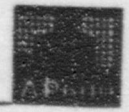
AP600



WESTINGHOUSE ELECTRIC CORPORATION

PRESENTATION

TO

UNITED STATES

NUCLEAR REGULATORY COMMISSION

WESTINGHOUSE ROCKVILLE NUCLEAR LICENSING CENTER

APRIL 20, 1993

Enclosure 1

AP600

AP600 OVERVIEW

APRIL 20, 1993

AGENDA

INTRODUCTION	ANDREA STERDIS
AP600 PASSIVE SYSTEMS	TERRY SCHULZ
AP600 PROBABILISTIC RISK ASSESSMENT	CINDY HAAG

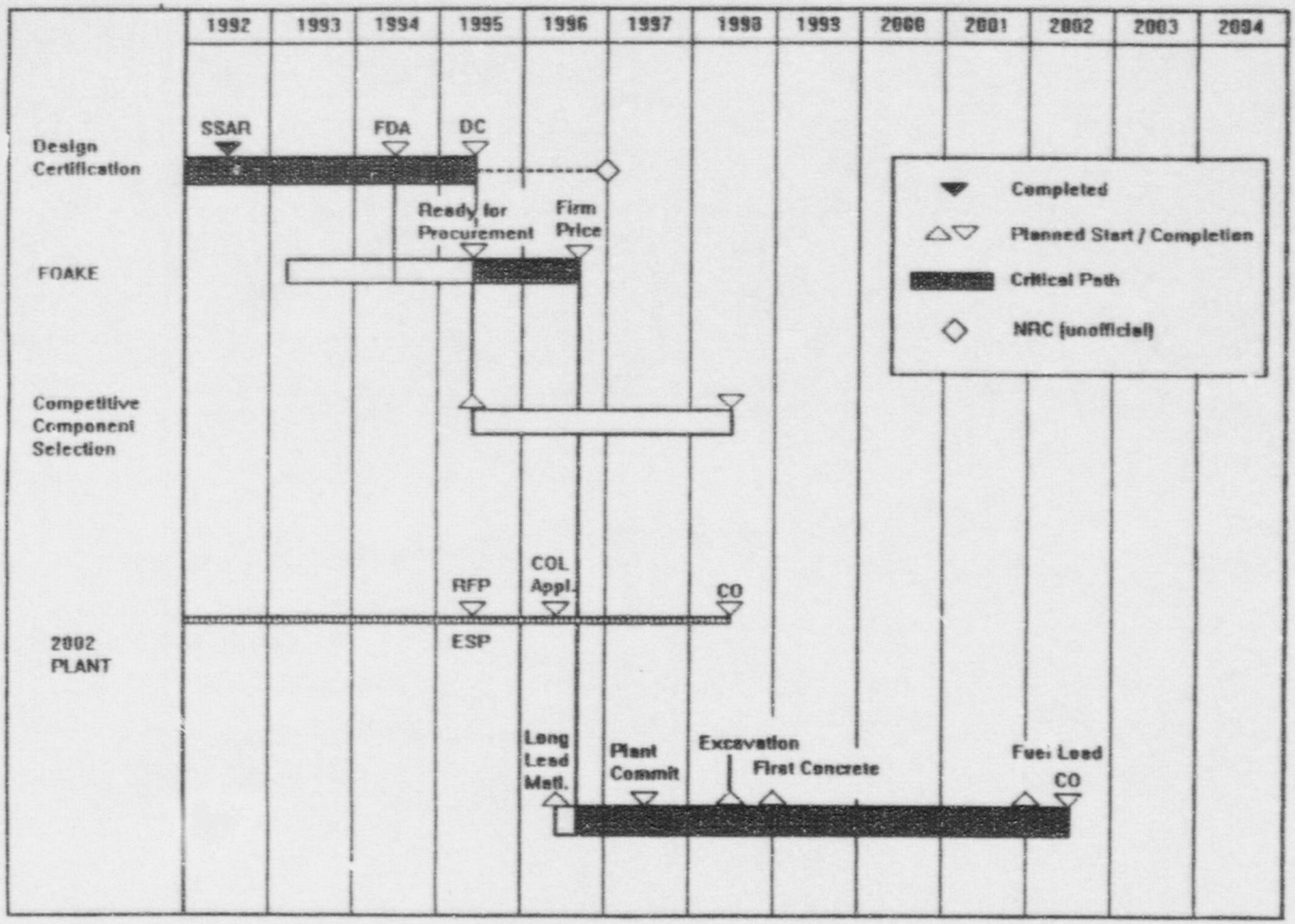
0930A

INTRODUCTION

ANDREA STERDIS

ADVANCED PLANT SAFETY & LICENSING

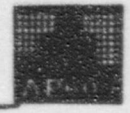
AP600



Reference: First-Of-A-Kind Engineering AP600 Advanced Light Water Reactor Design Proposal to Advanced Reactor Corporation

DESIGN CERTIFICATION ISSUES IMPACTING FOAKE

- 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 PASSIVE SYSTEMS

T. L. SCHULZ, FELLOW ENGINEER

SYSTEMS AND EQUIPMENT ENGINEERING

0930A

AP600 PASSIVE SYSTEM AGENDA

- PASSIVE SYSTEM DESIGNS
- PASSIVE SYSTEMS DEFENSE-IN-DEPTH
- PASSIVE SYSTEMS CAPABILITIES DURING SHUTDOWN
- PASSIVE SYSTEMS LONG TERM SHUTDOWN CAPABILITIES
- SAFETY RELATED ISOLATION OF NONSAFETY SYSTEMS

Passive Systems Design

AP600 SYSTEMS DESIGN

- **Greatly Simplify Systems to Improve Safety, Cost, Construction, Maintenance, & Operation**

- **Provide Simple Passive Safety Systems**
  - Use "natural" driving forces only
  - One-time alignment of active valves
  - No support systems after actuation
  - Reduced operator dependency

- **Provide Non-Safety Systems**
  - Redundant active equipment powered by nonsafety diesels
  - Minimize unnecessary use of passive safety systems
  - Reduced risk to utility & public

AP600 SAFETY SYSTEMS

- **Provide Passive Safety Systems**
  - Greatly simplified construction, maintenance, operation, ISI / IST
  - Mitigate design basis accidents withcut use of NNS systems
  - NRC PRA goals w/o NNS system; EPRI PRA goals w NNS system

- **Safety Systems Design Features**
  - Only passive processes; no "active" equipment
  - Conservative design for DBA; margins, single failure criteria
  - Best estimate design for PRA; multiple failures
  - Greatly reduced need for operator actions

- **Safety Equipment Design Features**
  - Reliable / experience based equipment
  - Improved inservice testing / inspection
  - Reg Guide 1.26 Quality Group A, B, or C; Seismic I design
  - Availability controlled by Tech Spec with shutdown requirements
  - Reliability Assurance Program
  - Tier I description and ITAAC

AP600 PASSIVE SAFETY FEATURES

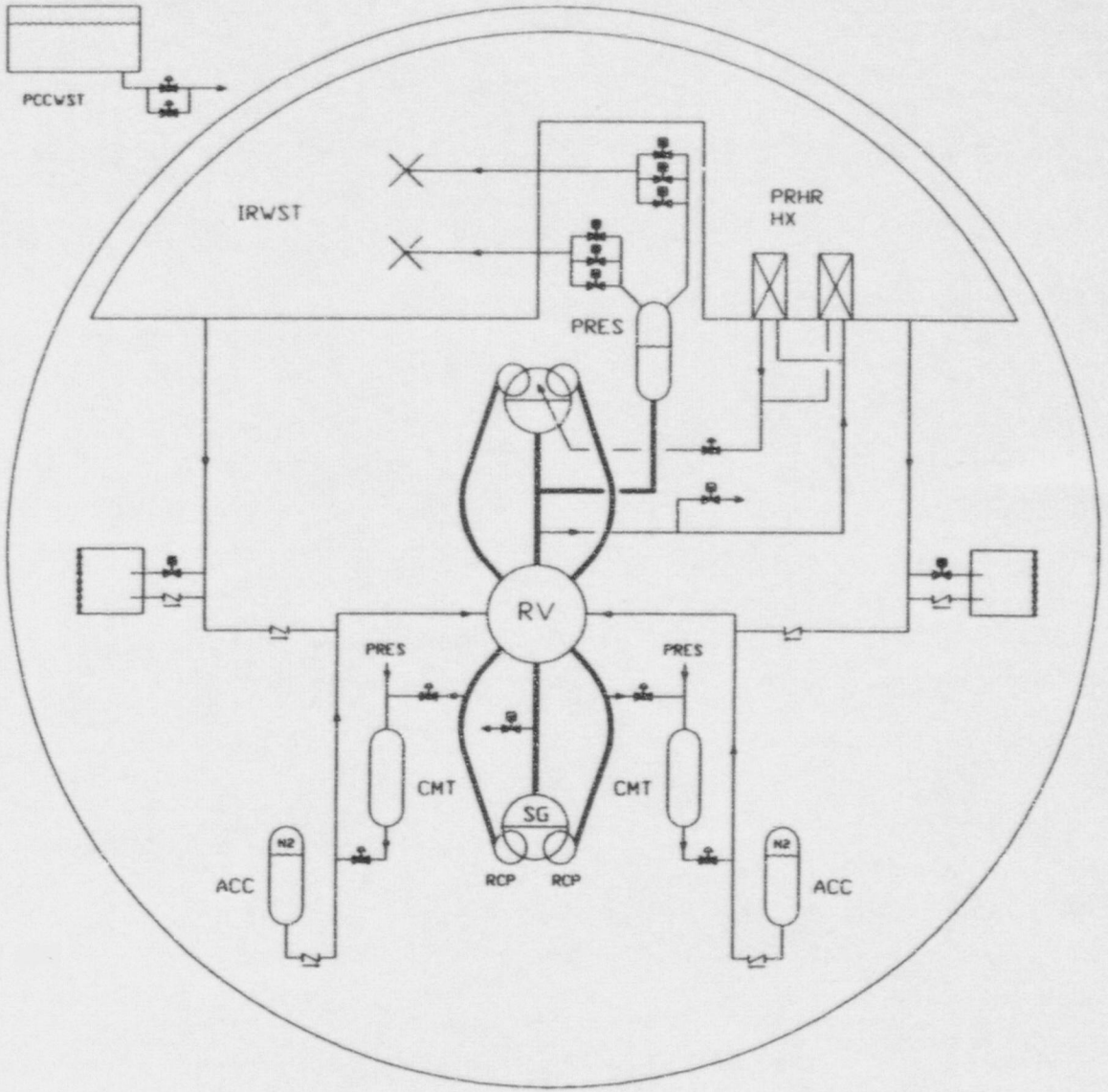
- **Passive Decay Heat Removal**
  - Natural circulation HX connected to RCS

