Westinghouse
Electric Company

Nuclear Systems

Box 355
Pittsburgh, Pennsylvania 15230-0355

DCP/NRC1479
Project 711

July 10, 2001

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

Attention: Mr. Alan C. Rae, AP1000 Project Manager
Future Licensing Organization
Office of Nuclear Reactor Regulation
One White Flint Pike - MS12E15
Rockville, MD 20852-2738

SUBJECT: Transmittal of Proprietary AP1000 Pre-Certification Documents

Dear Mr. Rae,

Attached please find the following documents that are requested by the NRC staff for their use in performing the pre-certification review of the AP1000:

1. AP1000 Steam Generator Drawings
2. Summary of AP1000 Steam Generator Data
3. Summary of AP1000 Reactor Coolant Pump Data
4. Summary of AP1000 Scaling Reference Values

These documents contain data for the AP1000 that is considered proprietary to Westinghouse. In addition, non-proprietary versions of attachments 2, 3, and 4 listed above are provided.

Also enclosed are:

1. One (1) copy of the Application for Withholding, AW-01-1471, with Proprietary Information Notice and Copyright Notice

2. One (1) copy of Affidavit, AW-01-1471

This submittal contains 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.

D063

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.

Correspondence with respect to the any Application for Withholding or the Westinghouse Affidavit should reference this letter, AW-01-1471, and should be addressed to Hank A. Sepp, Manager of Regulatory and Licensing Engineering, Westinghouse Electric Company, 4350 Northern Pike, P.O. Box 355, Pittsburgh, Pennsylvania, 15230-0355.

Please contact me on 412-374-5355, if you have any questions concerning this transmittal.

Very truly yours,

M. M. Corletti

M. M. Corletti
Passive Plant Projects & Development

/Attachments

cc: H. A. Sepp, Westinghouse (w/o Enclosure)

bcc: (w/o attachments)

J. W. Winters	EC E3-08	1L
W. E. Cummins	EC E3	1L
R. P. Vijuk	EC E3-05	1L

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).

COPYRIGHT NOTICE

The reports transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of 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 those 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.

Westinghouse Electric Company, LLC

Box 355
Pittsburgh Pennsylvania 15230-0355

AW-01-1471

July 10, 2001

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

ATTENTION: Mr. Alan C. Rae

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

SUBJECT: WESTINGHOUSE PROPRIETARY CLASS 2 DOCUMENTS FOR AP1000 PRE-CERTIFICATION

REFERENCE: Letter from M. M. Corletti to Mr. Alan Rae, DCP/NRC1479 dated 7/10/2001

Dear Mr. Rae:

The application for withholding is submitted by Westinghouse Electric Company LLC, a Delaware limited liability company ("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 drawings and data summaries. In conformance with 10CFR Section 2.790, Affidavit AW-01-1471 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-01-1471 and should be addressed to the undersigned.

Very truly yours,

J. W. Winters, Manager
Passive Plant Projects & Development

2722aff.doc

AW-01-1471

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared James W. Winters, 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:

J. W. Winters, Manager
Passive Plant Projects & Development

Sworn to and subscribed
before me this 17th day
of July, 2001

Lorraine M. Piplica

Notary Public

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

2722alf.doc

(1) I am Manager, Passive Plant Projects & Development, in the Nuclear Systems Division, of the Westinghouse Electric Company LLC, a Delaware limited liability company ("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 constitute Westinghouse policy and provide the rational basis required.

Under that system, information is held in confidence if it falls in one or more of the following areas of potential competitive advantage:

(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.

(v) The proprietary information sought to be withheld is appropriately marked within the transmitted "AP1000 Pre-Certification Documents" (Proprietary), for submittal to the Commission. This information is being transmitted by the Westinghouse Electric Company, LLC letter DCP/NRC1479 and Application for Withholding Proprietary Information from Public Disclosure, AW-01-1471, to the Document Control Desk, Attention: Alan C. Rae, Office of Nuclear Reactor Regulation.

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 several months of development effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, a significant manpower effort, having the requisite talent and experience, would have to be expended for developing a comparable method.

Further the deponent sayeth not.

Westinghouse Non-Proprietary Class 3

Attachments 2, 3, and 4

Delta 125 for AP1000, 3415 MWt NSSS Modulars BE / 0% SGTP

OVERALL OPERATING CONDITIONS:

a,c

Load,
Thermal Power, MW
Heat Transferred, Btu/hr
Primary Coolant
  Flow Rate, lb/hr
  Volumetric Flow Rate, gpm
  Inlet Temperature, F
  Average Temperature, F
  Outlet Temperature, F
  Operating Pressure, psia
Secondary Coolant
  Feedwater Flow Rate, lb/hr
  Steam Nozzle Flow Rate, lb/hr
  Blowdown Flow Rate, lb/hr
  Feedwater Temperature, F
  Steam Nozzle Outlet Pressure, psia
  Steam Nozzle Outlet Temperature, F
  Moisture Carryover
Circulation Ratio
Water Level below Mid-Deck Plate, in
Water Level from Top of Tubesheet, in
Sec. Separator Rho-V^2, lb/ft-sec2
Separator Parameter, lb-ft3/hr2

Number of Tubes
Number of Plugged Tubes (.00%)
Tube OD, in
Tube Thickness, in
Tube Pitch, in
Wrapper ID, in
Overall Surface Area, ft2
Effective Surface Area, ft2
Tube Bundle Height, in
Tube Material (STP = 20.00)
Tube Thermal Conductivity, Btu/hr-ft-F

a,c

THERMAL PARAMETERS:

Inside Resistance, hr-ft2-F/Btu
Tube Wall Resistance, hr-ft2-F/Btu
Fouling Resistance, hr-ft2-F/Btu
Outside Resistance, hr-ft2-F/Btu
Overall Resistance, hr-ft2-F/Btu
Overall H/T Coef., Btu/hr-ft2-F
Log Mean Temperature Difference, F
Heat Flux, Btu/hr-ft2

HYDRAULIC PARAMETERS - Primary Side:

Pressure Drop, psi
  Inlet Nozzle
  Tube Inlet
  Tube Friction
  Tube Outlet
  Outlet Nozzle
  Overall
Average Tube Reynolds No.
Average Tube Velocity, ft/sec
Tube Volume, ft3
Total Volume, ft3
Total Water Mass, lb
Total Primary Side Heat Content, Btu

HYDRAULIC PARAMETERS - Secondary Side:

Bundle Saturation Pressure, psia
Bundle Saturation Temperature, F
Bundle to Steam Nozzle Loss, psi
Pressure Drop, psi
  Feedwater Nozzle + Distribution Ring
  Downcomer
    D/C Entrance
    D/C Transition
    D/C Resistance Plate if any
    D/C Obstruction
    D/C Friction
    Wrapper Opening
    Bundle Entrance
    Turn
  Tube Bundle Friction
  Tube Support 1 / FDB (K = 3.412)
  Tube Support 2 (K = 3.412)
  Tube Support 3 (K = 3.412)
  Tube Support 4 (K = 3.412)
  Tube Support 5 (K = 3.412)
  Tube Support 6 (K = 3.412)
  Tube Support 7 (K = 3.412)
  Tube Support 8 (K = 3.571)

HYDRAULIC PARAMETERS - Secondary Side: (continued)

a,c

Tube Support 9 (K = 3.571)
U-Bend Cross Flow
Transition Cone
Riser Entrance
Primary Separators
Separator Orifice
Separator Transition
Secondary Separators
Steam Nozzle
Total Momentum
Total Elevation (Static)
Total Secondary Side (Dynamic)
Total Secondary Side (Dyn+Stat+Mom)
Downcomer Head, psi
Total Riser Head, psi
Subcooled Bundle Riser Head, psi
Boiling Bundle Riser Head, psi
Separator Riser Head, psi
Circulation Head, psi
Circulation Loop Pressure Drop, psi
Downcomer Velocity, ft/sec

SECONDARY VOLUMES AND MASSES:

Region	Liquid Volume ft3	Vapor Volume ft3	Total Volume ft3	Liquid Mass lb	Vapor Mass lb	Total Mass lb

a,c

Table 4
AP1000 / Δ125 Secondary Side Flow Areas in GENF Calculations

	Component		GENF Parameter	Area (ft^2)
1	Upper Downcomer Pool (just above lower deckplate)		APRE	a,c
2	Upper Downcomer Pool (Opposite lower deckplate)		ANURE	
3	Lower Downcomer Annulus (Between wrapper & shell)		ADLS	
4	Lower downcomer Annulus Obstruction Area	Tube support 9	ADCO(9)	
		Tube support 8	ADCO(8)	
		Tube support 7	ADCO(7)	
		Tube support 6	ADCO(6)	
		Tube support 5	ADCO(5)	
		Tube support 4	ADCO(4)	
		Tube support 3	ADCO(3)	
		Tube support 2	ADCO(2)	
		Tube support 1 (flow distribution baffle)	ADCO(1)	
5	Wrapper Opening (Crossflow opposite bundle inlet)		AHWO	
6	Bundle Entrance (Crossflow tube gap area opposite wrapper opening)		AFBE	
7	Tube Bundle (Axial, straight section)		AFB	

Table 4

a,c

8	Tube Support Plates (axial)	Tube support 9	AFTS(9)	
		Tube support 8	AFTS(8)	
		Tube support 7	AFTS(7)	
		Tube support 6	AFTS(6)	
		Tube support 5	AFTS(5)	
		Tube support 4	AFTS(4)	
		Tube support 3	AFTS(3)	
		Tube support 2	AFTS(2)	
		Tube support 1 (flow distribution baffle)	AFTS(1)	
9	U-bend (average for crossflow)		AFU	
10	Lower Wrapper (straight section)		ADIW	
11	Within Risers		AFR	
12	Upper Wrapper		ADIWU	
13	Swirl Vane Riser (Between hub & riser)		ASEP1	
14	Primary Separator Orifice (total)		ADPO	
15	Upper shell		ADIUS	
16	Inlet to secondary Separator Assembly		AUP	
17	Secondary Separator (Effective vane opening)		ASEP2	
18	Steam Nozzle (with venturis present)		ASNV	
19	Steam Pipe		ASN	
20	Feedwater Nozzle		AFWR	

Table 5
AP1000 Δ125 Secondary Side Flow Loss Coefficients from GENF Calculations

	Component		GENF Name	Kloss	Reference Flow Area	DeltaP (psi)
1	Downcomer Entrance (at upper pool)		CKSP1		ADLS	
2	Downcomer Area Transition (into lower annulus)		CKDCT		ADLS	
3	Additional Downcomer Flow Restrictions		CKDC		ADLS	
4	Downcomer Obstruction (total for all locations)		CKOBT		ADLS	
5	Downcomer Friction		CKFD		ADLS	
6	Area Change from Lower Downcomer to Wrapper Opening		CKC		ADLS	
7	Area Change from Wrapper Opening to bundle		CKC2		ADLS	
8	Turn from Lower Downcomer to Tube Bundle		CKT		ADLS	
	Downcomer Total		CKDTOT		ADLS	
9	Tube Bundle Friction (Axial)		(F)		AFB	
			4*F*(L/Dh)			
10	Tube Support Plates	Tube support 9	CK(9)		AFB	
		Tube support 8	CK(8)		AFB	
		Tube support 7	CK(7)		AFB	
		Tube support 6	CK(6)		AFB	

a,c

Table 5

a,c

		Tube support 5	CK(5)		AFB	
		Tube support 4	CK(4)		AFB	
		Tube support 3	CK(3)		AFB	
		Tube support 2	CK(2)		AFB	
		Tube support 1 (flow distribution baffle)	CK(1)		AFB	
11	U-bend Friction (Crossflow)		F		AFU	
			4*F*NCR			
12	Area change from U-bend to Wrapper Plenum		CKTR		AFU	
13	Area Change at Riser Entrance		CKRE		AFR	
14	Primary Separators		CKR		ASEP1	
15	Primary Separator Orifice		CKOR		ADPO	
16	Area Change from Primary to Secondary Separators		CKSEP		AUP	
17	Secondary Separator		CKSEP2		ASEP2	
18	Steam Nozzle (with integral venturi)		CKSN		ASNV	

Attachment 3

AP1000 Reactor Coolant Pump Design Data

Parameter	Value
Rated Velocity	
Rated Torque	
Rated Density	
Initial Pump Velocity (Cold Startup)	

a,c

The AP600 single phase homologous, two-phase multiplier table, and two-phase difference tables can be used for the AP1000.

