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**Statement: Fabrication Flaws in the Pressure Vessel of the EPR Flamanville 3.**

The Flamanville Nuclear Power Plant (NPP) is located in Flamanville, France. The NPP already has two pressurized water reactors (PWRs) that produce 1.3 GWe each and came into service in 1986 and 1987, respectively. Since 2007 the operator EDF tries to build a third reactor, the new reactor model European Pressurized Water Reactor (EPR).

Originally, Flamanville 3 was meant to be completed until 2012. Meanwhile it is estimated that it might be operational by the end of 2019. Besides the significant delays, the construction caused a lot of financial troubles. The costs were initially estimated at Euro 3,2 billions and have already tripled. Due to the problems with the reactor pressure vessel, the costs will surely increase.

In April 2015 the French Nuclear Safety Authority (Autorité de sûreté nucléaire, ASN) announced fabrication defects in the upper and lower heads of the Flamanville 3 reactor. These anomalies are a very serious defect in the material of the reactor pressure vessel. They absolutely question the safety of the reactor pressure vessel, which is the core element of the reactor. Following the discovery, the manufacturer Areva NP and the operator Électricité de France (EDF) had to submit a new safety case to prove the safety of the flawed reactor pressure vessel. The investigation is now completed and the results sent to the ASN.



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On 28 June 2017, the ASN presented its position regarding the anomalies and gave the public the opportunity for a public consultation until 12 September 2017. ASN considers that the mechanical characteristics of the pressure vessel bottom head and closure head are adequate with regard to the loadings to which these parts are subjected, including accident situations.

First, I would like to state, that the ongoing procedure is inadequate. I believe that the problems with the material of the reactor pressure vessel are very serious and that the ASN handles the issue in an inappropriate way. It is clear and undisputed by ASN that the flawed material has breached requirements of the French national nuclear rules and regulations. Therefore, the flawed components should be replaced before a startup of the reactor (see below). At the very least, France has to carry out a transboundary environmental impact assessment procedure (EIA) to give the public authorities and the public in Germany (and other concerned countries) the opportunity to give a formal statement in a fresh and clean procedure. Only then, people have the chance to give a formal statement and in case of doubt file a complaint against the nuclear authority, if their statement was not taken into account. The German government just answered me on 6 September 2017 that they are already checking officially whether the circumstances require a transboundary EIA (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, working number 08/245).

Additionally, I strongly disagree with the conclusion of the ASN. The reactor pressure vessel is not only the core element of the reactor, but also its first level of defense. It hosts the fission reaction of the nuclear fuel and is the most crucial component for the safety of a nuclear reactor. As Yves Marignac, the Director of WISE-Paris already stated in 2015, it "is even more true in the case of the EPR: with the design capacity of 1,650Mwe, its pressure vessel would hold more nuclear fuel, and therefore a higher potential of danger, than in any other reactor in the world. " (Marignac, Yves 2015: Fabrication Flaws in the Pressure Vessel of the EPR Flamanville-3. WISE-Paris Briefing). The anomalies might lead to cracks in the reactor pressure vessel lower head or closure head and could result in the fast fracture of the whole reactor pressure vessel. If it fractures, the nuclear fuel will no longer be cooled and a serious nuclear accident could be the result. For this reason, the usage of flawed material in the construction of a reactor pressure vessel is a very serious problem and affects the first and most important level of defense. This can only lead to one conclusion and that is to stop the ongoing construction immediately. There is no way to restore the required highest quality level of the fabrication that constitutes the first level of defense. The ASN itself says, "The anomaly in the chemical composition of the steel entails a reduction in the margins with respect to the fast



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fracture risk." However, the nuclear safety authority only mandated that EDF must implement "additional periodic inspections to ensure that no flaws appear subsequently." They further observed that such inspections can be performed on the vessel bottom head and therefore considers that they must be implemented. "However, the technical feasibility of similar inspections on the pressure vessel closure head is not established. ASN therefore considers that the use of the closure head must be limited in time." It notes "that it would take about seven years to manufacture a new closure head, which could thus be available by the end of 2024. In these conditions, ASN considers that the current closure head shall not be operated beyond that date". (ASN 2017: ASN presents its position regarding the Flamanville EPR reactor vessel anomaly. <http://www.french-nuclear-safety.fr/Information/News-releases/ASN-presents-its-position-regarding-the-Flamanville-EPR-reactor-vessel-anomaly>).

