May 2, 1996

Mr. Nicholas J. Liparulo
Nuclear Safety and Regulatory Activities
Nuclear and Advanced Technology Division
Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, Pennsylvania 15230

SUBJECT: RESPONSE TO WESTINGHOUSE LETTER NTD-NRC-95-4564 REGARDING FEEDWATER LEAK-BEFORE-BREAK (LBB) LOAD COMBINATION

Dear Mr. Liparulo:

The Nuclear Regulatory Commission (NRC) Civil Engineering and Geosciences Branch (ECGB), in accordance with the November 13, 1995, Westinghouse letter, reduced staff review effort for the AP600 advanced reactor design. As part of the review restart, ECGB, in the NRC letter dated, February 27, 1996, identified LBB as one of the four major issues that must receive significant attention to be resolved.

The staff has reviewed Westinghouse letter NTD-NRC-95-4564 on the subject of "AP600 Feedwater Line Load Combination," dated September 26, 1995. In the letter, Westinghouse requested for the load combinations for applying LBB to main feedwater lines that the effects of dynamic loads due to feedwater line break in the turbine building need not be included, especially the break induced depressurization loads. The staff's concerns were included in the NRC letter dated April 11, 1996. The enclosed review further explains the staff position.

The staff expects Westinghouse to contact the staff when it is ready to discuss these concerns. If you have any questions regarding this report, please contact me at (301) 415-8548.

Sincerely,
original signed by: William C. Huffman
Diane T. Jackson, Project Manager
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure: As stated

cc w/enclosure:
See next page

060016

DISTRIBUTION:

Docket File	PDST R/F	BGrimes
PUBLIC	TQuay	RArchitzel
TKenyon	DJackson	BHuffman
JSebrosky	WDean, O-17 G21	JMoore, O-15 B18
EJordan, T-4 D18	ACRS (11)	GBagchi, O-7 H15
SHou, O-7 H15	JBrammer, O-7 H15	

NRC FILE CENTER COPY

DF03

DOCUMENT NAME: A:FW-LBB.ECG (4D AP600 DISK)
To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	PM:PDST:DRPM		SC:PDST:DRPM							
NAME	DJackson		RArchitzel							
DATE	05/2/96		05/2/96							

OFFICIAL RECORD COPY

9605060214 960502
PDR ADOCK 05200003
A PDR

Mr. Nicholas J. Liparulo
Westinghouse Electric Corporation

Docket No. 52-003
AP600

cc: Mr. B. A. McIntyre
Advanced Plant Safety & Licensing
Westinghouse Electric Corporation
Energy Systems Business Unit
P.O. Box 355
Pittsburgh, PA 15230

Mr. John C. Butler
Advanced Plant Safety & Licensing
Westinghouse Electric Corporation
Energy Systems Business Unit
Box 355
Pittsburgh, PA 15230

Mr. M. D. Beaumont
Nuclear and Advanced Technology Division
Westinghouse Electric Corporation
One Montrose Metro
11921 Rockville Pike
Suite 350
Rockville, MD 20852

Mr. Sterling Franks
U.S. Department of Energy
NE-50
19901 Germantown Road
Germantown, MD 20874

Mr. S. M. Modro
Nuclear Systems Analysis Technologies
Lockheed Idaho Technologies Company
Post Office Box 1625
Idaho Falls, ID 83415

Mr. Frank A. Ross
U.S. Department of Energy, NE-42
Office of LWR Safety and Technology
19901 Germantown Road
Germantown, MD 20874

Mr. Ronald Simard, Director
Advanced Reactor Programs
Nuclear Energy Institute
1776 Eye Street, N.W.
Suite 300
Washington, DC 20006-3706

Ms. Lynn Connor
Doc-Search Associates
Post Office Box 34
Cabin John, MD 20818

Mr. James E. Quinn, Projects Manager
LMR and SBWR Programs
GE Nuclear Energy
175 Curtner Avenue, M/C 165
San Jose, CA 95125

