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Safety and environmental studies for a European DEMO design concept

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Pre-conceptual design studies for a European Demonstration Fusion Power Plant (DEMO) have been in progress since 2014. At this stage, while a range of design options are being considered, it is essential that assessments are carried out of the safety and environmental impact of these options. This is not only to ensure that the DEMO plant is optimised for safety performance, but also that it will demonstrate the favourable safety and environmental characteristics of fusion energy as part of its mission.

To this end, safety studies have been under way since the start of the project, to set clear safety objectives and requirements, to analyse the response of the plant to off-normal events, to assess hazardous inventories (principally tritium and neutron activation products) and strategies to minimize them, and to identify the main potential contributors to environmental releases in normal operation and to occupational radiation exposure. Development of codes and models for safety analysis has been accompanied by selected experimental activities focused on improving their validation. Safety analysts have engaged with design teams with the aim of selection of design options to achieve the highest safety performance. At the same time, studies are performed of key aspects of waste management, to minimize the waste burden of DEMO and of fusion power plants that will follow.

In this paper the main achievements of these safety and environmental studies are described, drawing preliminary conclusions and noting safety issues that arise from some aspects of the design choices. The future work needed as the EU DEMO project moves towards the conceptual design stage is also identified.

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