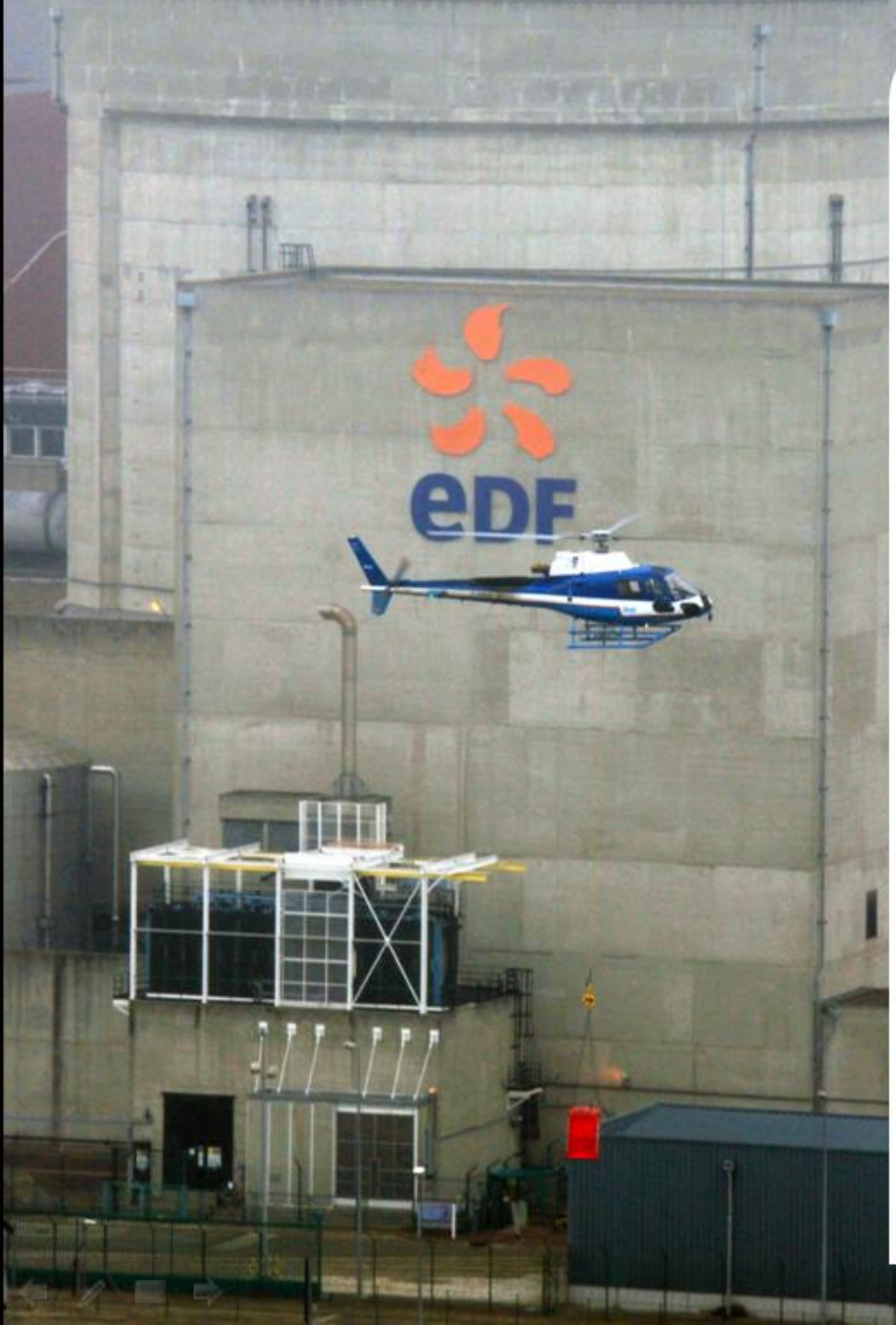
Mary Stuart , Queen of Scotland arrived in France in 1548 in my home town of Roscoff in Brittany

In 1548, Mary Stuart, the 6-year Queen of Scotland and future Queen of France landed in Roscoff

All that remains today is a door and a stoup embedded in the wall of a house now called 'Mary Stuart's house' even though this house dates from late 6th century, after the Queen's visit.



