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TRITIUM MANAGEMENT IN HCLL-PPCS MODEL AB BLANKET (P4-H-218)

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One the main issues in the HCLL blanket development for a prototype fusion reactor is the technical feasibility of the bred tritium processing system. The basis of such concern lies in the very low tritium-Pb17Li Sieverts' constant, as measured by different scientists in the past years.
In the PPCS reactor 650 g/d of tritium must be generated in the breeding blanket while less than 1 g/y of tritium has to be released to the environment through the secondary cooling circuit. As a consequence, CPS (Coolant Purification System) plays a fundamental role because it has to keep at an acceptable level the tritium partial pressure in the primary HCS (Helium Cooling Circuit) limiting, therefore, the tritium environmental release through leakage and permeation into the secondary cooling circuit. On the other hand, the He mass flow-rate to be processed by CPS is linear with the tritium permeation rate from the breeder into HCS. Therefore, with the above mentioned low Sieverts' constant values and the consequent high tritium partial pressure in the liquid metal, the possibility to keep acceptable the CPS capacity depends on a highly efficient and stable performance of tritium permeation barriers, to be applied not only on the blanket cooling plates but also on the steam generator walls. However, the experimental results on the tritium permeation barriers under relevant operative conditions were so far quite disappointing.
The new data on the Sieverts' constant achieved at ENEA CR Brasimone, one order of magnitude higher than those founding the past, have a big impact in relaxing the above mentioned requirements for the tritium management in PPCS model AB reactor.
Besides presenting and discussing these recent experimental results, an updated assessment of the tritium permeation rate from the liquid breeder into HCS through the cooling plates and from HCS into the environment through the steam generators is given in this paper. The consequent new constraints in terms of tritium permeation barrier efficiency coupled with CPS capacity are presented and discussed.
The results show that the such requirements can be realistically satisfied, leading to a technologically feasible tritium management system for a prototype reactor equipped with the HCLL blanket.

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