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The EU-Stresstest

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Nuclear power plants in Europe as of 25.05.2014

Reactors in operation:

• Europe (West):	117 KKW	113,5 GW el.
• Europe (Middle and east):	68 KKW	48,6 GW el.

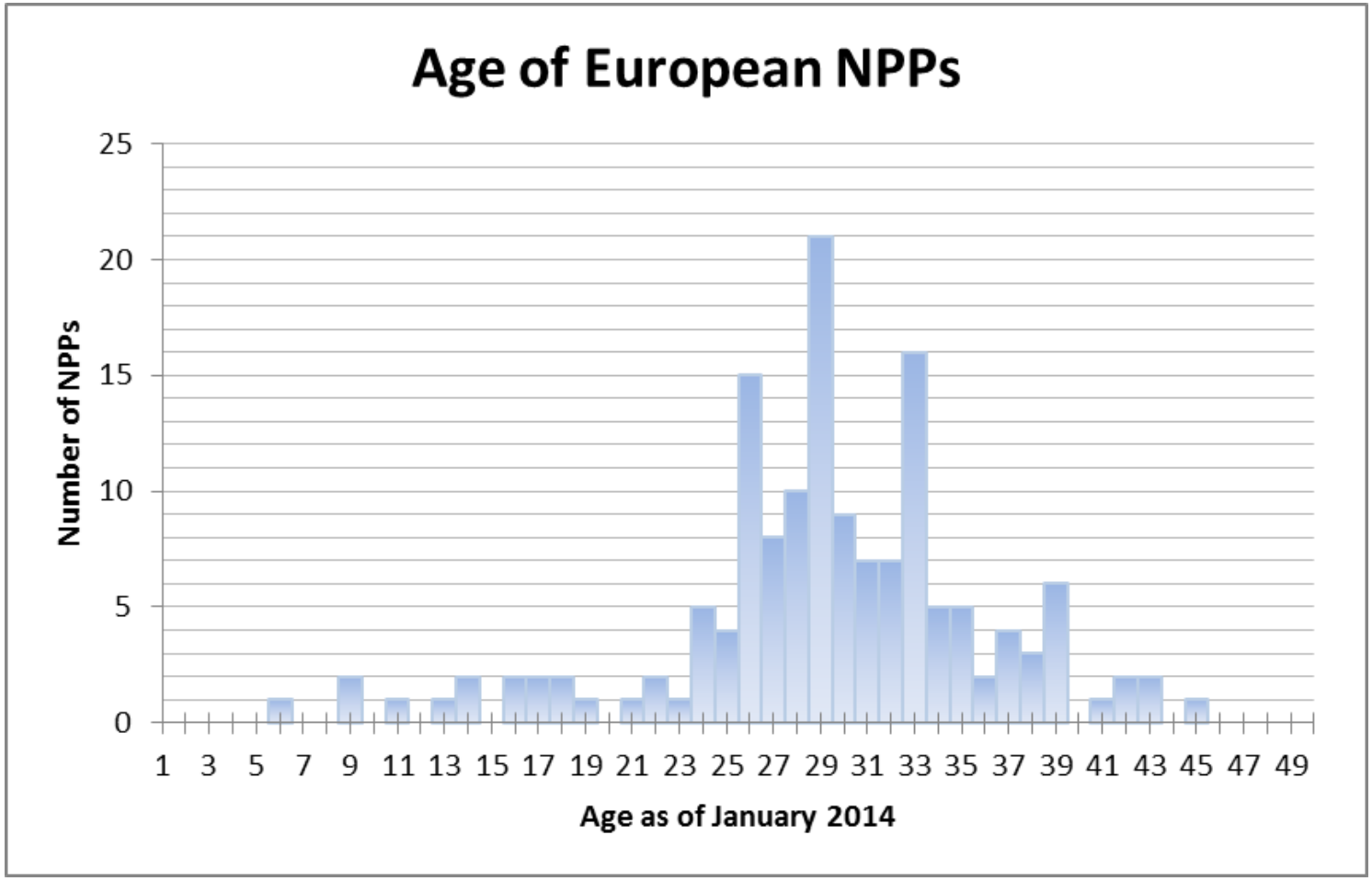
Under construction:

• Europa (West):	2 KKW	3,2 GW el.
• Europa (Middle and east):	15 KKW	12,3 GW el.

Shut-down:

• Europa (West):	80 KKW	25,6 GW el.
• Europa (Middle and east):	20 KKW	9,6 GW el.

