International Conference on Research Reactors

Safe Management and Effective Utilisation

The French approach for the regulation of research reactors

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Introduction

- ✓ The ASN ensures supervision and regulation of an important pool of major nuclear facilities (BNI)

- ✓ 164 major nuclear installations : 58 PWR and an entire fuel cycle
  - 42 research facilities on 5 major research centers (CEA)
  - 11 research reactors (10 to the CEA, 1 to ILL)
  - CEA : the Atomic Energy Commission is the main public entity responsible for the nuclear research and development in France
    - **Optimization of the present nuclear industry**
    - **Research on the future nuclear industry (GEN IV)**
    - **Research and development for nuclear waste**

- ✓ One challenge is to allow the necessary flexibility for research while ensuring a high level of safety

Research reactors in FRANCE

Overview of the French research reactors

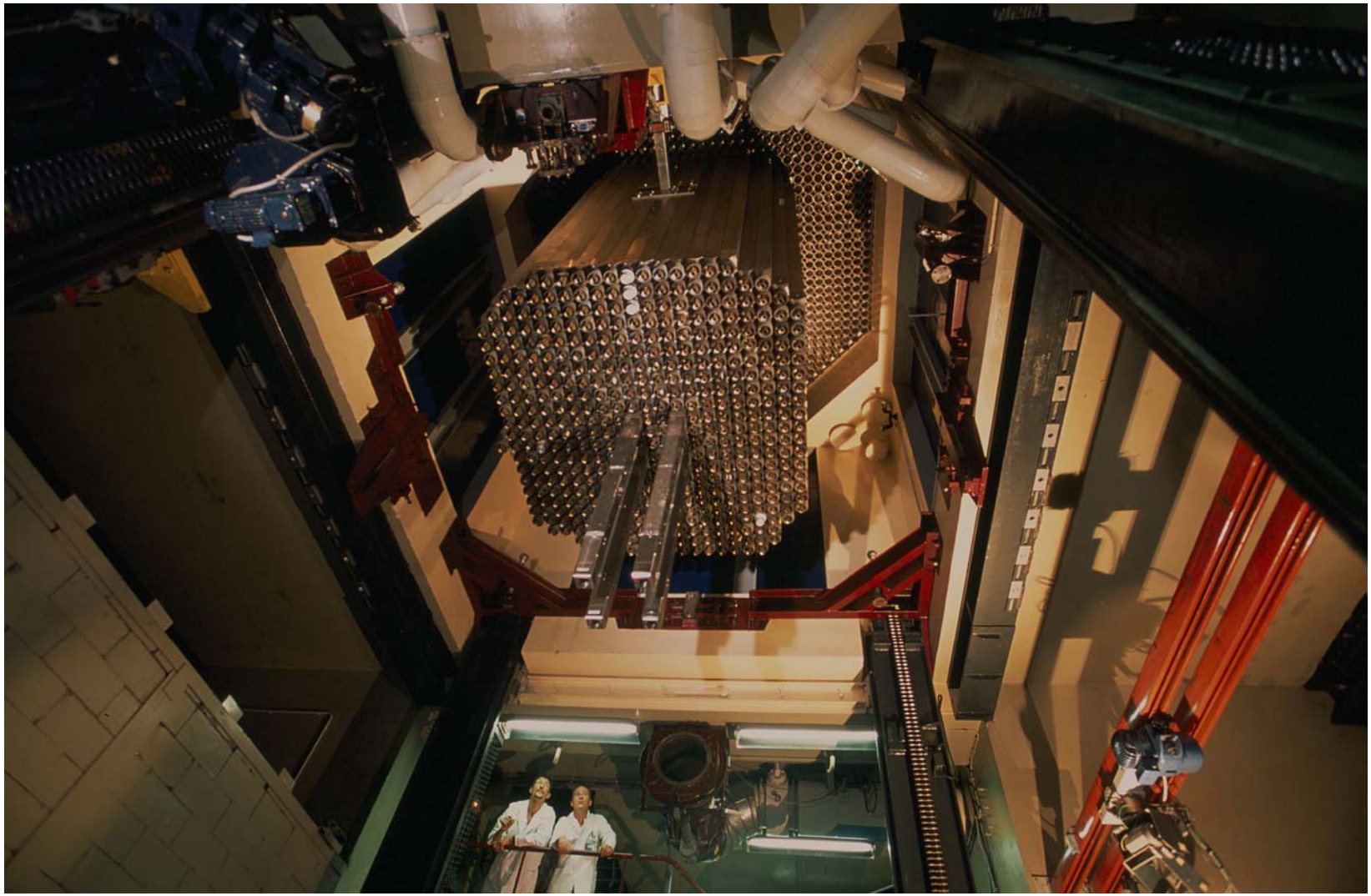
✓ CEA Research Reactors

- Reactors for neutronic studies
  - **Crititical Mockup : EOLE (1965- 1 kW), MINERVE (1959- 100 W) and MASURCA (1966- 5 kW)**
- Neutron beam reactors :
  - **ORPHEE (1980 -14 MW)**
- Technological irradiation reactors
  - **OSIRIS (1966 - 70 MW)**
- Prototype :
  - **PHENIX (1973 -350 MW)**
- Safety tests reactors :
  - **CABRI (1972- 25 MW), PHEBUS (1977-38 MW)**
- Teaching reactors :
  - **ULYSSE, ISIS (1966,700 kW)**

