1. Introduction to ITER Licensing and ITER Safety Aspects

2. Large Involvement of F4E in the design/fabrication of ITER PIC/SIC components

3. F4E processes related to the management of design & fabrication of PIC/SIC components

4. Lessons learned of ASN inspections
ITER Licensing process

ITER is to be licensed in France as a Basic Nuclear Installation (*Installation Nucléaire de Base, INB*)

- according to the law on transparency and security in the nuclear field (*Loi Relative à la Transparence et à la Sécurité en Matière Nucléaire, TSN*)

In order to obtain the decree to authorise ITER, at this stage, ITER had to submit to the French nuclear safety authorities (*Autorité de Sûreté Nucléaire, ASN*):

### The DAC files:

1. Request for authorisation (*Demande d’Autorisation de Création, DAC*), comprising 14 files including
3. Impact Study (*Etude d’Impact*)
1. Introduction to Nuclear Framework

- Parliamentary framework
- Regulatory framework
- Standardisation framework
- Internal technical rules

- Laws
  - Decrees, departmental orders
  - ASN decisions
- RFS fundamental safety rules
- ASN guides
- Technical Directives
- Design and Construction codes
- Standards

- General application
  - Compulsory

- Executive power
- Industry

- Technically specific
  - Possible deviations
1. Introduction to Nuclear Framework

- **French TSN**: Law on transparency and security in the nuclear field (n° 2006-686 of 13 June 2006) set up **ASN as an independent administrative authority**

- **INB Order 07/02/2012**: The general technical regulations applicable to Basic Nuclear Installations (INB)

- **ESPN Order** (Order of 12 December 2005 concerning nuclear pressure equipment)
  
  and **ASN ESPN Guideline**: Application of the Order concerning nuclear pressure equipment, draft version 1.2 of 27 August 2008

- **RFS (Règles Fondamentales de Sureté)**: Fundamental Safety Rules

- **Design and Manufacturing**: Nuclear Code and Standards:
  - Mechanical: RCC-M, RCC-MR, ASME III, ASME NOG 1, KTA,…
  - Electrical: RCC-E, IEEE, …

  ASN doesn’t oblige to use a Specific Code but asks to IO a justification of the use of a specific Code and Standard
1. ITER Safety Aspects

Principal hazards

- the inventory of radioactive material
  - tritium
  - neutron-activated material

- direct radiation exposure
  - from plasma during operation
  - from activated material
# Safety Functions of ITER

<table>
<thead>
<tr>
<th>Safety Function</th>
<th>Detailed Safety Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confinement of radioactivity</td>
<td>Process confinement barriers</td>
</tr>
<tr>
<td></td>
<td>Building confinement barriers including systems for maintaining depression and filtering/detritiating effluents</td>
</tr>
<tr>
<td>Limitation of exposure</td>
<td>Shielding to limit exposure and ALARA principle</td>
</tr>
<tr>
<td></td>
<td>Access control</td>
</tr>
<tr>
<td>Supporting Functions</td>
<td>Detailed Supporting Functions</td>
</tr>
<tr>
<td>Protection of systems for confinement and limiting exposure</td>
<td>Management of pressure</td>
</tr>
<tr>
<td></td>
<td>Management of chemical energy</td>
</tr>
<tr>
<td></td>
<td>Management of magnetic energy</td>
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<tr>
<td></td>
<td>Management of heat removal and long term temperatures</td>
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<tr>
<td></td>
<td>Fire detection/mitigation</td>
</tr>
<tr>
<td></td>
<td>Mechanical impact (including seismic, dropped load, etc.)</td>
</tr>
<tr>
<td></td>
<td>Management of mobilizable radioactive inventory</td>
</tr>
<tr>
<td></td>
<td>Control of safety protection and mitigation systems</td>
</tr>
<tr>
<td>Supporting functions</td>
<td>Providing auxiliaries essential for implementing safety functions (electrical power supply, I&amp;C, compressed air, etc…)</td>
</tr>
<tr>
<td></td>
<td>Monitoring plant status: safety functions, radiation monitoring, etc…</td>
</tr>
<tr>
<td></td>
<td>Providing protection of important to safety systems (e.g. earthing, lightning, etc…)</td>
</tr>
<tr>
<td></td>
<td>Provide transport/lifting of radioactive components/materials</td>
</tr>
<tr>
<td></td>
<td>Providing support to operator intervention (lighting, communications, etc..)</td>
</tr>
</tbody>
</table>
2. Large Involvement of F4E in the design/fabrication of ITER PIC/SIC components

