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Overview of FHR Technology

Summary / Objectives:

Fluoride Salt Cooled High Temperature Reactors (FHRs) use solid, ceramic fuel with a molten salt coolant, and deliver heat in the temperature range from 600° C to 700° C. This presentation will review key design features of FHRs and recent work to develop the technical basis for safety analysis and licensing.

Meet the Presenter:

Per F. Peterson holds the William and Jean McCallum Floyd Chair in the Department of Nuclear Engineering at the University of California, Berkeley. He performs research related to high-temperature fission energy systems, as well as studying topics related to the safety and security of nuclear materials and waste management. He participated in the development of the Generation IV Roadmap in 2002 as a member of the Evaluation Methodology Group, and cochaired its Proliferation Resistance and Physical Protection Working Group. His research in the 1990's contributed to the development of the passive safety systems used in the GE ESBWR and Westinghouse AP-1000 reactor designs. Currently his research group focuses primarily on heat transfer, fluid mechanics, and regulation and licensing for advanced reactors.

1. FHRs leverage experience and technology from multiple sources

FHR design concept is based on technologies and experiences from multiple fields such as LWR passive safety, SFR, HTGR, MSR, and gas combined cycle.

FHRs leverage experience and technology from multiple sources

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- Passive Advanced Light Water Reactors
  - Established licensing methodology for passive safety
  - Integral Effects Test (IET) experiments, CSAU/PIRT
- Sodium Fast Reactors
  - Design and structural materials for low pressure, high temperature
  - Inert cover gas systems; thermal insulation and control, DRACS/RVACS
- High Temperature Gas Reactors
  - TRISO fuel / functional containment
  - Graphite and ceramic-fiber composite structural materials
- Molten Salt Reactors
  - Fluoride salt chemistry control and thermophysical properties
- Natural Gas Combined Cycle Plants (some types of FHRs)
  - Current dominant technology for new U.S. power conversion; adaptable to FHRs

2. R&D has developed an improved foundation for understanding FHRs

The base technology related to FHR concept has been improved and documented through design studies and various experiments.