- **Passive Safety Injection**
  - N2 pressurized accumulators
  - Gravity drain core makeup tanks (RCS pressure)
  - Gravity drain refueling water storage tank (containment pressure)
  - Automatic RCS depressurization

- **Passive Containment Cooling**
  - Steel containment shell transfers heat to natural circulation of air and evaporation of water drained by gravity

- **Passive HVAC**
  - Compressed air for habitability of main control room
  - Concrete walls for heat sink (MCR and I&C rooms)

AP600 – PASSIVE SAFETY SYSTEMS



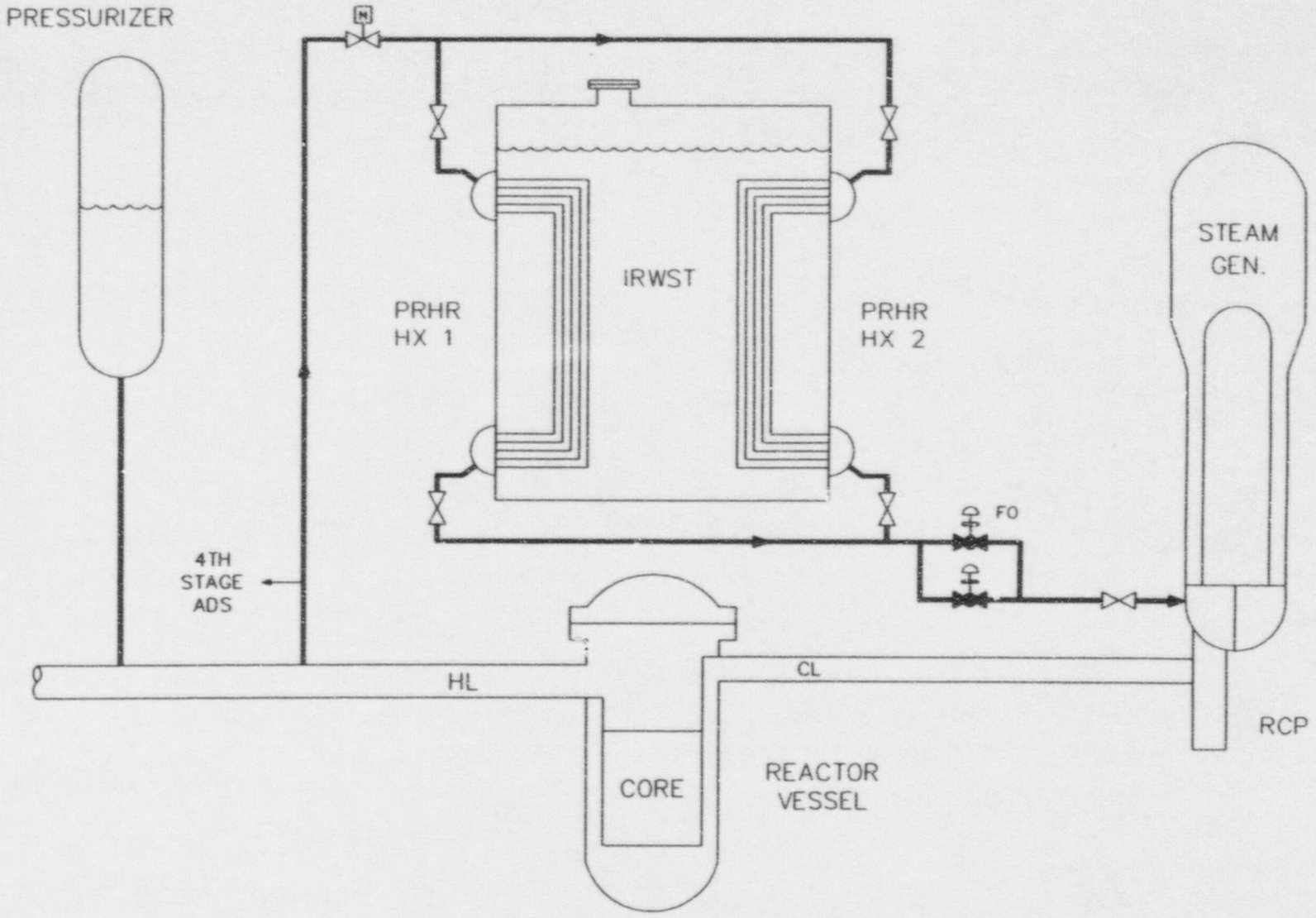
AP600 DECAY HEAT REMOVAL

- **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, auto load on NNS diesels

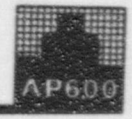
- **Passive RHR Heat Exchanger**
  - Safety cooling when SFW is unavailable and non-LOCA accidents
  - Two heat exchangers connected directly to RCS
  - Forced flow with RCP; natural circ without RCP
  - Automatic actuation; two fail-open valves
  - PRHR HX located in IRWST, provides heat sink, boils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

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

AP600 – PASSIVE RHR HX



AP600 RCS MAKEUP

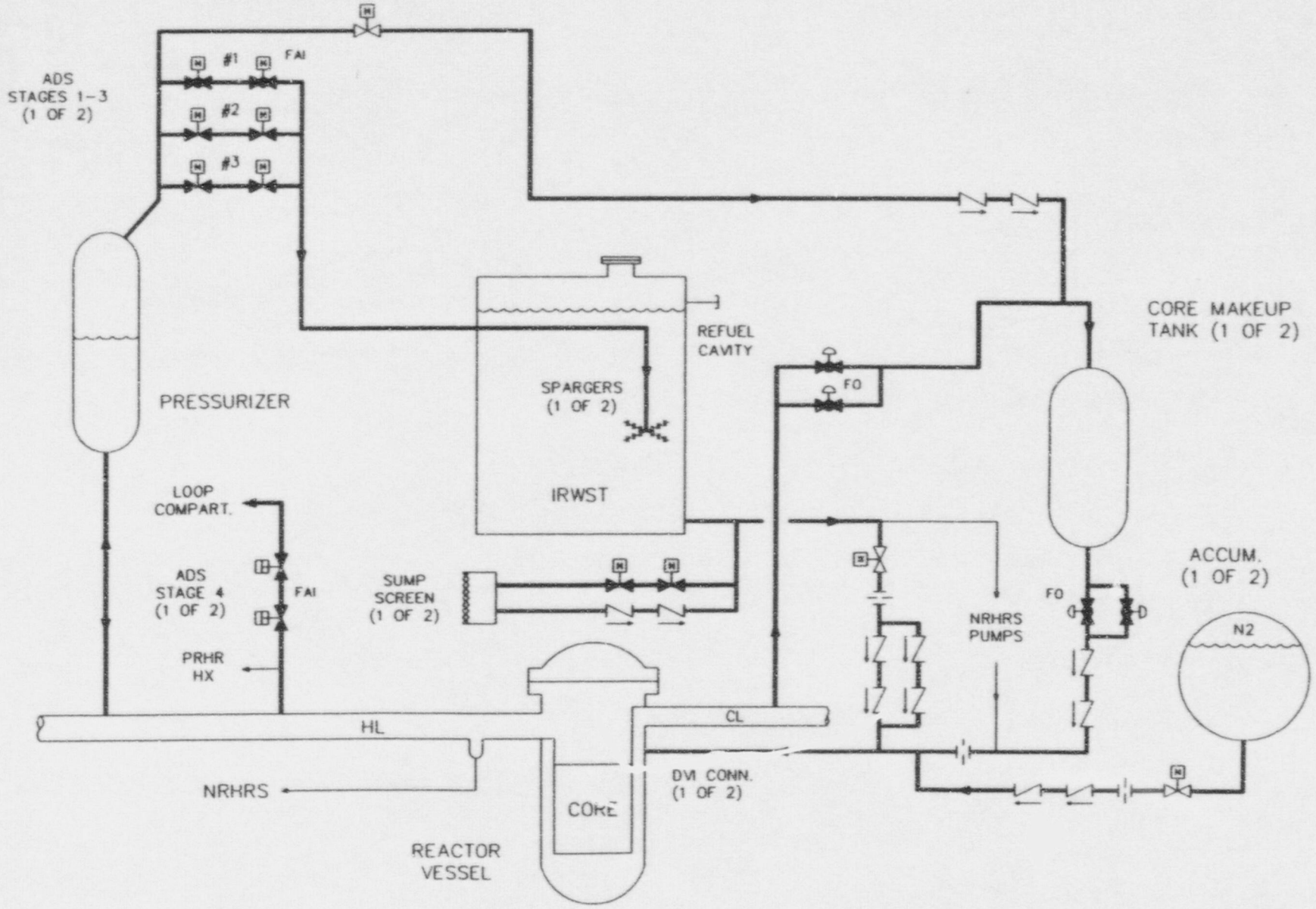


- **CVS Makeup Pumps**
  - Non-safety makeup for normal plant operation
  - Can accommodate 3/8" break without SI
  - Two motor driven centrifugal pumps
  - Automatic start and connection to diesel

- **Core Makeup Tanks**
  - Safety makeup to RCS when CVS unavailable or with larger leaks
  - Two tanks provide makeup by gravity at any RCS pressure
  - Automatic actuation by opening redundant air operated valves, fail open, for each CMT
  - Provides significant makeup before ADS act; 3 gpm leak / 40 hr

- **PXS Tanks and ADS**
  - Safety injection for LOCA
  - Also PRA backup to CMT & CVS
  - Two CMT, two Accumulators and one IRWST provide makeup
  - Four stages ADS provide controlled depressurization of RCS

