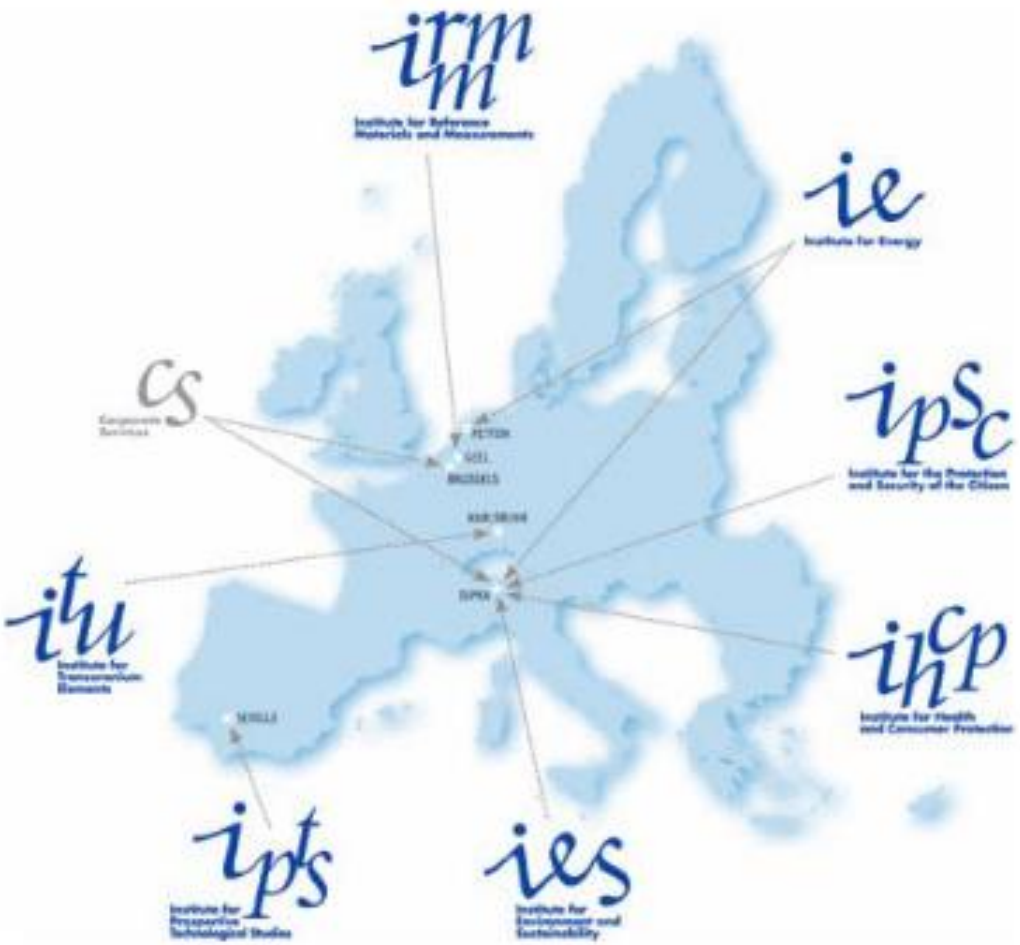
- Cost estimation
- Technical specifications
- Feasibility and option studies
- Risk assessments

Licensing and regulatory assistance

- Review of documentation
- Assessment of licensing documentation
- Legal assistance

Project management Assistance

- Review, assessment and development of Decommissioning and Waste management programme



DECOMMISSIONING EXPERIENCE IN NUCLEAR FACILITIES ARMENIA: Support to Government on RWM

An European Commission funded project.

Strategy for spent fuel and radioactive waste management: analysis of RAW inventory, strategy for the **waste management** (treatment, conditioning, etc.) and SNF management, legislative proposals (in line with international best practices).

Enhancement capabilities of Armenian Authorities (ANRA, NRSC) for safety review and assessment of radioactive waste management facilities and activities.

DECOMMISSIONING EXPERIENCE IN NUCLEAR FACILITIES ARCTIC SEA: radioactive sunken objects

SOGIN

An European Commission contract.

To perform feasibility study/action plan for the safe and secure management of sunken radioactive object.

