



Westinghouse Electric Company
Nuclear Plant Projects
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USA

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

Direct tel: 412-374-5355
Direct fax: 412-374-5456
e-mail: corletmm@westinghouse.com

Your ref: Docket No. 52-006 *Proj 711*
Our ref: DCP/NRC1513

July 24, 2002

SUBJECT: Response to NRC Requests for Additional Information Letter No. 1 – AP1000
Design Certification, dated June 27, 2002.

Please find in Attachment 1 and 2 our responses to your requests for additional information in support of your review of the AP1000. Attachment 4 provides AP1000 drawings referenced in our responses. Attachment 3 is a list of these AP1000 drawings. Attachment 5 and 6 provide the AP1000 Passive Core Cooling System Safeguards Data Package.

The Westinghouse Electric Company Copyright Notice, Proprietary Information Notice, Application for Withholding, and Affidavit are also attached to this submittal letter as Enclosure 1. Attachments 1, 4, and 5 contain Westinghouse proprietary information consisting of trade secrets, commercial information or financial information which we consider privileged or confidential pursuant to 10 CFR 2.790. Therefore, it is requested that the Westinghouse proprietary information attached hereto be handled on a confidential basis and be withheld from public disclosures. Attachments 2, 3 and 6 contain no proprietary information.

This material is for your internal use only and may be used for the purpose for which it is submitted. It should not be otherwise used, disclosed, duplicated, or disseminated, in whole or in part, to any other person or organization outside the Commission, the Office of Nuclear Reactor Regulation, the Office of Nuclear Regulatory Research and the necessary subcontractors that have signed a proprietary non-disclosure agreement with Westinghouse without the express written approval of Westinghouse.

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Correspondence with respect to the application for withholding should reference AW-02-1538, and should be addressed to Hank A. Sepp, Manager of Regulatory and Licensing Engineering, Westinghouse Electric Company, P.O. Box 355, Pittsburgh, Pennsylvania, 15230-0355.

Please contact me at 412-374-5355 if you have any questions concerning this submittal.

Very truly yours,



M. M. Corletti
Passive Plant Projects & Development
AP600 & AP1000 Projects

/Enclosure

1. Westinghouse Electric Company Copyright Notice, Proprietary Information Notice, Application for Withholding, and Affidavit

/Attachments

1. Westinghouse Proprietary Responses to NRC Requests for Additional Information for AP1000 Design Certification Review
2. Westinghouse Non-Proprietary Responses to NRC Requests for Additional Information for AP1000 Design Certification Review
3. List of Westinghouse AP1000 Drawings
4. Westinghouse AP1000 Proprietary Drawings (28) for AP1000 Steam Generator, Reactor Vessel Upper and Lower Internals, and Core Shroud
5. AP1000 Passive Core Cooling System Safeguards Data Package, RAIs 440.4, 440.5, and 440.6, Proprietary Class 2
6. AP1000 Passive Core Cooling System Safeguards Data Package, RAIs 440.4, 440.5, and 440.6, Non-Proprietary Class 3

DCP/NRC1513
Docket No. 52-006

July 24, 2002

bcc: C. B. Brinkman* - Westinghouse, Rockville, MD
W. E. Cummins - Westinghouse, Pittsburgh, PA, EC E3
H. A. Sepp - Westinghouse, Pittsburgh, PA, EC E4-07A
R. P. Vijuk - Westinghouse, Pittsburgh, PA, EC E3-05
J. W. Winters - Westinghouse, Pittsburgh, PA, EC E3-08

*(attachments without drawings)

Westinghouse Proprietary Class 2

DCP/NRC1513
Docket No. 52-006

July 24, 2002

Enclosure 1

Westinghouse Electric Company, LLC

Copyright Notice, Proprietary Information Notice, Application for Withholding, and Affidavit



RAI Number 440.8-1

07/24/2002

July 24, 2002

Copyright Notice

The documents transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies for the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.790 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond these necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

July 24, 2002

Proprietary Information Notice

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.790 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) contained within parentheses located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.790(b)(1).



Westinghouse Electric Company
Nuclear Plant Projects
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

July 24, 2002

AW-02-1538

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

ATTENTION: Mr. Lawrence Burkhart

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

SUBJECT: Transmittal of Westinghouse Proprietary Class 2 Documents:
Responses to NRC Requests for Additional Information and AP1000 Drawings

Dear Mr. Burkhart:

The application for withholding is submitted by Westinghouse Electric Company, LLC ("Westinghouse") pursuant to the provisions of paragraph (b)(1) of Section 2.790 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary version of the subject documents. In conformance with 10 CFR Section 2.790, Affidavit AW-02-1538 accompanies this application for withholding setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to this application for withholding or the accompanying affidavit should reference AW-02-1538 and should be addressed to the undersigned.

