



Westinghouse
Electric Corporation

Energy Systems

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Docket No.: STN-52-003

March 23, 1993

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

ATTENTION: MR. R. W. BORCHARDT

SUBJECT: DRAFT AP600 TEST/WITNESS MATRIX

Dear Mr. Borchardt:

In response to our commitment at the March 9-10, 1993 meeting on AP600 testing, attached is our draft of the test/witness matrix. In addition to the dates of the tests and suggested witness points, the table includes a summary of the test. We believe that you will find this summary useful in planning the NRC activities related to the AP600 testing program. We look forward to your comments on the matrix by April 1, 1993 and remain committed to finalizing the matrix by April 15, 1993.

Please contact Brian A. McIntyre on (412) 374-4334 if you have any questions concerning this transmittal.

N. J. Liparulo, Manager
Nuclear Safety & Regulatory Activities

/nja

Attachment

cc:	T. Kenyon	NRC
	R. Hasselberg	NRC
	B. A. McIntyre	Westinghouse

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AP600 TEST PROGRAM (1993-1994)												
Item No.	TEST DESCRIPTION	LOCATION	SCALE	CATEGORY	TEST PURPOSE	ADDITIONAL INFORMATION OBTAINED		TEST SCHEDULE		KEY TESTS	WITNESS (week of)	
								Start	End			
Passive Component Cooling System Tests												
Condensation Tests												
	1-Min. Scale Heat Transfer Test - Phase 2	W. Schrock & Technology Center - Chubbuck, PA	1:8 Scale	Safety Related	Obtain heat transfer data for RELAP5/SCD computer code validation	Investigate effect of non-condensables on heat transfer coefficient and visualize flow field		May 1993	July 1993	Transient Blanket with non-condensables	1-19-93	
	Water Distribution System Test - Phase 3	W. Schrock & Technology Center - Chubbuck, PA	1:1	Safety Related	Measure condensation water coverage using design distribution system	Obtain flow distribution measurements		May 1993	June 1993	High water flow rate	8-19-93	
	Wind Tunnel Test - Phase 4A	ONR Wind Tunnel - Chubbuck, PA	1:30 Scale	Safety Related	Verify Phase 1 & 2 test results at higher Reynolds numbers	Confirm flow distribution results		May 1993	June 1993	High water flow rate with solid reflecting only	8-19-93	
	Wind Tunnel Test Phase 4B	University of Windsor - Windsor, Ontario	1:100 Scale	Safety Related	Investigate air flow effects on air flow through PCCS	Investigate effects of large structures on air flow through PCCS		July 1993	August 1993	Simulation of test above air	8-19-93	
Passive Safety System Tests												
	Automatic Depressurization System Test - Phase B	ENRCA (FAPS) Facility - Canastota, NY	1:1	Safety Related	Obtain thermal hydraulic data for computer code validation	Obtain valve performance data, piping, structure leak frequencies		January 1994	March 1994	2nd stage ADS blowdown at full pressure	2-25-94	
	Cross Makeup Tank Test	W. Schrock & Technology Center - Chubbuck, PA	1:8 Scale	Safety Related	Obtain thermal hydraulic data for computer code validation	Confirm adequacy of CMT level instrumentation		April 1993	July 1993	Hot CMT blowdown during depressurization	1-19-93	
	DBSD Tests	Columbia University - New York, NY	1:1	Safety Related	Obtain DBSD data at low flow conditions	Obtain data on test assembly flow exiting grids at design flow conditions		May 1993	June 1993	Lowest flow DBSD test	8-19-93	
	Low Pressure 1/8 Height Integral System Tests	Oregon State University - Corvallis, OR	1:8 height 1:322 volume	Safety Related	Obtain thermal hydraulic data for computer code validation	Investigate long term cooling behavior		July 1993	December 1993	DBSD/CA - DBSD DVI flow break	10-19-93	
	Full Pressure Full Height Integral System Tests	OREY (RPS-2 Facility) - Phoenix, AZ	1:1 height 1:322 volume	Safety Related	Obtain thermal hydraulic data for computer code validation	Investigate system interactions during high pressure transients		May 1993	December 1993	DBSD/CA - DBSD DVI flow break Steam Generator Tube Rupture	7-19-93 1-19-93	
Component Design Verification Tests												
	RCP Water Hydraulic Pump Test	W. Schrock & Technology Center - Chubbuck, PA	1:2 Scale	Non-safety Related	Provide design data for Reactor Coolant Pump hydraulic performance	Obtain pump induced vibration loads, pump bearing loads		June 1994	August 1994	MITR hydraulic performance test	10-17-94	
	Nuclear Instrumentation System Phase Natural Oscillation Test	W. Schrock & Technology Center - Chubbuck, PA	1:1	Non-safety Related	Provide design data to provide vibration input due to PWR	Obtain vibration and manufacturing information for vibration design		February 1994	May 1994	High flow test	3-25-94	
	Check Valve Test In Situ	Energy Nuclear Plant - Dothan, AL	1:1	Non-safety Related	Measure opening pressure of check valve following exposure at operating conditions	TBD		September 1993	December 1993	Cartridge on safety schedule	TBD	
	Check Valve Test Qualification	[To Be Determined]	1:1	Non-safety Related	Provide verification information that check valve meets design specification	TBD		TBD	TBD	TBD	TBD	
	ADS Stage 4 Valve Test	[To Be Determined]	1:1	Safety Related	Provide verification information that ADS valve meets design specification	Valve performance data (e.g., flow, motor operator performance data)		September 1993	December 1993	TBD	TBD	

