

# Licensing experience for EPR Flamanville 3

**Autorité de sûreté nucléaire (France)**  
Nuclear Power Plants Department

- **French regulatory framework**

- Licensing process of a nuclear installation

- **Flamanville 3 EPR reactor licensing**

- Longstanding and continuous process
- Engaging the formal licensing process
- Timeframe
- FLA3 authorization decree and associated ASN licence conditions
- Commissioning authorization



# Global process to create and operate a NPP

## *3 main stages*

### 1) Political decision to build a new NPP

- Decision taken by government
- ASN is not involved in this political decision

+ National  
public debate

### 2) The authorization decree for NPP creation/construction licence

- Delivered by Government on the basis of the ASN position
- Aim of the authorization decree
  - To give the main “nuclear” characteristic to the NPP
  - To list the major requirements
  - To authorize the water intake and effluent discharges to the environment
- Process linked with other administrative authorizations (construction code...), especially an authorization to build, as well as national public debate process
- ASN can enact requirements (licence conditions) for detail design of the NPP

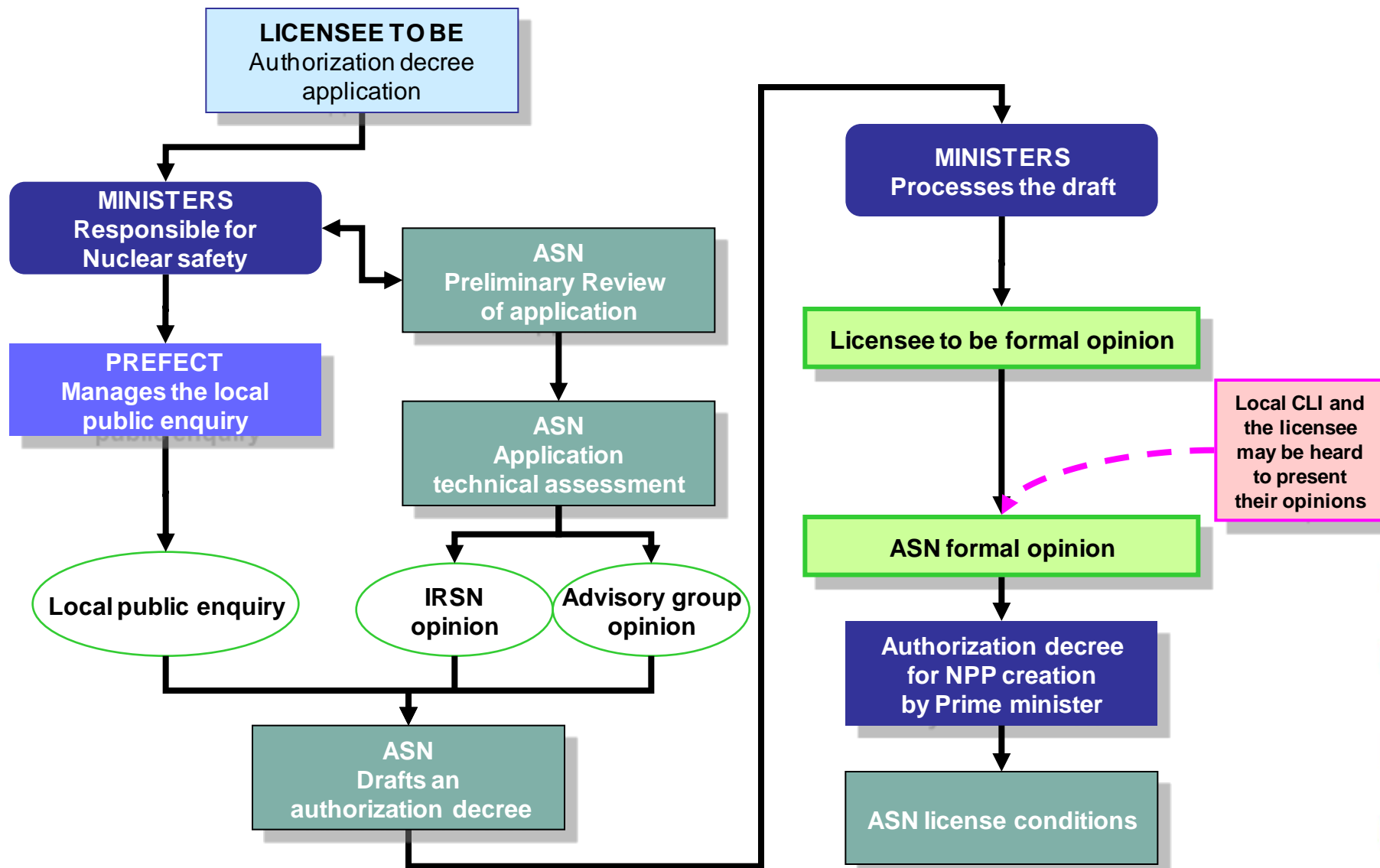
### 3) The commissioning and operation licence