R&D has developed an improved foundation for understanding FHRs

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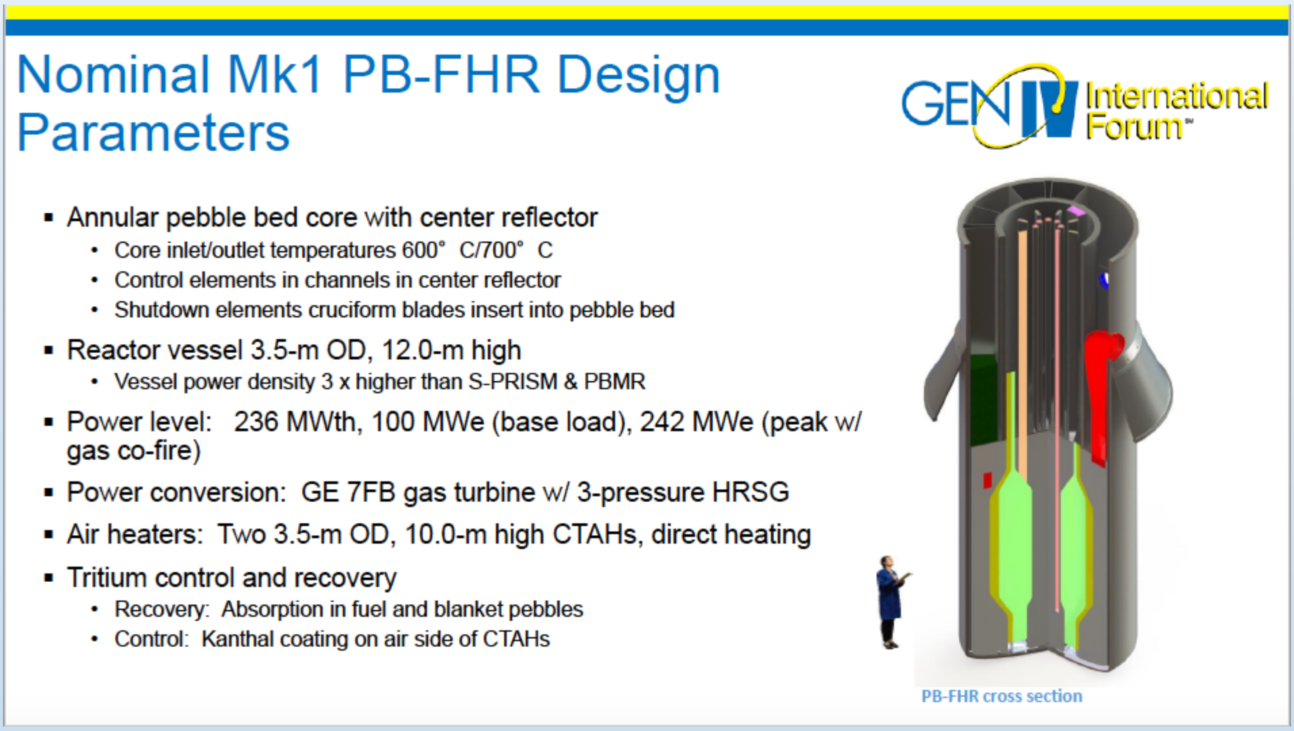
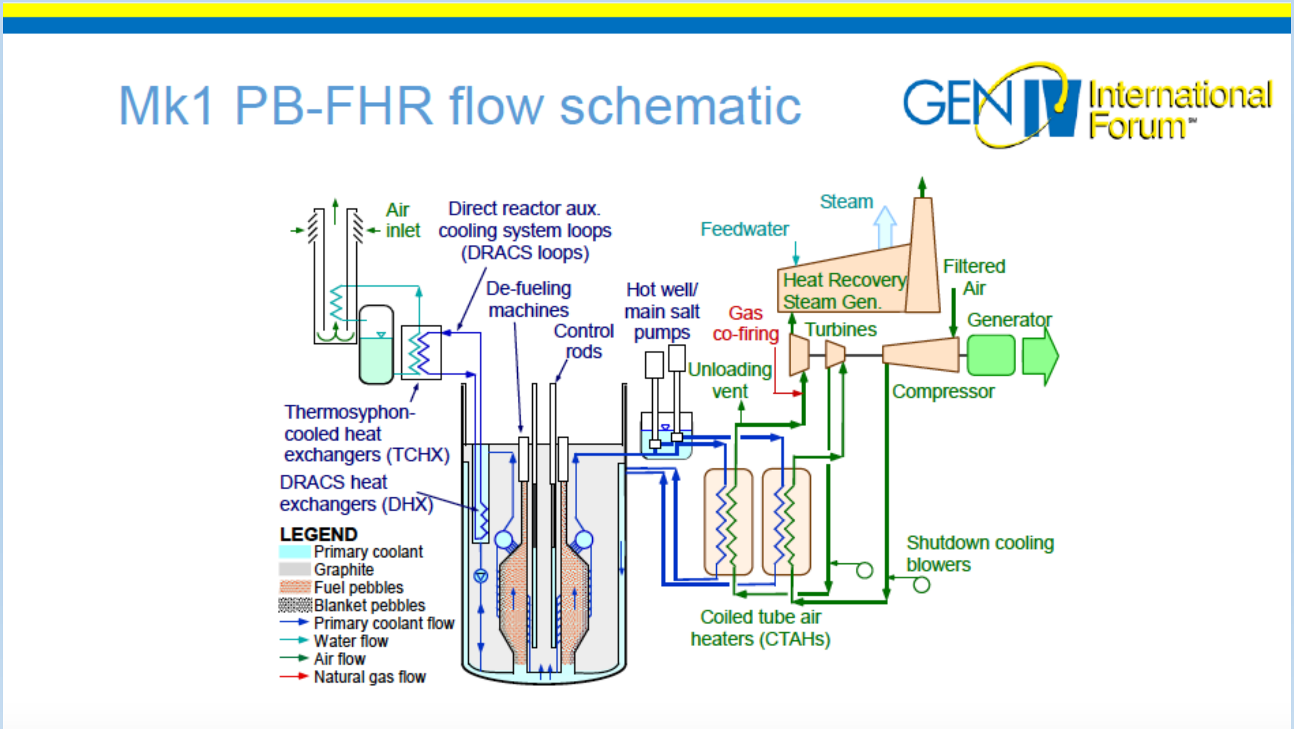
3. Nominal Mk1 PB-FHR Design parameters

Main plant parameters, core structure, power output, and mitigation measures for Tritium are shown.