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TEST DOCUMENT									
Item No.	TEST DESCRIPTION	DETAILED REVIEW	Testing Report	Test Specification	Operating Procedures	Facility Description Data, A	Minimum Data Required	Test Test Report	Test Analysis Report
Passive - Continuous Cooling System Tests									
	Condensation Tests		N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ASH Basin Heat Transfer Test - Phase II	March 25, 26, 1953	90-237-13240	90-237-13242	90-237-13240	90-237-13240	90-237-13240	90-237-13240	90-237-13240
	Water Distribution System Test - Phase I		N/A	90-237-13240	90-237-13240	90-237-13240	90-237-13240	90-237-13240	90-237-13240
	Water Transfer Test - Phase II		N/A	90-237-13240	90-237-13240	90-237-13240	90-237-13240	90-237-13240	90-237-13240
	Water Transfer Test - Phase III		N/A	90-237-13240	90-237-13240	90-237-13240	90-237-13240	90-237-13240	90-237-13240
Passive Safety System Tests									
	Automatic Depressurization System Test - Phase I	May 1953		90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242
	Automatic Depressurization System Test - Phase II	February 26, 1953		90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242
	Core Meltdown Test Test		N/A	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242
	EBR Test		N/A	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242
	Low Pressure Full Height Integral Systems Tests	December 18, 1952		90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242
	Full Pressure Full Height Integral Systems Tests	December 18, 1952		90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242
Compressed Design Verification Tests									
	High Water Hydraulic Flow Test		N/A	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242
	Steam Temperature System Flow Induced Vibration Test		N/A	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242
	Check Valve Test Isolation		N/A	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242
	Check Valve Test Qualification		N/A	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242
	ADS Ring & Valve Test		N/A	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242	90-237-13242

