

June 1, 1994

Docket No. 52-003

APPLICANT: Westinghouse Electric Corporation

FACILITY: AP600

SUBJECT: SUMMARY OF SENIOR MANAGEMENT MEETING WITH WESTINGHOUSE

On May 10, 1994, members of the Office of Nuclear Reactor Regulation staff met with representatives of Westinghouse Electric Corporation in Corvallis, Oregon, to discuss the status of design certification review activities of the Westinghouse AP600 design and to tour the Oregon State University (OSU) Advanced Passive Experimental (APEX) test facility. Enclosure 1 is a list of meeting attendees. Enclosure 2 is a copy of the meeting notice and agenda. Enclosure 3 is a copy of non-proprietary handout materials presented by Westinghouse at the meeting. Enclosure 4 is a copy of materials presented by the staff at the meeting. Enclosure 5 is a set of staff/Westinghouse action items resulting from the meeting. In addition to the agenda items listed in Enclosure 1, discussions at the meeting focused heavily on the recently revised staff review schedule for AP600 design certification activities described in SECY-94-117. Westinghouse stated that the development of a coordinated plan to recover slippage identified in the staff's review schedule was essential. The staff stated that it would meet with Westinghouse in the near future to review the assumptions reached in the development of the review schedule.

(Original signed by Ralph Architzel for)  
Frederick W. Hasselberg, Project Manager  
Standardization Project Directorate  
Associate Directorate for Advanced Reactors  
and License Renewal, NRR

Enclosures:  
As stated

cc w/enclosure:  
See next page

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Docket File	PDST R/F	DCrutchfield	RBorchardt
PDR	RArchitzel	KShembarger	PShea
FHasselberg	TKenyon	EJordan, 3701	JMoore, 15B18
WDean, EDO	WTravers	ALevin, 8E23	ATHadani, 12G18
ACRS (11) (w/o encl)		DMcPherson, 8E2	WRussell, 12G18

OFC	LA:PDST:ADAR	PM:PDST:ADAR	SC:PDST:ADAR	D:PDST:ADAR
NAME	PShea <i>ps</i>	FHasselberg:th	RArchitzel	RBorchardt
DATE	05/19/94	05/19/94	05/19/94	05/19/94

OFC	SRXB	DSSA	ADT	ADAR:NRR <i>05</i>
NAME	ALevin	DMcPherson	ATHadani	DCrutchfield
DATE	05/18/94	05/24/94	05/27/94	05/11/94

OFFICIAL RECORD COPY: OSUSMM.SUM

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*11*

Westinghouse Electric Corporation

Docket No. 52-003

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WESTINGHOUSE AP600  
SENIOR MANAGEMENT MEETING  
MAY 10, 1994

<u>Name</u>	<u>Organization</u>
F. Hasselberg	NRC/NRR
D. Crutchfield	NRC/NRR
A. Levin	NRC/NRR/SRXB
A. Thadani	NRC/NRR
D. McPherson	NRC/NRR
W. Russell	NRC/NRR
J. Wheeler	DOE
K. Vijaiyan	DOE
S. Franks	DOE
B. Tupper	Westinghouse
B. McIntyre	Westinghouse
B. Vijuk	Westinghouse
L. Hochreiter	Westinghouse
E. Piplica	Westinghouse
M. Mahlab	Westinghouse
A. Robinson	OSU Nuclear Engr.
J. Reyes	OSU Nuclear Engr.
D. Bland	Southern Nuclear Operating Comp.
J. Yedidia	EPRI

NRC/WESTINGHOUSE SENIOR MANAGEMENT MEETING  
OREGON STATE UNIVERSITY  
CORVALLIS, OREGON  
MAY 10, 1994

DRAFT AGENDA

8:30	Doors Open	
9:00	Introduction	R. M. Vijuk/OSU
9:10	Design Certification Project Overview	R. M. Vijuk
9:30	AP600 Test & Analysis Program Status	L. Hochreiter
11:00	Design Certification Discussion Items	B. McIntyre
12:00	Lunch	
1:00	SPES-2 Integral Systems Test Status	E. Piplica
1:30	OSU APEX Integral System Test Status	J. Reyes/M. Mahlab
2:30	General Discussion/Wrapup	All
3:00	Break (Walk to APEX test facility at the OSU Radiation Center)	
3:30	Tour of OSU APEX Facility	J. Reyes

Enclosure



Enclosure 3



## Westinghouse/NRC Senior Management Meeting

AP600 Design Certification

May 10, 1994

Corvallis, Oregon



WESTINGHOUSE ELECTRIC CORPORATION



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*WESTINGHOUSE/NRC SENIOR MANAGEMENT MEETING*

## **AP600 Design Certification**

*May 10, 1994*

*Corvallis, OR*

# AGENDA

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9:00	Welcome and Introduction	<u>W/OSU</u>
9:10	Design Certification Project Overview	R. M. Vijuk
9:30	Design Certification Program Discussion Items	B. A. McIntyre
10:30	AP600 Test/Analysis Program Status	L. E. Hochreiter/E. J. Piplica
12:00	Lunch	
1:00	SPES-2 Integral System Test Status	E. J. Piplica
1:30	OSU Integral System Test Status	J. N. Reyes/M. Mahlab
2:30	Commitments/Actions	All
3:00	Break	
3:30	Tour of OSU Test Facility	



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# **Design Certification Project Overview**

***Bob Vijuk***  
***AP600 Design Certification Project Manager***

# ***DESIGN CERTIFICATION PROJECT OVERVIEW***

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- **Design Status**
- **Review Status**
- **Test Program Status**
- **Schedule**

# ***DESIGN CERTIFICATION PROJECT OVERVIEW***

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## **DESIGN STATUS**

- **The changes should have a positive impact on the NRC review and review schedule, as they:**
  - **Simplify design and operation**
  - **Increase safety margin**
  - **Reduce uncertainties**
  - **Eliminate or reduce impact of identified concerns**
  
- **Cumulative impact of design changes should simplify and accelerate the review**



# ***DESIGN CERTIFICATION PROJECT OVERVIEW***

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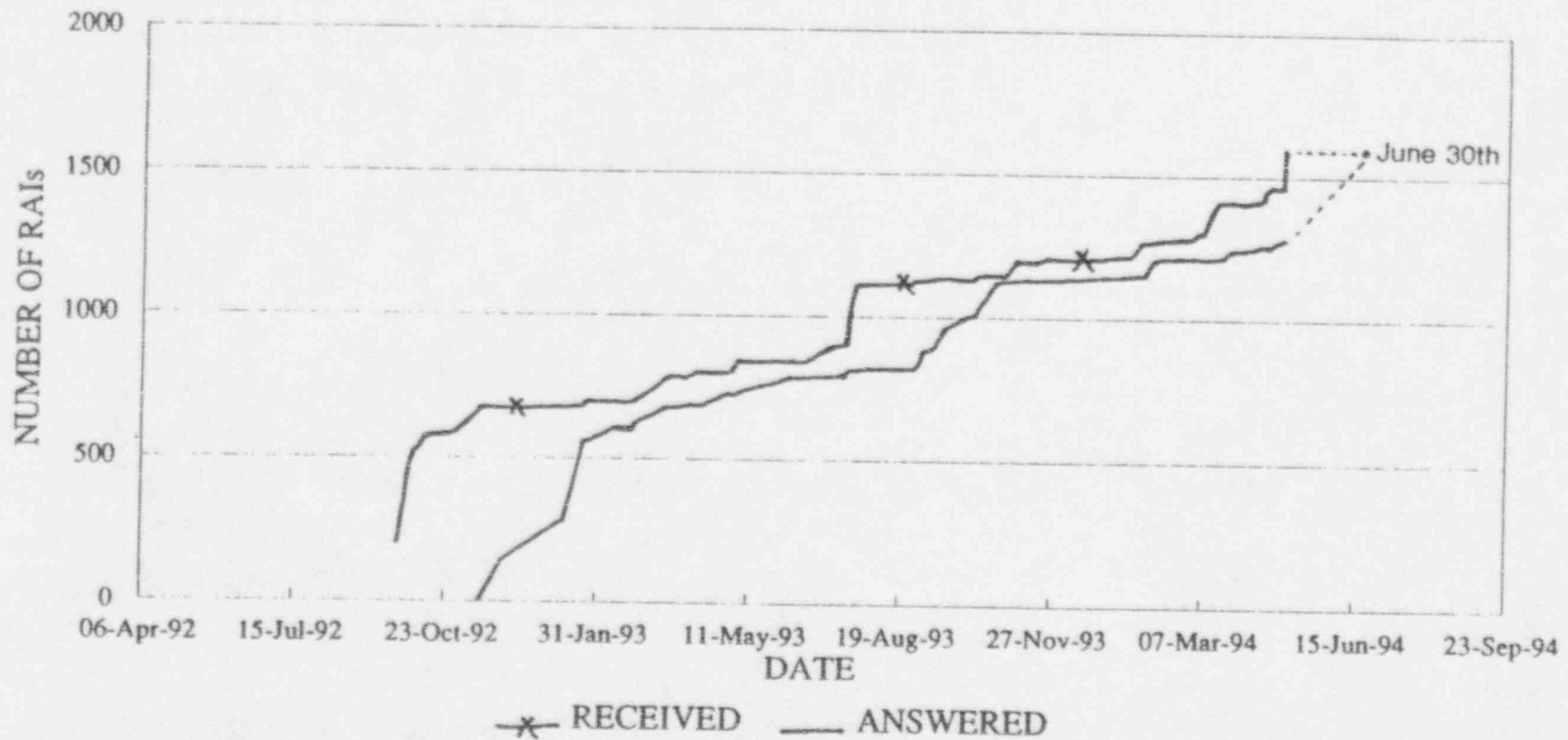


## **REVIEW STATUS**

### **Activities geared to support DSER**

- **Responses to RAIs**
  - **Approximately 200 RAIs received in April '94**
  - **Total of 1600 RAIs; approximately 1300 responses to date**
  
- **March 14th Agreement**
  - **Non-testing RAI responses by June 30, 1994**
  - **Testing RAI responses by July 31, 1994**
  
- **Focused meetings**

# REQUESTS FOR ADDITIONAL INFORMATION



# ***DESIGN CERTIFICATION PROJECT OVERVIEW***

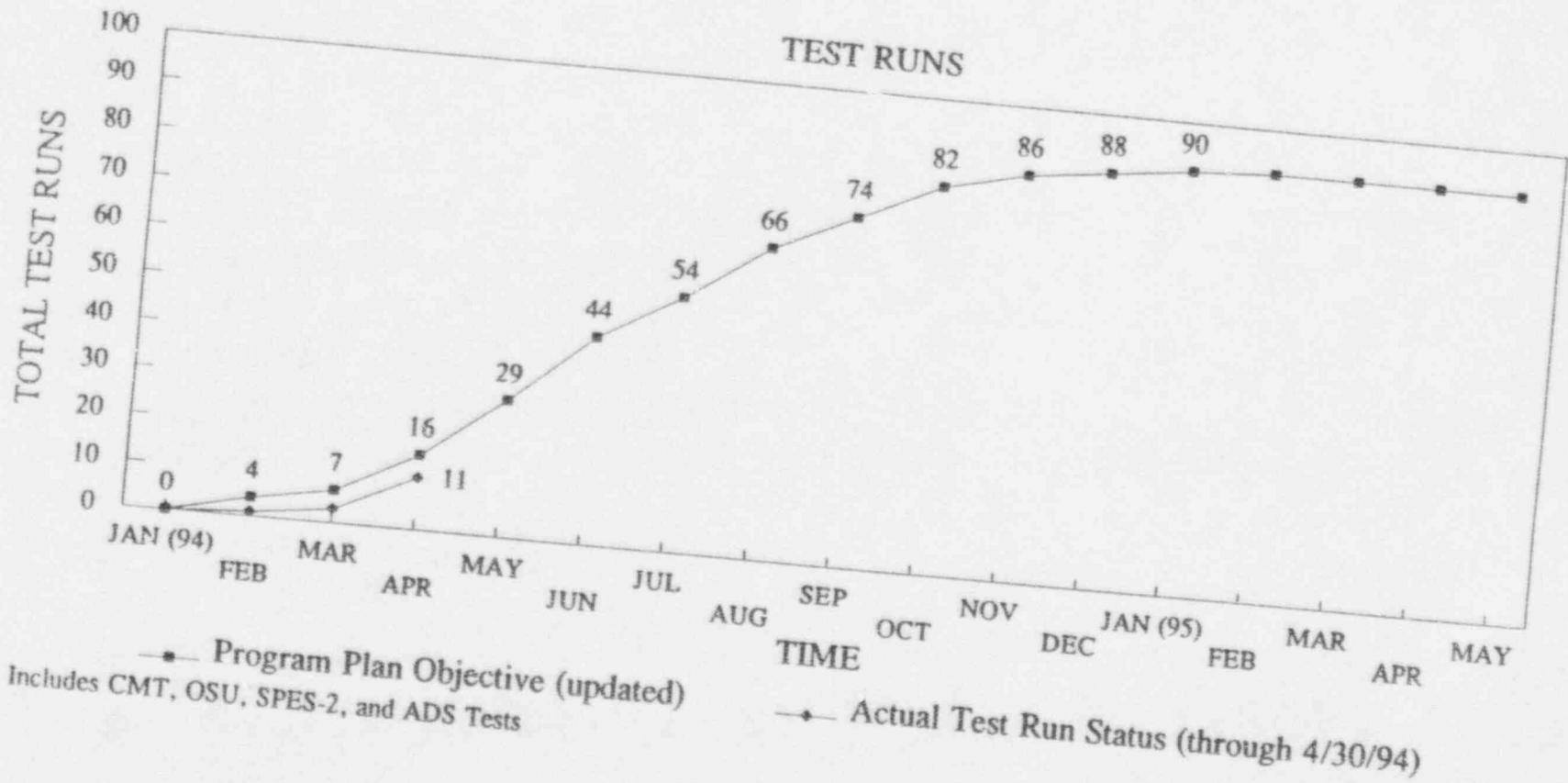
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## **TEST PROGRAM STATUS**

- Significant progress towards resolution of outstanding test issues
  - April 7, 1994 agreements
- Management attention required to close remaining issues
- Test program actively underway
  - CMT and SPES-2 matrix testing underway
  - OSU matrix testing to start ahead of schedule
  - ADS Phase B construction on-schedule
- Results to-date are as expected

# AP600 TESTING PROGRAM



# **DESIGN CERTIFICATION PROJECT OVERVIEW**

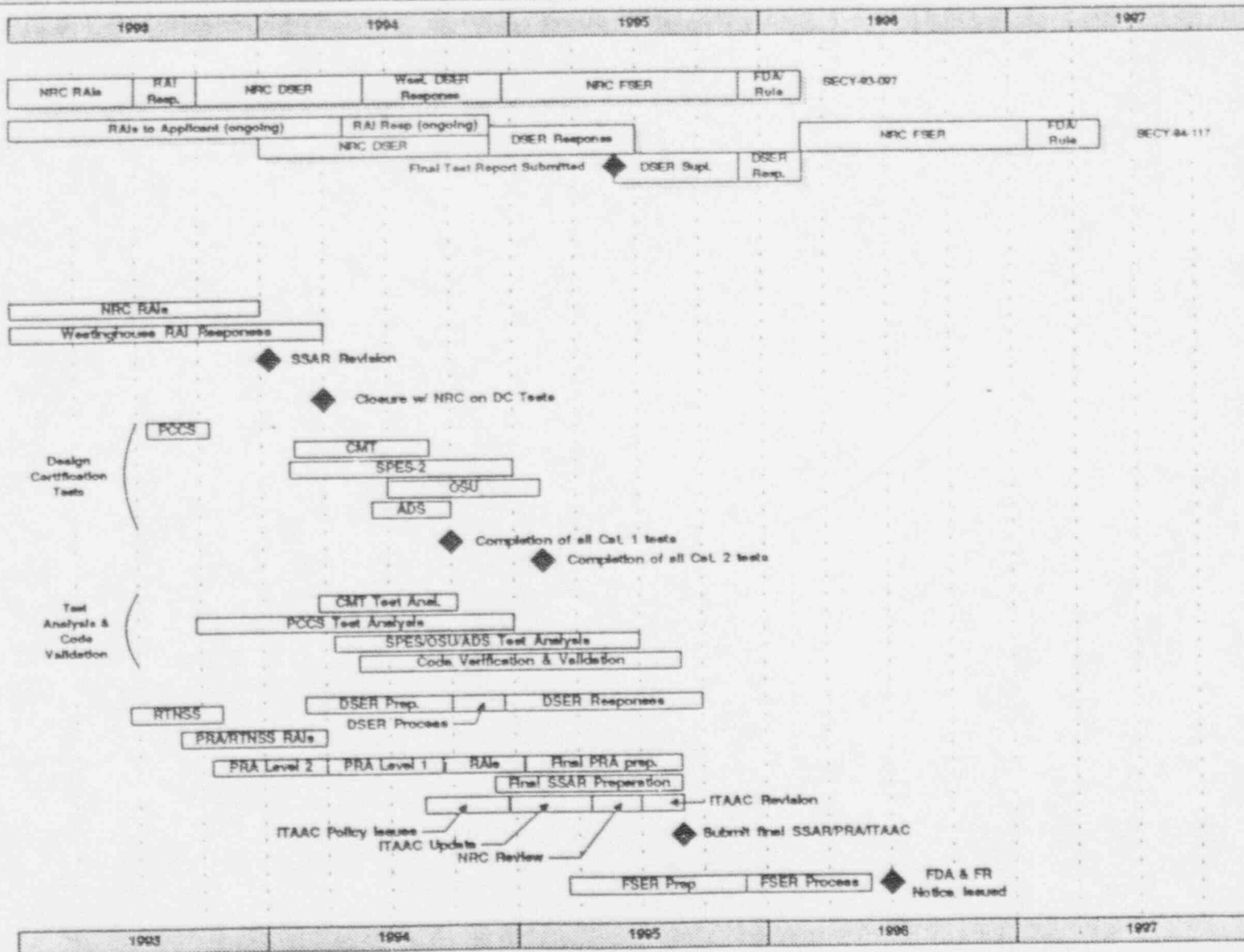
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## **SCHEDULE**

