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**Your Ref.:**

**Our Ref.:**  
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**Attention:** Mr. N. Prasad Kadambi

**Subject:** Transmittal of Preliminary PBMR Outcome Objective Summaries for Pre-Application (Project 732)

This letter provides a summary of the preliminary outcome objectives for the design certification pre-application engagement with NRC on PBMR.

The principal objectives for pre-application review of the PBMR design are to identify and clarify key technical and safety issues of particular importance to PBMR design certification and for NRC to provide an assessment and feedback on the activities proposed by PBMR (Pty) Ltd for the identified issues. Specifically, the PBMR objectives for the results of the pre-application effort are to:

- Identify an acceptable approach to key issues unique to the PBMR design certification application,
- Identify any further development and testing that may be required for PBMR certification in the U.S.,
- Identify the potential benefits and challenges of generic NRC initiatives that are evolving in parallel with the PBMR activities and establish an appropriate program for addressing those issues,
- Early identification of any policy issues with the design certification of PBMR requiring Commission consideration, and

- Identify the required content for the design certification application (DCA) documents for an advanced high temperature gas reactor design.

The discussion below highlights PBMR's view of the pre-application activities at this time as we continue our discussion in this planning phase.

### Phase 1 - Planning

The pre-application planning efforts will facilitate NRC's understanding of how the characteristics of the PBMR differ significantly from current and next generation light water reactors, including any measures used to provide enhanced margins of safety and simplified or other innovative means to accomplish safety functions. This phase should identify any regulatory issues that may require Commission policy decisions or technical issues that may necessitate considerable efforts to resolve.

For the planning phase, a key objective is for NRC and PBMR (Pty) Ltd to reach an agreement on a focused, achievable plan, including the technical areas of focus for the review. The purpose of the first planning meeting (held on June 30, 2005) was to introduce the potential topics to be addressed. During the second planning meeting (September 21-22, 2005), the technical topics will be discussed in greater detail. For each topic, the scope, depth and desired outcomes will be discussed. Recognizing the considerable effort invested by the NRC staff during their review of the Exelon proposed plant design, PBMR (Pty) Ltd will also identify the pertinent NRC RAIs from the Exelon review and use these RAIs to focus our technical discussions and identification of issues. A direct outcome of this second planning meeting will be the development of an agreed upon list of work items needed to achieve the desired outcomes for each topic.

In addition to the specific focus topics identified by PBMR, there are several generic initiatives that the NRC is undertaking that are relevant to advanced reactors and therefore potentially beneficial to PBMR.

PBMR (Pty) Ltd will work with the NRC to take the list of work items and develop a detailed work plan for scheduling the pre-application submittals and staff reviews to be conducted during Phase 2, pre-application review, of the design certification effort. This detailed work plan should identify the submittals, schedules, personnel resources and budgets needed for the review. PBMR (Pty) Ltd is sensitive to the NRC's prioritization of limited staff resources. Consequently, we propose to develop the detailed work plan through frequent communications and meetings with NRC project managers, in order to come to mutual agreement on the work plan before proceeding with the Phase 2 activities. It is expected that this final development of the work plan will take six to eight weeks following the September meeting, after which a brief, half day meeting with the NRC staff will result in a final confirmation of our mutual understanding of the plan and outcome objectives.

### Phase 2 – Pre-Application Technical Discussions

The pre-application discussions are focused on achieving the specific objectives for each focus area developed in Phase 1. The general approach is to take the following steps through each topic:

- Conduct topic education sessions
- Submit PBMR white papers or other defined products for NRC review and discussion for the defined outcome objectives.
- Conduct a topical workshop on the material submitted to allow a free exchange on the content, assuring a reasonable understanding of the submittal and to discuss the draft DCA section specification for the topic.
- NRC provide formal RAI's to PBMR for the outcome objectives identified
- Conduct a follow-up workshop on the RAI materials to assure a common understanding of the questions as well as the intended responses; agree on the final scope of the DCA
- Submit revised white papers, etc. to complete the PBMR pre-application inputs to NRC
- NRC will document its conclusions on each focus area and identify any remaining issues for the DCA to address.

In some cases, there may be multiple white papers and workshops for each focus area depending on the scope of the project and the most efficient use of technical resources.

The concurrent development of the DCA Content Specification during Phase 2 will assure that both PBMR and NRC are aligned on the format and content of the DCA including the information on unique characteristics of an advanced gas reactor. At the end of this phase, PBMR and NRC should each be prepared for the completion of the DCA and for its effective review.

The preliminary, specific outcome objectives for the focus areas are enclosed as an attachment to this overview. These outcome objectives will be modified from time to time as more detailed discussions take place between PBMR and the NRC Staff.