Sogin is leading an European consortium (EWN GmbH - Energiewerke Nord (Germany) , NRPA – Norwegian Radiation Protection Authority (Norway) and NUVIA – (United-Kingdom))

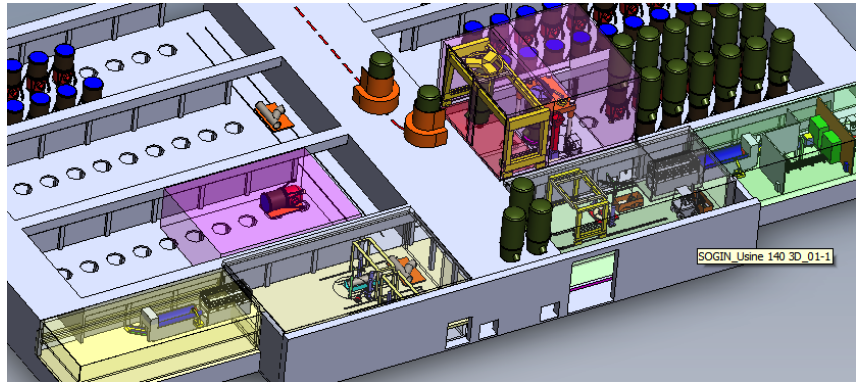
Activities:

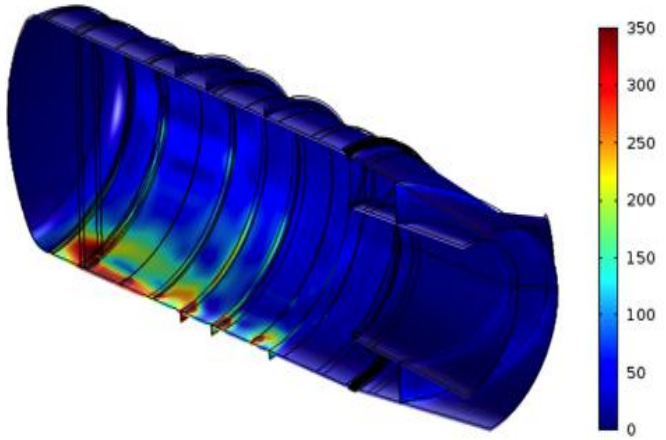
- Inventory of all types of **sunken objects in the Barents and Kara seas.**
- International and Russian norms, standards and legislation, applicable to the underwater operation, the retrieval, the treatment and the final storage of the sunken objects
- Assessment and prioritisation, in terms of hazard, of the sunken objects, based on the potential impact on people and environment
- Feasibility studies for the safe and secure retrieval/management/disposal of the most hazardous objects.
- Action Plan for the retrieval/management/disposal of the selected objects, containing in particular the time schedule and the needed resources

DECOMMISSIONING EXPERIENCE IN NUCLEAR FACILITIES FRANCE: George Besse-I

Technical support for the **decommissioning** of the George Besse-I **enrichment plant**.

- Definition of Plant dismantling scenarios and feasibilities studies.
- Plant Decommissioning Cost estimation and time schedule.
- Investigations on dismantling scenarios versus cost-benefit opportunities.
- Option studies.





DECOMMISSIONING EXPERIENCE IN NUCLEAR FACILITIES NORWAY: Technical support to NRPA

SOGIN

A 4 years framework contract with the Norwegian Radiation Protection Authority (NRPA)

Technical support on:

- improvement of the radiological safety of population and environment
- site remediation
- orphan sources retrieval
- management of spent nuclear fuel

DECOMMISSIONING EXPERIENCE IN NUCLEAR FACILITIES
International cooperation agreements

Sogin recognizes that international **cooperation and information exchange bring mutual benefit**s to the Parties in terms of increased safety, effectiveness and efficiency of technical action and optimization of time and costs.

Then:

- Promote exchange of experience and best practices, in the field of: decommissioning, radioactive waste management and disposal.
- CAs allow Sogin experts to be at the leading hedge of the technology and know-how benefiting of the valuable experience carried out by major players in the sector.

Cooperation Agreement are in place with:

