Westinghouse Electric Corporation
Energy Systems

Box 355
Pittsburgh Pennsylvania 15230-0355

AW-93-421

February 24, 1993

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

ATTENTION: MR. R. W. BORCHARDT

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

SUBJECT: SLIDES FROM THE FEBRUARY 24, 1993 AP600 PRESENTATION TO THE U.S. NUCLEAR REGULATORY COMMISSION

Dear Mr. Borchardt:

The application for withholding is submitted by Westinghouse Electric Corporation ("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 report. In conformance with 10CFR Section 2.790, Affidavit AW-92-421 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 10CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to this application for withholding or the accompanying affidavit should reference AW-93-421 and should be addressed to the undersigned.

Very truly yours,

P. J. Morris /for

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

/nja

cc: M. P. Siemien Office of the General Counsel, NRC
L. Barnett NRC (12H5)

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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 10CFR 2.790 of the commission's regulation 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 on the brackets remain, the information that was 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 Section (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10CFR2.790(b)(1).

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

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COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Peter J. Morris, 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 Corporation ("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:

Peter J. Morris

Peter J. Morris, Manager
Strategic Safety and Regulatory Issues

Sworn to and subscribed
before me this 24th day
of February, 1993

Lorraine M. Piplica

Notary Public

Notarial Seal
Lorraine M. Piplica, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Dec. 14, 1995
Member, Pennsylvania Association of Notaries

(1) I am Manager, Strategic Safety and Regulatory Issues, in the Nuclear and Advanced Technology Division, of the Westinghouse Electric Corporation 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 Energy Systems Business Unit.

(2) I am making this Affidavit in conformance with the provisions of 10CFR 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 Energy Systems Business Unit in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

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

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

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

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10CFR 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) Enclosed is Letter ET-NRC-93-3827, February 1993, being transmitted by Westinghouse Electric Corporation (W) letter and Application for Withholding Proprietary Information from Public Disclosure, N. J. Liparulo (W), to Mr. R. W. Borchardt, Office of NRR. The proprietary information as submitted for use by Westinghouse Electric Corporation is in response to questions concerning the AP600 plant and the associated design certification application and is expected to be applicable in other licensee submittals in response to certain NRC requirements for justification of licensing advanced nuclear power plant designs.

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

(a) Demonstrate the design and safety of the AP600 Passive Safety Systems.

(b) Establish applicable verification testing methods.

(c) Design Advanced Nuclear Power Plants that meet NRC requirements.

(d) Establish technical and licensing approaches for the AP600 that will ultimately result in a certified design.

(e) Assist customers in obtaining NRC approval for future plants.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting NRC requirements for advanced plant licenses.

(b) Westinghouse can sell support and defense of the technology to its customers in the licensing process.

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 advanced nuclear power designs and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

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

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended for developing analytical methods and receiving NRC approval for those methods.

Further the deponent sayeth not.

NON PROPRIETARY VERSION

OF

PRESENTATION FOR FEBRUARY 24, 1993

WITH THE U.S. NRC

WESTINGHOUSE ELECTRIC CORPORATION

PRESENTATION

TO

UNITED STATES

NUCLEAR REGULATORY COMMISSION

WESTINGHOUSE ENERGY CENTER

FEBRUARY 24, 1993

WESTINGHOUSE/NRC MANAGEMENT MEETING

FEBRUARY 24, 1993
AGENDA

INTRODUCTION	H. J. BRUSCHI
AP600 PROGRAM OVERVIEW AND SCHEDULE	B. A. McINTYRE
INTERNATIONAL PARTICIPANTS	S. L. KEANEY
PROBABILISTIC RISK ASSESSMENT	C. L. HAAG
REGULATORY TREATMENT OF NONSAFETY SYSTEMS	T. L. SCHULZ
INSPECTIONS, TESTS, ANALYSES AND ACCEPTANCE CRITERIA	B. A. McINTYRE
TESTING	E. J. PIPLICA

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INTRODUCTION

H. J. BRUSCHI, GENERAL MANAGER

ADVANCED TECHNOLOGY BUSINESS AREA

AP600 PROGRAM OVERVIEW

AND

SCHEDULE

B. A. McINTYRE, MANAGER

ADVANCED PLANT SAFETY & LICENSING

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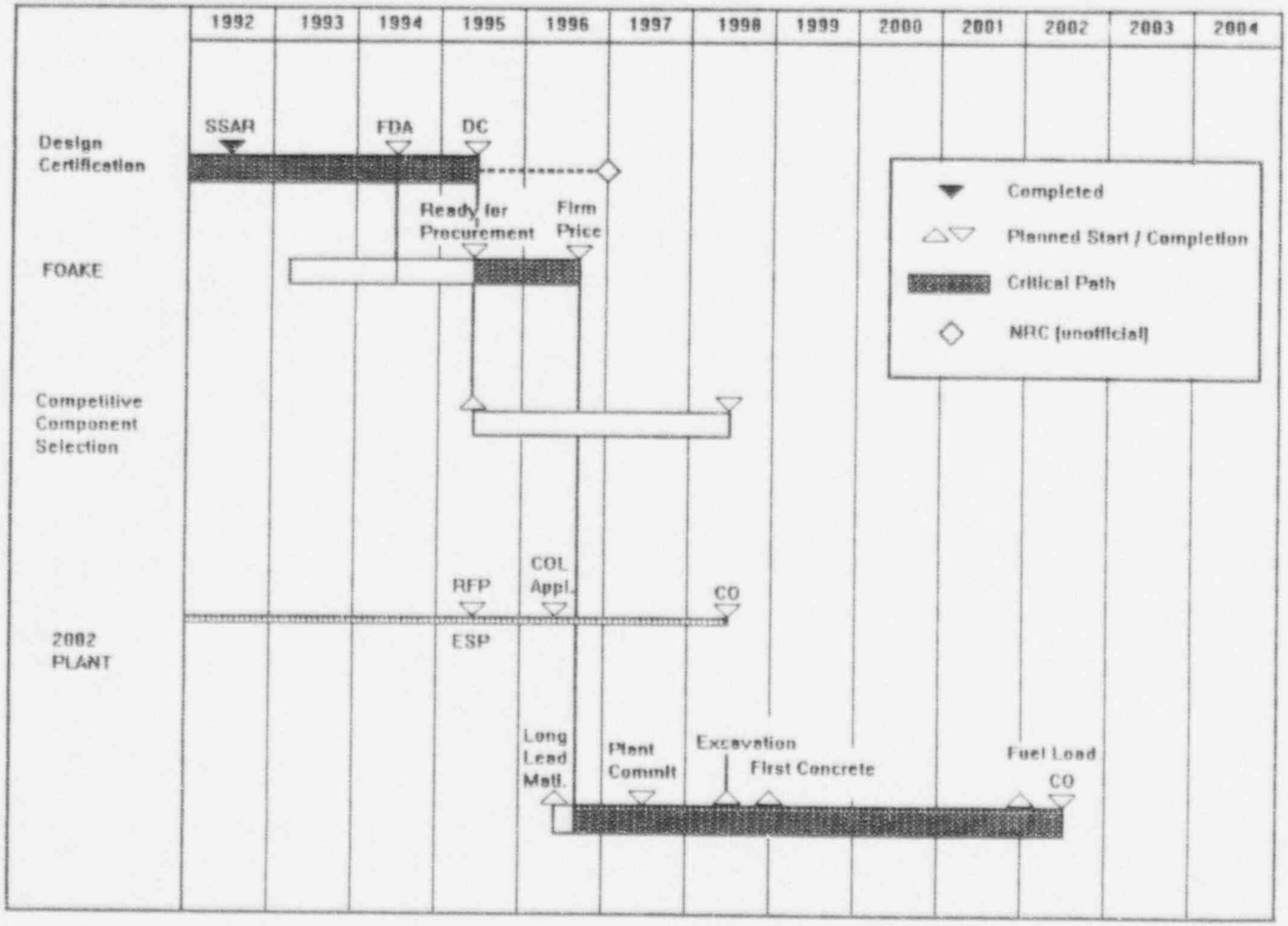
AP600 PROGRAM SCHEDULE



DESIGN CERTIFICATION ISSUES IMPACTING FOAKE

AP600

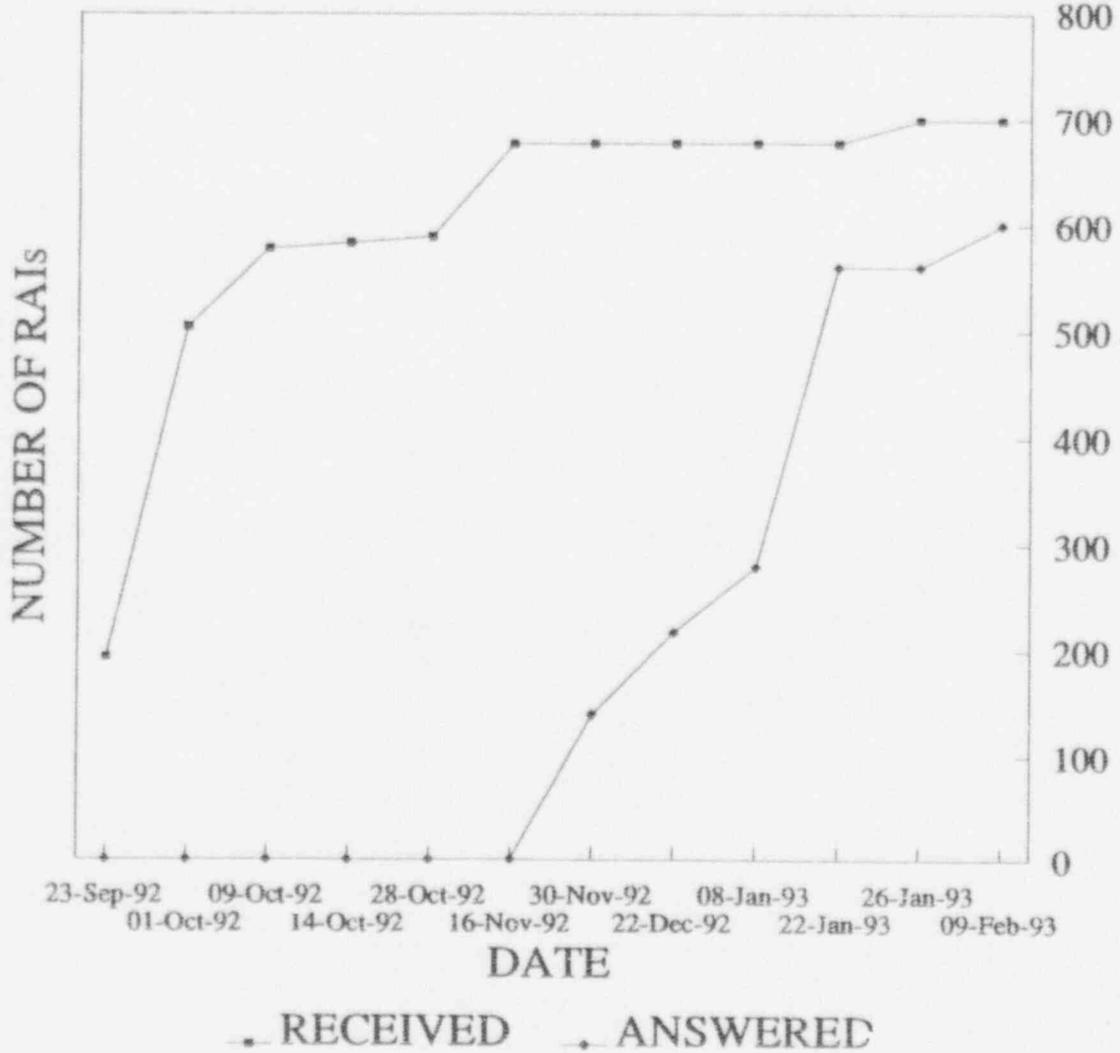
- ITAAC TESTING REQUIREMENTS
  - SYSTEM AND EQUIPMENT DESIGN REQUIREMENTS
  - PLANT LAYOUT
- REGULATORY TREATMENT OF NONSAFETY SYSTEMS
  - EQUIPMENT SPECIFICATIONS
  - CONTROL ROOM DESIGN
  - EMERGENCY RESPONSE GUIDELINES
- SOURCE TERM
  - EQUIPMENT QUALIFICATION
  - PLANT LAYOUT

AP600 TESTING MEETINGS

- AP600 Testing Program Review Meetings (December '92 - April '93):

December 9, 1992	-	OSU Tests Detailed Review
December 10, 1992	-	SPES-2 Tests Detailed Review
February 25, 1993	-	CMT Tests Detailed Review & Facility Visit
March 9-10, 1993	-	Test Program Review and Facility Visits
March 23-24, 1993	-	Containment Tests Review and Facility Visits
April 20, 1993	-	ADS Tests Review and Facility Visit
April 22, 1993	-	SPES-2 Tests Review and Facility Visit

AP600 RAI SUMMARY



AP600 REGULATORY TREATMENT OF NONSAFETY SYSTEMS

AP600

- THE KEY AP600 LICENSING ISSUE
  - PLANT DESIGN PHILOSOPHY
  - ITAAC
  - TECHNICAL SPECIFICATIONS
  - RELIABILITY ASSURANCE PROGRAM
- JANUARY 22 AGREEMENT IN PRINCIPLE IN LINE WITH WESTINGHOUSE APPROACH
- WORKING CLOSELY WITH ALWR USC
  - DEVIL IN THE DETAILS

INTERNATIONAL PARTICIPANTS

S. L. KEANEY, MANAGER

PROGRAM CONTROL AND

CONTRACT ADMINISTRATION

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AP600 INTERNATIONAL PARTICIPATION

COUNTRY	AGENCY/ ORGANIZATION	SCOPE OF WORK
Argentina*	CNEA - Comision National de Energia Atomica	TBD
Bulgaria*	NEK - Natsionalona Eleckricheska Kompania	TBD
Croatia*	Ministry of Industry, Energy & Shipbuilding; Croatian Electricity Generating Board	TBD
Czechoslovokia	Czech Power Board	Nuclear Safety Analysis
Egypt*	NPPA - Nuclear Power Plants Authority	TBD

AP600 INTERNATIONAL PARTICIPATION

COUNTRY	AGENCY/ ORGANIZATION	SCOPE OF WORK
Finland*	IVO - Imatron Voima Oy	TBD
Indonesia	BATAN - Badan Tenaga Atom Nasional BPPT - Badan Pengkajan dan Penerapan Teknologi PLN - Perusahann Umum Listrik Negara	plant layout; structural analysis; BOP design; electrical design; testing support
Italy	SOPREN/ANSALDO - (W) NSSS systems licensee	system and component design; testing; core design; fluid systems design; PCCS design studies