Very truly yours,

A handwritten signature in black ink, appearing to read 'M. M. Corletti'.

M. M. Corletti
Passive Plant Projects & Development
AP600 & AP1000 Projects

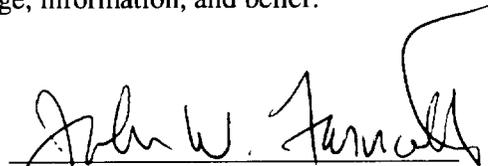
/Enclosures

COMMONWEALTH OF PENNSYLVANIA:

SS

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared John W. Fasnacht, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company, LLC ("Westinghouse"), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:


John W. Fasnacht, Manager
Integrated Plant Engineering Services
Westinghouse Electric Company, LLC

Sworn to and subscribed
before me this 24th day
of July, 2002


Notary Public



Notarial Seal
Lorraine M. Piplica, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Dec. 14, 2003
Member, Pennsylvania Association of Notaries

- (1) I am Manager, Integrated Plant Engineering Services, in the Nuclear Services Business Unit, of the Westinghouse Electric Company LLC ("Westinghouse"), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Electric Company, LLC.
- (2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.
- (3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Electric Company, LLC in designating information as a trade secret, privileged or as confidential commercial or financial information.
- (4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.
 - (i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.
 - (ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

- (a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.
- (b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.
- (c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.
- (d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.
- (e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.
- (f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

- (a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.
- (b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.
- (c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

- (d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.
 - (e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.
 - (f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.
- (iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.790, it is to be received in confidence by the Commission.
- (iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

The proprietary information sought to be withheld in this submittal is that which is appropriately marked in Attachments 1, 4, and 5 respectively as Proprietary Class 2 in the Westinghouse document DCP/NRC1513 for submittal to the Commission: (1) "Westinghouse Proprietary Responses to NRC Requests for Additional Information for AP1000 Design Certification Review", and (2) "Westinghouse Proprietary Drawings for AP1000 Steam Generator, Reactor Vessel Upper and Lower Internals, and Core Shroud," and (3) "AP1000 Passive Core Cooling System Safeguards Data Package."

This information is being transmitted by Westinghouse's letter and Application for Withholding Proprietary Information from Public Disclosure, being transmitted by Westinghouse Electric Company (W letter AW-02-1538) and to the Document Control Desk, Attention: Lawrence Burkhart, DIPM/NRLPO, MS10H1.

This information is part of that which will enable Westinghouse to:

- (a) Provide documentation supporting determination of APP-GW-GL-700, "AP1000 Design Control Document" analysis on a plant specific basis
- (b) Provide the applicable engineering evaluation which establishes the Tier 2 requirements as identified in APP-GW-GL-700.

Further this information has substantial commercial value as follows:

- (a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting NRC requirements for Licensing Documentation.
- (b) Westinghouse can sell support and defense of AP1000 Design Certification.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar methodologies and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended for performing and analyzing tests.

Further the deponent sayeth not.

July 24, 2002

Attachment 2

**Westinghouse Non-Proprietary Responses to NRC Requests
for Additional Information for AP1000 Design Certification Review**

RAI 440.1
RAI 440.2
RAI 440.3
RAI 440.4
RAI 440.5
RAI 440.6
RAI 440.7
RAI 440.8

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 440.1

Question:

Provide a description of the revised reactor vessel internals surrounding the core, since in the AP1000 design the radial reflector has been eliminated and replaced by a core shroud. Please provide the following information for both the core and the core bypass flow paths:

- a. the core bypass flow rate corresponding to thermal design flow at 10% steam generator tube plugging
- b. the number of baffle plates, and baffle plate flow loss coefficients
- c. the areas of the flow paths through the core bypass region
- d. dimensions, including the thickness and internal and external diameters of the core shroud, and core barrel, including the surface areas and metal masses
- e. the core shroud material including the thermal conductivity, density and heat capacity

Note: WCAP-15612, "AP1000 Plant Description and Analysis Report," page 2-22 listed the radial reflector design as "under review" by Westinghouse during Phase 2 of the review. Design parameters for the AP1000 have not been specified.