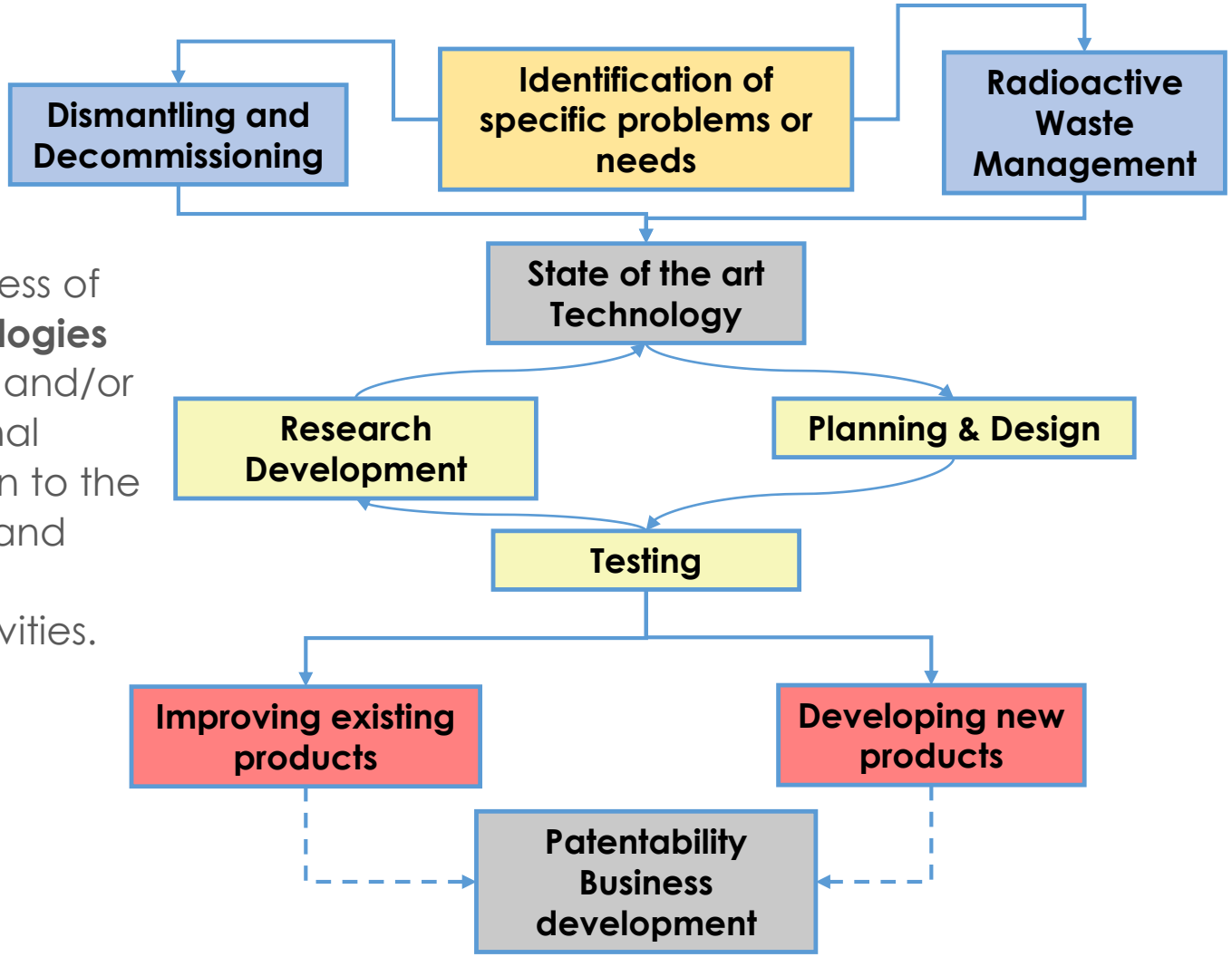
- ONDRAF/NIRAS (Belgium)
- ANDRA (France)
- EDF (France)
- ENRESA (Spain)
- SURAO (Czech Republic)
- ITER (International Organization)
- OECD/NEA

SOGIN
KNOW HOW AND TECHNOLOGY INNOVATION

R&D: THE PROCESS OVERVIEW

KNOW HOW AND TECHNOLOGICAL INNOVATION

Identification process of **Innovative Technologies** that allow to solve and/or optimize operational problems in relation to the decommissioning and radioactive waste management activities.

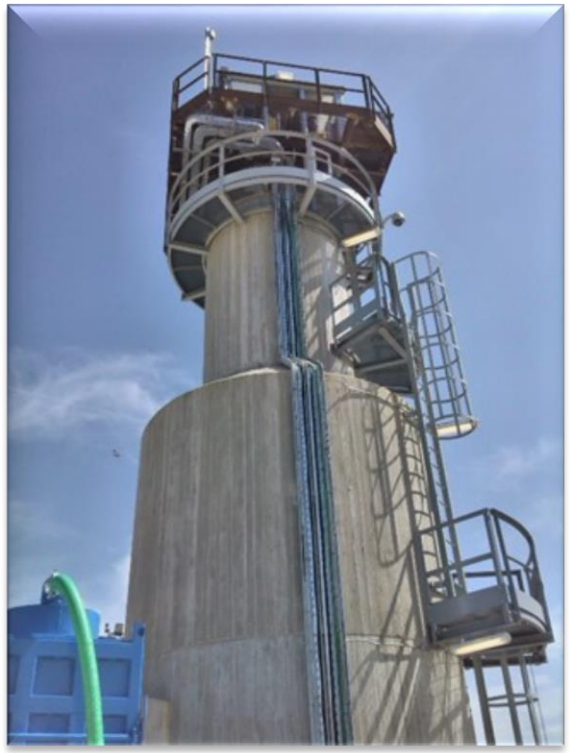


D&D needs that still present problems to be explored Requirements deriving from the management of challenging waste, for which a consolidated methodology has not been defined