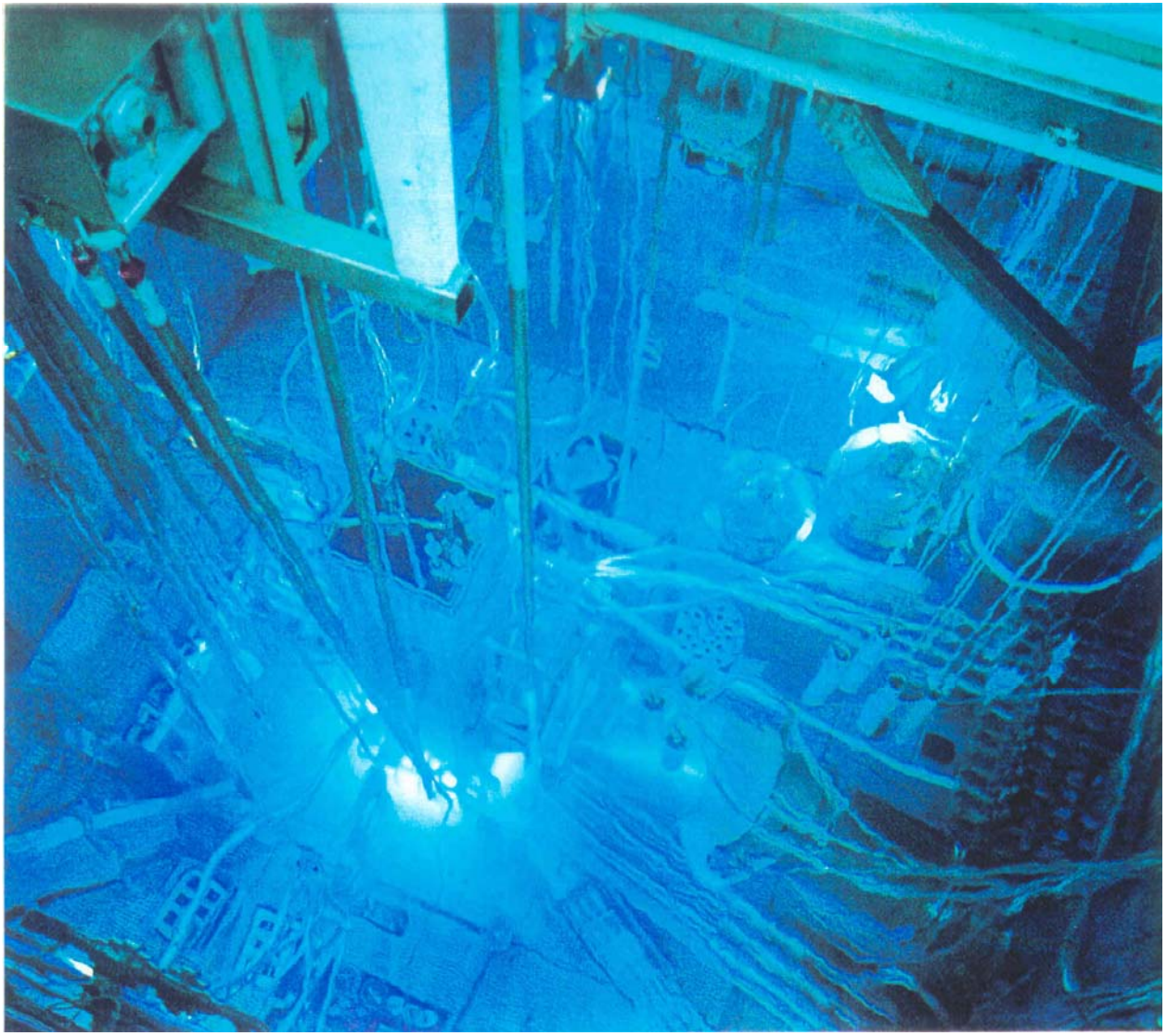
✓ Laue Langevin Institute RR

- **Neutron beam reactor : RHF (high flux reactor : 1971-58 MW)**

MASURCA (Cadarache)



OSIRIS (Saclay)



PHENIX (Marcoule)

High Flux Reactor (Grenoble)

ASN Challenges

- ✓ To monitor the ageing of the French research reactors
  - The first ones were built in the 60s and the last ones in the 80s
  - Important program of Periodic Safety Reviews (every 10 years)

- ✓ To regulate the new research reactors
  - “Renaissance” in the nuclear field
  - New projects
    - **RJH : Jules Horowitz Reactor**
    - **ITER : International Thermonuclear Experimental Reactor**

