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NSD-NRC-97-5098
DCP/NRC0838
Docket No.: STN-52-003

April 30, 1997

Document Control Desk
Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: T. R. Quay

SUBJECT: WESTINGHOUSE RESPONSES TO NRC REQUESTS FOR INFORMATION ON THE AP600

Dear Mr. Quay:

Enclosed are three copies of a Westinghouse response to an NRC question. This response provides additional information on ADS valves as requested in a letter from W. C. Huffman to N. J. Liparulo on April 23, 1997.

The NRC technical staff should review these responses as a part of their review of the AP600 design. These responses close, from a Westinghouse perspective, the addressed questions. The NRC should inform Westinghouse of the status to be designated in the "NRC Status" column of the OITS. We suggest "Action N".

Westinghouse requests you provide any comments on this response by May 16, 1997 so that we can meet the milestone in SECY-97-051 to provide the final AP600 supporting documentation by May 30, 1997.

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Please contact Brian A. McIntyre on (412)374-4334 if you have any questions concerning this transmittal.

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

br/cmp

Enclosure

cc: T. Kenyon, NRC (w/o Enclosure)
W. Huffman, NRC (w/Enclosure)
N. J. Liparulo, (W) (w/o Enclosure)

AP600 Automatic Depressurization Valve Area Specification and Definition

The following information is provided in response to NRC questions on the definition and specification of the flow areas for the AP600 ADS valves, received via NRC letter, W. C. Huffman to N. J. Liparulo, dated April 23, 1996.

ADS Test Program

1. Recent discussions between the staff and Westinghouse specifications for ADS valves have produced some confusion about how parameters such as flow areas are being specified and defined. Westinghouse has referred recently to an "effective flow area" for an ADS-1 valve, which is different from the actual valve throat area. It is not clear how this "effective" area is defined and determined.

Question:

a. Please define the "effective flow area". Is the concept related to critical flow, or "subsonic" flow, or both?

Response:

The term "effective flow area" was used to describe to the valve vendor a characteristic of a valve that could be used to calculate the critical flow that would occur through a valve with a complicated flow path geometry like a globe valve, or a globe valve with a special trim design. Westinghouse made use of the vendor's experience and/or test results to provide a valve for ADS testing that would pass the desired choked flow at a specified upstream pressure and fluid enthalpy. The ADS valves were also specified to have an L/D or Cv range that established the flow/delta-P that would occur during subsonic flow conditions.

Question:

b. Is there any way to determine the "effective" area of the valve without using test data for the specific valve design? That is, is there a formula that relates "effective" to "actual" area as a function, for instance, of valve type and/or size?

Response:

Westinghouse has not developed an analytical methodology for determining the "effective flow area" of a valve based on its size, Cv, and specific physical features of the flow path through a globe valve. As stated above, the valve vendor's experience with their specific valve design was relied on for selection of the ADS test valves.

Question:

c. How will the "effective flow area" be used in specifying ADS valve parameters for the AP600?

Response:

The ADS valve specification documents specify the required choked flow rate that the valves are to pass at a specified upstream pressure and fluid quality. The effective flow area that provides the required flow is also noted in the specifications.

Question:

d. Is this concept limited to ADS-1 valves, or will it be extended to the stage 2, 3, and/or 4 valves? Also, is it limited to only one of the two valves (isolation, control), or does it apply to both of them?

Response:

Effective flow areas have been specified for the ADS control valves including the stage 2 and 3 globe, and the stage 4 squib valves. Effective flow areas can also be specified for the ADS gate valves; however, because their flow path is essentially straight through or slightly convergent/divergent, their effective area is similar to their throat area. In addition, these valves do not experience choked flow during their ADS function since the downstream control valves have a much smaller flow area.

Question:

e. How was the "effective" area used in analysis of the data from Phase B1 of the ADS test program?

Response:

The analysis of test data from the Phase B1 ADS test confirms the effective flow areas of the ADS Stages. For example, the Phase B1 matrix test 110 data indicates that the ADS stage 1 globe valve has an effective flow area of 4.9 sq. in. which confirms the vendors estimated area. This area is greater than the minimum effective area of 4.6 sq. in. specified for this valve. The data from matrix tests 120 and 130 indicates that the effective flow area of the ADS stage 2 and 3 orifices is ~21 sq. in.; which was the actual area of these orifices. These results provide confidence that the actual ADS globe valves used in the AP600 plant can be readily specified and will provide the expected performance under choked flow conditions. The plant safety analysis uses the maximum or minimum effective flow areas specified for the ADS valves, as appropriate, in conjunction with the Fauske-HEM choked flow model; to determine the ADS flowrates under choked flow conditions. (See response to RAI 440.569, OITS 3397.)