- Detailed schedules developed and submitted that include:
  - Discrete logic between related activities
  - Current testing status
  - Intermediate deliverables
  - Results optimized testing order
  - Single DSER ▶ December 1994
  - FDA ▶ June 1996
  
- SECY-94-117
  - Split DSER
  - Unexpected 11 month FDA delay
  - Serial process
  
- Recovery plan is essential
  - Communication must be improved

# AP600 DESIGN CERTIFICATION SCHEDULE









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# Design Certification Program Discussion Issues

*Brian McIntyre*  
*Manager, Advanced Plant Licensing and Safety*



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**AP600 SENIOR MANAGEMENT MEETING**

**MAY 10, 1994**

**BRIAN A. McINTYRE**

# AP600 DESIGN CERTIFICATION REVIEW STATUS

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## RAIS

- 1697 RECEIVED
- 187 IN APRIL
- 102 IN MAY
- 1286 RESPONSES

## PRA

- ISSUES MEETING 2/15/94
- INEL PRESENTED AREAS OF CONCERN
- RAIS IN FOUR TO SIX WEEKS
- WESTINGHOUSE HAS REQUESTED MEETING
- KEY TO RTNSS IMPLEMENTATION REVIEW

# AP600 SSAR/PRA NRC Requests for Additional Information

## *Source Summary of RAIs Received to Date From Review Areas Within the NRC*

Printed: 05/06/94

Review Areas	No. of RAIs	Percent of Total	No. of Responses	Percent of Group	Average Turnaround
100 - General	11	1	10	91	96
210 - Mechanical Engineering	110	7	28	25	92
220 - Structural Engineering	90	6	52	58	64
230 - Seismology	95	6	51	54	72
231 - Geology	32	2	14	44	83
240 - Hydrologic Engineering	0	0	0	---	---
241 - Geotechnical Engineering	0	0	0	---	---
250 - Inservice Inspection	29	2	29	100	66
251 - Component Integrity	32	2	32	100	89
252 - Materials Application	145	9	145	100	92
260 - Quality Assurance	22	1	19	86	77
270 - Environmental Qualification	3	0	3	100	66
271 - Seismic & Dynamic Load Qualification	0	0	0	---	---
280 - Fire Protection	0	0	0	---	---
281 - Chemical Technology	19	1	19	100	84
290 - Environmental Engineering	0	0	0	---	---
310 - Regional Impact Analysis	0	0	0	---	---
311 - Site Analysis	0	0	0	---	---
320 - Antitrust & Economic Analysis	0	0	0	---	---
410 - Auxiliary Systems	106	7	106	99	106
420 - Instrumentation & Control Systems	124	8	123	99	88
435 - Electric Power Systems	83	5	73	88	92
440 - Reactor Systems	84	5	51	61	83
450 - Accident Evaluation	9	1	9	100	96
451 - Meteorology	0	0	0	---	---
460 - Effluent Treatment	16	1	16	100	110
470 - Radiological Impact	15	1	15	100	74
471 - Radiation Protection	21	1	21	100	82
480 - Containment Systems	78	5	46	62	70
490 - Fuels	10	1	0	0	---
491 - Nuclear Design	7	0	0	0	---
492 - Thermal & Hydraulic Design	5	0	0	0	---
610 - Operator Licensing	0	0	0	---	---
620 - Human Systems Interfaces	90	6	90	100	102
630 - Tech Spec/RAP	9	1	9	100	106
720 - Reliability & Risk Assessment	275	17	291	95	84
730 - Generic Issues	0	0	0	---	---
820 - Safeguards	4	0	2	50	73
950 - RES - General	0	0	0	---	---
951 - RES - Containment Systems	7	0	7	100	64
952 - RES - Reactor Systems	64	4	54	84	66
953 - RES - Valve Tests	0	0	0	---	---

# AP600 DESIGN CERTIFICATION REVIEW STATUS

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## RTNSS

- 9/23/93 SUBMITTAL
- STAFF DEVELOPING REVIEW GUIDANCE
- RAIs RECEIVED FROM SEVERAL BRANCHES
- WESTINGHOUSE/NRC AGREE ON ONE SYSTEM BY NOVEMBER 1994



# AP600 DESIGN CERTIFICATION REVIEW STATUS

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## TEST PROGRAMS

### Frequent And Detailed Interactions With NRC Staff

- **Meetings Have Been Held On Each Test Program (Facility Design Reviews, Test Matrix Reviews, Test Results)**
- **Responses Have Been Provided To Staff Requests For Additional Information (RAI's)**
- **Weekly Phone Calls On Test Program Schedules And Status**
- **Hundreds Of Test Program Documents Forwarded To NRC Staff**
- **NRC Staff Have Visited Test Sites To Witness Test Preparations And Operations**
- **Suggestions Of NRC Staff And Consultants Have Been Integrated Into The Test Program**
- **Issues Are Identified And Actions Are Taken To Reach Resolution**
- **Meeting Held 4/7/94 To Close Out Remaining Items**

# AP600 DESIGN CERTIFICATION REVIEW TESTING STATUS

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- SPES-2
  - TWO MATRIX TESTS COMPLETED
- CMT
  - ELEVEN MATRIX TESTS COMPLETED
- OSU
  - READINESS REVIEW 5/11-12
  - MATRIX TESTING EXPECTED TO START 5/20
- ADS
  - CONSTRUCTION ACTIVITIES WELL UNDERWAY
  - FACILITY COMMISSIONING TESTS TO BEGIN 6/21/94
  - MATRIX TESTING TO BE COMPLETED BY 10/28/94

# **AP600 DESIGN CERTIFICATION SCHEDULE WESTINGHOUSE - MARCH 28, 1993**

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**REQUIRED BY 3/7 NRC LETTER**

**INCLUDES ALL ACTIVITIES NECESSARY FOR**

- **DSER**
- **FSER**
- **FDA**

**ACCOUNTED FOR DELAY IN OSU TESTING PROGRAM**

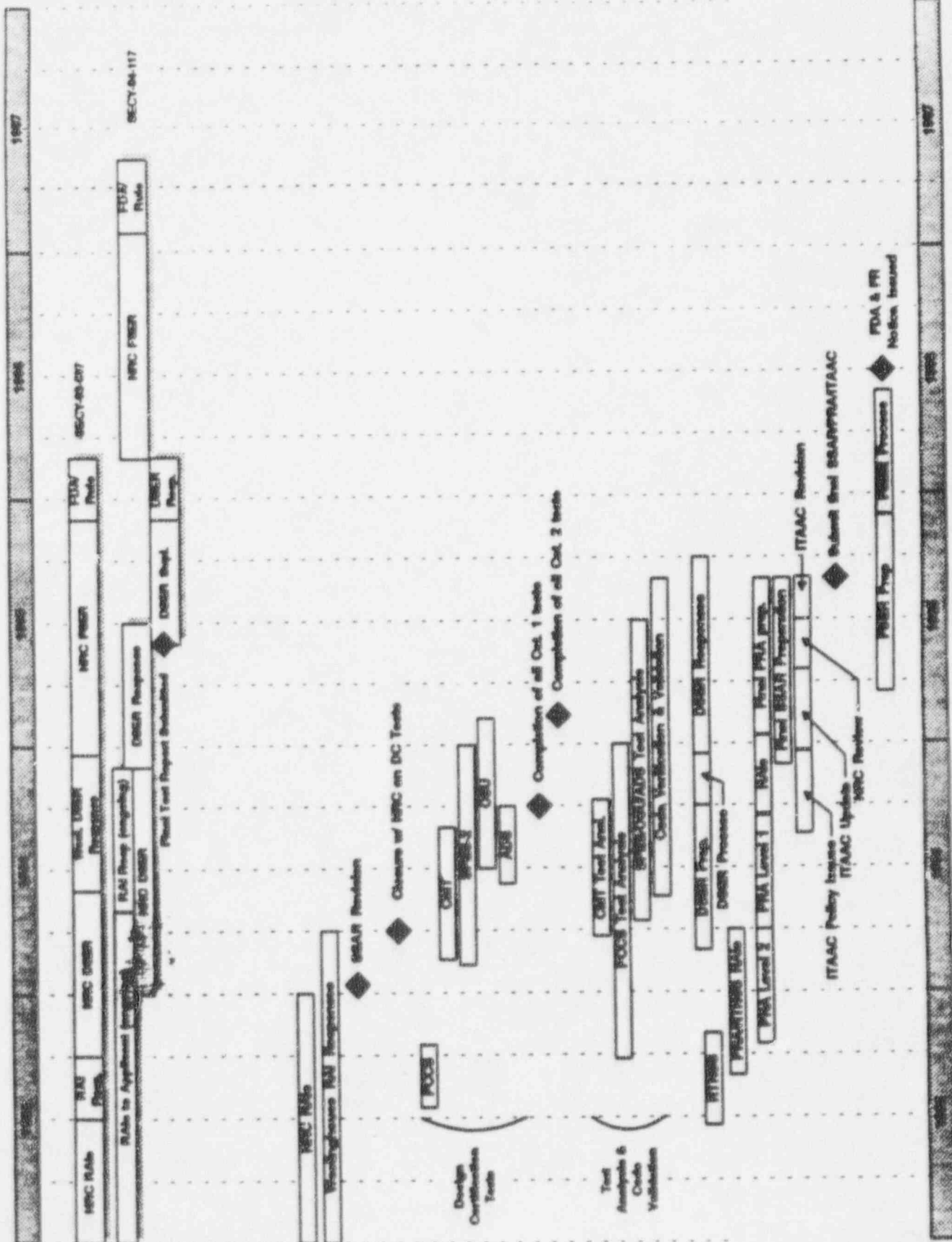
**TESTING PROGRAM LINKED TO REVIEW PROCESS**

- **INTERMEDIATE DELIVERABLES**
- **QUICK LOOK REPORTS**
- **TESTING ORDER REARRANGED**

**NRC TEST REVIEW/SER INCLUDED**

**NRC ACTIVITIES AND TIME SPANS FROM 93-097 INCLUDED**

# AP600 DESIGN CERTIFICATION SCHEDULE



# TEST PROGRAM REPORTS

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	QUICK LOOK	FINAL
PCCS	11/93 - 5/94	8/94
CMT	5/94 - 9/94	11/94
SPES-2	5/94 - 12/94	3/95
OSU	8/94 - 4/95	6/95
ADS		3/95

# CODE VALIDATION REPORTS

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<b>WGOthic*</b>	<b>5/95</b>
- <b>PHENOMENOLOGICAL REPORTS</b>	<b>4/94</b>
- <b>DBA LETTER REPORT</b>	<b>6/94</b>
- <b>PRE BLIND TEST MODEL REVIEW</b>	<b>11/94</b>
<b>LOFTRAN*</b>	<b>5/95</b>
<b>WCOBRA/TRAC*</b>	<b>9/95</b>
<b>NOTRUMP*</b>	<b>8/95</b>

\* Includes blind test prediction



# **NRC SECY-94-117**

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## **DELAYS ATTRIBUTED SOLELY TO TESTING DELAYS**

- **COMPARED TO SECY-93-097**
  - **DELAY OF 6 MONTHS IN FIRST DSER**
  - **DELAY OF 14 MONTHS IN FSER**
  - **DELAY OF 15 MONTHS IN FDA**
  
- **COMPARED TO WESTINGHOUSE 3/28 SCHEDULE**
  - **FIRST DSER AT SAME TIME**
  - **SECOND SERIAL DSER ADDED**
  - **DELAY OF 10 MONTHS IN FSER**
  - **DELAY OF 10 MONTHS IN FDA**

# **SECY-94-117**

## **WESTINGHOUSE OBSERVATIONS**

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**5/95 ONLY INPUT FROM WESTINGHOUSE 3/28 SCHEDULE**

- **PROCESS IGNORED**

**NO ATTEMPT TO ESTABLISH PARALLEL ACTIVITIES TO REDUCE DELAY**

**1400 RAIs RECEIVED ARE ONLY 2/3 OF TOTAL FOR DSER IN 11/94**

- **IMPLIES 700 MORE RAIs FOR DSER**
- **NOT CONSISTENT WITH 3/14 SENIOR MANAGEMENT MEETING**
  - **6/30 NONTESTING RAI CUTOFF**
  - **7/31 TESTING RAI CUTOFF**

# **SCHEDULE**

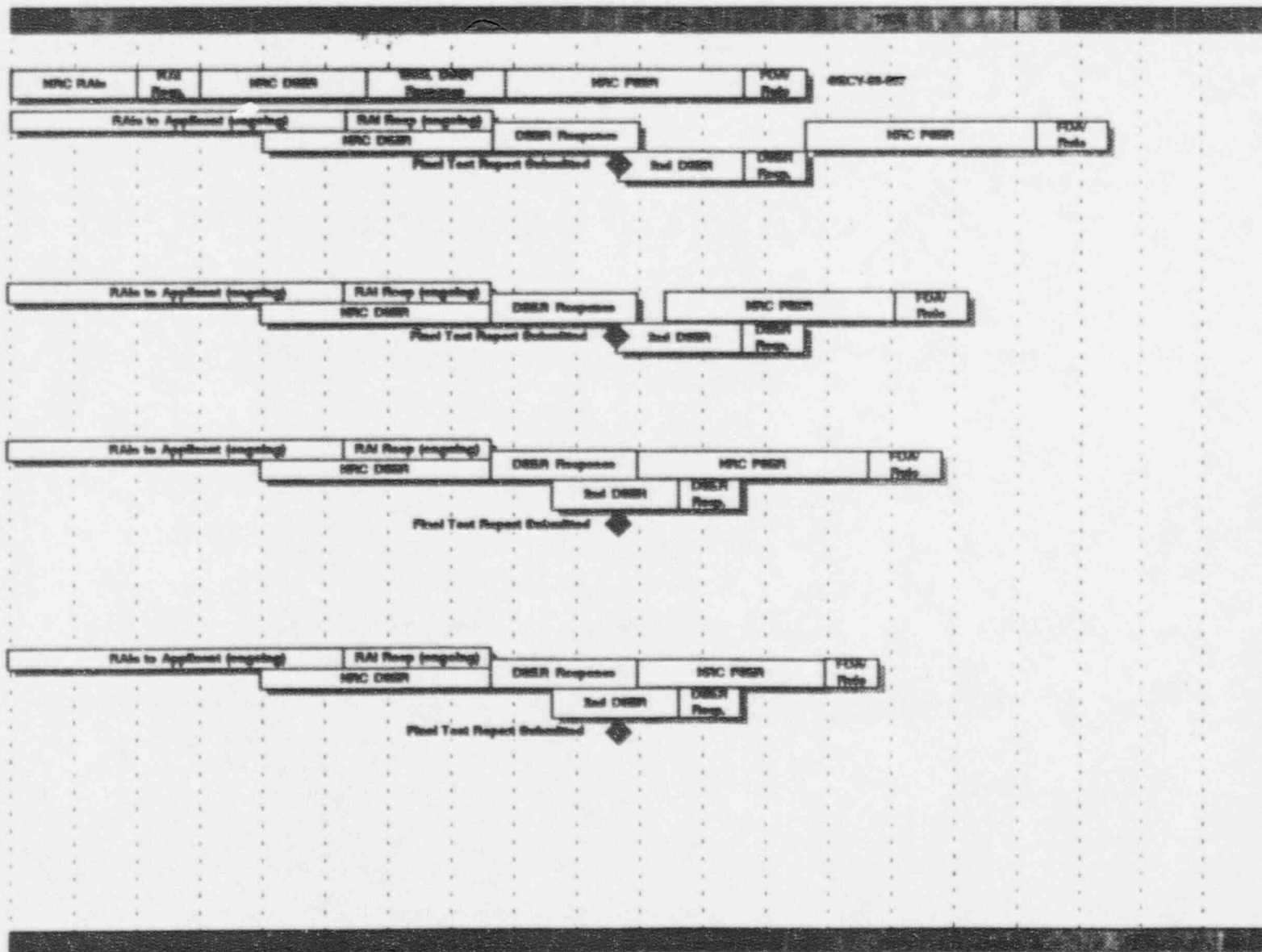
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## **10 Opportunities for Improvement in SECY-94-117 schedule**

- 1. Start non-testing portions of FSER earlier**
- 2. Accelerate test program reporting to facilitate early review**
- 3. Take full advantage of parallel tasks**