AP600 INTERNATIONAL PARTICIPATION

COUNTRY	AGENCY/ ORGANIZATION	SCOPE OF WORK
Italy	ENEA - Comitato Nazionale per la Ricerca e per lo Sviiuppo Dell 'Energia Nucleare e delle Energie Alternatice	ADS testing; full height, full pressure integral systems tests; safety system analysis
	ENEA-CRE (research branch of ENEA); part of four party Technical Cooperation Agreement	ADS testing; ADS valve testing
	ENEA-DISP (regulatory branch) subcontractor to SOPREN/ANSALDO	fluid systems design; in-service inspection requirements; containment analysis
	ENEL - Ente Nazionale per L'energia Electrica	probabilistic safety studies; LOCA; severe accident analysis

AP600 INTERNATIONAL PARTICIPATION

COUNTRY	AGENCY/ ORGANIZATION	SCOPE OF WORK
Italy	FIAT-CIEI - Componenti e Impianti per L'Energia e L'Industria; subcontractor to SOPREN/ANSALDO and direct participant	fluid systems; NSSS component design (RV internals, integrated head package, fuel handling system)
	Belleli - engineering company; subcontractor to SOPREN/ANSALDO	design of passive residual heat removal heat exchanger
	SIET - Societe Informazioni Esperienze Termoidrauliche; research company (shareholders = ENEL and ENEA)	full height full pressure integral systems tests

AP600 INTERNATIONAL PARTICIPATION

COUNTRY	AGENCY/ ORGANIZATION	SCOPE OF WORK
Japan	JAPC - Japan Atomic Power Company	I&C design, BOP
Latvia*	Latvia Academy of Sciences	TBD
Lithuania*	Lithuanian Ministry of Energy	TBD
Poland	IEA - Institute of Atomic Energy	safety analysis; PRA; equipment design; BOP design
Spain	ENDESA - Empresa Nacional de Electricidad SA (through EPRI)	fluid systems; NSSS design
	ENUSA	nuclear safety analysis

AP600 INTERNATIONAL PARTICIPATION

COUNTRY	AGENCY/ ORGANIZATION	SCOPE OF WORK
Spain	INITEC - Empressa Nacional de Ingenieria y Technologia	PSARV module analysis; structural steel framing; floor slabs, NI basemat
	UNESA - Unidad Electrica SA	I&C; Reactor Vessel; Pressurizer, NI module design
	UTE - Initec/Agrupacion JV	piping system analysis; piping modules design; electrical equipment specifications; plant design and layout inside containment
Thailand*	EGAT - Electricity Generating Authority of Thailand	TBD

* Currently under negotiation

PROBABILISTIC RISK ASSESSMENT

C. L. HAAG, SENIOR ENGINEER

RISK MANAGEMENT AND

OPERATIONS IMPROVEMENT

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AP600 PRA

AGENDA

- Passive System Reliability
- Initiating Event Evaluation
- Sensitivity Studies of Nonsafety Systems
- PRA Insights and System Importance

PASSIVE SYSTEM RELIABILITY

AP600 PRA

PASSIVE SYSTEM MODELING

- **Input to calculate system reliability**
  - Detailed design information
  - System success criteria for each initiating event
  - Initial system configuration
  - Required support systems

- **Develop and quantify system fault trees**

- **Example illustrates calculation of Passive RHR reliability**

EXAMPLE PRHR SYSTEM INPUT

- **Detailed Design Information**
  - System Specification Document
    - System Functions
    - System Description
    - Maintenance and Testing
    - Equipment Description
    - Instrumentation and Controls
    - Electrical Power
    - System Interfaces
  - Piping and Instrumentation Diagrams
  - Major equipment drawings
  - Pipe routing drawings
  - Plant arrangement drawings
  - Technical Specifications

EXAMPLE PRHR SYSTEM INPUT

- **Initiator**
  - Transient event
- **Success Criteria**
  - PRHR to remove decay heat from RCS
  - 1/2 AOVs on HX outlet line must open
- **Initial System Condition**
  - Both AOVs normally closed
  - AOVs fail open on loss of air or power
- **Mission Time**
  - 24 hours
- **Support Systems**
  - Actuated by: Protection and Monitoring System
Diverse Actuation System

AP600 PRA

FAILURE CONSIDERATIONS IN A PRHR
FAULT TREE

- **Equipment Failures**
  - AOVs fail to open
  - IRWST ruptures
  - Plugging of flow venturi
  - Instrumentation and control equipment

- **Test/Maintenance Consideration**
  - AOVs tested every 3 months
  - System available during test
  - Component maintenance unavailability

AP600 PRA

FAILURE CONSIDERATIONS IN A PRHR
FAULT TREE

- **Operator Actions**
  - When automatic actuation fails:
    - Operator fails to recognize need for decay heat removal
    - Operator fails to actuate PRHR AOVs

- **Common Cause Failures**
  - Failure of AOVs
  - Instrumentation and Control

AP600 PRA

OTHER FAILURE CONSIDERATIONS OF PRHR

- **Gas Binding in PRHR HX**
  - Alarmed in control room
  - Venting performed after maintenance/inspection
  - H2 in RCS is saturated at 30 psig so it can not come out of solution
  - PRHR HX not required at RCS pressure where accumulator could empty (<100 psig)

- **Heat Transfer Performance**
  - Performed AP600-specific heat transfer test (full pressure/temp)
  - Verify with ITAAC (full pressure/temp)
  - Test HX every refueling (intermediate pressure/temp)

- **Appropriately not modeled in fault tree**

AP600 PRA

SYSTEM RELIABILITY DATA

- **Primary Source**
  - ALWR Utility Requirements Document (Volume III)

- **Secondary Sources**
  - NUREG/CR-2728 (IREP)
  - NUREG/CR-2815 (NREP)
  - NUREG/CR-4550
  - WASH-1400
  - IEEE Std 500
  - Westinghouse

AP600 PRA

PRHR SYSTEM RELIABILITY

- **Calculated PRHR system reliability**
  - Unavailability calculated to be 7.7E-5

- **Equipment in PRHR system similar in duty and design to operating plants which justifies the use of historical equipment reliabilities.**
  - Single AOV fail to open 1.1E-3
  - Both AOVs fail to open 1.2E-6
  - Common cause failure of AOVs 6.2E-5

INITIATING EVENT EVALUATION

AP600 PRA

INITIATING EVENT EVALUATION

- **Initiating event frequencies for AP600 are based on historical data and AP600-specific analysis**

- **Transients**
  - Detailed review of operating experience at 51 PWRs from 1984 to mid-1989 (INPO data). Adjusted data as appropriate to account for reduced number of loops.

- **Loss of Offsite Power**
  - Frequency based on ALWR URD data

- **Loss of Coolant Accidents**
  - LOCAs are AP600-specific pipe break analysis

- **Support System Initiators**
  - Based on AP600-specific fault tree analysis. Includes loss of CCW, SW, and Compressed Air

AP600 PRA

INITIATING EVENT FREQUENCY DEPENDENCY VS NSS/DID SYSTEMS

Initiating Event	NSS System	DID System
Transients:		
Turbine trip	x	
Loss of feedwater flow	x	
Secondary to primary side power mismatch	x	
Core power excursion	x	
Spurious S-signal	x	
Loss of CCW		x
Loss of SW		x
Loss of compressed air	x	
Main steamline break downstream of MSIV		
Main steamline break upstream of MSIV		
Main steam line safety valve stuck open		
LOOP	x	
LOCAs:		
Large LOCA		
Medium LOCA		
CMT line break		
SI line break		
Small LOCA		
Very small LOCA		x
PRHR tube rupture		
SGTR		
Vessel rupture		
ATWS	x	

AP600 PRA

EXAMPLE LOCA INITIATING EVENT
FREQUENCY CALCULATION

- **Very Small LOCA**
  - Ruptures in pipes less than 3/4 inch diameter
    - Pressurizer level instrumentation lines
    - Miscellaneous primary system lines < 3/4 inch
  - Frequency calculation equation

    Pipe rupture failure rate x number of pipe sections
  - Initiating event frequency is 5.5E-04 /yr

AP600 PRA

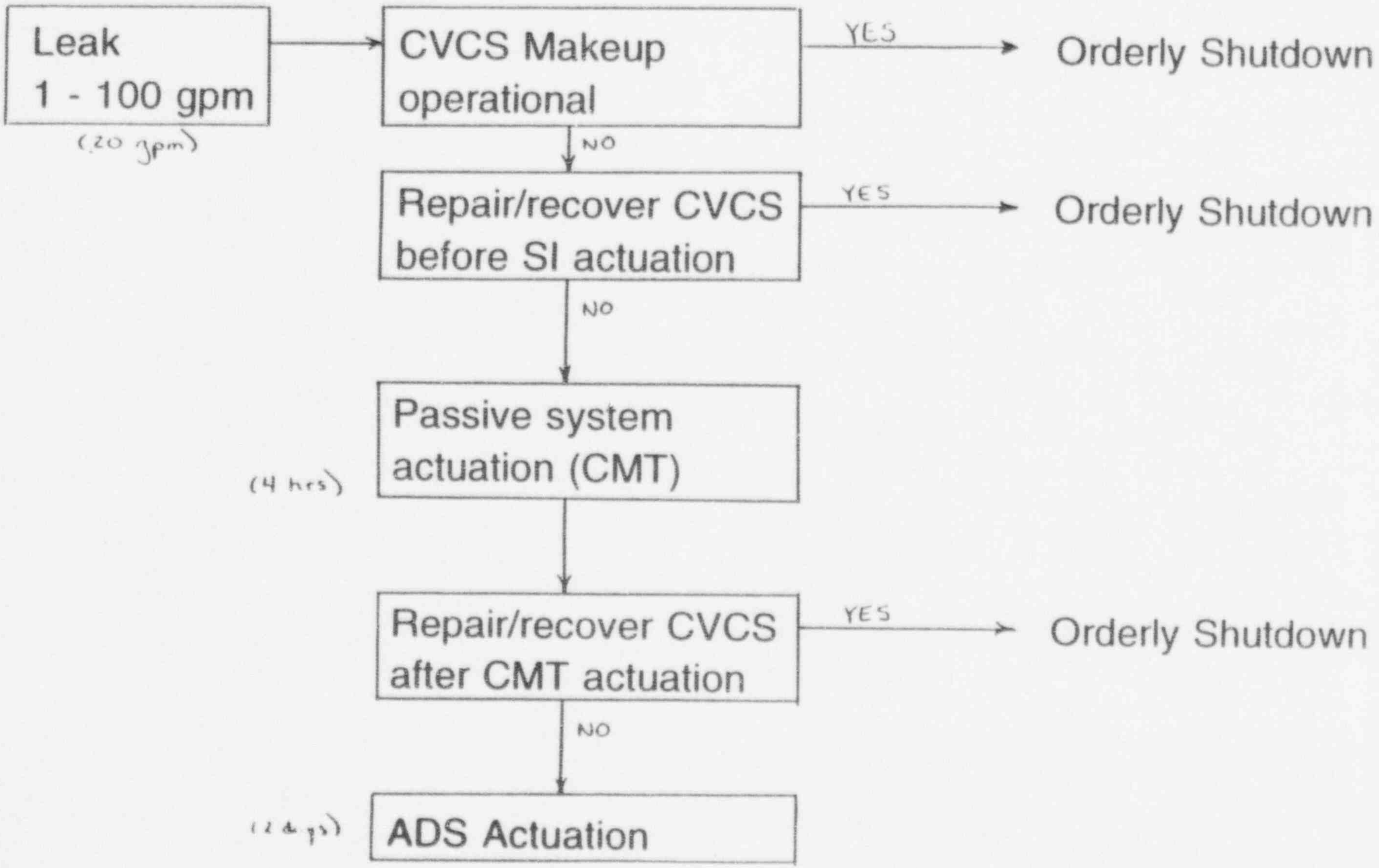
LEAKAGE EVENTS

- **NRC/Brookhaven reported 39 leakage events (1 gpm - 100 gpm)**
- **Westinghouse reviewed events and determined 5 at power events apply to AP600**

NRC #	LER #	Description	Leak (gpm)
17	323-89006	Pzr SV seal	10.0
20	339-91011	RHR valve packing	10.0
18	323-91004		1.9
11	302-90001	PORV block valve packing	1.3
28	369-90025	PORV packing	1.0

- **For leaks < 1 gpm, below Tech Spec limit, continue plant operation**
- **For leaks 1 - 100 gpm, proceed with orderly shutdown**

LEAKAGE EVENTS



SENSITIVITY STUDIES OF NONSAFETY SYSTEMS

AP600 NON-SAFETY SYSTEM
SENSITIVITY CASE

	Estimated Core Damage Frequency		
	At Power	Shutdown	Total
Base Case	3.3E-7 /yr	8.9E-8 /yr	4.2E-7 /yr
Sensitivity Case	2.6E-6 /yr	5.4E-7 /yr	3.1E-6 /yr
NRC Goal			1.0E-4 /yr

Note: Sensitivity case removes credit for CVS, SFW, RNS, offsite power and DGs following an initiating event

AP600 NON-SAFETY SYSTEM SENSITIVITY CASE

	Estimated Release Frequency At Power	Shutdown	Total
Base Case	2E-8 /yr	1E-9 /yr	2E-8 /yr
Sensitivity Case	2E-7 /yr	7E-8 /yr	3E-7 /yr
NRC Goal			1E-6 /yr

Note: Sensitivity case removes credit for CVS, SFW, RNS, offsite power and DGs following an initiating event

PRA INSIGHTS AND SYSTEM IMPORTANCE

AP600 PRA

PRA INSIGHTS VERSUS
IMPORTANT ANALYSIS

- **PRA Insights**
  - Identified insights in AP600 PRA report (Chapter 17)
  - Insights are changes made to the design, operation, or PRA success criteria
  - Insights are not intended to be a listing of the risk important features of the plant

- **Importance Analysis**
  - Used in response to some RAIs

PRA SYSTEM IMPORTANCE

RAI 720.13 - Requested system level importance

Results of RAI 720.13:

- Gravity Injection
  - Largest increase in core damage and release frequencies
  - System required for SI line break and large LOCAs

- Passive RHR
  - Second largest increase in core damage and release frequencies

- Accumulators, CMTs, ADS Stages 1-3, ADS Stage 4
  - Small increase in frequencies due to system redundancy

AP600 PRA

PRA SYSTEM IMPORTANCE

- Startup Feedwater, Normal RHR, and DGs
  - Negligible impact on core damage and release frequencies
- CVCS
  - Relatively minor importance on core damage
  - Small increase in release frequency due to LOCA events with a large, pre-existing opening in containment

AP600 PRA

AP600 PRA INSIGHTS

- **Success criteria changes**
  - Accumulator or CMT for small or medium LOCAs
  - One accumulator for large LOCA
  - Multiple ADS valve failures

- **Operation changes**
  - Start NRHR after any ADS
  - Require passive core cooling features during shutdowns
  - IST test intervals (ADS valves)