Westinghouse Response:

The AP1000 reactor vessel internals include a core shroud design. The core shroud is located between the lower core barrel and core, surrounding the core and forming the core cavity. The core shroud consists of formed vertical plates with fully welded vertical seams to prevent lateral flow from the fuel assemblies. The core shroud is based on proven designs and is currently utilized in operating plants designed by Westinghouse (W / CE). Attachment 4 to Westinghouse letter DCP/NRC1513 includes the engineering drawings associated with the reactor vessel and internals including the core shroud.

- a. The total design core bypass flow rates for the AP1000 are as follows:

Total core bypass flow, (pct. of total flow)	5.9%
Outlet nozzle leakage	1.0%
Head cooling flow	1.5%
Thimble flow	1.9%
Cavity bypass flow	1.0%
Core shroud cooling flow	0.5 %

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

- b. The AP1000 does not contain baffle plates. The function of the baffle plates is performed with the core shroud.
- c. The equivalent shroud inlet flow area is []^{b,c} in² based on []^{b,c} inch diameter holes corresponding to a loss coefficient of []^{b,c}. The equivalent shroud exit flow area is []^{b,c} in² based on []^{b,c} inch diameter holes with a loss coefficient of []^{b,c}.
- d. The dimensions of the core shroud, including the thickness and internal and external diameters of the core shroud, and core barrel, including the surface areas and metal masses are included in the drawings provided in Attachment 4 to Westinghouse letter DCP/NRC1513.
- e. The core shroud is constructed of 304 stainless steel. The mass of the core shroud is shown on the proprietary drawings provided in Attachment 4 to Westinghouse letter DCP/NRC1513.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 440.2

Question:

Provide the following dimensions and parameters related to the upper plenum:

- the number, type (support column or guide tube), and dimensions of upper plenum structures, including the metal masses of these structures and the flow path dimensions through the guide tubes
- the net free volume between the top of the upper core plate and the bottom of the upper support plate
- the core barrel inner diameter in the upper plenum
- the net free volume in the lower plenum (volume in the vessel below the bottom of the lower core support plate), and mass of the lower plenum metal structures
- the number and dimensions of holes through the upper core plate sufficient to determine the flow area from the core to the upper plenum and from the core to the guide tubes

Westinghouse Response:

- The number, type (support column or guide tube), and dimensions of the upper plenum structures are shown on the drawings provided in Attachment 4 of Westinghouse letter DCP/NRC1513.
- The net free volume between the top of the upper core plate and the bottom of the upper support plate is []^{b,c} ft³. This is a nominal cold value.
- The core barrel inner diameter in the upper plenum is []^{b,c} inches.
- The net free volume in the lower plenum (volume in the vessel below the bottom of the lower core support plate) is []^{b,c} ft³. This is a nominal cold value. The metal mass in the lower plenum, below the lower core support plate, is calculated to be []^{b,c} lbm for the structures excluding the vessel itself. Including the vessel, the metal mass is []^{b,c} lbm.
- The number and dimensions of the holes through the upper core plate and the dimensions of the upper plenum are shown on the drawings provided in Attachment 4 of Westinghouse letter DCP/NRC1513.

Design Control Document (DCD) Revision:

None

PRA Revision:

None



RAI Number 440.2-1

07/22/2002

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 440.3

Question:

Provide the following information related to the core and fuel assemblies:

- a. fuel assembly top nozzle flow area and loss coefficient
- b. fuel assembly bottom nozzle flow area and loss coefficient
- c. spacer grid loss coefficient

Westinghouse Response:

The following provides the requested information regarding the AP1000 core and fuel assemblies.

- d. The AP1000 Fuel Assembly Top Nozzle Loss Coefficient is []^{b,c}. The loss coefficient is based on a reference area of []^{b,c} in².
- e. The AP1000 Fuel Assembly Bottom Nozzle Loss Coefficient is []^{b,c}. The loss coefficient is based on a reference area of []^{b,c} in².
- f. The following provides the AP1000 spacer grid information.

Number of non-mixing vane grids = 2

Non-mixing vane grid loss coefficient = []^{b,c}

Reference area for determining loss coefficient = []^{b,c} in²

Number of mixing vane grids = 12 (8-zirc grids, 4 IFMs)

Mixing vane grid loss coefficient = []^{b,c}

Reference area for determining loss coefficient = []^{b,c} in²

Design Control Document (DCD) Revision:

None

PRA Revision:

None



RAI Number 440.3-1

07/22/2002

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 440.4

Question:

For the automatic depressurization system (ADS) please provide piping diagrams showing line sizes, lengths, and elevation changes for ADS piping from the top of the pressurizer to the in-containment refueling water storage tank (IRWST) for ADS-1, 2 and 3, and from the hot leg to the containment for ADS-4. Indicate the locations of valves.