Operating Procedures 1-1-1953-1

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AP600 TEST PROGRAMS (1993-1994)					
Item No.	TEST DESCRIPTION	LOCATION	SCALE	CATEGORY	TEST PURPOSE
Passive Containment Cooling System Tests					
	Condensation Tests	University of Wisconsin - Madison, WI	~1:16 height	Basic Research	Measure condensation heat transfer coefficient using 2D test model
	1/8th Scale Heat Transfer Test - Phase 2	W Science & Technology Center - Churchill, PA	~1:8 linear	Safety Related	Obtain heat transfer data for WGOthic computer code validation
	Water Distribution System Test - Phase 3	W Waltz Mill Site - Madison, PA	1:1	Safety Related	Measure containment water coverage using design distribution system
	Wind Tunnel Test - Phase 4A	CNRC Wind Tunnel - Ottawa, Canada	1:30 linear	Safety Related	Verify Phase 1 & 2 test results at higher Reynolds numbers
	Wind Tunnel Test Phase 4B	University of Western Ontario - London, Ontario	1:100 linear	Safety Related	Investigate site topography effects on air flow through PCS annulus
Passive Safety Systems Tests					
	Automatic Depressurization Systems Test - Phase B	ENEA (VAPORE facility) - Casaccia, Italy	1:1	Safety Related	Obtain thermal-hydraulic data for computer code validation
	Core Makeup Tank Test	W Waltz Mill Site - Madison, PA	~1:8 diameter ~1:2 height	Safety Related	Obtain thermal-hydraulic data for computer code validation
	DNBR Tests	Columbia University - New York, NY	1:1	Safety Related	Obtain DNB data at low flow conditions
	Low Pressure 1/4 Height Integral Systems Tests	Oregon State University - Corvallis, OR	1:4 height 1:292 volume	Safety Related	Obtain thermal-hydraulic data for computer code validation
	Full Pressure Full Height Integral Systems Tests	SIET (SPES-2 Facility) - Piacenza, Italy	1:1 height 1:395 volume	Safety Related	Obtain thermal-hydraulic data for computer code validation
Component Design: Verification Tests					
	RCP Water Hydraulic Flow Test	W Electro-Mechanical Division - Chewick, PA	~1:2 linear	Non-safety Related	Provide design data for Reactor Coolant Pump hydraulic performance
	Incore Instrumentation System Flow Induced Vibration Test	W Science & Technology Center - Churchill, PA	1:1	Non-safety Related	Provide design data to preclude thimble wear due to FIV
	Check Valve Test In-Situ	Farley Nuclear Plant - Dothan, AL	1:1	Non-safety Related	Measure opening pressure of check valve following exposure at operating conditions
	Check Valve Test Qualification	[To Be Determined]	1:1	Non-safety Related	Provide verification information that check valve meets design specification
	ADS Stage 4 Valve Test	[To Be Determined]	1:1	Safety Related	Provide verification information that ADS valve meets design specification

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ADDITIONAL INFORMATION OBTAINED		TEST SCHEDULE		KEY TESTS		WITNESS (week of)
Start	End	Start	End	Start	End	Start
Investigate effect of non-condensibles on heat transfer coefficient and visualize flow field	August 1993	May 1993	December 1993	Transient Blowdown with non-condensibles	TBD	7/19/93
Investigate effect of non-condensibles on PCS heat removal	May 1993	May 1993	June 1993	High water flow rate	5/24/93	5/10/93
Obtain film thickness measurements	May 1993	May 1993	June 1993	High wind speed with shield building only	6/21/93	2/28/94
Confirm baffle tornado loads	July 1993	August 1993	August 1993	Simulation of sea shore site	7/12/93	6/14/93
Investigate effects of large structures on air flow through PCS	January 1994	July 1993	March 1994	2nd stage ADS blowdown at full pressure	10/4/93	7/19/93
Obtain valve performance data; Piping, structure loads/responses	April 1993	June 1993	July 1993	Hot CMT draindown during depressurization	11/15/93	10/17/94
Confirm adequacy of CMT level instrumentation	May 1993	December 1993	December 1993	Lowest flow DNB test	3/28/94	TBD
Obtain data on fuel assembly flow mixing grids at design flow	July 1993	December 1993	December 1993	SBLOCA - DEG DVI line break	TBD	TBD
Investigate long term cooling behavior	May 1993	December 1993	December 1993	SBLOCA - 11in. Cold Leg Break Steam Generator Tube Rupture	TBD	TBD
Investigate systems interactions during high pressure transients	June 1994	August 1994	August 1994	M100H hydraulic performance test	TBD	TBD
Obtain pump induced vibration loads; pump bearing loads	February 1994	May 1994	May 1994	High flow test	TBD	TBD
Obtain maintenance and manufacturing information for thimble	September 1993	December 1993	December 1993	(Contingent on outage schedule)	TBD	TBD
Valve performance data (e.g., flows); Motor operator performance	TBD	TBD	TBD		TBD	TBD
	September 1994	December 1994	December 1994			