AP600 – PASSIVE SAFETY INJECTION



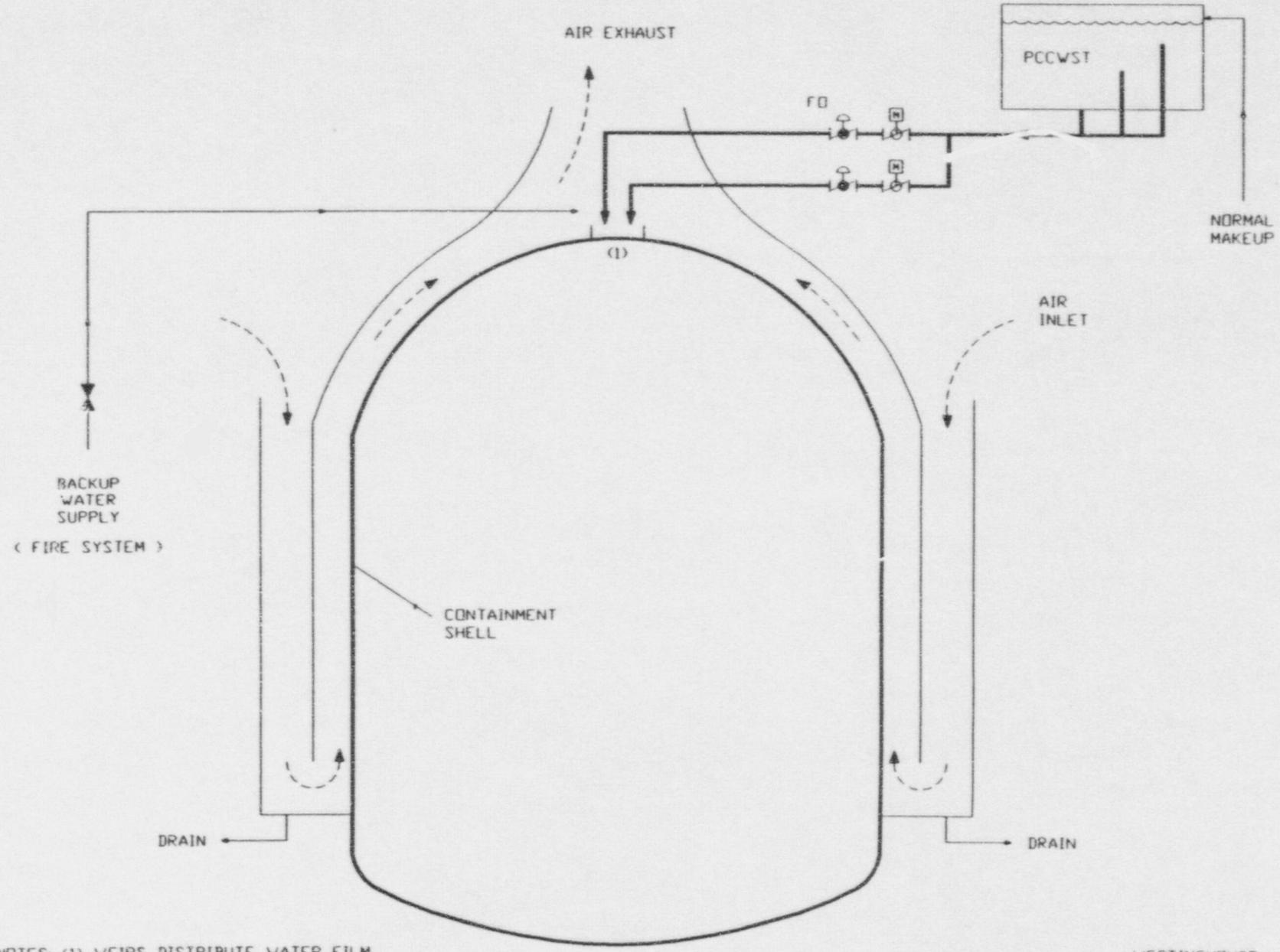
AP600 CONTAINMENT COOLING

- **Containment Fan Coolers**
  - Nonsafety heat removal during normal operation and transients
  - 2 coolers, each with redundant fans
  - Chilled water provides heat sink
  - Automatic control and loading on NNS diesels

- **Passive Containmemt Cooling System**
  - Safety heat removal when fan coolers are unavailable or during large energy releases
  - Steel containment shell cooled by air flow / water evaporation
  - Water drains by gravity from elevated tank, air circulates by natural circulation
  - Automatic actuation opens redundant air operated valves. fail open

- **Other Containment Cooling Features**
  - Boiling of water sprayed on outside of containment vessel from fire protection pumps
  - Natural circulation of air, without any water

AP600 – PASSIVE CONTAINMENT COOLING SYSTEM



NOTES: (1) WEIRS DISTRIBUTE WATER FILM

Passive Safety System Defense-In-Depth Capabilities

PASSIVE SYSTEM DID CAPABILITIES

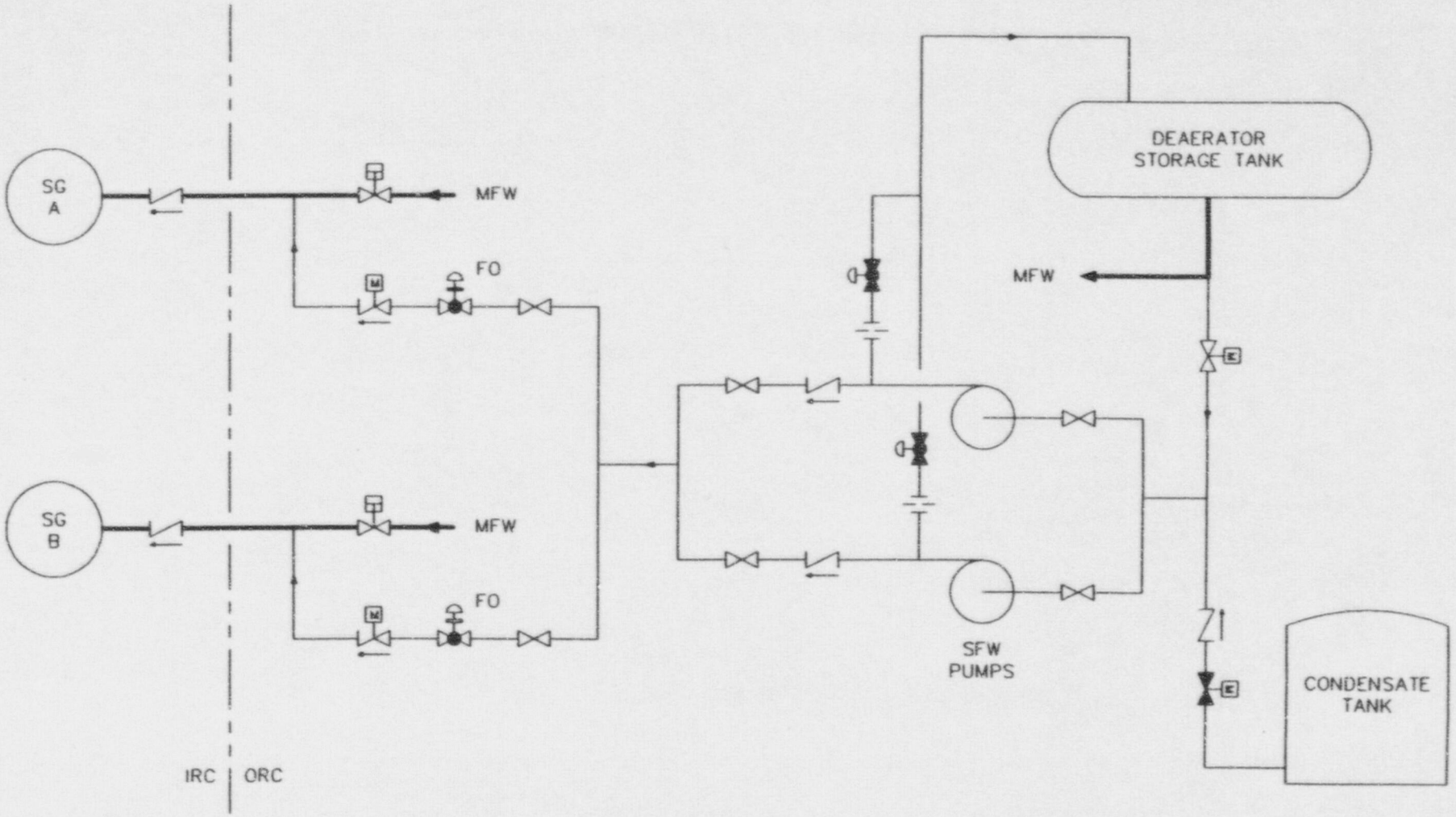
- **Passive Safety Systems Provide Defense-In-Depth Capabilities**
  - Some provided in original design; others provided in design changes incorporated to improve PRA
  - More probable events have greater protection
  - Supported by best estimate analysis

