Preliminary Design of the ITER Tokamak Complex and Hot Cell Facility Detritiation Systems

S. Beloglazov*, A. Perevezentsev, L. Lepetit, P. Camp, M. Benchikhoune
ITER Organization, CS 90 046, St Paul-lez-Durance, Cedex, France

High capacity air Detritiation Systems (DS) will be installed into both the ITER Tokamak Complex and Hot Cell Facility. The DS systems have a key role in minimising the exposure of workers, the public and the environment to tritium during normal operations and postulated incident and accident situations.

The design of the Detritiation Systems are therefore driven by the need for high integrity and system availability. A modular design approach has been adopted to provide a sufficient level of redundancy to ensure the required flow capacity will be available when required. There are two types of process module, a scrubber module and a dryer module. These can be arranged into parallel or series configurations depending on the function required of the system.

Each type of process module incorporates an oxidation stage and then utilizes either scrubbing columns or molecular sieve dryers to remove the tritiated moisture from the process stream prior to its transfer to the release point. Flow and pressure in the distributed piping network is maintained by set of blowers provided with 100 % redundancy and connected to two independent safety related electrical supplies. To support oxidation process air is heated to high temperature with high power electrical heater. Equipment design and energy utilization is optimized by usage of recuperative heat exchangers.

One of the challenges in design of the detritiation system is large number of interfaces to other systems such as Cooling Water System, Fuel Cycle systems, Vacuum Vessel and Vacuum Vessel Pressure Suppression System, Neutral Beam Injector, Test Blanket Module and large number of confinement sectors in Tokamak Complex and Hot Cell Facility. Complex and widely distributed piping network requires permanent effort for integration into the building and development of interfaces for building construction. System Design is supported and validated by HAZOP and RAMI analysis as required by ITER Quality Management Plant. Probabilistic safety analysis will be used to validate design against ITER safety requirements and targets.

This paper will describe the overall configuration and process flow diagram of the TC-DS and HCF-DS. The performance requirements of key process components and distributed piping network will be presented, along with mechanical design considerations for events such as fire and earthquake. ITER configuration and interface control implementation in the design will be outlined. Preliminary results of system analysis will be presented.