

# Tritium retention in JET and Next-Step Fusion Devices

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## Abstract

A major issue for future fusion power-generating plants is the retention of tritium within the machine, since this reduces the efficiency of the recycling process (leading to costs for extra tritium) and introduces additional safety considerations. The retention seen in existing machines is primarily associated with the re-deposition of carbon eroded from contact points between the plasma and the surrounding walls. In JET after operation with deuterium-tritium mixtures, the great majority of the tritium trapped in the vessel was in carbon-based deposits that flaked off and fell to the bottom of the vessel, where access is difficult. Future machines will also have an allowable limit for the amount of dust, and in JET the break-up of these flakes represents a possible source.

The issues of tritium retention and associated dust in a Next-Step device are being addressed in several ways. Firstly, the use of carbon is being minimised. Carbon is the only material that is tolerant of high surface power loads resulting from off-normal events, so it is not yet clear if the material of the critical contact area may be substituted. Secondly, the deposition mechanisms are being studied, with the aim of minimising the quantity of deposits and, within them, the fraction of tritium retained. Thirdly, ways are being developed of removing any deposits that do form within the device, ideally in such a way that the tritium can be returned (as tritium gas) to the storage beds. This is coupled with work on the more general issues of de-tritiation, such as methods of reducing the tritium content of carbon tiles, and reducing medium-level waste to low-level waste for subsequent disposal.

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