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AP600 TEST PROGRAMS (1993-1994)						
Item No.	TEST DESCRIPTION	DETAILED REVIEW MEETINGS	Scaling Report	Test Specification	Operating Procedures	Facility Description
Passive Containment Cooling System Tests						
	Condensation Tests		N/A	N/A	N/A	N/A
	1/8th Scale Heat Transfer Test - Phase 2	March 23-24, 1993	WCAP-13246	WCAP-13267	5/93	10/93
	Water Distribution System Test - Phase 3		N/A	WCAP-13290	5/93	WCAP-13292
	Wind Tunnel Test - Phase 4A		N/A	WCAP-13318	5/93	N/A
	Wind Tunnel Test Phase 4B		N/A	WCAP-13318	6/93	N/A
Passive Safety Systems Tests						
	Automatic Depressurization Systems Test - Phase B	May 1993	N/A	WCAP-13342	11/93	6/94
	Core Makeup Tank Test	February 25, 1993	5/93	WCAP-13345	(4/93)	10/93
	DNBR Tests		N/A	WCAP-12488	5/93	11/93
	Low Pressure 1/4 Height Integral Systems Tests	December 9, 1992	(4/93)	WCAP-13234	5/93	6/93
	Full Pressure Full Height Integral Systems Tests	December 10, 1992	Revised, 4/93	WCAP-13277	6/93	4/93
Component Design Verification Tests						
	RCP Water Hydraulic Flow Test		N/A	WCAP-13305	11/93	12/94
	Incore Instrumentation System Flow Induced Vibration Test		N/A	11/93	2/94	7/94
	Check Valve Test In-Situ		N/A	TBD	TBD	TBD
	Check Valve Test Qualification		N/A	TBD	TBD	TBD
	ADS Stage 4 Valve Test		N/A	TBD	TBD	TBD

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AP600 TEST PROGRAMS (1993-1994)					
Item No.	TEST DESCRIPTION	LOCATION	SCALE	CATEGORY	TEST PURPOSE
Passive Containment Cooling System Tests					
	Condensation Tests	University of Wisconsin - Madison, WI	~1:16 height	Basic Research	Measure condensation heat transfer coefficient using 2D test model
	1/8th Scale Heat Transfer Test - Phase 2	W Science & Technology Center - Churchill, PA	~1:8 linear	Safety Related	Obtain heat transfer data for WGOTHIC computer code validation
	Water Distribution System Test - Phase 3	W Waltz Mill Site - Madison, PA	1:1	Safety Related	Measure containment water coverage using design distribution system
	Wind Tunnel Test - Phase 4A	CNRC Wind Tunnel - Ottawa, Canada	1:30 linear	Safety Related	Verify Phase 1 & 2 test results at higher Reynolds numbers
	Wind Tunnel Test Phase 4B	University of Western Ontario - London, Ontario	1:100 linear	Safety Related	Investigate site topography effects on air flow through PCS annulus
Passive Safety Systems Tests					
	Automatic Depressurization Systems Test - Phase B	ENEA (VAPORE facility) - Casaccia, Italy	1:1	Safety Related	Obtain thermal-hydraulic data for computer code validation
	Core Makeup Tank Test	W Waltz Mill Site - Madison, PA	~1:8 diameter ~1:2 height	Safety Related	Obtain thermal-hydraulic data for computer code validation
	DNBR Tests	Columbia University - New York, NY	1:1	Safety Related	Obtain DNB data at low flow conditions
	Low Pressure 1/4 Height Integral Systems Tests	Oregon State University - Corvallis, OR	1:4 height 1:292 volume	Safety Related	Obtain thermal-hydraulic data for computer code validation
	Full Pressure Full Height Integral Systems Tests	SIET (SPFS-2 Facility) - Piacenza, Italy	1:1 height 1:395 volume	Safety Related	Obtain thermal-hydraulic data for computer code validation
Component Design Verification Tests					
	RCP Water Hydraulic Flow Test	W Electro-Mechanical Division - Cheswick, PA	~1:2 linear	Non-safety Related	Provide design data for Reactor Coolant Pump hydraulic performance
	Incore Instrumentation System Flow Induced Vibration Test	W Science & Technology Center - Churchill, PA	1:1	Non-safety Related	Provide design data to preclude thimble wear due to FIV
	Check Valve Test In-Situ	Varley Nuclear Plant - Dothan, AL	1:1	Non-safety Related	Measure opening pressure of check valve following exposure at operating conditions
	Check Valve Test Qualification	[To Be Determined]	1:1	Non-safety Related	Provide verification information that check valve meets design specification
	ADS Stage 4 Valve Test	[To Be Determined]	1:1	Safety Related	Provide verification information that ADS valve meets design specification

