

# Investigation of the DEMO WCLL Breeding Blanket Cooling Water Activation

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Within the framework of the activities foreseen by the EUROfusion action on the cooling water activation assessment for a DEMO reactor equipped with a Water Cooled Lithium Lead Breeding Blanket (WCLL BB), the University of Palermo is involved in the investigation of dose rates induced by the decay of nitrogen radioisotopes produced by water activation, nearby the main components (e.g. isolation valves) of both First Wall (FW) and Breeder Zone (BZ) cooling circuits.

In particular, the aim of this work is to assess the spatial distribution of nitrogen isotopes (<sup>16</sup>N and <sup>17</sup>N) in the WCLL BB cooling circuits. To this purpose, a coupled neutronic/fluid-dynamic problem is solved following a theoretical-numerical approach and adopting an integrated computational tool mainly relying on the use of MCNP6 and ANSYS CFX codes. The operative procedure adopted foresees the assessment of nitrogen isotopes production rate distribution within FW and BZ cooling channels and tubes by means of a totally heterogeneous neutronic analysis. A fully 3-D approach is, then, used to compute the nitrogen isotopes concentration within the In-Vessel complex flow domain, while a lumped parameters 1-D approach is adopted to calculate its distribution along the Ex-Vessel BB Primary Heat Transfer System.

The results obtained, herewith presented and critically discussed, provided the necessary data to perform dedicated neutronic and photonic transport analyses and, hence, to assess the dose rates in the aforementioned target locations.

*Keywords: DEMO, WCLL blanket, water activation, neutronics, CFD*

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