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European post-Fukushima nuclear stress tests 2015 review of National Action Plans

After the nuclear catastrophe in Fukushima, Japan, started on 11 March 2011, the European Commission and the European Nuclear Regulators Group ENSREG initiated a so-called stress test of all European nuclear power stations. These stress tests resulted in 2013 in National Action Plans.

Greenpeace has over the years critically followed the development of these European post-Fukushima nuclear stress tests. It highlighted already in 2011 that important issues like off-site emergency response and security (protection against sabotage, terrorist attack and acts of war) were prominently missing from the exercise. It published in May 2012 a commissioned independent critical review focusing on 13 nuclear power stations¹: Doel and Tihange (Belgium), Temelín (Czech Republic), Fessenheim, Gravelines and Cattenom (France), Gundremmingen (Germany), Mochovce (Slovakia), Krško (Slovenia), Almaraz (Spain), Ringhals (Sweden), Mühleberg (Switzerland), and Wylfa (UK). A summary with demands was published at the same time.² In 2013, one of the lead-authors of the first study carried out an assessment of the National Action Plans for these nuclear power stations.³ This was accompanied by a briefing with Greenpeace's conclusions.⁴

Two years later, ENSREG asked the national nuclear regulators to give an overview of the stand of implementation of their national action plans and carry out an update. Greenpeace once more asked Oda Becker to assess these plans for the same nuclear power stations. Questions resulting from this analysis have been forwarded to ENSREG to be addressed in its peer-review workshop on the issue.⁵ This briefing gives an overview of concerns that Greenpeace has on the basis of this analysis.

Greenpeace's conclusions about the need to shut down or phase out the assessed reactors have not relaxed, rather sharpened. There are viable alternatives to nuclear power that also help us fight climate change and support other energy goals such as energy independence and affordability⁶. Greenpeace concludes that a nuclear phase-out combined with energy efficiency measures and the development of renewable energy sources is the safest option. Old and risky reactors should be shut down.

- 1 Wenisch, Antonia (†) and Oda Becker, *Critical Review of the EU Stress Test performed on nuclear power plants*, Vienna, Hannover (2012) Greenpeace EU Unit, http://www.greenpeace.org/eu-unit/Global/eu-unit/reports-briefings/2012_pubs/Pubs_2_Apr-Jun/Critical_Review_of_the_EU_Stress_Test_.pdf
- 2 Greenpeace, *Nuclear Stress Tests – flaws, blind spots and complacency*, Brussels (2012) Greenpeace EU Unit, <http://www.greenpeace.org/eu-unit/en/Publications/2012/stress-tests-briefing/>
- 3 Becker, Oda and Patricia Lorenz, *Critical Review of the national Action Plans (NacP) of the EU Stress Tests on Nuclear Power Plants*, Vienna, Hannover (2013), Greenpeace EU Unit, http://www.greenpeace.org/eu-unit/Global/eu-unit/reports-briefings/2013/Report_EU_Stress_Tests_NAcPs.pdf
- 4 Haverkamp, Jan (ed.), *Updated review of EU nuclear stress-tests*, Brussels (2013) Greenpeace EU Unit; <http://www.greenpeace.org/eu-unit/en/Publications/2013/Briefing-Updated-review-of-EU-nuclear-stress-tests/>
- 5 Email dated 28 February 2015. http://www.greenpeace.org/sweden/Global/sweden/karnkraft/dokument/2015/Submission_Greenpeace_FoEEurope_EN_SREG_NAcPs.pdf
- 6 Teske, Sven (ed.), *Energy [R]evolution – a sustainable EU 27 energy outlook*, Brussels (2012) Greenpeace, EREC; <http://www.greenpeace.org/eu-unit/en/Publications/2012/ER-2012/>

An overview of the assessed concerns

All countries

The national action plans in all countries consist of an update of the plans worked out in 2012. **No assessments** were made on the basis **of new lessons** learned from the still ongoing catastrophe in Fukushima Daiichi. Issues like post-emergency radioactive water management; building integrity management; the need for, availability and use of robotic equipment for investigation and measurement work as well as debri-clearing; the need for, availability and use of advanced modelling techniques; the availability of a sufficient, skilled and qualified workforce, and many others have not been taken into account.

Since the formulation of the national action plans, also **no new developments in other nuclear installations** have been taken into account in the updated versions of most countries, like the discovery of large amounts of cracks in the Doel 3 and Tihange 2 reactors in Belgium.

There is no overall picture of which measures from the original action plans have been dropped or whether exemptions were given to certain reactors, and if so, why.

Greenpeace noted further that some actions involved **significant changes to reactors**, which should have been accompanied by an **environmental impact assessment** under the Espoo and Aarhus Conventions and EU Directive 2001/92/EU. It is unclear if this has happened.