# ILLUSTRATION OF SCHEDULE IMPROVEMENTS



SECY-04-117

## Example 1

1. Start non-testing FSER earlier

Delta = - 6 months

## Example 2

1. Start non-testing FSER earlier
2. Accelerate utilization of test results

Delta = - 8-9 months

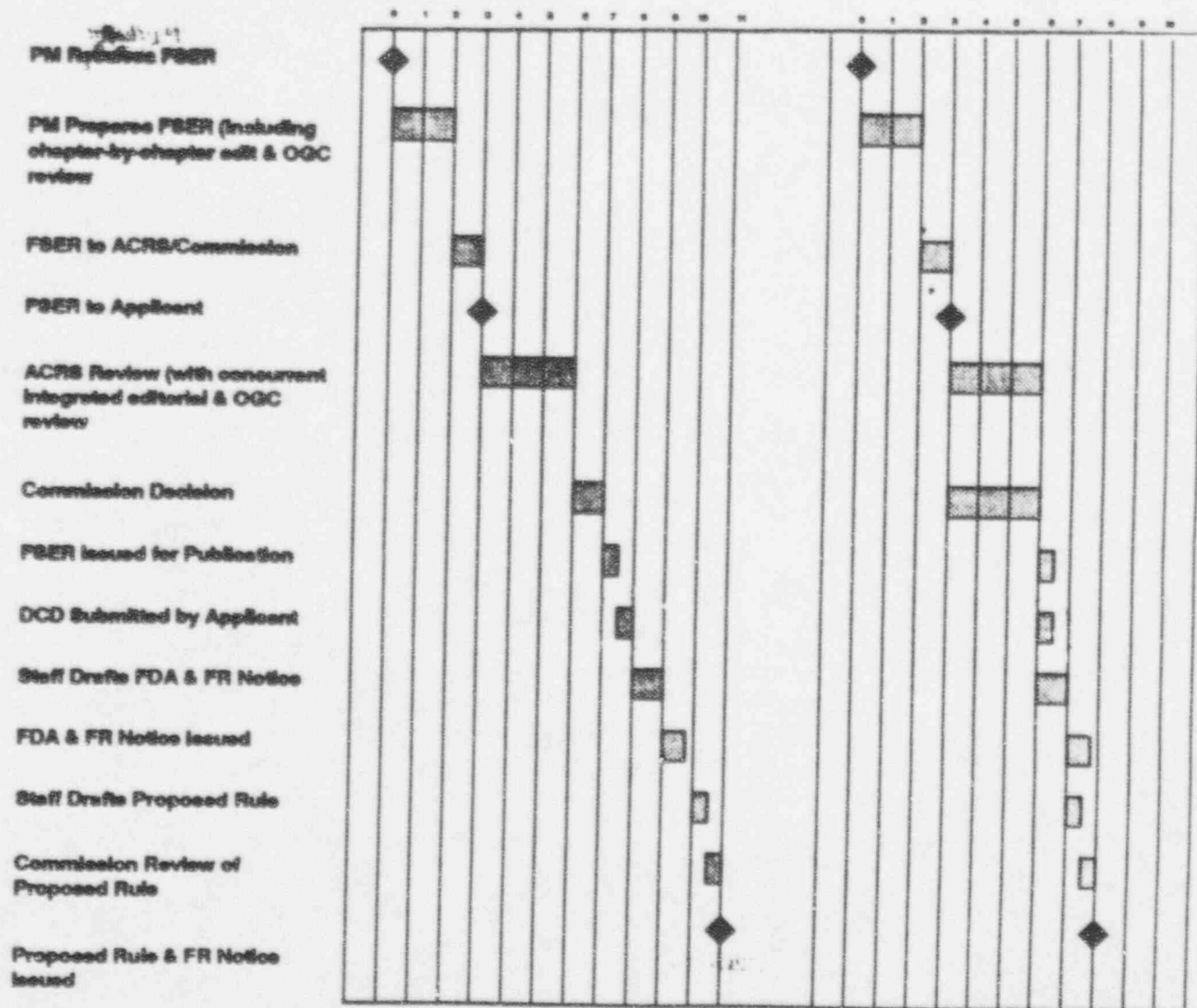
## Example 3

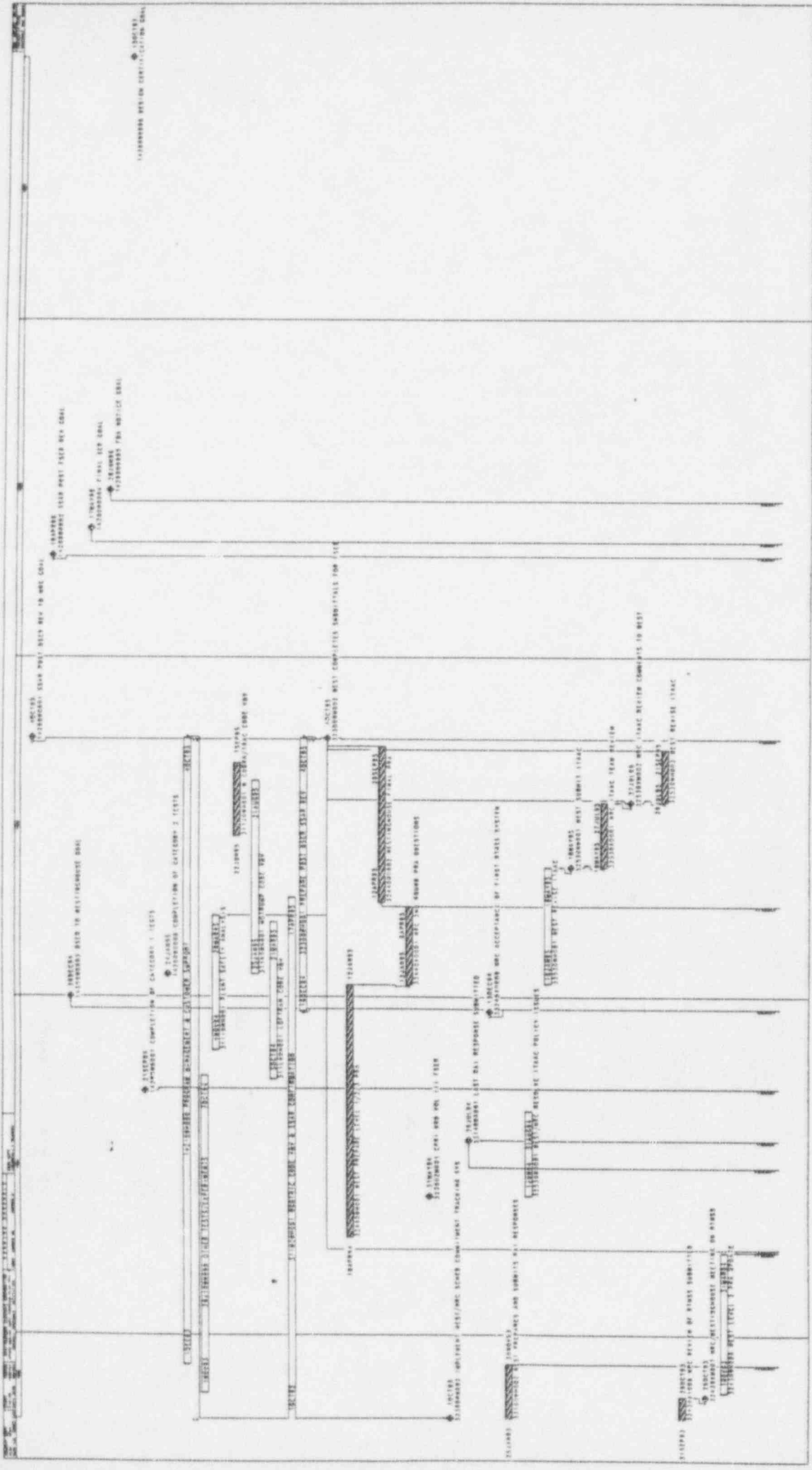
1. Start non-testing FSER earlier
2. Accelerate utilization of test results
3. Take advantage of parallel "FSER" tests

Delta = - 11-12 months

- Assumptions:**
1. SECY-94-117 durations maintained
  2. Allow for parallel activity

**Results:** Potential savings of 3 months



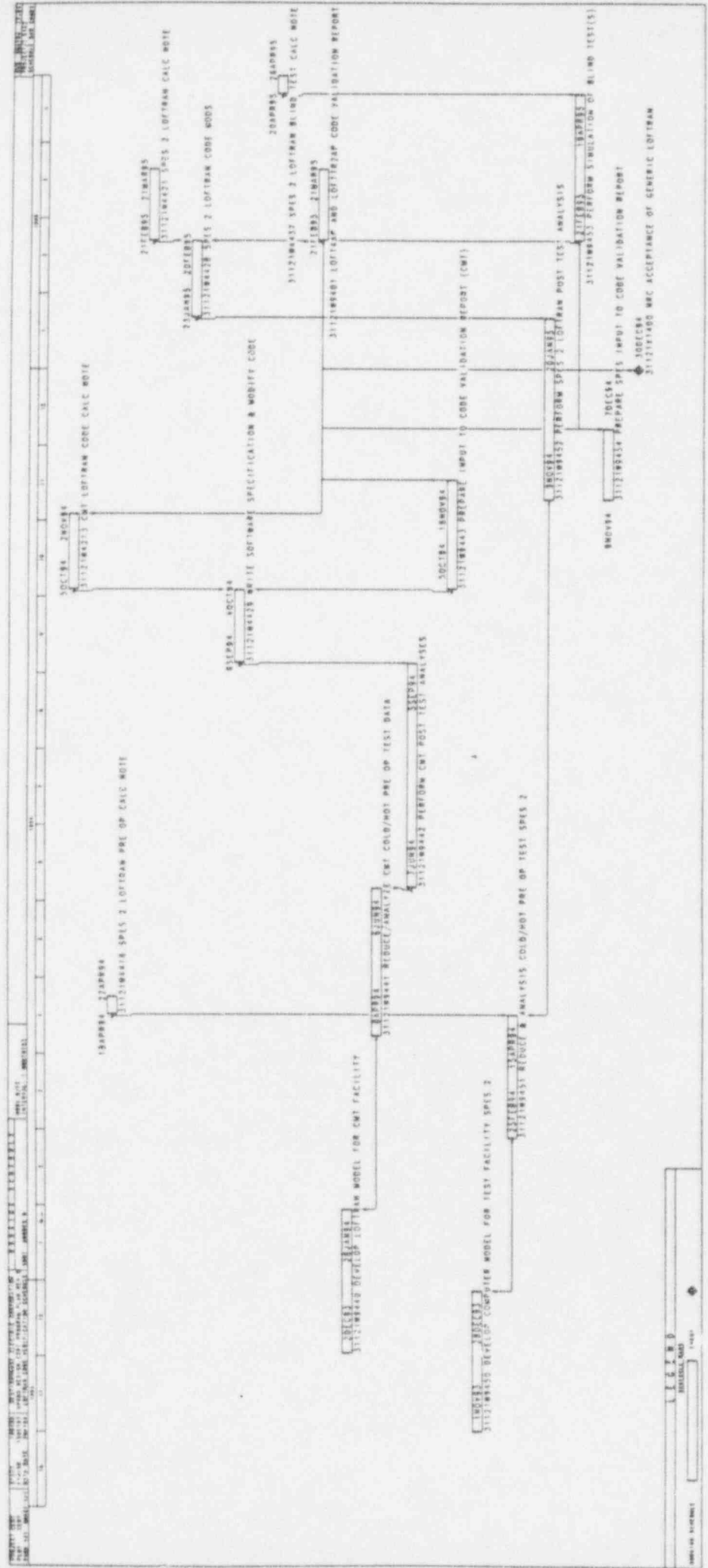












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 BY: J. W. B. / J. W. B.

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UNITED STATES DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

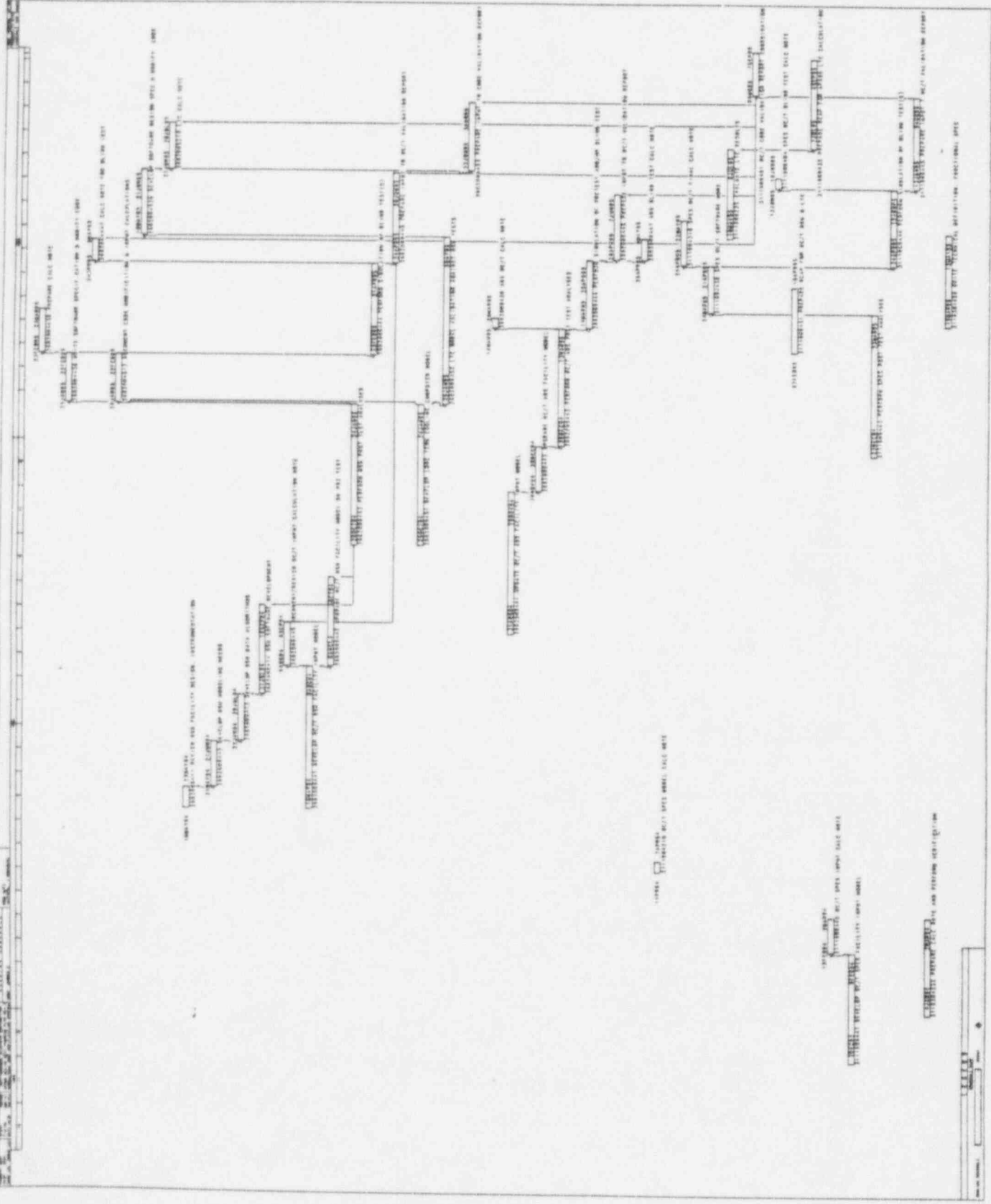
WATER RESOURCES DIVISION  
RIVER AND STREAM CHANNELS

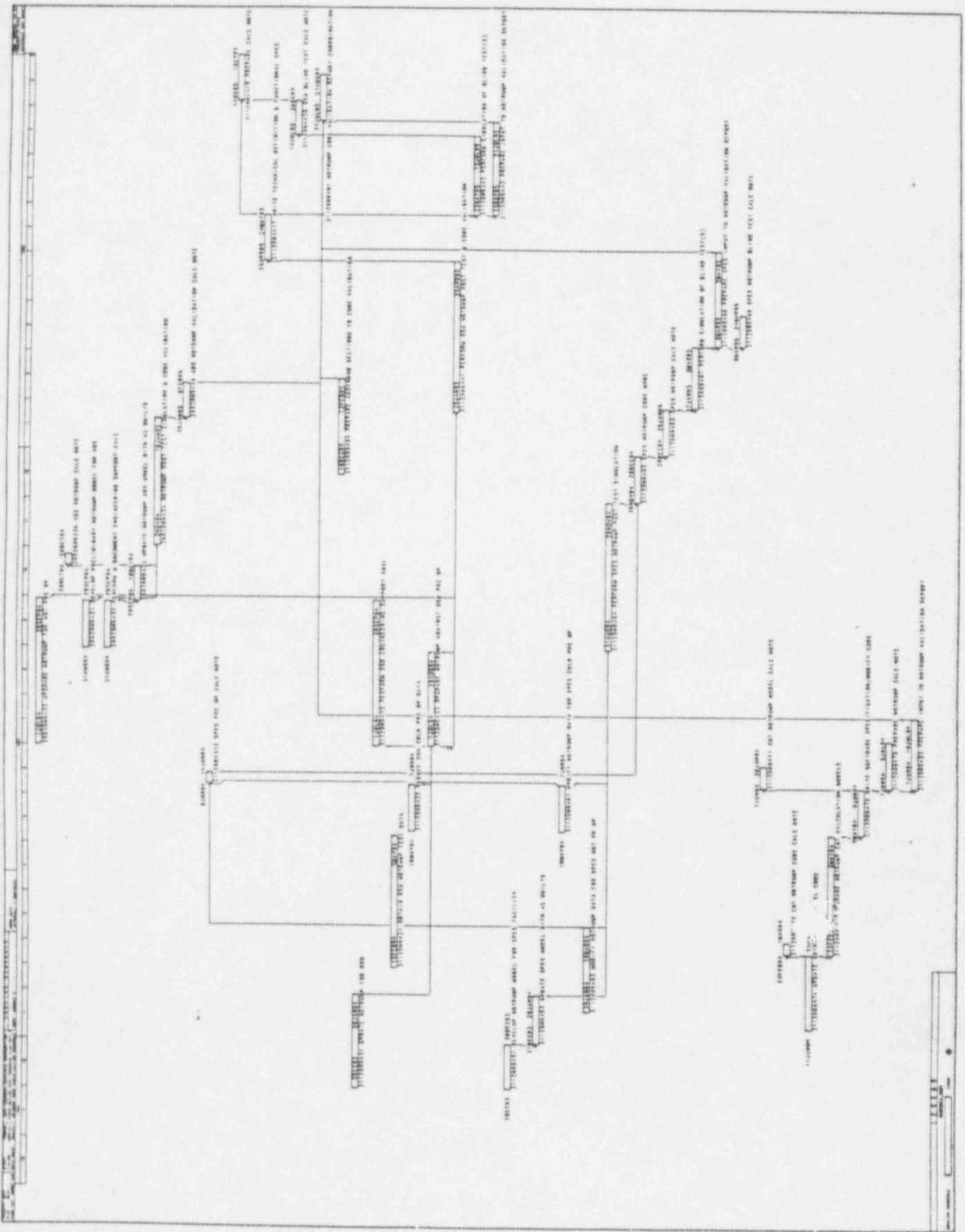
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# **AP600 Test/Analysis Program Overview**