Realizing costumer needs

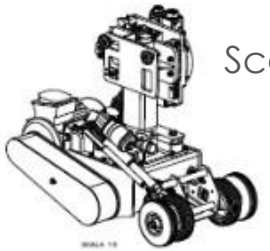
Highly experienced Engineers

R&D EXPERIENCE: TOOLS FOR DISMANTLING OF CONTAMINATED STACK

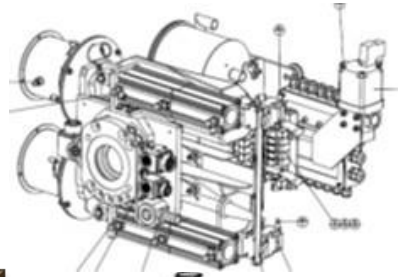


Mock-up of 12 metres high

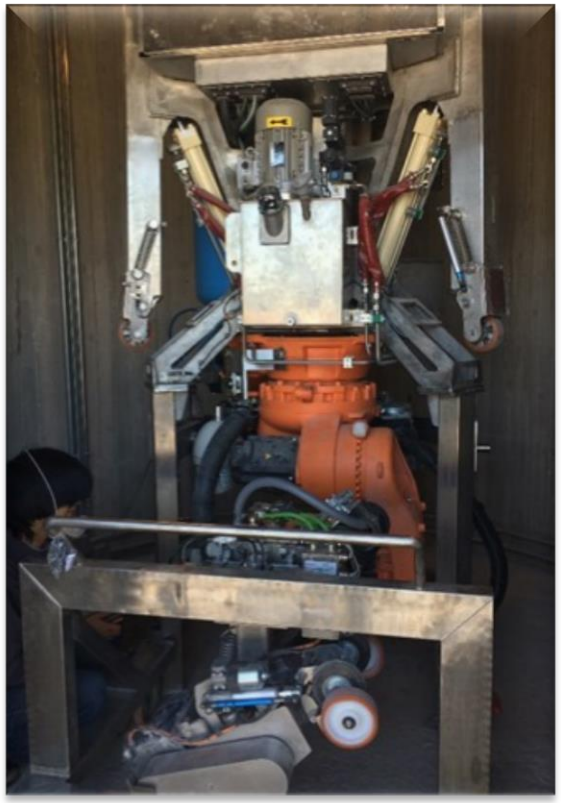
Purpose:	• Test of Robotic Equipment • Set-up of main Parameters
Tests of:	• Remote Control System • Concrete Scarifying Tool • Concrete Sample Tool

