PGSFR (KAERI, Korea)

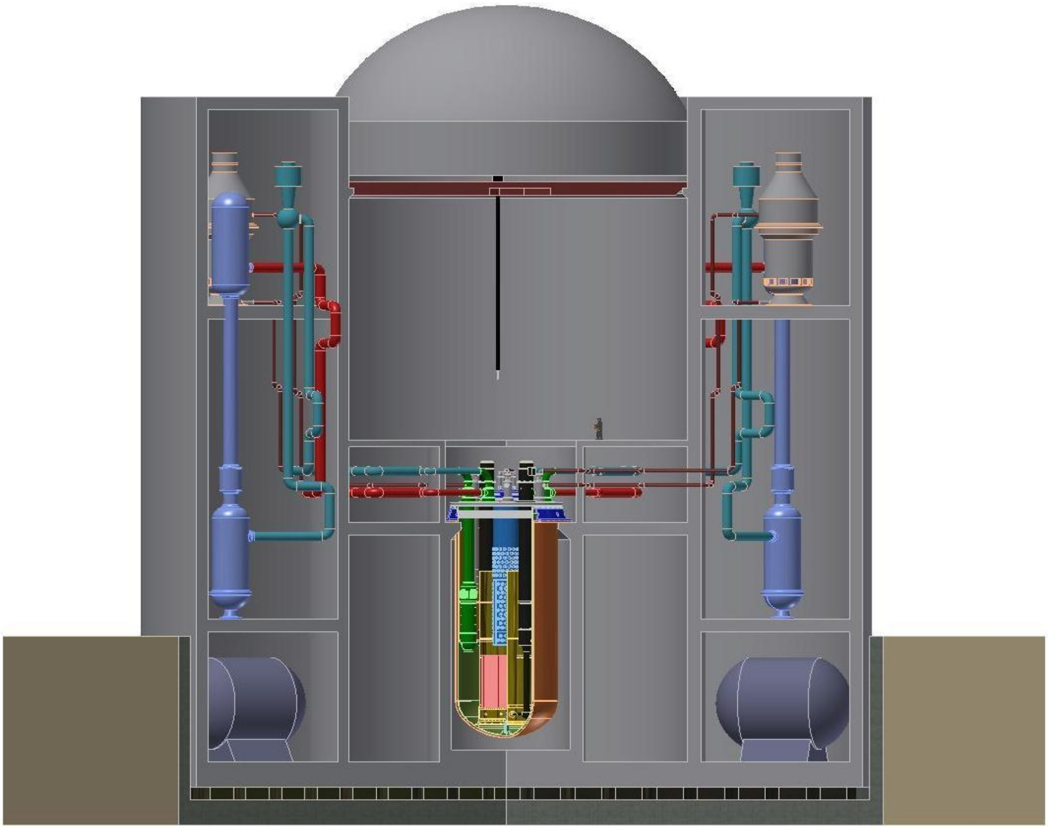

FIG. 9. Schematic view of PGSFR

Full name:	*Prototype Gen-IV Sodium-cooled Fast Reactor (PGSFR)*
Designer:	*Korea Atomic Energy Research Institute (KAERI)*
Reactor type:	*Sodium-cooled Reactor*
Thermal capacity:	*150 MWe*
Coolant	*Sodium*
Primary Circulation	*Pool*
System Pressure:	*~ 1 bar*
System Temperature:	*390-545 °C*
Fuel Material:	*U-Zr (initial core), U-TRU-Zr (reload core)*
Fuel Cycle:	*~10 Months*
Emergency safety systems:	*Hybrid (Passive and Active)*
Residual heat removal systems:	*Hybrid (Passive and Active)*
Design Life:	*60 Years*
Design status:	*Preliminary Design*
Planned deployment/1st date of completion:	*2028*
New/Distinguishing Features:	*Metal fuel, pool type reactor and RHRS features which accommodate SBO*

Introduction

The objectives of PGSFR are to test and demonstrate the performance of transuranics (TRU)-containing metal fuel required for a commercial SFR, and to demonstrate the TRU transmutation capability of a burner reactor as a part of an advanced fuel cycle system.

Description of the Nuclear System

PGSFR has plant capacity of 150MWe and features a proliferation-resistant core without blankets, metallic fueled core, pool type PHTS, and two IHTS loops. The core adopts a homogenous configuration in the radial direction that corporate annular rings of inner and outer driver fuel assemblies. All blankets are completely removed in the core so as to exclude production of the high quality of plutonium. The active core has the height of ~90 cm and a radial equivalent diameter of ~1.6 m. The metallic fuel of U-Zr (or U-TRU-Zr) is used as the driver fuel. The each fuel assembly includes 217 fuel pins. All the charged fuels have a single enrichment of U (or TRU) nuclide. The reactivity control and shutdown system consists of nine control rods assemblies that are used for power control, burnup compensation and reactor shutdown in response to demands from the plant protection control and systems. The heat transport system of PGSFR consists of PHTS and IHTS, steam generation system, and decay hear removal system (DHRS). PHTS mainly delivers the core heat to IHTS and IHTS works as the intermediate system between PHTS where nuclear heat is generated and the SGS where the heat is converted to steam. PHTS is a pool type in which all the primary components and primary sodium are located within a reactor vessel. Two mechanical PHTS pumps and four Intermediate Heat Exchangers (IHXs) are immersed in the primary sodium pool. IHTS has two loops, and each loop has two IHXs connected to one steam generator and one IHTS pump. Each steam generator has a thermal capacity of ~200 MWt. The IHTS sodium flows downward through the shell side while the water/steam goes up through the tube side. The IHTS adopts Electro-Magnetic pump to simplify installation and to reduce moving parts. The IHX design conditions were established to prevent water/steam and sodium water reaction products from being discharged into reactor vessel. The DHRS, one of the safety design features, is composed of two Passive Decay Heat Removal Systems (PDHRS) and two Active Decay Heat Removal Systems (ADHRS). DHRS is designed to remove the decay heat of the reactor core after a reactor shutdown when the normal heat transport path is unavailable.

For a simple reactor design, the reactor vessel has a uniform thickness of ~5 cm, and there are no penetrations and no attachment to the reactor vessel. The horizontal seismic isolation design is adapted for a reactor island including a reactor building, an auxiliary building, and a wastage/ maintenance building. For the design materials, 9Cr-1Mo-V steel is used for the IHX, DHX, IHTS piping, and steam generator. Others such as the reactor vessel, reactor internal structures, and reactor head are composed of 316 stainless steel.

Description of the Safety Concept

PGSFR is designed to be safe against severe accidents incurred through earthquakes and tsunamis. DHRS, combination of passive and active decay heat removal systems, has a sufficient capacity to remove the decay heat in all design basis events without operator's action by incorporating the principles of redundancy and independency. Double reactor vessels and double pipings in IHTS are designed for the prevention of sodium leakage. PGSFR has also a passive reactor shutdown system

Deployment Status and Planned Schedule

The long-term Advanced SFR R&D plan was updated by KAEC in November 2011 in order to refine the plan. The revised milestones include the specific design of a prototype SFR by 2017, specific design approval by 2020, and construction of a prototype SFR by 2028. The PGSFR has now entered into the preliminary design phase.