

Informal Information Sharing

Recent topics concerning SMR Development in Japan

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- JAEA's activities about R&D of SMR

HTGR, SFR

A yellow speech bubble with a blue outline and a tail pointing towards the word "HTGR".

Main topic

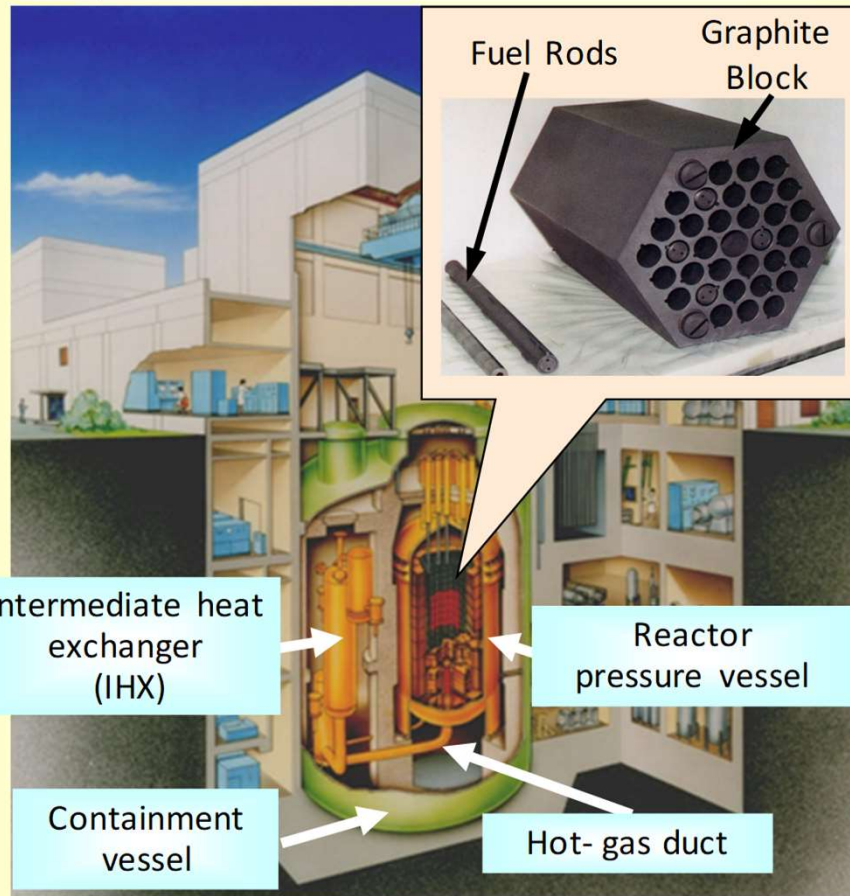
- Activities of private sectors

Major specification of HTTR, Japan's first HTGR



HTTR(High Temperature Engineering Test Reactor)

Graphite-moderated and helium-cooled HTGR



Major specification

Thermal power	30 MW
Fuel	Coated fuel particle / Prismatic block type
Core material	Graphite
Coolant	Helium
Inlet temperature	395°C
Outlet temperature	950°C
Pressure	4 MPa