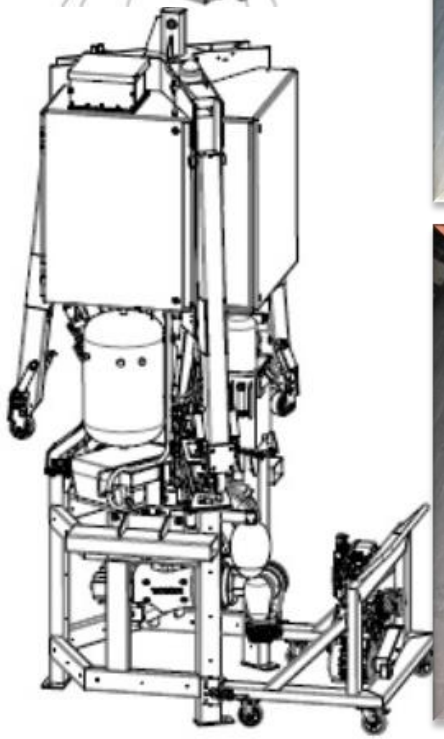


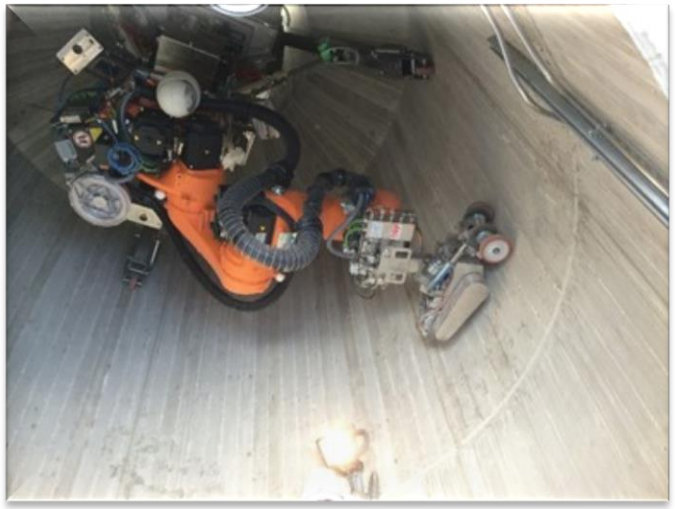
Scarifying Tool

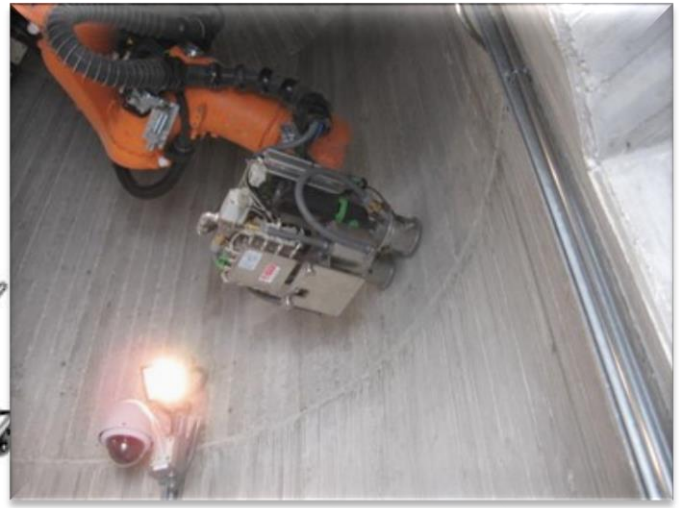


Sampling Tool









Robotic Equipment

KNOW HOW AND TECHNOLOGICAL INNOVATION

R&D EXPERIENCE: PU GLOVE-BOX DISMANTLING

KNOW HOW AND TECHNOLOGICAL INNOVATION

In MOX Fuel FP - the matter:

Dismantling of 56 Pu contaminated Glove Boxes in MOX fuel fabrication Plant

The solution:

A PVC alpha tight tent is built around the glove-box. The tent includes an external solid frame structure and an inner flexible PVC film.

It is equipped with gloves which allow to operate inside with appropriate tools.

When opening the contaminated glove-box, the spread of contamination is effectively enclosed by the tent's film.

R&D EXPERIENCE: TRANSPORTABLE CEMENTATION SYSTEM

KNOW HOW AND TECHNOLOGICAL INNOVATION

In Sites - the matter:

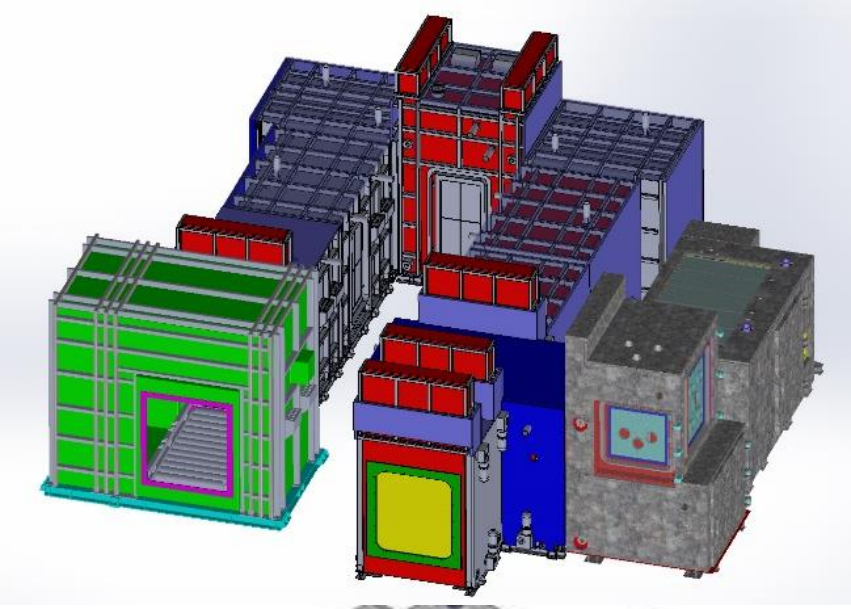
Develop a system able to process different types of radioactive waste (liquid, sludge, powder, etc.) containing β/γ and/or α-emitters. Modular system, transportable and easy dismountable, without any permanent building

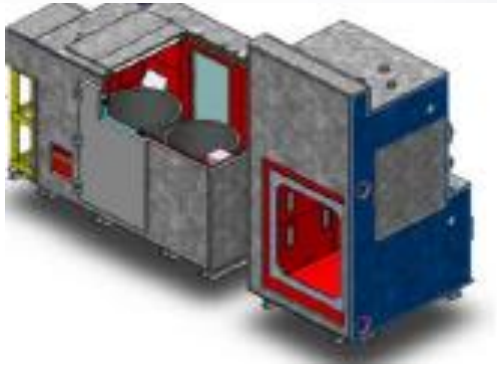
The solution:

SiCoMoR system is realized in separated module:

- Liquid waste receipt and calibration module (MOD-100);
- Cementation module (MOD-200);
- Module for capping;
- Modules for active matrix and capping maturation;
- Module for drum lid closing;
- Service modules (filter module, ventilator module, control module, module for the main electric panels);

Each module is preassembled and transportable and will be coupled to the other modules on the site of installation. Process modules are installed inside a confining structure.