Post Fukushima: Lessons and challenges for a nuclear utility

Bernard LE-GUEN

Background

11 March 2011: Earthquake off the coast of Fukushima followed by a tsunami

Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
2011										2012	

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5 May: Regulator decision on supplementary safety reviews

Basic principle: Defence-in-depth

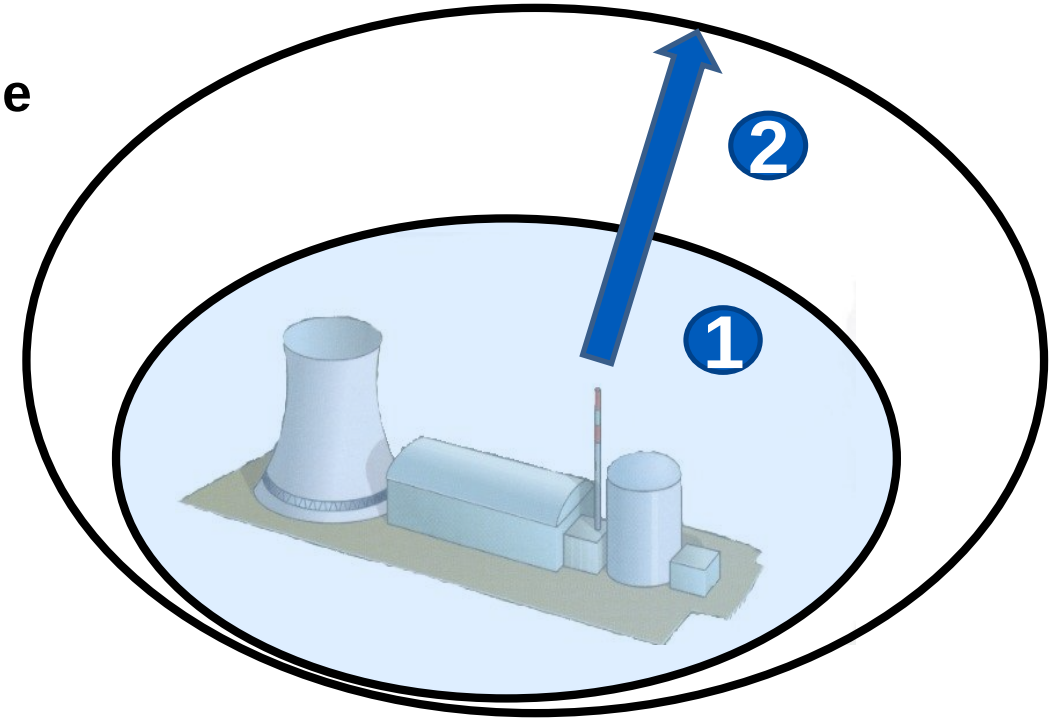
- **3 design and operating barriers fulfil safety functions on nuclear power plants:**
  - **1st barrier**: protection systems designed to safeguard the plant against natural events (earthquakes, floods , winds, etc.)
  - **2nd barrier**: equipment and safeguards designed to deal with loss of cooling water or electrical power (**emergency diesels, emergency fire-protection systems, etc**.)
  - **3rd barrier**: safeguards designed to mitigate the consequences of fuel and containment damage (**hydrogen recombiners, caesium filters, etc**.)

- **In the event of a significant disruption, the emergency planning and preparedness scheme would provide an additional barrier, supported by the necessary human and technical resources.**

ECS reviews: a two-pronged approach

6 review areas (specified by the regulatory authority):

- Earthquakes
- Flooding
- Loss of heat sink
- Loss of power
- Severe accident management
- Contractors



1 **In-depth review of existing barriers <u>with regard to conditions postulated at the time of design</u>:**

- Protection systems, dikes, embankments, anchor points, diesel generators, cooling water supplies, etc.
- All systems supporting the safety case

