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Impact of the impurity seeding for divertor protection on the performance of fusion reactors MATTIA SICCINIO, EMILIANO FABLE, CLEMENTE ANGIONI, Max Planck Institut fr Plasmaphysik, SAMULI SAARELMA, Culham Centre for Fusion Energy, ANDREA SCARABOSIO, HARTMUT ZOHM, Max Planck Institut fr Plasmaphysik — A 0D divertor and scrape-off layer (SOL) model has been coupled to the 1.5D core transport code ASTRA. The resulting numerical tool has been employed for various parameter scans in order to identify the most convenient choices for the operation of electricity producing fusion devices with seeded impurities for the divertor protection. In particular, the repercussions of such radiative species on the main plasma through the fuel dilution have been taken into account. The main result we found is that, when the limits on the maximum tolerable divertor heat flux are enforced, the curves at constant electrical power output are closed on themselves in the R-BT plane, i.e. no improvement would descend from a further increase of R or BT once the maximum has been reached. This occurrence appears as an intrinsic physical limit for all devices where a radiative SOL is needed to deal with the power exhaust. Furthermore, the relative importance of the different power loss channels (e.g. hydrogen radiation, charge exchange, perpendicular transport and impurity radiation), through which the power entering the SOL is dissipated before reaching the target plate, is investigated with our model.

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