Jules Horowitz Reactor Project

ITER Project

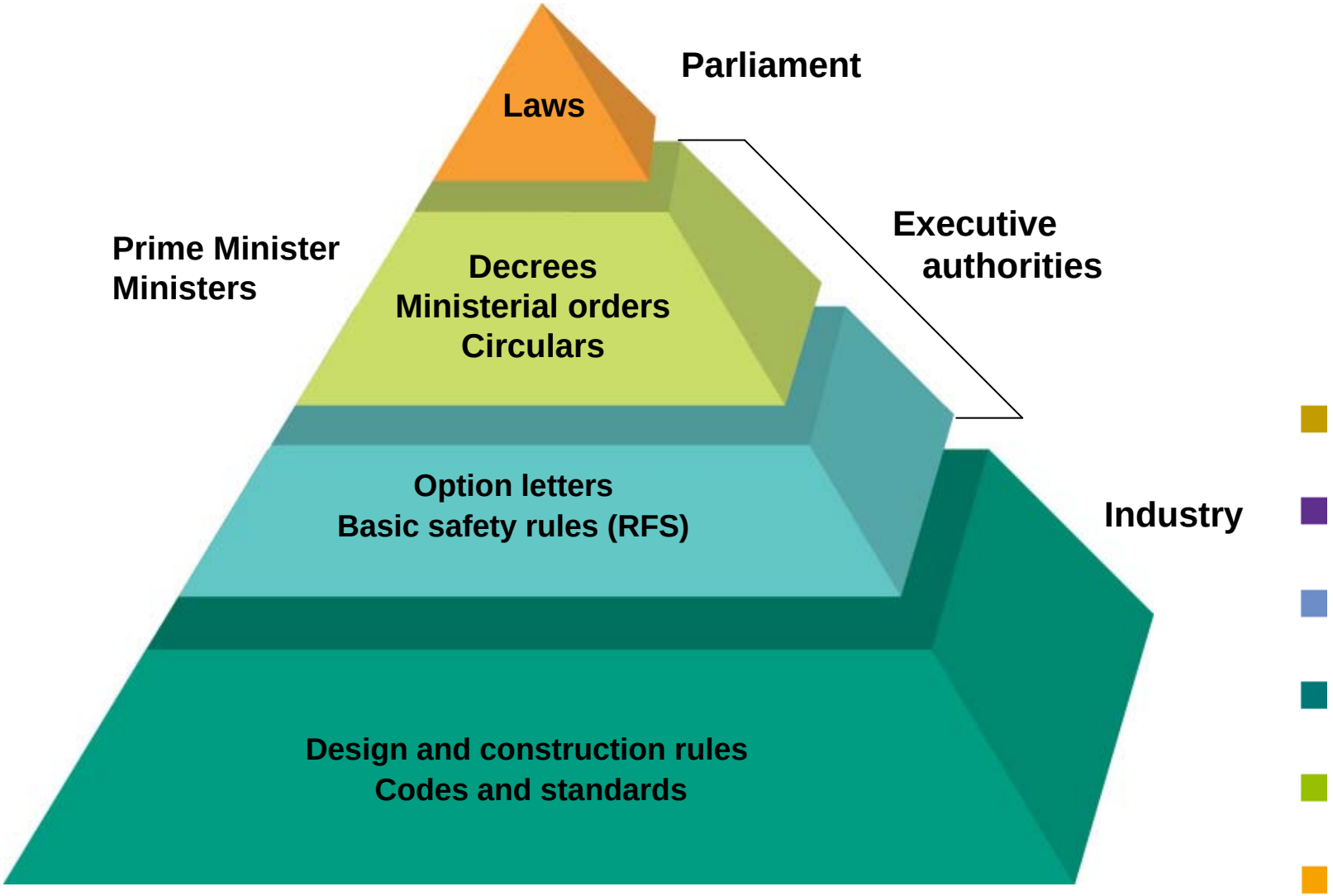
The French Regulatory Framework

- ✓ The French regulatory framework is applicable to all nuclear facilities, including RR

- **More and more similar to PWR but graded approach**
  - Deterministic safety assessment
  - Safety analysis applied to operating conditions
  - Use of design codes
  - Licensing Process is the same (PSR..)

- **RR safety reference system**
  - Inter ministerial authorization decree
  - Technical prescriptions by ASN and technical specifications
  - Safety Analysis Report
  - General Operating Rules
  - On site emergency plan
  - Release authorization

French Regulatory framework



The French Regulatory Framework

Commissioning procedure

- Transmission of the authorization dossier to the ministers and ASN
- Public enquiry
- Consultation of the ministers (environment, health, …)
- Examination of the Preliminary Safety Report by IRSN (Institute for Radioprotection and Nuclear Safety) and the Standing Group of Experts for Reactors
- Draft of the authorization decree by ASN
- Examination of the decree by CIINB (inter ministerial commission for BNI)
- Examination by the ASN College of Commissioners
- License (decree)

The Act on Transparency and Security in Nuclear Field

- ✓ Until 2006 the legislative basis for supervising the safety of the major nuclear installations were based on the decree of 11 December 1963

- ✓ The act of 13 June 2006 (TSN act) is a major step in strengthening the regulation of nuclear safety and radiation protection in France
  - **It creates ASN as an Independent Administrative Authority**
  - **It confirms the fundamental principles of Nuclear Safety (Convention of Nuclear Safety)**
