



NRC's Advanced Reactor Program

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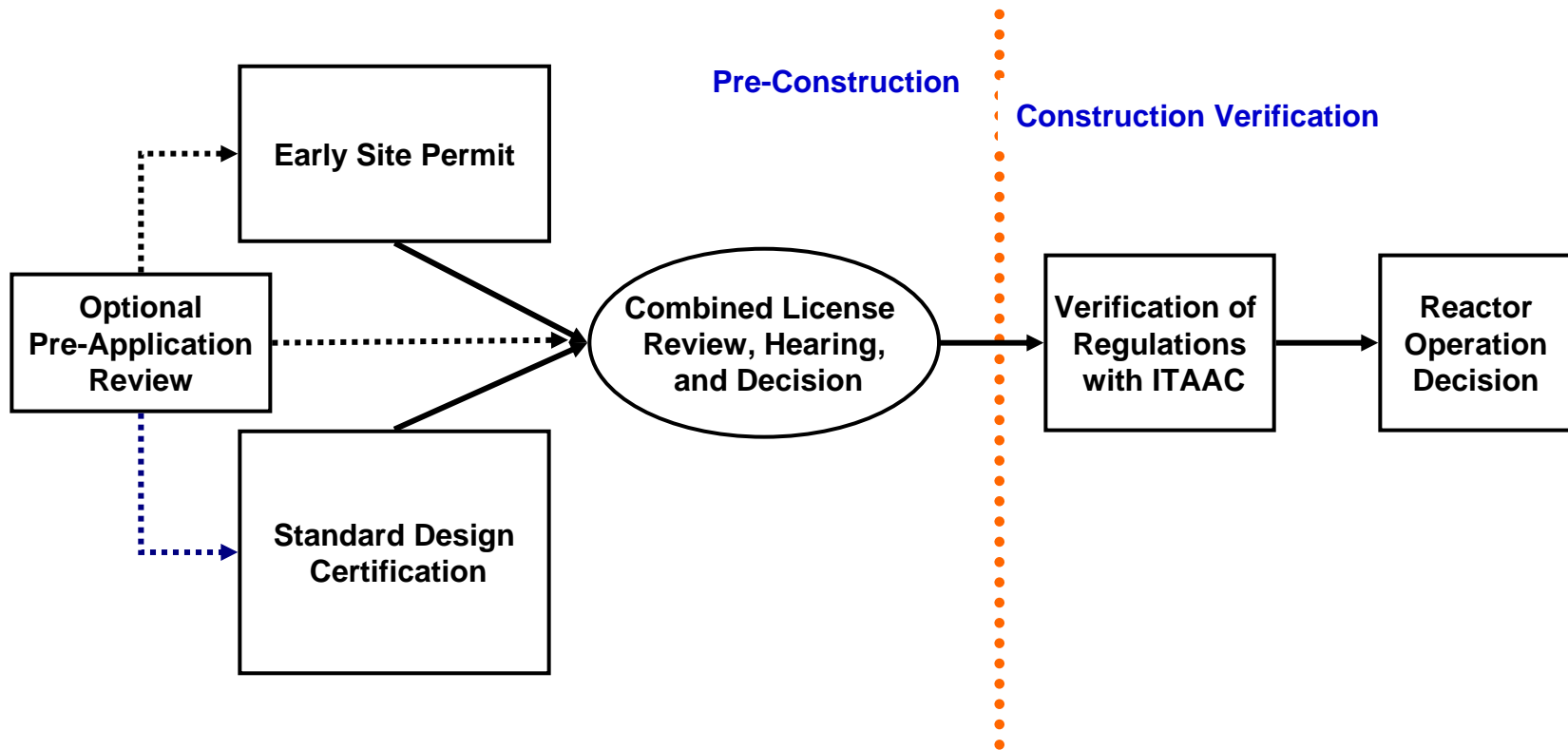
Advanced Reactor Program

Office of New Reactors

TOPICS

- Licensing Process
- Commission Policy Statement on Advanced Reactors
- Vendors requesting early interaction
- Commission position on budget priorities for new and advanced reactors
- Next Generation Nuclear Plant (NGNP)
- Possible future interest

Part 52 Licensing Process



- Licensing decisions finalized before major construction begins
- Inspections w/Inspection Test And Acceptance Criteria (ITAAC) to verify construction
- Limited work may be authorized before COL issuance
- <http://www.nrc.gov/reactors/new-reactors.html>