- **Design changes**
  - NRHR valves made remote
  - 4th stage ADS valves diverse
  - Expanded diverse I&C capabilities
  - Added redundant IRWST injection check valves
  - Added redundant / diverse IRWST recirc valves
  - Made CMT check valves normally open

REGULATORY TREATMENT OF NONSAFETY SYSTEMS

T. L. SCHULZ, FELLOW ENGINEER

SYSTEMS AND EQUIPMENT ENGINEERING

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REGULATORY TREATMENT
OF NONSAFETY SYSTEMS

- **Passive Systems Defense-In-Depth Capabilities**
- **Passive Systems Capabilities During Shutdowns**
- **Passive Systems Long Term Capabilities**
  (Hurricane Andrew / post 72 hours)
- **Nonsafety DID System Safety Isolation Functions**
- **Reliability of Important Systems / Components**

Passive Safety System Defense-In-Depth Capabilities

AP600

PASSIVE SYSTEM DID CAPABILITIES

- **Passive Safety Systems Provide Defense-In-Depth Capabilities**
  - Some provided in original design; others provided in design changes incorporated to improve PRA
  - More probable events have greater protection
  - Supported by best estimate analysis

AP600 LEVELS OF DEFENSE

FUNCTION	CURRENT PWR	AP600
REACTOR SHUTDOWN	- CONTROL RODS (BREAKERS) - RIDEOUT (NEG MTC, AMSAC, AFWS, CVCS)	- CONTROL RODS (BREAKERS) - CONTROL RODS (MG SETS) - RIDEOUT (MORE NEG MTC, DAS, PRHRS / SFWS, CMT / CVCS)
RCS OVERPRESSURE PROTECTION	- PZR PORV - HI PRES TRIP - PZR SAFETY VALVES	- LARGER PZR - HI PRES TRIP - PZR SAFETY VALVES
RCS HEAT REMOVAL	- MAIN FEEDWATER SYS - AUX FEEDWATER SYS - MANUAL FEED/BLEED (PZR PORV, HHSI)	- MAIN FEEDWATER SYS - STARTUP FEEDWATER SYS - PRHR HX - AUTO FEED/BLEED (CMT / IRWST, ADS) - MANUAL FEED/BLEED (ACCUM / NRHRS, ADS)
HIGH PRESSURE INJECTION	- CVCS PUMPS - HHSI PUMPS	- CVCS PUMPS - CMT - ACCUM / IRWST (ADS) - ACCUM / NRHRS (ADS)
LOW PRESSURE INJECTION	- ACCUM - LHSI PUMPS	- ACCUM - IRWST (ADS) - NRHRS PUMPS
LONG TERM RECIRC	- LHSI PUMPS FEEDING HHSI PUMPS	- CONTAINMENT SUMP (ADS) - NRHRS PUMPS
CONTAINMENT HEAT REMOVAL	- FAN COOLERS - CONT SPRAY PUMPS / HX	- FAN COOLERS - EXTERNAL AIR + WATER DRAIN - EXTERNAL WATER FIRE SYSTEM - EXTERNAL AIR ONLY COOLING

TLS - 2/18/93

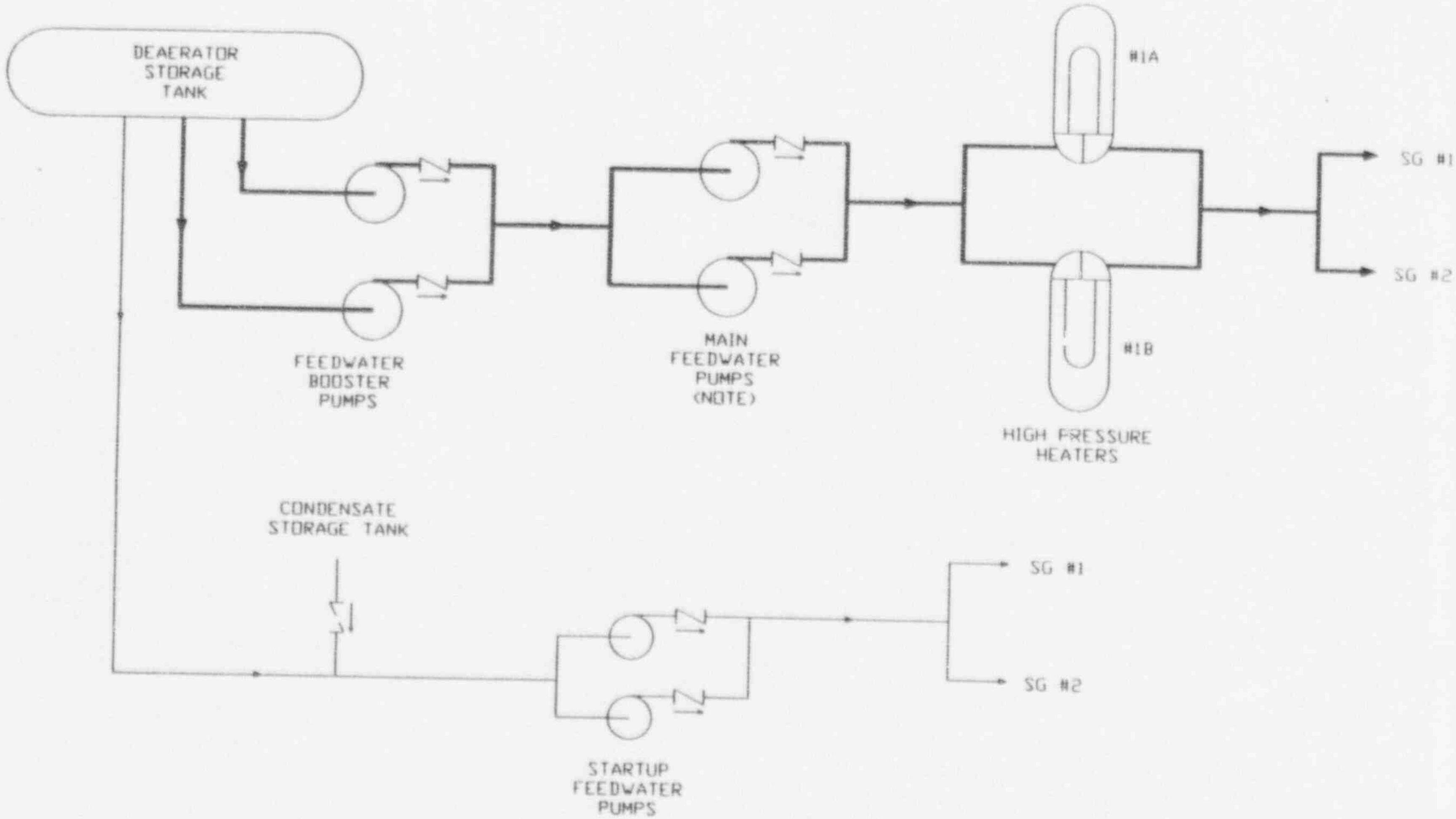
AP600 DECAY HEAT REMOVAL

- **Startup Feedwater System**
  - Non-safety feedwater for normal shutdowns and transients
  - Two motor driven pumps feed all SGs
  - Water supplied from deaerating heater or CST
  - Automatic start and flow control
  - Automatic load on NNS diesels

- **Passive RHR Heat Exchanger**
  - Safety cooling for events where SFW is unavailable and during non-LOCA accidents
  - Two heat exchangers connected directly to RCS
  - Forced flow with RCP; natural circ without RCP
  - Automatic actuation; two fail-open valves
  - PRHR HX located in IRWST, provides heat sink
  - IRWST remains subcooled for 2 - 3 hours
  - Passive containment cooling provides ultimate heat sink

- **RCS Feed and Bleed**
  - Provides backup to SFW and to PRHR HX for PRA multiple failure events
  - Feed from CMT/Accum/IRWST, bleed from ADS
  - Automatic actuation of CMT on high RCS temp with low SG level

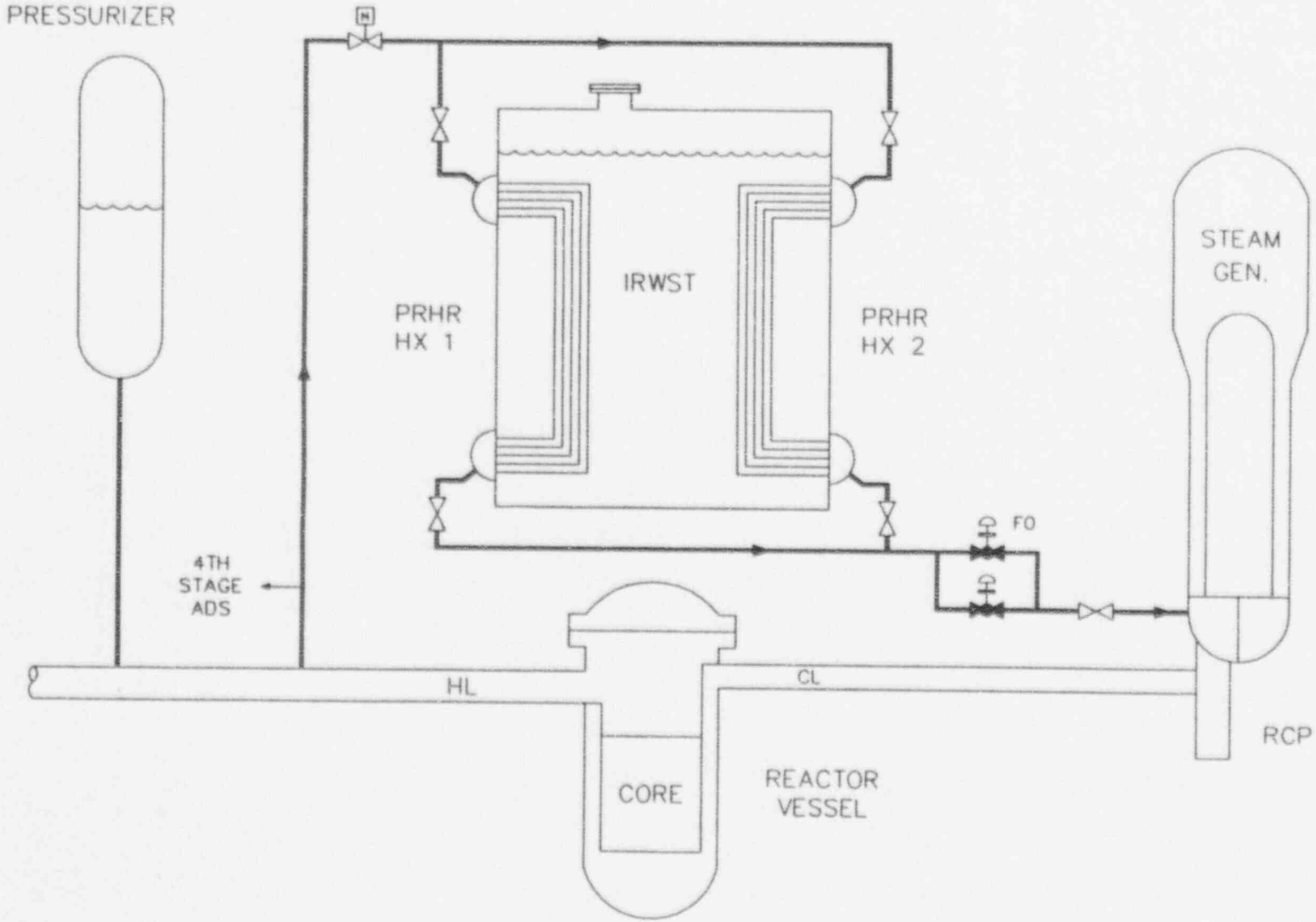
AP600 – MAIN & STARTUP FEEDWATER SYSTEMS



WESTINGHOUSE – 8/89

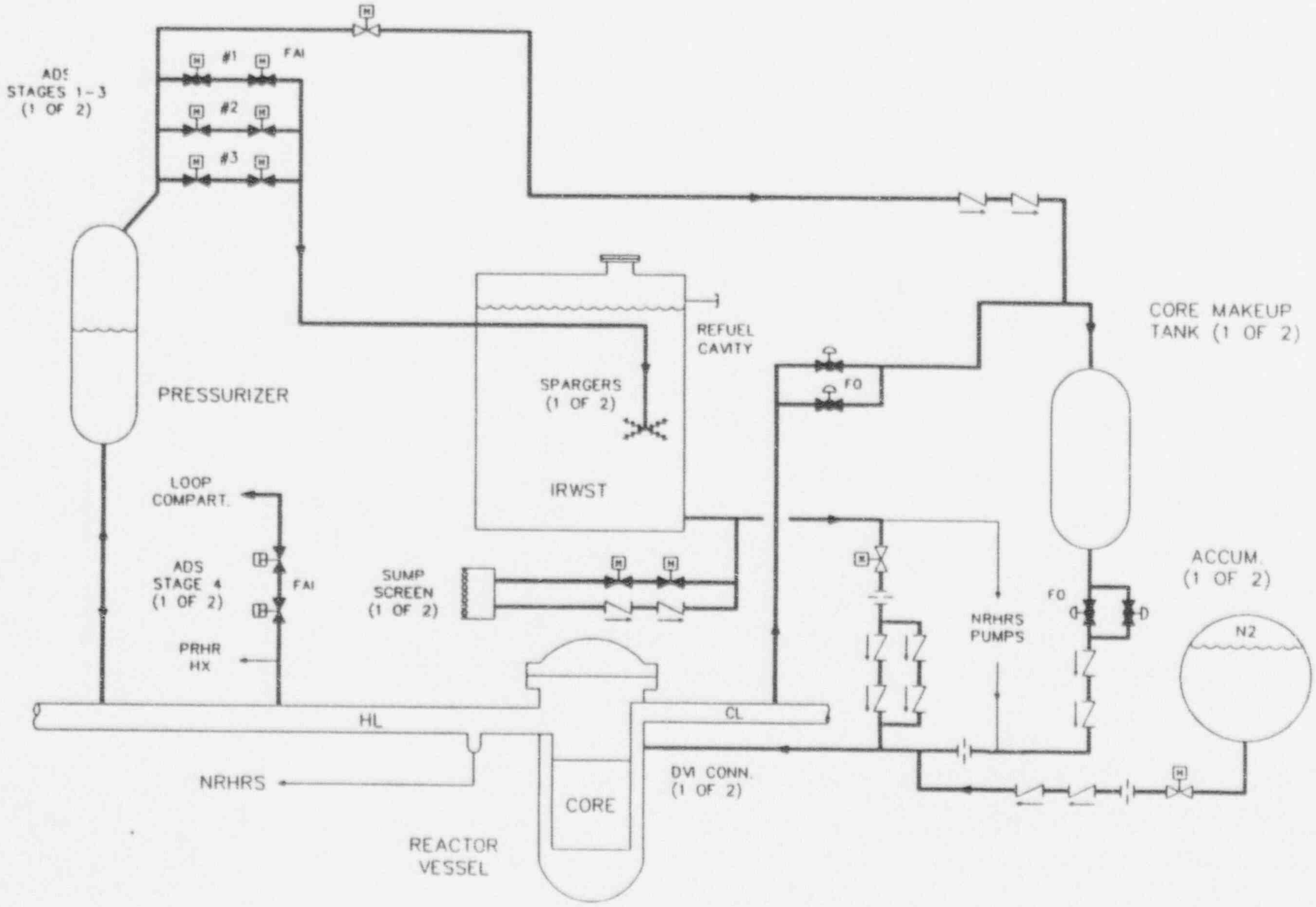
NOTE – VARIABLE SPEED MOTOR DRIVEN PUMPS