*L. E. Hochreiter  
Consulting Engineer*



# ***AP600 TEST AND ANALYSIS PROCESS***

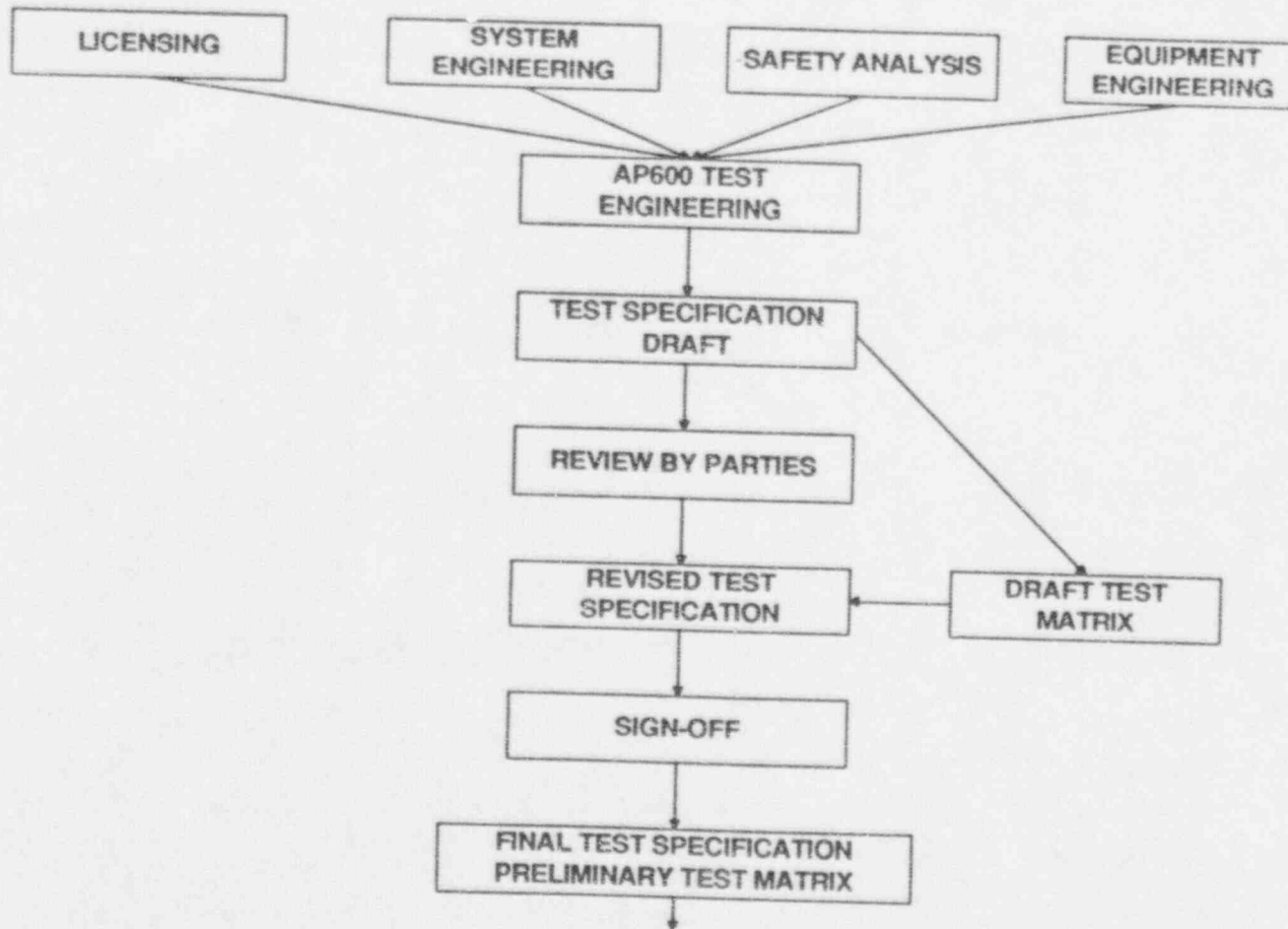
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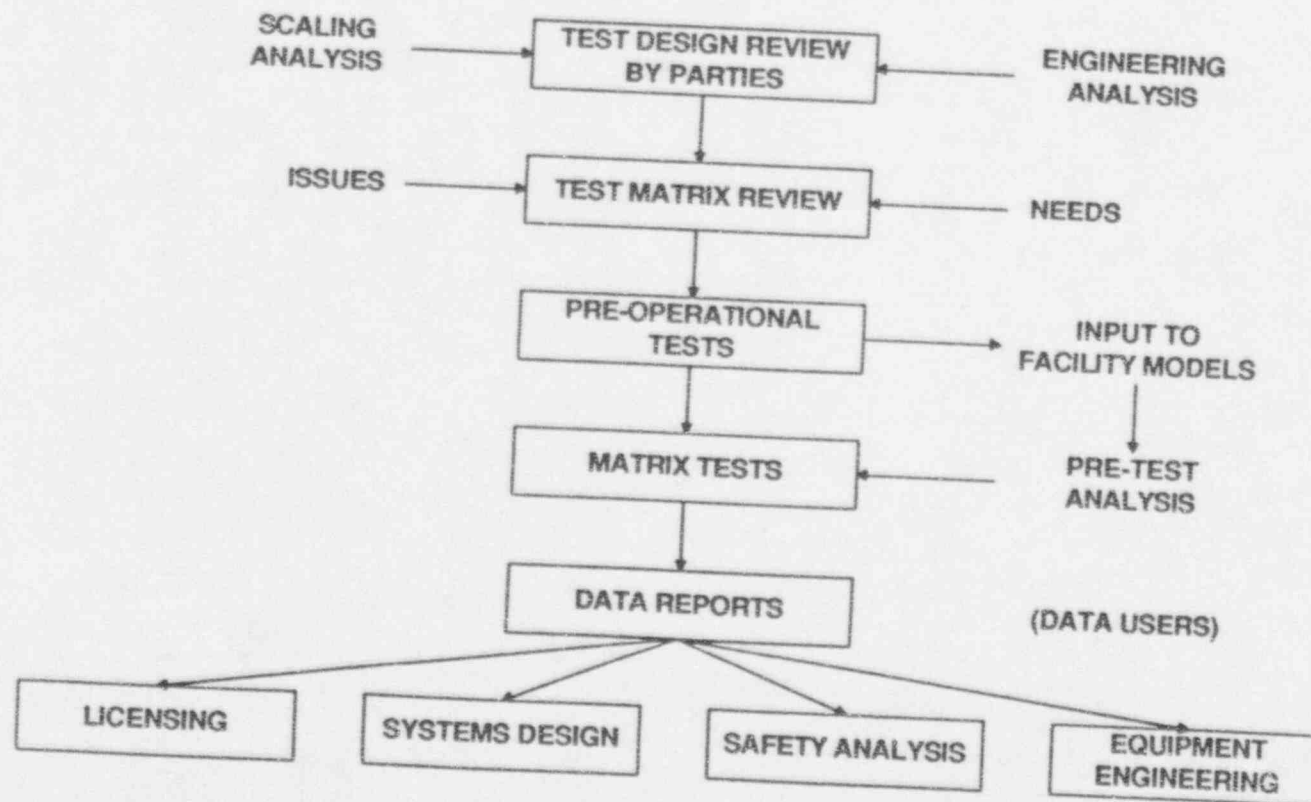
Test needs identified by engineering and analysis groups

- Provide for proper model/correlation development and verification
- Validation of the system codes with integral tests

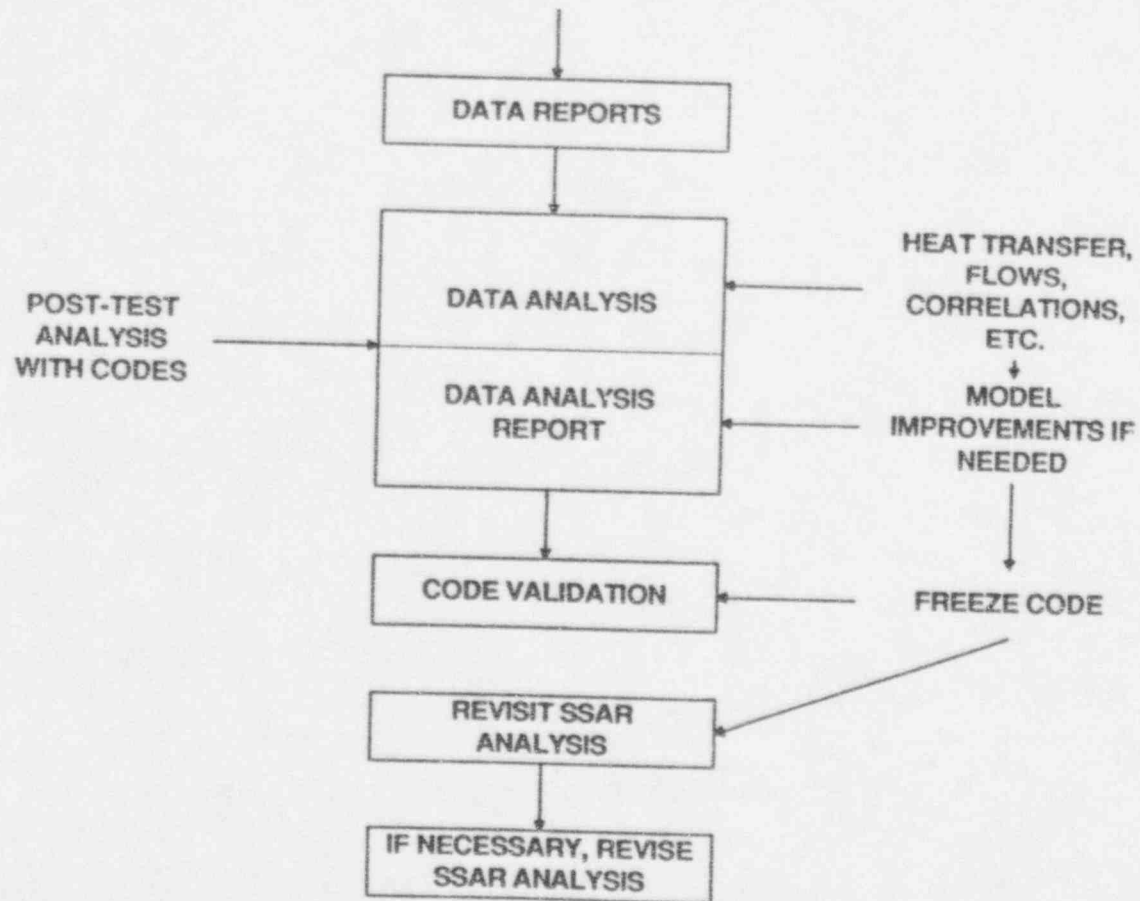
# AP600 TEST AND ANALYSIS PROCESS



# AP600 TEST AND ANALYSIS PROCESS



# AP600 TEST AND ANALYSIS PROCESS



# AP600 TEST AND ANALYSIS PROCESS

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- Specific model/correlation needs were identified for each specific transient type:
  - Large break LOCA
  - Small break LOCA
  - Transient analysis
  - Containment analysis
  - Long-term cooling
  
- The specific differences for the AP600 were examined relative to current W PWRs and the safety analysis computer codes used for the the SSAR
  
- The needs for systems tests were also evaluated to address systems interactions, mass distributions and multiple breaks

# AP600 TEST AND ANALYSIS PROCESS

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## Code model validation process and analysis - process - systems codes

- Code already validated for current PWR use; the program is to extend their validation to passive plant design
- Key models are being examined by separate effects tests
  - CMT, wall/interfacial condensation
  - ADS, Critical flow, 2 $\phi$  pressure drop, sparger behavior, condensation
- Integral systems tests will validate the systems performance of the codes and reveal if compensating effects are present
  - SPES-2, high pressure blowdowns
  - OSU, Low pressure blowdowns, long-term cooling performance
- Integral systems tests will also address NRC concerns expressed in SECY-92-30

# ***AP600 TEST AND ANALYSIS PROCESS***

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## **Process - Containment Codes**

- The containment code is WGOTHIC
- Separate effects tests have been run (heated plate test, University of Wisconsin experiments, etc.) as well as small and large scale integral tests
- Completed large scale integral tests being examined
  - Non-condensable behavior
  - He (H<sub>2</sub>) effect, distribution
  - Transient performance of code
  - Different break location, geometry

# AP600 TEST AND ANALYSIS PROCESS

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An example of the process used to identify safety analysis computer code validation needs is for Long-Term Cooling analysis (LTC)

- Code is WCOBRA/TRAC
  - Objective is to show that phenomena are understood with OSU tests and WCOBRA/TRAC analysis, then develop simpler model
  - Develop LTC WCOBRA/TRAC model from WCOBRA/TRAC OSU model, i.e., simplify
  - LTC process identified the key phenomena to be examined, data needs for computer code model and system validation



# AP600 TEST AND ANALYSIS PROCESS



## Long-Term Cooling Processes

Long Term Cooling Process	AP600 Uniqueness w.r.t. <u>W</u> Plants	Long-Term Cooling Model Verification (Does It Exist?)	AP600 Specific Validation Needed	Comments
- Natural Circulation	- Loop 2 $\phi$ natural circulation	Yes	Yes, systems data needed on AP600 specific geometry	Frictional/elevation heads should be properly scaled to insure correct flows
	- Multiple breaks	No		
	- CMT delivery in Downcomer	No		
	- Mass distribution			Code can handle multiple breaks and flow paths
- Long-term core heat removal	Gravity feed natural circulation, possible flooding, CCFL effects	No, not in AP600 configuration	Yes, Integral systems tests needed	Same as above
- Long-term steam generator heat removal	Yes, ADS reduced flow to SG	Yes, FLECHT-SEASET, ROSA-IV, LOFT, semiscale	None	AP600 should be less sensitive to SG behavior

# AP600 TEST AND ANALYSIS PROCESS



## AP600 Safety Analysis Codes, Technology Features and Capabilities

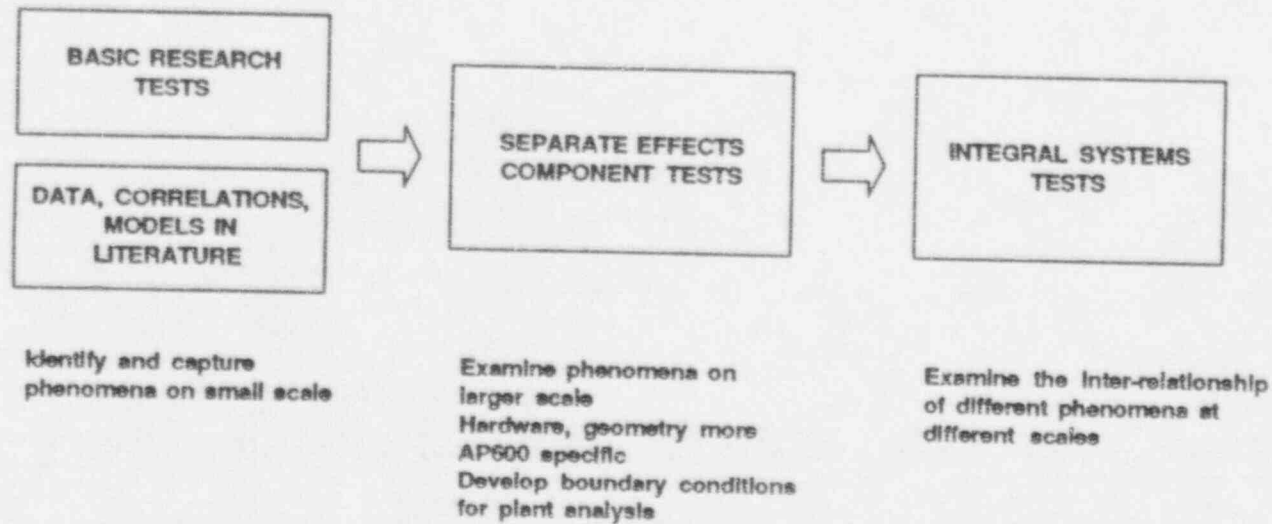
Computer Code	Single Phase, Homogeneous Flow	1-D Drift Flux	3-D Vessel Model Separate Two-Phase Flow Model
WCOBRA/TRAC	----->		
NOTRUMP	----->		
LOFTRAN/LOFTTR2	----->		

