Overview of Tritium R&D at Safety and Tritium Applied Research (STAR) facility, Idaho National Laboratory

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Magnetic fusion power promises to provide electricity generation with outstanding safety and environmental performance. Safety plays a crucial role in magnetic fusion material selection since tritium behavior in materials determines two key safety evaluation source terms: in-vessel inventory source term and ex-vessel release term, which are used in reactor safety assessments for licensing fusion facilities. The Safety and Tritium Applied Research (STAR) facility, DOE less than Hazard Category 3 nuclear facility at the Idaho National Laboratory (INL), embraces unique capabilities and infrastructure to perform high-risk experiments with tritium, radioactive materials and toxic material (such as beryllium and FLiBe) to advance technical readiness level in fusion nuclear sciences. The objective of the STAR research is to investigate the following experimental safety R&D for DOE Office of Science Fusion Energy Sciences program: 1) In-vessel tritium source term (i.e. tritium retention in plasma facing components), 2) Ex-vessel tritium release term (i.e. tritium absorption, desorption, extraction and permeation in PFCs and blanket/structural components), and 3) In-vessel dust source term (i.e. evaluation of dust production rate and explosivity determination). This presentation reports the current status and progress on existing international collaborations and discusses unique capabilities at STAR facility to facilitate future collaborations.

This work was prepared for the U.S. Department of Energy, Office of Fusion Energy Sciences, under the DOE Idaho Field Office contract number DE-AC07-05ID14517.