- Delivered by ASN
- ASN can enact requirements (licence conditions) for the NPP commissioning and operation

- **Environment code article L593-7 gives the legal basis for the authorization process of a nuclear installation**
  - “the creation of a basic nuclear installation is subject to authorization”
- **2<sup>nd</sup> November 2007: Decree concerning Basic Nuclear Installations (BNI)**
  - Before the application (“safety options”), the licensee to be can request ASN’s opinion on its project
  - Gives the detail of the process to get a this authorization decree (combined licence : site and design)
  - The first fuel load in the reactor is subjected to ASN’s authorization

# Authorization decree for NPP creation

## Processing the application (since 2007)



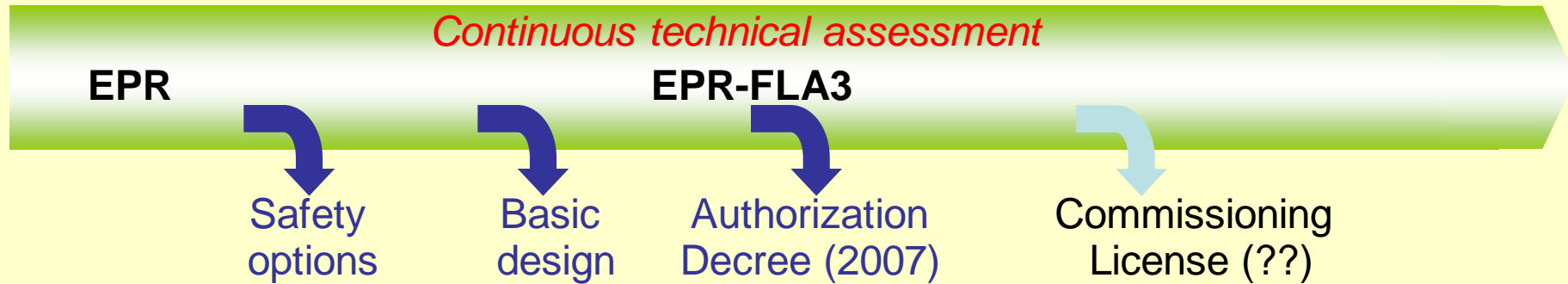
- **Commissioning authorization process is specified in the BNI procedure decree (art 20)**
- **To get the operating licence**
  - the operator has to submit several regulatory documents :
    - The **safety analysis report** comprising the updated preliminary safety analysis report and the data provided for assessment of installation conformity with the requirements of the authorization decree and the construction requirements;
    - The **general operating rules** (“GOR”) the licensee intends to implement for protection of the interests mentioned in I of Article 28 of the Act of 13 June 2006 (people and the environment);
    - A **study on waste management**, specifying the licensee's objectives for limiting the volume and radiological, chemical and biological toxicity of the waste produced in its installations and, by reuse and reprocessing of the waste thus produced, for reducing the size of the repository reserved for ultimate waste. This study takes account of all installation waste management channels up until disposal. It can cover the waste produced by all the installations and equipment located within the perimeter;
    - The **on-site emergency plan** (“PUI”);
    - An update, as necessary, of the **decommissioning plan and the environmental impact assessment**
  - ASN has 1 year (once the file is complete) to assess the case
  - ASN can enact licence conditions

- **French regulatory framework**
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# Flamanville 3 licensing

## *A longstanding and continuous process*



French and German political decision to launch the EPR program

Flamanville 3 authorization decree

18 years process (3 main steps)

