



THAYER SCHOOL OF ENGINEERING
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03755

24 July 1980

Mr. Gary Holahan
Analysis Branch
Division of Systems Safety
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20014

Re: Further Discussion of UHI

Dear Gary,

Following my memos of 8 and 16 July I have got hold of a copy of WCAP-8480 that adds a little to the small amount of information that I already have. I noted several points:

1) The UHI accumulator volume is said to be 1800 ft³ compared with the 710 ft³ of WCAP-9639.

2) For some of the break conditions studied, the total amount of UHI injected is only about 1000 ft³, about equal to the volume of the upper head. Therefore the "filled solid" condition may only barely be reached.

3) The maximum UHI injection rate is around 4000 lbs/sec. This is four times what I considered before and would require four times the condensation heat transfer coefficient in order to achieve thermodynamic equilibrium.

4) The "flow hole" may be in the upper core plate rather than the lid between the upper plenum and the upper head. In this case the "head cooling jets" could play a key role in transferring steam to the upper head when the pressure there is lower than in the RCS. All that WCAP-8480 says about this flow path is that it is "of high resistance". Can you obtain quantitative information?

5) The upper head is said to drain in 40 seconds compared with the 100-200 I calculated. It would be interesting to know what flow resistance is assumed for the support columns and whether it has been determined experimentally.

6) It is stated that "only steam can flow from the core to the upper head after UHI shut off" - surely this depends on whether or not a pool forms in the upper plenum.

7) There is an awareness of depressurization of the upper head by UHI but the consequences of it are viewed optimistically or vaguely (e.g. "it

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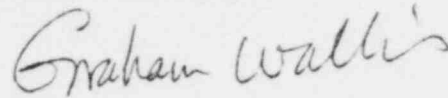
will eventually empty").

8) It is stated that the high velocity jets create turbulence leading to a uniform fluid temperature in the upper head. I am not sure that this will occur, because of turbulence suppression by the structures.

9) It is claimed that the guide tube spacers will enhance steam-water separation. Is there any evidence for this? Have any two-phase flow experiments been made to establish the characteristics of the flow paths?

10) The UHI temperature of 70-100°F is lower than I assumed (150°F); therefore more steam can be condensed than I calculated previously.

Yours sincerely,



Graham B. Wallis
Professor of Engineering

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