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

May 26, 1994

Docket No. 52-003

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

Dear Mr. Liparulo:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION (RAI) ON THE AP600

As a result of its review of the June 1992 application for design certification of the AP600, the staff has determined that it needs additional information in order to complete its review. The additional information is needed in the areas of reactor systems (Q440.167)* and testing (Q952.65-Q952.88). Enclosed are the staff's questions. Please respond to this request on a schedule that will support development of the November 1994 draft final safety evaluation report on the AP600 design.

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 this RAI does 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's Public Document Room.





*The numbers in parentheses designate the tracking numbers assigned to the questions.



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This RAI affects nine or fewer respondents, and therefore is not subject to review by the Office of Management and Budget under P.L. 96-511.

If you have any questions regarding this matter, you can contact me at (301) 504-1120.

Sincerely,

Original Signed By

Thomas J. Kenyon, Project Manager
Standardization Project Directorate
Associate Director for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc w/enclosure:
See next page

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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, Pennsylvania 15230

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

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

Mr. Sterling Franks
U.S. Department of Energy
NE-42
Washington, D.C. 20585

Mr. S. M. Modro
EG&G Idaho Inc.
Post Office Box 1625
Idaho Falls, Idaho 83415

Mr. Steve Goldberg
Budget Examiner
725 17th Street, N.W.
Room 8002
Washington, D.C. 20503

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

Mr. Victor G. Snell, Director
Safety and Licensing
AECL Technologies
9210 Corporate Boulevard
Suite 410
Rockville, Maryland 20850

Mr. Raymond N. Ng, Manager
Technical Division
Nuclear Management and
Resources Council
1776 Eye Street, N.W.
Suite 300
Washington, D.C. 20006-3706

REQUEST FOR ADDITIONAL INFORMATION
ON THE WESTINGHOUSE AP600 DESIGN

## ANALYSIS OF A MAIN STEAMLINE BREAK

440.167 The following questions pertain to the analysis of a main steamline break (MSLB) contained in the February 15, 1994 report on AP600 design changes.

a. Confirm that the analysis shown in the report assumes actuation of both passive residual heat removal (PRHR) heat exchangers (HXs) at time zero.

b. Is a failure of one CMT discharge MOV assumed, as stated in the original analysis in the SSAR?

c. Is there any other single active failure that could result in more limiting conditions, i.e., further draining of a CMT tank prior to system stabilization?

d. Has the actuation of non-safety-related systems that could exacerbate the consequences of the event been taken into account? If so, explain the assumptions that have been made. If not, show that non-safety systems cannot have negative impacts.

e. What assumptions have been made with respect to the temperature of the IRWST water and associated uncertainties, and the resultant impact on PRHR HX outlet temperatures?

f. What assumptions have been made with respect to PRHR heat transfer coefficients and associated uncertainties, and the resultant impact on PRHR HX outlet temperatures?

## TESTING

952.65 The staff has reviewed the test facility design and matrix for the automatic depressurization system (ADS) Phase B in the VAPORE facility, in view of the recent changes in the ADS design and actuation logic. The facility design and test matrix appear to be acceptable in most respects. However, it is unclear how the liquid flow rate is to be measured in those tests where saturated liquid is used from the water/steam reservoir. If these measurements are to be made indirectly, based on the level in the reservoir, the staff believes that such a method does not give a sufficiently accurate instantaneous measurement of flow rate. The staff concludes that a flowmeter to measure liquid flow rate would be a valuable addition to the facility instrumentation. Address this concern.

Enclosure

952.66 What is the location of the break on the Loop 2 B pipe (i.e., with respect to the downcomer connection) for the SPES-2 facility? Figure 952.49-3 in the April 12, 1994 response to Q952.49 is not legible enough to determine the location of the break piping off-take. Additionally, more detailed characterization data for the final break configuration is necessary to accurately model the break for assessment purposes. Specifically, rated flows for a given pressure and specific amount of subcooling if there is any is needed. Provide this information.

952.67 Clarify the general test procedures for the SPES-2 facility by providing the following information:

a. The location, size, and geometry for all planned experiment breaks.

b. Which CMT will be failed for failed CMT scenario experiments?

952.68 Will the safety setpoints for all of the experiments (e.g. reactor scram and "S" signal) at the SPES-2 facility be based on Chapter 15 values, or will some be based on best estimate values?

