Recent topics concerning SMR Development in Japan

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Contents

- JAEA’s activities about R&D of SMR
  - HTGR, SFR
- Activities of private sectors
Major specification of HTTR, Japan’s first HTGR

HTTR (High Temperature Engineering Test Reactor)
Graphite-moderated and helium-cooled HTGR

- 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”.

Press Release
Safety review scheme toward restart of HTTR

New regulation standard, issued on December 18th, 2013

- Application to NRA
  - Nov. 26th, 2014
  - Review of Changes to Reactor Installation
    (review of basic design and concept)

- Permission Granted
  - June 3rd, 2020
  - Need Approval

- Pre-service Inspection
  - Need Approval
  - Review of Design and construction methods

- Restart
  - Need Approval
  - Review of Operational Safety Program Change

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)

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

HTGR and Heat Application Technologies Development

(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
- 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

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<th>SMR type/ Design</th>
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<td>HTGR cogeneration</td>
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More than 10 designs are in discussion under Atomic Energy Society of Japan.

Thank you very much for your attention.