Next Generation Nuclear Plant Project

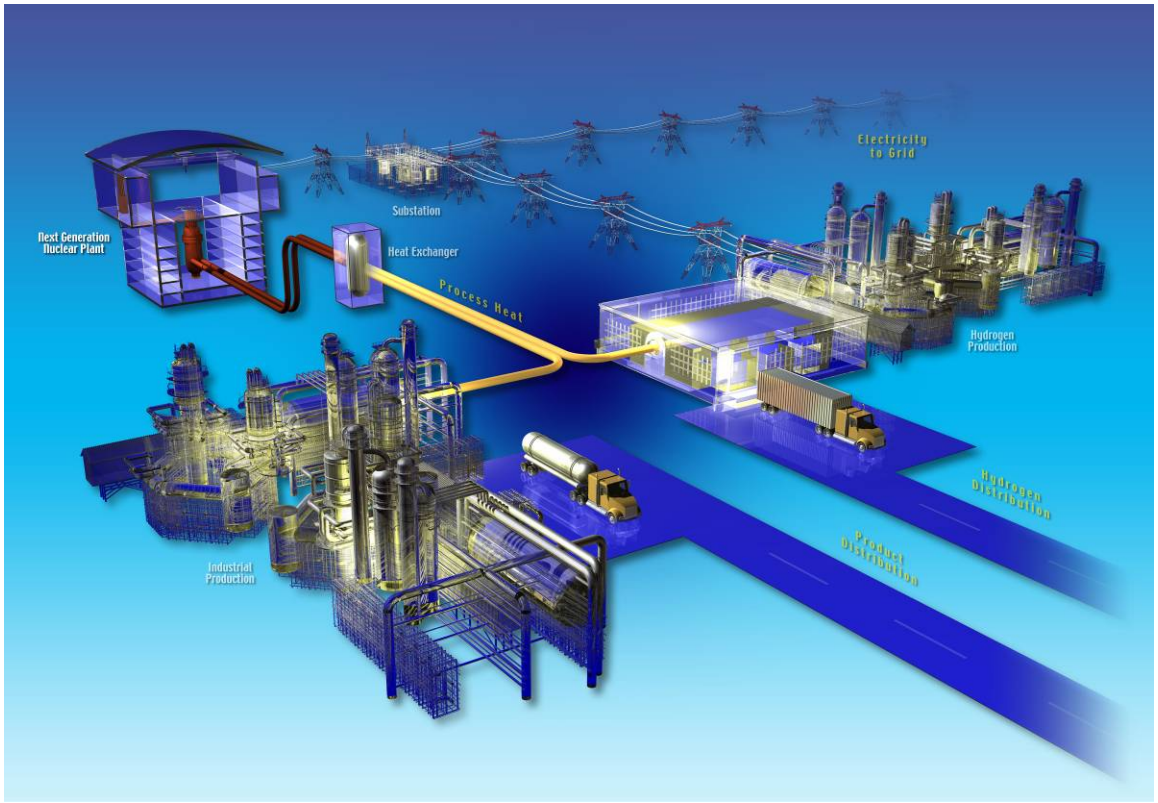
Senior Advisory Group Meeting
Reference Configuration

Crystal City, VA

October 28, 2008

Meeting Minutes

Revision 1, January 28, 2009



NGNP Senior Advisory Group
October 22, 2008 Meeting Minutes

Attendees

Senior Advisory Group
Steve Melancon (Entergy) – Meeting Chairman
Phil Hildebrandt (BEA)
Arkal Shenoy (General Atomics)
Finis Southworth (AREVA)
Ed Wallace (PBMR)

AREVA
Lew Lommers
Joe Stringer

Entergy
Curt Bregar

General Atomics
Mark Haynes

PBMR
Dan Mears

URS
Vytas Maciunas

INL
Larry Demick
Richard Garrett
Greg Gibbs
Jim Kinsey
Phil Mills
Keith Perry

DOE
Tom O'Connor

Meeting Objective

Reach agreement on the reference configurations that will be carried forward in the conceptual design work for NGNP.

Meeting Agreements

1. The NGNP Project will pursue two reference configurations for Conceptual Design as recommended by the HTGR Suppliers:

- PBMR will pursue an indirect[1] configuration using a pebble bed reactor design and a secondary gas loop to supply heat to the energy conversion processes, (e.g., steam turbine electricity generator, process steam demands). An Intermediate Heat Exchanger (IHX) provides the interface and heat transfer component between the primary and secondary gas loops. (see Figure 1, below)

- AREVA and General Atomics will pursue an indirect configuration using a prismatic block reactor design with a secondary loop using steam as the heat transport fluid. A steam generator transfers the heat from the primary loop in the form of steam that then supplies the energy conversion processes, (e.g., steam turbine electrical generator, process steam demands), see Figure 2, below.

- The NGNP Project Conceptual Design work will assume that the reference configurations will be used to supply process steam and electricity in a commercial co-generation application.

