

DE LA RECHERCHE À L'INDUSTRIE



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# Earthquake Hazard and nuclear facilities

December 12th – ENC Manchester

- Is there a need to take into account the seismic hazard?
  - Earthquake : a real and current risk
  - Nuclear energy growth
- On which parameters could we act?
  - Knowledge on seismic hazard
  - Seismic design :
    - New facilities
    - Old facilities
  - Seismic monitoring
  - Emergency preparedness
- how the earthquake arising risks are taken into account?
  - Flooding, tsunami
  - Fire, ...
- What is the regulatory body role in this process?

## Is there a need to take into account the seismic hazard ?

- Earthquake : a natural hazard that can't be avoid

From ages until now, earthquakes can cause damages on infrastructures, ...



# Is there a need to take into account the seismic hazard ?

..., buildings, ...



Haiti 2010



France 1909

...and nuclear facilities too.



Kashiwasaki-Kariwa 2007

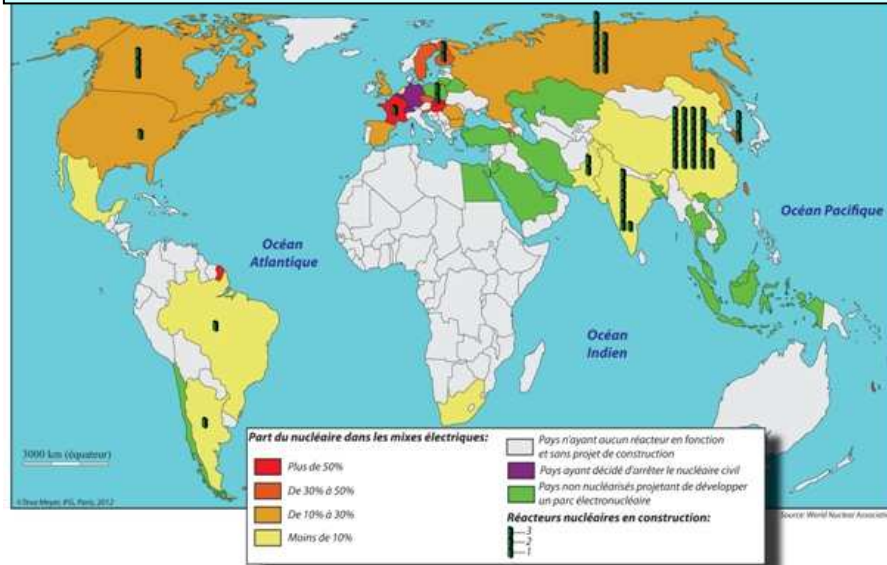
## It's a real and current risk



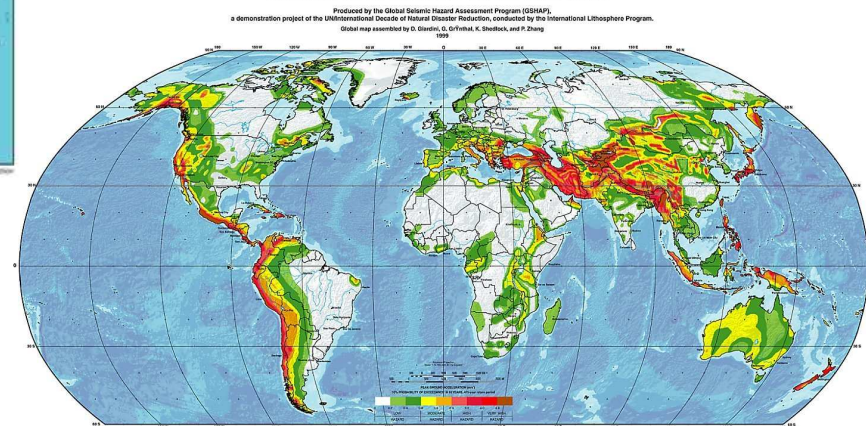
# Is there a need to take into account the seismic hazard ?

## Projected growth for Nuclear energy

### Nuclear energy in the world (2012)




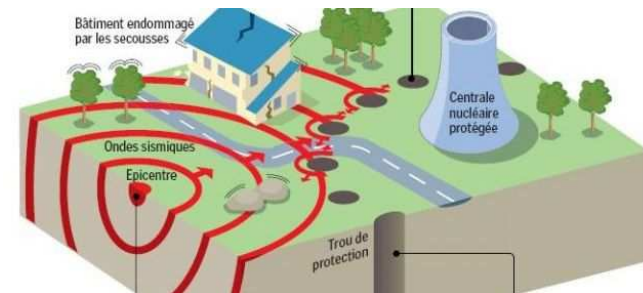
### GLOBAL SEISMIC HAZARD MAP



# On which parameters could we act?

It's not possible to act on earthquake itself, but ...

