Overview of Nuclear Fusion Safety and License of DEMO and its Implications on the Design and Operation

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A fusion DEMO program, like other advanced nuclear energy system, is highly expected to satisfy a range of goals including a high level of public and worker safety, low environmental impact, high availability, closed fuel cycle, and potentially to be economically competitive. It is well known that the experience of the ITER project will facilitate this program in developing a safety approach and safety design, performing safety analyses under the scrutiny of a nuclear regulator, ensuring the availability, managing the radioactive waste, and conducting the economic assessment. However, there is still a huge scientific and technical gap between the current ITER and any DEMO programs.

In this paper, the international efforts for fusion safety, environmental and economic research towards DEMO will be summarized following lessons learned from ITER. Importantly, the main scientific and technical challenges, in particular considering the difference between fission and fusion reactors, will be presented as well as the corresponding implications on DEMO design and operation, with the views not only from the fusion energy development but the development of advanced nuclear energy system (e.g. Generation-IV fission reactor). For instance, safety assessment methodology developed for the Generation-IV reactor system may be applied to DEMO considering specific changes.

Moreover, the potential research topics for international collaboration will also be addressed, as well as the role of International Energy Agency (IEA) implementing agreement on a cooperative program on Environmental, Safety and Economic aspects of Fusion Power (ESEFP).

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