-----> Increasing technology level

# AP600 TEST AND ANALYSIS PROCESS



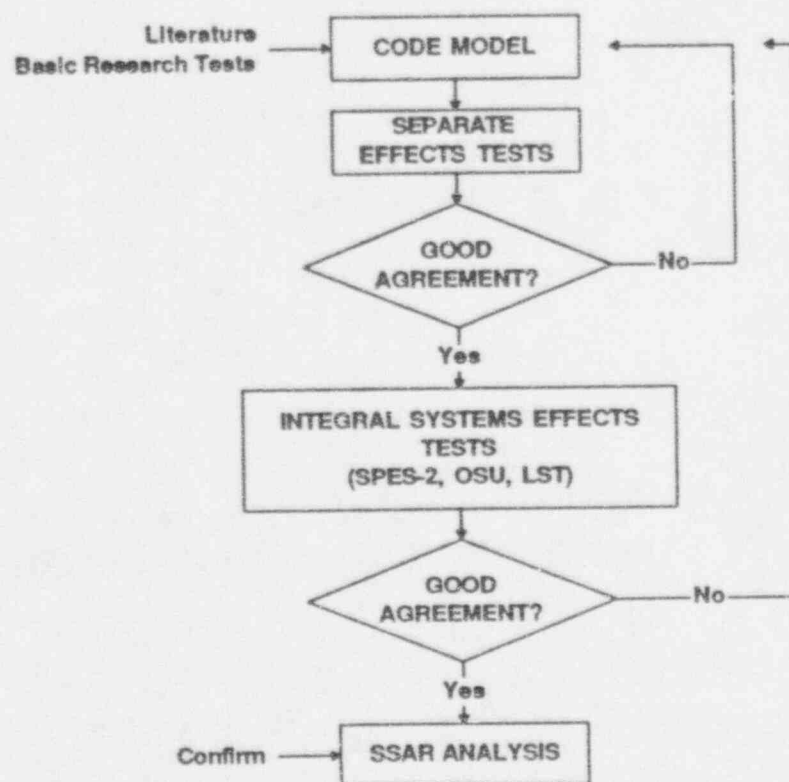
Relationship between basic research tests, component separate effects tests and integral tests for AP600 containment



# AP600 TEST AND ANALYSIS PROCESS



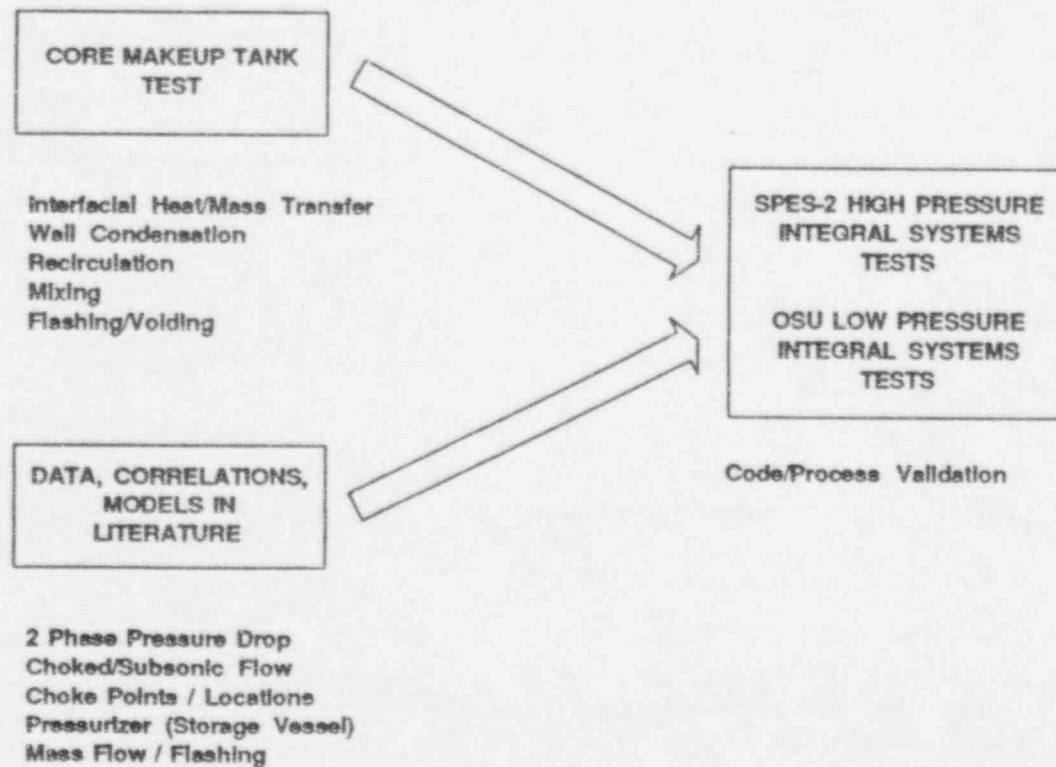
*Model development and verification process for code validation*



# AP600 TEST AND ANALYSIS PROCESS



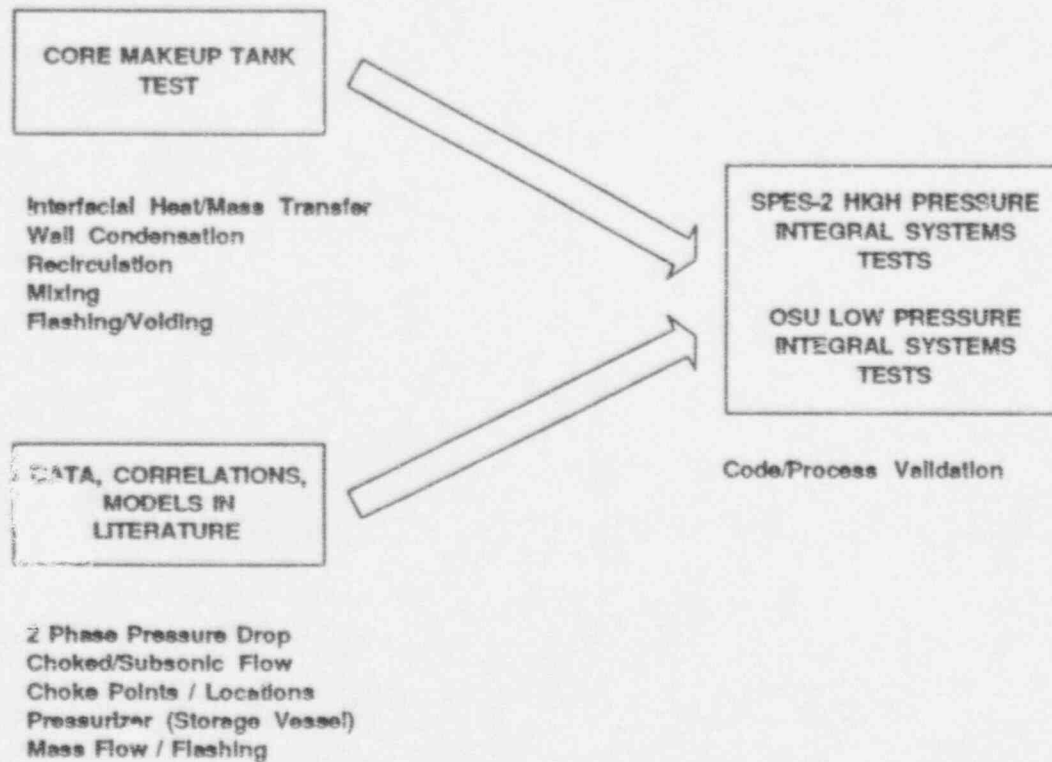
## WCOBRA/TRAC Verification with separate effects test and validation with integral systems tests



# AP600 TEST AND ANALYSIS PROCESS



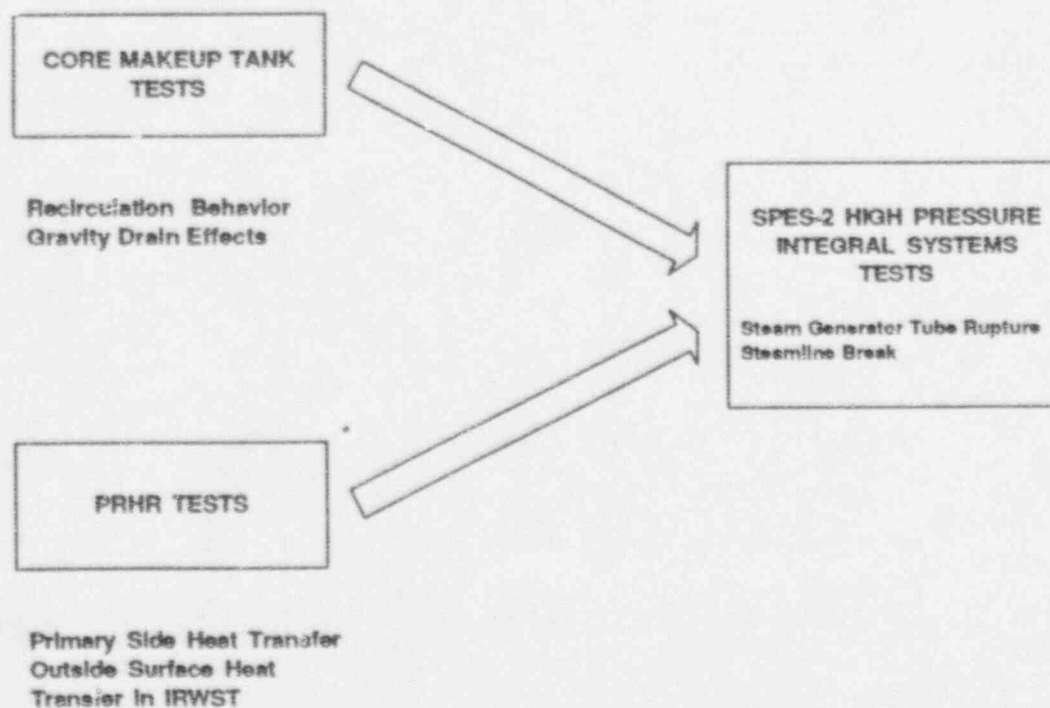
NOTRUMP Verification with separate effects test and validation with integral systems tests



# AP600 TEST AND ANALYSIS PROCESS



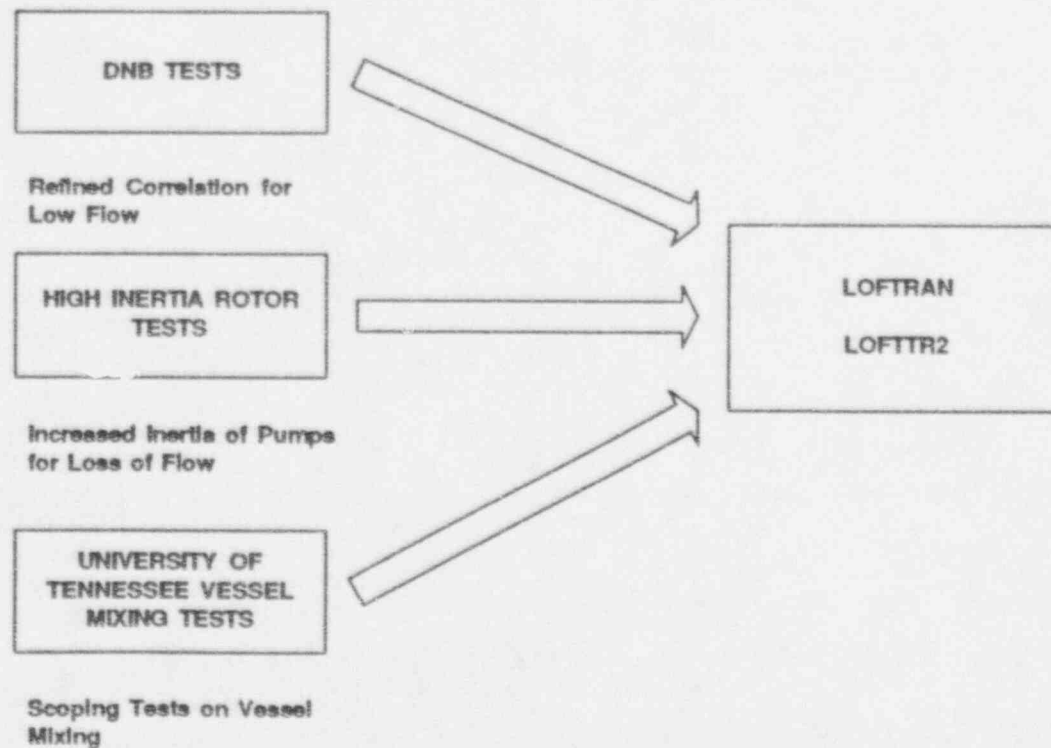
LOFTRAN Verification with separate effects test and validation with integral systems tests



# AP600 TEST AND ANALYSIS PROCESS



## Research and Engineering tests input to LOFTRAN Code

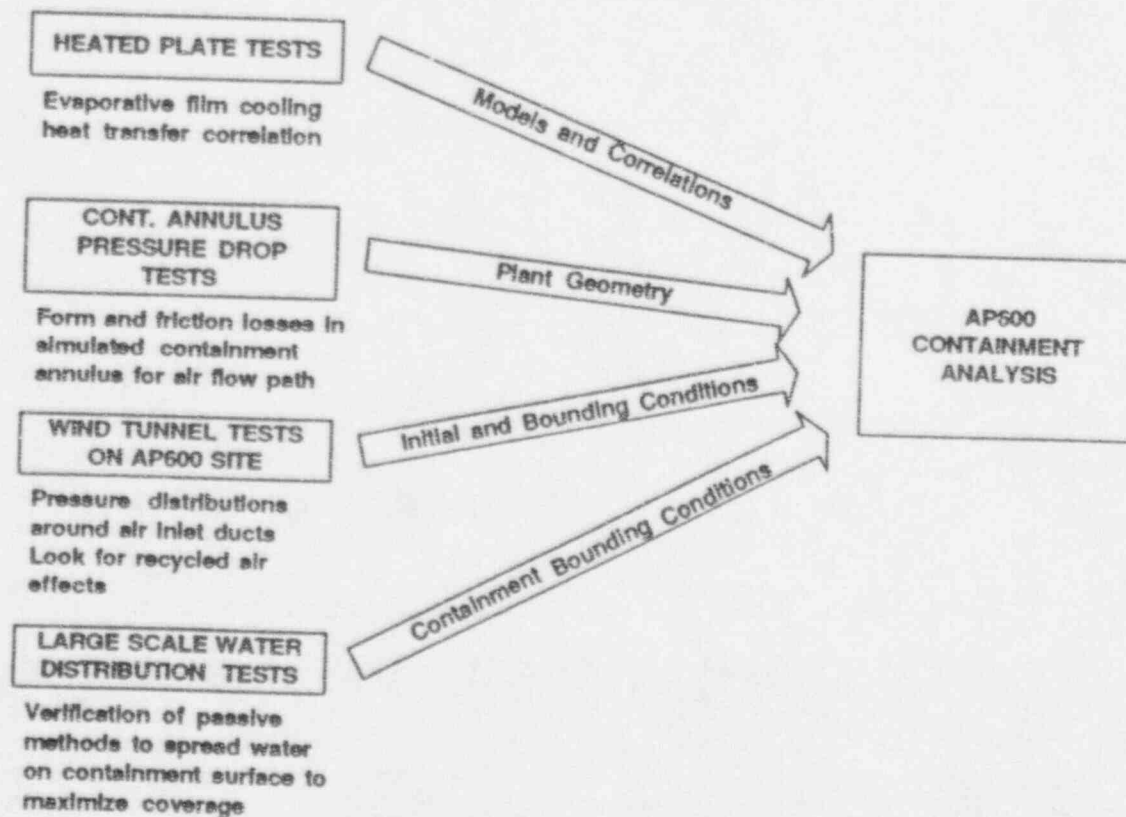




# AP600 TEST AND ANALYSIS PROCESS



Models, correlations and input conditions developed from component separate effects tests and engineering tests



# AP600 TEST AND ANALYSIS PROCESS

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## Documentation plan for tests/analysis

- Each DC test will have issued:
  - Data report
  - Data analysis report
  
- A code verification report will be issued for:
  - WCOBRA/TRAC
  - NOTRUMP
  - LOFTRAN/LOFTTR2
  - WGOTHIC

Individual code comparisons to ADS, CMT, SPES-2, OSU and Containment tests



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# AP600 Test/Analysis Program Status

*E. J. Piplica*  
*Manager, AP600 Test Engineering*



# PASSIVE CONTAINMENT COOLING SYSTEM TESTS

## PASSIVE CONTAINMENT COOLING SYSTEM TEST STATUS



### TESTING COMPLETED; TEST DOCUMENTATION UNDERWAY

- LARGE (1/8TH) SCALE HEAT TRANSFER TEST
  - 10 QUICK LOOK REPORTS COVERING 16 TESTS HAVE BEEN SUBMITTED TO THE NRC FOR REVIEW
  - 3 REMAINING QUICK LOOK REPORTS ARE IN PROGRESS
  