Westinghouse Response:

Attachment 5 to Westinghouse letter DCP/NRC1513 provides the Passive Core Cooling System safeguards data including the information requested.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 440.5

Question:

Provide piping diagrams or equivalent information to show line sizes, lengths, elevation changes for the paths connecting the IRWST, core makeup tanks (CMTs), and accumulators to the vessel. Indicate the locations of the valves, and flow limiting devices in the accumulators or CMT discharge lines. For the flow limiting devices please provide values of areas and flow loss coefficients input into Westinghouse computer codes for analysis of a postulated direct vessel injection (DVI) line break for both probabilistic risk assessment (PRA) and design control document (DCD) analyses.

Westinghouse Response:

Attachment 5 to Westinghouse letter DCP/NRC1513 provides the Passive Core Cooling System safeguards data including the information requested.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 440.6

Question:

Provide piping diagrams or equivalent information to show line sizes, lengths, elevation changes for the paths connecting the primary reactor coolant system (RCS) with the passive residual heat removal (PRHR) system.

Westinghouse Response:

Attachment 5 to Westinghouse letter DCP/NRC1513 provides the Passive Core Cooling System safeguards data including the information requested.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 440.7

Question:

For the steam generator, provide secondary side flow areas, volumes, and locations of the wide and narrow range tap locations. Provide the flow area of the gap between the mid-deck plate and the upper shell wall. Provide the geometry/size of the main steam lines and their valves (opening times, delay times, loss coefficients).

Westinghouse Response:

Steam generator secondary side flow areas are provided in Table 440.7-1. Secondary side volumes are provided in Table 440.7-2. The main steam lines have an ID of 34.12 inches and an OD of 38. inches. The main steam isolation valves have a maximum closure time of 5 seconds. An additional 2 second delay is assumed for protection system signal processing.

The design value for the main steam isolation valve pressure drop is 3.4 psi at a steam flow of 7.49E6 lbm/hr with steam generator exit conditions of 523 °F and 836 psia.

The steam generator level taps are located at the following distances above the top of the tube sheet.

Upper level taps []^{b,c} ft.

Lower narrow range level taps []^{b,c} ft.

Lower wide range level taps []^{b,c} ft.

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

Table 440.7-1 AP1000 Δ125 Steam Generator Secondary Side Flow Areas		Area (ft ²)	b, c
Component			
Upper downcomer pool (just above lower deck-plate)			
Upper downcomer pool (opposite lower deck-plate)			
Lower downcomer annulus (Between wrapper & shell)			
Lower downcomer annulus obstruction area (i.e. flow area to be subtracted from lower downcomer annulus flow area)	At tube support 10		
	At tube support 9		
	At tube support 8		
	At tube support 7		
	At tube support 6		
	At tube support 5		
	At tube support 4		
	At tube support 3		
	At tube support 2		
	At tube support 1 (flow distribution baffle)		
Wrapper opening (cross flow opposite bundle inlet)			
Bundle entrance (cross flow tube gap area opposite wrapper opening)			
Tube bundle (axial, straight section)			
Tube support plates (axial)	Tube support 10		
	Tube support 9		
	Tube support 8		
	Tube support 7		
	Tube support 6		
	Tube support 5		

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

b, c

	Tube support 4	
	Tube support 3	
	Tube support 2	
	Tube support 1 (flow distribution baffle)	
U-bend (average for cross flow)		
Lower wrapper (straight section)		
Within risers		
Upper wrapper		
Swirl vane riser (between hub & riser)		
Primary separator exit orifice (total)		
Mid-deck Plate (approximated)	Vent area	
	Drain area	
Upper shell		
Upper shell excluding primary separator risers		
Secondary separator (effective vane opening)		
Steam nozzle (with venturi tubes present)		
Feedwater nozzle		

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

Table 440.7-2 AP1000 Steam Generator Secondary Side Volumes		
Region	Volume, ft ³ b, c	
Volume outside the primary separators above the lower deck plate and below the mid-deck plate		
Downcomer volume (below lower deck plate and above the tube sheet)		
Tube bundle volume (above the top of tube sheet, below the top of the tubes and within the wrapper)		
Volume within the wrapper but above the top of the tubes and the volume within the primary separators		
Volume above the mid-deck plate but outside of the secondary separators		
Volume within the secondary separators, the steam dome and the steam outlet nozzle		
Total secondary side volume		

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 440.8

Question:

For the AP1000 core, provide the neutron lifetime, doppler feedback curve of reactivity versus fuel temperature, and curve of moderator density versus moderator reactivity (covering the initial full power moderator density down to and including highly voided conditions).