1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
9	9	9	9	9	9	9	9	9	9	9	0	0	0	0	0	0	0	0
8	9	9	9	9	9	9	9	9	9	9	0	0	0	0	0	0	0	0
9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7

**Step 1**  
*Definition of the safety objectives*

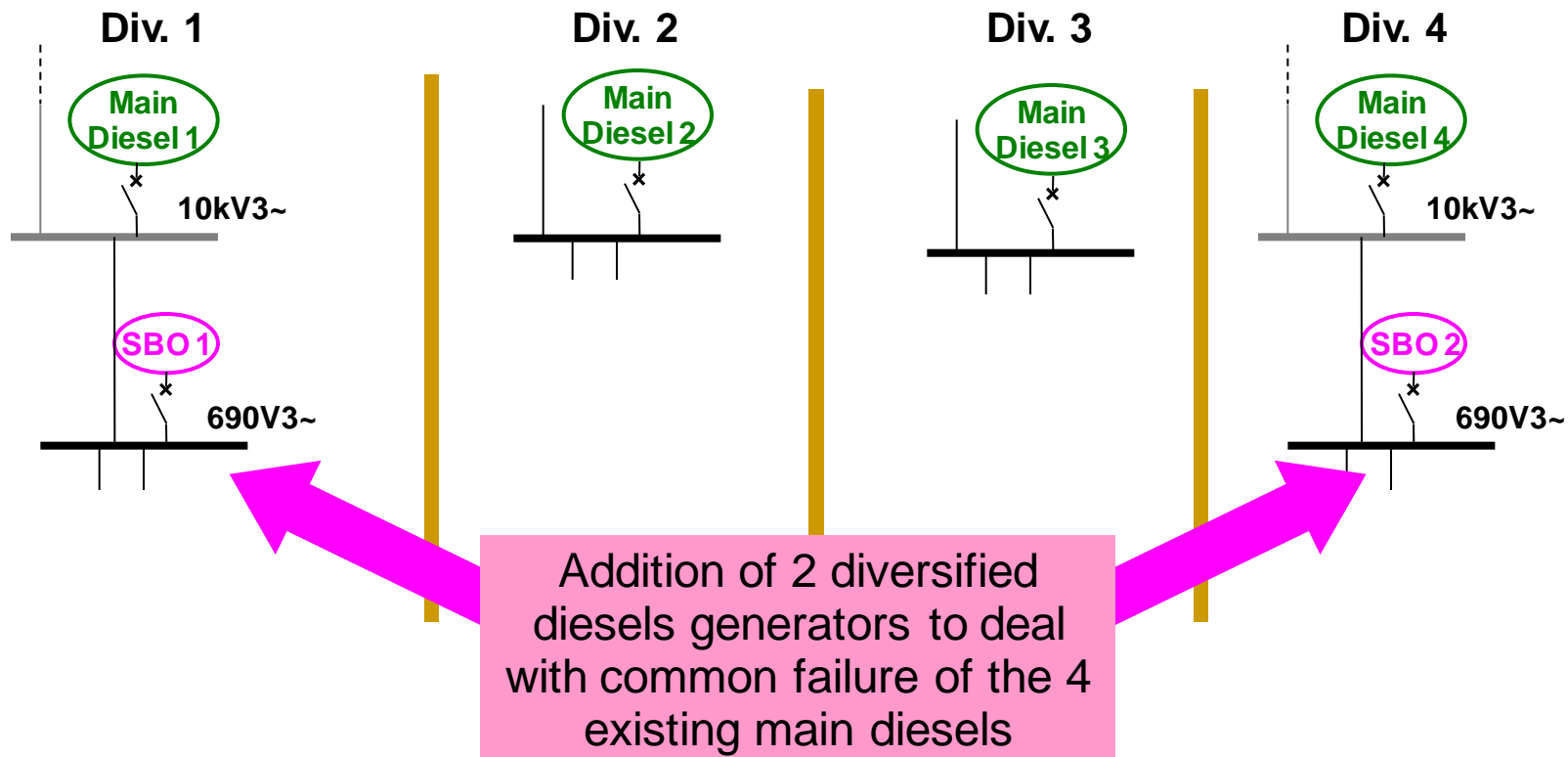
**Step 2**  
*Assessment of the safety options*