- WATER DISTRIBUTION TEST
  - FINAL TEST REPORT SUBMITTED TO THE NRC FOR REVIEW
  
- WIND TUNNEL TESTS
  - FINAL TEST REPORTS FOR PHASE 4A AND 4B COMPLETED AND UNDER REVIEW

ALL PCS TEST DOCUMENTATION WILL BE SUBMITTED TO THE NRC BY AUGUST, 1994



# CORE MAKEUP TANK TESTS

# CMT TEST MATRIX

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## CATEGORY 1 TESTS

- SERIES 100 TESTS
  - CMT WALL CONDENSATION WITH AND WITHOUT NONCONDENSIBLES (N<sub>2</sub>)
- SERIES 200 TESTS
  - CMT WALL AND WATER SURFACE CONDENSATION
- SERIES 300 TESTS
  - CMT DRAINDOWN AT CONSTANT PRESSURE

## CATEGORY 2 TESTS

- SERIES 400 TESTS
  - CMT DRAINDOWN DURING DEPRESSURIZATION
- SERIES 500 TESTS
  - NATURAL CIRCULATION FOLLOWED BY DRAINDOWN AND DEPRESSURIZATION

## CORE MAKEUP TANK TESTS



- TESTING PLAN
  - RUN HIGH PRESSURE CATEGORY 1 TESTS
  - INSTALL STEAM FLOW METERS
  - PERFORM LOW PRESSURE CATEGORY 1 TESTS
  - PERFORM LOW PRESSURE CATEGORY 2 TESTS
  - REMOVE STEAM FLOW METERS
  - PERFORM HIGH PRESSURE CATEGORY 2 TESTS





## CMT TEST STATUS

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PRE-OPERATIONAL TESTING COMPLETED

MATRIX TESTING UNDERWAY

- MATRIX TESTING BEGAN ON 2/15/94
- HIGH PRESSURE CATEGORY 1 TESTS COMPLETED
- STEAM FLOW METERS INSTALLED
- LOW PRESSURE CATEGORY 1 TESTS INITIATED
  - SERIES 100 TESTS COMPLETED
  - SERIES 200 TESTS UNDERWAY

# CMT TEST STATUS

---



## TEST DOCUMENTATION ON-GOING

- TEST SPEC REVISED FOR CMT/PZR BALANCE LINE DELETION
- SCALING REPORT COMMENTS ARE BEING ADDRESSED
- OPERATING PROCEDURES FOR SERIES 100, 200 & 300 ISSUED
- PRE-OPERATIONAL TESTING QUICK LOOK REPORTS PREPARED, UNDER REVIEW
- SERIES 100 QUICK LOOK REPORT STARTED



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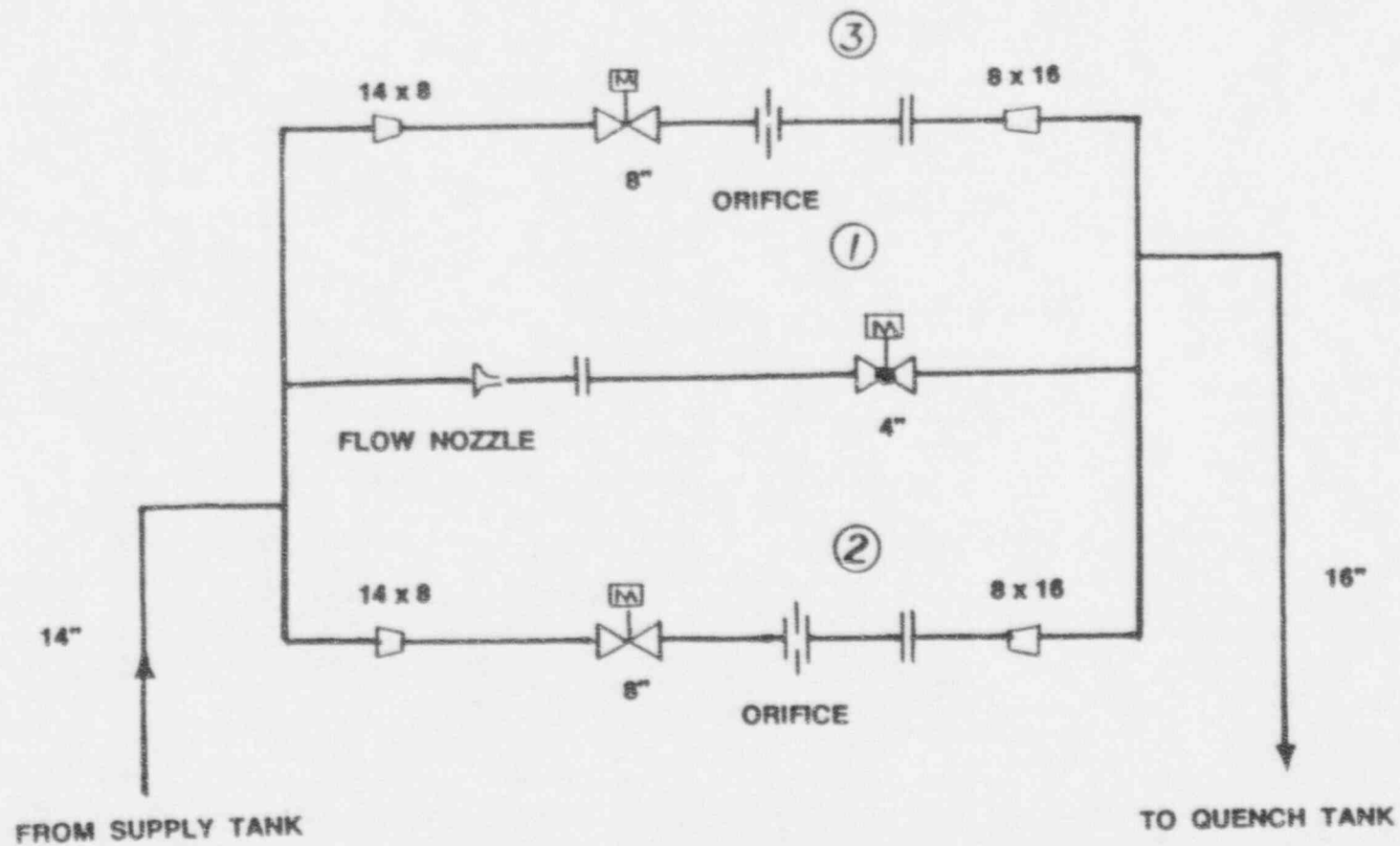
# **AUTOMATIC DEPRESSURIZATION SYSTEM TEST PLANS/STATUS**



## ADS TEST LOOP CONFIGURATION

- **FULL SCALE SIMULATION OF THE ADS SYSTEM:**
  - LOOP SEAL
  - ADS VALVE PIPING PACKAGE
  - DOWNSTREAM PIPING
  - SPARGER
  
- **QUENCH TANK GEOMETRY:**
  - DIAMETER 25 FEET
  - WATER LEVEL 24 FEET
  - SPARGER ARMS LOCATED 9.5 FEET BELOW WATER LEVEL

**FIGURE 1**  
**DESIGN CERTIFICATION TESTS**  
**ADS PHASE B TEST VALVE PACKAGE CONFIGURATION**



# ADS PHASE B TESTS (Preliminary)



Blowdown Fluid	ADS Simulation	AP600 Pressure Simulated	Comments
Saturated Steam from top of supply tank	· Stage 1 open	~ 2250 to 400 psig	Maximum flow resistance simulated. Obtain 1 $\phi$ T/H data.
	· Stages 1 and 2 open	~ 800 to 100 psig	
	· Stages 1 and 3 open	~ 500 to 50 psig	
	· Stages 1,2, and 3 open	~ 500 to 50 psig	
Saturated water from bottom of supply tank	· Stage 1 open	~ 2250 to 400 psig	Maximum flow resistance simulated. 12-inch gate valve positioned to obtain a range of 2 $\phi$ T/H data.
	· Stages 1 and 2 open	~ 1200 to 100 psig	
	· Stages 1 and 3 open	~ 500 to 50 psig	
	· Stages 1,2 and 3 open	~ 500 to 50 psig	
	· Stage 2 open (inadvertent opening at full power)	~ 2235 psig	
Saturated water from bottom of supply tank	· Stages 1,2 and 3 open*	~ 500 to 50 psig	Minimum flow resistance simulated. Maximum flow/minimum quality for max loads on sparger and quench tank. *- Quench tank water initially at 212°F
	· Stages 1,2 and 3 open	~ 500 to 50 psig	
	· Stages 1 and 2 open*	~1200 to 100 psig	
	· Stage 2 open*	~ 2235 psig	

# ADS PHASE B TEST STATUS



## PROCUREMENTS COMPLETE

- VALVES SHIPPED AND ON-SITE
- ALL PIPING AND FITTINGS OBTAINED
- DAS SHIPPED AND INSTALLED
- ALL INSTRUMENTS AVAILABLE

## CONSTRUCTION PROGRESSING

- VALVE PIPING PACKAGE SUPPORTS INSTALLED
- VALVE PIPING PACKAGE BEING FABRICATED
- SPARGER AND PEDESTAL INSTALLED IN QUENCH TANK
- SATURATED WATER SUPPLY LINE BEING INSTALLED
- DAS IS FUNCTIONING AND UNDERGOING CHECKOUT AND VALIDATION

CONSTRUCTION COMPLETION AND FACILITY TURNOVER SCHEDULED FOR JUNE 21



# SPES-2 INTEGRAL SYSTEMS TEST



## **SPES-2 INTEGRAL SYSTEMS TEST**



THE SPES TEST MATRIX WILL ADDRESS:

- SMALL BREAK LOCA SIMULATIONS
  - BREAK SIZE, LOCATION, INTERACTIONS WITH NON-SAFETY SYSTEMS
- STEAM LINE BREAK
  - INTERACTIONS WITH PASSIVE SYSTEMS, IF ANY
- STEAM GENERATOR TUBE RUPTURE
  - DESIGN BASIS WITH/WITHOUT ACTIVE SYSTEMS TO MITIGATE
  - DESIGN BASIS WITH ADS ACTUATION

# **SPES-2 INTEGRAL SYSTEMS TEST STATUS**



## **PRE-OPERATIONAL TESTING COMPLETE**

- **INCLUDED INADVERTENT ADS ACTUATION FROM FULL POWER**

## **MATRIX TESTING**

- **MATRIX TESTING BEGAN FEBRUARY 9, 1994**
- **AN EIGHT WEEK DELAY DUE WAS INCURRED TO REPAIR FAILED GASKETS AND REPLACE THE UPPER SUPPORT PLATE IN THE POWER CHANNEL**
- **THE REFERENCE MATRIX TEST, A 2-INCH COLD LEG BREAK WAS PERFORMED FOR THREE DESIGN CONFIGURATIONS:**
  - **THE SSAR DESIGN**
  - **THE REVISED DESIGN AS PRESENTED TO THE STAFF OF FEBRUARY 22**
  - **THE REVISED DESIGN WITH THE CMT/PZR BALANCE LINE DELETED**
- **THE MOST RECENT MATRIX TEST WAS SUCCESSFULLY PERFORMED ON MAY 6, 1994, A 1-INCH COLD LEG BREAK**



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# DESIGN CERTIFICATION TEST ISSUES

E. J. Piplica, Manager  
Test Engineering

# CORE MAKEUP TANK TEST - NRC ISSUES



## TEST MATRIX/INSTRUMENTATION

- TEST MATRIX MODIFIED
- ADDITIONAL INSTRUMENTATION INSTALLED

## SCALING ANALYSIS

- SCALING REPORT ISSUED FOR NRC REVIEW
- WESTINGHOUSE IS RESPONDING TO NRC COMMENTS ON THE SCALING REPORT

**NRC ISSUES HAVE BEEN ADEQUATELY ADDRESSED**

**WESTINGHOUSE HAS THE ACTIONS TO PROVIDE REVISED CMT TEST MATRIX AND RESPOND TO NRC COMMENTS ON CMT SCALING REPORT**

## SPES-2 INTEGRAL SYSTEMS TEST - NRC ISSUES



### SGTR LEADING TO ADS ACTUATION

- STAFF CONCERN IS WITH ADS OCCURRING DURING A SGTR AND THE RESPONSE OF THE PASSIVE SYSTEMS DURING THIS SCENARIO
- ANALYSIS INDICATES THAT MULTIPLE TUBE RUPTURES WILL NOT ACTIVATE ADS
- WESTINGHOUSE HAS AGREED TO PERFORM A SGTR TEST WITH FORCED ADS ACTIVATION AND DELETE THE MULTIPLE SGTR TEST
- STAFF AGREED THIS APPROACH IS ACCEPTABLE
- STAFF TO PROVIDE A RECOMMENDATION FOR THE TIMING FOR MANUAL ADS ACTUATION IN THE TEST

## SPES-2 INTEGRAL SYSTEMS TEST - NRC ISSUES (CONT'D)



### STATION BLACKOUT FOLLOWED BY ADS ACTUATION

- STAFF IS CONCERNED WITH UNIQUE T/H PHENOMENA
- WESTINGHOUSE HAS PERFORMED STATION BLACKOUT ANALYSIS AND CONCLUDED THAT THE RELEVANT PHENOMENA ARE ALREADY COVERED BY THE SPES-2 TESTS
- STAFF IS AWAITING RESULTS OF INEL CALCULATIONS TO CONFIRM WESTINGHOUSE POSITION
- STAFF HAS THE ACTION TO REVIEW WESTINGHOUSE SUBMITTALS AND THE INEL CALCULATIONS
- THIS ISSUE REMAINS OPEN UNTIL NRC REVIEW IS COMPLETE

## SPES-2 INTEGRAL SYSTEMS TEST - NRC ISSUES (CONT'D)



### ATWT

- CORE POWER RESPONSE CANNOT BE SIMULATED IN SPES-2
- PLANT CONDITIONS AND PHENOMENA WILL BE ADEQUATELY ADDRESSED IN SPES-2, OSU AND CMT TESTS
- ATWTS RESPONSE HAS BEEN ANALYZED AND SUBMITTED TO THE STAFF
- STAFF IS AWAITING RESULTS OF INEL CALCULATIONS TO CONFIRM WESTINGHOUSE POSITION
- STAFF HAS THE ACTION TO REVIEW WESTINGHOUSE SUBMITTALS AND THE INEL CALCULATIONS
- THIS ISSUE REMAINS OPEN UNTIL NRC REVIEW IS COMPLETE

## SPES-2 INTEGRAL SYSTEMS TEST - NRC ISSUES (CONT'D)



### NON-CONDENSIBLES

- NITROGEN IS USED IN THE ACCUMULATORS AND IS ALLOWED TO ENTER THE RCS FOLLOWING ACCUMULATOR INJECTION
- HYDROGEN IS NOT A CONCERN AS A RESULT OF THE DELETION OF THE CMT/PZR BALANCE LINE
- THIS ISSUE IS ADEQUATELY ADDRESSED BY THE DESIGN CHANGE



## OSU INTEGRAL SYSTEMS TEST - NRC ISSUES



### SIMULATION OF HIGHER RISK SHUTDOWN EVENTS

- STAFF ASKED FOR CLARIFICATION ON THE AP600 RESPONSE TO SHUTDOWN EVENTS AND WHETHER TESTS SHOULD BE RUN AT OSU TO SIMULATE THESE EVENTS
- WESTINGHOUSE MET WITH THE STAFF ON MARCH 10TH TO SPECIFICALLY DISCUSS AP600 RESPONSE TO SHUTDOWN EVENTS
- STAFF CONCLUDED THAT TESTS ARE IN PLACE AT OSU TO PROVIDE ADEQUATE INFORMATION TO QUALIFY THE CODES
- THIS ISSUE IS ADEQUATELY ADDRESSED

## OSU INTEGRAL SYSTEMS TEST - NRC ISSUES (CONT'D)



### EFFECTS OF HYDROGEN AND NITROGEN

- NITROGEN IS USED IN THE ACCUMULATORS AND IS ALLOWED TO ENTER THE RCS FOLLOWING ACCUMULATOR INJECTION
- HYDROGEN IS NOT A CONCERN AS A RESULT OF THE DELETION OF THE CMT/PZR BALANCE LINE
- THIS ISSUE IS ADEQUATELY ADDRESSED BY THE DESIGN CHANGE

## OSU INTEGRAL SYSTEMS TEST - NRC ISSUES (CONT'D)



### CAPABILITY OF PERFORMING SGTR AND MSLB

- OSU CURRENTLY DOES NOT HAVE THE FULL CAPABILITY TO PERFORM SGTR AND MSLB TRANSIENTS
- HOWEVER, THIS CAPABILITY HAS NOT BEEN PRECLUDED
- IN THE EVENT SPES-2 TESTS IDENTIFY ANY UNUSUAL OR UNEXPECTED BEHAVIOR FOR THESE EVENTS, WESTINGHOUSE WILL EVALUATE THESE RESULTS TO DETERMINE WHETHER ADDED TESTING IS WARRANTED AND WHETHER THIS TESTING SHOULD BE PERFORMED AT OSU
- THIS POSITION ADEQUATELY ADDRESSES THE ISSUE

## PRHR HEAT EXCHANGER - NRC ISSUES



### NEED FOR ADDITIONAL PERFORMANCE TESTING

- ADDITIONAL INFORMATION HAS BEEN PROVIDED TO THE STAFF ON THE PRHR TESTS AND THEIR APPLICABILITY IN RAI 952.14 AND 440.13
- WESTINGHOUSE IS INVESTIGATING THE LITERATURE TO OBTAIN INFORMATION ON CHF LIMITS FOR TUBE BUNDLES AND ARRAYS SIMILAR TO THE C-TUBE GEOMETRY OF THE REVISED PRHR
- CALCULATIONS WILL BE PERFORMED TO QUANTIFY CHF MARGIN
- THE STAFF IS REVIEWING THE RESPONSES TO THE RAI'S
- THIS ISSUE REMAINS OPEN UNTIL THE STAFF COMPLETES THE REVIEW OF WESTINGHOUSE SUBMITTALS AND OTHER PERTINENT INFORMATION



## 4TH STAGE ADS VALVES - NRC ISSUES

### PERFORMANCE TESTING

- AS PART OF DESIGN CERTIFICATION, WESTINGHOUSE WILL PERFORM SENSITIVITY CALCULATIONS TO QUANTIFY THE DESIGN MARGIN
- DURING THE EQUIPMENT QUALIFICATION PROGRAM, TESTING OF THE PROTOTYPE 4TH STAGE VALVES WILL BE PERFORMED
- WESTINGHOUSE WILL PROVIDE ADDITIONAL INFORMATION ON TESTING TO BE PERFORMED OUTSIDE OF DESIGN CERTIFICATION
- THIS ISSUE IS ADEQUATELY ADDRESSED BY THE SENSITIVITY STUDIES
- THE STAFF WILL ASSESS THE ADEQUACY OF THE POST DC TEST PLANS



## CHECK VALVES - NRC ISSUES

---

### PERFORMANCE AND RELIABILITY QUALIFICATION TESTING AND ISI/IST

- WESTINGHOUSE PROVIDED ITS TEST PLAN AT THE DECEMBER 10, 1993 MEETING WHICH INCLUDES ADDITIONAL TESTING OF EXISTING CHECK VALVES AT OPERATING PLANTS
- WESTINGHOUSE IS REVISING THE IST PLAN TO INCLUDE MEASUREMENTS OF THE  $\Delta p$  REQUIRED TO INITIATE FLOW AND THE FLOW REQUIRED TO FULLY OPEN THE VALVES
- THE STAFF AGREES, IN PRINCIPLE, WITH THE WESTINGHOUSE PLANS FOR PERFORMANCE AND RELIABILITY QUALIFICATION TESTING
- WESTINGHOUSE HAS THE ACTION TO PROVIDE ISI/IST PLANS IN RESPONSE TO RAI 210.24

## PASSIVE CONTAINMENT COOLING SYS. TEST - NRC ISSUES



### SCALING ANALYSIS

- ADDITIONAL SCALING EVALUATIONS ARE UNDERWAY AND WILL BE PROVIDED IN DRAFT FORM TO THE STAFF IN JULY

### TEST SIMULATIONS

- INTERIOR VELOCITY MEASUREMENTS
- AP600 WETTED FRACTION
- DOWNCOMER FLOW

A SERIES OF FOCUSED MEETINGS TO CLARIFY THE ISSUES AND EXCHANGE INFORMATION HAVE BEEN PLANNED.