    - Broadened conception of nuclear safety covering accident prevention but also the protection of the environment and human health
    - Prime responsibility of the licensee
    - The licensee must conduct periodic safety reviews
  - **It gives ASN the responsibility for inspections**
    - in case of licensee shortcomings, administrative sanctions and criminal penalties
  - **It guarantees the right of the public to reliable and accessible information on Nuclear Security**

The internal authorization system

- The Safety Authority must be informed of any modification in the safety reference documents
- For the research facilities, small modifications are often necessary $\Rightarrow$ frequent ASN authorizations
- ASN authorized CEA (2002) to establish an internal authorization system for minor modifications to allow the needed flexibility in RR safety reference system
  - to set up the operator back to its prime responsibility for the safety
  - to concentrate on the major safety problems

✓ Requirements
  - The licensee must set up an internal independent review system
  - He must have a clear reassessed safety reference system
  - The licensee must keep the safety documents up to date at any moment
  - He must inform the ASN of the modifications

The internal authorization system

Procedures and principles

- ✓ The internal authorization system must be auditable and transparent
- ✓ The licensee may authorize only minor modifications that do not impact the decree or the technical prescriptions or specifications, neither compromising the installation safety demonstration

- ✓ The licensee must send every six months the projected program for internal authorizations
- ✓ The licensee must transfer to ASN two weeks before operating a copy of the authorization delivered and the safety case on which the authorization is based