**Step 3**  
*Assessment supporting the authorisation decree*



- **Technical assessment program related to the authorization decree mainly built on:**
  - The safety objectives defined in 1993
    - Control of the normal operation of the installation
    - Reduction of the number of significant incidents
    - Reduction of the core-meltdown risk
    - Practically-eliminated situations
    - Reduction of the radiological impact of accidents
  - The integration of recent experience feedback from operating reactors
    - Design basis against internal and external hazard
    - Sump-clogging risk of emergency core cooling systems
    - Crash of commercial aircraft
  - The innovations introduced in comparison to operating reactors in response to industrial concerns
    - Break-preclusion hypothesis
    - Principles and approach for equipment qualification
    - Preventive-maintenance operations in power states
    - Digital control and instrumentation
  - Design and manufacturing of nuclear pressure equipment
    - Nozzle support ring and the vessel closure head
    - Envelopes of fuel-bundle control mechanisms
    - Main components: pressurizer, steam generators...
  - Other selected topics

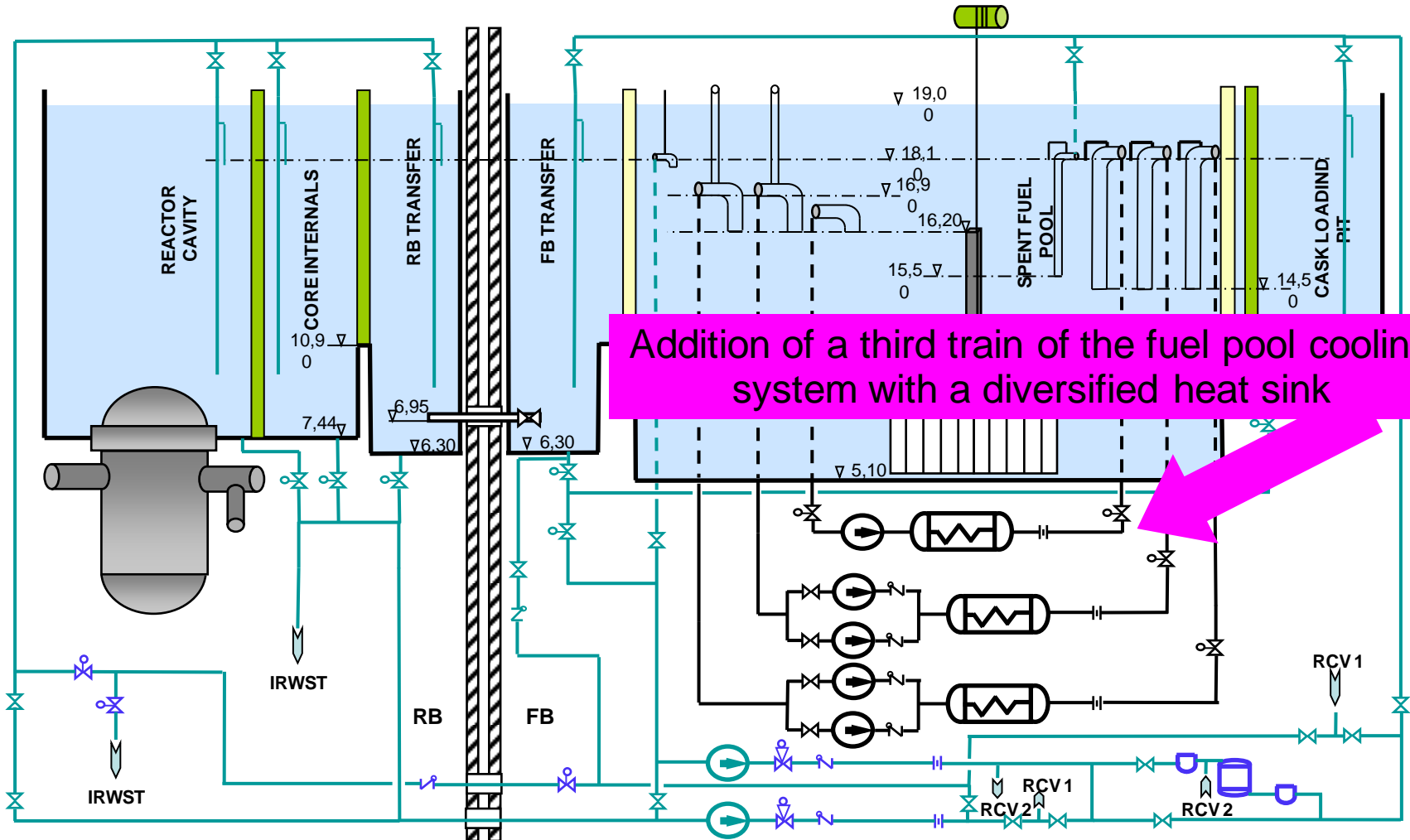
- Examples of modifications resulting from the technical assessment
  - Diversification of the emergency electrical supply



