Westinghouse Electric Corporation

Energy Systems

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DCP/NRC1168
NSD-NRC-97-5472
Docket No.: 52-003

December 4, 1997

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

ATTENTION: T. R. QUAY

SUBJECT: AP600 RESPONSE TO FSER OPEN ITEMS

Dear Mr. Quay:

Enclosed with this letter are the Westinghouse responses to FSER open items 720.424F through 720.426F, and 720.428F. These open items pertain to the AP600 PRA in-vessel steam explosion topic. Also enclosed is the response to FSER open item 720.441F, which pertains to an NRC Level 2 PRA insights request. The OITS numbers associated with these open items are #6139 - 6141, 6143, and 6179. The Westinghouse status column in the OITS will be changed to "Action N."

The NRC should review the enclosed responses and inform Westinghouse of the status to be designated in the "NRC Status" column of OITS.

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

CL Haag for BAM
Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

jml

Enclosure

cc: J. M. Sebrosky, NRC (Enclosure)
N. J. Liparulo, Westinghouse (w/o Enclosure)

E004

Enclosure to Westinghouse
Letter DCP/NRC1168

December 4, 1997

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Question: 720.424F (OITS # 6139)

FSER OI Pertaining to In-Vessel Steam Explosion:

Partitioning of heat flux in the melt pool; information on partitioning as well as demonstration that the partitioning remain constant.
(See copy of enclosure to NRC transmittal letter dated November 4, 1997 for the staff's clarification to this FSER open item).

Response:

The partitioning of the upward, sideward, and downward heat fluxes at the boundaries of the oxide pool is presented as a function of time in Figure 4.13(b) in the DOE/ID-10541 report.

SSAR/PRA Revisions: None.

Question: 720.425F (OITS # 6140)

FSER OI Pertaining to In-Vessel Steam Explosion:

Bounding approach to melt release rates; consideration of higher release rates and sensitivity studies. (See copy of enclosure to NRC transmittal letter dated November 4, 1997 for the staff's clarification to this FSER open item).

Response:

The release rates considered in the ROAAM evaluation include, with margin, the rate of approximately 160 kg/s estimated to have occurred in TMI-2. This rather gradual side-pour occurred over a time period of approximately 90 seconds, and gradually burned a hole to the baffle plate having the approximate final dimensions of 60 cm x 150 cm. Such a development is also consistent with the ROAAM evaluation of the AP600. In particular, three points can be implicitly made:

1. The rate found in TMI-2 shows that the initial melt-through area (ROAAM study's intangible) is of limited size. Specifically, since melt velocities would be about the same, the ROAAM study's largest pour area is more than twice the starting pour area at TMI-2.

2. The growth of the pour area was gradual, as expected, according to the mechanisms discussed in the DOE/ID-10541 report. Moreover, the pour area remained coherent, as opposed to burning through in multiple locations.

3. The design differences between the AP600 and TMI-2, specifically the presence of a thick second barrier in the AP600 (the reflector), has the effect of promoting the above two items in the direction of even more gradual melt release than occurred in TMI-2.

SSAR/PRA Revisions: None.

Question: 720.426F (OITS # 6141)

FSER OI Pertaining to In-Vessel Steam Explosion:

Splinter scenario involving downward melt relocation; demonstration as to why the scenario is "physcially unreasonable" or consideration of the scenario within the ROAAM framework.
(See copy of enclosure to NRC transmittal letter dated November 4, 1997 for the staff's clarification to this FSER open item).

Response:

A teleconference was held on November 19, 1997 between NRC (S. Basu, M. Snodderly, J. Sebrosky), DOE (C. Thompson, T. Theofanous - ARSAP), and Westinghouse (J. Scobel, C. Haag) to discuss the NRC's November 4, 1997 letter providing this FSER open item. As was discussed during the telecon, Westinghouse submitted further information on the downward melt relocation in Volume 2 of DOE report titled "Addenda to DOE/ID-10541, -10503, -10504." The DOE report was transmitted to the NRC via Westinghouse letter DCP/NRC1133, dated November 12, 1997. The expanded discussion on downward melt relocation is provided in section "Addendum to Chapter 4" of the DOE report.

PRA Revision: None.

Question: 720.428F (OITS # 6143)

FSER OI Pertaining to In-Vessel Steam Explosion:

High peak pressure in one explosion calculation; investigation of the case.
(See copy of NRC transmittal letter dated November 4, 1997 for the staff's clarification to this FSER open item).

Response:

A teleconference was held on November 19, 1997 between NRC (S. Basu, M. Snodderly, J. Sebrosky), DOE (C. Thompson, T. Theofanous - ARSAP), and Westinghouse (J. Scobel, C. Haag) to discuss the NRC's November 4, 1997 letter providing this FSER open item. As was discussed during the telecon, Westinghouse submitted further information on the quantification of explosion loading in Volume 2 (pages 6-15 and 6-16) of DOE report titled "Addenda to DOE/ID-10541, -10503, -10504." The DOE report was transmitted to the NRC via Westinghouse letter DCP/NRC1133, dated November 12, 1997. The discussion of the high peak pressure case is provided in section "Addendum to Chapter 6" of the DOE report.

PRA Revision: None.

Question: 720.441F (OITS #6179)

Reactor Cavity Flooding System:

The IRWST injection squib valves are diverse from the containment recirculation squib valves. Diversity between these valves is specified in SSAR Section 6.3.2.2.8.9, but the criteria for confirming that diversity has been achieved is not provided. This needs to be addressed by ITAAC. This is Open Item 720.441F.

Response:

As stated in SSAR subsection 6.3.2.2.8.9, the IRWST injection squib valves are diverse from the containment recirculation squib valves because they are designed to different design pressures. The following discussion, taken from AP600 PRA subsection 12.5.1, further explains the diversity:

> "The squib valves in the recirculation lines are normally in a different environment than the squib valves in the injection lines. The injection line valves have reactor coolant system pressure on one side and the pressure head of the IRWST on the other side. These valves are designed to withstand and open under this type of load.
>
> The recirculation squib valves have the head of the IRWST on one side and the containment atmosphere pressure on the other side. These valves do not have to support the reactor coolant system pressure, nor do they have to open under such conditions"

Thus, the IRWST injection squib valves are designed to withstand high pressure of approximately 2500 psig whereas the recirculation squib valves are designed for a lower pressure of approximately 150 psig. Because these two sets of squib valves are designed to withstand different design pressures, the thickness of some of the valve components and the size of the propellant charges are different. Because of these differences, the IRWST injection squib valves are diverse from the recirculation squib valves.

Because diversity is derived from the difference in design pressures and operating conditions, there is no need for an ITAAC.

Revisions:		
	SSAR	None.
	PRA	None.
	ITAAC	None.