



**U.S.NRC**

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

# **PERIODIC BRIEFING ON NEW REACTOR ISSUES**

**February 20, 2008**

**Luis Reyes**

**Executive Director for Operations**

# **Agenda**

- **Overview of New Reactor Status**
- **Advanced Reactor Licensing Activities**
- **Staff Planning for Advanced Reactors**

# **Accomplishments Since Last Briefing**

- **Completed acceptance reviews for AP1000, Bellefonte, Calvert Cliffs Part 1, North Anna, South Texas**
- **Published final Limited Work Authorization rule in the Federal Register**
- **Issued ESP for North Anna**

# **Current Reviews Design Certifications**

<b>Design</b>	<b>Next Milestone</b>
<b>AP1000</b>	<b>Issue RAIs – July 2008</b>
<b>ESBWR</b>	<b>Advance FSER to ACRS October 2008</b>
<b>EPR</b>	<b>Complete acceptance review 2/28/08</b>
<b>US- APWR</b>	<b>Complete acceptance review 2/29/08</b>

# **Current Reviews Combined License Applications**

<b>Bellefonte</b>	<b>Issue Preliminary SER and RAIs – September 2008</b>
<b>Lee Station</b>	<b>Complete acceptance review 2/25/08</b>
<b>Calvert Cliffs</b>	<b>Receive complete application 3/31/08</b>
<b>North Anna</b>	<b>Issue review schedule 2/27/08</b>
<b>South Texas</b>	<b>No dates established pending notification from applicant</b>

# **Expected COL Applications through FY2008**

- **South Carolina E&G – Summer**
- **Progress Energy – Harris**
- **Progress Energy – Levy County, FL**
- **Southern – Vogtle**
- **Entergy – Grand Gulf**
- **Entergy – River Bend**
- **Exelon – Victoria County**
- **PPL Generation – Berwick**
- **AmerenUE – Callaway**
- **TXU – Comanche Peak**

# **Advanced Reactors Licensing Activities**

# Potential Advanced Reactor Licensing Applications

An estimated schedule by Fiscal Year (October through September)

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
NGNP LS									
NGNP NRC Active Participation & R&D Activities									
NGNP Licensing Review								Hearing	
PBMR Pre-application Review		PBMR Design Certification Review							
IRIS Testing Program Review				IRIS Design Certification Review					
4S Pre-application Review		Toshiba 4S Design Approval Review							
Galena Pre-application Review									
Hyperion Pre-application Review				Hyperion Manufacturing License Review					
NuScale Pre-app		NuScale Design Approval Review							
Advanced Reactor Technical & Review Infrastructure Development									

**Legend:**

 NGNP Activities	 NGNP Licensing Review	 Design Approval	 Hearing
 Pre-application Review	 Manufacturing License	 Design Certification	 R&D/Infrastructure Development

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.



# Challenges

- **Commission policy on priorities - domestic partner requirement**
- **Congressional direction to accelerate Next Generation Nuclear Plant**
- **FY 2008 and FY 2009 budget for advanced reactors**
- **Hiring/developing knowledgeable staff and contractors**
- **Developing regulatory infrastructure**

# **Advanced Reactor Program – Project Management Infrastructure**

- **Separate from ongoing LWR licensing**
- **Consolidate licensing project management function in NRO for LWRs and Non-LWRs**
- **Office of Research continues research on technical bases and provides expertise to support licensing reviews**



# **Staff Planning for Advanced Reactors**

**February 20, 2008**

**Brian Sheron, Director**

**Office of Nuclear Regulatory Research**

# Outline

- **Potential Applications**
- **NGNP**
- **HTGR Infrastructure Development**
- **Other designs**
  - **PBMR, Toshiba 4S, IRIS, Hyperion**
- **Concluding remarks**

# Potential Applications

<b>Applicant</b>	<b>Design</b>	<b>MWt</b>	<b>Proposed DC Application</b>	<b>Utility Interest</b>
<b>Toshiba</b>	<b>LMR</b>	<b>30</b>	<b>2010</b>	<b>Galena<sup>#</sup></b>
<b>PBMR, Pty, Ltd</b>	<b>HTGR</b>	<b>500-600</b>	<b>2010</b>	<b>unknown</b>
<b>Hyperion</b>	<b>other</b>	<b>75</b>	<b>2012</b>	<b>unknown</b>
<b>NuScale Power, Inc.</b>	<b>MASLWR</b>	<b>30</b>	<b>2008 Pre-application</b>	<b>unknown</b>
<b>IRIS</b>	<b>PWR</b>	<b>1000</b>	<b>2012</b>	<b>unknown</b>

