Ⅱ. HTTR Design and Tests

1. Overview of HTTR

A bird's-eye view of the HTTR site is shown in Fig.Ⅱ.1.1. The reactor building, which has two stories above ground and three stories under ground, covers an area of about 50m×52m. In the reactor building, the reactor containment vessel and other component such as the control system, the electric power supply and cooling system are installed as illustrated in Fig.Ⅱ.1.2. The reactor pressure vessel, the intermediate heat exchanger (IHX), the (primary) pressurized water cooler (PWC) and other heat exchangers in the cooling system are installed in the reactor containment vessel.

The laboratory building and the development building are on the west of the reactor building. On the east of the reactor building locates the spent fuel storage building.

The HTTR is the first HTGR in Japan. It is a helium gas cooled and graphite moderated test reactor with 30MW thermal power, and

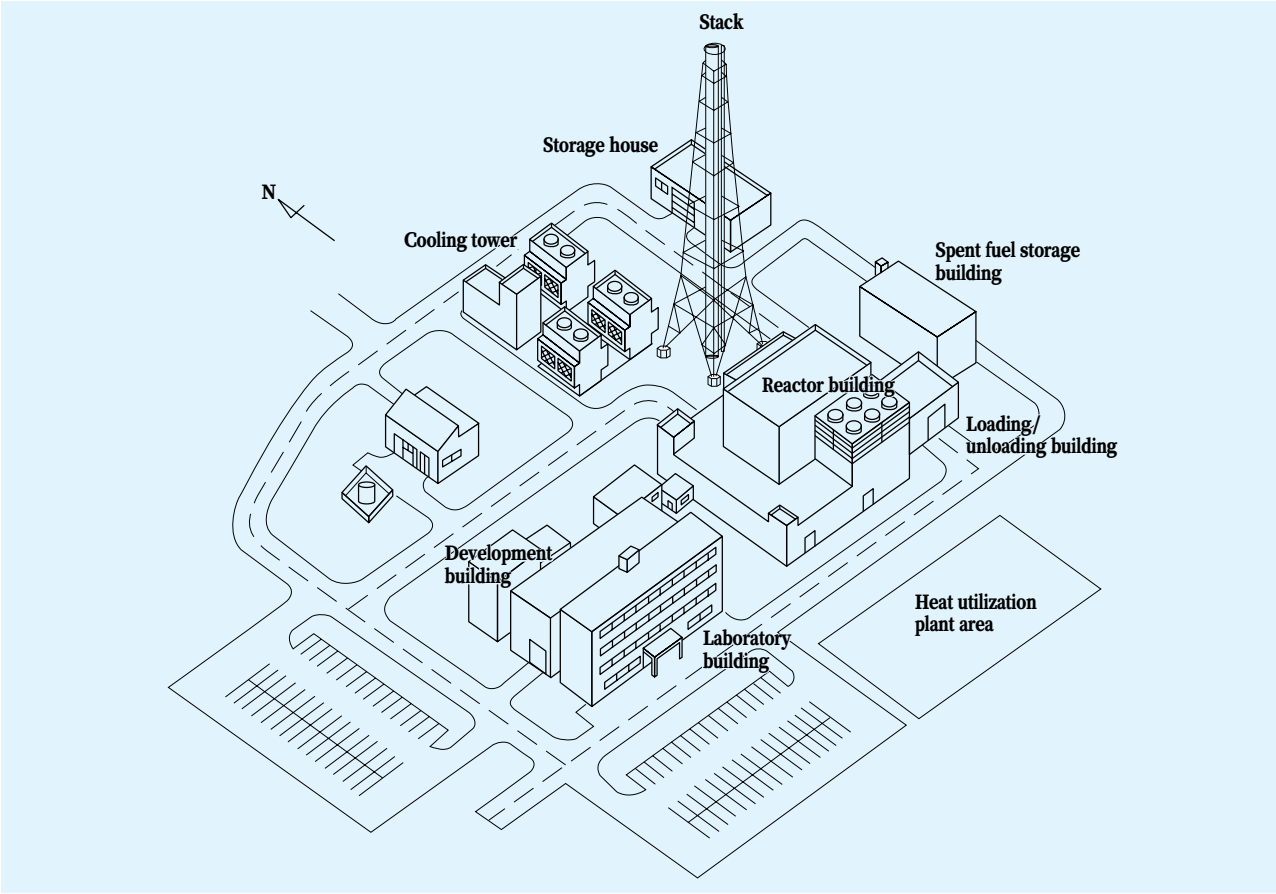

Fig. Ⅱ.1.1 Bird's-eye view of HTTR site.