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	ADDITIONAL INFORMATION OBTAINED	TEST SCHEDULE		KEY TESTS	WITNESS (week of)
		Start	End		
ing	Investigate effect of non-condensibles on heat transfer coefficient and visualize flow field	August 1993	December 1993	TBD	TBD
de	Investigate effect of non-condensibles on PCS heat removal capability	May 1993	July 1993	Transient Blowdown with non-condensibles	7/19/93
	Obtain film thickness measurements	May 1993	June 1993	High water flow rate	5/24/93
	Confirm baffle tornado loads	May 1993	June 1993	High wind speed with shield building only	5/10/93
	Investigate effects of large structures on air flow through PCS annulus	July 1993	August 1993	Simulation of sea shore site	6/21/93
	Obtain valve performance data; Piping, structure loads/responses	January 1994	March 1994	2nd stage ADS blowdown at full pressure	2/28/94
	Confirm adequacy of CMT level instrumentation	April 1993	July 1993	Hot CMT draindown during depressurization	7/12/93
	Obtain data on fuel assembly flow mixing grids at design flow conditions	May 1993	June 1993	Lowest flow DNB test	6/14/93
	Investigate long term cooling behavior	July 1993	December 1993	SBLOCA - DEG DVI line break	10/4/93
	Investigate systems interactions during high pressure transients	May 1993	December 1993	SBLOCA - 11in. Cold Leg Break Steam Generator Tube Rupture	7/19/93 11/15/93
	Obtain pump induced vibration loads; pump bearing loads	June 1994	August 1994	M100H hydraulic performance test	10/17/94
o	Obtain maintenance and manufacturing information for thimble design	February 1994	May 1994	High flow test	3/28/94
	TBD	September 1993	December 1993	(Contingent on outage schedule)	TBD
	TBD	TBD	TBD	TBD	TBD
ys	Valve performance data (e.g., flows); Motor operator performance data	September 1994	December 1994	TBD	TBD

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AP600 TEST PROGRAMS (1993-1994)

Item No.	TEST DESCRIPTION	DETAILED REVIEW MEETINGS	Scaling Report	Test Specification	Operating Procedures	Facility Description
Passive Containment Cooling System Tests						
	Condensation Tests		N/A	N/A	N/A	N/A
	1/8th Scale Heat Transfer Test - Phase 2	March 23-24, 1993	WCAP-13246	WCAP-13267	5/93	10/93
	Water Distribution System Test - Phase 3		N/A	WCAP-13290	5/93	WCAP-13292
	Wind Tunnel Test - Phase 4A		N/A	WCAP-13318	5/93	N/A
	Wind Tunnel Test Phase 4B		N/A	WCAP-13318	6/93	N/A
Passive Safety Systems Tests						
	Automatic Depressurization Systems Test - Phase B	May 1993	N/A	WCAP-13342	11/93	6/94
	Core Makeup Tank Test	February 25, 1993	5/93	WCAP-13345	(4/93)	10/93
	DNBR Tests		N/A	WCAP-12488	5/93	11/93
	Low Pressure 1/4 Height Integral Systems Tests	December 9, 1992	(4/93)	WCAP-13234	5/93	6/93
	Full Pressure Full Height Integral Systems Tests	December 10, 1992	Revised, 4/93	WCAP-13277	6/93	4/93
Component Design Verification Tests						
	RCP Water Hydraulic Flow Test		N/A	WCAP-13305	11/93	12/94
	Incore Instrumentation System Flow Induced Vibration Test		N/A	11/93	2/94	7/94
	Check Valve Test In-Situ		N/A	TBD	TBD	TBD
	Check Valve Test Qualification		N/A	TBD	TBD	TBD
	ADS Stage 4 Valve Test		N/A	TBD	TBD	TBD

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TEST DOCUMENT

Report	Interim Data Report	Final Test Report	Test Analysis Report	Other Relevant Information
	NO	3/94	6/94	WCAP-13307
	NO	10/93	6/94	WCAP-13566
	NO	9/93	6/94	WCAP-13353, WCAP-13296
	NO	9/93	6/94	WCAP-13294, WCAP-13323
	NO	10/93	6/94	WCAP-13294, WCAP-13323
	NO	6/94	8/94	
	YES	10/93	1/04	
	NO	11/93	11/93	
	YES	3/94	6/94	
	YES	3/94	6/94	
	NO	12/94	12/94	
	NO	7/94	7/94	
	TBD	TBD	TPD	WCAP-13268, WCAP-13560
	TBD	TBD	TBD	WCAP-13288, WCAP-13560
	TBD	TBD	TBD	

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