# City of Galena Alaska

# **Next Generation Nuclear Plant (NGNP) Licensing Strategy**

- **Report to Congress**
  - **Aug 7, 2008**
- **NRC-DOE Licensing Strategy**
- **NRC needs for technical infrastructure development including analytical tools & data**
- **Resource requirements**

# **Non-LWR Technical Infrastructure**

- **NRC does not currently have the technical infrastructure to support review of non-LWR reactor designs**
- **NRC infrastructure was developed and refined over the past 40 years for LWRs**
- **We need to develop similar capabilities for HTGR & LMR**

# **Technical Tools Strategy**

- **Applicants are expected to conduct the R&D needed to establish the safety basis for the proposed design**
- **Pre-application reviews will be used to provide feedback to applicants on policy issues and needed R&D**
- **Staff will utilize licensee-generated information and leverage international information to the extent practical**



# **NRC non-LWR Confirmatory Analysis**

- **NRC should develop independent capability to assess the safety performance of non-LWRs**
  - **Started development of some of the needed tools for HTGR**
  - **Data for code validation will be needed**
- **Staff will identify when NRC-funded confirmatory research is recommended**

# **NRC HTGR Confirmatory Analysis**

- **Fuel performance**
  - **MIT Cooperative Agreement**
  - **DOE**
  - **International collaboration**
- **Thermal fluids & Accident analysis**
  - **MELCOR**
  - **CFD**
- **Nuclear analysis**
  - **PARCS**

# **NRC HTGR Confirmatory Analysis**

- **Materials performance**
  - **High temp materials & graphite**
- **PRA quality and use**
  - **ASME developing PRA quality standard for advanced reactors**
- **H<sub>2</sub> production facility hazards analysis**

# **NRC HTGR Confirmatory Analysis**

- **Data required to validate NRC codes will be obtained from existing integral test facilities, where possible**
- **Need for additional integral test facilities will be assessed during NGNP & PBMR pre-application reviews**
  - **We may need an integral facility in USA to address emerging issues**

# Potential Collaborations

- **CSNI**
- **IRSN and CEA, France**
- **NNR, S. Africa**
- **European Commission (EC)**
- **Germany**
- **United Kingdom**
- **Japan Atomic Energy Research Institute**
- **China**
- **Universities**
- **Department of Energy**

## **Other designs**

- **NRC Skill set and tools are lacking for LMR and hydride reactor**
- **With adequate resources and staff, it will take at least 5 years to develop independent capabilities for LMR**
- **For PBMR, RES will not be able provide independent capabilities for COL review until 2013**

## **Concluding Remarks**

- **NRC could meet its commitment to support 2005 EPAct, provided:**
  - **DOE selects an NGNP design and operational envelope in early 2009**
  - **DOE accelerates NGNP technology development**
  - **pre-application review begun in 2010**
  - **policy/technical issues resolved by 2012**
  - **Sufficient NRC resources available**

# **Concluding Remarks**

- **Implementation poses challenges to NRC**
  - **Developing necessary skill set & infrastructure for the review**
  - **Adequate funding and personnel**
  - **Resolve technical & policy issues**
  - **Interact closely with DOE and applicants to ensure adequacy of data and tools**
  - **Participate in international collaborations**



# Acronyms

- **4S: Super-Safe, Small, and Simple**
- **CEA: Commiserate Energies Atomique**
- **CFD: Computational Fluid Dynamics**
- **COL: Combined License**
- **CSNI: Committee on the Safety of Nuclear Installations**
- **DOE: Department of Energy**
- **EPAct: Energy Policy Act of 2005**
- **EPR: Evolutionary Power Reactor**

# Acronyms

- **ESBWR: Economic Simplified Boiling Water Reactor**
- **ESP: Early Site Permit**
- **FSER: Final Safety Evaluation Report**
- **H<sub>2</sub>: Hydrogen**
- **HTGR: High Temperature Gas Reactor**
- **IRIS: International Reactor, Innovative and Secure**
- **IRSN: Institut Radioprotection et Sûreté Nucléaire**

# Acronyms

- **LMR: Liquid Metal Cooled Reactor**
- **LWR: Light Water Reactor**
- **MASLWR: Multi-Application Light Water Reactor**
- **MELCOR: MELCOR Severe Accident Code**
- **MIT: Massachusetts Institute of Technology**
- **NGNP: Next Generation Nuclear Plant**
- **NNR: National Nuclear Regulator (Republic of South Africa)**

# Acronyms

- **PARCS: Purdue Advanced Reactor Core Simulator**
- **PBMR: Pebble Bed Modular Reactor**
- **PRA: Probabilistic Risk Assessment**
- **R & D: Research and Development**
- **RAI: Request for Additional Information**
- **SER: Safety Evaluation Report**
- **US-APWR: U.S. Advanced Pressurized Water Reactor**