Inventory to be Confined:

- tritium
- active dust (Be and W)
- activated corrosion products (coolant leak)

First confinement system:
- vacuum vessel
- extensions
- windows in penetration lines
- isolation valves

Second confinement system:
- active filtering and detritiation systems
- walls of the building

Fusion For Energy
SIC/PIC Components
3. Introduction to French INB Order

Quality of design/manufacture

prescribed by law

and required in Annex A of contracts

French Order 10/08/1984

01 July 2013

French Order 07/02/2012

Main specificity of new Order:

Radiological and non radiological hazards with the same management
Essentially no change from 1984 Quality Order

Protection of the interests
safety, environment, public

\[ \text{PIC} = \text{SIC} + \text{EIC} + \text{CMC} \]

- Protection Important Components
- Safety Important Components
- Environmental Important Components
- Crisis Management Components

- No modifications in current baseline
- Few additional detectors

The sequence to be controlled and attested:

**PIC** (Protection Important Component) & **DR** (Defined Requirements on PIC)

**PIA** (Protection Important Activities) F4E Guideline 27WDLC

**DR** (Defined Requirement on PIA)

<table>
<thead>
<tr>
<th>PIC</th>
<th>DR on PIC</th>
<th>PIA</th>
<th>DR on PIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>Withstand normal and accidental situations</td>
<td>Design</td>
<td>Agreed Code &amp; Standard, Qualification programme, ...</td>
</tr>
<tr>
<td></td>
<td>No load drop</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>No crane collapse</td>
<td></td>
<td>Material grade, Welders qualification, ...</td>
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</tbody>
</table>
Main documents

• The F4E **Quality System and QA Programme for ITER**

• Contract, Annex A
  
  F4E-QA-115 (F4E Ref.: 22F8BJ) – **Supplier Quality Requirements** for the suppliers including NCRs and DR management

• A dedicated procedure
  
  F4E-QA-013/113/016 - **Safety arrangements follow-up**

• + **DR/Nonconformity management** procedures
3. QA as a mean to guarantee compatibility with all basic safety and Nuclear safety requirements

EU-DA Suppliers must comply, Quality wise, with the F4E-QA-115 - “Suppliers Quality Requirements” as defined in the Contract Annex A.

This ensures compliance with:

- IO propagation of INB Arrêté du 7 février 2012
- EUDA QA Program for ITER
- ITER QA Program is based on IAEA Safety Standard GS-R-3
3. Introduction: Role of ASN/IO/F4E/Suppliers

**ASN (Authorité de sûreté nucléaire)**
oversees, AUDITS nuclear operators and issues and monitors nuclear site licenses

**ITER ORGANISATION (Nuclear Operator)**
Manages the facility, applies for and holds the site operating license, manages the nuclear safety demonstration confirms the nuclear safety requirements, audits the propagation of nuclear safety responsibility and audits the supply chain

**F4E (DA)**
Specifies the means to satisfy the Nuclear Safety Requirements and the Protection Important Activities (PIA), monitors and audits the supply chain

**Suppliers (EFLs and Industry)**
Design and/or provide equipment and evidence to demonstrate that the nuclear safety requirements on a PIA have been conducted satisfactorily. Design activities may include independent PIA review in- or outside their organization. It is recommended to keep track of such review via verification report.
3. Role of IO/F4E/Supplier

Propagation of Defined Requirements in Supply Chain:

1. **IO (The Operator)** will SPECIFY the Defined Requirements (DRE) for the Protection Important Components (PIC) and processes, Protection Important Activities (PIA) Guideline for a build to print.

2. **F4E** will transfer through Annex B the Defined Requirement (DRE) across the appropriate PIA and the Verification Activities (VA) to show how the DRE will be satisfied.