- **Examples of modifications introduced in result of the technical assessment**
  - Practical elimination of fuel melt in fuel pool
    - Assessment of reliability of the water-cooling function in the spent fuel pool performed notably on the basis of the Level-1 PSA results
    - Conclusion: excessive sensitivity of the initial design to a common-mode failure involving the two redundant systems that were originally planned for that function
    - Modification of the detailed design: the selected design evolution consisting in adding a third diversified cooling system was reviewed and approved
  - Diversification of the heat sink and essential service water system

# Technical assessment supporting the authorization decree

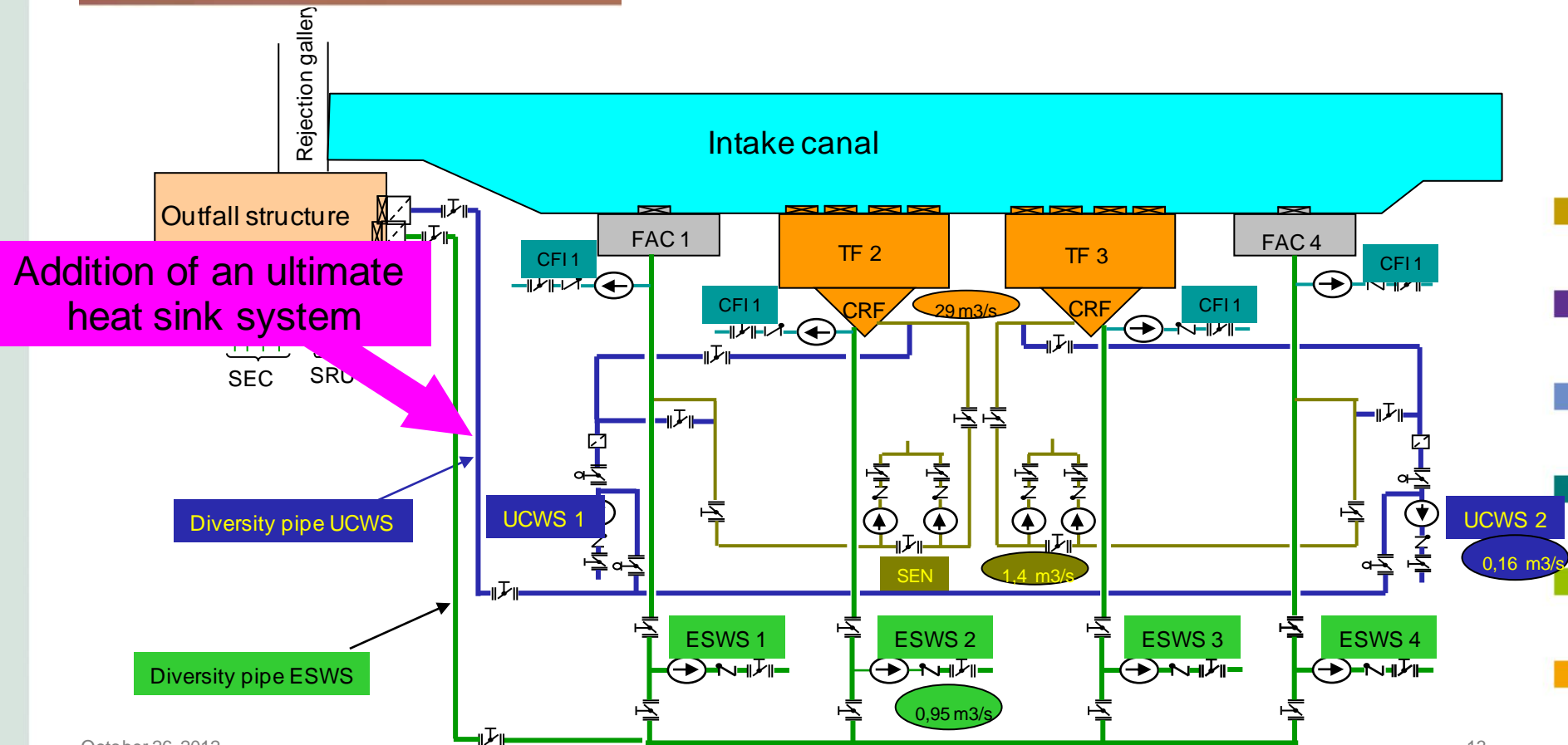
## Practical elimination of fuel melt in fuel pool



