

Peer review of theoretical report by Group 4 on the concept of nuclear  
safety - Fukushima accident

Compact Reactor Simulator - Exercises in Reactor Kinetics and Dynamics/SH270

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## 1 Abstract

In the abstract, it is stated that the report deals with topics such as nuclear safety concepts, defense in depth, safety objectives, different safety concepts, safety culture, and safety analysis, and their relevance to the Fukushima accident. However, this statement is not accurate as the information about the accident represents majority of the report.

## 2 Fukushima accident

### 2.1 Introduction

The introduction is nicely written and gives an introduction and overall description how the Fukushima accident happened.

### 2.2 Brief event description

In this case, a more detailed timeline of the event is described. Since it is just rephrased source, there are no significant mistakes in the text.

### 2.3 Operational and accident conditions during the event

Again, the description is very detailed and complex. It is very hard to remember a lot of data from the text. It would be better to cut the text and focus on e.g. only one unit, in the first hours. This would be better for the reader since it would be easier to focus on the text. This applies for most of the text in section 2. Once again, it is good to mention that the detailed text about the complex event had no use for me as a reader (personally), since the amount of information (without any highlights) was just enormous and I was not sure what to remember.

On page 7 it is nice to see the general description of the system for core cooling in case of reactor isolation. Since the Fukushima accident is one of the most severe and famous ones, the huge amount of documentation and figures are sufficiently used and some nice figures or tables can be found in the text. The same for page 14, which describes shortly the containment.

Page 11, we would more precision about the reason why the control logic didn't automatically prioritize safety system and did require operators action to do so.

Page 16, it would be interesting to detail a bit more why operators left the plan after the emergency responses of NPP. Why did this confusion occur? Was it due to fear/poor training/poor alarm design?

In general, the figurines helped to understand the Fukushima NPP. But at some points it would be enough to add a short description to the figur instead of a long description.

## 3 Nuclear safety

It is nice to see the addressed safety objectives for the Fukushima accident. They cope wide range of assessments and they point to the breach in nuclear safety of the plant.

A misunderstanding of the use of the PSA seems to appear when analysing the height of the protective wall (tsunami). The probability of a tsunami with a wave of more than 5.5 m was already ridiculously low. If a 20 m wall had been built, the risk would still have existed, but the probability would have been even more ridiculous. As we saw in the course, the probability of an event like Fukusmima was E-24. So even if the designers had been as conservative as possible, the site would have been flooded anyway. The opposite extreme case would imply refusing to build NPPs, because there is no such thing as 0 risk.

In the first block on page 20, it is a bit strange to use the term safeguard when talking about the safety assessment. The nuclear safeguards deal with the topic of non-proliferation, not nuclear safety. It is nice to discuss the levels of DiD that were breached.

The safety culture within the NPP company and the regulators/governments should at least be mentioned to give a better understanding. (e.g why is there so much delay between communication between operator and the government)

In the case of the diesel generator, there should be a clear focus on redundancy, diversification and separation that miss.

Finally, it would be nice to have a focus on the operators. In an accident situation, the most conservative assumption is not to take any action of the operators as granted.

## 4 Observations and lessons learned

This section nicely shows the observations and lessons taken from the accident.

However some subject that seems important had been forget or not mentioned such ;

- the risk of multiple accidents (spent fuel and NPP)
- risk of losing cooling in the spent fuel

Finally a misconception had been detected about conservatism study at Page 25. In fact, the implementation of conservative input and models can assist in effectively managing a broad spectrum of accidents in nuclear power plants.

## 5 Nuclear safety analysis

In the third paragraph, it it said, that the BEPU analysis combines DSA and BE analysis. This might be not be right, becouse BEPU combines DSA and PSA.

You should talk a bit more about commun cause failure inside the PSA part.

For the analysis introduction, the copying of response of Chat GPT should be avoided. The following paragraphs describes only shallow general informations and some specifications and examples should be added.

# Appendix