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

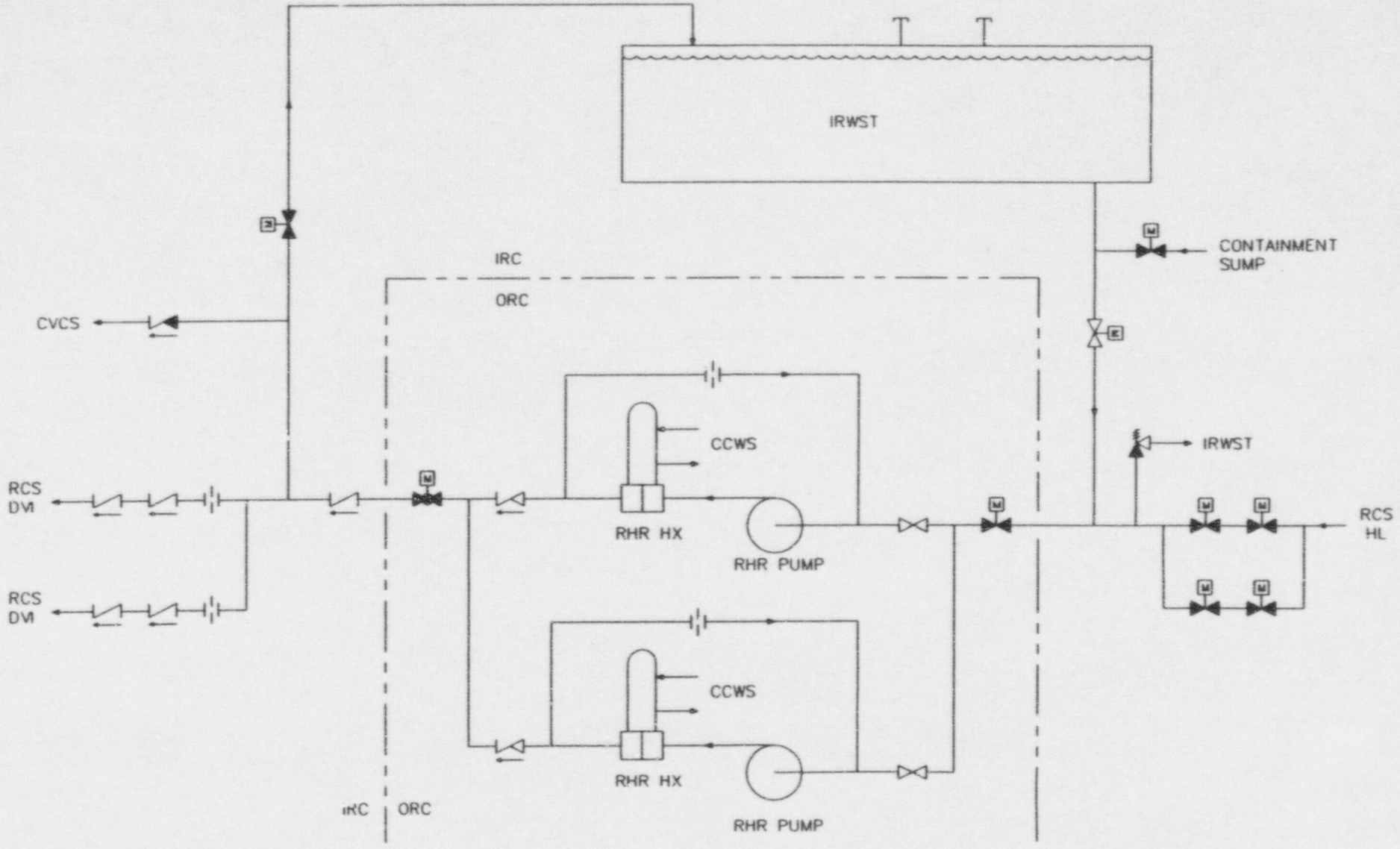
TLS - 2/18/93

AP600 – STARTUP FEEDWATER SYSTEM



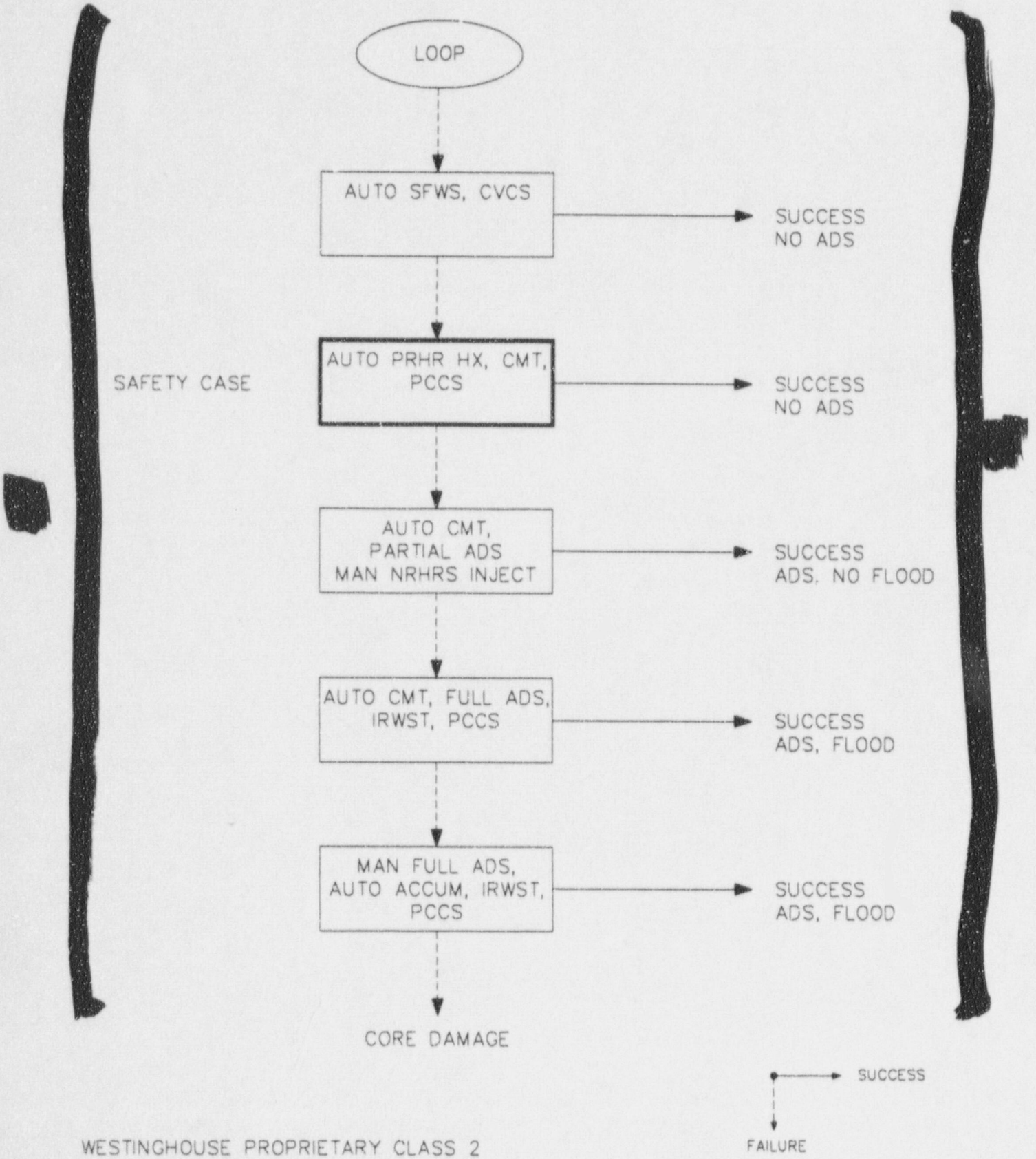
WESTINGHOUSE – 3/93

AP600 – NORMAL RESIDUAL HEAT REMOVAL SYSTEM



WESTINGHOUSE – 2/92

AP600 – LOSS OF OFFSITE POWER



Plant: **AP600**

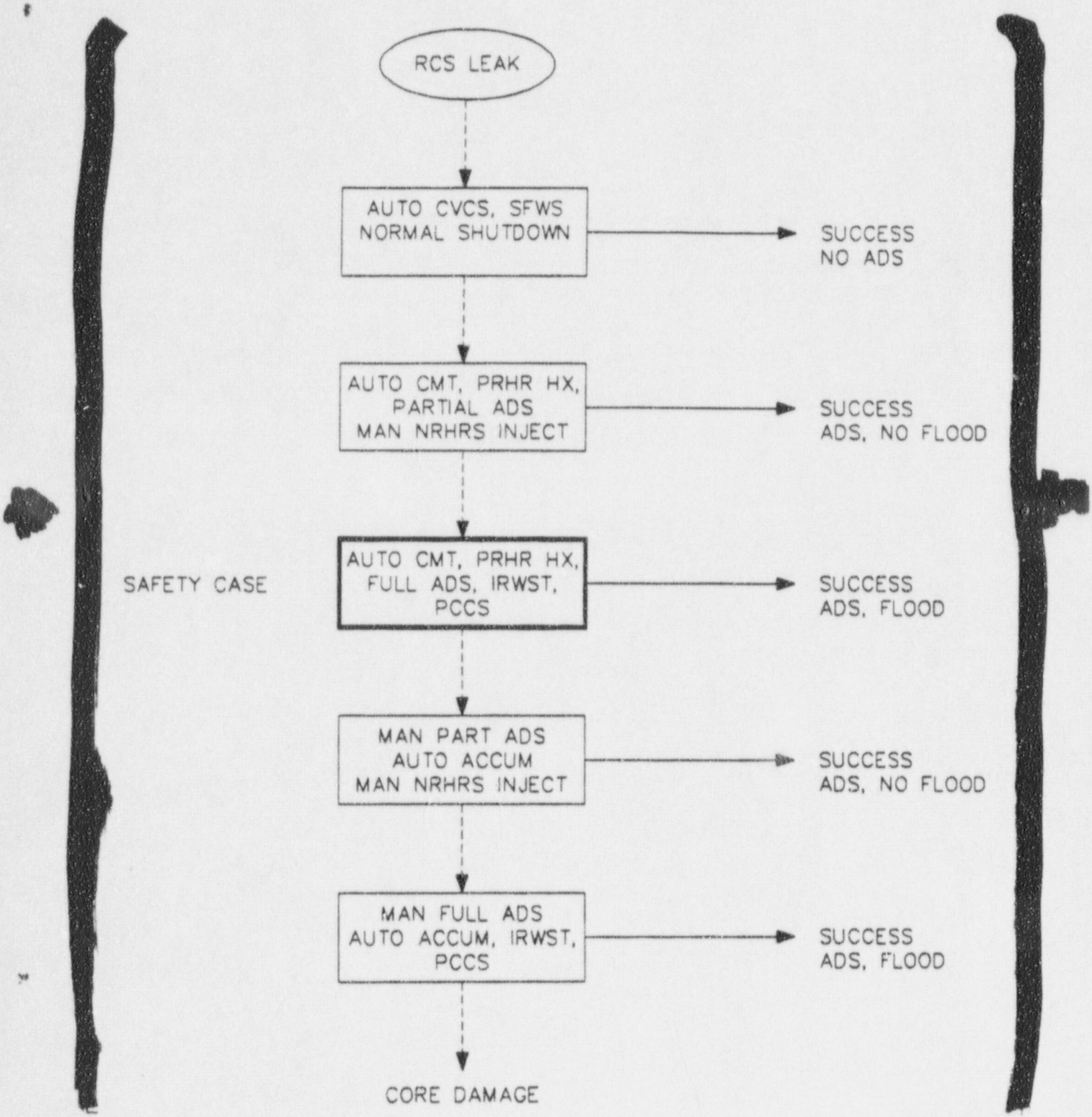
Event: **LOSS OFFSITE POWER** at **FULL POWER**

Function System Order of Use	Actuation / Electrical Systems						
	Non-Safety			Safety		Diverse	
	PLS	DC	AC	PMS(1)	DC	DAS	HW
o Reactor Shutdown							
1. Control Rods	-	-	-	A	-	-	-
2. Control Rods	-	-	-	-	-	A	-
3. Control Rods	-	-	-	-	-	-	M
4. Ride Out (2)	M	Yes	Yes	-	-	A	M
o RCS Inventory Control							
1. CVS	A	Yes	Yes	-	-	-	-
2. CMT	-	-	-	A	-	-	-
3. CMT	-	-	-	-	-	A	-
4. CMT	-	-	-	-	-	-	M
5. CMT, RNS, part ADS	M	Yes	Yes	A	Yes	-	-
6. CMT, IRWST, full ADS	-	-	-	A	Yes	-	-
7. Accum, RNS, part ADS	M	Yes	Yes	-	Yes	-	M
8. Accum, IRWST, full ADS	-	-	-	-	Yes	-	M
o RCS Heat Removal							
1. SFW	A	Yes	Yes	-	-	-	-
2. PRHR HX	-	-	-	A	-	-	-
3. PRHR HX	-	-	-	-	-	A	-
4. PRHR HX	-	-	-	-	-	-	M
5. CMT, RNS, part ADS	M	Yes	Yes	A	Yes	-	-
6. CMT, IRWST, full ADS	-	-	-	A	Yes	-	-
7. Accum, RNS, part ADS	M	Yes	Yes	-	Yes	-	M
8. Accum, IRWST, full ADS	-	-	-	-	Yes	-	M
o Containment Cooling							
1. Fan Coolers	A	Yes	Yes	-	-	-	-
2. CV external air, water drain	-	-	-	A	-	-	-
3. CV external air, water drain	-	-	-	-	-	A	-
4. CV external air, water drain	-	-	-	-	-	-	M
5. CV external water fire sys only	M	Yes	Yes	-	-	-	-
6. CV external air only	-	-	-	-	-	-	-