2. The group defined the following high level technical and functional requirements that impact HTGR configuration:

- The Nuclear Heat Supply System (NHSS[2]) shall be design certified for a broad range of applications and sites.
- The NHSS shall be licensed independent of the application. In this regard the licensing boundary and interface requirements shall be defined for the reference configurations, (e.g., transients, feed and gas return chemistry).
- The NHSS designs shall be applicable, on economic, availability and reliability bases, to a broad range of co-generation applications supplying, singly or in combination, electricitysteam and hot gas (helium).
- The reactor gas outlet temperature shall be in the range of 750°C to 800°C
- The plant shall be capable of completing design, licensing, construction, and startup testing for initial operation by 2021
- The NHSS shall be capable of controlling the transport of radionuclides to the end products at levels below the concentration or exposure requirements for the product (e.g., tritium in steam, gas, hydrogen) [Initial acceptable tritium levels will be set at a TBD fraction of the EPA limits for drinking water and air]
- Can be collocated with the process; PAG limits at site boundary of ~ 400 meters
- Capable of following process load variations
- Costs for anticipated NOAK, based on design certification, construction, and operation of FOAK design, supports viable economic business model (competitive with natural gas price at $8/MMBtu)
- Normal maintenance exposure target limit of no more than 50 person-Rem/year per module in a refueling year
- Target availability factor >= 90%

[1] For the purposes of this discussion an indirect configuration is defined as one in which energy is transferred from the primary helium loop to one or more secondary loops that supply the energy conversion processes, (i.e., in the indirect configuration no energy conversion occurs in the primary loop.

[2] The Nuclear Heat Supply System includes the nuclear island (e.g., the reactor, primary coolant system and supporting systems) and the heat transfer/transport system.

- Target plant design lifetime of 60 years (calendar)

3. The Group identified the following developmental issues to be addressed early in Conceptual Design:

   - Define the required ranges of functional and performance requirements for target applications, (e.g., steam pressure, temperature and flow ranges; electricity supply; and hot gas pressure, temperature and energy)
   - Continue development of the Project Systems Requirements Manuals based on commercial end user functional and performance requirements
   - Update the capital cost and schedule estimates for completing the design, licensing, construction and commissioning of the reference configurations for the target application
   - Update the operating cost estimates for the reference configurations in the target applications
   - Identify the respective range of target applications' operating conditions and transients of most concern, and the controls provided to maintain the operating conditions within acceptable bounds for the reference configurations
   - Complete design and analysis for control of primary and secondary gas pressures for loss of heat sink transients in the secondary gas loop indirect configuration
   - Complete design and analysis for control of temperature, pressure and material corrosion for the full range of potential steam generator tube leaks in the secondary steam loop indirect configuration
   - Confirm the stability and control under normal and upset operating conditions for the reference configurations in the respective target applications
   - Define the boundaries for licensing each reference configuration; the objective is to license the NHSS within these boundaries independent of the energy conversion process. The uncertainties in this approach need to be clearly identified and addressed.
   - The following generic safety issues need to be addressed in addition to the specific issues identified in the preceding:

     - General water and air ingress
     - Tritium management
     - Need for active safety systems
     - Loss of heat sink

   - Determine if there are any significant differences in the following areas when comparing the reference configurations:

     - TDRM complexity and requirements
     - TRL of major components and systems
     - Reliability budgeting
     - Maintenance complexity, (e.g., IHX versus SG leakage, changeout)

4. The Senior Advisory Group (SAG) will be convened periodically.

Supplier and BEA Presentations made during the course of this meeting are attached.

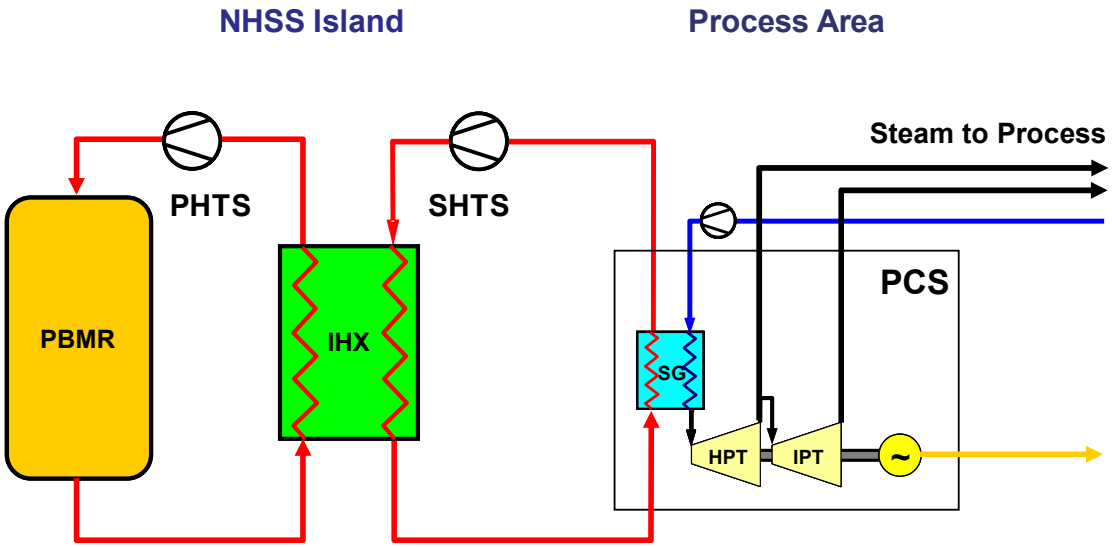


Figure 1 – Reference PBMR Design

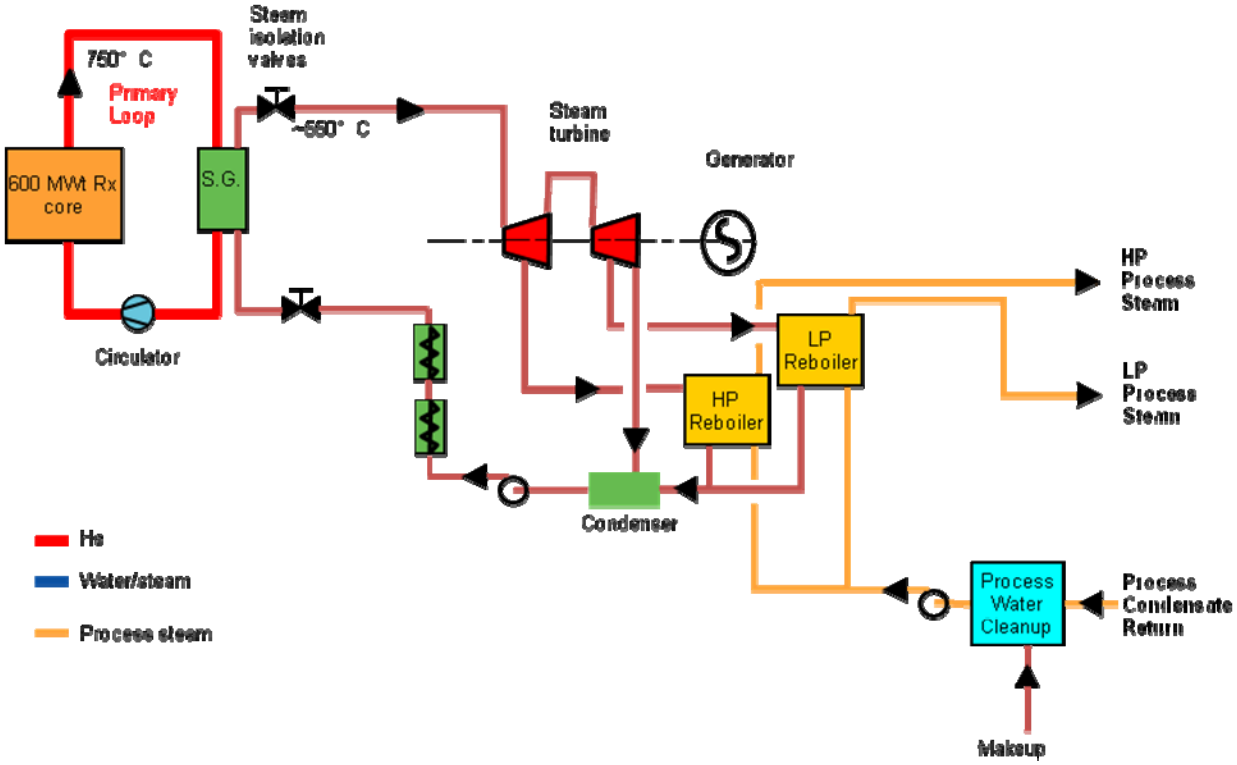


Figure 2 – Reference Prismatic Block Reactor Design

Additional Action Items

1. Determine what constitutes a production scale demonstration for fuel for NRC licensing purposes – INL (Petti)

2. Determine the strategy for certifying a NHSS design independent of a wide range of process applications for which a business case can be made. – INL (Kinsey)

3. Determine basis for margins on radiological limits and controls, (e.g., for tritium). Consider domestic and international standards. – INL (GA)

4. Establish the design limit and basis for annual allowable worker exposure by unit and plant. (Contact NEI and INPO) – Entergy (Melancon)

5. Develop a basis document for defined functional and performance requirements. – INL (Garrett)

6. Evaluate TDRM impacts & TRL perturbations based on the two configurations and the performance and functional requirements chosen. – INL (Garrett)

7. In concert with the supplier teams, identify the breakdown between forced and planned outages that results in 95% capacity factor – Entergy (Melancon)

8. Implement a process for posting all NGNP related reports on the NGNP Project web site. – INL (Perry)

Attachment 1 – PBMR/Westinghouse Presentation

PBMR - SG in SHTS R6.ppt

Attachment 2 – General Atomics Presentation

GA - NGNP Plant config.ppt

Attachment 3 – AREVA Presentation

AREVA NGNP Recommendation Oct

Attachment 4 – BEA Presentation

BEA - Reference Configuration Meetin

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NEXT GENERATION NUCLEAR PLANT PROJECT
INFORMATION INPUT SHEET

1. Document Information

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