SECTION 100-200

NUCLEAR DECOMMISSIONING CHALLENGES AND SOGIN APPROACH

NUCLEAR CYCLE

GREEN FIELD | COMMISSIONING | OPERATION | **DECOMMISSIONING** | GREEN FIELD

DECOMMISSIONING IS THE NEGLECTED SIDE OF THE NUCLEAR CYCLE

This perception leads to unintended negative consequences on the efficient implementation of the decommissioning activities

Lack of vision and strategy

Underestimated engineering and PM **challenges**

Need of further **international coordination** among D&D companies

Public acceptance not easier than in the operation phase

Social issues: workers reconversion from operation to decommissioning

DECOMMISSIONING: THE NEGLECTED SIDE OF THE NUCLEAR CYCLE

SOGIN

ISSUES	• SOGIN APPROACH
Lack of vision and strategy	• **Indipendent review** of national and/or companies' deco programmes • Strategy alternatives
Underestimated engineering and PM challenges	• **Comprehensive approach** based on more than 20 years of experience • **Risk Management** based on volatility calculated on almost 30 years of data • Physical Progress Decommissioning Indicators - **PPDI®**
Need of further international coordination among D&D companies	• World Association for Nuclear Decommissioning and Environmental Remediation – **WANDER**
Public acceptance not easier than in the operation phase	• **Stakeholder engagement** strategies
Social issues: workers reconversion from operation to decommissioning	• **Training and knowledge transfer**: Sogin Radwaste Management School

PPDI® PHYSICAL PROGRESS DECOMMISSIONING INDICATORS

SOGIN

PPDI® is a comprehensive approach based on:

International standards coupled with **20 years of experience**

INTERNATIONAL STANDARDS

- RADIOLOGICAL STATUS & PHISICAL INVENTORY
- 3D MODELLING
- COST ESTIMATE
- UNCERTAINTY EVALUATION
- PROJECT RISK
- MONTECARLO ANALYSIS

- NPP BWR
- NPP PWR
- NPP MAGNOX
- NUCLEAR FUEL MANUFACTURING PLANT
- NUCLEAR FUEL CYCLE RESEARCH PLANT

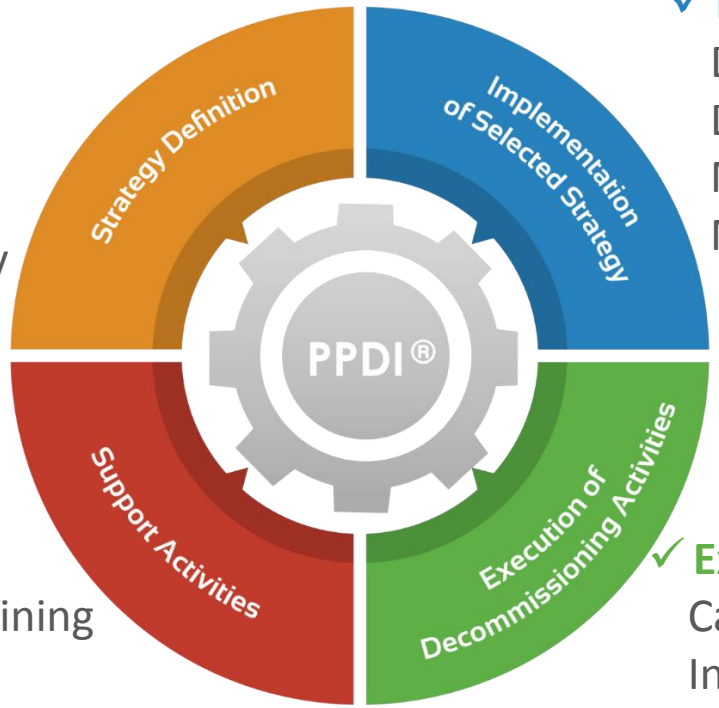
DECOMMISSIONING PROJECTS

PPDI® - PHYSICAL PROGRESS DECOMMISSIONING INDICATORS

SOGIN has developed a proprietary methodology, PPDI® (**Physical Progress Decommissioning Indicators**), intended to provide a comprehensive approach to nuclear decommissioning.

