

ABNORMAL TRANSIENT
OPERATING GUIDELINES
(ATOG)

B&W OWNERS GROUP
SUBCOMMITTEE MEETING

FEBRUARY 22, 1980

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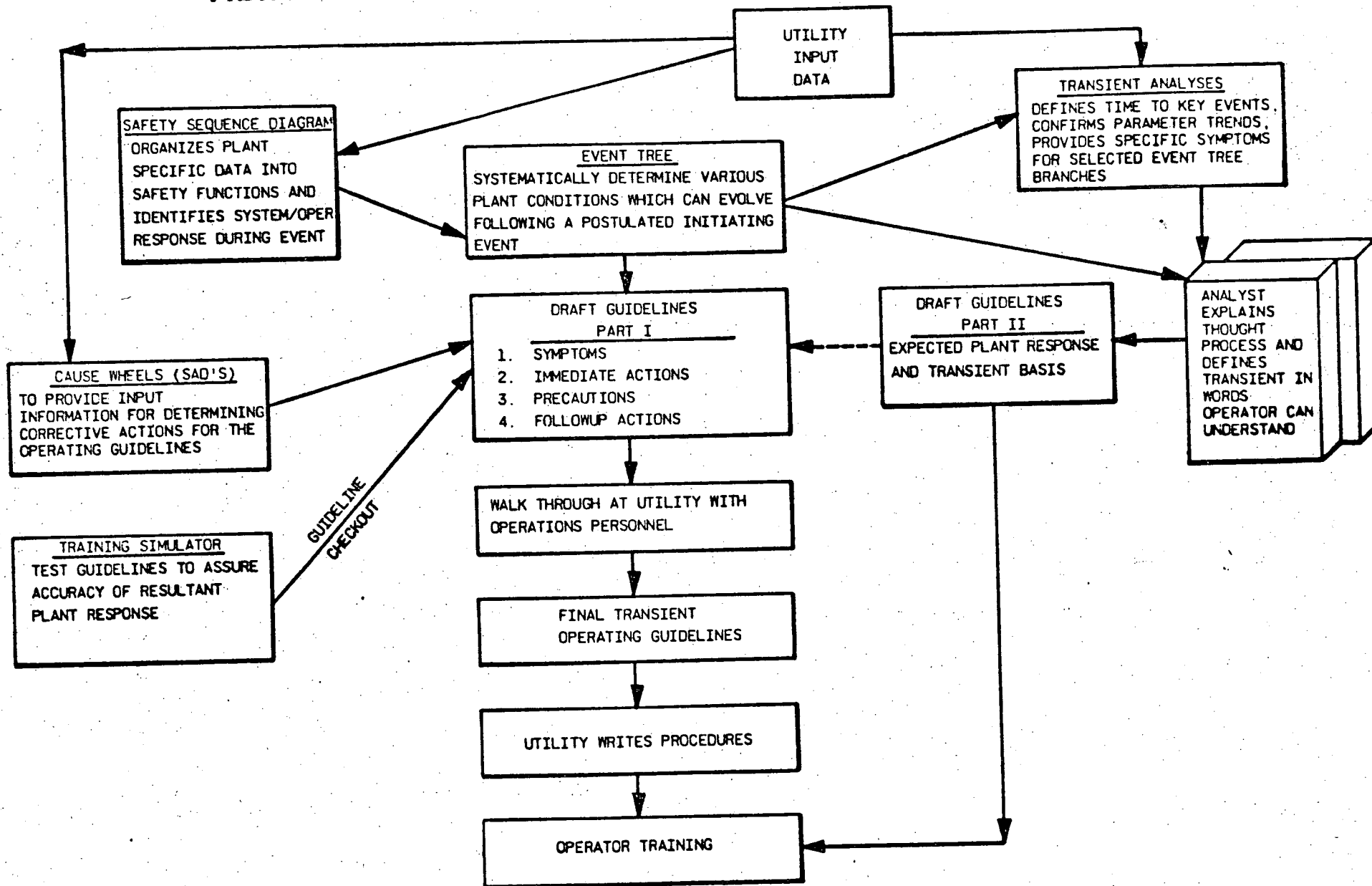
ATOG Objective