Licensing Guidance

- Regulatory Guide 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition),” June 2007
 - Provides guidance **to applicants** on information to be submitted in combined license (COL) application.
 - Draft supplement to address Limited Work Authorization
- Guidance will be revised for non-LWRs

Licensing Guidance cont'd

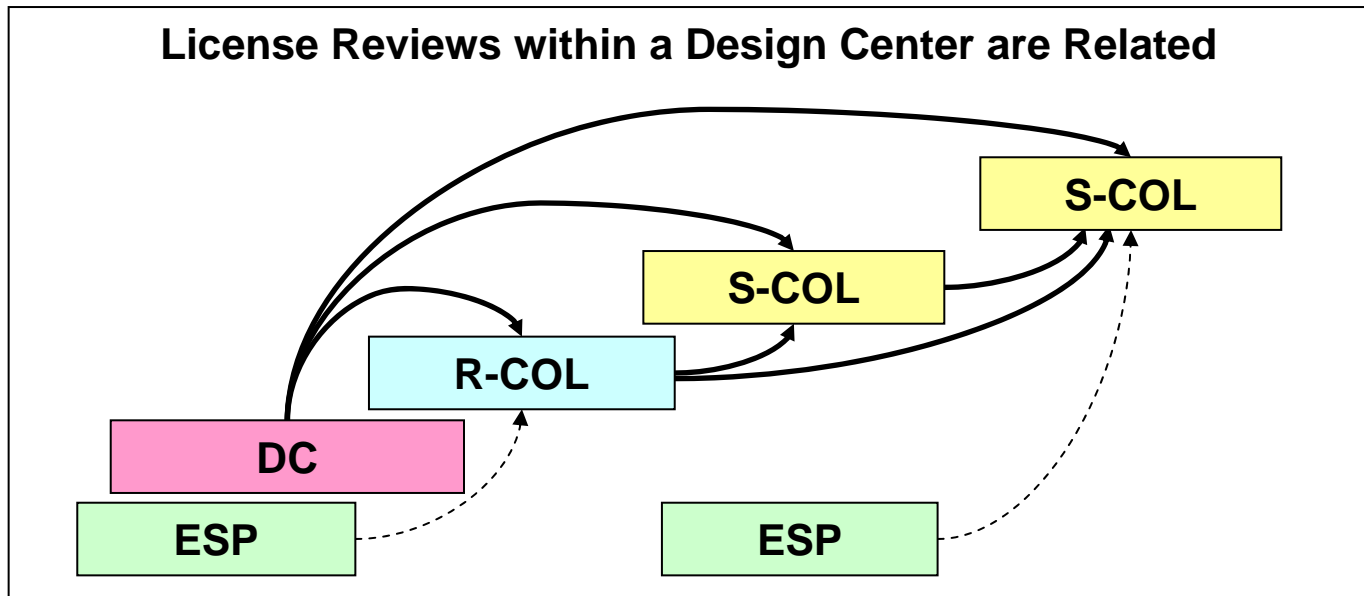
- NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,” March 2007
 - Provides guidance **to NRC staff** in performing safety reviews of applications under 10 CFR Parts 50 and 52 (including requests for amendments).
- Guidance will be revised for non-LWRs

Licensing Overview

- Design Centered Review Approach
- One Decision-Multiple Applications
- Efficient Use of NRC Resources and Contractor Support

One Issue - One Review – One Position

- Design-centered review approach
 - Reviews organized into design centers based on reactor design (e.g., ESBWR, EPR, AP1000)
 - Decisions, experience, and lessons-learned from earlier reviews will be applied, where appropriate, to later reviews in the same design center



Cost and Schedule

- **Design Certification**
 - 77 FTE + \$11 Million in contractor support
 - 42 Months to complete
- **Reference Combined License**
 - 36 FTE + \$7.3 Million in contractor support
 - 30 months
- **Subsequent Combined License**
 - 19 FTE + \$4.6 Million
 - 30 Months



