Regulatory framework and safety requirements for new (gen III) reactors

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On behalf of the State, ASN regulates nuclear safety and radiation protection in order to protect workers, patients, the public and the environment in France against the risks related to nuclear activities.

ASN contributes to informing the public.

ASN is not in charge of defence facilities, security and physical protection of nuclear installations and is not involved in energy policy.
French approach for regulations

Preventing accidents and incidents and limiting their effects

The licensee is responsible for nuclear safety and radiation protection

ASN is responsible for the control of nuclear safety and radiation protection
Roles and Responsibilities

Nuclear Safety Authority

- Defines the general objectives of nuclear safety and radiation protection
- Propose practical details to reach these objectives
- Makes sure that the method is appropriate to reach these objectives and issues (or proposes) authorization
- Implement the method approved
- Verifies the implementation through regulatory assessments and inspections.
- Informs the public.

Nuclear installations licence holders:
- EDF, CEA, AREVA, ANDRA, ...

Ionizing radiations users
French regulations

- Code of Environment
  - Decree 2007-1557 of 2 November 2007 (Procedures for nuclear installations)
  - Order of 7 February 2012 on safety of nuclear installations
    + Orders of 10 Nov. 1999 and 12 Dec. 2005 (nuclear pressure equipments)
  - Regulatory ASN decisions
    - ASN Guides (and basic safety rules [RFS])
International input

- INSAG 12
- IAEA SSR-2/1

WENRA

- Safety objectives for new reactors
- Safety report on the safety of new NPP design
Safety objectives for new NPPs

O1. Normal operation, abnormal events and prevention of accidents
   - Reducing the frequency of abnormal events
   - Better controlling abnormal events

O2. Accidents without core melt
   - No or only minor off-site radiological impact
   - Reducing, as far as reasonably achievable, the core damage frequency
   - Reducing, as far as reasonably achievable, the radioactive releases from all sources
   - Reducing the impact of external hazards and malevolent acts

O3. Accidents with core melt
   - Reduce potential releases, also in the long term
     - Accidents leading to large or early releases: practically eliminated
     - Other core melt accidents: only limited protective measures in area and time

O4. Independence between all levels of defence-in-depth
   - Enhancing the effectiveness of the independence of levels of DiD

O5. Safety and security interfaces
   - Integration, seeking synergies between safety and security

O6. Radiation protection and waste management
   - Reducing as far as reasonably achievable
     - Individual and collective doses
     - Radioactive discharges to the environment
     - Quantity and activity of radioactive waste

O7. Leadership and management for safety
   - The licensee shall have sufficient in house technical and financial resources
   - From the design stage, organisations
Principles

- Comprehensive **deterministic** safety assessments and **probabilistic** safety assessments

- Take into account **operating experience feedback**, lessons learnt from accidents, developments in nuclear technology and improvements in safety assessment

- Consideration of **multiple failures** in a more systematic and complete way

- **Improved probabilistic goal of** $<10^{-5}$ severe core damage events per plant operating year (safety targets, no acceptance criteria)

- Enhanced application of **Defense-in-depth** (DiD)

- **Balanced design**: no accident sequence makes a disproportionately large or significantly uncertain contribution to the overall risk
Regulations for Flamanville 3 NPP

- Technical Guidelines for the design and construction of the next generation of nuclear power plants with pressurized water reactors
  - Adopted during the French GPR/German RSK experts plenary meetings held on October 19th and 26th, 2000
    - safety philosophy and approach + general safety requirements for the design and construction of the next generation of nuclear power plants of the PWR (pressurized water reactor) type.
    - common work of the French Institut de Protection et de Sûreté Nucléaire (IPSN, which became IRSN) and of the German Gesellschaft für Anlagen- und Reaktorsicherheit (GRS).
  - Endorsed by ASN in 2004

- Ministerial order of 7 February 2012 setting the general rules relative to basic nuclear installations
- Article 3.1 I.
  - defence in depth

- Article 3.2 I. —
  - demonstration of nuclear safety
  - prudent deterministic approach
  - technical, organisational and human dimensions
  - single initiating events and plausible situations of combined initiating events

- Article 3.3
  - probabilistic analyses of accidents and their consequences

- Article 3.9
  - prove that accidents that could lead to early or large releases are physically impossible or, if physical impossibility cannot be demonstrated, that the measures taken on or for the installation render such accidents extremely improbable with a high level of confidence ("practical elimination").
ASN public statements

« The safety of new nuclear reactor construction projects worldwide has to be ensured » (2008)
- Learning about nuclear safety is a long process
- IAEA, INRA: a considerable period of time is necessary to acquire competences and a true safety culture before operating a nuclear power station
- Establish a safety authority, laws and regulations – 5 years
- Assessment of the application for at new NPP – 2 to 10 years

« Which level of safety for new reactors built around the world? » (2010)
- WENRA has established safety objectives for new reactors
- We do not want a « two-speed » safety
- Lessons learnt from TMI, Chernobyl and sept 11, 2001 [and Fukushima] must be taken into account
- If nuclear reactors which do not meet these safety objectives are proposed for export, ASN will not hesitate to declare that such reactors could not be built in France