### Phase 3 – Final Design Approval and Design Certification

This phase begins with PBMR's submittal of the DCA. The NRC acceptance review is expected to follow the agreed upon DCA Content Specification developed during Phase 2. The remainder of Phase 3 is focused on the NRC review of the design for certification, conduct of any independent reviews, completion of the Final Design Approval Safety Evaluation Report, and conduct of the DC rulemaking proceedings.

Following your review of this summary, PBMR would like to discuss any additions, clarifications or differences in objectives that may exist between PBMR and the NRC Staff.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'E. Wallace', written in a cursive style.

Edward G. Wallace  
Senior General Manager- US Programs  
PBMR (Pty) Ltd

Cc: J. Dana, NRC RES  
S. Rubin, NRC RES

## **Preliminary PBMR Focus Topic Outcome Objectives**

### **Licensing Basis Event Selection:**

- Agreement on selection method:
  - Use of PRA to select a comprehensive set of event sequences
    - *Inclusion of multiple and common cause failures*
    - *Treatment of events affecting more than one reactor module*
    - *Inclusion of external events and shutdown events*
    - *Inclusion of statistically-combined uncertainties in frequencies and consequences*
    - *Highlight defense-in-depth by explicitly considering all SSCs capable of performing a safety function*
  - Based on the mean frequencies of event sequences per plant year
  - Event sequences < TBD/plant year need not be considered
- Agreement on the role of defense-in-depth in LBE selection
- Understanding of how PBMR process is aligned with the Staff's technology-neutral licensing framework initiative

### **Structures, Systems and Components Classification and Defense-in-Depth:**

- Agreement on what is meant by safety classification
- Agreement on the process by which SSCs are classified as safety-related and their regulatory special treatment
- Agreement on the role of defense-in-depth for the PBMR
- Agreement on the kinds of regulatory review and treatment to be applied to SSCs that are not classified as safety-related
- Understanding of how PBMR process is aligned with the Staff's technology-neutral licensing framework initiative

### **Materials Selection and Codes & Standards:**

- High Temperature Metallic Materials Selection
  - Agreement on the PBMR approach to materials selection and qualification
  - Understanding of acceptance criteria for material qualification programs
  - Understanding of the extent of documentation required to describe the effects of helium chemistry impurities during normal and upset conditions which affect material performance lifetimes and reliability
- Carbon-based and Ceramic High Temperature Materials Selection
  - Agreement on the PBMR approach to materials selection and qualification
  - Understanding of acceptance criteria for material qualification programs

- Understanding of the extent of documentation required on the effects of helium chemistry impurities during normal and upset conditions on material performance lifetimes and reliability
- Codes and Standards
  - Understanding of PBMR's use of NRC accepted conventional LWR codes and standards where applicable
  - Understanding of PBMR's use of other codes, code cases, and standards and the level of justification documentation required
  - Confirmation of approach toward development of HTGR specific codes and standards where needed
  - Identification of additional issues/questions that need to be clarified about the approach to these issues or documentation required in the DCA

**Fuel Design and Qualification:**

- Identification of scope of the fuel qualification test program
- Agreement on methods and monitoring to confirm that fuel design complies with the performance envelope
- Understanding of the scope of documentation required in the DCA

**Analytical Code Verification and Validation (V&V):**

- Agreement on PBMR Evaluation Model (EM) development and assessment process
- Agreement on the scope of the V&V computer code/EM suite
- Agreement on scope for the PBMR testing program for computer code / EM V&V
- Understanding of the scope of documentation required in the DCA

**Single vs. Multi-Module Certification:**

- Agreement on approach
  - The fundamental safety case is based on a single module.
  - Interface requirements are specified for systems that are wholly or partially outside the scope of the PBMR basic module that assure that module safety is maintained.
  - Shared systems, common cause failures, and systems interactions are addressed in the DCA and verified during COL review.
- Understanding on level of detail needed to describe the various options for the configuration of the design, including variations in, or sharing of, common systems

**Physical Security Protection by Design:**

- Review of recommended NRC policy statements / current practices for access to DBT information for plant designers

- Development plan for security feature assessment of design for a PBMR plant
  - Importance of inherent and passive safety in design
  - Importance of slow response behavior
  - Understanding of site specific conditions that could influence physical module/plant design
- Level of information needed in DC vs. COL
- Obtaining review and feedback on conceptual security vulnerability assessment during pre-application period

**Utilization of the new Risk-Informed, Performance-Based, Technology-Neutral Regulatory Process:**

- Establish a rationale program for using the PBMR design to develop the proof of concept of the new Technology-Neutral framework with a real design
- Determine the benefits and challenges of using the new framework as an alternate method of obtaining PBMR design certification under 10CFR52, including whether the timing of the new framework will support the schedule for certification