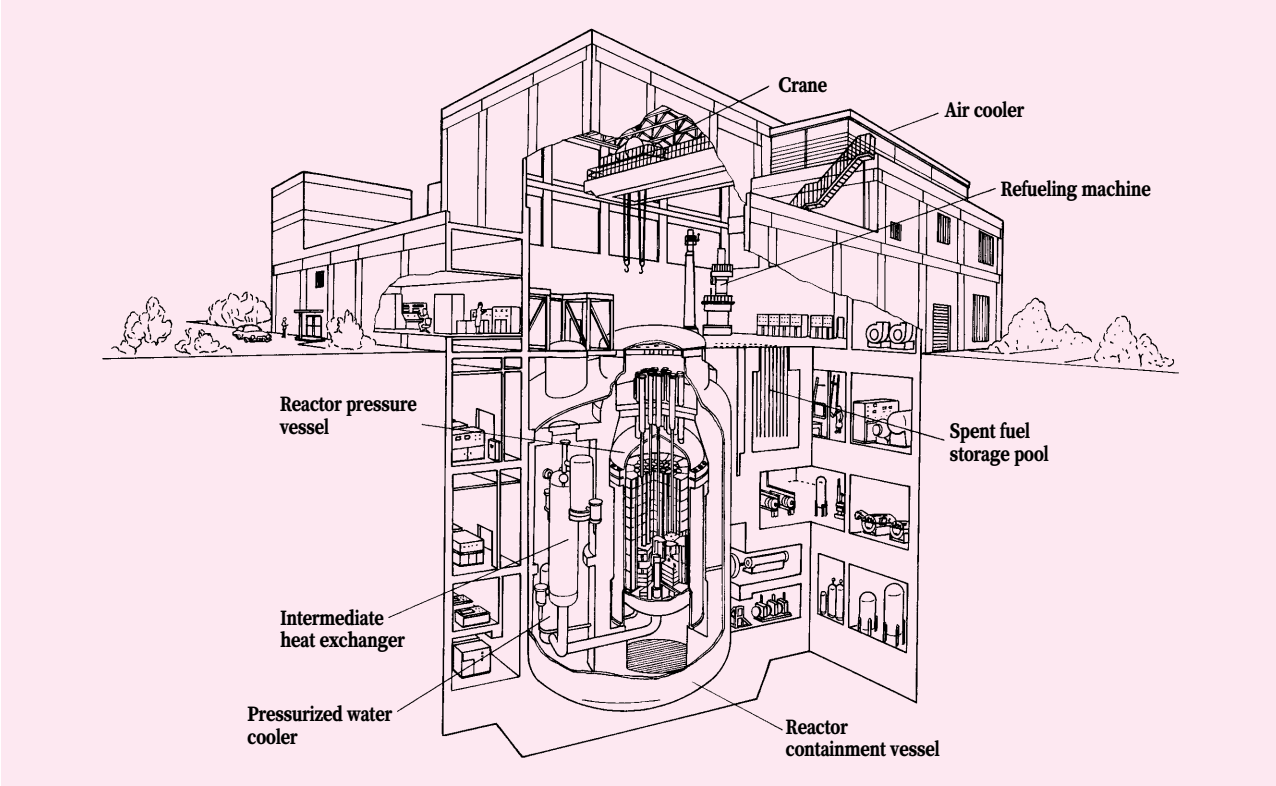

Fig. Ⅱ.1.2 Cutaway View of the HTTR Reactor Building.

outlet coolant temperature of 850℃ at the rated operation and 950℃ in high temperature test operation. The HTTR uses pin-in-block type fuel assembly and is capable of demonstrating nuclear process heat utilization.

The purposes of the HTTR are establishment of the HTGR and nuclear heat utilization technologies, and development of innovative high temperature new frontier technologies. The major specifications of the HTTR are shown in Table Ⅱ.1.1.

Table Ⅱ.1.1 Major Specification of the HTTR.

Thermal Power	30MW
Outlet coolant temperature	850℃/950℃
Inlet coolant temperature	395℃
Fuel	Low enriched UO_2
Fuel element type	Prismatic block
Direction of coolant flow	Downward flow
Pressure vessel	Steel
Number of main cooling loop	1
Heat removal	Intermediate heat exchanger (IHX) Pressurized water cooler (PWC)
Primary coolant pressure	4MPa
Containment type	Steel containment
Plant lifetime	About 20 years

2. Construction of HTTR

JAERI obtained the installation permit for the HTTR from the Government in November 1990. JAERI received approval of the HTTR design and construction methods from the Science and Technology Agency (STA) in January 1991 and started the construction work for HTTR in March 1991. Excavation was completed in August 1991 and the construction of the concrete base-mat was completed in May 1992.

