**Abstract**

**Thermal hydraulic analysis of a proposed Tokamak Diverter Cooling System**

*Importance:* Nuclear fusion is considered as a future source of sustainable energy supply. Among the contemporary fusion reactor designs, Tokamak is one of the best of its kind. It consists of a complex system of magnetic fields to confine the plasma of reactive charged particles in a hollow, doughnut-shaped vacuum vessel. The first wall of the chamber is protected from in the plasma impact by divertor plates.

*Background:* Many countries are conducting experiments to make fusion reactors successful. Pakistan is also working on development of an indigenous medium sized Pakistan Spherical Tokamak (PST) in collaboration with ASIPP, Hefei, China. There are multiple technical issues hindering the success of the fusion reactors. One of the issues is impingement of high particle flux having kinetic energy of the order of 1.3 - 7.5 MJ/m2 in a short time (~ 3-1.5 ms) on the divertor. This leads to high thermal loads at the surface resulting in thermal quench even with cooling system in place. Thus, the cooling channel design becomes important to save divertor plates from melting. The goal of this work is to propose a novel concept of an active water cooling system for the PST divertor. Optimization of the design and its thermal hydraulic analysis are the key objective of the project.

*Objectives:* Design development of an active divertor’s cooling system that can address the problem faced by the current designs is the main goal of the present works. The plausible objectives include thermal hydraulic analysis of the proposed design and its optimization.

*Methodology:* A thorough review of literature is carried out to identify problems and issues related to the existing divertor’s cooling system designs, their operation, and maintenance. A new design is proposed that can address existing problems. The proposed designed is analyzed through RELAP5 simulations. The design is optimized by consideration variations in the design parameters.