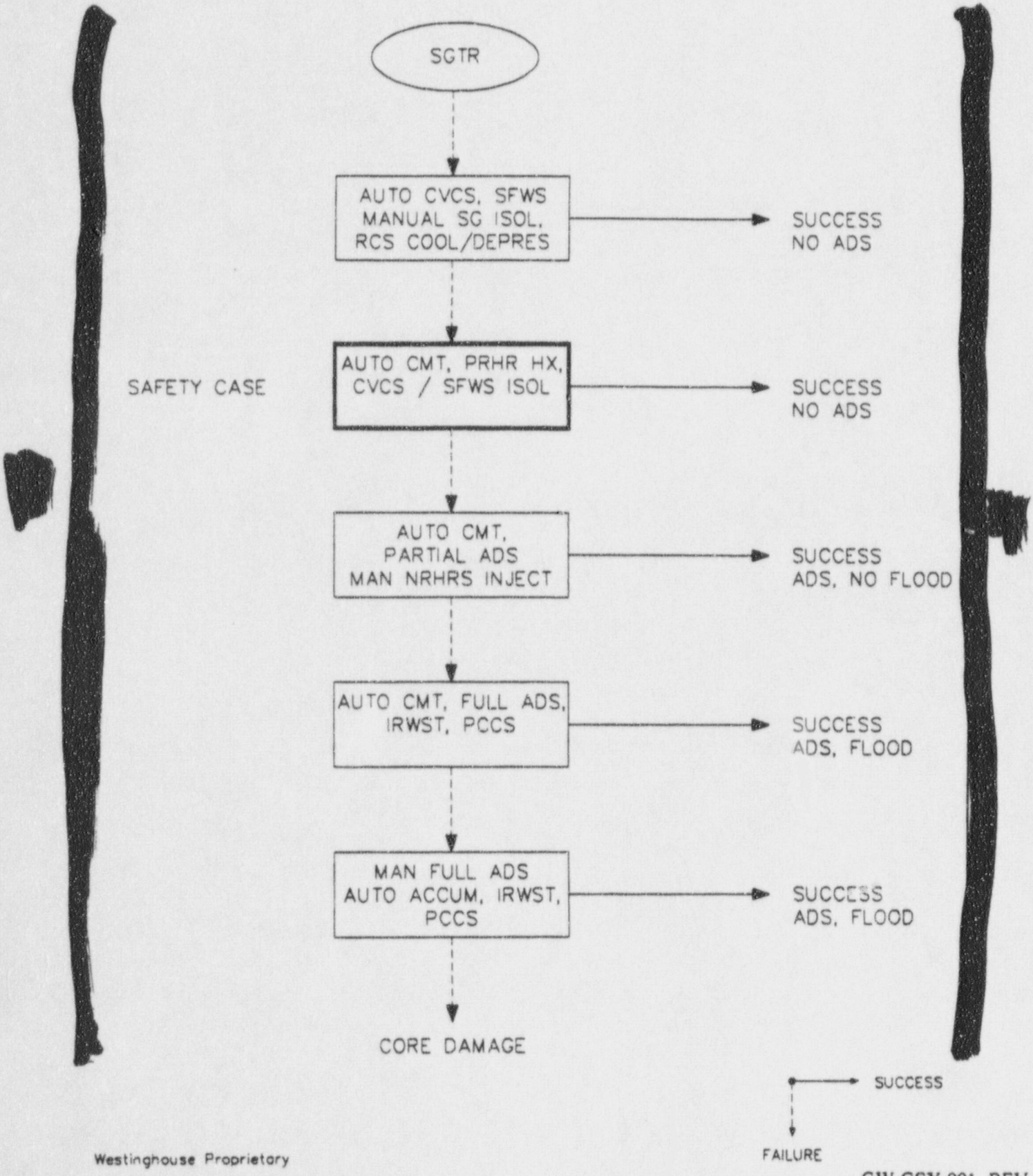
Notes:

1) Safety components have safety related MCB manual controls via both individual soft control switches and dedicated system level switches.
2) Reactor is shut down by negative moderator temperature coefficient as the coolant heats up. Requires automatic RCS pressure relief, turbine trip, and PRHR HX actuation. Also requires manual CMT or CVS boration.

AP600 – RCS LEAK (0–3/8")



AP600 – SG TUBE RUPTURE



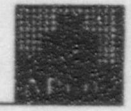
ADS DEFENSE-IN-DEPTH

- **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

PASSIVE CAPABILITY DURING SHUTDOWNS

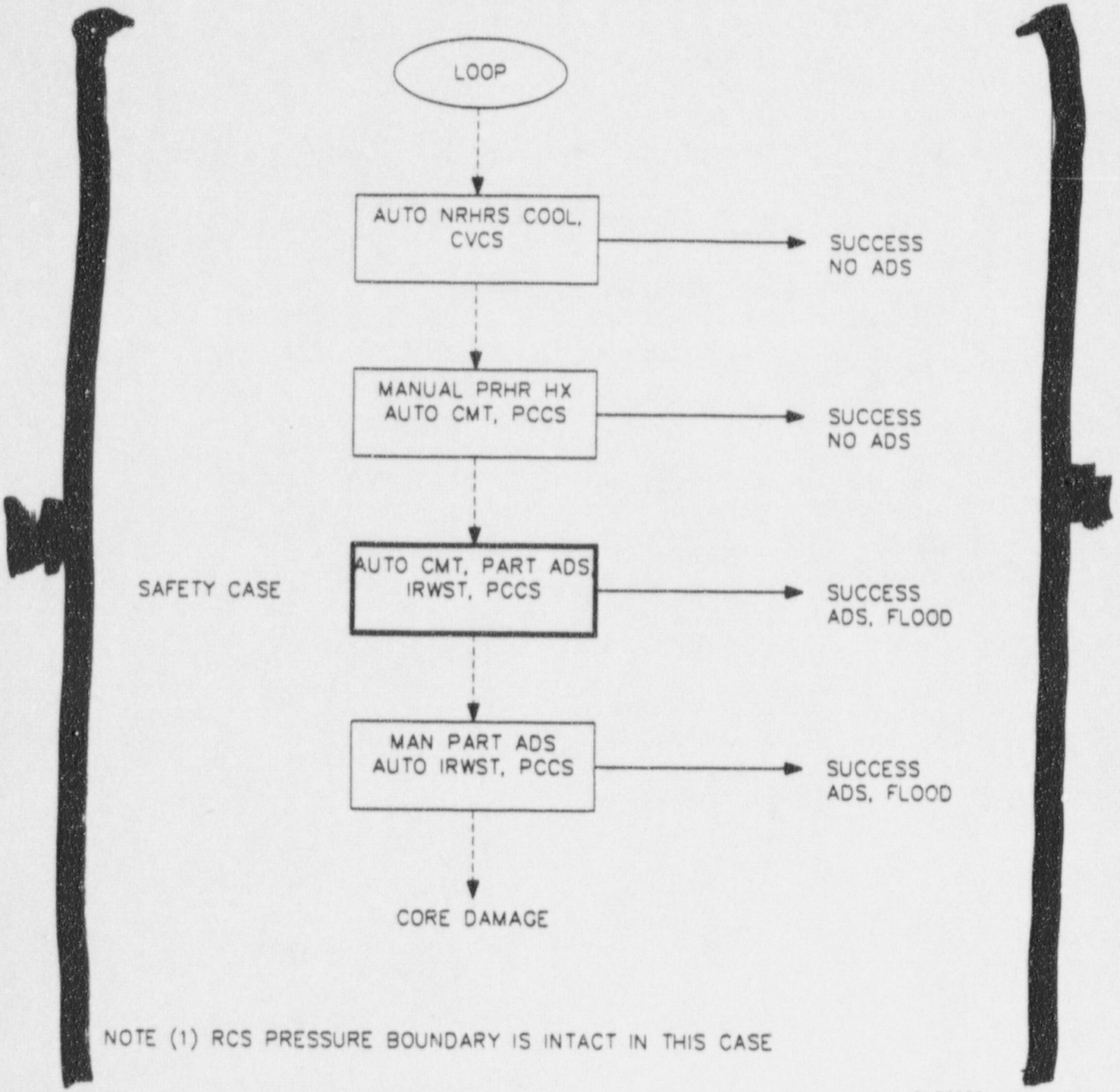
- **Passive Safety Functions Provided During All Shutdown Modes**

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

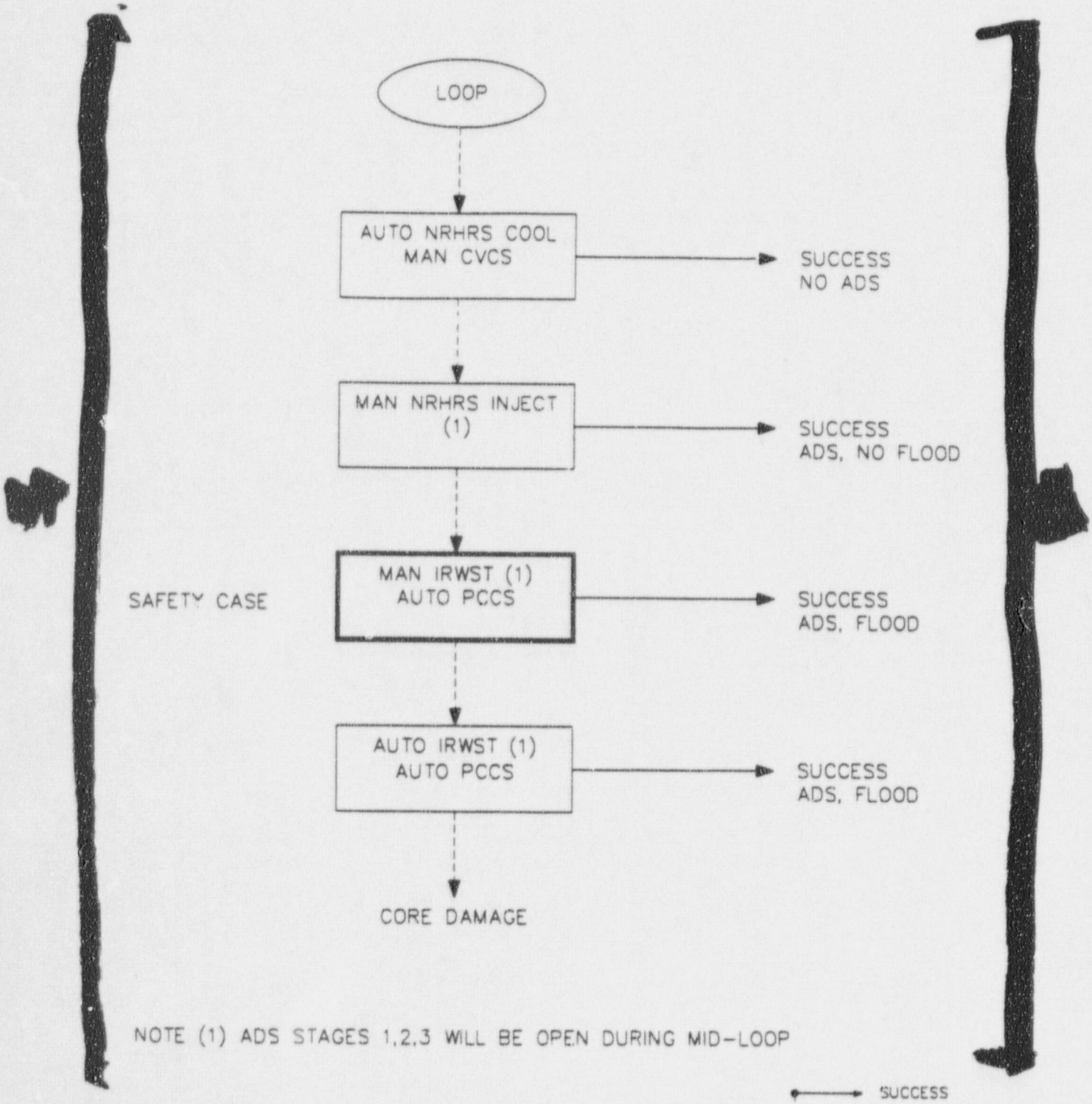
- **Cold Shutdown Mid-Loop**
  - PRHR HX ineffective (RCS open)
  - CMT / accum unnecessary
  - Tech Spec require:
    - Containment integrity
    - ADS stages 1, 2, 3 open
    - IRWST MOV available