Simplify operator problem of identifying
and treating abnormal transients

Transients Selected for Guideline Preparation

- Increase in heat removal by secondary system
 - Small steam leaks
 - Excessive feedwater flow
- Decrease in heat removal by secondary system
 - Loss of feedwater
 - Loss of station power
- Decrease in reactor coolant inventory
 - Steam generator tube rupture
 - Inadequate core cooling
 - Loss of coolant

Abnormal transient operating guidelines program



Event Trees

Purpose Systematically determine various plant conditions which can evolve following a postulated initiating event

Assumptions Initial conditions
Equipment failures
Operator action

Analysis

Purpose: Realistically portray expected plant response

Analyze: Design success path
All single failure paths

Discuss subsequent failures:

Verify LOCA paths covered in small break guidelines

Design Basis/Expected Plant Response

- Communication between designer and operator
- Supports operator action portion of guidelines
- Written for operator understanding

Training Simulator

- Test various methods of approach to guidelines
- Verify final product
- Train operator

Operator Feedback

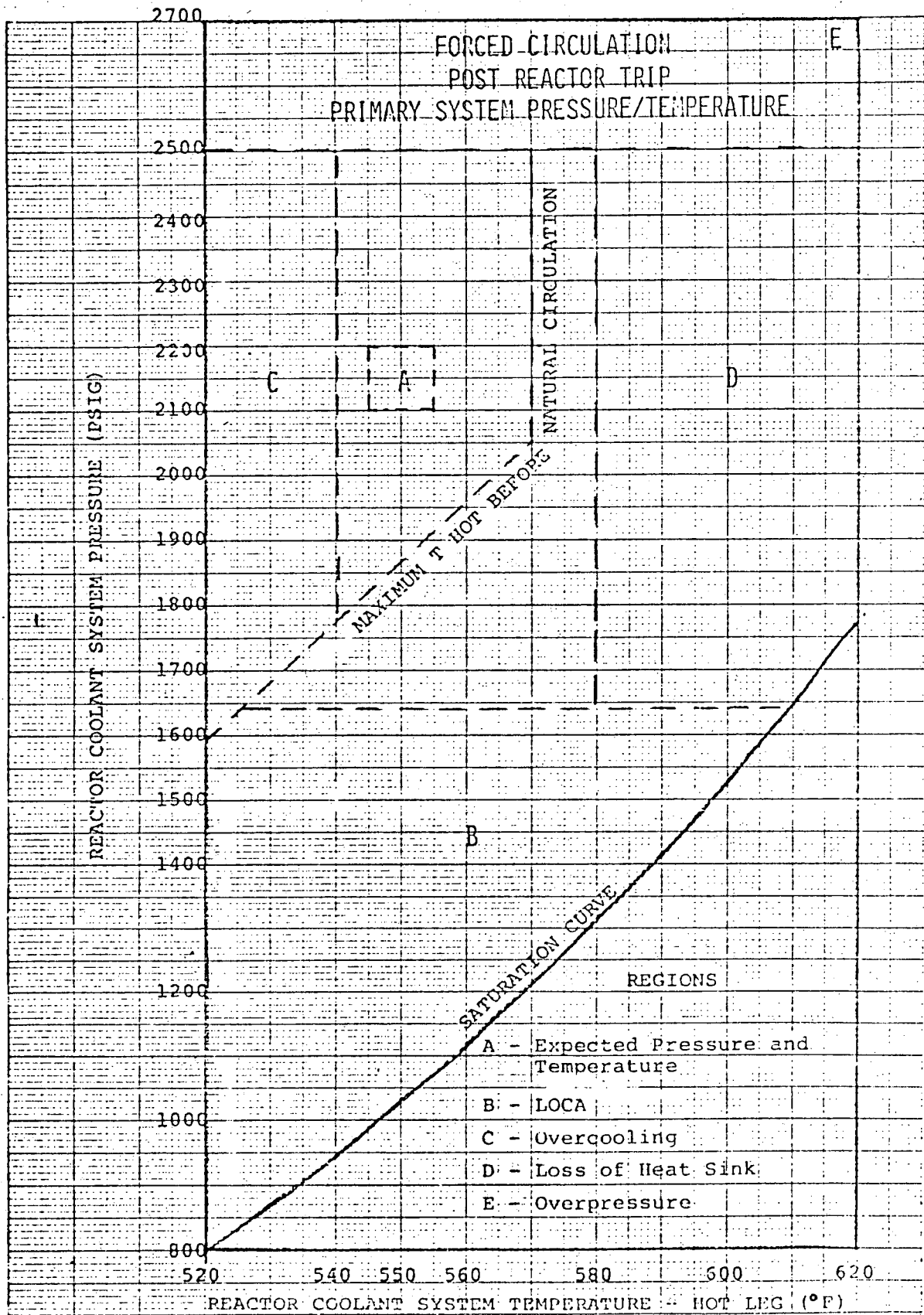
- Detailed review of event trees
- Input to guideline format
- Plant walk through
- Training