First criticality : 1998

Full power operation : 2001

50 days continuous 950°C operation : 2010

Loss of forced cooling test at 9MW : 2010



Great East Japan earthquake: 2011
New regulation standard: 2013

Licensing progress of HTTR toward restart

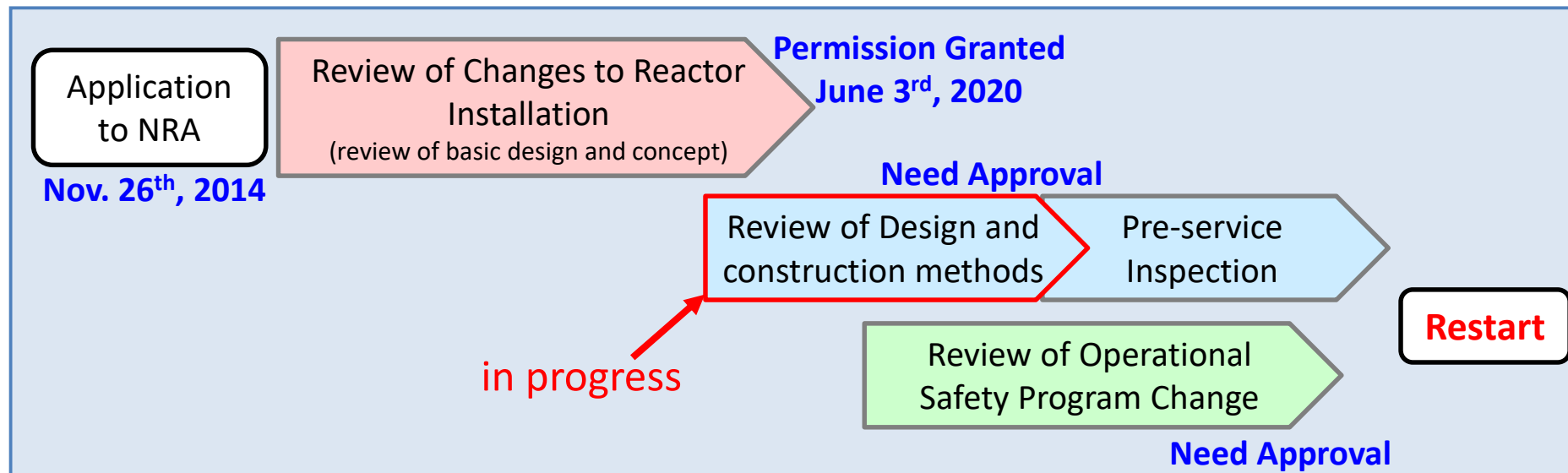


- ❑ JAEA had submitted the application including evaluation results satisfying the New Regulatory Requirements to the Nuclear Regulation Authority (NRA) on Nov. 26th, 2014.
- ❑ Through many discussions with the NRA, on June 3rd, 2020, JAEA obtained the permission by the NRA for changes to Reactor Installation of the HTTR.
- ❑ It was confirmed that no fuel damage would occur even in the event of a beyond design basis accident(BDBA).
- ❑ On June 8th, 2020, the NRA started the review of “Design and Construction Methods”. The refurbishments to the HTTR will be carried out, including installation of countermeasure systems against internal and external fires, installation of diverse radiation monitoring systems, etc.
- ❑ JAEA will make every effort to obtain the approval of “Design and Construction Methods” and “Operational Safety Program”.

Safety review scheme toward restart of HTTR



New regulation standard, issued on December 18th, 2013



Please join
GIF Webinar

GIF Webinar: 22 April 2021

Series 52: Experience of HTTR licensing for Japan's New Nuclear Regulation

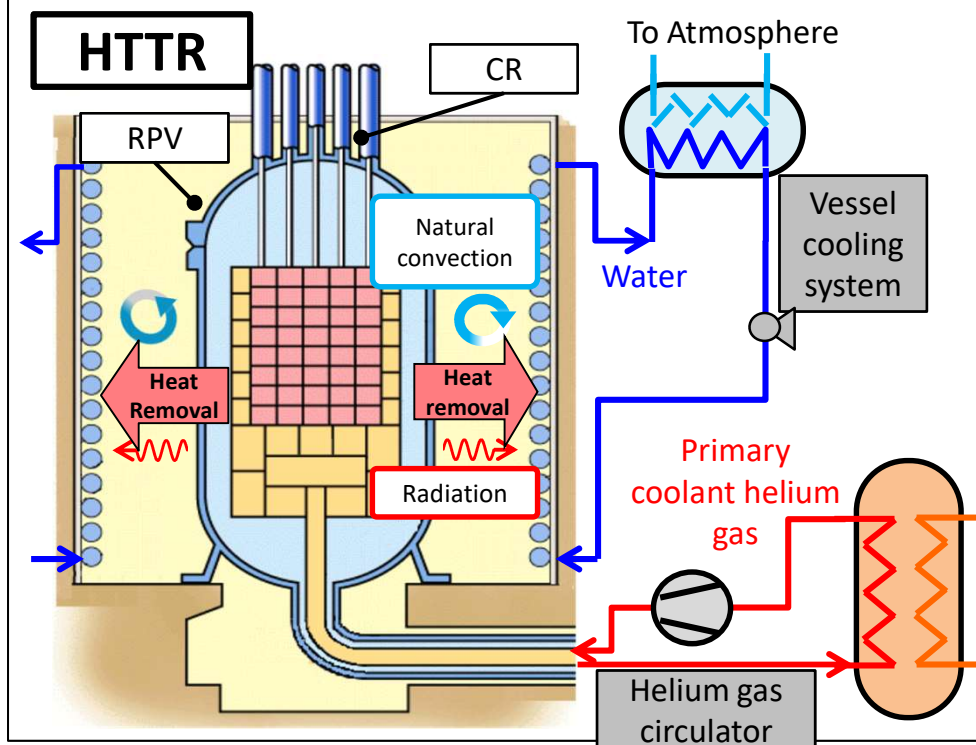
https://www.gen-4.org/gif/jcms/c_82831/webinars

