Safety Classification of ITER Structures, Systems and Components

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The licensing of ITER as a nuclear facility requires a robust demonstration that safety targets will be met in all foreseen normal, incidental and accidental conditions. Part of this demonstration is to show how the design includes features that will provide the necessary safety functions. The two principal safety functions are the confinement of radioactive material and the limitation of exposure to ionizing radiation. A number of subsidiary functions support these two, for example prevention of fire that might degrade confinement systems.

In order to show that the design contains the required provisions, an important step is the identification of those systems, structures and components (SSCs) that are credited with providing these safety functions in the safety analysis. These SSCs are classified as Safety Important Class (SIC). Two SIC classes are defined in order to distinguish the importance of different SSCs, and to apply appropriate requirements. The first class, SIC-1, is assigned to those SSCs that are required to maintain the safe state of ITER, or to return the facility to a safe state after the initiation of an incident or accident. For example, components providing the confinement of radioactive materials are SIC-1. Other SSCs playing a role that may be credited in safety analyses, for example to reduce the impact of an accident scenario, are classified SIC-2. A system that provides radiological protection of personnel in abnormal situations, for example, may be classified SIC-2.
All other SSCs are non-SIC, but a further category, Safety Relevant (SR), is assigned to those which have some safety role to play, even though not credited with performing a safety action in the analyses. Systems that monitor radioactive content of fluids through off-line sampling would be regarded as SR, for example. This relatively simplified classification scheme is made possible by the low hazard potential and favourable safety characteristics of ITER. There are rather few systems classified as SIC-1.

The paper outlines the implications of SIC classification in terms of requirements such as single failure, redundancy and seismic criteria, specific fabrication standards, qualification (e.g. against seismic and environmental conditions), operation and maintenance criteria and relevant standards.
Considering the safety functions of ITER, the methodology and the experience in the licensing of other nuclear facilities (e.g. fission research plants and tritium laboratories) is taken into account at the maximum extent in the safety classification and for relevant implementation.

A spreadsheet database has been produced for each of the main ITER systems, reporting the SIC classification at component level. Consistency of this classification with the safety analysis is assured by cross-checking with the relevant accident analysis reports of ITER. The paper includes, as an example, the SIC classification of Tokamak Cooling Water Systems.