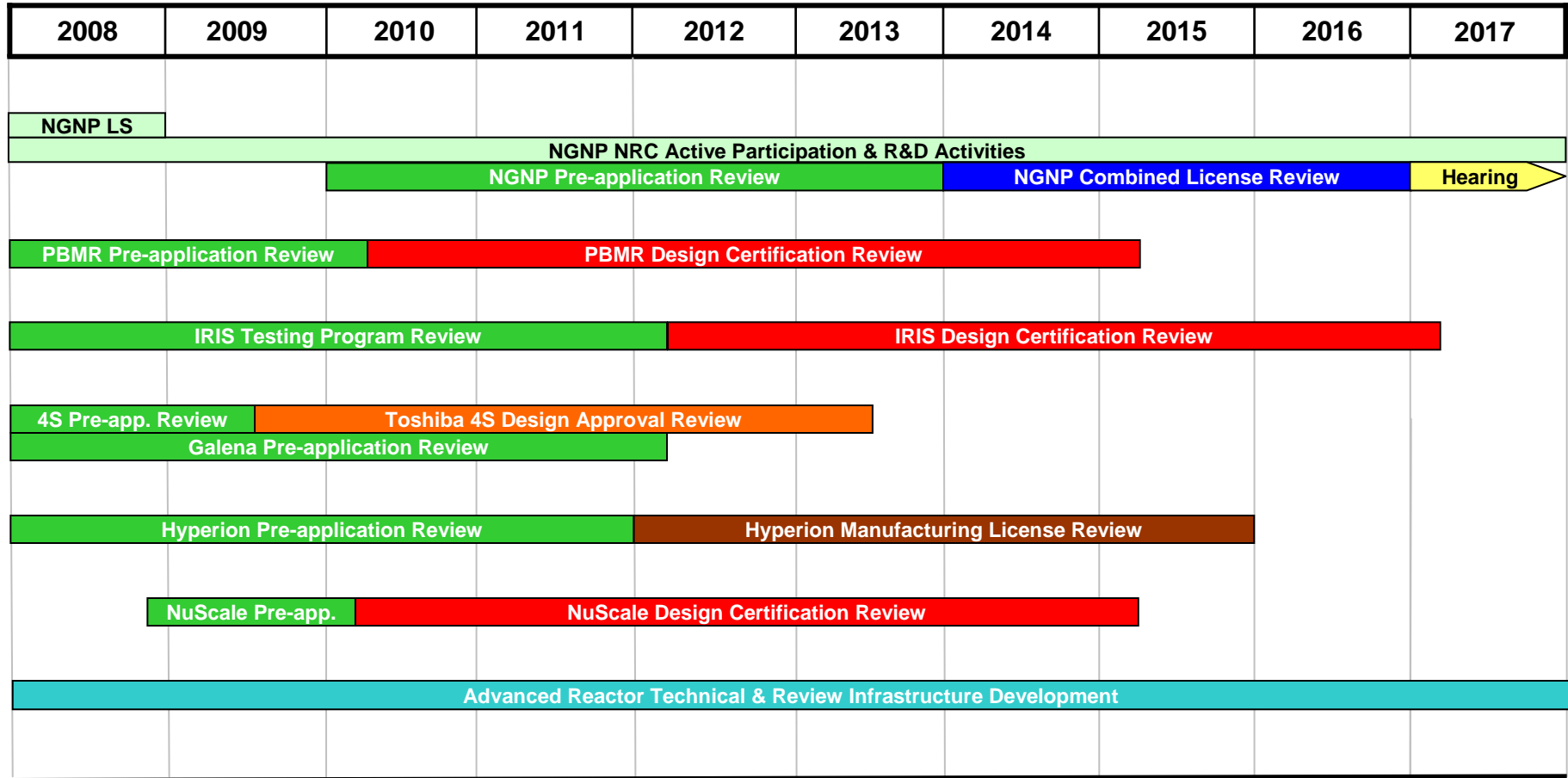
ADVANCED REACTOR PROGRAM

Commission Policy Statement on Advanced Reactors

Commission's Statement of Policy on the Regulation of Advanced Nuclear Power Plants (Volume 59 of the *Federal Register*, page 35461; July 12, 1994) encourages the earliest possible interaction between applicants, vendors, other government agencies, and the U.S. Nuclear Regulatory Commission (NRC) to allow for the early identification of regulatory requirements for advanced reactors and to provide a timely independent assessment of the safety characteristics of advanced reactor designs

Potential Advanced Reactor Licensing Applications

An estimated schedule by Fiscal Year (October through September)



Legend:

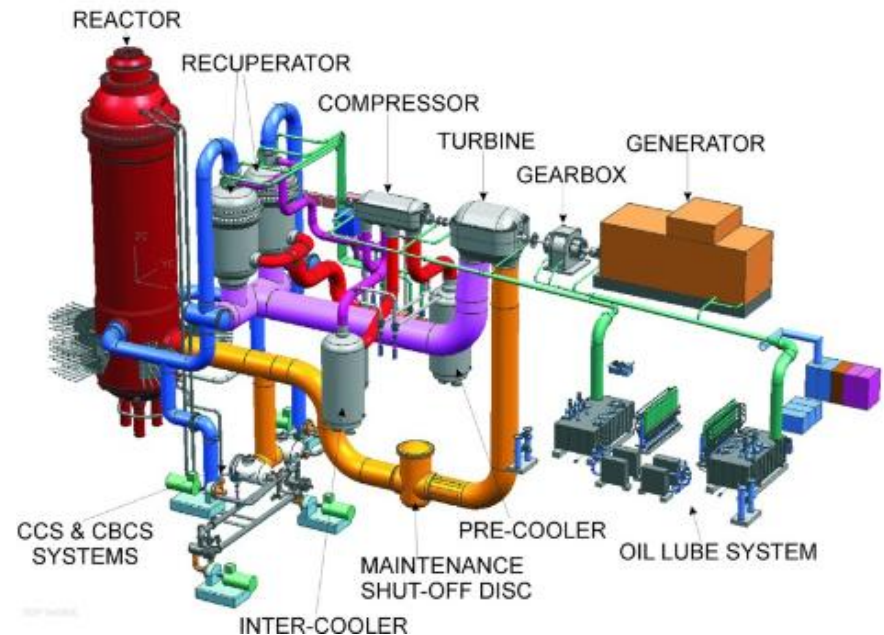


NOTE: Schedules depicted for future activities represent nominal assumed review durations based on submittal time frames in letters of intent from prospective applicants. Actual schedules will be determined when applications are docketed.

PBMR

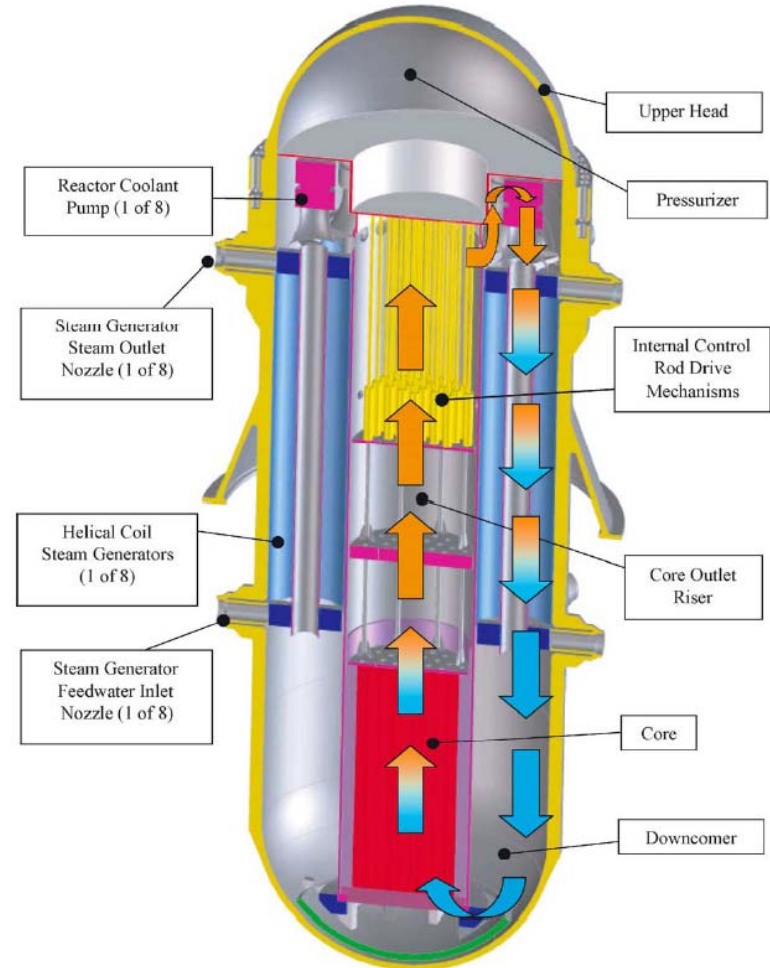
(Pebble Bed Modular Reactor)

