



LESSONS LEARNED AFTER FUKUSHIMA AND NUCLEAR ACCEPTANCE

Washington
2012 december



LESSONS LEARNED AFTER FUKUSHIMA

2 MAIN LESSONS LEARNED AFTER FUKUSHIMA:

- The first one relative to the necessity of regular safety improvements, but also to the conditions for nuclear acceptance and so the improvements to be implemented with regard to robustness of design and resilience of organizations
- The second one relative to the reinforcement of the nuclear governance worldwide.

LESSONS LEARNED AFTER FUKUSHIMA : INDUSTRIAL MODEL AND NUCLEAR ACCEPTANCE

→ Necessity for plants built for decades to get regular design improvements :

- ▶ To take into account the incidents and accidents: TMI, Tchernobyl
- ▶ To take into account the progress of knowledge
- ▶ To take into account the evolution of the environment

→ Necessity for an operator to be able to master operation AND design

→ Nuclear acceptance = no long term contamination of territories, whatever the events



LESSONS LEARNED AFTER FUKUSHIMA : INDUSTRIAL MODEL AND NUCLEAR ACCEPTANCE

➔ What we have already done before Fukushima:

- ▶ After TMI and Tchernobyl: passive hydrogen recombiner, sand filter retaining 99,9% of Cesium
- ▶ 10 years nuclear safety reinforcement: modelisation of torsion effect due to seism, modifications leading to a reduction of risk of core melting due to internal events by a factor 10. stringent « non conformance » policy.
- ▶ Reinforcement of the design of our plants after the first french tropical storm in 1999



LESSONS LEARNED AFTER FUKUSHIMA: INDUSTRIAL MODEL AND NUCLEAR ACCEPTANCE

➔ What we are going to do after Fukushima: to make long term contamination of territories IMPOSSIBLE, thanks to Complementary Safety Assessments (ECS) :

- ▶ To increase ROBUSTNESS of our plants inside original design frame: by protecting the key safety functions preventing core melting
- ▶ To develop ROBUSTNESS of our plants far beyond the original design through the design of a « hardened safety core », a set of systems, structures and components designed to prevent large radioactive releases to environment in extreme conditions
- ▶ To be able to be prepared for the unforeseeable: through the strengthening of the RESILIENCE of our organisations: Nuclear Rapid Response Force (FARN)