- Research and development **lead to improve the knowledge on the seismic hazard** :
  - Better understanding of the phenomenon,
  - Better estimate of seismic risk,
  - Development of new prevention/protection devices (monitoring, ...)
- To be continue  In the future :
  - Will we be able to deflect earthquakes ?
  - Will we be able to predict earthquakes ?
  - ...



# On which parameters could we act?

- Seismic design

- Facilities sitting

Soil liquefaction



Soil analysis

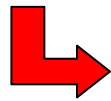
# On which parameters could we act?

- Seismic design

- Safety framework – seismic building codes

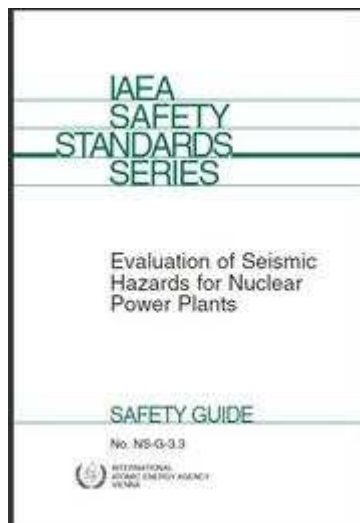
France :

- RFS 2001-01
- ASN 2/01 guideline



Design margins

International standards



Agate



RJH



# On which parameters could we act?

- Seismic design

- Strategy regarding old facilities : safety reassessment

- Strengthening



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# On which parameters could we act?

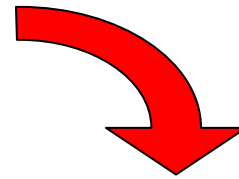
- Seismic design

- Strategy regarding old facilities : safety reassessment

- New facility building



MCMF



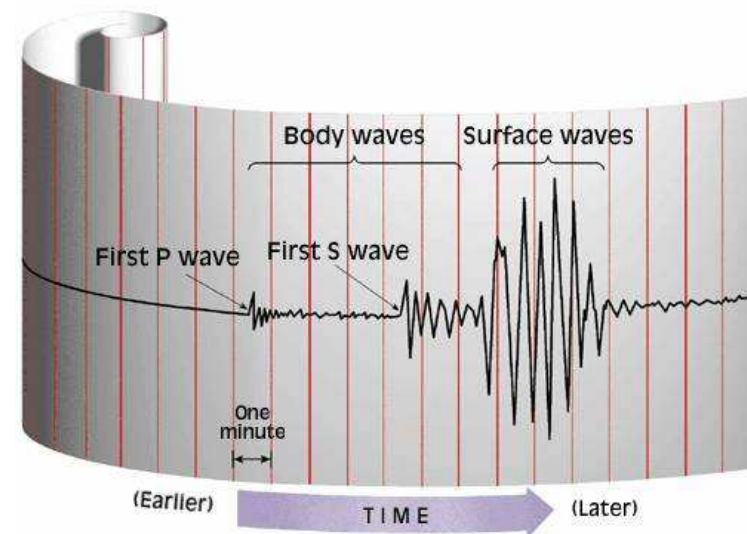
MAGENTA



# On which parameters could we act?

- Seismic monitoring


- Automatic protective actions
- Information for emergency response forces
- Records for post event analysis



# On which parameters could we act?

- Emergency preparedness

Should be taken into account :

- severely damaged infrastructure,
  - Roads,
  - Power supply,
  - Water supply,
  - ...
- That several facilities could be affected in the same time,
- The need to carry out exercises at **local** and **national** level,
  -  Training people and organisation at different level
- The need to share information



# How the earthquake arising risk are take into account?

- An earthquake could have :
  - Direct consequences :
    - Building damage,
    - Equipment damage,
    - People injured,
    - ...
  - Arising consequences :
    - Flooding, tsunami
    - Fire,
    - ...



- The design and the safety framework have to consider that earthquake and other event can combine.

## What is the regulatory body role in this process ?

- As in other fields the regulatory body has to :
  - Regulate
  - Authorize
  - Control the effective implementation of the safety framework
  - Participate in the crisis management
  - Ensure the public information



Necessity to have :

- Authority,
- Competence,
- Resources

**THANK YOU FOR YOUR  
ATTENTION**

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