The European Council and European Commission started giving attention to the issues of **security** and **off-site emergency preparedness and response**, but both initiatives have silently disappeared from the table without clear, demonstrable improvements.

Greenpeace: *The process of post-Fukushima response in Europe does not give sufficient trust that all lessons learned are incorporated.*

Belgium: Doel and Tihange NPP

Of high concern for Belgium, Netherlands, Germany, Luxembourg, France, the UK

Because the reactors Doel 1 and 2 were originally to be closed down in 2015, the Belgian regulator FANC did not require several of the in the action plan proposed measures for these reactors.

However, Belgium now wants to run them for another 10 years. Because of this change in decisions, several important measures are now proposed to be implemented with a delay.

Earlier promised seismic studies, their conclusions and to be implemented new measures have not been mentioned in the updated plan. There are complications with flood protection and separation of high voltage lines. It is unclear whether ENSREG recommendations concerning extreme weather conditions have been followed. Important safety features like installation of filtered vents are delayed.

Greenpeace: *The oldest reactors Doel 1 and 2 and Tihange 1 should not be operated further and closed this year. Life-time extension and delayed back-fitting cause unacceptable extra and unnecessary risks. There are still concerns about the seismic strength, flood and extreme weather protection of Belgium's nuclear power stations. Doel 3 and Tihange 2 should be closed because of the ongoing crack-issues. Tihange 3 should be taken out of operation until all flood protection and filtered venting measures are implemented. Doel 4 and Tihange 3 should be phased out as soon as possible.*

Czech Republic: Temelín NPP

Of high concern for the Czech Republic, Austria, Germany

The report lacks a lot of detail about the implementation of measures. There is no reference to other documents that can provide this. It looks like the Czech regulator's long time habit of "just trust us" is standing in the way of transparency once more. The potential seriousness of seismic activity remains

obscured in a state of denial. Some implementation has been delayed to 2022. The important issue of re-criticality, mentioned in the first action plan, has disappeared. Many emergency response improvements have been put on hold until some international body suggests action.

Greenpeace: *The continuing lack of clarity in detail severely undermines the credibility of the long lists of actions. Temelin should be phased out as soon as possible.*

France: Fessenheim, Gravelines and Cattenom NPP

Of high concern for France, Germany, Belgium, Luxembourg, Switzerland

It is not clear which structures, systems and components have a too small safety margin for seismic threats and which measures are proposed. The same concerning fire-fighting systems. At Fessenheim, the robustness of the Grand Canal d'Alsace against seismic risk is still unclear and subsequently too little is known about the risk of earthquake induced flooding. The system of alternate ultimate heat-sinks still needs further improvement and there is no clarity about time schedules for implementation. The same for measures to manage thermo-hydraulic developments in the fuel ponds. Filtered venting back-fitting measures have only been studied but not yet implemented as earlier foreseen. The idea to create a geotechnical containment to prevent radioactive contamination of the groundwater is still under review.

Greenpeace: *France is requiring a lot of investments in post-Fukushima upgrades, but there is still a lot of space for improvement. Especially for older reactors it is the question whether these investments make sense, because not all problems can be addressed. Fessenheim and Gravelines should be shut down immediately. Cattenom should be phased out as soon as possible.*

Germany: Gundremmingen NPP

Of high concern for Germany, Austria, Switzerland, France

Seismic evaluations do not seem to have been updated. There is still lack of clarity about which evaluations have taken place and what the results were in the area of flooding and extreme weather conditions. There is still no permanent injection path for extra cooling water into the spent fuel pool in case of a station black-out or loss of heat sink. It is not clear why Gundremmingen does not require a review of the performance of filtered venting systems under severe accident conditions, like other German NPPs. Some or maybe even many of the to be implemented upgrades seem time-wise not to make sense for the relative short time that Gundremmingen still will operate.

Greenpeace: *Given the current lack of clarity on several points and the lack of sense in investment in expensive upgrades because the Gundremmingen reactors are slated for shut-down in 2016 and 2017 anyway, Greenpeace is of the opinion they should be shut down immediately.*

Slovakia: Mochovce NPP

Of high concern for Slovakia, Hungary, Austria, Czech Republic

There is lack of clarity about the outcome of seismic assessments and implementation time schedules. The same for flood protection measurements, protection against extreme weather, accident management in the case of multi-reactor accidents, the conditions of the environment of rooms with safety relevant equipment, and the replacement of seals. It is still unclear whether Mochovce will install filtered vents and extra auto-catalytic re-combiners to decrease the hydrogen risk. Slovakia so far refused to consider the consequences of a reactor pressure vessel failure, against the recommendations of the ENSREG peer-review. Only indicating progress with “completed” or “ongoing” reflects an attitude of “trust us” where transparency is required. What misses are references to documentation that can back up the claims in the report.