# Technical assessment supporting the authorization decree



Diversification of the heat sink and essential service water system



- **Article 1: Generalities**

- Name of the licensee
- The nature of the installation and the maximal power of the NPP
- Perimeter of the installation

- **Article 2: Main safety objectives**

- I. Main characteristics of the installation
- II. Management and control of accidents
- III. 3 fundamental safety functions
- IV. Management of the internal and external hazards
- V. Qualification of the SSCs of the safety demonstration
- VI. Management of the impact of the installation on the environment and on the public
- VII. Information of IRSN in case of emergency

See ASN website:

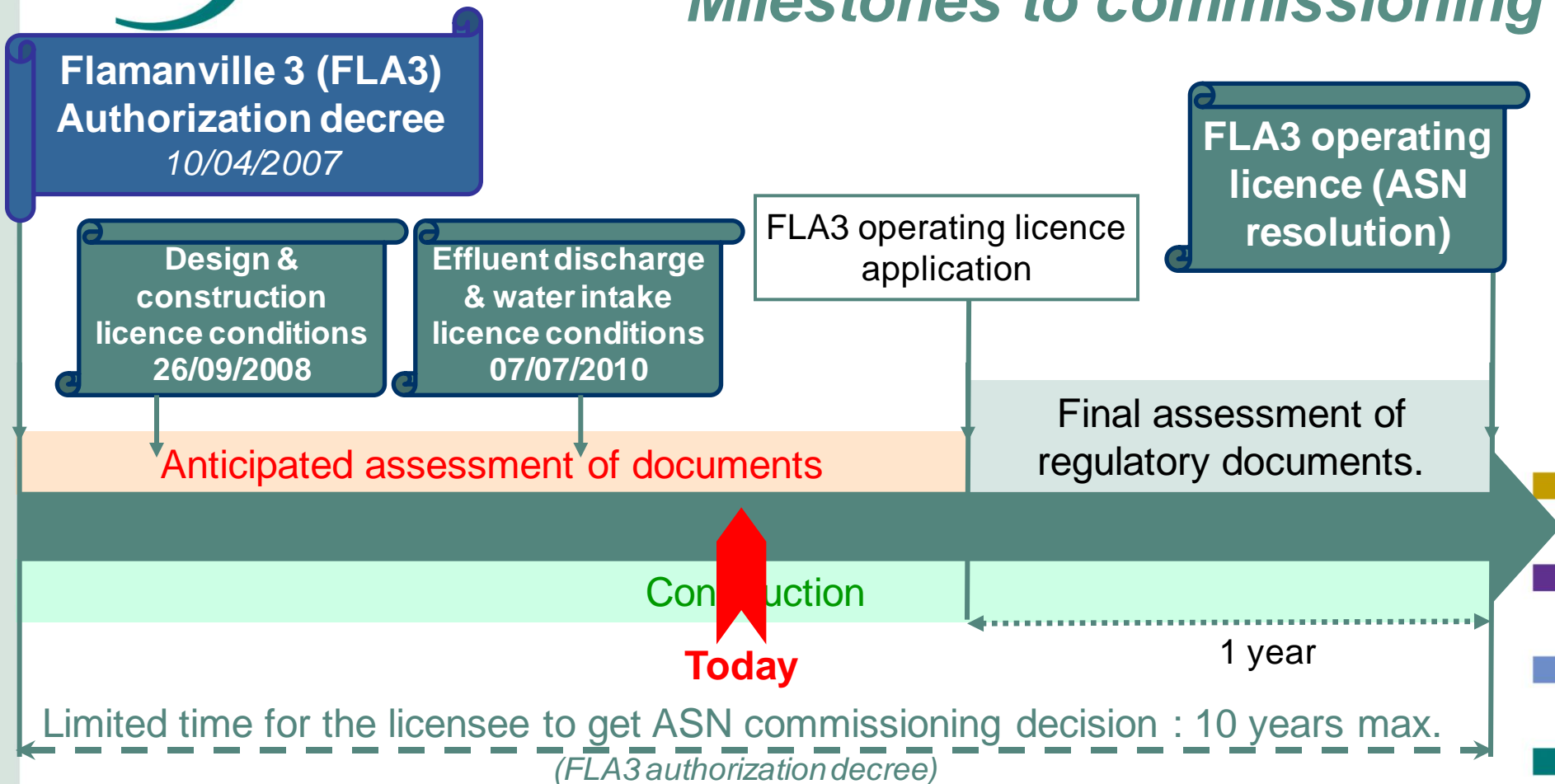
<http://www.french-nuclear-safety.fr/index.php/English-version/Supervision-of-the-epr-reactor/Ressources>

