Comment:

Dear authors, please see below the comments from the peer review.

Reviewer 1: Hello! Thank you for your paper! In fact, S/U analyses is a difficult aspect of licensing the innovative nuclear system. Thus, the exchange of experience in such matters becomes very important for development of nuclear energy worldwide. No suggestions for corrections.

Reviewer 2: An interesting study of S/U analysis in the ALFRED core using ERANOS system for quantifying uncertainties in safety parameters towards investigating adequacy of their safety margins. Though the methodology adopted in this study is well established, it uses ENDF/B-VIII cross sections and the associated covariance data. ECCOLIB library is newly prepared for this purpose. The manuscript is well-written and the conclusions are nicely derived.

* + The nuclear data uncertainty in safety parameters is only a part of their total uncertainty. It has dependence on cross sections, sensitivity coefficients and the covariance data. Whether the covariance data used in this study is complete or it is tested in any experiments? If no, it has implications in the conclusions derived based on the present analysis. Authors are requested to justify it.

Thank you for your valuable suggestion. To answer this question, the following text has been added to the article, par.2: “Concerning cross sections, the entire generation process was firstly tested with the old JEFF3.1 libraries with the aim of verifying its correctness via direct comparison of cell and core calculations performed with the official version of the same library released with the ERANOS code. Moreover, partial cross-sections were combined into five primary reactions named ELASTIC, CAPTURE, FISSION, INELASTIC, and NxN some of which include different MT number. In particular, CAPTURE includes processes in which no neutrons are emitted (MT=102 + 103 + …), INELASTIC includes any process emitting one neutron only and leaving the target nuclide in an excited state (MT=4 + 22 + …), and NxN includes any process emitting several neutrons, except fission. Uncertainty-side, only MF=31 and MF=33 files containing, respectively, uncertainties information on fission neutron multiplicities and cross-sections, were processed, while covariances of the fission spectrum and in general of information on secondary particles energy (MF=35), angle distributions (MF=34) and delayed data were not used.”

* + The uncertainty analysis uses different methods such as SPT, EGPT and GPT. The criteria of their usage for each safety parameter may please be discussed for better clarity.

Highlighting the differences among the different methods can be useful in making the paper more complete. The differences among the different methods used in perturbation theory has been highlighted in the article, par.4. The following text has been added to the original article: “For the effective multiplication factor SPT was used since it is specifically tailored for the latter, GPT was instead used for the effective delayed neutron fraction since applicable to bilinear ratios of flux and importance; finally, EGPT was used for all the reactivity effects (coolant density, fuel Doppler and protection system worth) since it has the ability to considerably simplifies the problem to a difference between two SPT calculations for each of the two reactivity states.”

* + The need to improve accuracy in neutron cross sections for fissile and coolant nuclides is well established before to enable safe and economic design of fast reactor cores of GEN-IV type. The statement that use of ENDF/B-VIII cross sections helps to reduce uncertainties in the safety parameters of ALFRED system requires more explanation with reference data. How is it possible to assetatin that the results of present analysis are correct?

We have been concerned with addressing this important issue. The following text has been added to the article, in the Conclusions: “Indeed, by direct comparison with a S/U analysis performed with the JEFF3.1 library and the BOLNA covariance matrix [7] on the same safety-relevant effects considered in this work it was clearly showed that the use of more recent datasets brings about a reduction of nuclear data related uncertainties.”

We would like to thank the reviewers for their work in revising the paper, and for their valuable comments and suggestions.

Overall: Please upload a revised paper incorporating the minor corrections/comments above. If you have new relevant data, you are welcome to include these. Please upload a revised paper by 1st of April 2022.