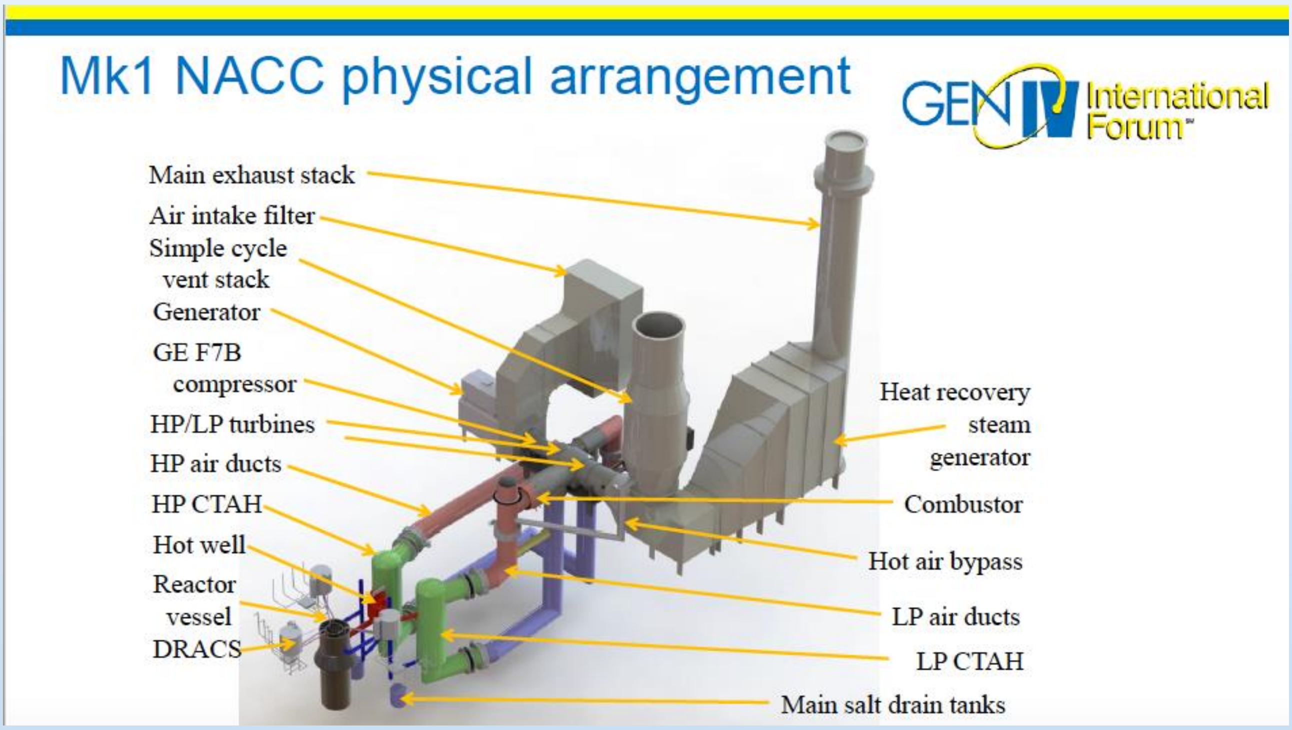
4. Mk1 PB-FHR flow schematic

The main heat transport system transfer the core heat to the power conversion system (PCS) through coiled tube air heaters.



5. Mk1 NACC physical arrangement

Each FHR unit has one PCS (NACC: nuclear air-brayton combined-cycle) .



6. Notional 12-unit Mk1 PB-FHR nuclear station

The total of 12 units can produce 1200 MWe base load and 2900 MWe for peak load with natural-gas co-firing boost function.