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Experimental tritium activities in support to tokamak operation and safety

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In the future of fusion activities, the mastering of tritium release is a challenge which needs tritium R&D as well as better understanding of tritium impacts on health and environment. We have been working for years on such topics and the purpose of this presentation is to highlight some of the outcomes of these activities.
First, tritium inventory (TI) of different fusion relevant materials (steel, cement, plastic…) when submitted to tritium absorption will be presented. These results are of high importance for safety studies of room potentially contaminated by a tritium gas release. Large discrepancies of tritium inventory between materials are observed (cement TI ~ 100 Steel TI). Due to surface effects, dust can store much higher quantities of tritium than massive samples (1 µm W particles TI ~500 massive samples TI).
The high tritium inventory in dust and the induced electrostatic charging has a major consequence on particle adhesion and resuspension. We will thus present the consequences of particle charging according to the constituent material of the powders but also of their support: 1) on the transport of the dust in operation and on their contribution to the plasma impurities, 2) on the dust explosion and oxidation processes and the likely releases to the environment during an accident (LOVA or LOCA).
Various points concerning the tritiated dust release will be also highlighted: 1) what is the specific metrology for the monitoring of workers occupational exposure? 2) what could be the impact on the health of workers potentially exposed to these tritiated releases? Our answers will rely on results obtained in our laboratory after in vitro exposure of biological samples to tritiated tungsten particles.
Waste management of metallic tritiated dust is more complex than for tritiated solid and we will present the technical solutions that we propose to be tested.

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