- **Vendor:** PBMR Pty.
- **Reactor Power:** 400 MWt
- **Electrical Output:** 165 MWe
- **Coolant:** Helium
- **Outlet Temperature:** 900°C
- **Fuel Design:** Low-enriched TRISO pebbles, UO₂
- **Refueling:** Online
- **Application:** Late 2010
- **Reference:** ML082130430



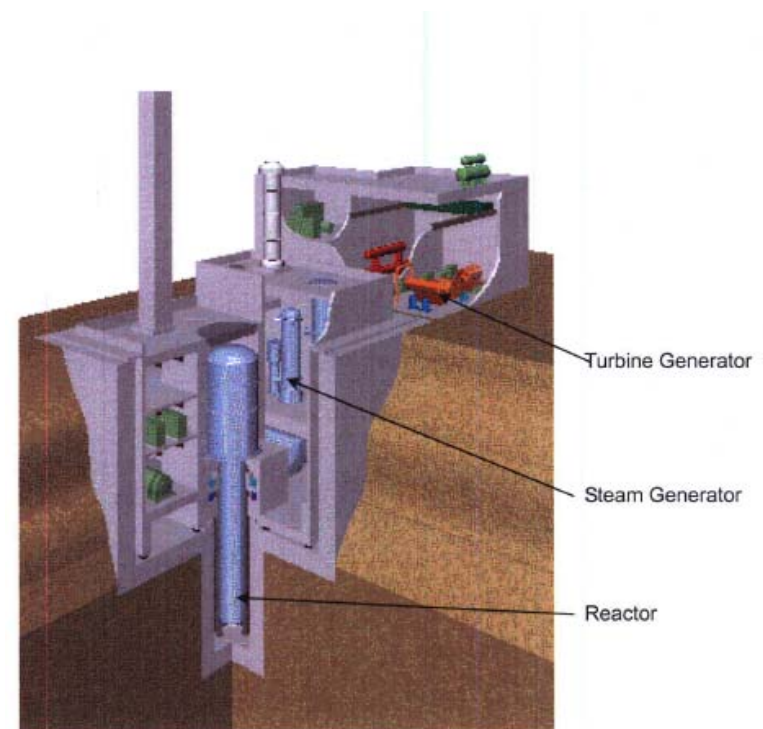
IRIS (International Reactor Innovative and Secure)

- **Vendor:** Westinghouse
- **Reactor Power:** 1000 MWt
- **Electrical Output:** 335 MWe
- **Coolant:** Light water
- **Outlet Temperature:** 327°C
- **Fuel Design:** 17 x 17 assemblies
 - 4.95% enrichment UO₂
- **Refueling:** 3 – 3.5 years
- **Application:** Late 2012
- **Reference:** ML081270251



4S (Super-Safe, Small and Simple)

- **Vendor:** Toshiba
- **Reactor Power:** 30 MWt
- **Electrical Output:** 10 MWe
- **Coolant:** Liquid- Metal (Sodium)
- **Outlet Temperature:** 510°C
- **Fuel Design:** Hexagonal fuel assemblies
 - U-10%Zr Alloy
- **Refueling:** 30 years
- **Application:** Late 2009
- **Reference:** ML072950025



NuScale

- **Vendor:** NuScale Power Inc.
- **Reactor Power:** 150 MWt
- **Electrical Output:** 45 MWe
- **Coolant:** Light Water
- **Outlet Temperature:** 296°C
- **Fuel Design:** 6' long, 17 x 17 assemblies
 - 4.95% enrichment
- **Refueling:** 30 Months
- **Application:** Late 2010
- **Reference:** ML082130430



Hyperion

Vendor: Hyperion Power Generation
Reactor Power: 75 MWt
Electrical Output: 30 MWe
Coolant: Potassium
Outlet Temperature: 550 C
Fuel Design: Uranium Hydride
4.95% enrichment
Refueling: 5 Years
Application: October 2011
Reference: ML072340518



Budget Priorities for New and Advanced Reactors

- Budget for all low and medium uncertainty applications
- Give priority to applications aligned with partners submitting COL applications
- Assign lower priority to applications not aligned with a COL application
- Only NGNP currently funded

Next Generation Nuclear Plant (NGNP)