The reactor containment vessel was installed and passed pressure-proof and leakage tests successfully in November 1992. The reactor pressure vessel, intermediate heat exchanger, primary helium circulators and primary pressurized water cooler were installed in the reactor containment vessel in1994. The first pressure test for the primary cooling system was carried out successfully in October 1995. Construction of the reactor building was completed by closing the temporary opening for carrying in large components in December 1995.

JAERI obtained the uranium material for the first loading fuel in 1994, and manufacture of the fuel rods was completed in October 1997. Assembly of fuel elements was carried out in the reactor building, and was completed in December 1997.

Comprehensive and functional tests for each system were started in October 1996, and several malfunctions requiring improvements were found. The improvements were finished by March 1998.

Preparation for the first fuel loading of the HTTR was started in April 1998. During this preparation, some unsuitableness were found in the fuel handling machine and other devices. After measures against these unsuitableness were finished, the first fuel loading was started on July 1, 1998. The first criticality was achieved in core of 19 columns at 14:18 on November 10, 1998.

The rise-to-power test was started on September 28, 1999, and the HTTR achieved the full-power of 30MW and the reactor outlet coolant temperature of about 850℃ on December 7, 2001. The operation permit of the HTTR was issued on March 6, 2002 from the Ministry of Education, Culture, Sports, Science and Technology (MEXT). Extensive tests using the HTTR started in FY2002. The maximum reactor outlet coolant temperature of 950℃ will be attained in 2004.

The HTTR construction schedule is shown in Fig. Ⅱ.2.1.

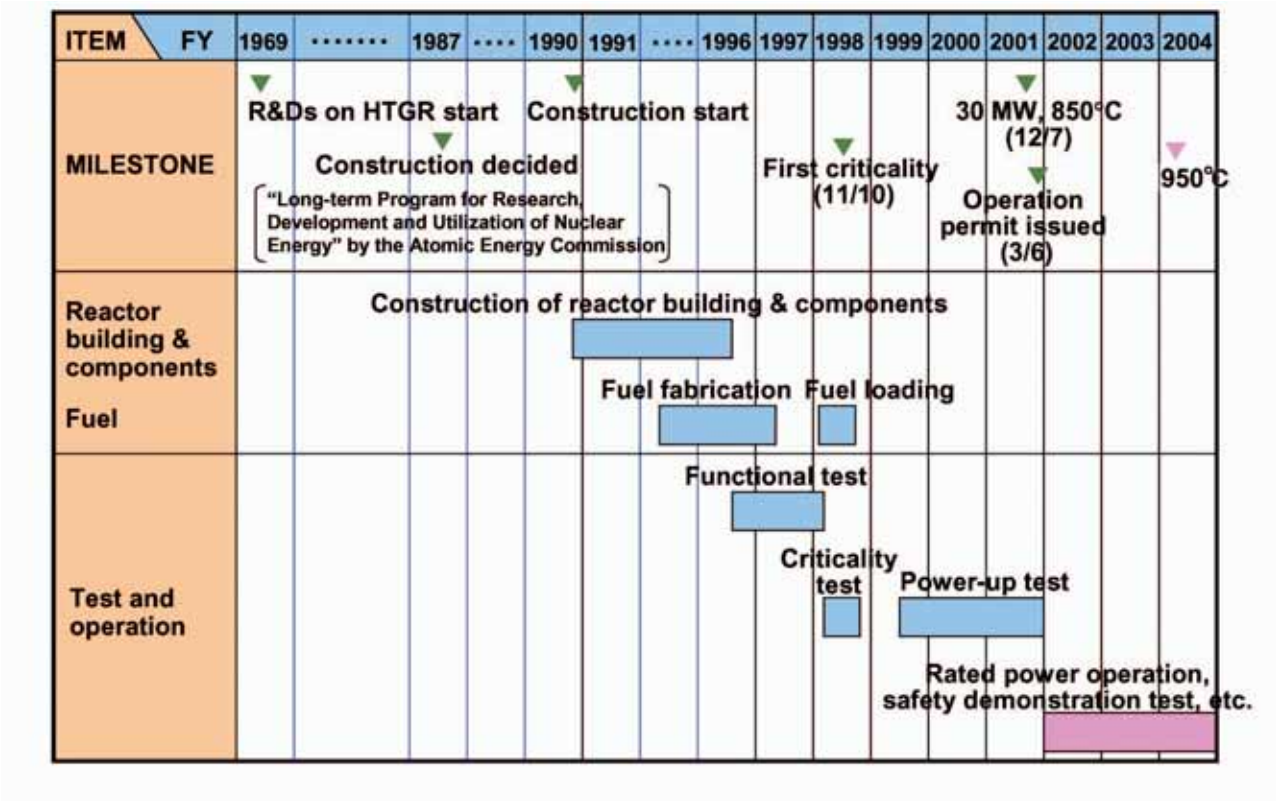

Fig. Ⅱ.2.1 HTTR construction schedule.