

Review of the ITER Deuterium / Tritium Fuel Cycle Systems

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ITER is a fusion tokamak being fully designed for equimolar deuterium / tritium operation. The plasma will be fuelled through pellet injection and gas puffing. Plasma heating will be ohmically, by electron cyclotron resonance, by ion cyclotron resonance and through deuterium Neutral Beam injection. The ITER vacuum pumping systems are employed for evacuation and maintenance of the required conditions in the torus. This system comprises of a high vacuum cryo-pumping part and a roughing vacuum pumping part discharging into Tritium Plant systems. In addition to the proven techniques for plasma density control it will be possible to adjust the neutral particle exhaust on ITER by varying the opening to the torus cryo-pumps.

The Tritium Plant systems supply deuterium and tritium from external sources and treat all tritiated fluids from ITER operation through Tokamak Exhaust Processing, Isotope Separation and Storage and Delivery Systems to remove and recover deuterium and tritium for refueling. It also provides tritium confinement systems for the Tokamak Complex and the Hot Cell.

The ITER Fuel Cycle systems are designed to process considerable and unprecedented deuterium / tritium flow rates with flexibility and reliability. Some Fuel Cycle related challenges are tritium accountancy and tracking, tritium removal and recovery from fluids such as highly tritiated water. ITER is being designed to minimize the time constants for fuel recycling – the benefit being that the lower the time constant the lower the Fuel Cycle tritium inventory.

Confinement of tritium is achieved through multiple passive physical barriers and active Detritiation Systems. In contrast to other tritium facilities ITER features room atmosphere detritiation in case of incidental or accidental spills and will have the facility to recover tritium from tritiated water collected in the Detritiation Systems.

The paper will review technical progress and technical challenges in the ITER Fuel Cycle design and procurements, and will give an overview of the status on construction supporting R&D designed to address open issues.