952.69 The last RELAP5 input deck* for the SPES-2 facility provided 13 Kw to the pressurizer heaters. Is this the power that the pressurizer heaters will be operated at when they are turned on?

952.70 The February 22, 1994 AP600 design changes document indicates that the CMT volume-based level setpoint for the first stage ADS actuation has been changed to a smaller volume level of 67.5 percent. The April 12, 1994 response to Q952.49 on the SPES-2 facility identifies a value of 67 percent volume level. What is the reason for the difference in the setpoint values? Clarify these values.

952.71 What will be the initial positions and planned operation of the PRHR valves during tests involving the PRHR system at the SPES-2 facility? How does the planned test operation of the PRHR at the SPES-2 facility compare with the recent Westinghouse design change plans for the PRHR operation of the plant?

952.72 Provide the results of the hot and cold shakedown data for the SPES-2 facility. Some of these results were shown to the NRC during its site visit to the SPES-2 facility in February 1994. This information will enable the staff to correctly determine local heat and pressure losses for the entire system. For example, the CMT discharge flow losses are critical to obtaining a correct time for first stage ADS level actuation, and these losses should be obtainable from cold shakedown data. Provide this information.

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*Letter from A. Alemberti, ANSALDO S.p.A. to Marcos G. Ortiz, EG&G Idaho, Inc., INEL, "Revised RELAP5/Mod3.0 input deck 'spes2.1' of SPES-2 facility," June 14, 1993.

952.73 The initial and boundary condition data identified in the April 12, 1994 response to Q952.49 on the SPES-2 facility indicates that the RCP pumps will coast down to zero in 5-8 seconds. Provide a plot or table of the pump speeds during the coastdown, because this behavior differs so much from the longer coast down times predicted based on pump characterization data.**

952.74 Is the leakage power of 1.3% from the heater rod power cable which runs through the lower plenum of the SPES-2 facility a portion of the total power of 4.9 MW or additive to the total power?

952.75 What are the steam generator recirculation ratios and riser inlet temperatures for the SPES-2 facility? Also, were the volumes for the steam generator bypasses accounted for in the second provided RELAP5 input model?***

952.76 What L/d values will be used for the ADS 1-4 valve orifices of the SPES-2 facility? For a given flow, what are the pressure drops from the ADS valves to their respective catch tanks?

952.77 What will be the pressure and the temperature of the air surrounding the CMTs of the SPES-2 facility and what control systems will be used to control the temperature and pressure in this outer tank? The test procedure entitled, "AP600, SPES-2 FHFP Integral System Test-2; CL Break Matrix Test No. 3," indicates that the secondary side of the CMTs will begin pressurized at 957.2 psia, and will open up the PORV at 971.7 psia. What will be the initial temperature and will any attempt be made to control the temperature of the CMT secondary side air?

952.78 What is the expected volume and fluid temperature of the lower plenum of the SPES-2 facility that will become stagnant at the very bottom of the pressure vessel?

952.79 The test procedure entitled, "AP600, SPES-2 FHFP Integral System Test-2; CL Break Matrix Test No. 3," states that the upper head average temperature of the SPES-2 facility must be 296 ± 5 degrees Celsius. This temperature is 20 degrees Celsius warmer than cold leg temperatures. How will the temperature in the upper head be raised to this initial condition if it only sees the bypass coolant fluid, which would be at nearly the same temperature as the cold leg fluid? Has this desired temperature been achieved in tests to date?

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**M. Rigamonti, O. Vescovi, SPES Pump Characterization, SIET NT/54, 12/30/87.

***Letter from A. Alemberti, ANSALDO S.p.A. to Marcos G. Ortiz, EG&G Idaho, Inc., INEL, "Revised RELAP5/Mod3.0 input deck 'spes2.1' of SPES-2 facility," June 14, 1993.

952.80 Provide the size, location and characteristics of flow orifices that exist in the primary and safety systems piping of the SPES-2 facility so that the staff can simulate them or their effect in its analysis. How will the additive effects of orificing in the CL to obtain proper steady state pressure losses and orificing to simulate missing pump resisting counter-current flow be treated?