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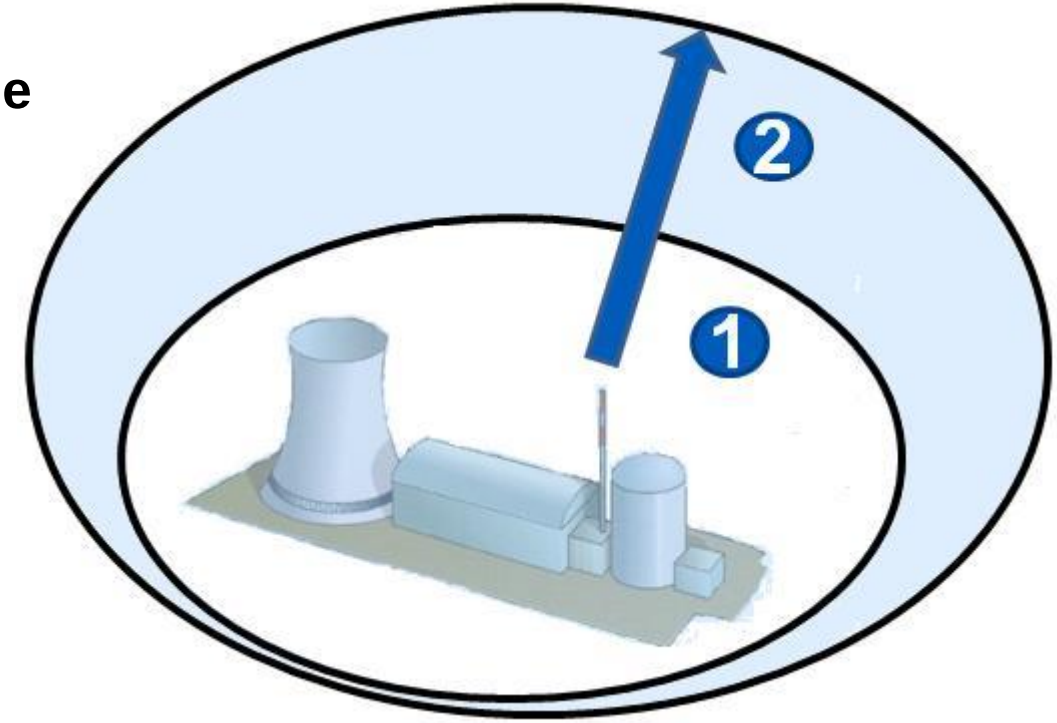


2

New assessment <u>beyond conditions postulated at the time of design</u>:

- Management of extreme conditions regardless of likelihood
- Organisational arrangements and equipment items required in extreme conditions to prevent massive radioactive releases like those that occurred at Fukushima**:** Prevention of core melt risk, radioactive release mitigation and emergency management.

4 measures selected for deployment further to assessments

- **Bolstering** systems designed to protect plant facilities against external hazards (earthquakes and flooding, etc.)

Examples:

- **Reinforced or raised embankments,** enhanced building integrity
- **Reinforced switchyard flood protection**
- **Greater earthquake resistance for electrical components**
- **Reinforced support structures and anchor points**

4 measures selected for deployment further to assessments

- **Bolstering** systems designed to protect plant facilities against external hazards (earthquakes and flooding, etc.)

- **Increasing** cooling water and power supply capacity.

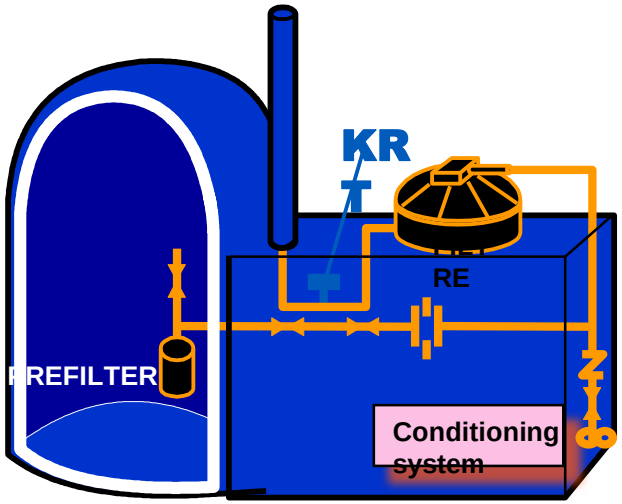
  Examples:

  - **Electrical power: Last-resort diesel generator**
  - **Water: Last-resort water supply for steam generators, the primary circuit or the fuel pond (residual heat removal)**

4 measures selected for deployment further to assessments

- **Bolstering** systems designed to protect plant facilities against external hazards (earthquakes and flooding, etc.)
- **Increasing** cooling water and power supply capacity

- **Minimizing** radioactive releases in the event of a severe accident (to avoid significant long-term contamination of surrounding areas)
  - **Reinforcing and upgrading the filtration system in the event of loss of pressure inside containment**



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  - **Basic pH in containment sumps (iodine retention)**
  - **Development of additional countermeasures to protect the water table against corium**

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- **Bolstering** on-site and corporate emergency planning arrangements (human and technical resources).

