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From: Donald Carlson RES EXL
To: Raji Tripathi
Date: Fri, Jun 22, 2001 6:26 PM
Subject: Re: INVITE COMMENTS on Exelon Minutes

Ex 6

Raji,

I like the first part of your version of the minutes. It is obviously much more comprehensive than what I wrote.

Still, I would like to retain the previous detail about the AVR melt-wire tests, and maybe even add more (see revision below). Our experiences with applicants in NMSS/SFPO have reinforced the importance of being explicit when raising an important technical issue. The same principle would seem to apply when dealing with pre-applicants. Since we don't have anything like an RAI process with Exelon (it is not clear to me what we do have), we should be willing to sacrifice brevity for clarity in the only written communications we have. Note that my meeting handout was in German and not very explicit, so further explanation really is warranted.

I can't find any proprietary information in my earlier input to the minutes. I may be mistaken, but I think the 1060 degree C maximum fuel operating temperature was stated during the public portion of the meeting. (I'm convinced that 1060 C is way low; hence the issue). Of course, none of my AVR melt-wire information is proprietary; it is all available in the published German literature. Have you checked whether the stated similarity to the reference AVR-21-2 fuel is proprietary information?

Below is a slightly edited and expanded version of my AVR melt-wire discussion for the meeting minutes.

Have a great weekend!

Don
(from home, via Citrix, on my CWS day off)

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During the public portion of Wednesday's meeting, the NRC staff handed out pages 88 and 89 copied from the German report "AVR - 20 Jahre Betrieb" [AVR - 20 Years of Operation] (VDI Berichte 729, VDI Verlag, 1989). As described below, the figure provided in the staff's handout referred to the higher-than-expected maximum coolant temperatures seen in test results from the AVR pebble-bed reactor.

Because a pebble-bed core lacks structures to accommodate traditional in-core instrumentation, maximum coolant temperatures under normal operating conditions in the AVR core were inferred from a melt-wire experiment. In that experiment, hundreds of non-fueled graphite pebbles were equipped with a graphite plug containing twenty encapsulated wires with melting temperatures ranging up to 1280 degrees C. Along with normal fuel-containing pebbles, these so-called monitor pebbles were added to the top of the pebble bed, through either the central loading tube or one of the peripheral loading tube positions, and then removed from the bottom discharge tube after a single pass through the core.

Since the AVR monitor pebbles produced negligible heat (i.e., they contained no fuel), the number of melted wires provided an indication of the maximum helium coolant temperature seen by that pebble. Unexpectedly, a significant number of monitor pebbles (i.e., six loaded in the central core region, sixteen in the peripheral core region) proved to have melted all twenty wires, thus indicating a maximum coolant temperature in excess of 1280 degrees C. These results were with the AVR operating at a nominal coolant outlet temperature of 950 degrees C.

After briefly describing these AVR monitor-pebble results, the staff asked a series of questions to find out to what extent the PBMR design team had considered the implications of the AVR test results when

H12

stating that the maximum fuel operating temperature is 1060 degrees C in the PBMR when the nominal coolant outlet temperature is 900 degrees C. Mr. Venter (RSA) responded with the familiar explanation that the AVR results can be attributed to the neutron moderating effects from the graphite "noses" that protruded from the side reflector into outer core region of the AVR and that are absent in the PBMR design. Specifically, as has been previously claimed (e.g., Nuclear Engineering and Design, Volume 121, No. 2, p. 144, July 1990), Mr. Venter indicated that the unexpected hot spots seen in the AVR monitor-pebble results were caused by elevated power production in the fuel pebbles near the graphite noses.

The staff commented that this explanation seems inconsistent with the data, since the inner radial core region - far removed from the graphite noses - showed roughly as many hot spots as the outer core region (i.e., more monitor pebbles were loaded into the outer fuel region than the inner). The staff then asked whether the familiar explanation of the AVR monitor-pebble results has been supported by a detailed analysis that quantitatively predicts the observed range of maximum coolant temperatures in the AVR and whether the prediction of the maximum fuel operating temperature in the PBMR has been based on similarly detailed analysis. Mr. Venter said he did not know the particular details of the thermal analyses for the AVR test results and the PBMR design but that he would look into them and have detailed answers provided at a future meeting. The staff expects to further pursue the issue of maximum fuel operating temperatures in relation to the fuel testing program and the integral testing planned for the demonstration module in South Africa.

>>> Raji Tripathi 06/22/01 07:55AM >>>
SECOND ATTEMPT TO SEND:

Don -

As mentioned in my earlier note.on the format of the Exleon mtg. mts., at Tom's instructions, I am keeping the discussions brief. On fuel, I have included two paragraphs (in addition to the lead in para), without any references to specifics. Note that in the last para something had to be said about the anticipated max fuel temp. only to be able to introduce the staff handout.

Let me know your thoughts. I am here until noon today. If you would like to e-mail me, pl. also cc my home e-mail:[ ] EX 6

EX

Thanks...Raji

CC: Flack, John; King, Thomas; Rubin, Stuart