ATOG OBJECTIVES

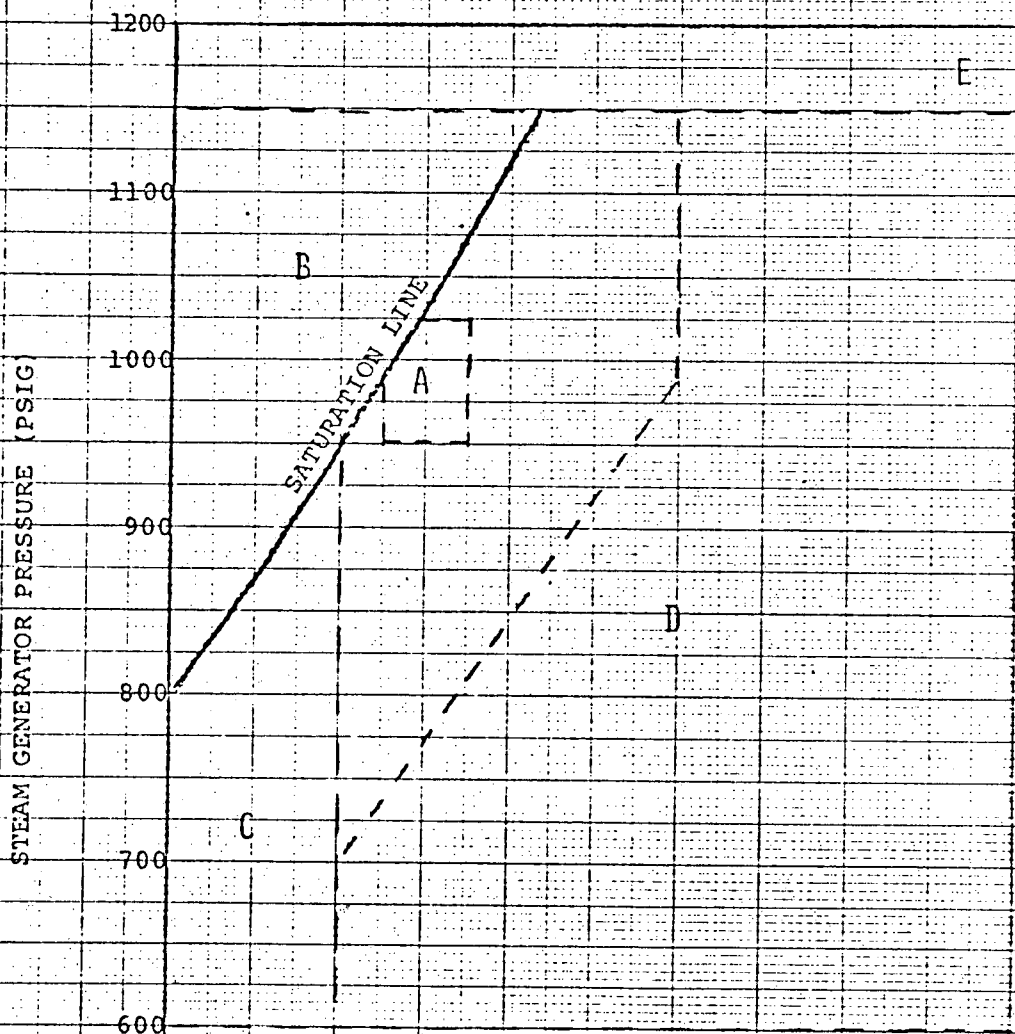
- I. KEEP THE CORE COOLED - PROVIDE ADEQUATE CORE COOLING
- II. MINIMIZE RADIATION RELEASE
- III. PREVENT A LOCA - IF POSSIBLE
- IV. PREVENT OR MINIMIZE EQUIPMENT DAMAGE
- V. TERMINATE TRANSIENT - STABILIZE PLANT
- VI. IMPROVE THE COMMUNICATION OF INSTRUCTIONS TO THE OPERATOR TO HELP HIM PROPERLY MANAGE THE TRANSIENT

