Life Management and Safety of Nuclear Facilities

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ARGENTINA

Surface: 2,7 millions km²

Population: 40 millions

5 RRs in operation

2 NPPs → 5 % total energy

1 NPP under construction

1 NPP under study

1 Prototype reactor under construction

1 Multipurpose reactor under study

Nuclear Programme: Nuclear power, medical and industrial applications, waste management, R&D and human training.

Related companies

- **CONUAR S.A**: nuclear fuel elements.
- **FAE S.A**: special alloys and Zry tubes.
- **DIOXITEX S.A**: uranium supply.
- **ENSI S.A**: heavy water production.
- **INVAP S.E**: aerospace, hot cells, nuclear medicine, and nuclear reactors for research & isotopes production, etc.

Present nuclear facilities: RR + NPP

Reactor	Type	Location	Main Application
RA-0	RA-1 critical facility	Córdoba University	Human resources for nuclear industry Promote nuclear energy applications
RA-4	Critical facility	Rosario University	
RA-1	UO2-graphite fuel rods, water cooled and moderated, tank reactor, 40 kW	Buenos Aires /CNEA	Long term material irradiations, nuclear instrumentation testing, training
RA-6	MTR, pool type, 1 MW	Bariloche/CNEA	Teaching/BNCT/NAA
RA-3	MTR, pool type, 10 MW	Buenos Aires/CNEA	RI production
Atucha I	PHWR	Lima/NASA	357 Mwe
CNE	CANDU	Embalse/NASA	648 Mwe

Current nuclear projects

NPP	TYPE	POWER
Atucha II	PHWR	745 MWe
CNE+	life extension and power upgrade	656 MWe
CAREM 25	prototype Argentinean PWR	25 MWe
RA-10	Multipurpose RR	30 MW

SAFETY EVALUATION PROCESS: is the way to prevent failures and accidents due to ageing consequences on SSCs important to safety.

Objective: is to justify that all the components concerned by an ageing mechanism remain with the design and safety criteria

1 - Selection of relevant SSCs
2 - Review design and construction data
3 - Review operational behavior
4 - Ageing assessment
5 - Safety Evaluation: - No Action
- Monitoring
- Action

<u>Relevant components related with safety</u>

- **<u>Mechanical Components</u>**: critical components of nuclear plants suffer several types of degradation during operation. Examples: reactor internal coolant tubes suffer oxidation and hydrogen absorption, irradiation embrittlement, and irradiation creep and growth.

- **Heavy Components Replacement:**

The objective is to anticipate potential safety risk and to be ready on time to repair or replace components important to the safe operation of the nuclear power plants.

- ❖ Zero injuries
- ❖ Low radiation exposure
- ❖ Reasonable cost and time
- ❖ Replacement must be in compliance with safety rules
- ❖ Replacement policy should be based in safety criteria and the best economic criteria
- ❖ Successful HCR will enhance safety and economic benefits for the nuclear industry

- **Electronic components**

Obsolescence of electronic components in nuclear facilities is a common issue concern. A component becomes obsolete when the manufacturer decides to finish the production. Since nowadays is expected a safe long term operation of nuclear facilities a series of issues can be found:

- analogical technologies without technical support
- unavailable spare parts
- suppliers that no longer exist
- equipment without the required functionalities
- high maintenance and operation cost

Nuclear plants that face these situations must determine how to inspect and repair/replace electronic components. Therefore a detailed evaluation process to review the obsolescence consequences is important to safety.

Defense in Depth during design

DID concept must be implemented during all stages of the plant life cycle.
The design should compliance with all regulatory requirements including international safety standards.

***Concepts to enhance safety during design stage*:**

- "Defense in Depth" concept will be applied in all the facility supplying multiple levels and protection barriers against accidental release of irradiated materials under operational incidents foreseen and design base events.

- Safety systems will be designed with the redundancy, diversity and independence principles to ensure reliable performance and reduce potential failures mode.

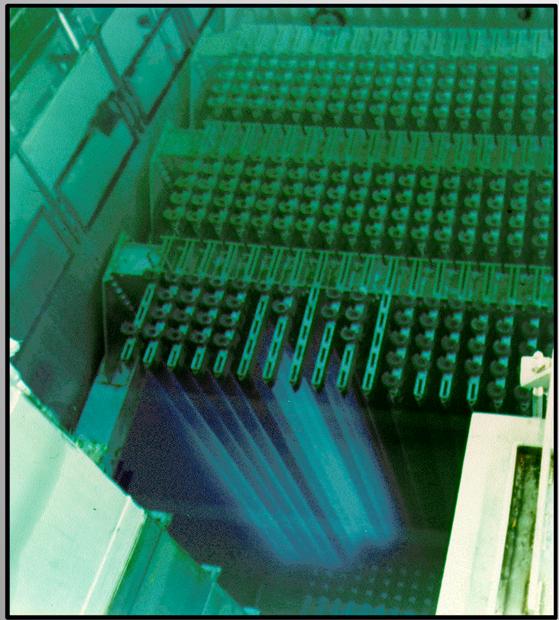
Defense in Depth during design

- Whenever possible will be incorporated inherent and passive safety features in the design of systems important to safety, in particular systems that ensure the three basic safety functions: reactor shutdown, heat removal, and containment of radioactive material

- When an equipment or component has several functions one of which is safety, it should be classified as part of the safety system.

- The design must foresee that all the components of security systems can be adequately inspected and verified before the commissioning and at regular intervals during operation in order to ensure its availability.

Spent Fuel Facilities



- PHWR spent fuel: wet storage
- CANDU spent fuel: wet and dry storage

Waste Management and Safety Legal Framework

- National Constitution: prohibit the ingress of radioactive waste into the country.

- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

- Nuclear Regulatory Authority (ARN):
  Responsible for regulation and control.

- National Atomic Energy Commission (CNEA):
  Responsible for the management of RW and SF.

Conclusions

A safety evaluation process of SSCs ensures an effective operation of nuclear facilities with the implementation of the *Defense in Depth* concept to enhance safety for the protection of the *public*, the *workers* and the *environment.*

Thank you