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# SPES-2 Integral System Test Status

*E. J. Piplica*  
*Manager, AP600 Test Engineering*





## SPES-2 TEST RESULTS SUMMARY

### TRANSIENTS INITIATED FROM FULL POWER CONDITIONS COMPLETED TO DATE

- **INADVERTENT ADS ACTUATION (H-06)**
  - PERFORMED AS LAST PRE-OP TEST
  - ADS STAGE 1 OPENED AT FULL POWER
  - NO NON-SAFETY SYSTEM OPERATION
  - ADS ACTUATIONS BASED ON CMT LEVEL  
2ND AT 60%, 3RD AT 50%, 4TH AT 20%
  - ADS 4TH STAGE NOT OPENED
  
- **2-INCH COLD LEG BREAK (S00103)**
  - NO NON-SAFETY SYSTEM OPERATION
  - "2-INCH DIAMETER", SQUARE-EDGED BREAK ORIFICE

## SPES-2 TEST RESULTS SUMMARY (CONTINUED)



### TRANSIENTS INITIATED FROM FULL POWER CONDITIONS COMPLETED TO DATE

- 2-INCH COLD LEG BREAK (S00203)
  - REPEAT OF S00103
  - "2-INCH DIAMETER", ROUNDED ENTRANCE BREAK ORIFICE
  - REVISED ADS SETPOINTS AND VALVE SIZES
    - 1ST AT 67% CMT LEVEL, 2ND AND 3RD TIMED, 4TH AT 20% CMT LEVEL
  - PRHR HX ACTUATED ON "S" SIGNAL
  
- 2-INCH COLD LEG BREAK (S00303) ON 4/30
  - REPEAT OF S00203
  - PZR TO CMT BALANCE LINES DELETED
  - DATA PROCESSING IN PROGRESS
  - NO DIFFERENCES WITH S00203 OBSERVED
  
- 1-INCH COLD LEG BREAK (S00401) ON 5/6
  - NO NON-SAFETY SYSTEM OPERATION
  - DATA TAPE NOT YET RECEIVED
  - NO UNEXPECTED OCCURRENCES

## SPES-2 TEST RESULTS SUMMARY (CONTINUED)



TRANSIENTS INITIATED FROM FULL POWER CONDITIONS COMPLETED TO DATE

NEXT SCHEDULED TRANSIENTS

- 2-INCH COLD LEG BREAK (S00504)
  - SCHEDULED FOR WEEK OF 5/15/94
  - WILL INCLUDE NON-SAFETY SYSTEM OPERATION TO OBSERVE PASSIVE/NON-SAFETY SYSTEMS INTERACTION
- DVI LINE BREAKS - 2-INCH AND DEGB
- CL TO CMT BALANCE LINE BREAKS - 2-INCH AND DEGB

# **OVERVIEW OF APEX SCALING BASIS**

**For:  
AP600 Design Certification  
Westinghouse/NRC Senior Management Meeting**

**May 10, 1994**

**Presented By:  
Dr. José N. Reyes  
Oregon State University**

## SCALING OBJECTIVES

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- A. Obtain the similarity groups that should be preserved between the test facility and the full-scale prototype,
- B. Establish priorities for preserving similarity groups,
- C. Assure that important processes have been identified and addressed,
- D. Provide specifications for test facility design, and
- E. Quantify biases due to scaling distortions.

# HIERARCHICAL TWO-TIERED SCALING ANALYSIS METHOD

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- Developed by USNRC
- Documented in NUREG/CR-5809
- Comprehensive scaling methodology
- Ishii-Kataoka similarity criteria can be developed using H2TS method

## APEX Facility Scaling Ratios

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<u>Parameters</u>	<u>Scaling Ratio</u>
1. Length Scale	1:4
2. Time Scale	1:2
3. Velocity Scale	1:2
4. Flow Area Scale	1:48
5. Power Scale	1:96
6. Volume Scale	1:192
7. Pressure Scale*	~1:3
8. Mass Flow Rate	1:96

\*Can be varied by adjusting initial conditions in APEX.

## OSU SCALING AND FACILITY DESIGN



- TO FURTHER EXAMINE THE OSU FACILITY SCALING, THE OSU TEST FACILITY HAS BEEN COMPARED TO THE AP600 PLANT USING THE PRESSURE SCALING FACTORS
- OSU INITIAL STEADY-STATE CONDITIONS:

### REACTOR COOLING SYSTEM

CORE POWER	0.700 MWt
CORE FLOW	116.7 lb/sec
PRESSURIZER PRESSURE	400 psia
CORE INLET TEMPERATURE	410.4 °F
CORE OUTLET TEMPERATURE	415.6 °F

### SECONDARY

STEAM GENERATOR TEMPERATURE	407.6 °F
BREAK SIZE SIMULATED	2" cold leg break



## Conclusions

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- Preliminary comparisons of the NOTRUMP AP600 Plant and OSU APEX look favorable and support the pressure scaling approach to establish initial conditions in APEX.
- H2TS scaling methodology is comprehensive and traceable.
- Scaling analysis indicates that pressure scaled phenomena in the model will be representative of that expected in the full-scale AP600
- Long-term cooling behavior will occur when fluid property similitude exists. Processes occurring subsequent to ADS 4<sup>th</sup> stage depressurization will be modeled well in APEX.
- OSU APEX will provide sufficient long-term cooling data to benchmark the codes.

---

# Technical Brief on AP600 OSU Test Facility

Low Pressure Integral System Test - Facility Status  
for  
U.S. Nuclear Regulatory Commission  
Senior Management Meeting  
at Oregon State University

May 10, 1994

presented by

Moshe Mahlab, Manager  
OSU Test Facility Project  
Westinghouse Electric Corporation

# Presentation Outline

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- Program Objectives
- Facility Design
- Facility Construction and T/O
- Instrumentation and Control
- Data Acquisition System (DAS)
- Pre-operational Testings
- Facility Operation
- Data Reduction
- Matrix Test Schedule

# Objectives of OSU Test Program

---

- To provide data to validate the computer codes used in Westinghouse AP600 SSAR Analysis.
- Simulate gravity injection and natural convection due to small break in long-term cooling mode.
- Obtain data on the passive safety system performance
- To meet the objectives of the OSU program, the test facility incorporates:
  - All AP600 RCS and passive injection systems are modeled according to the scaling analysis
  - All interconnecting piping and pipe routing to more accurately represent form losses
  - A unique Break and ADS Measurement System (BAMS) to determine mass and energy releases
  - Over 750 data instrumentation to provide the data needed to validate the computational models

# Facility Design

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- Design pressure is 400 psia
- Design temperature is 450°F
- 1/4 linear scale
- 1/2 time scale
- Sizes are determined by scaling analysis performed by OSU

# Primary Systems

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- Simulated reactor vessel and internals
- Two simulated loops: Each with two cold legs, one hot leg, and one S/G
- Simulated pressurizer and surge line
- One simulated PRHR HX and associated loop
- Four simulated RCPs
- 48 heater rods simulating approximately 2% decay heat

# Injection Systems

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- Two simulated CMTs and two accumulators with associated piping
- Simulated IRWST with associated lines and a sparger
- Simulated containment sump and associated pipings
- Simulated ADS 1-4 stages
- Simulated DVI lines and pressure balance lines
- Simulated RNS RHR pump and lines from IRWST to reactor vessel
- Simulated sump injection at containment pressure in long-term cooling mode

## Break & ADS Flow Measurement System

---

- Designed to:
  - Separate 2 phase flow into steam and liquid for direct measurement
  - Simulate containment pressure increase over time
  - Provide for heated condensate return to IRWST and primary sump
  - Redundant/confirmatory steam flow measurement
  - All steam piping and moisture separators are heated



## Break & ADS Flow Measurement System (Cont.)

---

- Break simulation at hot leg
- Break simulation at cold leg (top and bottom)
- Break simulation at CMT - Cold leg pressure balance line
- Break simulation at the DVI injection line
- Flow separators and flow measurement system
- Condensate makeup system

# Auxiliary Systems

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- Feedwater System
- Vent and Drain System
- S/G Blowdown System
- Water Makeup System
- Water Treatment System
- Nitrogen Pressure System
- Electrical Power Supply
- Grounding
- UPS

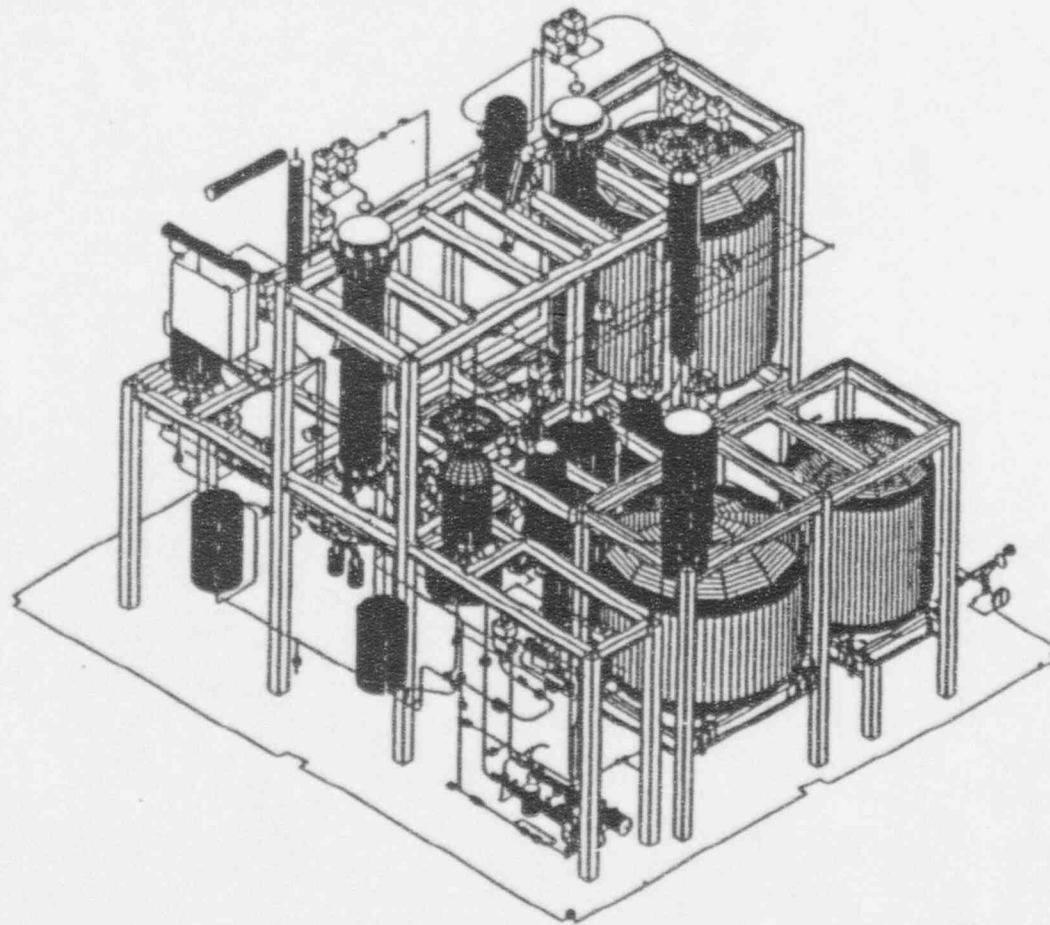
# Building Services

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- Structure/Floors/Platforms
- Fire Protection
- HVAC
- Instrument Air Supply
- Insulation
- Heat Tracing
- Lighting

# AP600 Low Pressure Integral System Test Isometric

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# Facility Construction

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- Constructor - The Industrial Company (TIC), Northwest
- Construction Manager - Jim Nylander
- TIC is an ASME Section I and Section VIII Certificate Holder with U, R, A Vessel Stamps and Power Piping Stamp
- TIC developed and implemented a QA/QC program for the OSU test facility
- TIC provided on-site Q/A, Q/C manager to follow the construction quality
- TIC provided an onsite, full instrument calibration service

# Construction Turnover

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- System walkdown
- Generation of punch list items
- System flushing
- System hydrotest (1.5 design pressure)
- Vessels and piping accepted by the A/I
- Systems and component documentation records were prepared and submitted to Westinghouse/OSU
- Electrical system accepted by the State Inspector
- Westinghouse has performed an independent review of all pressure vessels
- Westinghouse has performed static and dynamic piping and support analysis for all high energy lines and all break piping and equipments
- Facility turned over to OSU on March 31, 1994 for hot shake-down testing

# Instrumentation and Control

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- Use of commercial reliable instrumentation
- Design instrumentation to obtain system wide, and component mass/energy balances by direct measurement or calculated from data
- Supply redundant measurements when possible
- Control process instrumentation is separated from the data acquisition system



# Instrumentation and Control (Cont.)

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- Total of 754 instruments measuring flow, differential pressure drops, levels, heat flux, phase, power, and temperature
  - 118 Differential Pressure Detectors
  - 42 Pressure Transmitters
  - 25 Magnetic Flow Meters
  - 5 Turbine Flow Meters
  - 6 Vortex Flow Meters
  - 5 RMS - Power kW Meters
  - 12 Load Cells
  - 12 Heated Phase Switches
  - 53 Heat Flux Meters
  - 16 Heat Trace Thermocouples
  - 405 Thermocouples
  - 7 Process Controllers
  - 48 Solenoids with Limit Switches



# Instrumentation and Control (Cont.)

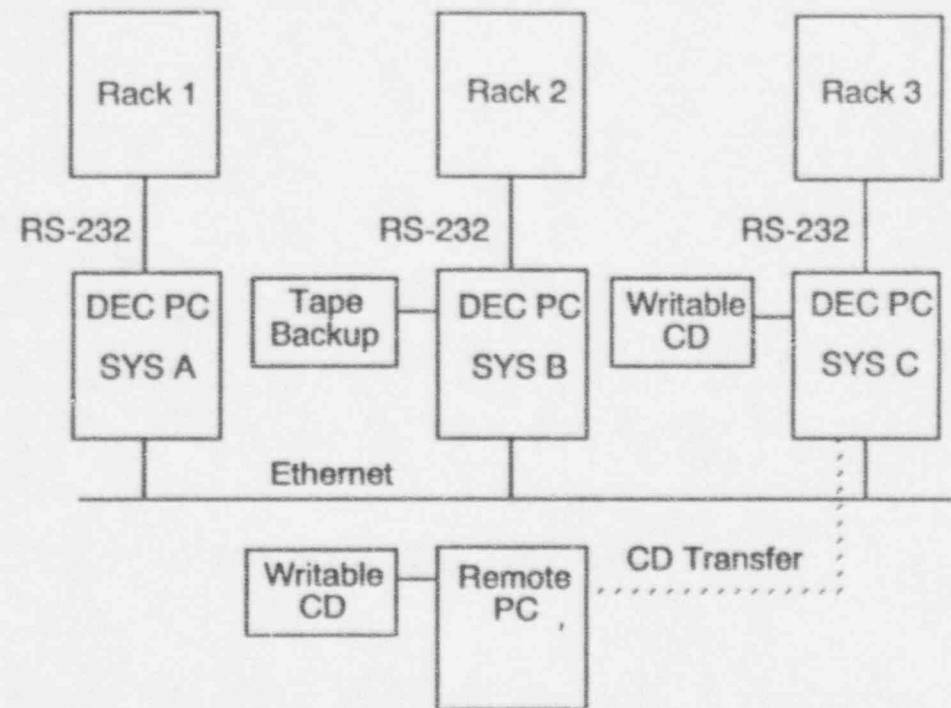
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## Control System