Safety demonstration test using HTTR



Verification of inherent safety of HTGR

- ☒ 30% power (9MW) **Loss of forced cooling test**
(All HGC tripped) . . . Finished (2010)
- ☐ 100% power **Loss of forced cooling test**
(All HGC tripped) . . . Planned
- ☐ 30% power **Loss of core cooling test**
(All HGC + VCS tripped) . . . Planned



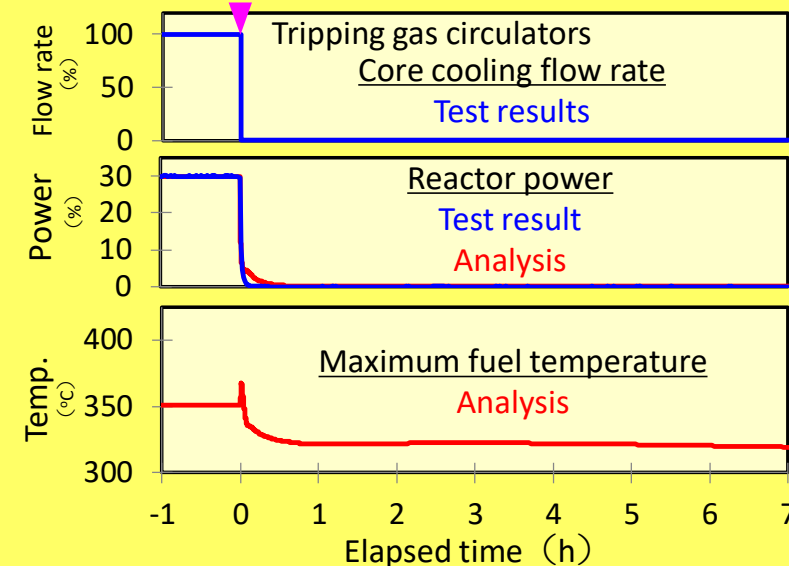
Test condition



- Initial power 30% (9MW)
 - Reducing core flow rate to zero
 - Keeping VCS operation
 - No scram operation (No CR insertion)
- OECD/NEA cost share project**

Test result

Reactor is naturally shut down as soon as the core cooling flow rate to zero. Reactor is kept stable long after the loss of core cooling



(1) Reactor technology



- Reactor outlet coolant temperature 950°C at 30 MWt (April 2004)
- 950°C / 50 days operation (March 2010)

- HTTR tests for HTGR safety enhancement
- Safety evaluation by NRA has been completed (June 3, 2020).

(2) Heat application technologies



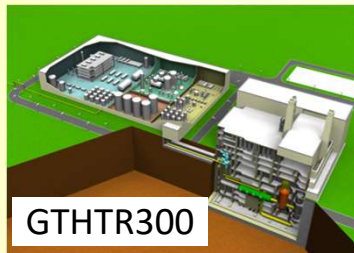
He compressor



Hydrogen facility

- Completion of basic technologies related to hydrogen production facility and gas turbine power generation
- Establishment of operation control technology and facility reliability for IS process
- 150 hours of H₂ production with rate of 30L/h in January 2019

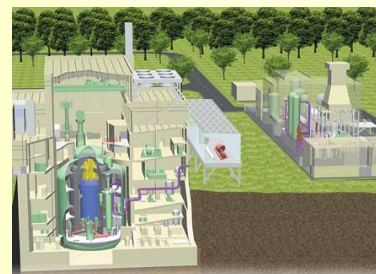
(3) Commercial HTGR design



- Design study of commercial HTGR systems
- Core design of plutonium burning HTGR
- Establishment of safety design philosophy and international standardization

- Design of HTGR for exporting overseas

(4) HTTR – GT/H₂ test



- Coupling to HTTR
- Licensing demonstration
- Plant performance test

- Integrated demonstration of HTGR heat application system technologies

Expecting international cost share project

Activities of private sectors



Designers	SMR type/ Design
Toshiba Energy Systems and Solutions	HTGR
	MoveluX™ (heat pipe)
Mitsubishi Heavy Industries	Small Modular LWRs for Multi-Purpose Use (PWR)
	Multi-purpose Modular Ultra-safety Micro Reactor
	HTGR cogeneration
	Small SFR
Hitachi-GE	BWRX-300
	Light Water Cooled Fast Reactor
	Innovative Small SFR
StandardPower	Fast Molten Salt Reactor
Beyond Energy Research & Development Association	Integral Molten Chloride Salt Fast Reactor

More than 10 designs are in discussion under Atomic Energy Society of Japan.

Ref) Journal of the Atomic Energy Society of Japan, pp25-32, Vol.62, 3, 2020.

Ref) Program of 2020 Fall Meeting, Atomic Energy Society of Japan, Sept. 2020.

***Thank you very much
for your attention.***