Westinghouse Response:

Neutron Lifetime

The nominal value for Prompt Neutron Lifetime is given in AP1000 DCD Table 4.3-2 (Sheet 1 of 2), "Nuclear Design Parameters (First Cycle)" as 0.0000198 seconds. The AP1000 safety analyses use a conservative (minimum or maximum) neutron lifetime value consistent with the event being analyzed. Prompt neutron lifetime values used in the AP1000 safety analyses range from a minimum of 0.000016 seconds to a maximum of 0.00002716 seconds.

Doppler Feedback

Doppler feedback for AP1000 is provided in DCD Figure 4.3-18, "Typical Doppler Temperature Coefficient at BOL and EOL".

Curve of Reactivity vs Fuel Temperature

The reactivity vs fuel temperature curve used in the Westinghouse COBRATRAC and NOTRUMP codes for the AP1000 LOCA Analyses is provided as Figure 1.

Curve of Moderator Density vs Moderator Reactivity

The moderator density reactivity feedback vs moderator reactivity curve used in the AP1000 LBLOCA Analyses is provided as Figure 2.

For the AP1000 SBLOCA analyses presented in the AP1000 DCD, the kinetics model is not active. Constant power is assumed until reactor trip at which time the 1971 + 20% decay heat curve is utilized. The kinetics model is only required for very small breaks (typically below 1-1/2 inches) where shutdown may not be possible unless the kinetics model is turned on.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

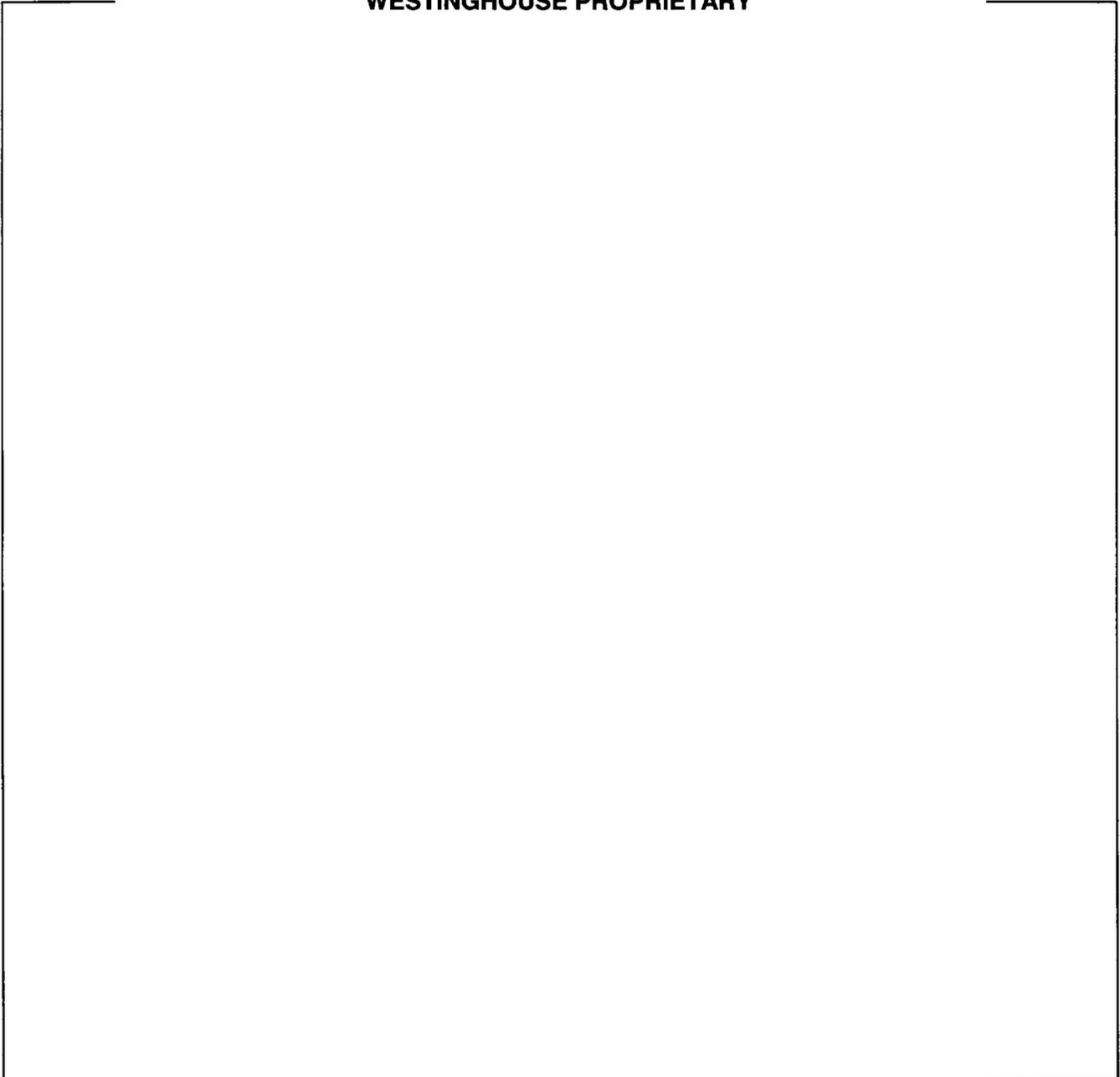
AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