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

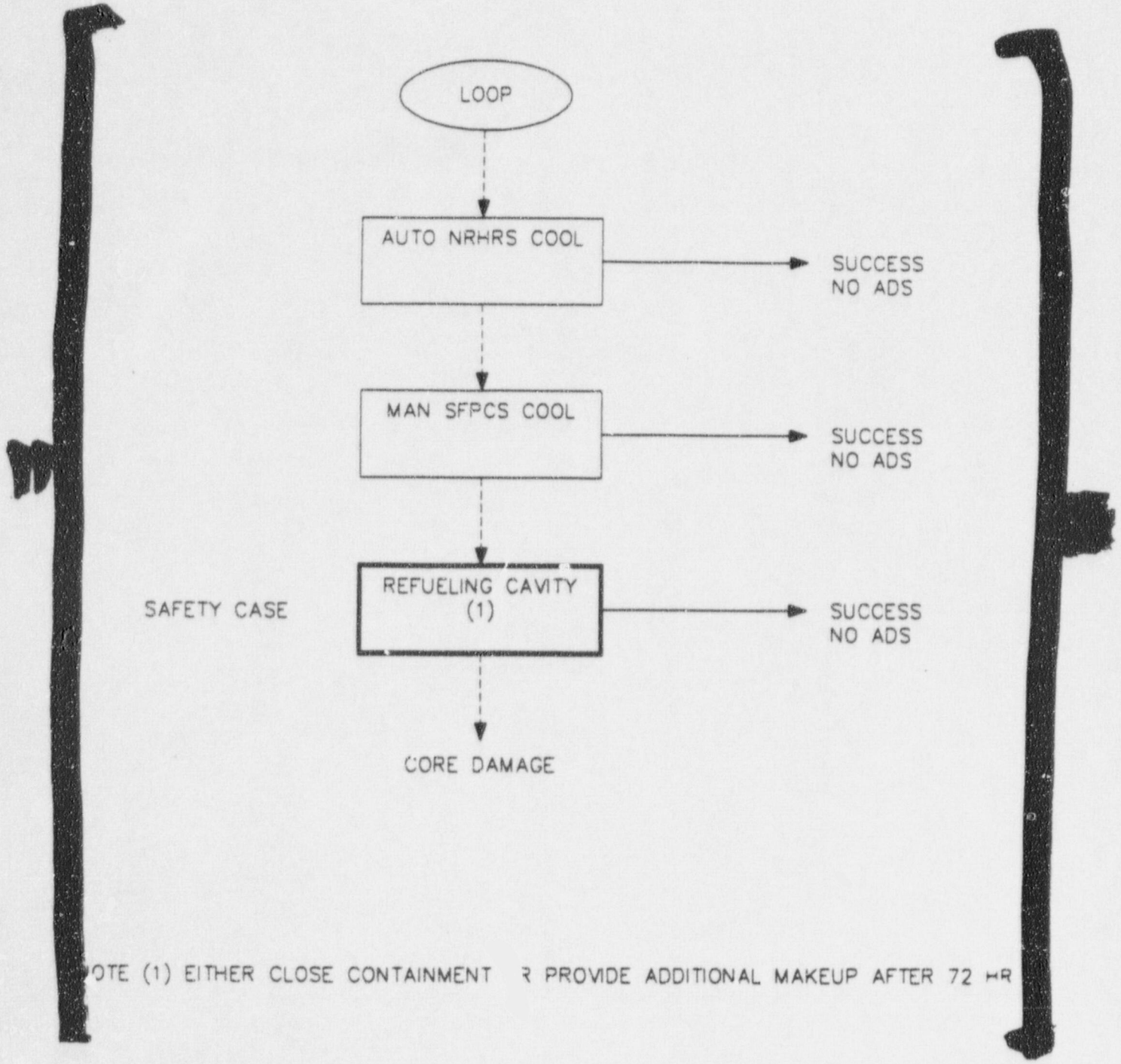
AP600 – LOSS OF OFFSITE POWER (HOT/COLD SHUTDOWN) (1)



AP600 – LOSS OF OFFSITE POWER (MID–LOOP)



AP600 – LOSS OF OFFSITE POWER (REFUELING)



Passive Safety System Long Term Shutdown Capabilities

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

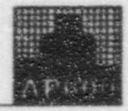
- **Safety System Extended Support Actions** (continued)
  - Provide breathable, compressed air for the control room air supply and pressurization system
    - Only required in case of serious core damage and containment leakage
  - Provide control room cooling and air recirculation
    - Only required 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

