



What are the impacts of the Fukushima accident to the German NPP?

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Time schedule - part 1

- ▶ **2011-03-11:** Earthquake and Tsunami in Japan
- ▶ **2011-03-15:** Moratorium and switch-off of all 8 “old” NPP through the German Government
- ▶ **2011-03-22:** Set-up of an Ethic Commission to evaluate the impact of NPPs on the community
- ▶ **2011-03-22:** Order to the Reactor Safety Commission (RSK) for the safety review of German NPP

- ▶ **2011-05-17:** RSK provides the safety review
- ▶ **2011-05-30:** Ethic Commission gives their final report

RSK results of the safety review

Conclusion

- ▶ It follows from the insights gained from Fukushima with respect to the design of these plants that regarding the electricity supply and the consideration of external flooding events, a higher level of precaution can be ascertained for German plants.
- ▶ The RSK has furthermore reviewed the robustness of German plants with respect to other important assessment topics.
- ▶ The assessment of the nuclear power plants regarding the selected impacts shows that for the topic areas considered, there is no general result for all plants in dependence of type, age of the plant, and generation.
- ▶ The existing plant-specific design differences according to the current state of licensing were only partially considered by the RSK. Plants that originally had a less robust design were back fitted with partly autonomous emergency systems to ensure vital functions. In the robustness assessment performed here, this selectively leads to evidentially high degrees of robustness.

Results of the Ethic Commission

Conclusion

- ▶ **The Ethic Commission suggest the switch-off of all German NPPS within 10 years:**

“The phasing out of nuclear energy is necessary and recommended to exclude the risks of the German nuclear energy in the future. It is possible, because there are low-risk alternatives. The phasing out shall be designed in a way, that the competitive ability of the industry and business location is not endangered.”

- ▶ **The Ethic Commission requires, that electric power shall be still affordable and that the German climatic targets shall not be endangered.**

No recommendations were given by the Ethic Commission for the case, if these targets will not be reached.

Time schedule - part 2

- ▶ **2011-06-06:** German Cabinet decides to change the Atomic Energy Act
- ▶ **2011-06-30:** German Bundestag decides to switch-off of all German NPP until 2022 (all 8 “old” NPP stays switched-off)
 - KKG until 2015
 - KRB-B/-C until 2017
 - KKP-2 until 2019
 - KBR, KWG until 2021
 - GKN-2, KKI-2, KKE (KONVOI) until 2022
- ▶ **2011-07-08:** German Bundesrat finally approves switch-off

Some obvious problems

▶ German electric power mix

2010: Coal: 42.5% NPP: 22.5% Gas: 13.5% Renewable: 17% Other:4.5%

2022: Coal: 42,5% NPP: **0%** Gas: 13,5% Renewable: **35%** Other:4.5%

(+ 4.5 % reduction due to increase of efficiency)

▶ Base load part of German NPP in 2010: 50%

▶ New grid lines required from North to South Germany (from the new wind energy parks in North Sea and Baltic Sea)

▶ Before Fukushima Germany exports about 3.500 MWh per day to neighboring countries. After switch-off of 8 „old“ NPPs now Germany imports 2.500 MWh per day (by the way: 33% from foreign NPPs)

At least one non-obvious problem

- ▶ In 2010 an agreement between German Government and German Utilities for longer lifetime (up to 2040) for the NPP were signed. One point of this agreement were taxes on fuel rods, so almost every German NPP filled up their core with fresh fuel before the taxes were established.

A few month later 8 NPP are switched-off...

No calculation available for almost new fuel rods in the fuel pool. Some NPP cools the rods in the core with the safety systems, some cools the rods in the fuel pool with the fuel pool cooling system.

Several years of cooling required before CASTOR transports are possible.

New approaches to be discussed

► RSK Open Points

- ◆ Investigation of conditions during low-power and shutdown operation
- ◆ Determination of the probabilities that seismic acceleration loads may be exceeded
- ◆ Investigation of critical influences due to flooding of the annulus in PWR plants
- ◆ Examination of precautionary measures to prevent load crashes in the area of the primary system and the fuel pool
- ◆ Investigation of consequential mechanical effects due to an aircraft crash that lead to a limited loss of coolant, e.g. leaks in small pipes
- ◆ Automatic detection of toxic gases

New approaches to be discussed

- ▶ **Independent Expert (TÜV) rises questions**
 - ◆ **What about aftershocks after SSE?**
 - Is the equipment still functional if aftershocks happens?
 - ◆ **Is old I&C equipment still functional under SSE conditions?**
 - Investigations already happens
 - ◆ **Is the border between 1E and N1E in German NPPs right?**
 - E.g. overvoltage detection (Forsmark)
 - ◆ **Electric equipment with electronics has to be qualified like Reactor Protection Systems**
 - Stronger focus on environmental qualification