AP600 - PASSIVE RHR HX



WESTINGHOUSE - 3/92

AP600 - PASSIVE SAFETY INJECTION



WESTINGHOUSE - 3/92

AP600 - LOSS OF OFFSITE POWER

a,c

a,c

Plant: **AP600**

Event: **LOSS MAIN FEEDWATER** at **FULL POWER**

a,c

a,c

AP600 - RCS LEAK (0-3/8")

a,c [ ] a,c

ADS DEFENSE-IN-DEPTH

- **DBA Performance**
  - Conservative decay heat, line resistances, pressure drop calc, containment pressure
  - Successful IRWST gravity injection achieved with single failure
    - Limiting failure is one 4th stage valve or one battery train (causes failure of one 1st & 3rd stage valves)

ADS DEFENSE-IN-DEPTH (Continued)

- **PRA Performance**
  - Best estimate decay heat, line resistances, pressure drop calc, containment pressure
  - Successful IRWST gravity injection achieved with multiple failures
    - Can tolerate common mode failure of all stage 1/2/3 valves or all stage 4 valves
  - Successful RNS pump injection achieved with opening of any **one** 2/3/4 stage line

- **ADS sizing basis provides substantial margin and failure tolerance**

Passive Safety System Capabilities During Shutdowns

AP600

PASSIVE CAPABILITY DURING SHUTDOWNS

- **Passive Safety Functions Provided During All Shutdown Modes**

- **Hot Shutdown / Hot Standby / Cold Shutdown Same As At Power**
  - Tech Spec require PRHR HX, CMT, IRWST, and ADS to be available

- **Cold Shutdown Mid-Loop**
  - PRHR HX ineffective (RCS open)
  - CMT / accum unnecessary
  - Tech Spec require:
    - Containment integrity
    - ADS stages 1, 2, 3 open
    - IRWST MOV available

- **Refueling Shutdown**
  - Refueling cavity provides >72 hours with equipment hatch open
  - Equipment hatch can be closed without AC power

AP600 – LOSS OF OFFSITE POWER (HOT/COLD SHUTDOWN)[1]

a,c

a,c

AP600 – LOSS OF OFFSITE POWER (MID-LOOP)

a,c

a,c

AP600 - LOSS OF OFFSITE POWER
(REFUELING)

a,c

a,c

Passive Safety System Long Term Shutdown Capabilities

- After 72 hours
- Hurricane Andrew

POST 72 HOUR ACTIONS

- **Long Term Passive Safety System Operation**
  - Core cooling and ultimate heat sink remain available indefinitely (>> 72 hours) without operator action or offsite support
  - Other safety functions require limited offsite support after 72 hours
  - Limited offsite support after 72 hours
    - Uses readily accessible and transportable equipment and supplies from offsite
    - Safety-related connections provided to engage offsite support equipment
  - Installed nonsafety systems NOT required to sustain safety system functions
    - Recovery to cold conditions accomplished when nonsafety systems are made available

POST 72 HOUR ACTIONS

- **Safety System Extended Support Actions**
  - Provide makeup water into containment
    - Only needed after one month assuming DBA containment leakage
  - Provide makeup water to the passive containment cooling water storage tank
    - Air cooling alone maintains containment pressure below design pressure
  - Provide electrical power to supply the post-accident and spent fuel pit monitoring instrumentation
  - Provide electrical power to the hydrogen recombiners
    - Only needed for events where containment hydrogen buildup is a concern

POST 72 HOUR ACTIONS

- **Safety System Extended Support Actions** (continued)
  - Provide breathable, compressed air for the control room air supply and pressurization system
    - Only required in case of serious core damage and containment leakage
  - Provide control room cooling and air recirculation
    - Only required in hot weather conditions
  - Provide ventilation cooling to post-accident monitoring equipment rooms
    - Only required in hot weather conditions
  - Provide makeup water to the spent fuel pit
    - 7 days at BOL, 21 days at EOL
    - 72 hr for worst case emergency core unload

HURRICANE ANDREW/AP600 CAPABILITY

CORE COOLING/DECAY HEAT REMOVAL

Turkey Point Actions

- Shutdown in advance (T < 350°F)
- D/Gs tested in advance
- RHR system used to cool core
- Power from D/Gs after loss of grid
- Maintained potential for cooling via SGs with auxiliary feed pump
- Stayed on D/G for nearly 7 days until reliable offsite source restored

AP600 Capabilities

- Redundant D/Gs and normal RHR provide equivalent capability as used at Turkey Point
- Cooling via SGs and Startup Feedwater Pumps available to backup RHR
- Passive systems backup normal systems and D/Gs

HURRICANE ANDREW/AP600 CAPABILITY

AP600 PASSIVE SYSTEM BACKUP CAPABILITY

- Passive Systems not needed unless both D/Gs are lost ⇒ Station Blackout
- Upon station blackout PRHR would be actuated - natural circulation cooling to IRWST - boiloff to containment after 7 hours -- heat removal through containment shell -- condensate return to IRWST
- PRHR maintains RCS at $T < 450°F$, $p < 425$ psia, no primary inventory loss
- Continue on PRHR indefinitely as long as 1E battery capacity can be maintained - 20 kw AC generator within 24 hours is sufficient
- If 24 hour 1E battery nears depletion, ADS is actuated (RCS @ $\sim T = 425°F$, $p = 310$ psia)
- Continue to cool core indefinitely via recirculation within containment

HURRICANE ANDREW/AP600 CAPABILITY

STRUCTURAL DESIGN

Turkey Point Safety Related Structures
- No damage
- Tornado design loads more limiting than wind design loads

AP600 Safety Related Structures
- Also tornado limited, no damage

Turkey Point Non-Safety Related Structures
- Built to South Florida building code
- Majority of structures survived Andrew well
- Central receiving facility had damage to structure and some contents

AP600 Non-Safety Related Structures
- Standard design - limiting wind is South Florida - URD 110 mph/50 year
- Expected to survive Hurricane Andrew

Nonsafety Defense-in-Depth System Safety Isolation Functions

NONSAFETY SYSTEM ISOLATION FUNCTIONS

- **Nonsafety Systems Provide Some Safety Related Isolation Functions**
  - RCS pressure boundary isolation
  - Containment isolation
  - Other isolation functions provided to mitigate DBA's

- **These Isolation Capabilities Are Fully Safety Related**
  - Single failure capability
  - Reg Guide 1.26 quality group A, B, or C
  - Seismic I
  - Tech Spec controls
  - Described in SSAR and ITAAC

NONSAFETY SYSTEM ISOLATION FUNCTIONS

- **Example: CVS Functions**

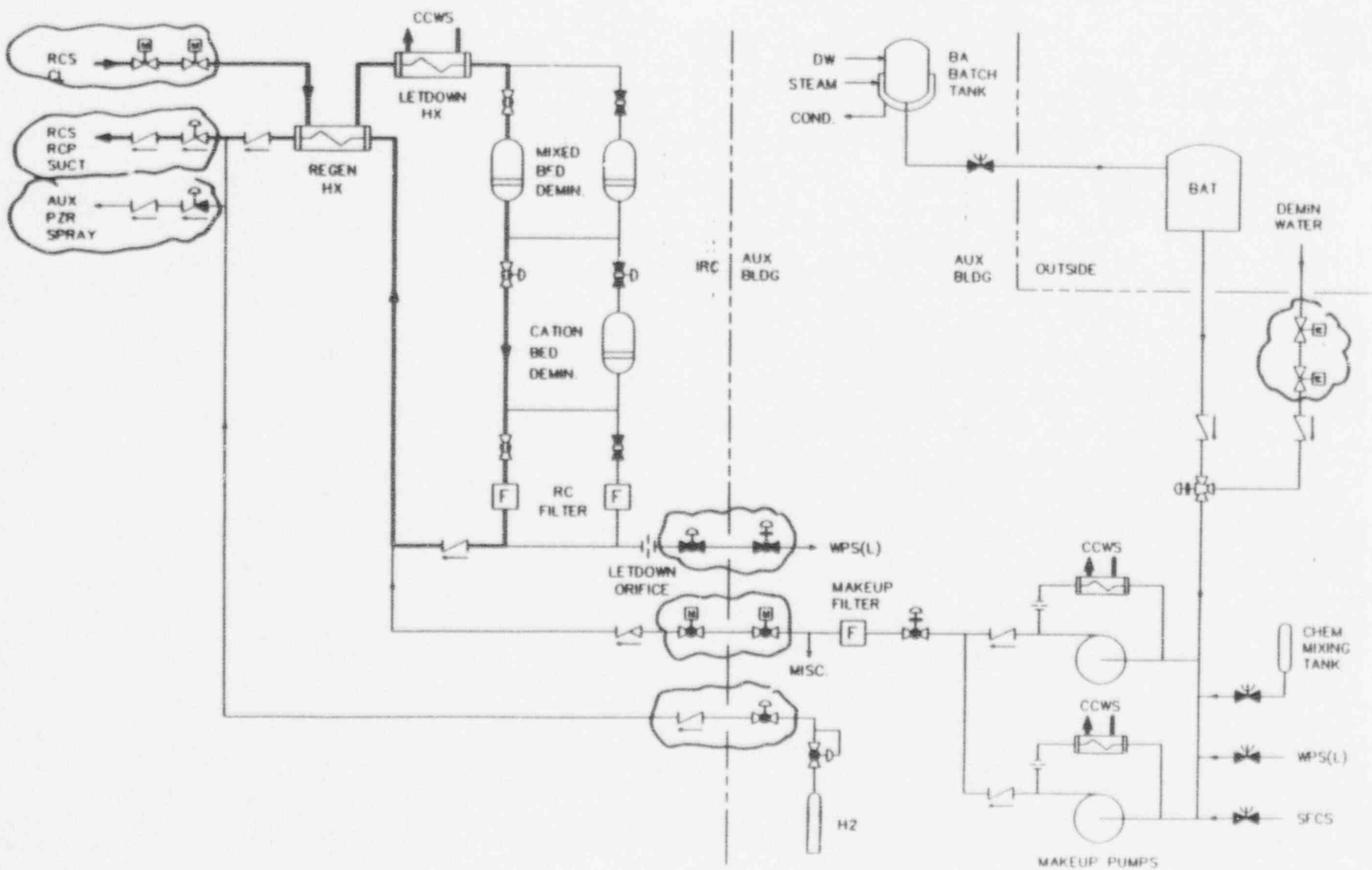
- **CVS Functions**

  - Safety Functions
    - RCS pressure boundary isolation
    - Containment penetration isolation
    - Boron dilution accident termination
    - Excessive makeup isolation

