Quantification of Loss-of-Reactor-Level Accident of Sodium-Cooled Fast Reactor with Continuous Markov Chain and Monte Carlo Method

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Abstract

A loss of reactor level accident (LORL) of a sodium cooled fast reactor (SFR) results in core degradation and causes fission products release from the reactor system to the environment. The authors couple Continuous Markov Chain and Monte Carlo(CMMC) method with AZORES code to investigate the fission product behavior during the LORL accident of the SFR.

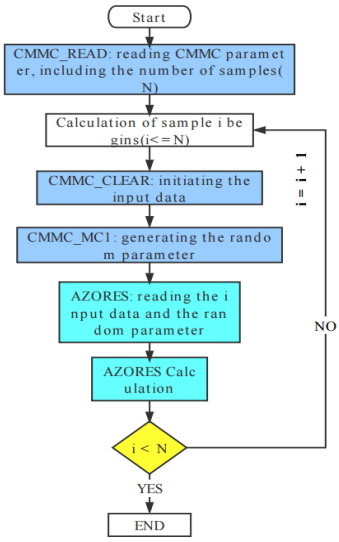
Keywords: LORL, CMMC method, fission product, SFR, severe accident

Introduction

For seismic induced loss-of-reactor-level accident (LORL) of the SFR, the authors use containment analysis code AZORES [1] with CMMC Method to analyze the stochastic responses of the containment function and fission product behavior.

Calculation Algorithm and Released Radioactivity

As the figure 1 illustrating, the calculation algorithm is a coupled method based on AZORES code and Continuous Markov Chain and Monte Carlo(CMMC) method.



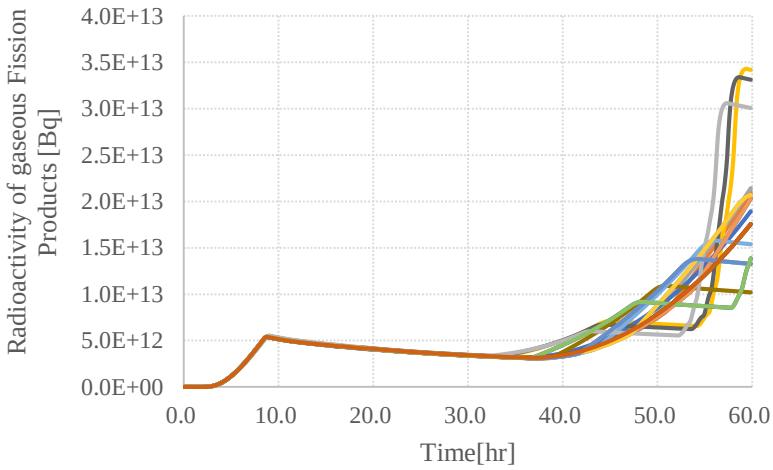


Fig.1 Calculation Algorithm

Fig.2 Radioactivity of gaseous Fission Products

Figure 2 illustrates the radioactivity of gaseous fission products released to the environment. In the first 35 hours, all the samples release about 5.0E+12 Bq radioactivity into the environment and after that the larger rupture sizes ($0.0045m^2$ [2], 10 times of others) seem to release larger amount of radioactivity, as the gray, black and yellow lines show.

Conclusion

We can conclude that: 1) the coupled method based on CMMC method and AZORES code is a promising method to quantify the level 2 PRA stochastically and accurately; 2) the larger rupture size of cold-leg pipe seems to release larger amount of radioactivity into the environment.

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References

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