

July 19, 2005

MEMORANDUM TO: Farouk Eltawila, Director  
Division of Systems Analysis and Regulatory Effectiveness  
Office of Nuclear Regulatory Research

THRU: Frederick D. Brown, Acting Chief */RA/*  
Advanced Reactors and Regulatory Effectiveness Branch  
Division of Systems Analysis and Regulatory Effectiveness  
Office of Nuclear Regulatory Research

FROM: Stuart D. Rubin, Senior Level Advisor */RA/*  
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Division of Systems Analysis and Regulatory Effectiveness  
Office of Nuclear Regulatory Research

SUBJECT: SUMMARY OF PUBLIC MEETING WITH PEBBLE BED MODULAR  
REACTOR (PTY) LTD. AND INTERESTED STAKEHOLDERS  
REGARDING PEBBLE BED MODULAR REACTOR PRE-  
APPLICATION REVIEW PLANNING

On June 30, 2005, from 8:30 a.m. to 3:30 p.m., the NRC staff met with representatives from Pebble Bed Modular Reactor (Pty) Ltd. (PBMR Pty) and interested stakeholders to discuss planning for a potential pre-application review for the Pebble Bed Modular Reactor (PBMR). The meeting was widely attended by industry and members of the public. Attachments 1 and 2 contain the meeting attendees list and the meeting agenda, respectively. PBMR Pty presentation material is provided in Attachment 3. NRC staff presentation and handout material are provided in Attachment 4.

In his opening remarks, Stuart Rubin (NRC) stated that, Commission policy on the regulation of advanced nuclear power plants is to interact with advanced reactor applicants and vendors as early as possible in order to provide for timely NRC safety assessment and feedback. Accordingly, a principle objective for a potential pre-application review of the PBMR would be to clarify key technical and safety issues of particular importance to PBMR design certification and to provide an assessment and feedback on the resolutions proposed by PBMR Pty for the identified issues. For the planning phase, a key objective would be for NRC and PBMR Pty to reach an agreement on a focused workable plan, including the technical areas of focus for the review.

Following his introductory remarks, PBMR Pty representatives presented a number of agenda topics, including: an overview of their proposed planning phase activities, the design and safety principles of the PBMR, their proposed focus topics for review, the potential impact of ongoing NRC and industry generic activities on PBMR design certification and, proposed next steps in the review planning process. Stuart Rubin also presented the NRC 's suggested focus topics for a PBMR pre-application review. A summary of each area is discussed below.

### Pre-Application Review Planning

PBMR Pty (Edward Wallace, Senior General Manager - US Programs) stated that they planned to submit a PBMR design certification application (DCA ) by the second calendar quarter of 2007. As such, its pre-application review objectives are intended to support the preparation of a DCA by clarifying the path to resolution of relevant issues identified from the earlier PBMR pre-application review with Exelon, identifying any new issues that will require pre-application assessment, and identifying any technical issues where further development and testing work would be required. PBMR Pty also has as an objective that any new Commission policy issues affecting PBMR design certification be identified as part of the pre-application review planning and implementation phases. PBMR Pty proposed that project planning be conducted over the course of two additional NRC/PBMR Pty planning meetings which would be completed by the end of FY 2005. PBMR Pty further proposed that the technical review begin in October 2005 with the submission of technical information by PBMR Pty, and be completed by January 2007, including the feedback of NRC assessment documents.

### PBMR Design and Safety Principles

PBMR Pty (Willem Kriel) provided a comprehensive overview of the PBMR plant design and safety. The PBMR has been designed to tradeoff core power as a means to achieve passive and inherent plant safety characteristics as well as simplified safety-related structures, systems and components. It was stated that the structural design of the PBMR plant is such that the impact of a large modern commercial aircraft would not compromise nuclear safety. The PBMR, as is the case of all current modular high-temperature gas-cooled reactor designs, relies on maintaining integrity of the ceramic coated fuel particles in the core to prevent the release of radiologically significant fission products during normal operation and accidents. The plant is designed to provide for fuel storage within the plant over the 40 year plant lifetime. A PBMR can be configured from as few as one reactor module to as many as eight reactor modules. According to PBMR Pty, PBMR safety does not rely on the presence of helium coolant for core cooling; the response time to off-normal transient events is very large (i.e., days) compared to current generation light water reactors (i.e., minutes or seconds); there are no inherent mechanisms for runaway reactivity or power excursions; and the fuel design provides for large temperature margins. It was also stated that, in the event a break were to occur in the helium coolant pressure boundary, the module building is designed to delay the ingress of air into the core to limit the extent of core graphite oxidation. Also described were the ongoing and completed development and testing programs, including the test facilities being used by PBMR Pty to address technology applications new to the PBMR and to provide benchmark and confirmatory data needed to validate the PBMR design and safety analysis computer codes. Program elements include fuel and materials irradiations, component development, and code validation (integral and separate effects).