952.81 Provide updated and complete schematics and plant drawings for the following systems of the SPES-2 facility:

a. PRHR supply, heat exchanger and return lines.
b. ADS Stage 1,2,3, and 4 inlet, valve nest, and discharge piping lines. (The staff has received some of the currently planned areas, but not the configuration of the piping surrounding the valves.)
c. CMT discharge line.
d. CMT inlet diffuser dimensions and characteristics.
e. IRWST Injection line.
f. Steam generators, in particular the separator bypass.
g. New DVI nozzle venturi information.
h. Pressurizer inlet diffuser dimensions and characteristics.

952.82 The February 22, 1994 submittal on the AP600 design changes indicates some piping changes for safety lines, including scheduling changes. Describe any changes that will be implemented in the SPES-2 facility.

952.83 What are the bend/elbow radii in the following piping systems in the SPES-2 facility:[****]

a. Downcomer-Upper Head bypass (pg. 30): 2 elbows
b. Cold Leg to CMT balance lines (pg. 32): 13 elbows
c. CMT Discharge lines (pg. 33): 10 elbows, 4 bends
d. IRWST Injection lines (pg. 34): 14 elbows
e. PRHR HX, Supply line, Return line (pg. 35): 7 elbows
f. Accumulator Injection lines (pg. 36): 8 bends or elbows

952.84 What are the type and size of valves in the following piping systems in the SPES-2 facility:[****]

a. Downcomer-Upper Head bypass (pg. 30):

1. Isolation valve at Elevation +1425
2. Check valve in piping run from Elevation +10911 to Elevation +10734 (to CMT-B).

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[****]The page numbers are from E. Gabbi, Ufficio Tecnico, SIET (Innovazione E Qualifica Nei Sistemi Energetici), Component and Piping Drawings, Westinghouse Electric Corporation Proprietary Class 2 Report, Enclosure 1 to Reference 8 Information Package, 12/31/92., Dwg. 00189DD92.

b. Cold Leg to CMT balance lines (pg. 32):

1. Air operated valve in piping run from Elevation +5833 to Elevation +5970 (to CMT-B).
2. Air operated valve in piping run from Elevation +5881 to Elevation +6027 (to CMT-A).

c. CMT Discharge lines (pg. 33):

1. Motor operated valve in piping run at Elevation -791 (from CMT-A).
2. Motor operated valve in piping run at Elevation -791 (from CMT-B).

d. IRWST Injection lines (pg. 34):

1. Isolation valves just below the IRWST (both lines).
2. Check valves in piping run from Elevation -991 to Elevation -508 (both lines).

e. PRHR HX, Supply line, Return line (pg. 35):

1. Air operated valve in piping run at Elevation +8026 (Supply line).
2. Motor operated valve in piping run at Elevation +2667 (Return line).

f. Accumulator Injection lines (pg. 36):

1. 2-air operated valve in piping run from Elevation -3569 to Elevation -508 (one in each accumulator injection lines).

952.85 Clarify the position relationship of the pressure vessel connections of DVI A and B of the SPES-2 facility with respect to the pressure vessel cold leg nozzle attachment locations. Is DVI A between Cold Legs A2 and B1 or between Cold Legs B2 and A1?

952.86 Provide information on the insulation material, thickness, and lengths for the entire SPES-2 facility. This request is in addition to previous inquires on the measured heat losses of the SPES-2 facility.

952.87 Page 8 of Dwg. 00189DD92***** shows a cross-section of the upper plenum and annular downcomer in SPES-2. The 8 circumferential pressure drop fins and the 2 hot leg baffle plates can be seen.

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*****E. Gabbi, Ufficio Tecnico, SIET (Innovazione E Qualifica Nei Sistemi Energetici), Component and Piping Drawings, Westinghouse Electric Corporation Proprietary Class 2 Report, Enclosure 1 to Reference 8 Information Package, 12/31/92., Dwg. 00189DD92

However, there are 4 other structures shown in this cross-sectional view that correspond to the same vessel azimuthal angles as the cold leg nozzles. What are these devices, their physical dimensions (including elevation in the annular downcomer), and their purpose in the SPES-2 facility, including their relationship to any feature or expected phenomena in the AP600's downcomer or vessel?

952.88 Does the SPES-2 pressurizer have the retainer basket that AP600 has? If so, provide a drawing of it.