Safety Related Isolation Of Nonsafety Systems

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**

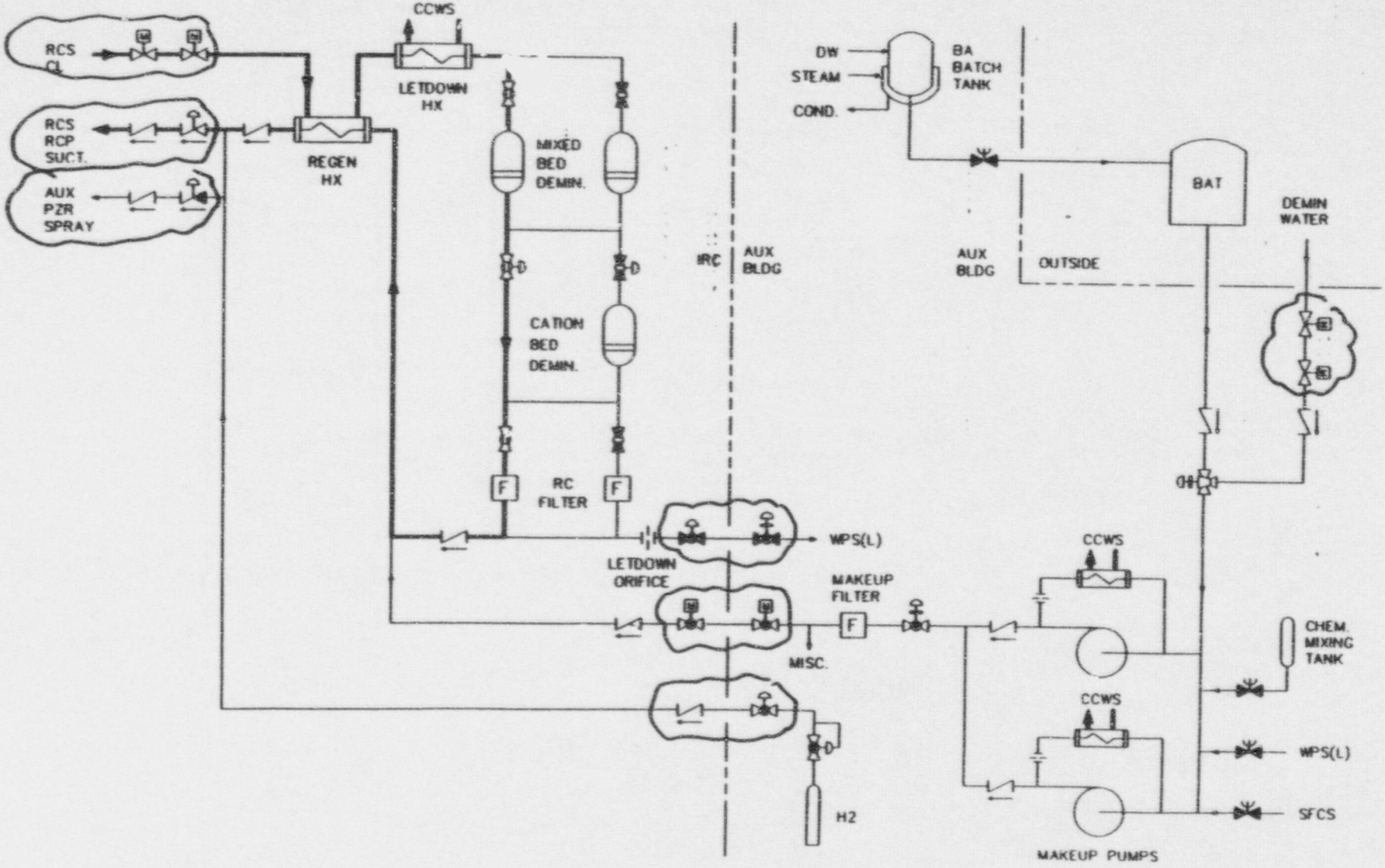
- **CVS Functions**

  - 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

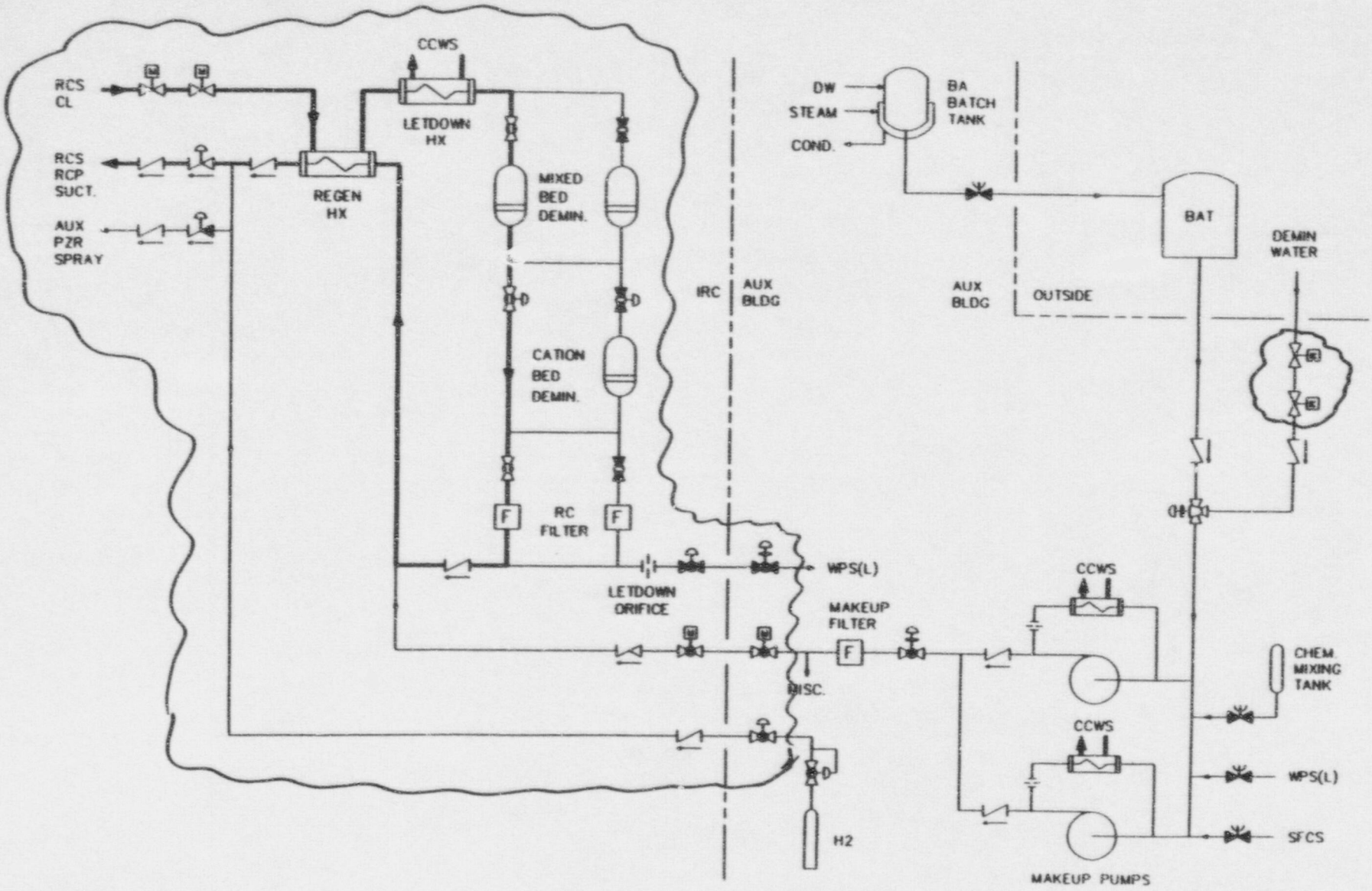
SAFETY RELATED ISOLATION

AP600 – CHEMICAL AND VOLUME CONTROL SYSTEM



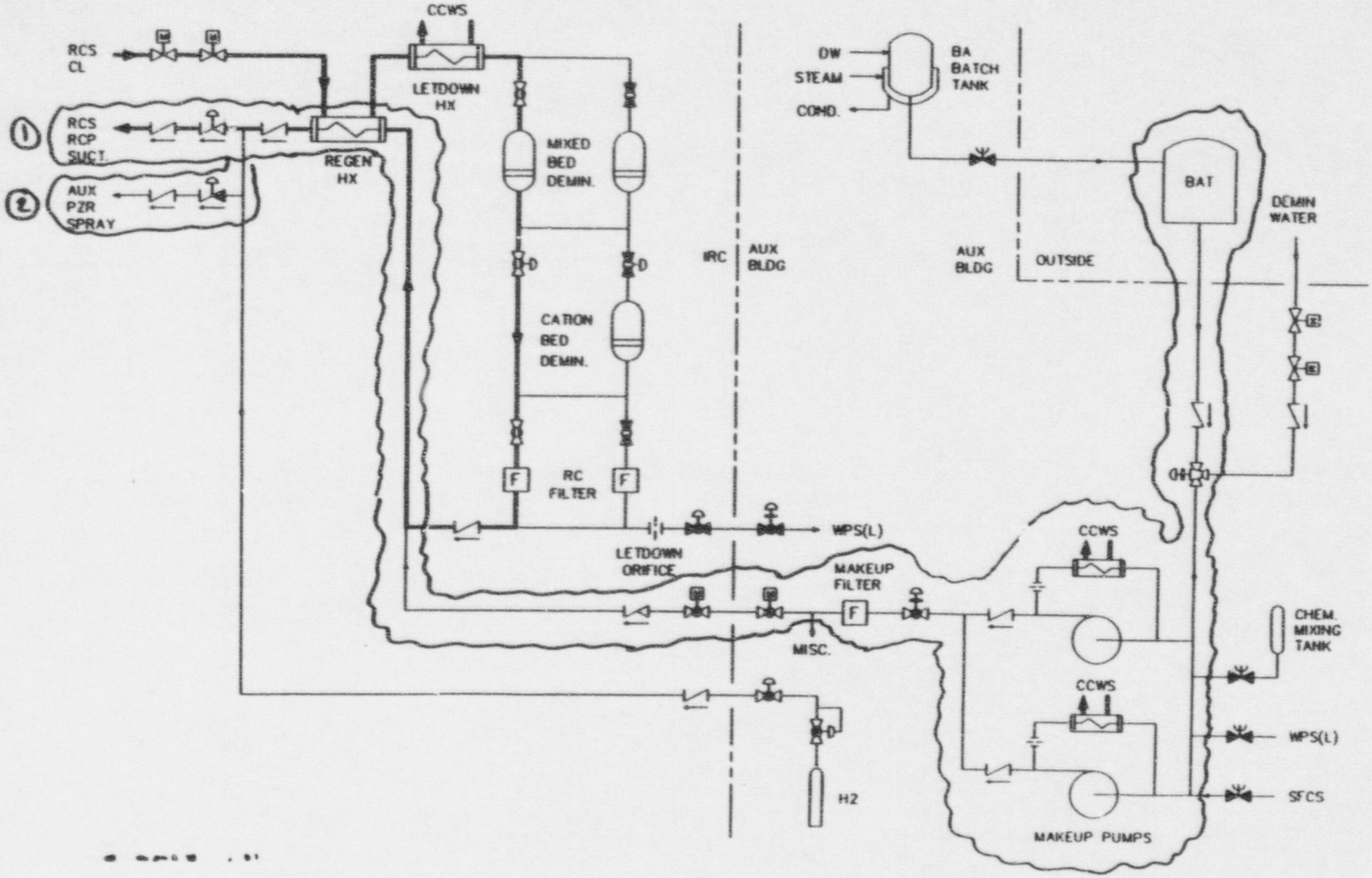
SAFETY RELATED PIPING

AP600 – CHEMICAL AND VOLUME CONTROL SYSTEM



NON SAFETY DID FUNCTIONS

AP600 – CHEMICAL AND VOLUME CONTROL SYSTEM



AP600 NON-SAFETY SYSTEMS

- **Provide Non-Safety Systems**
  - Reliably support normal operation
  - Minimize challenges to passive safety systems
  - Not required to mitigate design basis accidents
  - Not required for NRC PRA goals; used for EPRI safety goals

- **Non-Safety Systems Design Features**
  - Redundancy for more probable failures, automatic actuation
  - Power from offsite / onsite (nonsafety diesels) sourses
  - Separated from safety systems

- **Non-Safety Equipment Design Features**
  - Reliable / experienced based equipment
  - Reg Guide 1.26 Quality Group D; limited hazzard protection
  - Short term availability by plant procedures w/o shutdown requirements
  - Long term availability by Reliability Assurance Program
  - Less detailed Tier I description and ITAAC

PROBABILISTIC RISK ASSESSMENT

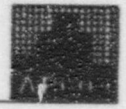
C. L. HAAG, SENIOR ENGINEER

RISK MANAGEMENT AND

OPERATIONS IMPROVEMENT

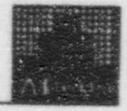
0810A

AP600 PRA



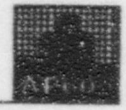
AGENDA

- 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

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

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**

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

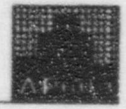
PRHR SYSTEM RELIABILITY

- **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

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

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	

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

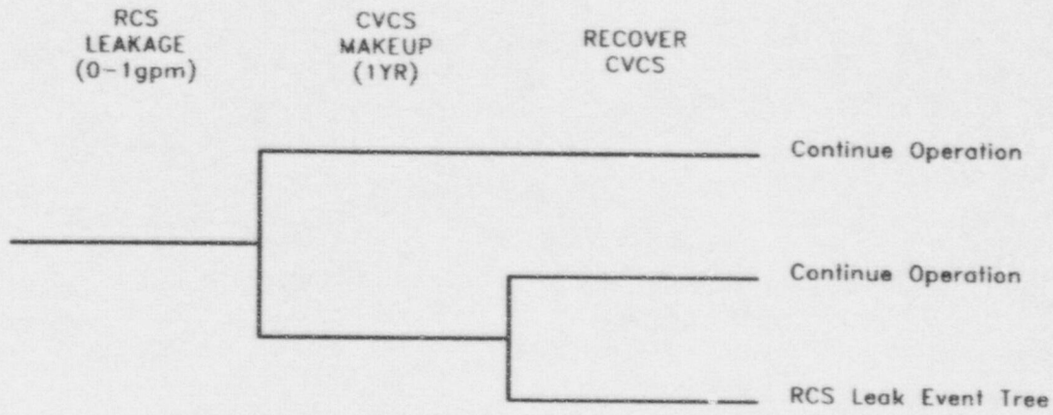
LEAKAGE EVENTS

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

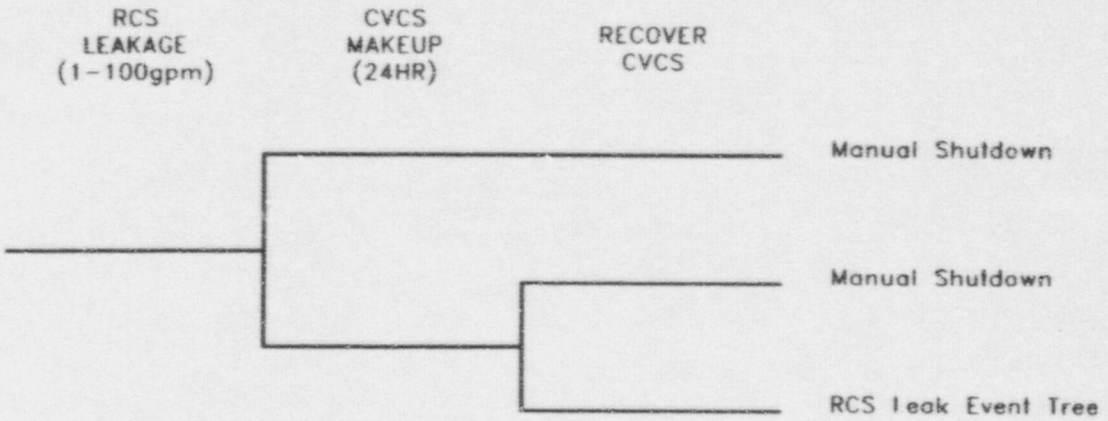
NRC #	LER #	Description	Leak (gpm)
17	323-89006	Pzr SV seal	10.0
20	339-91011	RHR valve packing	10.0
18	323-91004		1.9
11	302-90001	PORV block valve packing	1.3
28	369-90025	PORV packing	1.0