Age distribution of european reactors



Data: IAEA PRIS

Initiation of EU-Stresstests

Request by the European Council 24./25.03.2011:

“… the safety of all EU nuclear plants should be reviewed, on the basis of a comprehensive and transparent risk assessment ("stress tests"); …”

Source: EUCO 10/11 (paragraph 31)

Implementation of the EU-Stresstests

Specification of EU-Stresstests by European Nuclear Safety Regulators Group (ENSREG) (31.05.2011):

- Methodology
- Scope
- Timeline
- Required Reports
- Peer Review System

Nuclear Security to be assessed by Ad-Hoc Group Nuclear Security (AHGNS)

Methodology of the EU-Stresstests

Analysis of

- Initiating (external) events
  - Earthquake
  - Flooding
  - Extreme weather situations
- Postulated loss of safety functions
  - Loss of electrical power (external and internal)
  - Loss of Ultimate heat sink and combination with SBO
- Severe Accident management issues

But: No comprehensive assessment (no internal events, safety culture …)

Methodology of the EU-Stresstests

- Provisions taken in the Design design basis
- Assessment of the robustness of the plants and identification of cliff edge effects
- Identification of potential for modifications to enhance safety

- Covering core cooling as well as spent fuel pool cooling
- Covering all operational states

But: Focus was clearly on „Robustness“, revision of Design basis was not in focus

Timeline of the EU-Stresstests

- 01.06.2011: National regulators request operators to perform stress test
- 31.10.2011: operators deliver reports
- Check of reports by national regulators
- 31.12.2011: National regulators deliver reports
- Peer Review process
- 25.04.2012: Peer Review Reports to ENSREG
- Oktober 2012: Joint ENSREG/EU-Statement

But: very tight schedule, use of existing documentation required, often assessment relys on „expert judgment“

Peer Review

- Review of National Reports by Topics
  - Writen Questions (>2000) to national regulators
  - Workshop in Luxembourg in February 2012 (> 90 Experts)
- Country Visits
  - 4-5 Days per country
  - One plant site per country (until september 2012 8 additional sites)
- 3 Topical Reports
- 17 Country Reports

Only very limited site visits, but accompanying country specific review processes

Transparency

- Information sessions open to general public
- Publication of results via ENSREG-Website:
  - Many (but not all) plant specific reports by operators
  - All National Reports
  - All Peer Review Reports
  - ENSREG Conclusions and Recommendations

Recommendation of the EU/ENSREG Joint Statement

ENSREG and EU-Commission identify four major aspects for safety enhancements

- Issuing WENRA guidance with the contribution of the best available EU expertise on assessment of natural hazards and margins taking account of the existing IAEA guidelines
- Underlining the importance of Periodic Safety Review
- Implementing the recognised measures to protect containment integrity
- Minimising accidents resulting from natural hazards and limiting their consequences

51 additional recommendations and best practices

Source: Joint statement of ENSREG and the European Commission. 26 April 2012

Example Periodic Safety Review

- Periodic review of design basis
- As often as appropriate but at least every 10 years
- Including re-evaluation of natural hazards

Examples of Recommendations for External Events

- Use of a return frequency of 10^{-4} per annum
  - Expample:
    France: no PSA for exteral events up to now,
    Romania: 1000 year return periode for earthquakes
  - Example:
    Beglium (Tihange) 400 year return periode for flooding,
    Netherlands (Borselle) 4.000 year return periode for flooding
- Consideration of secondary effects
  - Fires or flooding due to earthquakes
- Enhancement of seismic instrumentation
- Development of WENRA Reference Level T and Guidances

Enhancement of Containment function

- Filtered venting systems
  - Concerns Belgium, Romania, Slowakia, Spain …
- Measures for hydrogen management
  - Inertisation of Containment or passive autocatalytic recombiners (PAR)
    - PAR in some countries only for DBA
- Insufficient measures for primary system pressure control

→ Severe accident management measures not yet (sufficiently) implemented

Further measures to enhance safety

- Robust safety systems (bunkered systems)
- Diverse ultimate heat sink (wells, lakes …)
- SAMGs
- Mobile equipement and storage
- Plannings for external support
- Impact on neighboring plants

→ But: many measures recommended as „Good Practice“, not mandatory to implement everywhere (yet)

Follow-Up

- April 2012 formal end of EU-Stresstes
- 31.12.2012: National Action Plans of all countries
  - Drawn Conclusions
  - Recommendations of ENSREG
  - Recommendations of CNS 2012
- April 2013: Public Presentation of National Action Plans in Bruxelles
- Continuous work on National Action Plans and Implementation status
- Aim: Implementation of all measures until 2020
- Last update of National Action Plans End of 2014

Follow-Up

- 2014: Amendment of EU safety directive
  - Enhance independance of regulatory body
  - Avoidance of severe accidents with large or early releases
  - Introduction of Peer-Reviews (Start 2017, at least every 6 years)
  - Enhance transparency
  - Periodic safety review (at least every 10 years)

Remember

Causes of Fukushima according to TEPCO:

- *it was assumed, that severe accidents have a low chance of occurrence*
- *there were concerns about liability issues and public anxiety if severe accident measures were implemented and*
- *there was a fear of plant shut down for the time until measures are implemented*

→ Mandatory, short term and comprehensive implementation of identified safety enhancements absolutely essential

Source: Tepco Nuclear Reform Special Task Force: Fundamental Policy for the Reform of TEPCO Nuclear Power Organization. October 12, 2012