Mr. John E. Leatherman, Manager
SBWR Design Certification
GE Nuclear Energy, M/C 781
San Jose, CA 95125

Barton Z. Cowan, Esq.
Eckert Seamans Cherin & Mellott
600 Grant Street 42nd Floor
Pittsburgh, PA 15219

Mr. Ed Rodwell, Manager
PWR Design Certification
Electric Power Research Institute
3412 Hillview Avenue
Palo Alto, CA 94303

Mr. Charles Thompson, Nuclear Engineer
AP600 Certification
NE-50
19901 Germantown Road
Germantown, MD 20874

ECGB Review of Westinghouse Letter NTD-NRC-95-4564,
"AP600 Feedwater Load Combination," dated September 26, 1995

The staff reviewed the bases of the Westinghouse submittal. The following are our evaluation and concerns:

1. In Enclosure 1 of the letter NTD-NRC-95-4564, Westinghouse provided a justification for excluding dynamic loads induced by feedwater line break in the turbine building for applying leak-before-break (LBB) to the AP600 main feedwater lines, based on a probabilistic approach. Westinghouse concludes that the probability of a pipe break of nonsafety-related main feedwater pipe in the turbine building is negligibly small. Thus, the depressurization transient loads induced by such a break is an event of low probability and should be excluded from load combination considerations for LBB application.

   The staff has the following concerns:

   A. General Design Criterion 4 requires that structures, systems, and components important to safety shall be designed to accommodate dynamic effects of pipe ruptures. The staff position for postulated pipe rupture is delineated in SRP 3.6.2. The Branch Technical Position MEB 3-1 is deterministic and it governs postulated pipe rupture of high energy lines inside and outside the containment, either designed by the ASME Code or otherwise. This criterion is applicable to the feedwater lines.

   B. Although General Design Criterion 4 permits exclusion of dynamic effects associated with postulated pipe ruptures from the design basis when it can be demonstrated that the probability of pipe rupture is extremely low, the staff acceptance criteria are as delineated in the NUREG-1061, Volume 3, which indicates that for justifying such exclusion, a deterministic fracture mechanics evaluation should be performed for demonstrating sufficient margins against pipe failure.

   C. Currently, piping design is based on deterministic Code rules with specified loads and load combinations, and the pipe stresses are deterministically calculated for meeting specific limits under various defined plant operating conditions. No probabilistic approach either in load combination or in stress analysis is allowed in the piping design.

2. Westinghouse indicated that the feedwater line anchor located at the exterior auxiliary building wall will eliminate transfer of dynamic loads from a feedwater line break in the turbine building. The staff concludes that the anchor may be effective to prevent transfer of jet thrust loads due to a feedwater line break in the turbine building. However, the portion of feedwater line inside containment will still be affected by the break induced depressurization loads.

Enclosure

Based on the above discussion, the staff does not accept the bases and the probabilistic approach included in the Westinghouse letter NTD-NRC-95-4564 for justifying exclusion of dynamic effects of feedwater line break in the turbine building.

According to guidance provided in NUREG-1061, a factor of 2 between the leakage-size flaw (postulated under normal loads) and the critical-size flaw (calculated under normal plus Service Level D loads) is required to ensure an adequate stability margin for the leakage-size flaw. The dynamic loads stated above are Level D loads which ought to be considered for qualifying LBB to the portion of feedwater line inside containment.

In addition, the staff is also concerned about the potential susceptibility of the feedwater line to degradation mechanisms such as water hammer events. Although during the piping design review meeting, Westinghouse described various design and operating features to address water hammer concerns on the feedwater line, the staff observed that these features would serve to minimize, but not necessarily eliminate water hammer occurrences. Besides, the staff observed that there is no operating experience for the AP600 feedwater line design. Consequently, occurrence of water hammer events in the AP600 feedwater line can not be ruled out.

In conclusion, the staff does not accept application of LBB to the feedwater line for the AP600.