✓ **Strategy Definition**
- Independent D&D Review
- Project Management: PPDI®
- Decommissioning Strategy
- Decommissioning Organization
- Spent Fuel Management Strategy
- RAW Management Strategy

✓ **Implementation of Selected Strategy**
- Decommissioning Planning
- Design of Dismantling Activities
- Management Planning of RAW
- Management Planning of Spent Fuel



✓ **Support Activities**
- Engineering Services
- Nuclear Safety Assistance & Training
- Radioprotection Services
- Plant & System Characterization
- Decontamination
- Environmental Remediation

✓ **Execution of Decommissioning Activities**
- Care & Maintenance
- In-field Activities
- Treatment of Radioactive Waste
- Spent Fuel Treatment/Storage

EDUCATION AND TRAINING IN SOGIN

SOGIN – RADWASTE MANAGEMENT SCHOOL

The "Radwaste Management School" (RMS) has been operating since 2008, providing education and training to the staff of SOGIN Group and external companies, in accordance with international safety standards and requirements established by the Italian Regulatory Authority. In this way, the RMS guarantees the highest levels of safety in the field of decommissioning and radioactive waste management.

Goals of RMS

The Radwaste Management School aims to:

- train SOGIN Group, with particular emphasis on disciplines related to nuclear safety regarding spent fuel and radioactive waste management;
- promote, improve and extend best practices in the nuclear safety culture, radiation protection and environmental safeguard;
- assure integration, promotion and sharing of knowledge management systems;
- involve universities and international nuclear training centres;
- train young graduates and undergraduates in the field of nuclear decommissioning and radioactive waste management activities.

RMS – EDUCATIONAL FIELDS

Nuclear Safety and Security
(13 courses)

Radiation Protection
(12 courses)

Environmental aspects of decommissioning
(6 courses)

Work Safety
(58 courses)

Integrated Management System
(8 courses)

Management and Legislative Matters
(5 courses)

Nuclear Plant Technology and Training on the job
(specific nuclear plant courses)

Decommissioning & Waste Management
(7 courses)

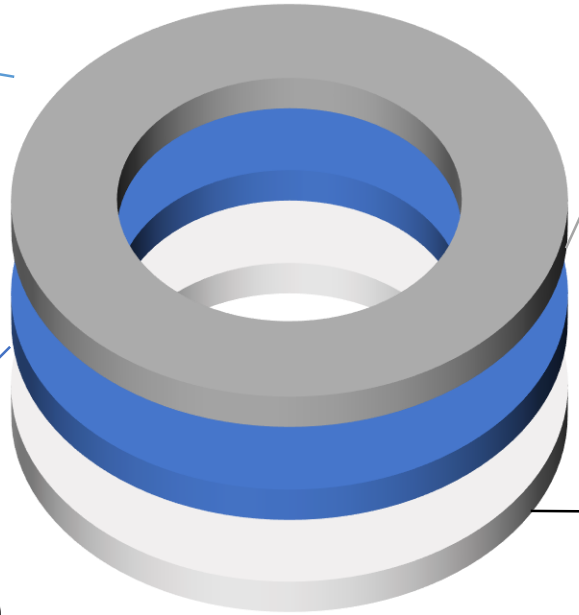
SEVERAL COURSES IN EIGHT DIFFERENT TECHNICAL & SCIENTIFIC SUBJECTS

Radwaste Management School has been certificated according to rules ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007

SOGIN – RADWASTE MANAGEMENT SCHOOL

CREDITS AND PARTNERSHIP

Nuclear Operators
(e.g. TAIPOWER, KHNP)