- **Article 3: Milestones to commissioning**

- Conditions to introduce fuel inside the perimeter of the installation or for the 1<sup>st</sup> fuel loading
- Limited time for the licensee to get ASN decision : 10 years max.

- **Article 4: Conditions to introduce some modifications**

# Flamanville 3 licensing *Milestones to commissioning*



## ▪ Commissioning tests:

- Beginning of the cold tests during the construction period of time
- Beginning of the hot tests (with fuel) after the ASN decision for commissioning

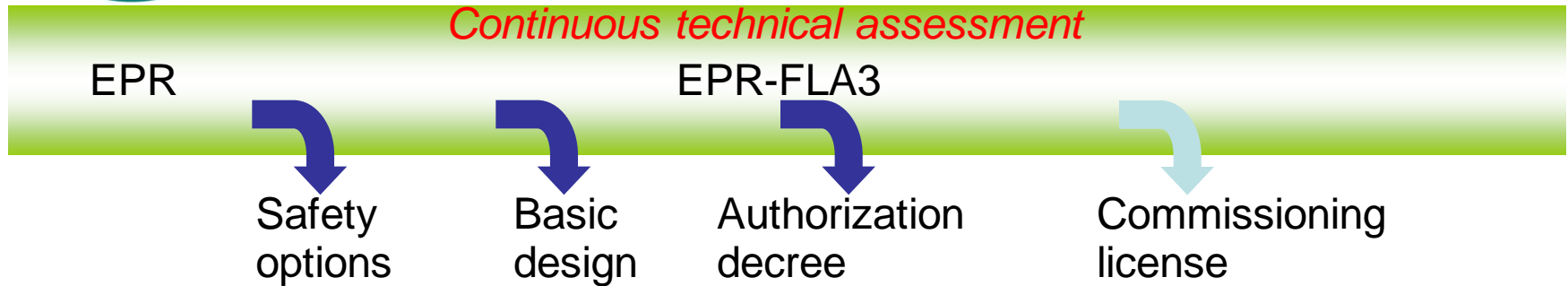
## *Licence conditions : design & construction*

See ASN website:

<http://www.french-nuclear-safety.fr/index.php/English-version/Supervision-of-the-epr-reactor/Ressources>

- **58 licence conditions** (“prescriptions”)
- **Technical requirements related to the detailed design of the facility**
  - Aim: to “implement” the authorization decree (article 2) by detailed requirements
  - Contents:
    - Conclusions of the technical assessment performed from 1993 to 2006
      - To strengthen the difficult points of the technical assessment (when EDF did not agree the ASN position)
    - Requirements due to the status of « first-off kind »
      - To strengthen some technical measures which are some specific functions of EPR (practically eliminated situations, containment, hazards)
- **Requirements to control the conditions of construction**
  - Aim: to define the necessary elements to perform the regulation strategy of the construction endorsed by ASN Commissioners at the end of November of 2007
  - Contents :
    - Definitions of information that the licensee has to provide to ASN (schedule, non-compliances,...)
    - Definition of the ASN hold points
    - To strengthen the ASN requirements concerning the hazards that EPR construction may induce on the two adjacent operating nuclear plants and vice versa