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

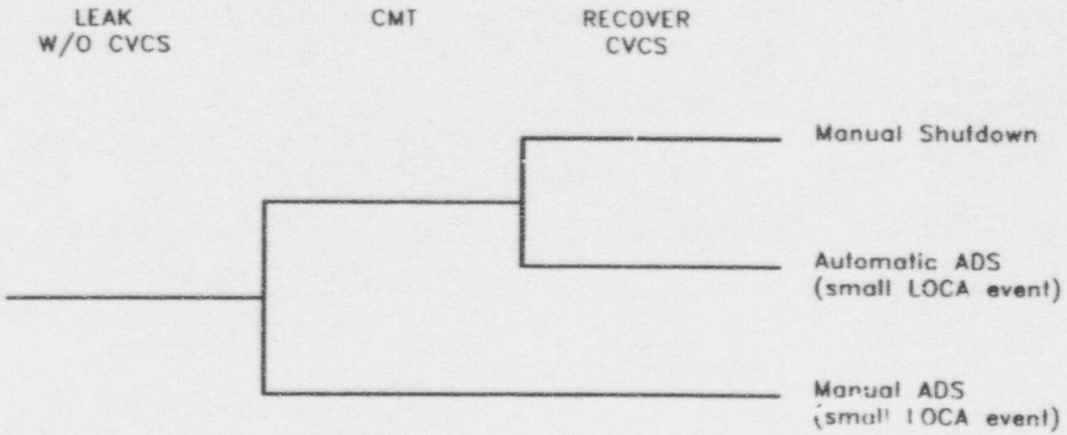
AP600 PRA



RCS Leak Initiating Event



RCS Leak Initiating Event



RCS Leak Event Tree

RCS LEAK EVALUATION

- Currently evaluating RCS leakage events with respect to RTNSS
- Anticipate core damage frequency increase will be negligible
- Importance of CVCS should not change

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

INITIATING EVENT CONTRIBUTION TO CORE DAMAGE (AT POWER)				
Initiating Event	Base Case		Sensitivity Case	
	CDF	% of Total	CDF	% of Total
Transients/LOOP	7.5E-8	22.4	6.2E-7	24.0
Small LOCA	2.3E-8	6.9	1.3E-7	4.8
Very small LOCA	1.2E-8	3.6	1.3E-7	5.1
PRHR tube rupture	4.2E-8	12.6	1.4E-6	53.1
Medium LOCA	1.2E-8	3.6	1.3E-7	5.1
Safety injection line break	7.3E-8	21.9	7.7E-8	3.0
CMT line break	2.7E-9	0.8	3.0E-8	1.2
Large LOCA	1.6E-8	4.8	1.6E-8	0.6
SG tube rupture	2.6E-9	0.8	2.7E-9	0.1
ATWS loss of feedwater w/o scram	4.5E-8	13.6	4.9E-8	1.9
Vessel rupture	3.0E-8	9.0	3.0E-8	1.2
Total	3.3E-7		2.6E-6	

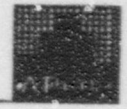
INITIATING EVENT PERCENT CONTRIBUTION TO CORE DAMAGE (AT POWER)		
Initiating Event	**Base Case**	**Sensitivity Case**
Transients/LOOP	22.4	24.0
Small LOCA	6.9	4.8
Very small LOCA	3.6	5.1
PRHR tube rupture	12.6	53.1
Medium LOCA	3.6	5.1
Safety injection line break	21.9	3.0
CMT line break	0.8	1.2
Large LOCA	4.8	0.6
SG tube rupture	0.8	0.1
ATWS loss of feedwater w/o scram	13.6	1.9
Vessel rupture	9.0	1.2

AP600 PRA

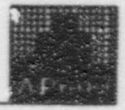
AP600 NON-SAFETY SYSTEM SENSITIVITY CASE

	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



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

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

Distribution: Mary Fat
B. J. Huffman

Westinghouse Electric Corporation Energy Systems

Box 355
Pittsburgh Pennsylvania 15230-0355

DCP/NRC1409
NSD-NRC-98-5753
Docket No. 52-003

August 13, 1998

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

ATTENTION: T. R. QUAY

SUBJECT: RESPONSE TO NRC LETTERS CONCERNING REQUEST FOR WITHHOLDING INFORMATION

Reference:

1. Letter, Sebrosky to McIntyre, "Request for withholding proprietary information for Westinghouse letters dated December 14, 1992, and December 17, 1992," dated July 10, 1998.

2. Letter, Huffman to McIntyre, "Request for withholding information from public disclosure of Westinghouse AP600 design letters of December 15, 1992," dated July 14, 1998.

3. Letter, Sebrosky to McIntyre, "Request for withholding information from public disclosure for Westinghouse AP600 design letter of February 24, 1993, April 19, 1993, and July 14, 1993," dated June 18, 1998.

4. Letter, McIntyre to Quay, "Status review of AP600 proprietary submittals," dated September 18, 1995.

Dear Mr. Quay:

Reference 1 provided the NRC assessment of the Westinghouse claim that proprietary information was provided in a letter dated December 14, 1992, that provided the NRC with copies of presentation material from a management meeting held December 14, 1992, discussing the AP600 testing program. The NRC has no record of a nonproprietary version of the slides being provided. At the time this presentation was made, the information was proprietary since that description of the AP600 testing program had commercial value to Westinghouse. At this time, almost six years later, this information does not have commercial value and is no longer considered to be proprietary by Westinghouse.

Reference 1 also provided the NRC assessment of the Westinghouse claim that proprietary information was provided in a letter dated December 17, 1992, that provided the NRC with copies of presentation material from a meeting with the technical staff held December 9-10, 1992, discussing the AP600

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Enclosure 2

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testing program. The NRC has no record of a nonproprietary version of the slides being provided. At the time this presentation was made, the information was proprietary since that description of the AP600 testing program had commercial value to Westinghouse. At this time, almost six years later, this information does not have commercial value and is no longer considered to be proprietary by Westinghouse.

Reference 2 provided the NRC assessment of the Westinghouse claim that proprietary information was provided in a letter dated December 15, 1992, that contained a preliminary description of the AP600 refueling outage plan activities. The NRC assessment was that no material in the letter was specifically identified as being proprietary and that a nonproprietary version was not provided. At the time this subject was being discussed with the NRC technical staff, the information was considered to be proprietary by Westinghouse since it contained information that had commercial value to Westinghouse. At this time, almost six years later, this information does not have commercial value and is no longer considered to be proprietary by Westinghouse.

Reference 3 provided the NRC assessment of the Westinghouse claim that proprietary information was provided in a letter dated February 24, 1993, that contained presentation materials from the February 24, 1993, Westinghouse/NRC AP600 senior management meeting. The NRC assessment was that the material was similar to material that exists in the current (1998) nonproprietary version of the AP600 probabilistic risk assessment and AP600 standard safety analysis report. In addition the staff indicated the material was used by the staff in the development of the AP600 draft safety evaluation report and therefore should remain on the docket. Our 1995 request, Reference 4, indicated that the material provided in the Westinghouse letter of February 24, 1993, was presentation material that was intended for clarification only, not part of the formal review material and requested that the material be returned to Westinghouse. At the time this subject was being discussed with the NRC technical staff, the information was considered to be proprietary by Westinghouse since it contained information that had commercial value to Westinghouse. If this presentation material was indeed used by the staff in development of the AP600 draft final safety evaluation report in November 30, 1994, then at this time, over five years later, this information is no longer considered to be proprietary by Westinghouse.

Reference 3 provided the NRC assessment of the Westinghouse claim that proprietary information was provided in a letter dated April 19, 1993, that contained presentation materials from the April 20, 1993, AP600 overview. The NRC assessment was that the material was similar to material that exists in the current (1998) nonproprietary version of the AP600 probabilistic risk assessment and AP600 standard safety analysis report. In addition the staff indicated the material was used by the staff in the development of the AP600 draft safety evaluation report and therefore should remain on the docket. Our 1995 request, Reference 4, indicated that the material provided in the Westinghouse letter of April 19, 1993, was presentation material that was intended for clarification only, not part of the formal review material and requested that the material be returned to Westinghouse. At the time this subject was being discussed with the NRC technical staff, the information was considered to be proprietary by Westinghouse since it contained information that had commercial value to Westinghouse. If this presentation material was indeed used by the staff in development of the AP600 draft final safety evaluation report in November 30, 1994, then at this time, over five years later, this information is no longer considered to be proprietary by Westinghouse.

Reference 3 provided the NRC assessment of the Westinghouse claim that proprietary information was provided in a letter dated July 14, 1993, that contained presentation materials from the July 14, 1993, meeting where the AP600 main control room habitability was discussed. The NRC assessment was that the material was similar to material that exists in the current (1998) nonproprietary version of the AP600 probabilistic risk assessment and AP600 standard safety analysis report. In addition the staff indicated the material was used by the staff in the development of the AP600 draft safety evaluation report and therefore should remain on the docket. Our 1995 request, Reference 4, indicated that the material provided in the Westinghouse letter of July 14, 1993, was presentation material that was intended for clarification only, not part of the formal review material and requested that the material be returned to Westinghouse. At the time this subject was being discussed with the NRC technical staff, the information was considered to be proprietary by Westinghouse since it contained information that had commercial value to Westinghouse. If this presentation material was indeed used by the staff in development of the AP600 draft final safety evaluation report in November 30, 1994, then at this time, over five years later, this information is no longer considered to be proprietary by Westinghouse.

This response addresses the proprietary issues delineated in the references.

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

jml

cc: J. W. Roe - NRC/NRR/DRPM
J. M. Sebrosky - NRC/NRR/DRPM
W. C. Huffman - NRC/NRR/DRPM
H. A. Sepp - Westinghouse

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