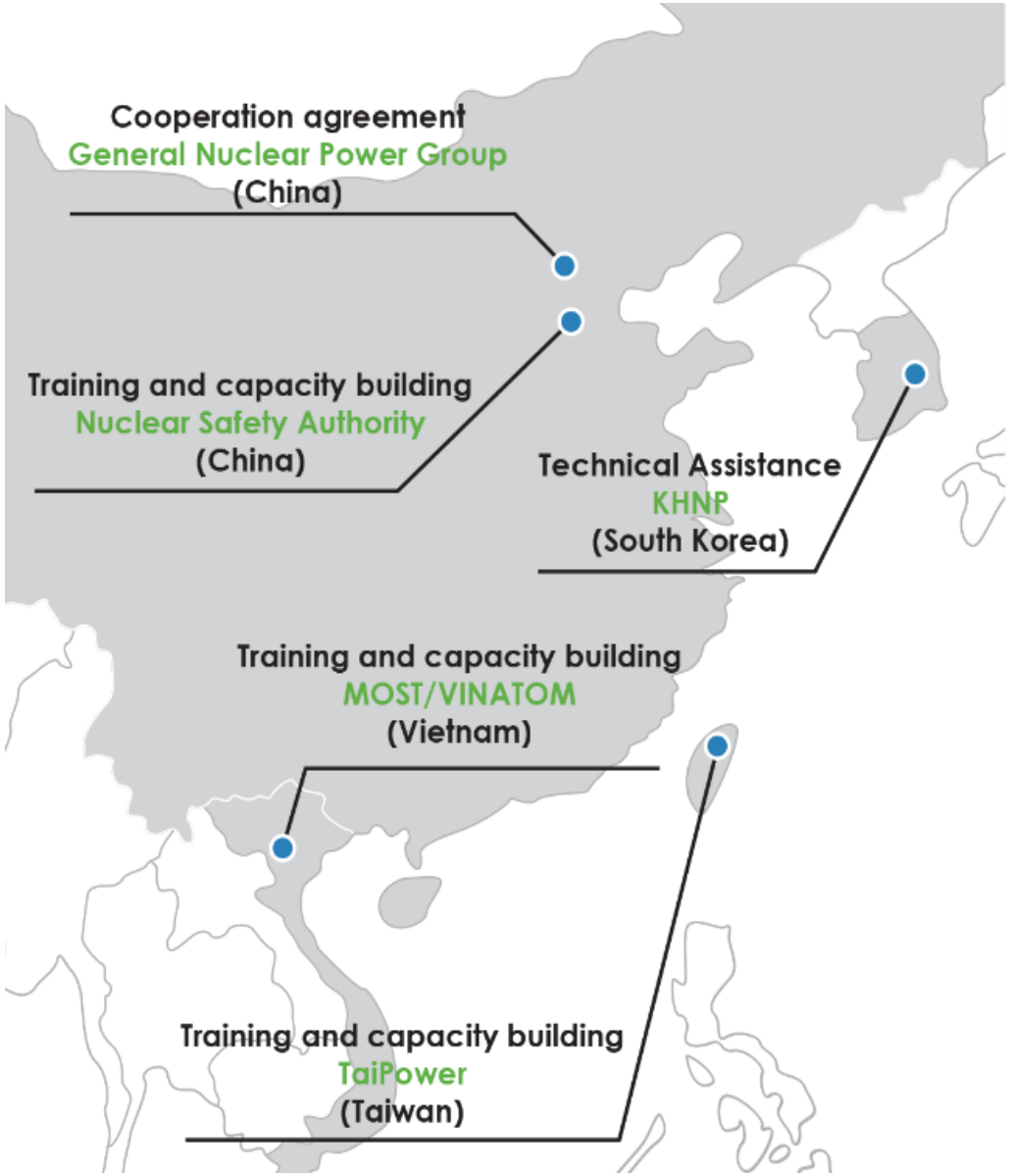


International Organizations
(e.g. IAEA, NEA/OECD, JRC)

Universities and Research Centers
(e.g. CIRTEN, POLIMI, SAPIENZA,TOR VERGATA, UPO, BARI)

Mandatory Nuclear Training for SOGIN Group

INTERNATIONAL TRAINING INITIATIVES



KNOWLEDGE AND EXPERIENCE SHARING WITH INTERNATIONAL NUCLEAR COMMUNITY

- In these years, RMS has been involved with institutional partners and public companies in order to share knowledge and experiences in nuclear field with international nuclear community.
- In particular:
  - International Summer School on Nuclear Decommissioning and Waste Management
  - Chinese Nuclear Safety Authority and Operators
  - Training course for institutional representatives of Socialist Republic of Vietnam
  - Taiwan Power Company
  - Korea Hydro & Nuclear Power
  - ELINDER Project

ELINDER PROJECT

- **ELINDER** stands for ***European Learning Initiatives for Nuclear Decommissioning and Environmental Remediation***
- Over the last years some training initiatives were taken in European countries to improve knowledge, skills and competences in nuclear decommissioning, going from short professional induction training programmes to academic graduate and postgraduate courses. ELINDER supports, coordinates, develops and promotes them in a joint project in cooperation with IAEA
- Together with Nuvia, Sogin will organize a course on "'decommissioning programme and project management". The two-week course will be a "training on the job" which will alternate lessons and visits to various Sogin facilities

Studiecentrum voor Kernenergie - Centre d'Etude de l'Energie Nucléaire	BE
Karlsruher Institut für Technologie	DE
Commissariat à l'énergie atomique et aux énergies alternatives	FR
University of Birmingham	UK
Slovenská Technická Univerzita v Bratislave	SK
University of Tartu	EE
NUVIA	FR
Società Gestione Impianti Nucleari	IT
European Nuclear Education Network association	EU
European Nuclear Safety Training & Tutoring Institute	EU
European Nuclear Society	EU
European Atomic Forum	EU
European Commission Joint Research Centre	EU

SOGIN

We protect the present
We guarantee the future