Bolstering emergency planning arrangements (human and technical resources)

- **Improving skills of personnel permanently present on site**
- **Optimised arrangements and procedures**

- Exercises and training courses; increased equipment operability and reliability,

- **Local emergency control centre:**

- More robust emergency management premises, designed to cope with an emergency affecting the whole station over a long period

- **“Plug and play” water and electricity supplies**
- **Nuclear accident strike force (FARN)**

FARN responds as part of the corporate emergency arrangements

- The decision to mobilize FARN is taken by the corporate emergency director at the request of the affected power station's director.
- The director of the affected power station remains the nuclear operator.
- FARN members are **EDF** personnel and are dedicated to this force
- FARN responders officiate in strict **compliance with the emergency regulations**
- FARN must be able to act in complete autonomy for several days on a partially destroyed station

FARN: an entity comprising more than 300 people with national and regional coverage

1 lead team consisting of approx. 30 people

4 bases on NPP (Civaux, Paluel, Dampierre, Bugey) ≈60 p / NPP

4 short-term equipment bases

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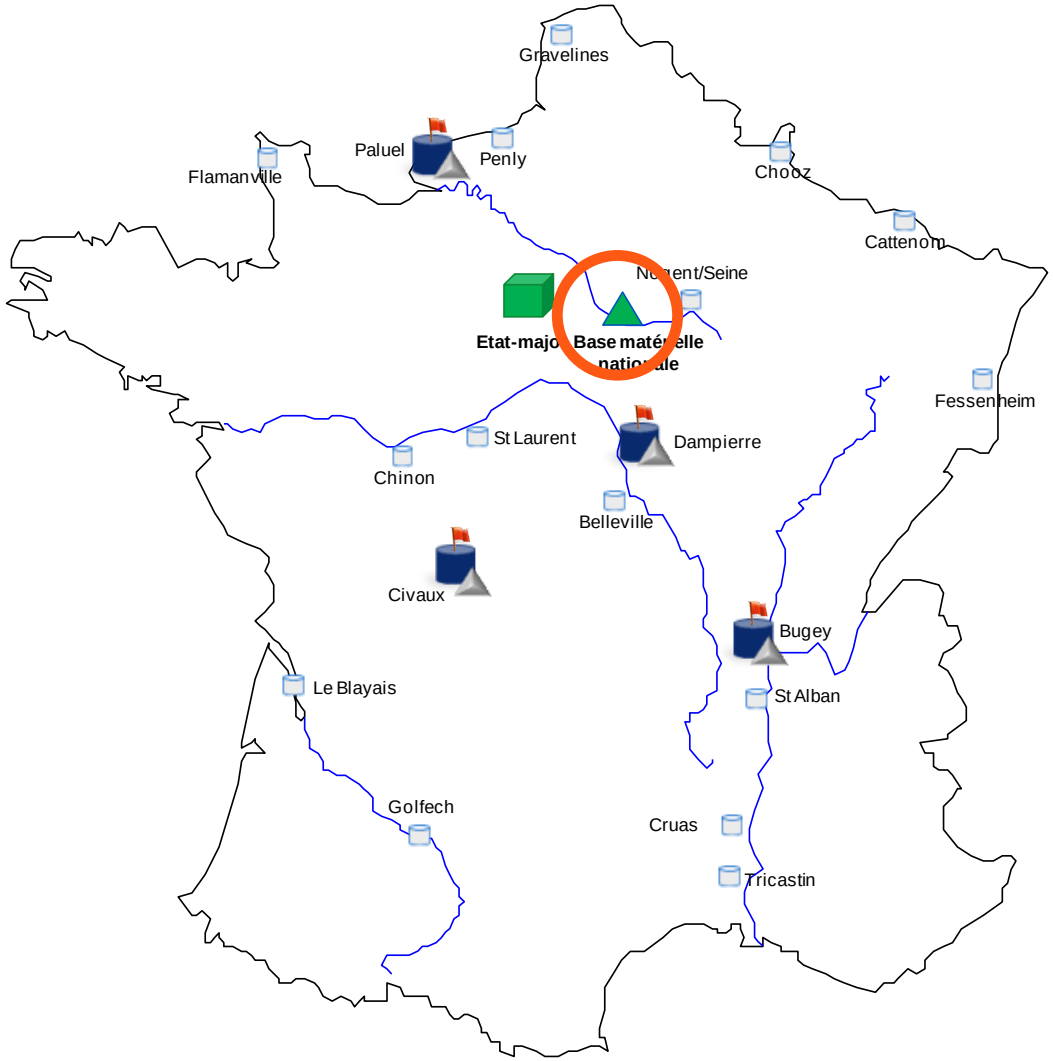

