

Progress of the conceptual design of the European DEMO Breeding Blanket, Tritium Extraction and Coolant Purification Systems

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In the frame of the EUROfusion consortium activities the Helium Cooled Pebble Bed (HCPB) and the Water Cooled Lithium Lead (WCLL) concepts are being developed as possible candidates to become driver Breeding Blanket (BB) for the EU DEMO, which aims at the tritium self-sufficiency and net electricity production. The two BB design options encompass water or helium as coolants and solid ceramic with beryllium/beryllides or PbLi as tritium breeder and neutron multipliers. The BB segments have evolved towards a more stable conceptual design taking into account multiple feasibility aspects and requirements imposed by interfacing systems. The reference and back-up technologies for the Tritium Extraction and Removal (TER) from the helium purge gas and the PbLi are developed addressing key feasibility aspects and implications on the tokamak layout. The impact of water coolant activation is assessed by studying the spatial distribution of ¹⁶N and ¹⁷N isotopes dose rates, in particular in proximity of isolation valves. As the BB internals offer an ideal environment (high temperatures, thin structural material) to promote the tritium permeation, studies are devoted to the assessment of the permeation rate and inventory in the coolant. Those are the key parameters for the feasibility assessment and technology selection for the Coolant Purification Systems (CPS) as well as for assessment of the tritium permeation at the Steam Generator and the associated Safety analyses of the DEMO plant.

Keywords: Breeding Blanket, Coolant Purification, Tritium Extraction and Removal

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