  - DID functions
    - RCS makeup for leaks
    - RCS pressure reduction

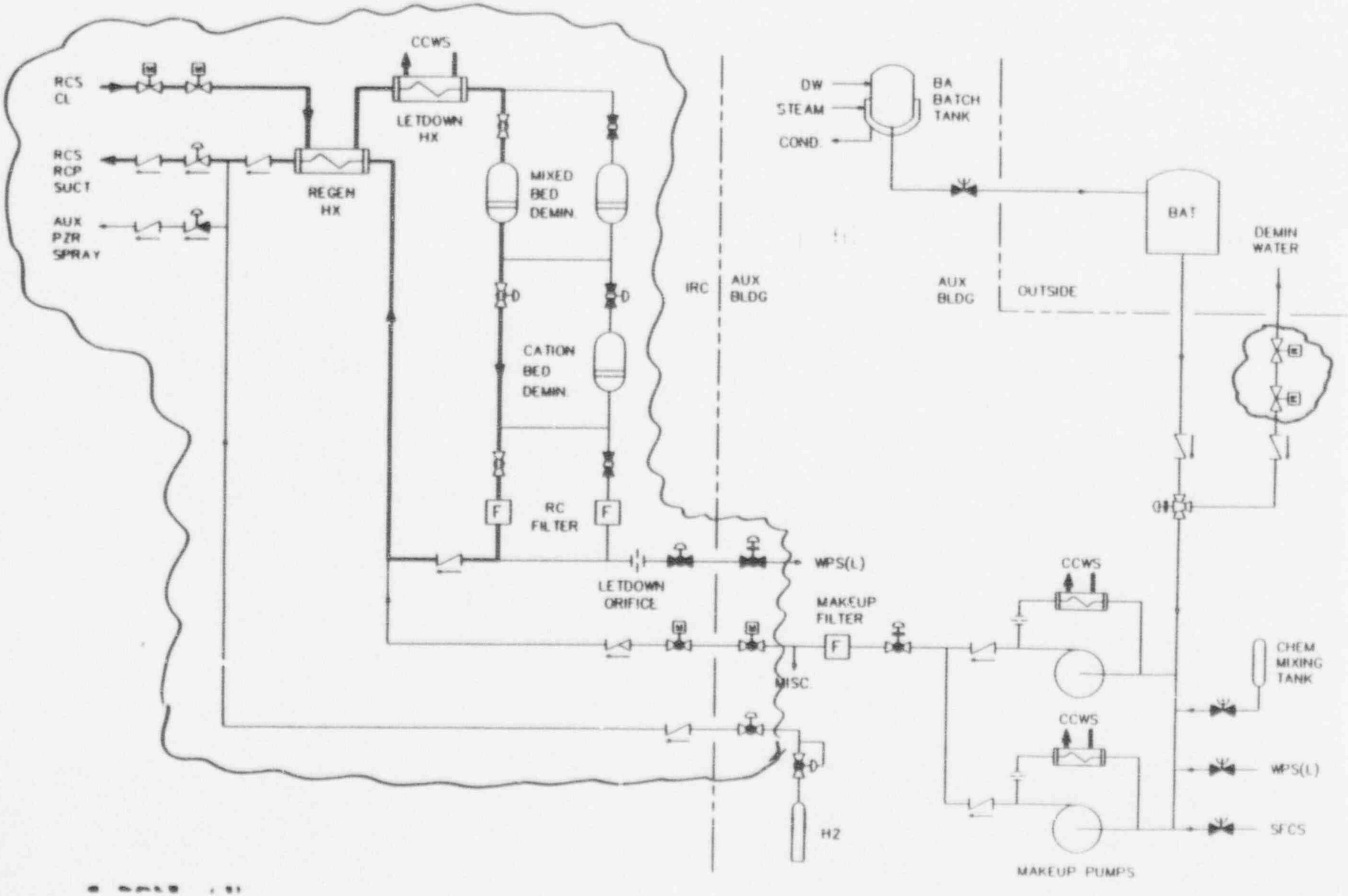
SAFETY RELATED ISOLATION

AP600 - CHEMICAL AND VOLUME CONTROL SYSTEM



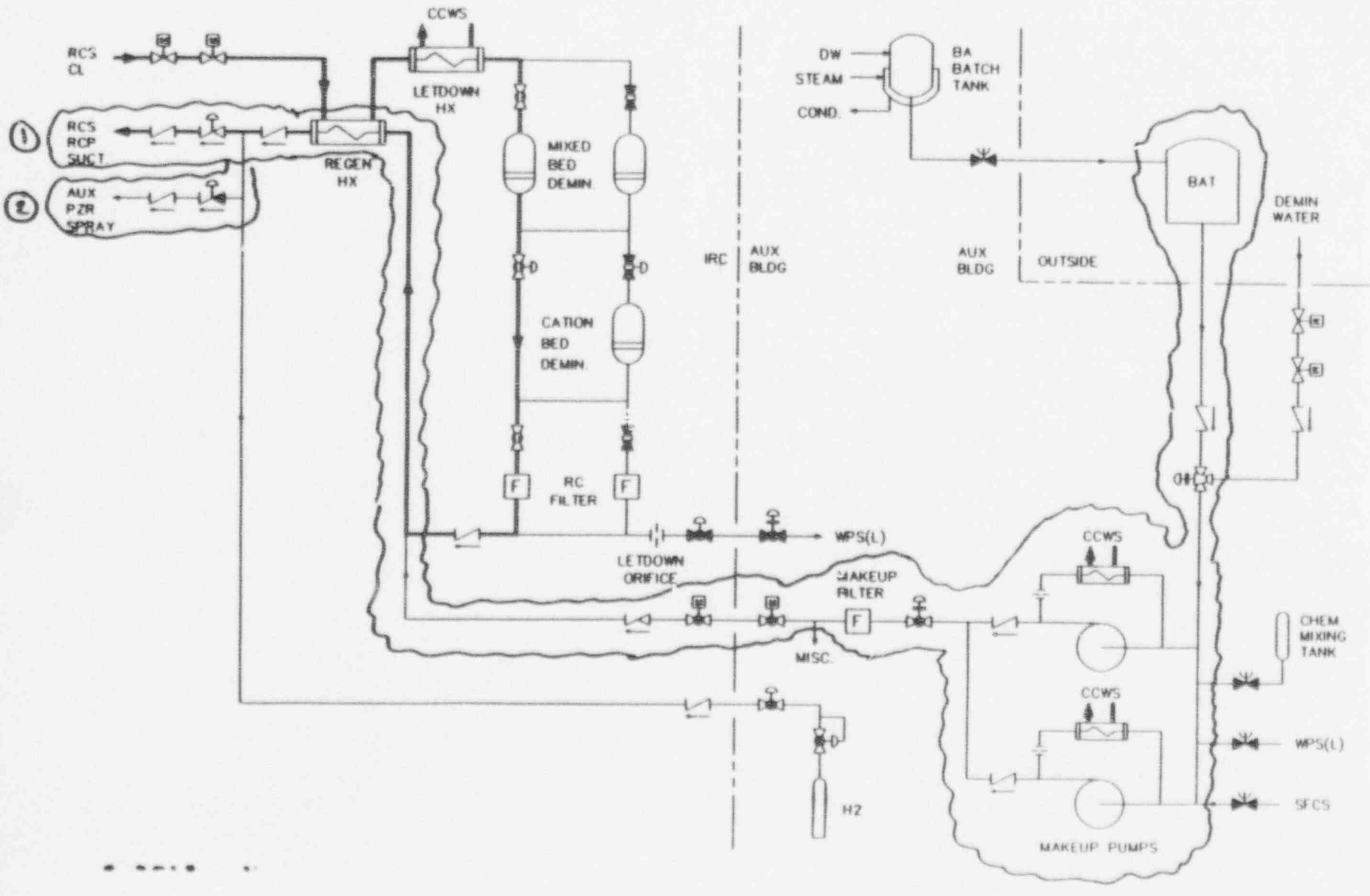
SAFETY RELATED PIPING

AP600 - CHEMICAL AND VOLUME CONTROL SYSTEM



NON SAFETY DID FUNCTIONS

AP600 – CHEMICAL AND VOLUME CONTROL SYSTEM



Reliability of Important Systems / Components

RELIABILITY OF SYSTEMS/COMPONENTS

- **Importance of Systems / Components Identified in AP600 PRA**
  - PRA functions identified in SSAR descriptions

- **Reliability Controlled By Design / Construction / Operation Activities**
  - Design; PRA insights / importance, historical experience, equipment vendor inputs, feasibility testing (where required)
  - Construction; QA/QC, ITAAC
  - Operation; Tech Spec, IST/ISI, O-RAP

RELIABILITY OF SYSTEMS/COMPONENTS

Design Phase Reliability Activities

- **PRA Insights / Importance**
  - Passive safety systems important
  - Importance ranking
    - IRWST injection
    - PRHR HX
    - ADS stages 1, 2, 3
    - ADS stage 4
    - Accum
    - CMT

RELIABILITY OF SYSTEMS/COMPONENTS

Design Phase Reliability Activities (Continued)

- **Equipment Requirements Developed To Avoid Historical Problems**
  - Utility inputs
  - Equipment vendor inputs
  - Incorporate into E-Spec
  - Do not specify component reliability
    - Vendors don't know quanitative reliability
    - Vendors unwilling to quote, at best will increase cost to cover their risk

- **Feasibility Testing As Required**
  - Only Required for IRWST check valves and ADS valves
    - Demonstrates operability not reliability
  - Use historical reliability for all valves

INSPECTIONS, TESTS, ANALYSES AND ACCEPTANCE CRITERIA

B. A. McINTYRE, MANAGER

ADVANCED PLANT SAFETY AND LICENSING

0816A

AP600 ITAAC PROGRAM

- AP600 ITAAC PROGRAM WILL BE DIFFERENT
- SCREENING CRITERIA
- DECEMBER 15, 1992 SUBMITTAL
  - 36 SYSTEM ITAAC
    - 12 SAFETY SYSTEMS
    - 24 NONSAFETY SYSTEMS
      - DEFENSE IN DEPTH AND SUPPORT
  - NONSYSTEM ITAAC
    - HUMAN FACTORS
    - NUCLEAR ISLAND BUILDING
    - SAFETY RELATED PIPING
    - INTERFACE

TIER 1 Design Description/ITAAC Screening Criteria Checklist

Purpose: The purpose of this checklist is to determine those systems and structures for which Tier 1 design descriptions and associated ITAACs must be prepared.

I. System or Structure:

II. Evaluation:

A. Are there any structures, systems, or components classified as Class A, B, or C? ____ YES ____ NO

Justification:

B. Are there any structures, systems, or components classified as Class D because they provide defense-in-depth functions as defined in GW G1 010, AP600 Nuclear Safety Classification and Seismic Requirement Methodology? ____ YES ____ NO

Justification:

III. Conclusion

Tier 1 Design Description and associated ITAAC will be developed for this system. ____ YES ____ NO

Justification:

System Engineer/Date ______________________________

Technical Review Team ______________________________

AP600 ITAAC

- REACTOR
  - Fuel Handling and Refueling System
  - Reactor Coolant System
  - Reactor System

- NUCLEAR SAFETY SYSTEMS
  - Automatic Depressurization System
  - Containment System
  - Passive Containment Cooling System
  - Passive Core Cooling System
  - Steam Generator System
  - Main Control Room Habitability System

- INSTRUMENTATION AND CONTROL
  - Diverse Actuation System
  - Data Display and Processing System
  - Incore Instrumentation System
  - Plant Control System
  - Protection and Safety Monitoring System
  - Radiation Monitoring System

AP600 ITAAC

- o AUXILIARY SYSTEMS
  - o Component Cooling Water System
  - o Chemical and Volume Control System
  - o Standby Diesel and Auxiliary Boiler Fuel Oil System
  - o Fire Protection System
  - o Mechanical Handling System
  - o Primary Sampling System
  - o Normal Residual Heat Removal System
  - o Spent Fuel Pit Cooling System
  - o Service Water System
  - o Containment Hydrogen Control System

- o STEAM AND POWER CONVERSION SYSTEMS
  - o Main and Startup Feedwater System
  - o Main Steam System

AP600 ITAAC

- ELECTRICAL POWER
  - Main AC Power System
  - Non Class 1E DC and UPS System
  - Plant Lighting System
  - Class 1E DC and UPS System
  - Onsite Standby Power System

- HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS
  - Nuclear Island Nonradioactive Ventilation System
  - Central Chilled Water System
  - Annex/Auxiliary Building Nonradioactive Ventilation System
  - Diesel Generator Building Ventilation System

AP600 ITAAC PROGRAM

- o PROGRAM PLANS
  - o KEEP ITAAC OFF CRITICAL PATH
  - o REVIEWED WITH STAFF, FEBRUARY 16
- o MAINTAIN INVOLVEMENT IN INDUSTRY ITAAC ACTIVITITES
  - o MARCH 9, GE BUILDING
  - o MARCH 9, GE ELECTRICAL DISTRIBUTION
  - o ABB/CE INDUSTRY REVIEWS
  - o NUMARC ACTIVITIES

AP600 ITAAC PROGRAM

- o UPDATE AP600 TO CURRENT INDUSTRY STANDARDS
  - o FLUID AND MECHANICAL SYSTEMS
    - o APRIL 15, 1993
  - o BUILDING, ELECTRICAL AND I&C
    - o JUNE 1, 1993

TESTING

E. J. PIPLICA, MANAGER

TEST ENGINEERING

AP600 TEST PROGRAM

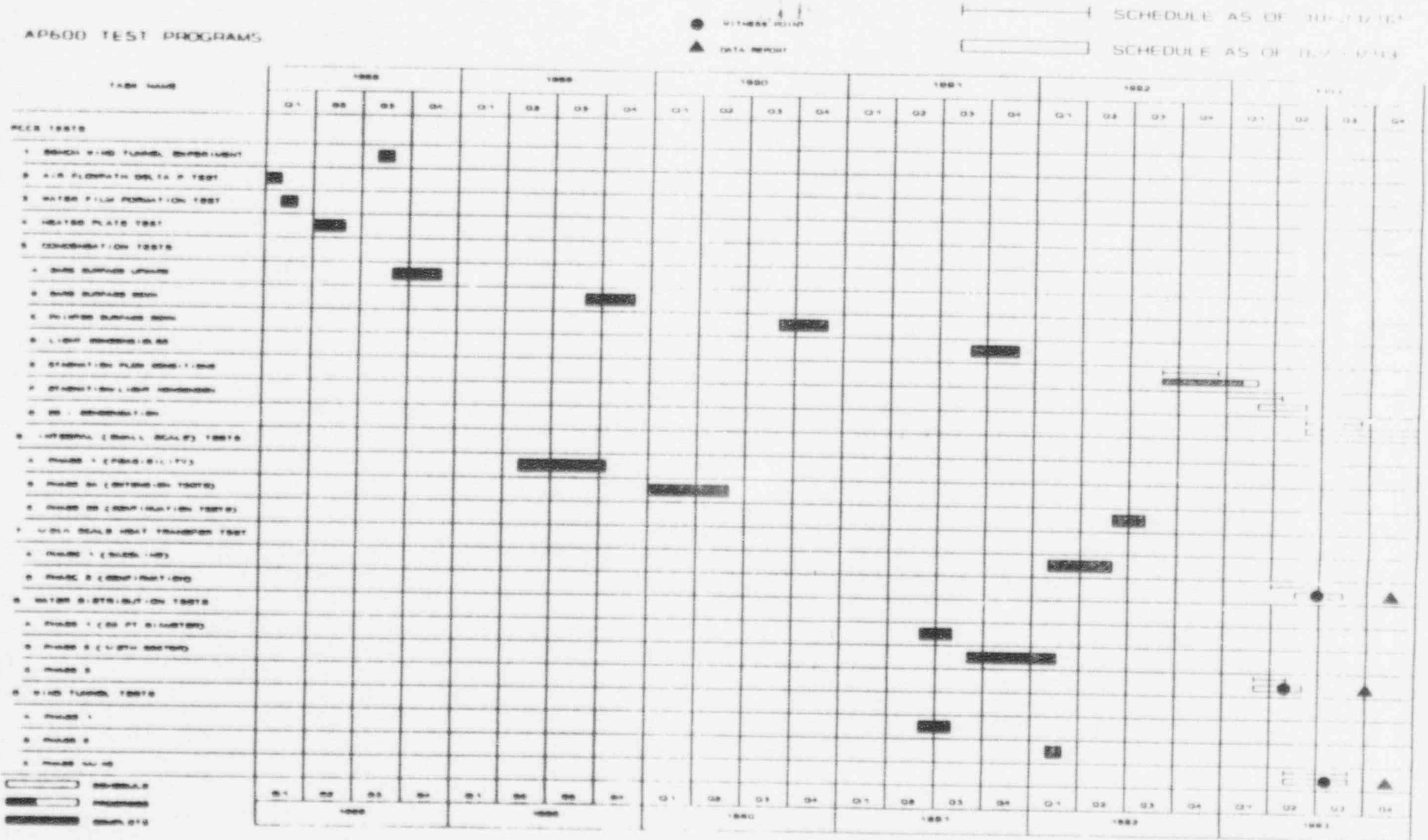
- DESIGN CERTIFICATION TESTS
  - PASSIVE CONTAINMENT COOLING SYSTEM TESTS
  - PASSIVE CORE COOLING SYSTEM TESTS
- DESIGN VERIFICATION (ENGINEERING) TESTS
  - COMPONENT DESIGN VERIFICATION TESTS

