CFR-600 (China Institute of Atomic Energy, China)

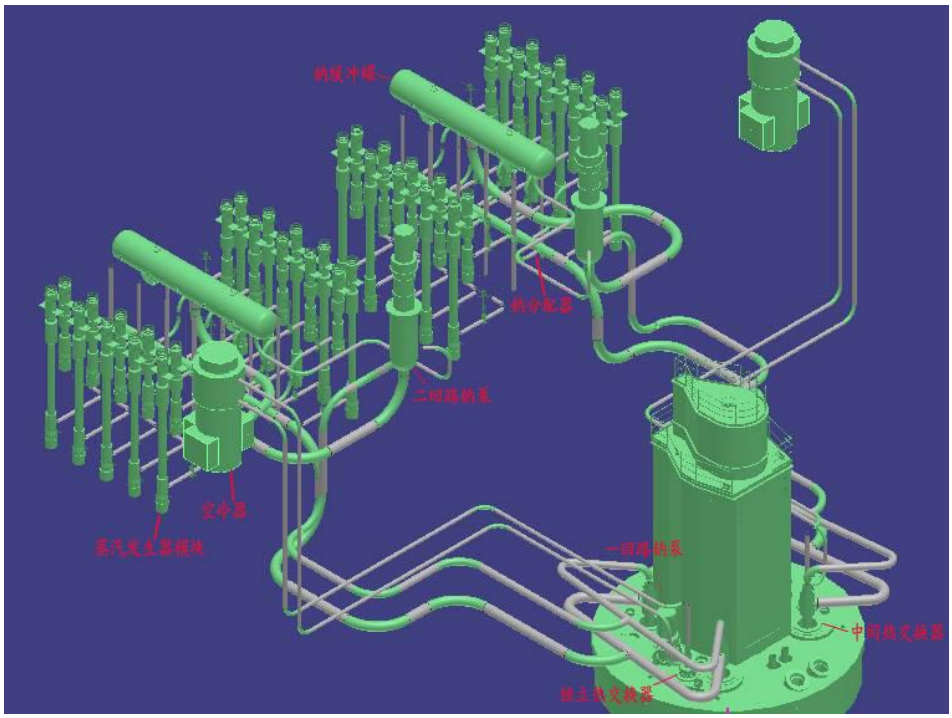

FIG. 5. Schematic representation of CRF-600.

Full name:	*China Fast Reactor 600*
Designer:	*China Institute of Atomic Energy*
Reactor type:	*Sodium -cooled Pool type Reactor*
Electrical capacity:	*600MWe*
Thermal capacity:	*1500 MWth*
Coolant	*Sodium*
Primary Circulation	*Forced*
System Pressure:	*0.054MPa*
System Temperature:	*380(inlet)/550(outlet) °C*
Fuel Material:	*UO2(initial stage)/MOX(later stage)*
Emergency safety systems:	*hybrid*
Residual heat removal systems:	*hybrid*
Design Life:	*60Years*
Design status:	*Concept*
Planned deployment/1st date of completion:	*2017 FCD*
New/Distinguishing Features:	*CFR 600 will be designed to demonstrate the breeding ability of fast reactor*

Introduction

CEFR (China Experimental Fast Reactor), which is the first fast reactor of China, has achieved its first criticality at 21st July 2010 and was connected to the grid with 40% rated power on 21st July 2011. Based on the experience of CEFR, CFR-600 (China Fast Reactor-600), the second step of fast reactor development in China, is a sodium cooled pool type fast reactor, with 1500MW thermal power and 600MW electric power. CFR-600 is a prototype reactor and a three circuit design. The primary circuit and the second circuit both apply on the two-loop design. The inlet core temperature is about 380℃, and the outlet core temperature about 550℃. The design objective for thermal efficiency is 40%.

Description of the Nuclear System

CFR-600 is flexible for two fuel types, UO_2 and MOX. UO_2 fuel respectively, that will be loaded first and then convert to MOX fuel along with the development of MOX technology.

Breeding ability is a significant feature of CFR-600 with 1.2 as the breeding ratio objective.

At the pre-conceptual design stage, research about key parameters related to breeding ratio, including fuel pin diameter, axial blanket design, core layout etc., is done in detail. Another important feature of CFR-600, sodium void effect is researched at the same time.

CFR-600 will be divided into three fuel regions. The maximum burn up is about 100MWd/kgHM. Control rods are utilized for reactivity control and reactor shut down. CFR-600 will also be equipped with passive emergency shutdown system.

The instrumentation and control system will be digital system and will be optimized based on CEFR experience.

For the reactor vessel, the main vessel and protection vessel will be used as in the CEFR. Furthermore, containment will be set up for CFR-600.

Description of the Safety Concept

As mentioned above, a passive shutdown system will be used in CFR-600. The hydraulic suspend rod is now under consideration.

To provide defence in depth against core melting caused by beyond design basis accidents, CFR-600 will be equipped with a core catcher, which will keep the melting material subcritical and provide long-term cooling.

For the residue heat removal after the accidents, a passive residue heat removal system will be designed and equipped. The specific scheme is being investigated at this stage.

Deployment Status and Planned Schedule

The pre-conceptual design of CFR-600 started at 2012. The latest design status is technological design, which will be finished at 2014. For the construction, FCD will be carried out at 2017. The first fuel loading will be launched at 2023.