- The control system is independent from the Data Acquisition System (DAS)
- Several field signals are being duplicated to be used in the control system for setpoint detection, alarms and annunciation
- The control system is based on PLC (OMRON) hardware and on process control devices (Fischer Porter)
- The Control System Documents are
  - The setpoint documents
  - The facility logic diagrams
  - The PLC ladder logic diagram
  - The process control devices programming
  - The control logic test procedure
  - The control logic test report

# Data Acquisition System

- Monitors 750 data points
- Maximum scan rate is 1 channel per second in burst mode
- A 12 channel strip chart used for selected instruments
- Data stored and transmitted to Energy Center on CD ROM
- Software validated to NQA-1
- Signals from the control panel will be restored on dedicated PC



# Pre-operational Testing

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- Cold and hot pre-operational tests used to characterize the system and components of the facility
- Cold pre-operational testings included
  - Vessels Volume Determination
  - Lines flows vs. pressure drops including flow orifice sizing and testings
  - Pumps flow curves
  - Simulated control logic testings
  - Instruments calibration and testings
  - Background electrical noise measurement

# Hot Pre-operational Testing

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- Ambient heat loss determination
- Steady-state characteristics at various power levels
- Obtain data to determine the PRHR HX, S/G, and CMT performance at various plant power levels
- The capability and performance of the BAMS
- Obtain data to verify the algorithm for the decay power
- Obtain data to verify valve actuations and flow injection values
- Verify the performance of DAS under test conditions

# QA and Configuration Management

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- Developed and implemented a specific Project Quality Plan (PQP) for the test facility for design, construction and testing
- The PQP is focused on assuring the quality of the:
  - Plant physical data
  - The instrumentation data measurements
  - Personnel safety
  - Protection of the investment
  - A set of as-built facility data has been generated and is controlled. This set of data is intended to be the basis for the facility description report
  - A detailed software validation program was established for the project to assure the quality of the measured data

# Onsite Test Data Handling

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- Objective
  - Verify that individual test requirements have been met
  - Prepare “day-of-test report”
- Procedure
  - Download data from DAS PCs to CD ROM including display files, continuous monitoring files, burst data files, and configuration files
  - Break data files into 1.4 MB size with matrix format and convert to engineering units
  - Record the formatted files on CD ROM for analysis at the Westinghouse Energy Center
  - Plot display files on hard copy

# Site Operation and Testing Staff

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## Program Manager

Dr. J. Reyes

### Data Processing

V. Nayyar

L. Ross\*\*

D. Wert\*\*

### Operators

J. Groome-Mgr

J. Haitis

M. Yundt

M. Miller

C. Bexter

### Test Engineer

C Dumdsay-Mgr

R. Ferrel

J. Schlaman

M. Carter

### Tech Support

F. Kengle

D. Holland\*\*

R. Klein\*

Dave Dody\*

\*\*Service Contract - as needed basis

\*TIC-Contractor



# Operation

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- Operators are trained and qualified to operate the facility
- Operation and maintenance procedures are in place
- Spare parts are stored onsite
- Instrument calibration lab is in operation
- OSHA and F/P evaluation has been completed
- Emergency operating procedures are approved and were incorporated into the Radiation Center safety procedures
- Operating permit was obtained from the State



## Matrix Test Schedule (2 Week Intervals)

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SB01	April 1-21	Prepare and Review Test Procedure
	July 1-7	Perform Test
	July 8-11	Prepare and Issue Day-of-Test Report
	July 13-14	Prepare Determination on Proceeding to SBO4
	August 9	Issue SB01 Quick Look Report
SB13	Sept. 16-22	Perform LAST Category 1 Test
SB19	Feb 2-8, 1995	Perform LAST Category 2 Test
	May 2, 1995	Final Test Report

# Readiness Review

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- Scheduled May 11 and 13
- Will be conducted by Westinghouse Test Engineering, Safety and Licensing, Project Engineering with Utility, DOE and EPRI representation
- NRC has been invited to observe
- Expect to concur with the initiation of matrix testing by May 20, 1994

## **PRA CONCERNS**

- **RAI RESPONSES ARE TIMELY  
BUT LACK SUBSTANCE**
  
- **PRA DOES NOT REFLECT  
CHANGED PLANT DESIGN**
  
- **STAFF AWAITING INFO ON  
MAAP AND NOTRUMP**
  
- **ADEQUACY OF RESPONSE  
TO OUTSTANDING RAI'S  
MUST BE ASSURED**
  - **SEISMIC METHODOLOGY**
  - **SHUTDOWN EVENTS**
  - **HUMAN RELIABILITY**
  - **CONTAINMENT BYPASS**
  - **I&C FAILURES**

AP600 REVIEW SCHEDULE

VENDOR TESTING AND ANALYSIS PROGRAMS--REACTOR SYSTEMS

PROJECTED COMPLETION DATES FOR TEST PROGRAM REVIEWS

VENDOR COMPLETION DATES: FIRST DATE IS COMPLETION OF TEST PROGRAM; SECOND DATE IS ESTIMATED DATE OF SUBMITTAL OF FINAL REPORT  
 REVIEW COMPLETION DATE IS ESTIMATED DATE OF TEST PROGRAM REVIEW (DOES NOT INCLUDE REVIEW OF APPLICABLE COMPUTER CODES)

<u>TEST PROGRAM</u>	<u>VENDOR COMPLETION DATES (EST)*</u>		<u>REVIEW COMPLETION DATE**</u>
	<u>TEST</u>	<u>REPORT</u>	
CMT	9/94	11/94	2/95
ADS PHASE B	10/94	12/94	3/95
SPES-2	11/94	3/95	6/95
OSU/APEX	2/95	5/95	8/95

\*WESTINGHOUSE HAS IDENTIFIED "CATEGORY 1" AND "CATEGORY 2" TESTS FOR EACH PROGRAM. CATEGORY 1 TESTS ARE THOSE DETERMINED BY WESTINGHOUSE TO BE ESSENTIAL FOR DSER PREPARATION. DATES FOR COMPLETION AND DOCUMENTATION (QUICK-LOOK REPORTS) OF CATEGORY 1 TESTS ARE APPROXIMATELY 3-6 MONTHS EARLIER THAN SHOWN FOR TEST PROGRAM COMPLETION DATES.

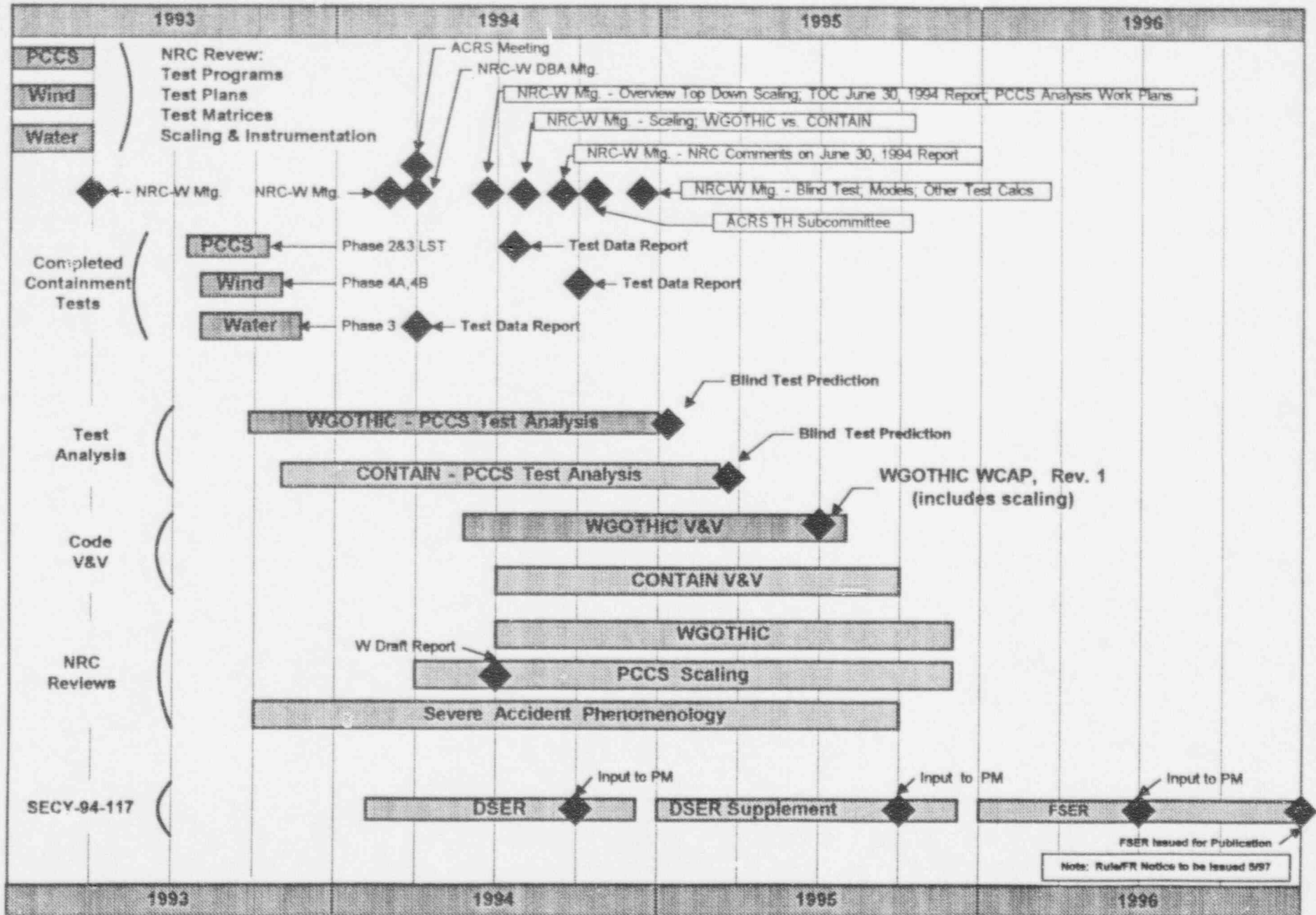
\*\*REVIEW COMPLETION DATES SHOWN ASSUME THE FOLLOWING:

- PROMPT RESOLUTION OF ALL CURRENT OUTSTANDING TESTING ISSUES
- COMPLETION OF VENDOR TESTING AND FINAL REPORT PER SCHEDULE SHOWN
- PROMPT SUBMISSION OF TESTING DATA IN QUICK-LOOK REPORTS TO PERMIT EARLY STAFF REVIEW

STAFF IS PREPARED TO CONTINUE TEST PROGRAM REVIEWS UPON RECEIPT OF TEST DATA FROM TEST PROGRAMS IN PROGRESS OR COMPLETED (DNB, CMT, SPES)

<u>COMPUTER CODE</u>	<u>SUBMISSION DATE</u>	<u>REVIEW COMPLETION DATE</u>
WCOBRA/TRAC	/93	8/95
NOTRUMP	11/94	8/95
LOFTTRAN	11/94	8/95

# SCSB Review Status for AP600 Testing & Analysis



NRC/WESTINGHOUSE SENIOR MANAGEMENT MEETING  
MAY 10, 1994

ACTION ITEMS

1. Westinghouse will perform and submit to the staff, a sensitivity study on the effect of containment backpressure on key DBA transients and prepare a position with regard to the acceptability of decoupling system transient analysis from containment analysis. Due June 30, 1994.
2. The NRC staff will review the sensitivity study and position from Item 1 and reflect its conclusion in the November 1994, DSER.
3. It was agreed that the cutoff dates of June 30, 1994, for non-testing related information and July 31 for testing related information are still valid for the November 1994, DSER.
4. Westinghouse will develop and status a listing of tests and testing related deliverables scheduled to be completed by July 31, 1994. Progress will be reviewed in the weekly testing program conference calls.
5. Westinghouse will meet with the staff to review staff concerns on the AP600 PRA and develop detailed plans to address these concerns.
6. Westinghouse will propose an approach to evaluate potential uncertainties in the performance of passive safety systems on the PRA with the objective of using the results to examine the adequacy of the planned matrix tests.
7. The staff will develop outlines for those sections of the DSER dealing with vendor-sponsored test programs and related computer code validation and verification activities. These sections will address each testing program, its stated purpose, test objectives, facility description, scaling, test matrix, and the status of test monitoring activities, quality assurance reviews, pre-test predictions, analyses activities, etc.
8. Westinghouse will review the outline developed in Item 7 and provide comments with regard to timely availability of test program results for the November 1994, DSER.
9. Westinghouse will define the relationship between test results and code activities that are critical to preparation of the DSER supplement and/or the FSER.
10. The November DSER will include staff positions on each vendor-sponsored test facility to the extent possible.
11. a) Westinghouse will review the results of Items 7, 8, and 9 and develop further recommendations on schedule optimization for DSER supplement and FSER



- b) Westinghouse and NRC will meet again on May 25, 1994, for further schedule discussions.
- 12. The staff will review the process for reviewing, communicating, evaluating the ROSA test results to Westinghouse.
- 13. The staff will develop the technical approach for severe accidents and outline appropriate DSER sections to ensure the subject is addressed in the November 1994, DSER.
- 14. The staff will provide feedback to Westinghouse on the tests selected for blind test predictions no later than May 27, 1994.
- 15. The staff will check to insure that all applicable PCCS test data reports (Quick Look Reports) have been forwarded to it's consultants.
- 16. The staff will prepare an RAI on AP600 plant shutdown operating procedures.
- 17. Westinghouse will look at the effects of initiating both PRHR heat exchangers to ensure that the tests matrices envelope the most challenging DBA operating conditions.
- 18. The staff will review the material in the February 15, 1994, AP600 design change summary to determine if it believes that the MSLB test at SPES-2 should be run earlier in the program.
- 19. The staff will request the Vendor Inspection Branch, NRR to review Westinghouse test facilities and documentation to ensure that the appropriate QA procedures are in place and are being followed.
- 20. The next senior management meeting (SMM) will be held in late-June 1994, in Rockville, Maryland. Another meeting will be in mid-August in Monroeville, Pennsylvania. SMMs will then be held at six-week intervals until the DSER is issued in November 1994.
- 21. The NRC staff will advise the Commission if any of the positions it has taken in test program SECY papers need to be revised. The staff will also describe any revised technical positions related to testing in the November DSER.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

May 3, 1994

Docket No. 52-003

MEMORANDUM FOR: W. Russell                    G. Lainas                    C. Rossi  
                          F. Miraglia                    J. Roe                        R. Wessman  
                          A. Thadani                    J. Zwolinski                B. Boger  
                          L. Reyes                      E. Adensam                C. Thomas  
                          D. Crutchfield               B. Grimes                   F. Congel  
                          W. Travers                   B. Sheron                   E. Butcher  
                          F. Gillespie                  B. D. Liaw                  W. Bateman, EDO  
                          S. Varga                      R. Jones                    J. Caldwell  
                          J. Calvo                      M. Virgilio                  Operations Center

THRU: R. W. Borchardt, Director <sup>B</sup>  
 Standardization Project Directorate  
 Associate Directorate for Advanced Reactors  
 and License Renewal, NRR

FROM: Frederick W. Hasselberg, Project Manager  
 Standardization Project Directorate  
 Associate Directorate for Advanced Reactors  
 and License Renewal, NRR

SUBJECT: DAILY HIGHLIGHT - NOTICE OF SENIOR MANAGEMENT MEETING WITH  
 WESTINGHOUSE

DATE AND TIME: May 10, 1994 (8:30 a.m. - 4:30 p.m.)

LOCATION: USDA National Forage Seed Production Research Center  
 Conference Room  
 3450 SW Campus Way  
 Oregon State University  
 Corvallis, Oregon 97330

PURPOSE: To discuss the status of design certification review  
 activities of the Westinghouse AP600 design. A tour of the  
 Oregon State University (OSU) Advanced Passive Experimental  
 (APEX) test facility will follow the meeting. A proposed  
 meeting agenda is enclosed.

NOTE: Proprietary features of the AP600 design will be  
 discussed.

9405100122



May 3, 1994

PARTICIPANTS*:	<u>NRC</u>	<u>WESTINGHOUSE</u>
	W. Russell	R. M. Vijuk
	A. Thadani	B. McIntyre
	D. Crutchfield	E. Piplica
	D. McPherson	L. Hochreiter
	A. Levin	M. Mahlab
	F. Hasselberg	J. Reyes
		J. Butler

*Original Signed By*

Frederick W. Hasselberg, Project Manager  
Standardization Project Directorate  
Associate Directorate for Advanced Reactors  
and License Renewal, NRR

Enclosure:  
As stated

cc w/enclosure:  
See next page

\*Meetings between NRC technical staff and applicants or licensees are open for interested members of the public, petitioners, intervenors, or other parties to attend as observers pursuant to the "Open Meetings and Statement of NRC Staff Policy," 43 Federal Register 20858, June 28, 1978. However, portions of this meeting may be closed to protect Westinghouse proprietary information. Members of the public who wish to attend should contact me at (301) 504-1141.

Westinghouse Electric Corporation

Docket No. 52-003

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Nuclear and Advanced Technology Division  
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