RELATIONSHIP TO THE DESIGN PROCESS

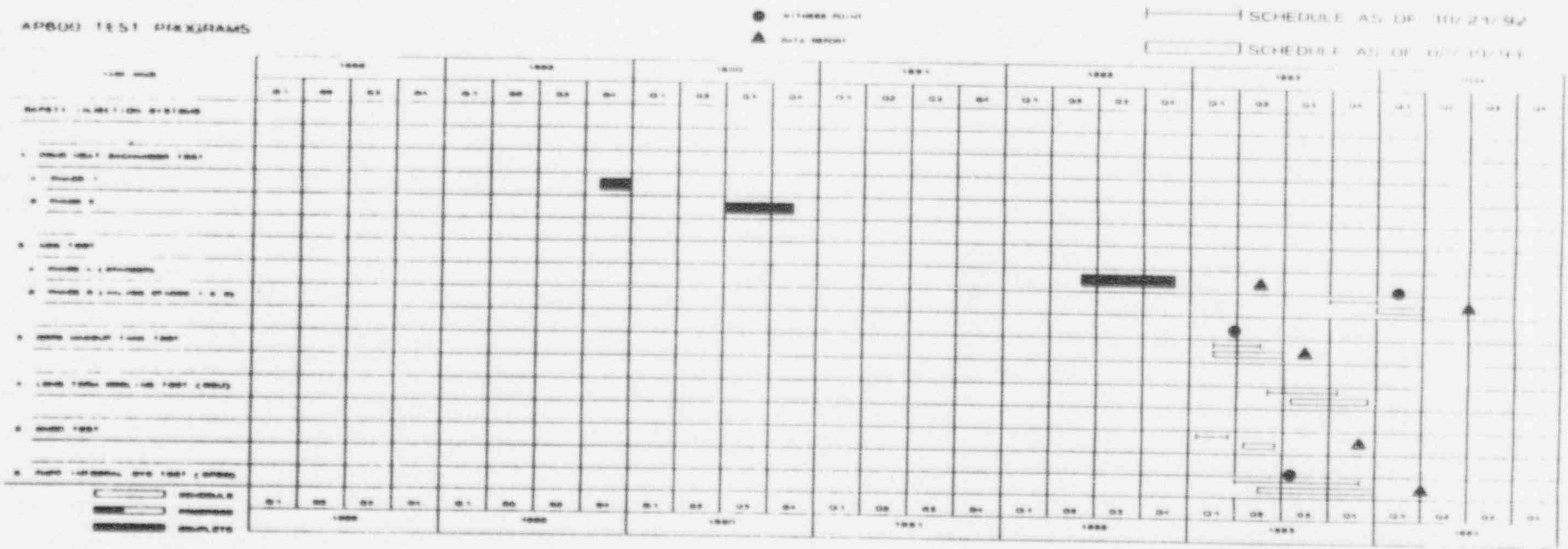
AP600

- PERFORM A RANGE OF TESTS TO OBTAIN HIGH FIDELITY DATA
- TEST DATA USED TO DEVELOP OR VERIFY MODELS USED IN EXISTING COMPUTER CODES
- COMPUTER ANALYSIS IS PERFORMED MODELING THE TEST FACILITY GEOMETRY
- SAME COMPUTER CODES ARE USED TO ANALYZE THE PERFORMANCE OF THE AP600
- IF NECESSARY, THE AP600 DESIGN IS OPTIMIZED BASED ON THE RESULTS OF COMPUTER ANALYSIS

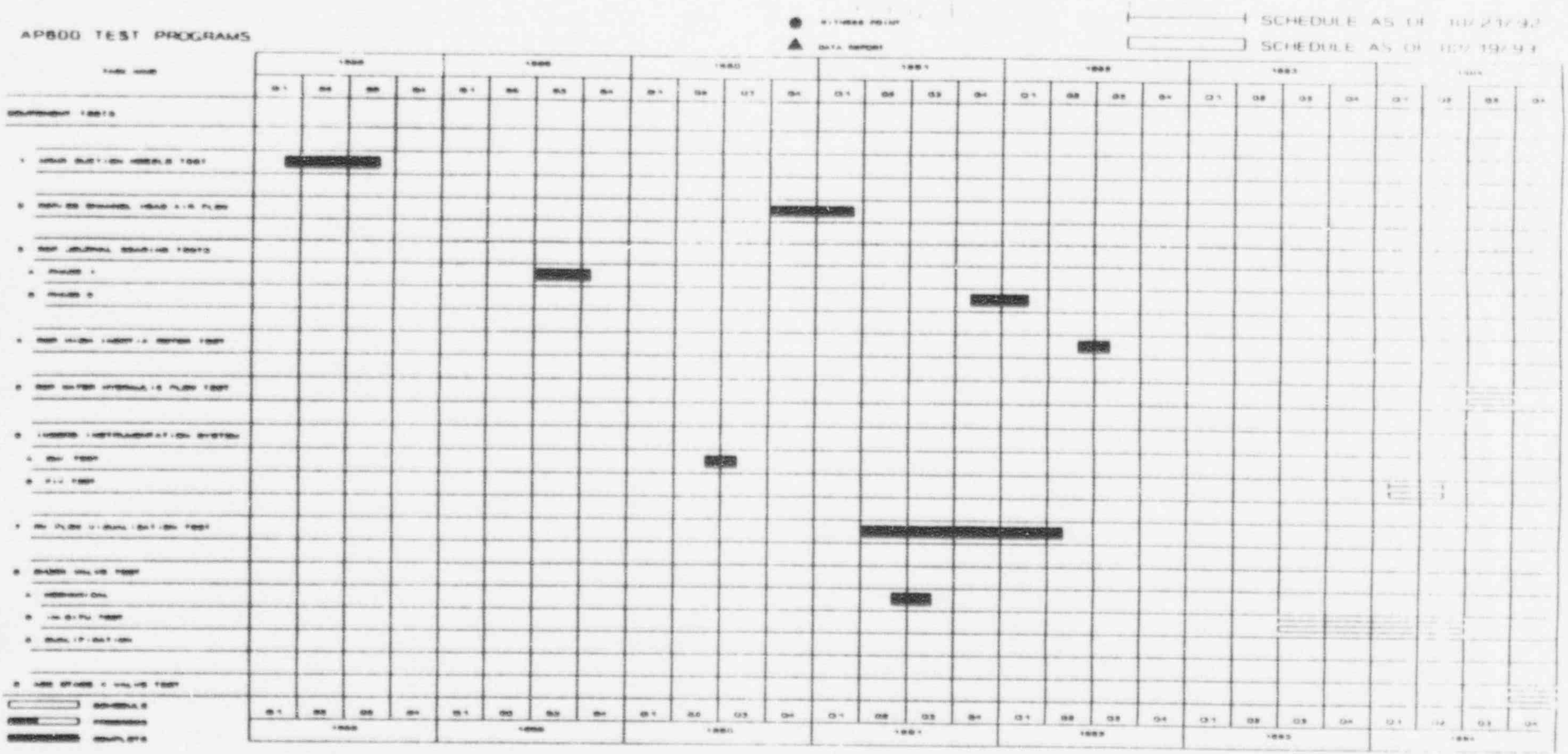
PASSIVE CONTAINMENT COOLING SYSTEM TESTS



PASSIVE CORE COOLING SYSTEMS TESTS



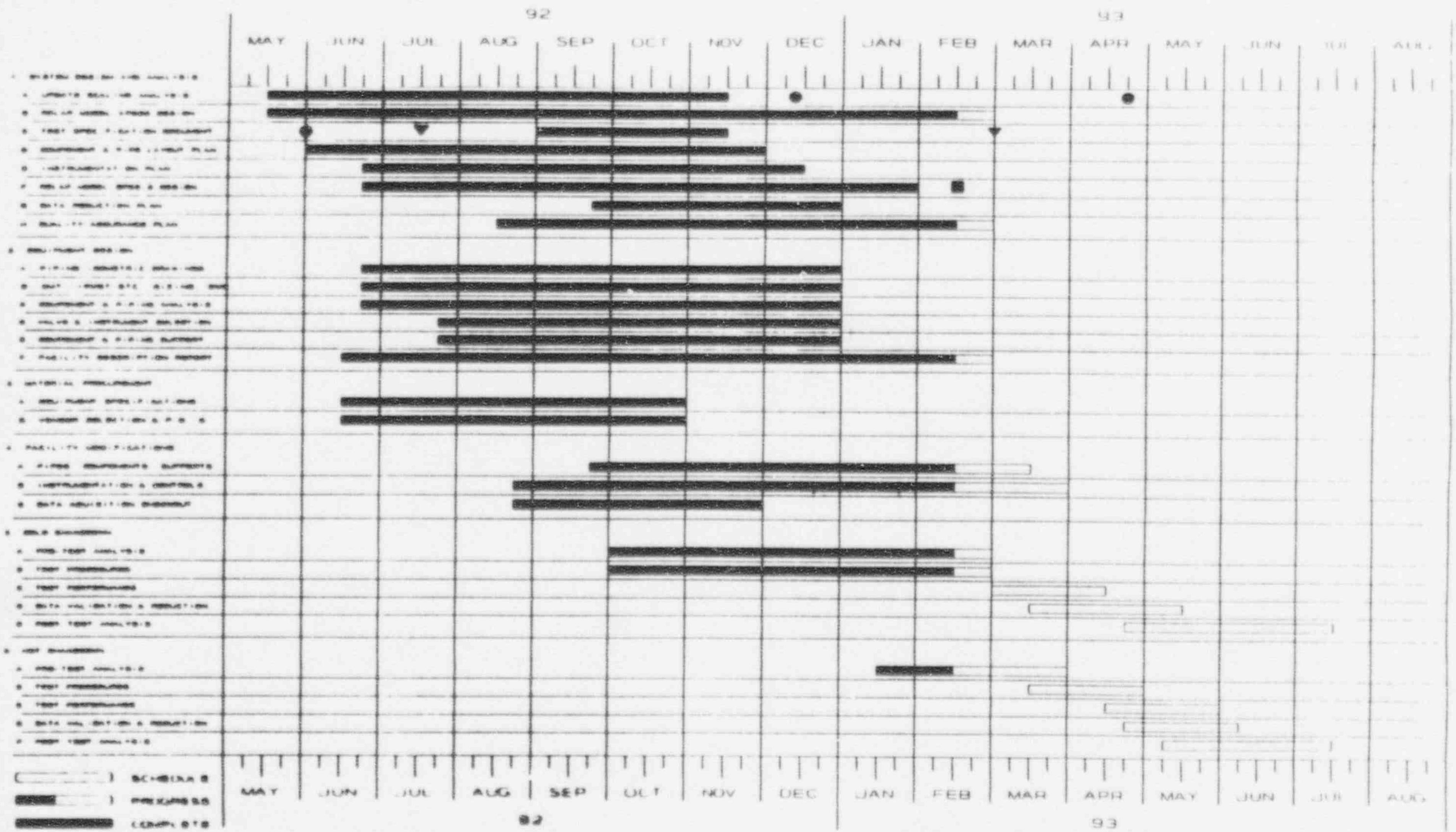
COMPONENT DESIGN VERIFICATION TESTS



SPES-2 TEST SCHEDULE (SHEET 1 OF 2)

● NRC
▼ - A & TRT
■ - ENEL

SCHEDULE AS OF



AP600 TEST OBJECTIVES/CONCLUSIONS

Component Design Tests	Test Objective/Conclusion	Completion Date	Test Results Required for		
			SSAR	FDA/DC	Design Verification
Normal RHR Suction Nozzle Test (East Pittsburgh)	Eliminated Suction Vortex	Completed, September 1988			X
Reactor Coolant Pump (RCP)/SG Channelhead Air Flow (Westinghouse EMD)	No SG to Pump Flow Anomalies	Completed, March 1991			X
RCP Journal Bearing (Westinghouse STC)	Demonstrated manufacturability of depleted uranium rotor sections and large radial bearings and determined rotor drag losses				X
o Phase 1		Completed, December 1989			
o Phase 2		Completed, February 1991			
RCP High Inertia Rotor (Westinghouse STC)	To optimize rotor drag losses	Completed, August 1992			X
RCP Water Flow (Westinghouse EMD)	To obtain flow, head and efficiency data to accurately predict the performance of the full-scale AP600 reactor coolant pump	September 1994			X
In core Instrumentation Tests					
o Electromagnetic Interference (Westinghouse EMD)	Demonstrated that system is not susceptible to Electromagnetic Interference from the CRDMs	Completed, September 1990			X
o Flow Induced Vibration (facility not chosen)	To demonstrate that the thimble is not subjected to excessive wear	May 1994			X

AP600 TEST OBJECTIVES/CONCLUSIONS

Component Design Tests (Continued)	Test Objective/Conclusion	Completion Date	Test Results Required for		
			SSAR	FDA/DC	Design Verification
Reactor Vessel Internals Test					
o Flow Visualization (University of Tennessee)	Demonstrated that no abnormal flow distribution occurs in the reactor vessel downcomer and lower plenum	Completed, February 1992			X
o 1/7 Scale Hydraulic (facility not chosen)	To verify the hydraulic characteristics of the AP600 vessel and internals	May 1997			X
Check Valve					
o Preliminary Hydraulic (Westinghouse AESD)	Determined flow vs. dP for prototypic check valves	Completed, June 1991	X		
o In situ (Operating Nuclear Plants)	To determine opening dP for check valves following prolonged exposure to plant conditions	December 1994			X
o Qualification Testing (facility not chosen)	To assess check valve performance	(Later)			X
ADS 4th Stage Valve Test (facility not chosen)	To verify valve and operator performance	December 1994			X

AP600 TEST OBJECTIVES/CONCLUSIONS

Passive Safety System Tests	Test Objective/Conclusion	Completion Date	Test Results Required for		
			SSAR	FDA/DC	Design Verification
Passive RHR HX (Westinghouse STC)	Determined heat transfer characteristics of the PRHR heat exchanger and mixing characteristics in the IRWST				
o Phase 1		Completed, December 1989	X		
o Phase 2		Completed, October 1990	X		
Automatic Depressurization System Test (Cassacia, Italy)					
o Phase A Sparger Performance & Tank Loads	Confirmed the capacity of the sparger and determined the dynamic effects on the IRWST structure	Completed, November 1992		X	
o Phase B Valve Performance	To simulate operation of the automatic depressurization system and to confirm the capacity and operability of the ADS valves	March 1994		X	
Core Makeup Tank (Westinghouse AESD)	To verify the gravity drain behavior of the core makeup tank over a full range of flow rates and pressures and to verify the operation of the tank level instrumentation	June 1993		X	
Long Term Cooling (1/4 Scale) (Oregon State University)	To provide data to evaluate the operation of the PXS at low pressure	December 1993		X	
DNB (Columbia University)	To extend the existing critical heat flux correlation for W fuel assemblies at lower flow conditions	June 1993		X	
Full Height Full Pressure Integral Systems Test (SPES facility in Italy)	To provide data to evaluate the operation of the PXS at high pressure, including response to small break LOCA, tube ruptures and steamline break transients	December 1993		X	

