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Comparative analysis of WCLL to different European DEMO blanket concepts in terms of activation and decay heat after exposure to neutron irradiation

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Activation inventories and decay heat are important nuclear quantities which need to be assessed on a reliable basis for fusion materials for the safe operation of a fusion nuclear power reactor and its final decommissioning. This comparative paper describes the activation and decay heat calculations for WCLL performed in the frame of the EUROfusion WPSAE programme and specifications in comparison to other European DEMO blanket concepts (i.e. DCLL, HCLL and HCPB) on the basis of using a three dimensional neutronics calculation model. Results are provided for a range of decay times of interest for maintenance activities, safety and waste management assessments. The study revealed that WCLL have the highest (~2-3 orders of magnitude) total decay heat at longer decay times in comparison to HCLL design which has the lowest total decay heat (17.5 MW) at short decay times. In addition, major nuclides were identified for WCLL in W armor (W187 and W185), Eurofer (Fe-55, Mn-56, Cr-51, W-187, Ta-182) and LiPb excluding tritium (Pb-207 and Pb-203). In addition, the great attention has been dedicated to the analysis of the decay heat and activity both from the different WCLL blanket modules for the entire reactor and from each WCLL blanket module separately.

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