One cannot predict whether the mechanical toughness of the reactor pressure vessel will be sufficient in all operating situations, including severe accident situations. Additionally, no one knows how the long operational phase of 60 years will affect the anomalies. One also has to keep in mind that the head and bottom were already forged in 2006. When they go into operation, they will already be about 14 years old.

In sum, the material is already of very poor quality. Thus, the reactor pressure vessel is not fit for permanent service and should not be allowed to operate or start up.

Additionally, the question remains, how EDF wants to guarantee the integrity and thus safety of the closure head if it is not able to perform the periodic inspections to ensure that no flaws appear subsequently! Another question is, in which way the anomalies differentiate in the vessel bottom and the closure head. Although ASN claims that the inspections are easier to perform at the bottom head, another reason why it is not replaced as well might be that it is technically very unlikely to separate it from the whole pressure vessel. The remaining questions raise serious uncertainties.

That a nuclear reactor, which is still under construction shall be put into operation although its material is already flawed and its first level of defense is affected, is irresponsible and a huge safety risk to the people living in Europe. In short, it is an absolute NO GO! It is not sufficient to implement periodic inspections and to only replace one element of the flawed reactor pressure vessel. The documented faultiness should lead to the decision to replace the whole reactor pressure vessel. This of course, would increase the already high costs for the construction. Another problem is that earlier this year, the construction license for the EPR already had to be extended for three years, as it was set for only ten years until 2017. Because of this, the EPR has to be operational at the latest in 2020. That (in addition to the high costs) might be yet another reason



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why the nuclear safety authority did not mandate to replace the whole reactor pressure vessel or to at least wait until the new closure head is manufactured in 2024. Additionally to that, the news agency Reuters reported on 26 June 2017, the "European Commission has said the ASN's green light for the Flamanville reactor vessel is a precondition for EU approval of the recapitalization of Areva and the planned sale of its reactor division Areva NP to EDF." (Reuters 2017: EDF may need to replace Flamanville reactor lid in few years-ASN report. <https://uk.reuters.com/article/edf-flamanville-nuclear/edf-may-need-to-replace-flamanville-reactor-lid-in-few-years-asn-report-idUKL8N1JN20C>). Also, the Economist reported in December 2016, further "delays might also hinder EDF in its plan to build two EPRs at Hinkley Point, in Britain. British loan guarantees need certain conditions to be met, and these reportedly include seeing Flamanville operate by 2020." (The Economist 2016: France's nuclear-energy champion is in turmoil. <https://www.economist.com/news/business/21711087-electricity-de-france-has-had-shut-down-18-its-58-nuclear-reactors-frances-nuclear-energy>). If EDF loses both of his showcase projects, the future of the French nuclear industry might be at risk. Again, the handling of the problem proves to me that when it comes to nuclear, safety concerns are not top-of-mind. Safety issues are only second to economic interests and profits.

General concerns:

Nuclear energy has been used for commercial power generation for 60 years and still it is not economically viable. Construction projects everywhere have suffered from increased costs, technical problems and delays. It is highly questionable why such a form of power generation is still promoted by states. Moreover, although there is a wide field of research areas, huge problems with nuclear energy remain unsolved. Worldwide, there is no repository for high-level radioactive waste available. Even though, a few countries, including Germany, are at the very beginning of the search for a disposal site it will take decades to develop it. Nevertheless, the risks of the millions of years that the radioactive waste has to be contained will remain. A problem future generations will have to cope with.

Moreover, even when a reactor is built with intact materials there is no such thing as complete nuclear safety. The costs of a nuclear accident, not only the financial aspect but also especially the personal tragedies, are difficult to estimate. What is clear, however, is that there will be huge costs when it comes to compensation, decontamination and decommissioning of the nuclear power plant – for which the operators are not being held accountable.



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I am strongly opposed to nuclear energy, which I consider to be expensive and a high risk technology which causes huge environmental damage in case of a nuclear accident.

Since we share the same environment that does not recognize borders, I am asking the ASN to re-evaluate its decision and to stop the ongoing construction of Flamanville 3 until the reactor pressure vessel is replaced completely. The better and in my opinion not only safer but also cheaper option would be to abandon this project altogether. Please, keep in mind: An accident anywhere is an accident everywhere!

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