

## **Tritium Permeation into the ITER Primary Heat Transfer Loops as a Support of the Management of tritiated Effluents**

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Tritium permeation through the plasma facing and other surfaces of in-vessel components is a source for the tritium contamination of the ITER Primary Heat Transfer Loops (PHTS).

This source depends on the properties of the real materials such as content of impurities, grain boundaries, technologies used to join different materials (HIPping, welding etc.), radiation damage, isotope productions, corrosion layers and operational parameter such as baking time, coolant and material temperatures as well as incidental thermal hot spots.

To determine the provisions needed in ITER for the treatment and destination of tritiated effluents, a sensitivity study is performed on permeation and operational parameters. The permeation calculations are performed by use of Mathcad™ models supplemented and validated by the TMAP code. The main parameters are the trapping energies of tritium in the materials as many of the imperfections listed above act as traps for tritium. Beside the main operational parameters the calculations include the normal leakages of coolant from primary to secondary coolant loop through the heat exchangers, the release and/or recycling of coolant during maintenance, as well as the processing (detrification) rates and the coolant disposal frequencies. These parameters allow the estimation of the tritium concentration in the primary and secondary cooling circuits and in their operational effluents. Provisions are proposed to handle these effluents in the range of the evaluated uncertainty, taking into account the upper and lower limits of the tritium concentration and the throughput of the water detrification system and the regulatory limits on concentration and amount for effluent releases and relevant disposals.