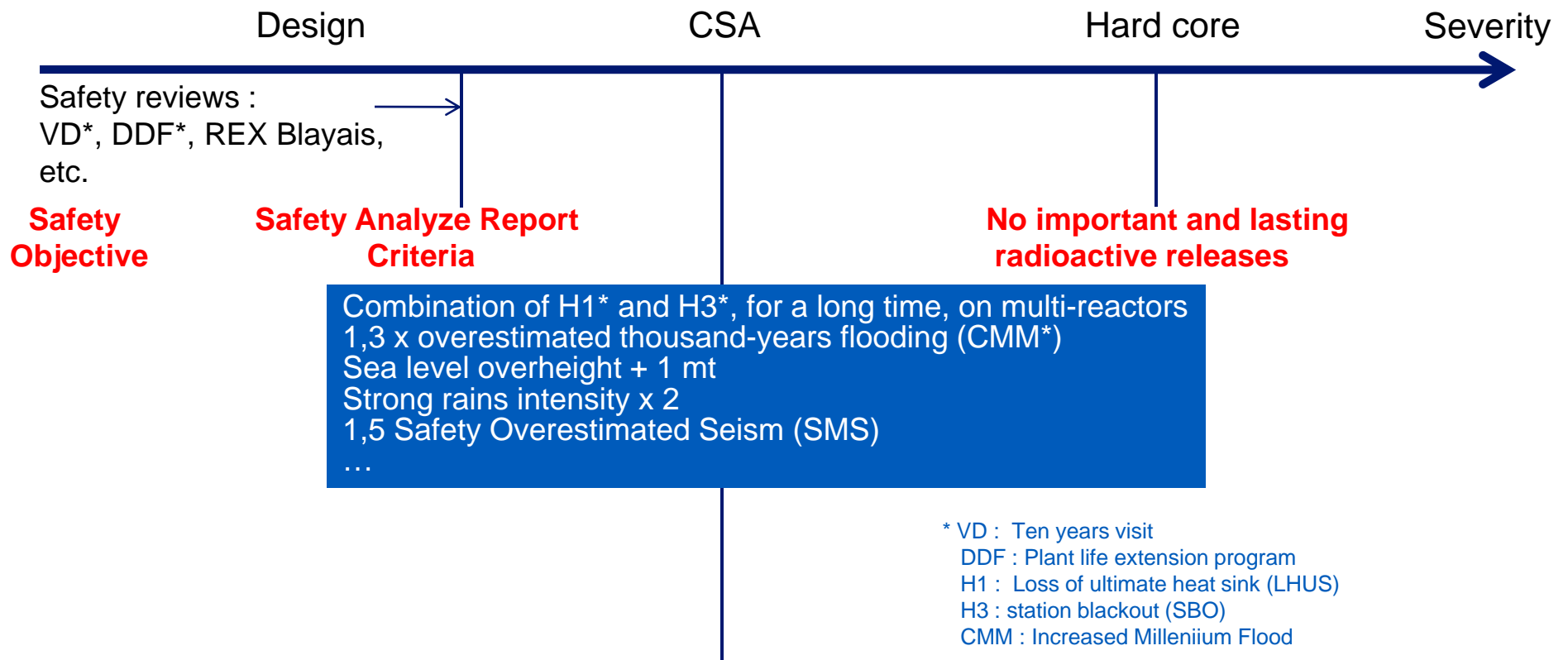


THE 4 ACTIONS RESULTING FROM THESE CSA

- Nr 1** → **Reinforce** the physical protections of the plants to cope with extreme external hazards (Seism, flooding,..).
- Nr 2** → **Reinforce** water make-up and electricity supply.
- Nr 3** → **Limit** as much as possible the radioactive releases in case of a severe accident (no major and sustainable contamination of the region).
- Nr 4** → **Reinforce** the Emergency Crisis Organization on sites and on the national level (human resources and equipment).



THE « POST-FUKUSHIMA » GENERAL APPROACH



For these CSA levels, in case by case :

- ▶ either integration during the next safety review in the referential : example margins required by the new flooding guide,
- ▶ either increase the robustness of some equipments : to prevent H1, H3
- ▶ either protection by hard core

IMPLEMENTATION IN 3 PHASES EDF FLEET(1/2)

2012 – 2015

- **Phase 1 : At short term to cover by temporary means the situation « H1 and H3 multi-units and duration over the actual referential », in line with international trend**
- ▶ Develop short term post-CSA measures: crisis management, crisis local means, temporary extra diesel generator, etc.
 - ▶ Coherent phase with the measures taken at international (mobiles equipments and means : FLEX...)
 - Multi units and long duration crisis management means : crisis organization, local crisis means, safety mobil equipments, connections, communications means, ...
 - Temporary EDGs, temporary ultimate make-up
 - FARN implementation and other supplementary crisis means.

2015 – 2019

- **Phase 2 : To cover by definitives means the situations « H1 and H3 multi-units and duration over the actual referential »,**
- ▶ For these situations, improvement of the robustness of the safeguard functions (RIS, EAS, ASG, etc) beyond current design, first by setting in place Ultimate EDG (DUS) and ultimate make-up
 - ▶ Progressive implementation of the hard core SSC (System Structures and Components), having a robustness increased to the aggressions (of which DUS, ultimate make-up)

The 2 first phases allow a significant increase of safety level, by managing certain extrem situations beyond the actual referential and directly coming from Fukushima experience feedback

IMPLEMENTATION IN 3 PHASES EDF FLEET(2/2)

2019 – 2025

- ➔ **Phase 3** : The ultimate safety net 'hardcore' allowing, in the most extrem situation largely beyond the referential, to avoid massive and durable radioactive releases in the environment.