AP600 TEST OBJECTIVES/CONCLUSIONS

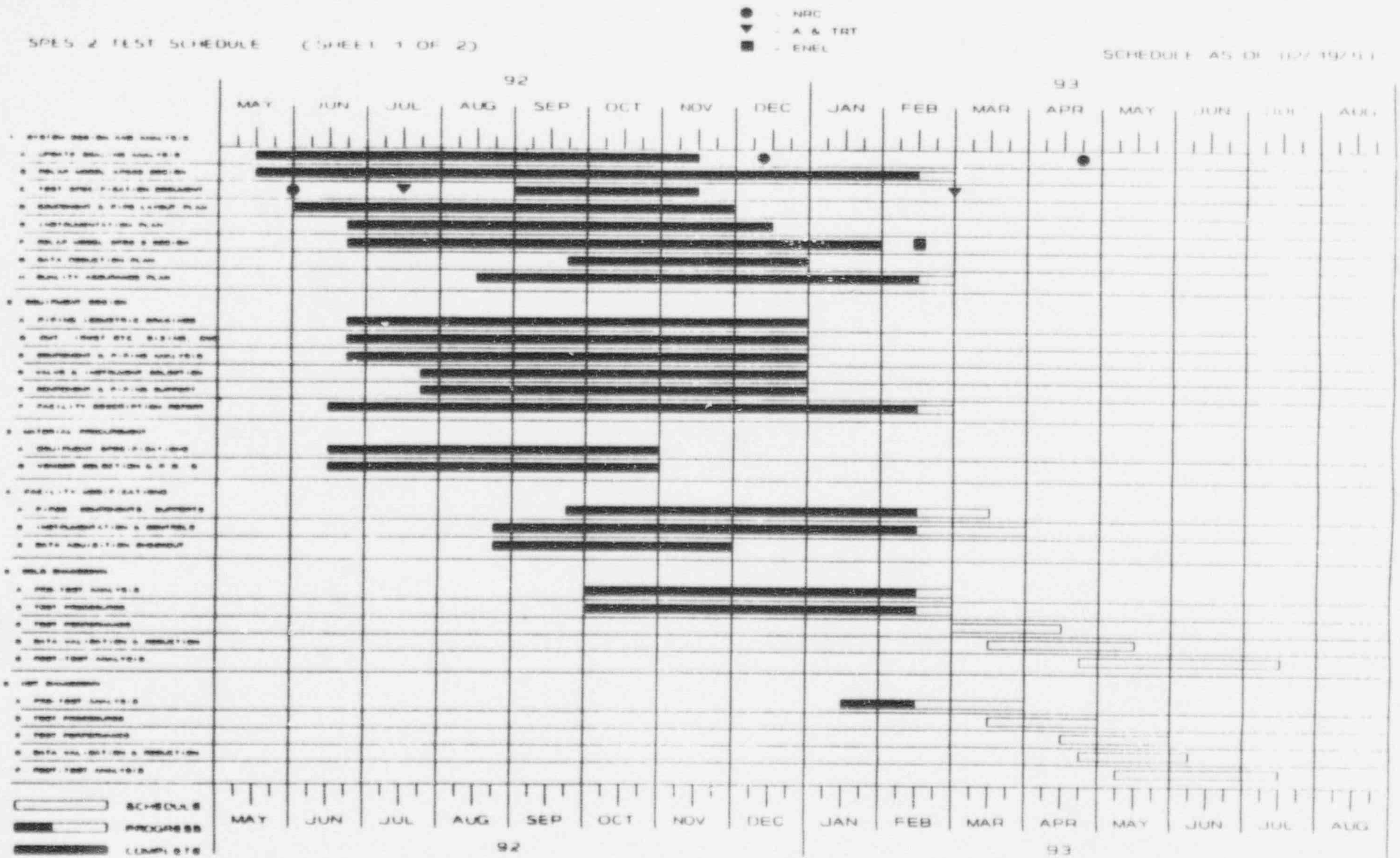
Passive Containment Cooling Tests	Test Objective/Conclusion	Completion Date	Test Results Required for		
			SSAR	FDA/DC	Design Verification
Integral PCCS Test (Westinghouse STC)	Demonstrated operation of the PCCS over the full range design basis operating conditions	Completed, July 1992	X		
Large Scale PCCS (Westinghouse STC)	To demonstrate operation of the PCCS on a scaled structure which accurately models both the containment dome and sidewall heat transfer areas, and inside containment structures	Phase 1 - May 1992 Phase 2 - June 1993	X	X	
PCCS Water Distribution (Westinghouse AESD)					
Phase 1 Center of Dome, 20' Diameter	Demonstrated the effectiveness of water distribution on the center of the containment dome	Completed, June 1991	X		
Phase 2 Full Scale 1/8 Section	Demonstrated the effectiveness of water distribution on the containment dome and upper sidewall	Completed, January 1992	X		
Phase 3 Full Scale 1/8 Section	Verify design of water distribution system	April 1993			X
PCCS Wind Tunnel (University of Western Ontario)					
o Phase 1 Overall building effects (1/100th scale)	Demonstrated the wind induced pressure on the containment shield building due to air inlet/outlet configurations and site structures	Completed, July 1991	X		
o Phase 2 Detailed Model, Final Verification (1/100th scale)	Determined baffle loading and demonstrated the effect of wind on containment annulus air flow	Completed, February 1992	X		
o Phase 4A 4B 1/25th scale & 1/500th scale	To perform tests at higher Reynold's numbers and to demonstrate effects of site geography	September 1993		X	

AP600 TESTS IN PROGRESS

AP600

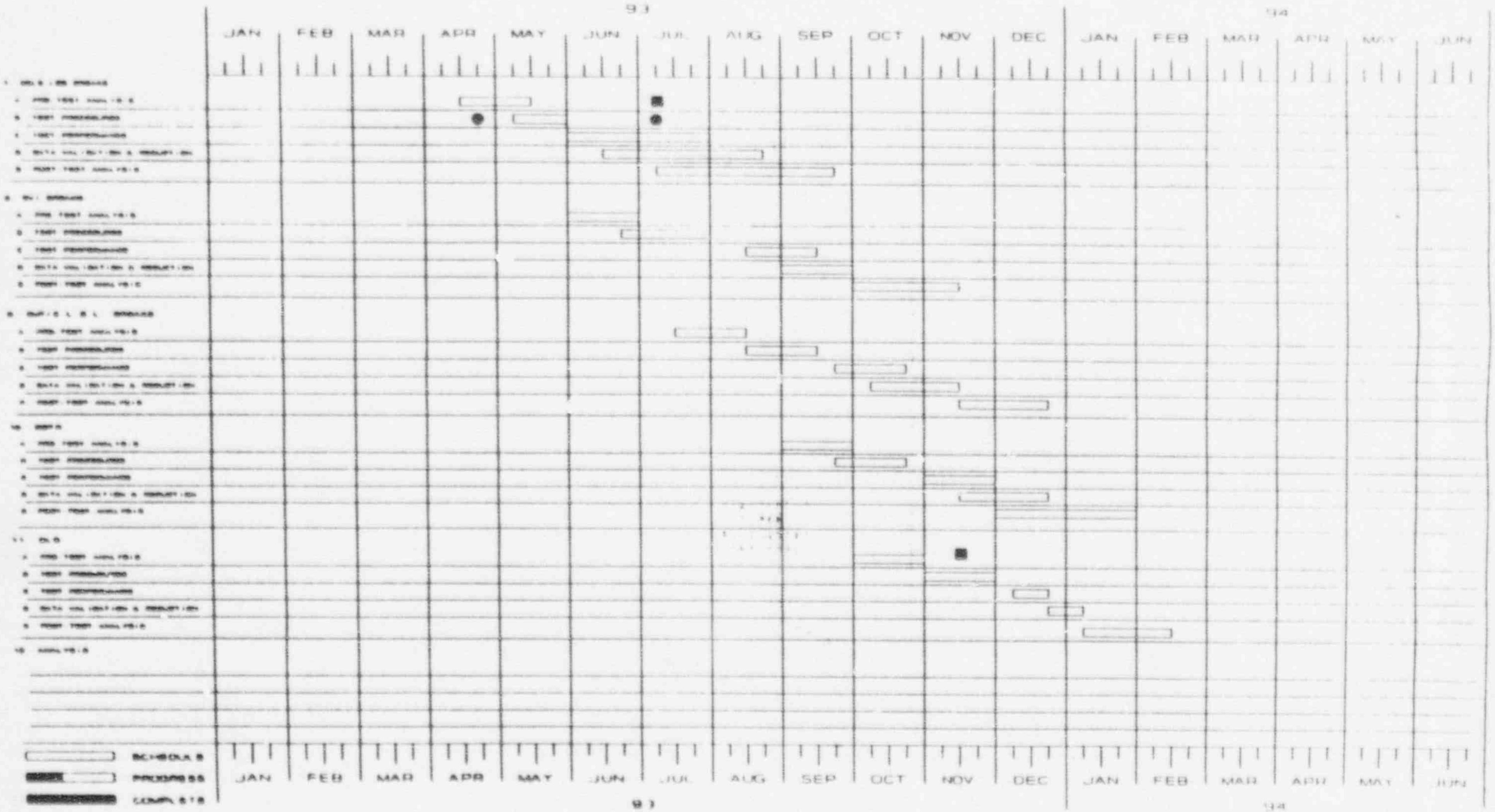
- INTEGRAL TESTS
  - SPES-2 FULL HEIGHT FULL PRESSURE TEST
  - OSU 1/4 HEIGHT SCALED PRESSURE TEST
  - PCCS LARGE SCALE HEAT TRANSFER TESTS
- SEPARATE EFFECTS TESTS
  - CORE MAKEUP TANK TEST
  - AUTOMATIC DEPRESSURIZATIONB TEST - PHASE B

SPES 2 TEST SCHEDULE (SHEET 1 OF 2)



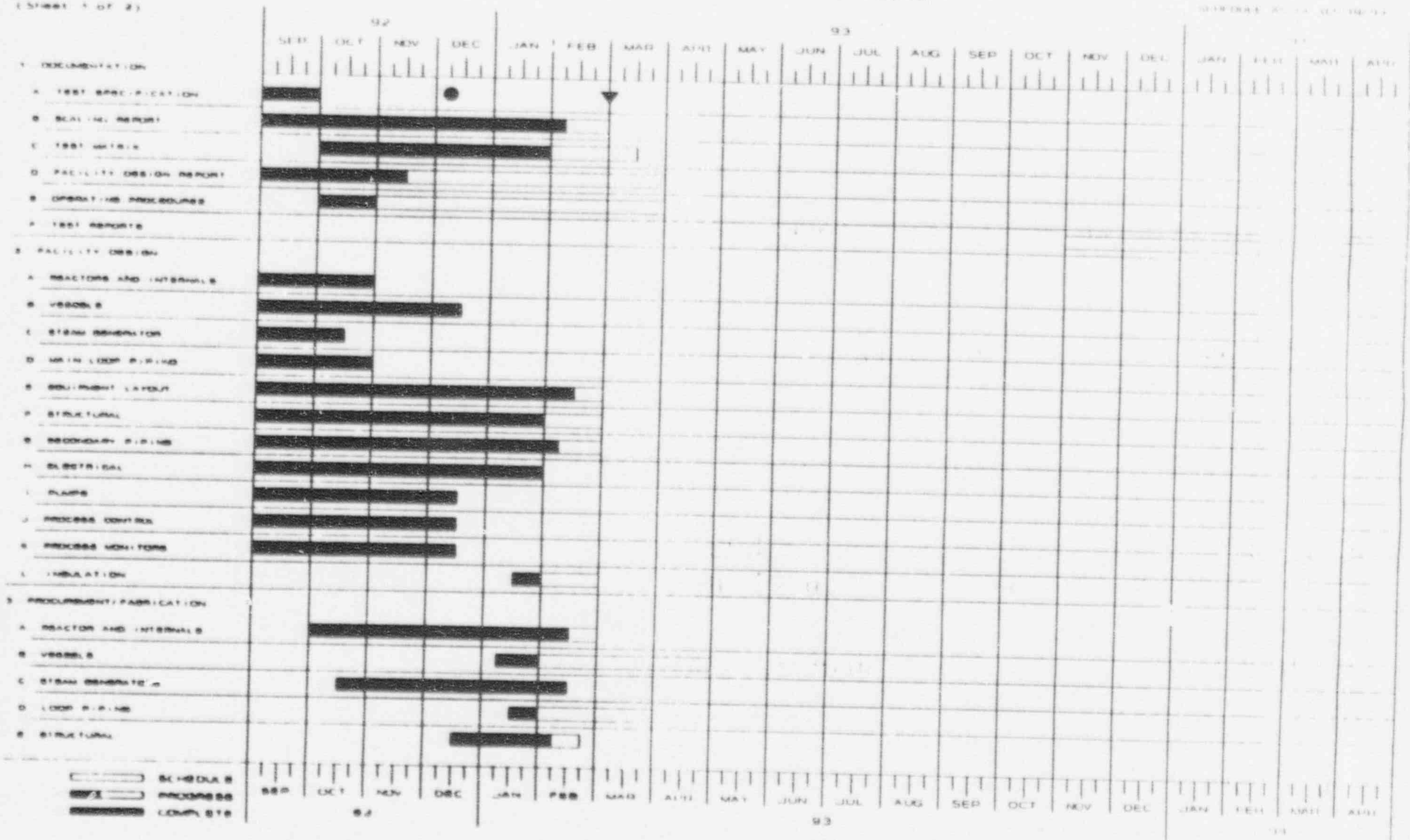
SPES 2 TEST SCHEDULE (SHEET 2 OF 2)