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1 long-term equipment base

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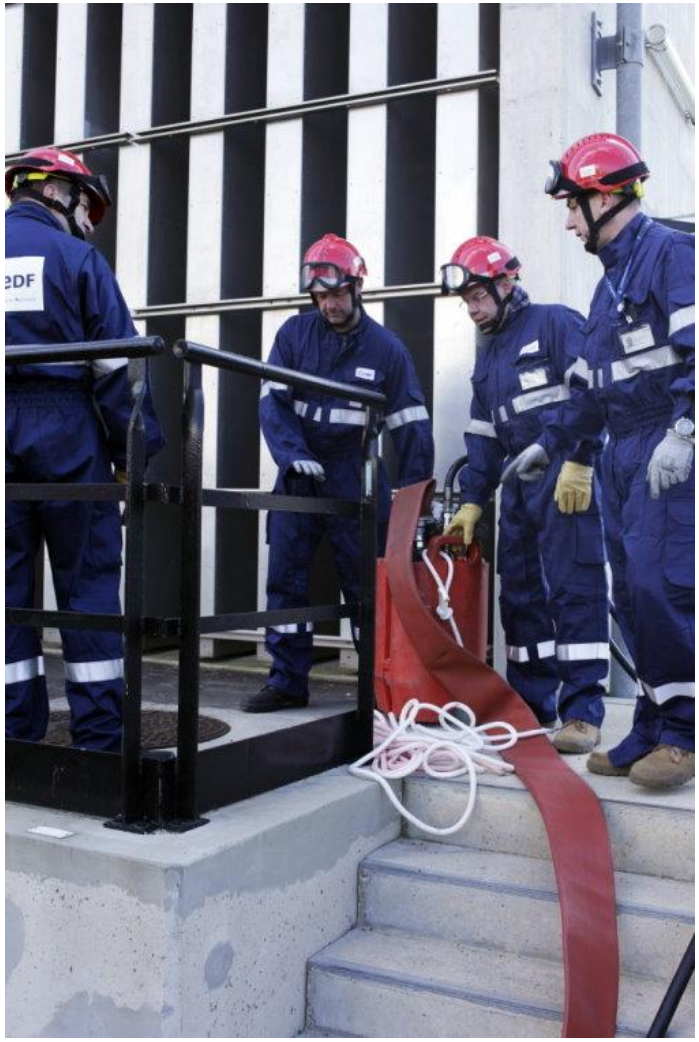
4 short-term equipment bases

FARN aims

- Responding to the needs of a station facing an emergency in order to restore water and electricity supplies within less than 24 hours, thus helping to:
  - Mitigate worsening conditions
  - Contain any radioactive effluent or waste (e.g. reinjection of effluent into containment)
  - Avoid core meltdown

- **Taking over from plant crews.**



Response based on the following assumptions

Nagaoka Japan – 16 July 2007

- Large-scale destruction of infrastructures including access

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Nagaoka Japan – 16 July 2007

- Large-scale destruction of infrastructures including access

- On-call teams of affected station potentially not operational
- Combination of chemical and radiological hazards

The nuclear accident strike force is deployed as part of a pre-planned process

FARN members are not liquidators but professional emergency responders. They are trained and equipped to perform this duty.

The nuclear accident strike force is deployed as part of a pre-planned process

Mobilize
- One national team and 4 regional teams on base stations (Civaux, Dampierre, Bugey and Paluel)

Assess
- Situation on the station
- Positioning of rear base (10 to 30 km)

Act
- Restoring water and power supply to plant facilities
- Plug & play connections
- Responding within less than 24 hours and relieving operations crews after 24 hours

Deploy
- Large-scale resources in 3-4 days: diesel generators, pumps, C2 contamination monitors, whole-body counters

Plan
- Longer-term handling of the situation (water production, effluent and waste treatment, etc.)

For each station, a number of sites able to accommodate rear bases have been identified

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Conclusion