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Preliminary Research on Reliability Index System of Fusion Power Plant

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Nuclear fusion is one of the most promising options for generating large amounts of carbon-free energy in the future. Since fusion energy is innovative and fusion facilities contain unique and expensive equipment, the reliability issue is very important from their efficiency perspective. The evaluation of reliability is an important part in the safety study of fusion reactor. And the system reliability index is the premise and the basis of reliability evaluation.

This paper aims to establish the reliability index system of fusion reactor. Firstly, the safety goals of fusion reactor were given in this paper. In this study, the safety goals were separated into quantitative safety goals and subsidiary numerical objectives. Quantitative safety goals are higher than the numerical objectives, which come from the two 0.1% risk limits defined by the United States Nuclear Regulatory Commission (USNRC). Subsidiary numerical objectives are actually developed under the quantitative goals and are more specific to the characteristics of fusion reactor. Secondly, the safety goals of fusion reactor were assigned to the components which performed safety functions. In the part of this study, the Probability Safety Assessment (PSA) was used to establish the risk models for fusion reactor. The PSA is an important method to evaluate the risk of system, which has rich experience applied in nuclear industry for fission power plants and other nuclear installations. Thirdly, the reliability index system was given based on the results of the risk analysis of fusion reactor.

The validation of reliability index system is still on study. The reliability index system is expected to be the basis and the reference for the reliability evaluation of fusion reactor and nuclear safety monitoring in future.

Eligible for student paper award?

No

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