● - NRC
▼ - A & TRT
■ - ENEL

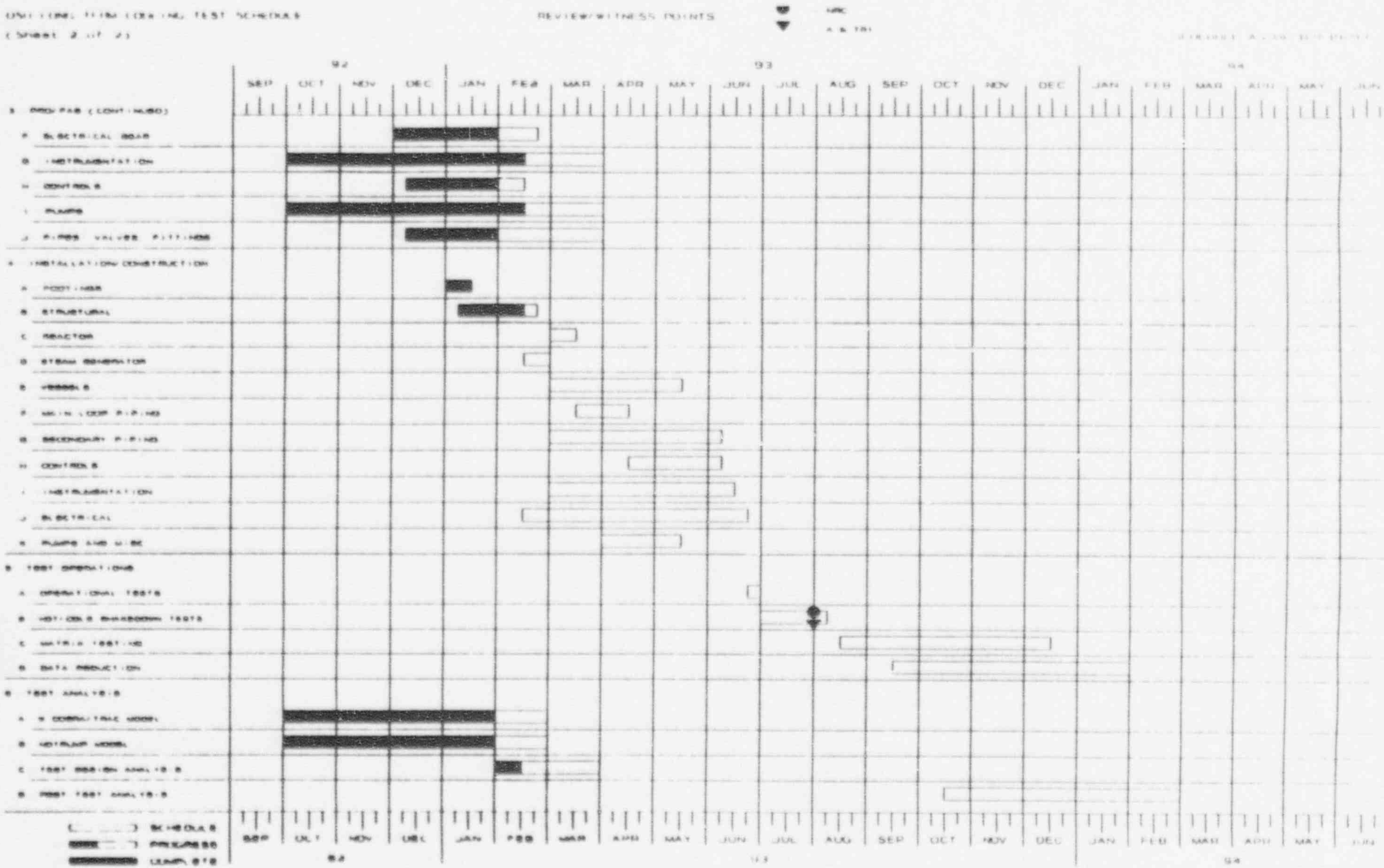


OSU LONG TERM COOLING TEST SCHEDULE
(Sheet 1 of 2)

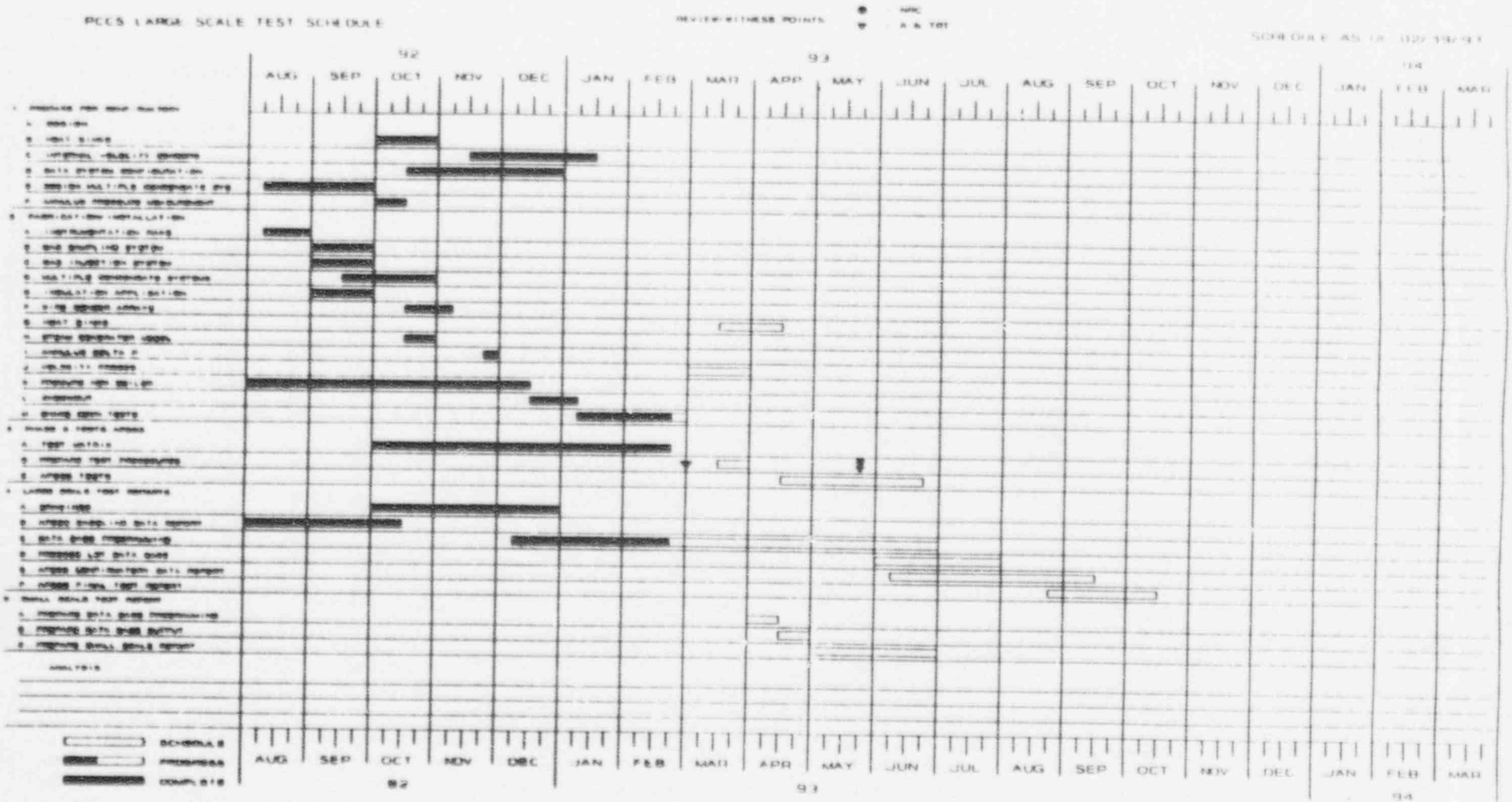
REVIEW/WITNESS POINTS ● - NRC ▼ - A & TRI



OSU LONG TERM COOLING TEST SCHEDULE
(Sheet 2 of 2)

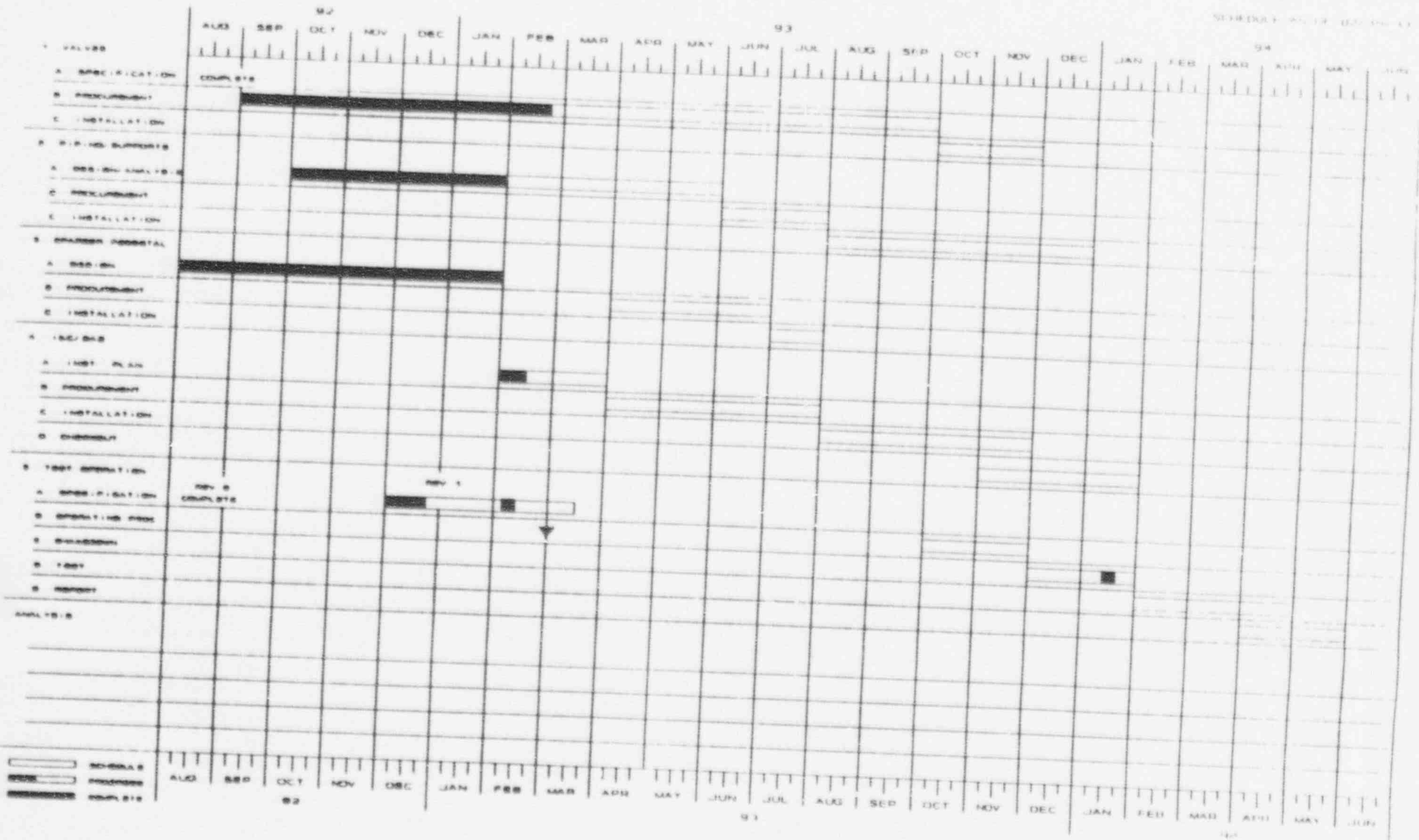


PCCS LARGE SCALE TEST SCHEDULE

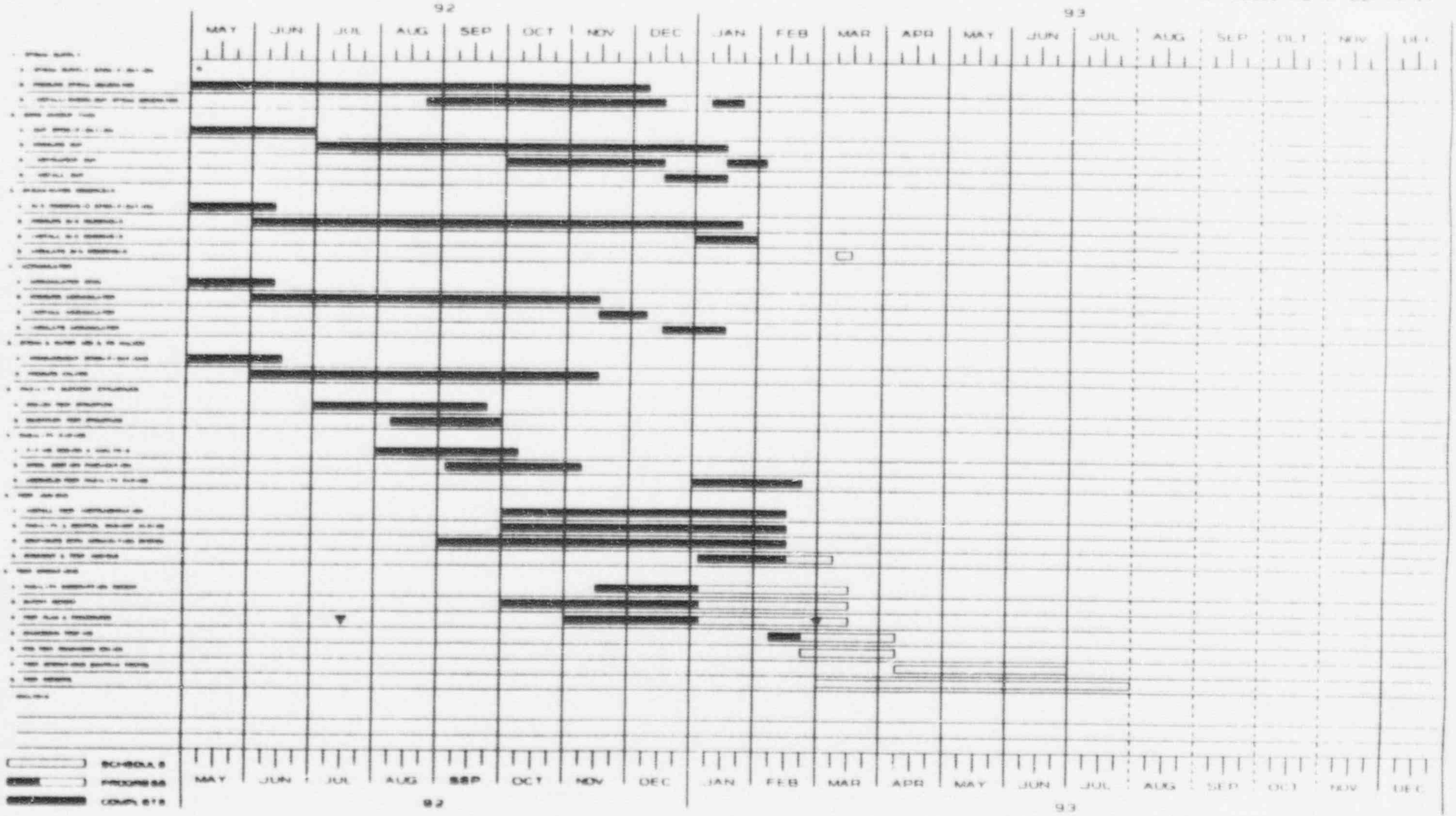


ADS PHASE B TEST SCHEDULE

REVIEW/WITNESS POINTS



CORE MAKEUP TANK TEST SCHEDULE



CONCLUSIONS

AP600

- COMPREHENSIVE AP600 TEST AND ANALYSIS PROGRAM HAS BEEN DEVELOPED AND IS IN PROGRESS
- DATA FROM TEST PROGRAMS ALREADY INCORPORATED IN SSAR ANALYSIS
- KEY NEW PLANT FEATURES ARE BEING TESTED
- TEST WILL CHARACTERIZE THE UNIQUE FEATURES AT LARGE SCALES SO THAT COMPUTER MODELS CAN BE DEVELOPED OR VERIFIED
- COMBINED TEST AND ANALYSIS PROGRAM WILL MEET THE LICENSING NEEDS
- TEST DATA WILL BE FORWARDED TO THE STAFF AS TEST SERIES ARE COMPLETED
- UPCOMING TESTS ARE BEING CAREFULLY FOLLOWED TO MEET TEST OBJECTIVES AND SCHEDULES