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DCP/NRC1133
NSD-NRC-97-5434
Docket No.: 52-003

November 12, 1997

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: T. R. QUAY

SUBJECT: TRANSMITTAL OF "APPENDICES TO DOE/ID-10541" (VOLUME 1), "ADDENDA TO DOE/ID-10541, -10503, -10504" (VOLUME 2) AND A WHITE PAPER ON EFFECTS OF CONTAINMENT SPRAY ON LEVEL 2 PRA

Dear Mr. Quay:

Enclosure 1 of this letter provides a copy of a two-volume DOE report which is dated October 1997. Volume 1 is titled "Appendices to DOE/ID-10541" and Volume 2 is titled "Addenda to DOE/ID-10541, -10503, -10504." The topic of these DOE reports is in-vessel steam explosion. This enclosure provides the staff with the latest disposition of comments from the DOE reports' Expert Peer Reviewers. Enclosure 1 is being provided to support the NRC's review of the in-vessel steam explosion topic for AP600.

Enclosure 2 provides a copy of a white paper entitled "The Effects of Containment Spray on the AP600 Level 2 PRA Hydrogen Analysis." This paper is being provided to respond to part of action item 6 of the NRC letter to Westinghouse titled "Summary of August 7, 1997 Meeting to Discuss the Containment Spray Design for the AP600," dated August 22, 1997. Action item 6 reads ... address how the containment spray would affect the containment isolation mode and hydrogen combustion modeling in the Level 2 PRA for the AP600. This enclosure provides the response concerning the hydrogen analysis modeling in the Level 2 PRA. A telecon will be held this week with the staff to discuss the containment isolation mode portion of the action item.

Please contact Cynthia L. Haag on (412) 374-4277 if you have any questions concerning this transmittal.

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

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jml

Enclosures

cc: J. M. Sebrosky, NRC (Enclosure 1)
T. J. Kenyon, NRC (Enclosure 2)
N. J. Liparulo, Westinghouse (w/o Enclosures)

Enclosure 2 to Westinghouse
Letter DCP/NRC1133

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The Effect of Containment Spray on the AP600 Level 2 PRA Hydrogen Analysis

Containment spray mainly affects the hydrogen phenomena by increasing the rate of containment mixing and by decreasing the steam concentration in the containment atmosphere, thereby increasing the global hydrogen concentration. The AP600 containment spray is a relatively low-flow, nonsafety-related system which sprays the upper compartment of the containment. The system's primary purpose is the reduction of aerosol fission products, not pressure suppression, although some small pressure decrease is expected to occur during the spraying.

The AP600 PRA Hydrogen Assessment (PRA Chapter 41) breaks the containment failure potential from hydrogen combustion phenomena into four scenarios: 1) Early Flame Acceleration - evaluation of DDT during the hydrogen release to the containment when local hydrogen concentrations could be elevated due to releases into dead-ended compartments; 2) Intermediate Deflagration - evaluation of the peak pressure from the global combustion of all the hydrogen released to the containment after it is mixed with the containment atmosphere; 3) Intermediate Flame Acceleration - evaluation of DDT in during the global burning; 4) Diffusion Flame - evaluation of the heat fluxes on the containment shell from hydrogen burning as an unmixed plume from the IRWST vents. The evaluations determine the containment failure probability assigned on the containment event tree for each burning mode. The effect of sprays on the evaluation of containment failure for each burning mode is discussed below.

Early Flame Acceleration (node DTE on the containment event tree)

The early flame acceleration analysis evaluates the likelihood of an early local burn in a confined compartment accelerating from deflagration to detonation. As can be seen in Table 41-13, the phenomena occurs in dead-ended compartments, which are not sprayed. The spraying of the upper compartment will lower the local pressure slightly and increase the rate of mixing from the dead-ended compartments to the mixed volume, but this does not have a significant impact on the results of the analysis. Therefore, there is no significant impact on the analysis of early flame acceleration.

Intermediate Deflagration (node DFG on the containment event tree)

The containment sprays would impact the pre-burn containment pressure probability distributions (Figures 41-21, 41-24 and 41-27) by shifting them in the direction of a slightly lower pressure. The result would be that, while the pre-burn hydrogen concentration would increase slightly, the initial pressure is lower, and the final containment pressure would be slightly lower. The vaporization of the airborne spray water into steam has a negligible impact on the peak pressure from the burn. Therefore, there is no significant impact on the current PRA assessment of the deflagration failure probability.

Intermediate Flame Acceleration (node DTI on the containment event tree)

The intermediate flame acceleration analysis evaluates the likelihood of a global burn accelerating from deflagration to detonation. As can be seen in Table 41-14, this phenomena occurs in the CMT room, which is not sprayed. Additionally, the CMT room atmosphere is considered to be dry air in the analysis to conservatively account for the potential stratification of steam. Therefore, the reduced steam concentration during the spray operation does not impact the results of the evaluation. Turbulence induced by the spraying is not expected to impact the probability of DDT in the upper compartment since the sprays are low flow and upper compartment geometry is wide open and does not induce flame acceleration.

Diffusion Flame (node DF on the containment event tree)

The sprays have no impact on the burning of the unmixed plumes.

<u>Conclusion</u>

The operation of the nonsafety-related spray system has no significant impact on the results of the containment failure probability as determined in the AP600 PRA Hydrogen Assessment (PRA Chapter 41).

Enclosure 1 to Westinghouse
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