Attachment 4
Summary of AP1000 Scaling Reference Values

This attachment contains tables of reference values used to calculate scaling ratios between AP600 and AP1000 plants and the OSU and SPES test facilities for SBLOCA transients. This information was requested at the meeting with the NRC staff The results are contained in WCAP-15613, AP1000 PIRT and Scaling Assessment. The worksheets are arranged according to the following phases of a SBLOCA transient (note that the Blowdown phase is not included as it is similar to conventional plants and was not scaled for AP1000):

- Natural Circulation Phase
- ADS Phase
- ADS-IRWST Transition Phase
- IRWST Injection Phase
- Sump Injection Phase

As it is often difficult to provide a best estimate value of some parameter of a scaling ratio, it is accepted practice to provide simple estimates or range the expected values. Consequently, the reference values contained in the following tables typically are boundary, initial, or final conditions that represent the expected or possible range of reference values. This also avoids reliance upon a computer code to generate scaling ratios and all that is entailed. Note that some of the numerical scaling ratios contained herein appear slightly different than those shown in WCAP-15613. This is due in large part to typos in the report or differences in rounding, however, it does not effect the conclusions regarding the scaling of the test facilities to AP600 and AP1000.

Summary of AP1000 Scaling Reference Values

Natural Circulation Phase Scaling

Natural Circulation Core Exit Quality Scaling – Reference Values

a, c

Parameter		Units	AP600	AP1000	OSU	SPES	Remarks
RCS Pressure	p	psia					Secondary side pressure as reference
Density of liquid	ρ_f	lbm/ft^3					Thermodynamic property of saturated liquid
Density of gas	ρ_g	lbm/ft^3					Thermodynamic property of saturated vapor
Enthalpy difference	H_fg	BTU/lbm					Thermodynamic property at saturation
Elevation difference	z_prhr-z_c	ft					Elevation difference between midpoints of PRHR HX and reactor core[1]
Resistance of PRHR outlet/area squared	R_out	ft^-4					Resistance from hot leg to PRHR HX plus 1/2 PRHR HX resistance
Resistance of PRHR inlet/area squared	R_in	ft^-4					Resistance from PRHR HX outlet to SG plus 1/2 PRHR HX resistance
Core power ratio		N/A					Core power relative to AP600

Notes:

1. For scaling purposes, gas-liquid interfaces considered to be located at midpoints of PRHR HX and reactor core.

Test/Plant Scaling Ratio	**Core exit quality-density**
OSU/AP600	a,c
OSU/AP1000	
SPES/AP600	
SPES/AP1000	

Attachment 4
Summary of AP1000 Scaling Reference Values

Cold Leg Flow Pattern Scaling - Reference Values

a,c

Parameter		Units	AP600	AP1000	OSU	SPES	Remarks
RCS Pressure	p	psia					Secondary side pressure as reference
Density of liquid	ρ_f	lbm/ft^3					Thermodynamic property of saturated liquid
Density of gas	ρ_g	lbm/ft^3					Thermodynamic property of saturated vapor
Enthalpy	H_fg	BTU/lbm					Thermodynamic property at saturation
Core power ratio		N/A					Core power relative to AP600
Cold Leg diameter	d_cl	in					Inside diameter of cold leg

Test/Plant Scaling Ratio	Cold Leg Froude Number
OSU/AP600	
OSU/AP1000	
SPES/AP600	
SPES/AP1000	

a,c

Phase Separation at Cold Leg-CMT Balance Line Tee - Reference Values

a,c

Parameter		Units	AP600	AP1000	OSU	SPES	Remarks
Cold Leg diameter	d_cl	in					Inside diameter of cold leg
CMT BL diameter	d_cmt bl	in					Inside diameter of cold leg balance line