The internal authorization system

- The operator must sent a document assessing the efficiency of the system and the main problem encountered while applying it; the feedback document includes also dosimetry, type and quantities of produced waste …

- The information system has several objectives :
  - **To check that the safety demonstration of the facility is not compromised**
  - **To check the process for in-house authorization**
  - **To have a safety reference system up to date**
  - **To enable effective supervision by knowing what operations are in progress**

The case of experimental devices and experiments

- **ASN established a specific guide**
  - Based on the fact that the safety of the facility is not compromised
- **The operator draw up a technical guide on the safety requirements necessary to implement a new device**
  - Number of barriers
  - Number of devices to avoid flying off
  - Codes for the construction of the device…
- **The guide is submitted to ASN**
- **The experiment must not be the origin of new operating conditions**

The internal authorization system

Feedback after 4 implementation years

Year	2003	2004	2005	2006	2007*
Internal authorizations	3	9	11	14	24
ASN assessments	22	18	32	29	NS

The return feedback is satisfactory

- **Numerous inspections have been conducted on this theme**
  - The independence of the internal control is effective
  - The internal expert committees are efficient and ask a lot of safety improvements
  - The follow up of the recommendations is not always done
- **ASN intends to extend the system of internal authorization to other facilities (now days 20 out of 42 for the CEA)**
- **But the ASN requirements are not always fulfilled to be able to grant it**
  - The safety reference documents must be updated
  - A safety reassessment is very often necessary

Periodic safety review and operation feedback

Ageing management

- **The French practice does not limit the life of a nuclear facility**
- **Numerous systems may be changed in RR even the reactor vessel**
- **ASN implemented periodic safety reviews (every 10 years)**
  - ➢ to check the conformity of the facilities to the description of the safety reference system,
  - ➢ to reassess the design taking into account current knowledge , codes and standards and lessons learned from operational experience,
  - ➢ to examine the necessity to proceed to changes regarding to the outlooks of operating in the next years

Periodic safety review and operation feedback

Year	Reactors	Main topics
1999	Osiris/Isis	Ageing, accidental situations (≠ operating situations approach)*
2001	Phenix	Major reactor renovation work, checks of the vessel and sodium circuit, Sodium fire hazards.
2002	RHF	Seismic reinforcement.
2003	RJH	Safety options
2004	Cabri	Replacement of the sodium loop by a water loop, seismic reinforcement, work needed to comply with the current requirements for continuing reactor operations for twenty years (Preliminary safety analysis report of the refurbished installation).
2006	Masurca	Seismic reinforcement, power supply, command.
2008	RJH	Preliminary safety analysis report
	Cabri	Intermediate safety analysis report
2009	Eole + Minerve	Seisme, Fire hazards, human and organizational factors, safety analysis (operating situations approach), containment, criticality, external hazards
	Orphee	General safety analysis
	Masurca	Safety analysis after refurbishment

* The operating situations approach is used for the periodic safety reviews since approximately 2004

Periodic safety review and operation feedback

Operation feedback

- **Significant increase in reported events**
  - 1999 - 5 incidents
  - 2006 – 29 incidents
  - Not necessary a degradation of the safety
  - But more transparency and new events
  - RP events scale, new criteria for safety events
  - Most of them = level 0
  - Some are due to the ageing of installations
- **Letters from ASN to operators**
  - Generic incidents or interesting events
- **Cross analysis by IRSN presented to the Advisory Committee**
- **The importance of the human factors**

CONCLUSION

- **Research reactors are necessary equipment for research and development**
  - Each of them is a particular case : a graded approach
  - A safety approach more and more generic and inspired from the NPP one : major progress in safety
  - An ageing pool of RR : periodic reassessments are necessary
  - The importance of the human and organizational factors
- **“Renaissance” of the nuclear**
  - New projects to be instructed
  - Jules Horowitz Reactor (100 MW pool - type reactor)
  - ITER (International Thermonuclear Experimental Reactor) : fusion reactor with an international status
- **The challenges for ASN**
  - RR must be an example in the field of safety
  - New context with majors stakes
  - The TSN act

Thank you for your attention !

more information available at

www.asn.fr