Figure 1: AP1000 LOCA Analysis – Reactivity vs Fuel Temperature

WESTINGHOUSE PROPRIETARY

b, c



AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

Figure 2: AP1000 Large Break LOCA Analysis – Moderator Density Reactivity Feedback

WESTINGHOUSE PROPRIETARY

b, c



July 24, 2002

Attachment 3

List of Westinghouse Drawings

July 24, 2002

Attachment 3

List of Westinghouse Drawings

AP1000 Drawing Number	Rev	Description
APP-MB01-V1-001	0	AP1000 Steam Generator Outline
APP-MB01-V1-002	0	AP1000 Steam Generator Outline
APP-MB01-V1-003	0	AP1000 Steam Generator Outline
APP-MB01-V1-004	0	AP1000 Steam Generator Outline
APP-MB01-V1-005	0	AP1000 Steam Generator Outline
APP-MB01-V1-006	0	AP1000 Steam Generator Outline
APP-MB01-V1-007	0	AP1000 Steam Generator Outline
APP-MB01-V2-001	0	AP1000 Steam Generator General Arrangement
APP-MB01-V2-101	0	AP1000 Steam Generator Channel Head Layout
APP-MB01-V2-102	0	AP1000 Steam Generator Channel Head Layout
APP-MB01-V2-103	0	AP1000 Steam Generator Channel Head Layout
APP-MB01-V2-104	0	AP1000 Steam Generator General Arrangement Details
APP-MI01-V2-102	1	AP1000 Lower Internals Layout
APP-MI01-V2-104	1	AP1000 Lower Internals Assy Radial Support Key
APP-MI01-V2-106	1	AP1000 Lower Internals Assy Layout
APP-MI01-V2-107	1	AP1000 Lower Internals Assy Layout
APP-MI01-V2-114	0	AP1000 Lower Internals Assy Clevis Insert
APP-MI01-V2-201	0	AP1000 Reactor Upper Internals Guide Tube Assembly
APP-MI01-V2-202	0	AP1000 Reactor Upper Internals Guide Tube Assembly
APP-MI01-V3-201	0	AP1000 Core Shroud General Assembly
APP-MI01-V3-202	1	AP1000 Core Shroud Ring Brace
APP-MI01-V3-203	0	AP1000 Core Shroud Top Plate
APP-MI01-V3-204	1	AP1000 Core Shroud Bottom Plate
APP-MI01-V3-205	0	AP1000 Core Shroud Extended "C" Panels
APP-MI01-V3-206	0	AP1000 Core Shroud Extended "W" Panels
APP-MI01-V3-207	0	AP1000 Core Shroud Quarter Round, Channel, Ribs
APP-MV01-V1-001	1	AP1000 Reactor Vessel Outline Evaluation
APP-MV01-V1-002	0	AP1000 Reactor General Assembly

July 24, 2002

Attachment 6

**“AP1000 Passive Core Cooling System
Safeguards Data Package”**

for RAIs 440.4, 440.5, and 440.6

“AP1000 Passive Core Cooling System Safeguards Data Package”

July 11, 2002