3. **Supplier** will check the DRE and VA can be complied with.
   - **Supplier** will indicate the PIA in the QA control plan (F4E Guideline 27WDLC)
   - **Supplier** will RECORD all changes (deviations) or non-conformances (NCR) during their PIA (F4E and IO approve these where they affect PIC)
   - **Supplier** will produce the evidence records that the DRE and VA have been demonstrated.
3. QA and Nuclear Safety Trainings

INTERNAL AND EXTERNAL TRAININGS

**In 2011 Internal Trainings:**
Nuclear safety training course on the French Order of 10 August 1984 was given to **85 F4E** technical officers (TOs)

**In 2012 External Trainings:**
A training course on QA and Nuclear Safety on the French Order of 10 August 1984 and the basis of Nuclear Safety Culture has been given to more than **100** technical and management staff of various suppliers (AMW, IBERDROLA, NATEC, GTM, ENERGEA, ENGAGE, GTM, APAVE,...) involved in the design and construction of the buildings and the Vacuum Vessel.

**In 2013 Internal and External Trainings:**
A training course on QA and Nuclear Safety to **99** F4E Colleagues and a specific Nuclear Safety training to around **40** technical and management staff of some suppliers (AMW,..)
3. QA and Nuclear Safety Trainings

Program of 2014 *Internal and External Trainings*

1. IO Trainings to more than **100 F4E** Staff Members on Nuclear Safety Culture (30/01/2014) and ITER Safety Requirements (8/04/2014 and 29/04/2014)
2. IO Training to F4E Staff on 2-8/07/2014 on INB Order of 07/02/2012
3. F4E Internal Trainings on Nuclear Safety and QA to 6 different groups
4. F4E External Trainings on Nuclear Safety and QA to Companies: IDOM, SRS, working on design of primary confinement boundary
5. F4E External Presentations on Nuclear Safety and QA during Kick-off meetings: Associations and Companies

**GOAL IMPROVE NUCLEAR SAFETY CULTURE ON ITER PROJECT**
3. Management of PIC/SIC related activities: F4E organization and resources

- **Management System and Organisational Improvement**
  - Vincenzo Esposito

- **Internal Audit Capability**

- **F4E Director**
  - Henrik Bindslev

- **Legal Service**
  - Acting: Radoslav Hanak

- **Communication and Stakeholder Relations**
  - Stavros Chatziapanagiotou

- **Planning and Monitoring**
  - Federico Casci

- **Nuclear Safety Teams**

- **QA Officers (QAO)**

- **Management of PIC/SIC related activities**

- **F4E organization and resources**

- ** ITER**
  - Jean-Marc Filhol

- **Broader Fusion Development**
  - Pietro Barabaschi

- **Deputy of Head of Department**
  - ...

- **Technical Process Integration**
  - Acting: Stefano Puppin

- **Technical Support Services**
  - Pierre-Yves Chaffard

- **ITERM and Materials Development**
  - Stéphane Potvin

- **Antennas and Plasma Engineering**
  - Gabriella Salone

- **Neutral Beam and ET Power**
  - Supplies and Sources
  - Tullia Bonicelli

- **Remote Handling**
  - Carlo Damiani

- **Cryoplant and Fuel Cycle**
  - Alain Teissier

- **Site and Building and Power**
  - Supplies
  - Laurent Schneider

- **Advisor and ITER Manager**
  - Susana Clement Lorenzo

- **IFMIF**
  - Roland Feldinger

- **IFMIF**
  - Roland Feldinger

- **Finance**
  - Javier Roc Martinez

- **Information and Communication Technology**
  - Massimo Capra

- **Accounting Officer**
  - Roberto Abad Villanueva

- **Human Resources**
  - Poloma Alvarez Hidalgo

- **Contract and Procurement**
  - Leonardo Biagioli

- **Human Resources**
  - Poloma Alvarez Hidalgo

- **Planning and Monitoring**
  - Federico Casci

LEGEND:

- Senior Management: Head of Department

- ITER Project Manager
- Head of Unit
- Advisor
- Function

16 March 2014
More than 10 Inspections of ASN since July 2011 at Cadarache ITER Site and Suppliers:

1. Improvement of Nuclear Safety Culture  ➔  F4E has a Specific Training Program for 2014 and put Nuclear Safety as a Top Priority!

2. Management of Non Conformities ➔  F4E updates QA 115

3. Supervision of the Supply Chain ➔  F4E Nuclear Safety in Collaboration with QA is doing a strict follow-up.

4. Integration of Lessons Learned from Other International projects ➔  F4E participates to several high level meetings/Conferences/Workshops with IAEA , OECD, International Nuclear Conferences...
Thank you for your attention

any questions?