Next Generation Nuclear Plant

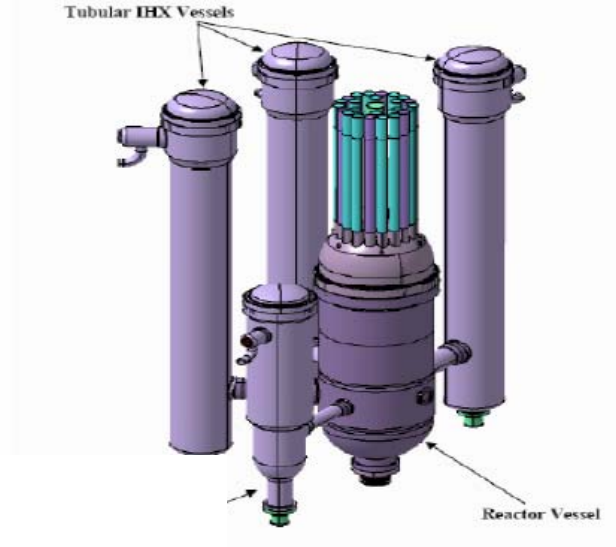
- DOE lead program to build High Temperature Gas Cooled Reactor
- Congress mandated NRC license the reactor
- Pebble bed and prismatic core reactors being considered
- NGNP has higher priority than other advanced reactors

NGNP Designs – PBMR, General Atomics, and AREVA

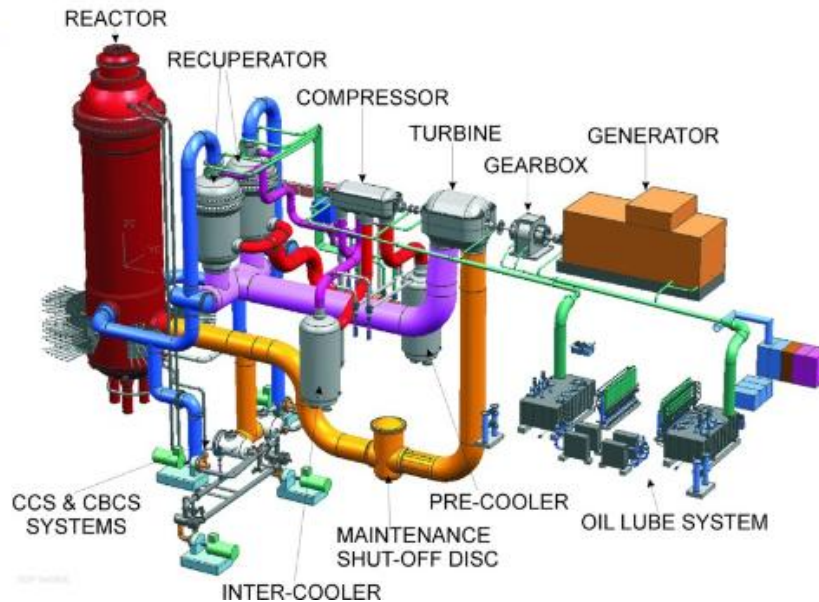
GA GT-MHR Concept



AREVA Antares Concept



PBMR Concept



NGNP Key Technical and Policy Issues

- Fuel Qualification and Performance
- Source Term
- Containment Functional Performance
- Defense-in-Depth (DiD)
- Material performance under very high temperatures
- Extent of PRA use in the Licensing Process

NGNP

Technical Arenas

- Fuel Performance Analysis[†]
- Nuclear Analysis[†]
- Thermal-Fluids Analysis[†]
- Accident & Consequence Analysis[†]
- Graphite Component Analysis[†]
- Metallic Component Analysis
- Structural/Seismic Analysis
- Risk-Informed Licensing Infrastructure^{*}
- PRA^{*}
- Human Factors^{*}
- Advanced I&C^{*}
- Fuel Cycle/Materials Safety
- Material Protection
- H₂ Production Facility

[†] Part of the NRC Accident Analysis “Evaluation Model” ^{*} Generic Technical Arena

NGNP Schedule

- 2008-2011 - Policy and key technical issues identified, design underway
- 2011-2013 - Design completed and COL application developed
- 2013 - COL application submitted
- 2016 - Applicant begins site preparation activities
- 2017 - COL issued and safety-related construction begins
- 2021 - Construction complete and authorization to load fuel granted