

From: Yuri Orechwa *> NR*
To: Amy Cabbage
Date: Wed, Jan 9, 2002 11:54 AM
Subject: PBMR Chemical Attack White Paper RAIs

Amy,

Attached is my contribution to the RAIs with regard to Excelon's White Paper on chemical attack in the PBMR.

Yuri

CC: Frank Akstulewicz; Gary Holahan; Jared Wermiel; Ralph Caruso; Undine Shoop

6/43

Request For Additional Information with regard to "Control of Chemical Attack In the PBMR Presentation to USNRC In Support of PBMR Pre-application Activities"

In the subject presentation the claim is made that the PBMR design constrains the external dose to below 100 μ S/hr. This claim is supported by two arguments:

A. The PBMR design is sufficiently different to preclude the events that have lead to chemical attack of graphite in the past in operating reactors. Such as:

- i) Water ingress experienced by AVR and Fort St. Vrain
- ii) Air ingress experienced at Windscale and Chernobyl

B. The PBMR design has taken account of the potential problem of water or air ingress through operating procedures and design features:

i) Water ingress is limited by operating procedures such as ensuring that the water circuits are not activated until the gas pressure exceeds the water pressure by a suitable margin.

ii) Air ingress in the case of small pipe breaks is limited physical considerations and result in a maximum corrosion fraction of 0.00005 of the graphite content of the RPV; for medium breaks both physical considerations and operator procedures result in a maximum corrosion fraction of 0.002 of the graphite content of the RPV; for large breaks, beyond the design basis, the assumption that the total inventory of air in the reactor building passes through the reactor results in the oxidation of < 0.01 of the graphite content of the RPV.

The first argument (A), based on a comparison with other reactor designs, is peripheral to the issue.

The second argument (B) is based on integral values of the maximum corrosion fraction, which are difficult to assess in light of the fact that corrosion is a local phenomenon depended on the local environment of the graphite. Moreover, the validity of the quoted estimated corrosion fractions is impossible to judge without a description and validation of the basic corrosion models which quantify the *potential* for corrosion over the parameter space of interest.

Thus, to judge the results of the subject report, we request the following additional information:

1. Identify the gas/graphite reactions germane to the air and water ingress analyses of PBMR.
2. Rank them in order of importance (high, medium, low) and identify those deemed sufficiently important to include in the analyses and those that were not and why.
3. Identify (if any) catalysts for the reactions used in the analyses.
4. Give the mathematical description of the models used to compute the oxidation rates. In particular: