

February 12, 2001

MEMORANDUM TO: Ashok C. Thadani, Director
Office of Nuclear Regulatory Research

FROM: Thomas L. King, Director/**RA**/
Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

SUBJECT: MEETING WITH EXELON GENERATION COMPANY AND
OTHER INTERESTED STAKEHOLDERS REGARDING THE
PEBBLE BED MODULAR REACTOR

On January 31, 2001, from 1:30 PM to 4:00 PM, the NRC staff met with the representatives of Exelon (Exelon Nuclear and Exelon Generation Company) and other interested stakeholders to discuss the Pebble Bed Modular Reactor (PBMR) design, technology and the potential for Exelon's request for NRC review. The meeting was widely attended with representatives from industry, public interest groups, the national laboratories and ACRS. Attachment 1 contains a list of attendees. Presentation material distributed at this meeting is also included (Attachment 2).

In their opening remarks, W. Travers (NRC) and A. Thadani (NRC) stated the purpose of the meeting as an opportunity to learn more about the PBMR design with the principal focus on various technical and licensing issues. Referring to the NRC's advanced reactor policy, both emphasized the need for identifying key issues and their resolution, and soliciting Commission approval before proceeding with interactions on the PBMR design.

Exelon presenters were W. Sproat, V. Nilekani, K. Borton and J. Muntz. Following introductions, Exelon stated that their main objectives were to initiate a dialogue with the NRC on the PBMR licensing process by providing a summary of the PBMR design and identifying potential design and licensing issues and share initial thoughts on the licensing approach and projected schedule.

Phase 1 of the PBMR project has a multi-national ownership: Exelon Generation (12.5%), British Nuclear Fuel, Ltd. (22.5%), ESKOM (40%) and the Republic of South Africa (RSA) (25%). The design feasibility study for a 100 MWe PBMR is scheduled to be completed by June 2001 and the decision to build a prototype plant in South Africa is to be made by the end of 2001. If built, the prototype module will be a full-scale facility. This facility would allow testing under postulated accident conditions. Exelon's decision to proceed with the PBMR project will be based on several factors such as whether this design can be a source of low-cost electrical energy, with a high safety level, to be able to successfully compete in the U.S. energy markets.

The PBMR is a high temperature gas-cooled reactor (HTGR) with helium as a coolant, typically, at 900°C and 1000 psi. The reactor pressure vessel is made of steel and is about 19.5-ft diameter and 65-ft high, which is housed in a 175-ft square and 108-ft high reactor building - about two-thirds of which is below grade. The accidents for which the plant is to be designed to accommodate without loss of fuel integrity include a range of internal and external events, including ATWS and station blackout. The fuel element is a multi-layer 60-mm diameter graphite sphere (about the size of a tennis ball), in which low-enriched UO_2 is embedded in the form of coated particles about 0.5 mm in diameter. This sphere is not only a carrier of the fuel, but it is also the neutron moderator. The core contains 330,000 spherical fuel elements and 110,000 graphite spheres. The fuel spheres are similar to those used in Germany at AVR Jülich - a small research reactor which operated for 22 Years, and at thorium high temperature reactor (THTR) Hamm-Uentrop - a 300 MWe demonstration reactor, which operated for 6 years.

According to Exelon, the safety of the PBMR design is inherent in (1) low ratio of power density to heat capacity leading to slow temperature change in the event of failure affecting heat production and heat removal; (2) high temperature resistance of the ceramic fuel elements and structural material of the core (the failure rate of fuel elements is negligible up to temperatures of 2000°C); (3) strong negative temperature and power coefficients of reactivity under all operating conditions (low excess reactivity is possible in continuously-fueled pebble bed); (4) plant design features mitigate air and water ingress; and (5) helium - a chemically inert, single-phase, neutron-transparent gas - is used as a coolant. In addition to the fuel design and use of passive systems, other features are: its modular design; continuous power generation augmented by on-line fuel loading and unloading (plant outage 30 days every 6 years for turbine and generator maintenance); direct cycle gas turbine; on-site spent-fuel storage for 40 years; and low excess reactivity.

Exelon identified various design issues as well as alternate potential licensing schemes under either 10 CFR Part 50 or Part 52 licensing processes including early site permit. Issues included: qualification of the fuel and its fabrication as an integral aspect of the facility certification; development of the source term; assessment of a leak-tight versus vented containment; materials qualification, such as, high temperature metal creep, and thermal fatigue; verification and validation of design and safety analysis codes; and PRA and classification of SSCs. Other concerns which also need to be addressed include: regulatory treatment of non-safety systems; and determination of appropriate tests, including NDE.

In closing remarks, A. Thadani stated the need (1) to identify key issues for the NRC to develop the needed technical expertise to work efficiently and effectively; (2) to seek Commission approval of a review plan before proceeding; and (3) for the industry to provide more information to help the staff develop the plan.

For further information, please contact Thomas L. King at (301)-415-5790 or tlk@nrc.gov.

cc: SECY
OGC
OCA
OPA
CFO
CIO

Attachments: As stated

Distribution: (w/attachments) DRAA Chron, MWeber (NMSS)

w/o attachments

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All attendees listed in Attachment 1

DOCUMENT NAME: G:\Tom's General\Meeting Notice EXELON-1-31-01.WPD

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*See previous concurrence

OFFICE	DRAA*		DRAA		
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January 31, 2001

Meeting Between NRC and Exelon on PBMR

List of Attendees

<u>Name</u>	<u>Organization</u>	<u>Telephone #</u>
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Jan Freeman	Exelon Corp.	610-765-6906
Mike Callahan	GSI	202-544-4522
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Rod Adams	Adams Atomic Engines, Inc.	727-641-1081

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