- **Assessment of detailed design**

- A part of the way to oversee construction of Flamanville 3

- **To anticipate assessment of the regulatory documents to be part of the application to operate**

- For instance: assessment of new methodologies and principles used by the operator
- Aim: to prepare the final and quite short (1 year) regulatory assessment

- **Technical assessment program related to the authorization decree mainly did not cover:**
  - All topics addressed in the preliminary safety report because
    - the review performed during the examination of safety options was considered sufficient at this stage
      - for instance: design provisions aiming at eliminating practically all core-meltdown accidents at high pressure
    - those topics were neither a sensitive issue with regard to safety objectives nor a fundamentally design-related structuring element (those topics will be assessed for the commissioning authorization)
      - for instance: instrumentation used in Konvoï, staff training...
  - Fuel management characteristics (design of assemblies, choice of materials, enrichment rate, length of cycles, burn up rate, etc.)
- **All those topics will be examined for the commissioning authorization.**
- **All topics won't get the same level of review: need to focus the review to make best use of available (limited) resources**

- **Topics currently under review**

- Accident studies
- I&C
- Protection system
- Internal, external hazards
- Detailed design of EPR system playing a safety role as supporting systems (including risk of sump clogging, electrical supply, ventilation...)
- Equipment qualification to accidental conditions
- Radiological consequences
- Severe accident management
- Probabilistic studies (levels 1, 2, for the reactor, the fuel pool, regarding internal events, internal and external hazards...)
- Radiation protection
- Human and Organizational Factors
- Commissioning tests
- General Operating rules

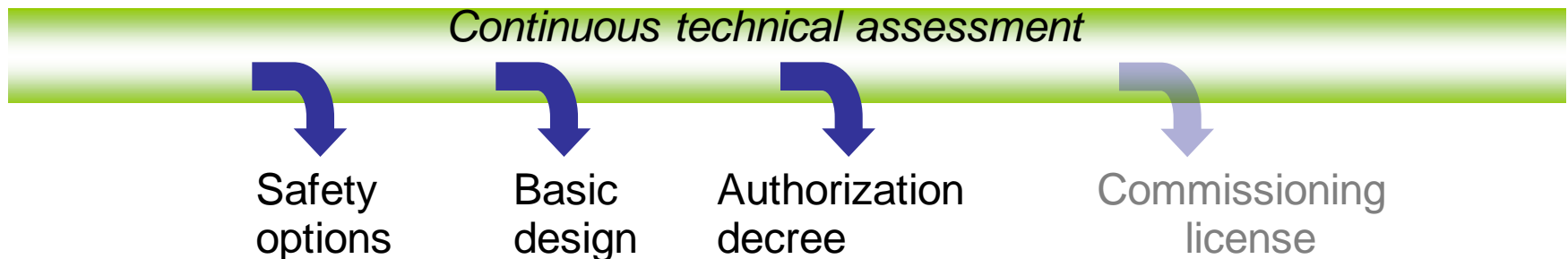
## • **Consequence of the “focusing” review principle:**

- Build a methodology to choose SSC which will be assessed in details
- What to consider in the methodology to choose SSC?
  - Defense in depth principle
  - Follow up of the assessment performed before Flamanville 3 authorization decree
  - New technologies used for EPR
  - Feedback of French and German design, operating French NPP, Konvoi,...
  - Feedback from international cooperation
- January 2009: ASN commission endorsed a methodology to focus the technical review

## • **Human resources:**

- Current ASN-IRSN activities: continuous EPR assessment + operating reactor activities
- New methodologies and principles used by the operator to elaborate the safety demonstration: heavy task
- Human resources (ASN+TSO) need to be scheduled

- **A long process (18 years) concluded by Flamanville 3 authorization decree**
  - Assessment is still going on in preparation of the commissioning and operation licence



- **A very detailed technical assessment performed all along the design process of the industrial project**
  - ↳ it enables the French nuclear safety authority to influence the design at an early stage of the project and facilitates the authorization application procedure
- **A position of ASN based on a technical assessment involving experts from several European countries**
  - ↳ France, Germany, Finland, Belgium, UK,...
  - ↳ Making use of regulatory cooperation as part of MDEP initiative

