Docket File

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 7, 1997

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

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION (RAIs) ON WCAP-14845, "SCALING ANALYSIS FOR AP600 CONTAINMENT PRESSURE DURING DESIGN BASIS ACCIDENTS"

Dear Mr. Liparulo:

The Nuclear Regulatory Commission's (NRC) Containment Systems and Severe Accident Branch staff reviewed WCAP-14845, "Scaling Analysis for AP600 Containment Pressure During Design Basis Accidents" and determined that it needs additional information in order to complete its review of the Westinghouse AP600 passive containment cooling system and WGOTHIC computer code. Enclosed are questions identified as RAI# 480.1017 to 480.1021. This is the second of two requests on WCAP-14845, based on commitments from the April 18, 1997, meeting with Westinghouse on the scaling study. It is expected that WCAP-14845 will be updated to reflect the questions and comments enclosed in this letter.

You have requested that portions of the information submitted in the June 1992, application for design certification be exempt from mandatory public disclosure. While the staff has not completed its review of your request in accordance with the requirements of 10 CFR 2.790, that portion of the submitted information is being withheld from public disclosure pending the staff's final determination. The staff concludes that these questions and comments do not contain those portions of the information for which exemption is sought. However, the staff will withhold this letter from public disclosure for 30 calendar days from the date of this letter to allow Westinghouse the opportunity to verify the staff's conclusions. If, after that time, you do not request that all or portions of the information in the enclosures be withheld from public disclosure in accordance with 10 CFR 2.790, this letter will be placed in the NRC Public Document Room.

DF03 1

If you have any questions regarding this matter, you may contact me at (301) 415-8548.

Sincerely,

original signed by:

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

DISTRIBUTION: ***Enclosure to be held for 30 days**

*Docket File	PDST R/F	MSlosson
PUBLIC	SWeiss	TRQuay
TKenyon	BHuffman	JSebrosky
DJackson	JMoore, O-15 B18	WDean, O-17 G21
ACRS (11)	CBerlinger, O-8 H7	EThrom, O-8 H7
GHolahan, O-8 E2		

DOCUMENT NAME: A:W14845 2.RAI
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		D:PDST:DRPM					
NAME	DTJackson:sg		TRQuay					
DATE	05/6/97		05/7/97					

OFFICIAL RECORD COPY

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

Ms. Cindy L. Haag
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. S. M. Modro
Nuclear Systems Analysis Technologies
Lockheed Idaho Technologies Company
Post Office Box 1625
Idaho Falls, ID 83415

Enclosure to be distributed to the following addressees after the result of the proprietary evaluation is received from Westinghouse:

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. Robert H. Buchholz
GE Nuclear Energy
175 Curtner Avenue, MC-781
San Jose, CA 95125

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

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

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

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

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

REQUESTS FOR ADDITIONAL INFORMATION

The following RAIs on WCAP-14845, "Scaling Analysis for AP600 Containment During Design Basis Accidents," February 1997, were generated as a result of the April 18, 1997, meeting:

480.1017 The report must be organized in a scrutable manner and the pertinent information must be clearly and unambiguously presented. In each section the premise on which the analysis is based needs to be stated and followed through in a logical manner to the conclusion. In its present form, the report is disjointed and lacks focus. Westinghouse should clearly state: (1) the purpose of each section, and (2) how the material supports the conclusions of the work. The key item is the pressure rate of change equation. Westinghouse must provide this equation in its final form, together with the π groups, in a single location.

480.1018 There are three related, and critical, items which must be addressed in order to establish that the Westinghouse approach is applicable at the scale of the AP600.

1. The Westinghouse scaling approach does not address the issue that the heat flux in the large scale test (LST) facility is too high and that the rate of pressure drop is too high by a factor of eight when compared to the AP600. The issue is that Westinghouse did not divide through by the coefficient on the dP/dt term (e.g., Equation (7) on Page xvii of WCAP-14845) in the pressure rate of change equation. The key variable of concern, in simple terms, is hA/V, where h is the heat transfer coefficient, A is the surface area for heat transfer and V is the containment volume. The governing equations show that this heat flux (Q = hA) to volume ratio is the key quantity that must be preserved, similar to the "power-to-volume" ratio that is used to scale primary system experimental facilities. With the 1/8 linear scaling of the LST, $(hA/V)_{LST} = 8\ (hA/V)_{AP600}$. Thus this key top level scaling criteria is not met. This needs to be addressed as a major distortion of the LST, and the scaling analysis needs to be revised to include this item in the correct manner.

   The distortion caused by the difference in hA/V (or Q/V) between the AP600 and the LST is operative in the steady-state and the transient mode. The scaling approach can either divide through by this term, which appears on the left side of the pressure rate of change equation, or the scaling approach can define a dimensionless time and incorporate the term into the rate of change. This is what is done in the Westinghouse analysis. The scaling is then such that dimensionless time proceeds eight times faster in the LST than in the AP600, or looked at it in another way, the heat removal rate per unit volume is eight times higher. It cannot be argued that the LST

is steady-state and therefore that time is irrelevant. Even in the steady-state the mixing, diffusion and condensation processes inside the containment volume and at the shell surface are rate dependent. Data from larger scale facilities is likely to be needed to address this distortion.

2. Scaling of mixing (circulation) and thermal stratification must be addressed. Data from international test programs, to supplement the LST data, will likely be needed to establish the applicability of the evaluation model at the AP600 scale. Data from HDR, Grenoble, and Japanese tests were identified as potentially being applicable to address this concern.

3. The distribution of noncondensibles is a function of scale. Westinghouse must establish the scaling for the distribution of noncondensibles as they affect condensation heat transfer. Data from HDR, Grenoble, and Japanese tests were also identified as potentially being applicable to address this concern.

480.1019 Westinghouse has included drops dispersed into the containment atmosphere during blowdown as a heat sink or heat source in the scaling equations. In the study, the drops are assumed to remain in the atmosphere for all of the double ended cold leg guillotine loss-of-coolant-accident (DECLG LOCA) phases. This is non physical. The surface area used for the drops is an arbitrary number. While Westinghouse has argued that the scaling analysis shows that the drops do not have a significant effect, it is recommended that the drops not be included. A thermodynamic equilibrium model is suggested as being more appropriate, as a simpler and acceptable approach. At a minimum, a better discussion of why drops were considered and what conclusions can be drawn from their consideration needs to be provided at the beginning of the section.

480.1020 Section 11, on the identification and evaluation of distortions, needs to be supplemented with information which indicates how the distortions are handled when using the LST data to validate the evaluation model. This may include pointers to the PIRT (WCAP-14812) and application (WCAP-14407) reports, as appropriate.

480.1021 The "Conclusions" section of the report, Section 12, must directly and concisely state how Westinghouse uses the results of the scaling work. In particular,

1. Explain what use is made of the LST data for the WGOTHIC computer program validation and how does the scaling study support this usage;

2. Explain how the scaling study used to support the PIRT evaluation; and

3. Explain how the scaling study used to support the use of the various models and correlations in WGOTHIC at the scale of AP600.