Greenpeace: *Crucial issues like filtered venting have not been adequately addressed yet. Given that the power station is based on a design without secondary containment, Greenpeace recommends*

halting the construction of Mochovce 3 and 4 and phasing out the reactors 1 and 2 as soon as possible.

Slovenia: Krško NPP

Of high concern for Slovenia, Croatia, Italy, Hungary, Austria

The high seismic risk at the Krško site is still not taken sufficiently seriously. There is no information about the status of new flood-protection measures, nor of the remaining safety margins. Time schedules for the implementation of extreme weather protection measures are unclear. Several time schedules for implementation of crucial upgrades have been postponed with three years, among others an improvement of the battery system, implementation of a secondary heat-sink, installation of mobile heat exchangers and the installation of a new emergency control room. Even this delay seems to be financially challenging.

Greenpeace: *Given the challenges to implement highly necessary upgrades and the seismic situation of the Krško NPP, Slovenia and Croatia should close it down immediately.*

Spain: Almaraz NPP

Of high concern for Spain and Portugal

In general there is a lack of detail about concrete measures and relevant documentation. There is lack of clarity about the reassessment of seismic risks and possible dam break, management of accidents in initial shutdown situations, the habitability of the control room, and the composition of emergency response organisations. There is no alternative heat-sink and also no plans for that. Not all measures around loss of electricity supply have been demonstrated yet as viable. Implementation of filtered venting will only be finished during a scheduled shut-down in 2017 in order to prevent (income) losses because of an early shut-down. The same for the lacking passive auto-catalytic re-combiners to prevent hydrogen explosions. Hydrogen build-up in general remains problematic.

Greenpeace: *Greenpeace demands that urgent issues like the installation of filtered vents and passive auto-catalytic re-combiners be speeded up and not be postponed to fuel change outages. Greenpeace recommends both units be phased out as soon as possible.*

Sweden: Ringhals NPP

Of high concern for Sweden and Denmark

The update from Sweden contains very little detail information and no references to other documentation. Transparency requires more clarity. Only stating “completed” or “ongoing” is basically giving non-information. Trust and credibility are built by transparency in the form of clarity and references, not by a “trust us” mentality. There are therefore many questions open on the status of many of the action points in the national plan. Implementation of many measures still has to start. This includes issues around seismic, flooding and severe weather hazards, necessary strengthening of AC and DC power, pump sealing, the requirement for an independent cooling system (a requirement from the early 2000s!) and the need for an alternate ultimate heat sink, cooling of the spent fuel pool, functioning of the filtered venting system, long term hydrogen management, operability and habitability of the control rooms, issues of re-criticality and a peculiar unique way of dealing with core melts.

Greenpeace: *Greenpeace has doubts about the seriousness in which the operator and regulatory system in Sweden are dealing with the Fukushima catastrophe. At least the lack and transparency around the implementation of the national action plan gives reason for concern. Given that situation, we believe that the necessary upgrades are not worth the investment any longer and it looks better to shut down Ringhals as soon as possible. The Ringhals reactors should be taken off-line at least until all initially proposed measures are resolved and implemented.*

Switzerland: Mühleberg NPP

Of high concern for Switzerland, France, Germany, Austria and Italy

Seismic studies have been delayed further; this includes investigations of potential risk from the Wohlensee dam. Blockage of the water intake system remains a concern and measures to tackle this have not been implemented yet. It is unclear what improvements are suggested for extreme weather protection. In the view of its proposed closure in 2019, the fact that Mühleberg has no alternate heat sink has been covered with stop-gap measures that would not survive a severe earthquake. There are ongoing issues with hydrogen management. Mobile emergency equipment is foreseen even for design-based events.

Greenpeace: *The ongoing wave of studies and too slow implementation of measures shows that Mühleberg is not upgradable to a satisfying levels for the remaining time it is supposed to operate. The ongoing risk of earthquake, design flaws and age of Mühleberg mean that the plant should be shut down immediately.*

United Kingdom: Wylfa NPP

Of high concern for Great Britain, Ireland

The last reactor at Wylfa is to be closed down in the end of the year. No advance was made in the action plan. Filtered venting was not installed and the iodine absorption system may not be sufficient in beyond design accidents. The approach of the operator, regulator and ENSREG seems to be that given the short remaining running time, upgrades were not necessary.

Greenpeace: *We have to count ourselves lucky there was no accident in Wylfa in the last few years. However, Wylfa can still face an accident in its remaining life time. Because the operator and regulator do not see any sense in large upgrading investments, many risk factors remain unremedied. The reactor should be shut down immediately.*

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