Test/Plant Scaling Ratio	Phase Separation
OSU/AP600	
OSU/AP1000	
SPES/AP600	
SPES/AP1000	

a,c

Attachment 4
Summary of AP1000 Scaling Reference Values

ADS Phase Scaling

Rate of Pressure Change Equation Scaling - Reference Values

a,c

Parameter		Units	AP600	AP1000	OSU	SPES	Remarks
Pressure @ ADS inlet, initial	p	Psia					RCS pressure at start of depressurization; use secondary side pressure as reference
Pressure @ end of ADS phase	p	Psia					RCS pressure at end of depressurization
Density of gas	ρ_g	lbm/ft^3					Thermodynamic property of saturated vapor
Enthalpy of gas	H_g	BTU/lbm					Thermodynamic property of saturated vapor
Enthalpy difference	H_fg	BTU/lbm					Thermodynamic property at saturation
Core power ratio		N/A					Core power ratio relative to AP600
Area of ADS-1/2/3	A_ads123	in^2					Total ADS-1/2/3 critical flow area
Volume of RCS steam ratio		N/A					Ratio of total RCS volume ratio relative to AP600[1,2] used as boundary value
Ratio of specific heat	γ_stm	N/A					Ratio of specific heats of steam vapor

Notes:

1. Actual volume ratio for SPES ~ 1/402. However 1/395 value for ideal scaling used as within few percent of actual.
2. Ideal volume ratio for OSU is 1/192. Actual is ~1/183.

Test/Plant Scaling Ratio	Fractional rate of change of RCS pressure due to steam Addition via core decay heat	Fractional rate of change of RCS pressure due to steam removal via ADS vent
OSU/AP600		
OSU/AP1000		
SPES/AP600		
SPES/AP1000		

a,c

Attachment 4
Summary of AP1000 Scaling Reference Values

ADS-IRWST Transition Phase Scaling

Vessel inventory scaling - CMT injection dominant - Reference Values

a,c

Parameter		Units	AP600	AP1000	OSU	SPES	Remarks
Pressure ratio		N/A					Pressure similitude approx. exists
Density ratio		N/A					Property similitude approx. exists
Enthalpy ratio		N/A					Property similitude approx. exists
Elevation difference	zcmt-zdvi	ft					Elevation difference between top of CMT and DVI elevation (downcomer liquid level at or below DVI elev.during transition phase)
Resistance of CMT-DVI path/area squared	R_cmt-dvi	ft^-4					Resistance associated with double ended DVI break (one injection path only)
Volume of vessel liquid	V_ves liq	ft^3					Total vessel volume represents boundary value
Core Power ratio		N/A					Core power relative to AP600

Test/Plant Scaling Ratio	Fractional rate of change of vessel inventory due to CMT injection	Fractional rate of change of vessel inventory due to core decay heat
OSU/AP600		
OSU/AP1000		
SPES/AP600		
SPES/AP1000		

a,c

Attachment 4
Summary of AP1000 Scaling Reference Values

Vessel inventory scaling - IRWST injection dominant - Reference Values

a,c

Parameter		Units	AP600	AP1000	OSU	SPES	Remarks
Pressure ratio		N/A					Pressure similitude approx. exists
Density ratio		N/A					Property similitude approx. exists
Enthalpy ratio		N/A					Property similitude approx. exists
Elevation difference	zirwst-zdvi	ft					Elevation diff. between IRWST intial liquid level and DVI elev. (downcomer liquid level at or below DVI elev.during transition phase)
Elevation difference	zpzr-zhl	ft					Elevation difference between top pressurizer and hot leg with void fraction of ~0.5[1]
Resistance of IRWST DVIpath/area squared	R_dvi	ft^-4					Resistance associated with double ended DVI break (one injection path only)
Volume of vessel liquid	V_ves liq	ft^3					Total vessel volume represents boundary value
Core Power ratio		N/A					Core power relative to AP600

Notes:

1. Simple estimate of collapsed liquid level held up above core when IRWST injection initiates.

Test/Plant Scaling Ratio	Fractional rate of change of vessel inventory due to IRWST injection	Fractional rate of change of vessel inventory due to core decay heat
OSU/AP600		
OSU/AP1000		
SPES/AP600		
SPES/AP1000		

a,c