### Proposed Pre-Application Review Focus Topics

PBMR Pty proposed eight focus topics which they believe are particularly important to determining an acceptable technical basis for PBMR design certification as well as the content of a potential PBMR DCA. Three of these topics involve key aspects of the PBMR licensing approach that were unresolved at the time of the earlier staff review of these topics when Exelon was the PBMR pre-applicant. These topics are the selection of events upon which the PBMR design and license would be based, the methods and criteria for the safety classification

of PBMR structures, systems and components and, the application of defense-in-depth philosophy to the PBMR plant design. Another proposed topic involves the regulatory approach to certify a PBMR plant design involving four alternative multi-modular configurations (i.e., 1, 2, 4 or 8 reactor modules). The remaining four topics involve PBMR design and technology certification issues. These are PBMR fuel design and qualification, the application of codes and standards for PBMR design certification, high temperature materials (i.e., metallic, graphite) selection, and the validation and verification of computer codes for design and safety analysis. At the meeting, the staff suggested two additional focus topics: probabilistic risk assessment (PRA) methodology and quality and, materials (i.e., metals) analysis. PBMR Pty indicated that they would provide a response on their plans for addressing these two topics. Each PBMR Pty presentation framed the focus topic area, including issues they considered important to the review and the possible review outcomes or objectives. The presentations laid the groundwork for more detailed discussions of each topic at the next planning meeting.

#### Ongoing NRC and Industry Generic Activities

PBMR Pty identified several current NRC and industry generic activities which they believe may provide outcomes or outputs that could affect a PBMR DCA. For these generic activities, PBMR Pty seeks to obtain NRC assessment, clarification, and feedback on their plans for applying the generic activity outcomes or outputs to the PBMR DCA rather than covering the subject matter as PBMR-specific focus topics within the pre-application review. Generic activities include the NRC's technology-neutral framework for new plant licensing, NRC requirements and guidance for increasing the use of risk methods for regulatory and licensing decisions, standards for PRA methods and quality, post-9/11 enhanced physical security requirements, and Part 52 rulemaking and, gas reactor codes and standards being developed.

#### Proposed Next Steps

The final aspect of the meeting involved discussions by NRC and PBMR Pty on plans for completing the PBMR pre-application review planning phase, including confirmation of the review topics and objectives and proposed dates for the next meeting. In this regard the staff reiterated that the level of NRC technical review that could be supported in FY2006 and FY2007 would depend on the relative priority of PBMR pre-application review activities in relation to other agency activities. It was tentatively agreed that the next public planning meeting would take place in early September 2005. The meeting adjourned at 3:30 PM.

Any questions regarding the meeting should be addressed to Stuart Rubin (301) 415-7480 or [sdr1@nrc.gov](mailto:sdr1@nrc.gov).

Attachments: As stated

of PBMR structures, systems and components and, the application of defense-in-depth philosophy to the PBMR plant design. Another proposed topic involves the regulatory approach to certify a PBMR plant design involving four alternative multi-modular configurations (i.e., 1, 2, 4 or 8 reactor modules). The remaining four topics involve PBMR design and technology certification issues. These are PBMR fuel design and qualification, the application of codes and standards for PBMR design certification, high temperature materials (i.e., metallic, graphite) selection, and the validation and verification of computer codes for design and safety analysis. At the meeting, the staff suggested two additional focus topics: probabilistic risk assessment (PRA) methodology and quality and, materials (i.e., metals) analysis. PBMR Pty indicated that they would provide a response on their plans for addressing these two topics. Each PBMR Pty presentation framed the focus topic area, including issues they considered important to the review and the possible review outcomes or objectives. The presentations laid the groundwork for more detailed discussions of each topic at the next planning meeting.

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NRC/PBMR PUBLIC MEETING  
 THURSDAY, JUNE 30, 2005, 8:30 A.M. - 3:00 P.M.  
 ATTENDANCE

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Agenda for Public Meeting Regarding PBMR Pre-Application Review Planning  
June 30, 2005

<u>Time</u>	<u>Topic</u>	<u>Lead by:</u>
8:30 a.m.	Opening Remarks	NRC/PBMR (Pty) Ltd.
8:45 a.m.	Planning Objectives, Approach and Process	PBMR (Pty) Ltd.
9:00 a.m.	PBMR Design and Safety Principles	PBMR (Pty) Ltd.
10:00 a.m.	Proposed Focus Topics for the Review	PBMR (Pty) Ltd.
11:00 a.m.	Break	
11:15 a.m.	Proposed Review Focus Topics (Cont.)	PBMR (Pty) Ltd.
12:00 a.m.	Policy Issue Identification/Resolution	PBMR (Pty) Ltd.
12:15 p.m.	Lunch	
1:15 p.m.	Generic Activities Applicable to PBMR Design Cert	PBMR (Pty) Ltd.
1:45 p.m.	Applicable NRC Administrative Procedures	NRC
2:00 p.m.	Discussion of Planning Process and Approach; Planning and Review Issues; Next Steps	NRC/PBMR (Pty) Ltd.
3:00 p.m.	Opportunity for Public Comment	All
3:15 pm	Adjourn	

**NOTE:**                    **Specific topics and associated discussion times may change without notice.**

**Contact:**  
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