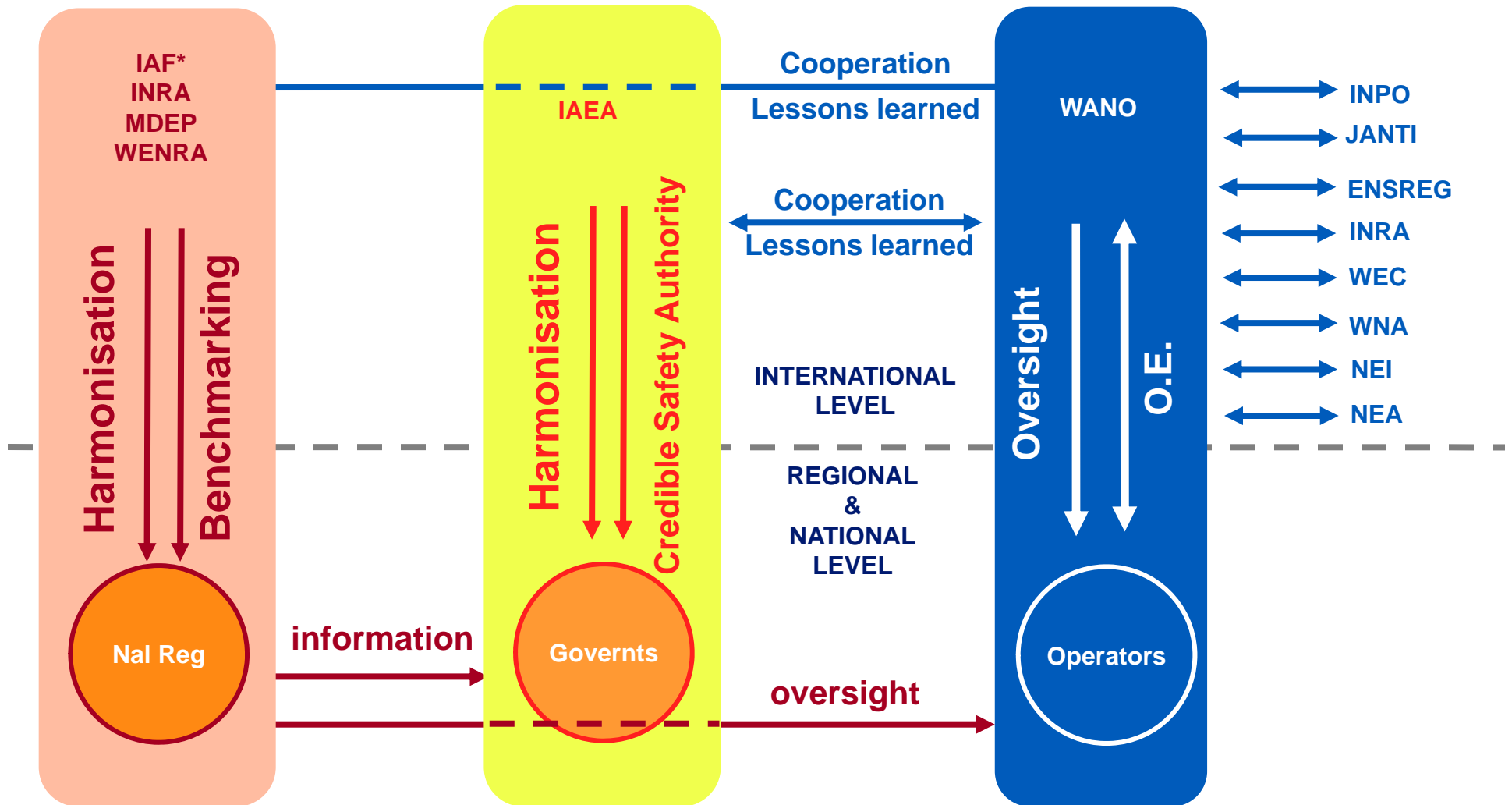


LESSONS LEARNED AFTER FUKUSHIMA : NEW GOVERNANCE OF NUCLEAR SAFETY WORLDWIDE

- ➔ A nuclear accident anywhere is a nuclear accident everywhere. Collective responsibility for nuclear safety
- ➔ Necessity of strengthening nuclear safety worldwide risk could be in front of us and not behind us
- ➔ Necessity to support strong nuclear policies and control at different levels:
 - ▶ States level: through IAEA stronger policies, with more oversight control
 - ▶ Nuclear Safety Authority level: through harmonization of practices and requirements through international organizations like WENRA, INRA
 - ▶ Operators level : through strengthening of WANO



LESSONS LEARNED AFTER FUKUSHIMA : NEW GOVERNANCE OF NUCLEAR SAFETY WORLDWIDE



* : Ibero American Foro

LESSONS LEARNED AFTER FUKUSHIMA : WANO IS OUR COLLECTIVE INSURANCE

→ Importance of WANO Post Fukushima Commission (PFK) set-up in April 2011 to propose changes inside WANO

→ PFK Commission proposed 5 major changes:

- ▶ To expand scope of WANO programs to design and accident management
- ▶ To set-up an event response strategy
- ▶ To increase WANO credibility (stronger internal control)
- ▶ To increase Transparency (WANO regular reports accessible to public)
- ▶ To increase internal consistency between the 4 Centers



→ PFK Commission recommendations endorsed unanimously in last BGM in November 2011. Then, necessity to speed up the implementation of the recommendations: 12 working groups set-up under Oversight Committee control.

→ Strong support from EDF: Involvement in all the working groups, one CNO from EDF Energy full time appointed on.