SYMPTOMS

1. LACK OF ADEQUATE SUBCOOLING MARGIN
2. LACK OF PRIMARY TO SECONDARY HEAT TRANSFER
3. TOO MUCH PRIMARY TO SECONDARY HEAT TRANSFER
4. NORMAL



POST REACTOR TRIP
SECONDARY SYSTEM PRESSURE/TEMPERATURE

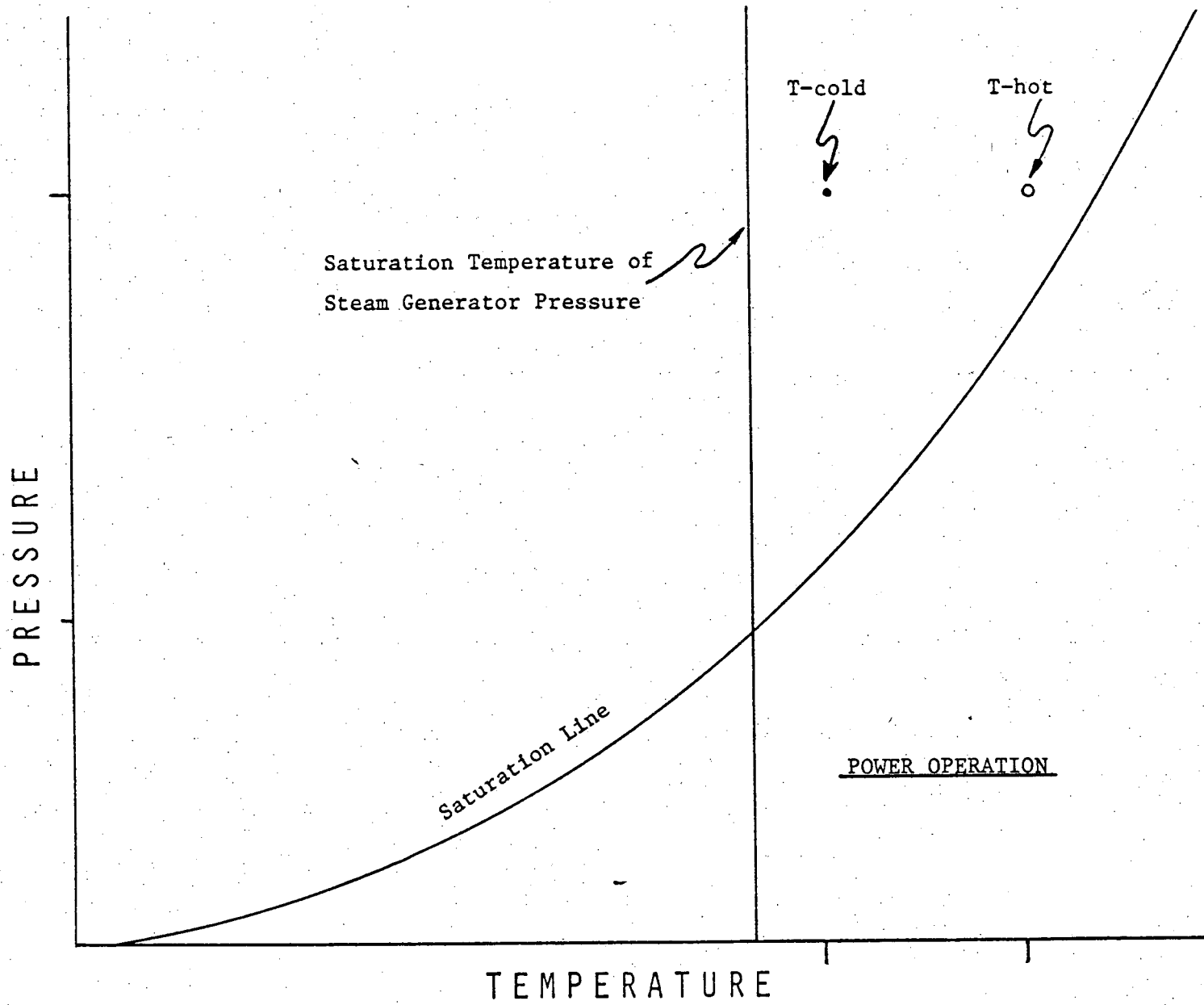


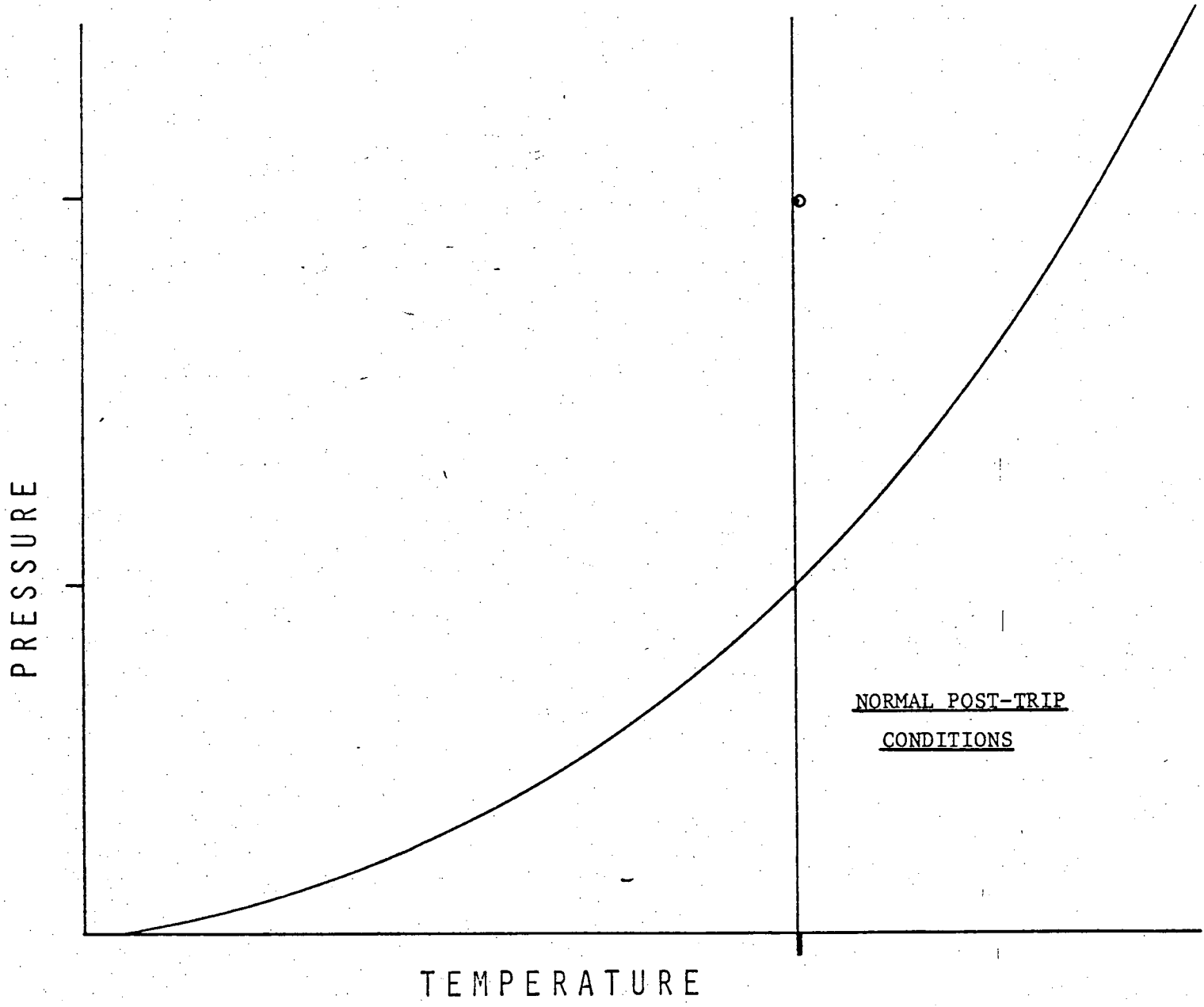
REGIONS

- A - Expected Pressure & Temperature
- B - Reverse Heat Transfer
- C - Overcooling
- D - Loss of Heat Sink
- E - Overpressure

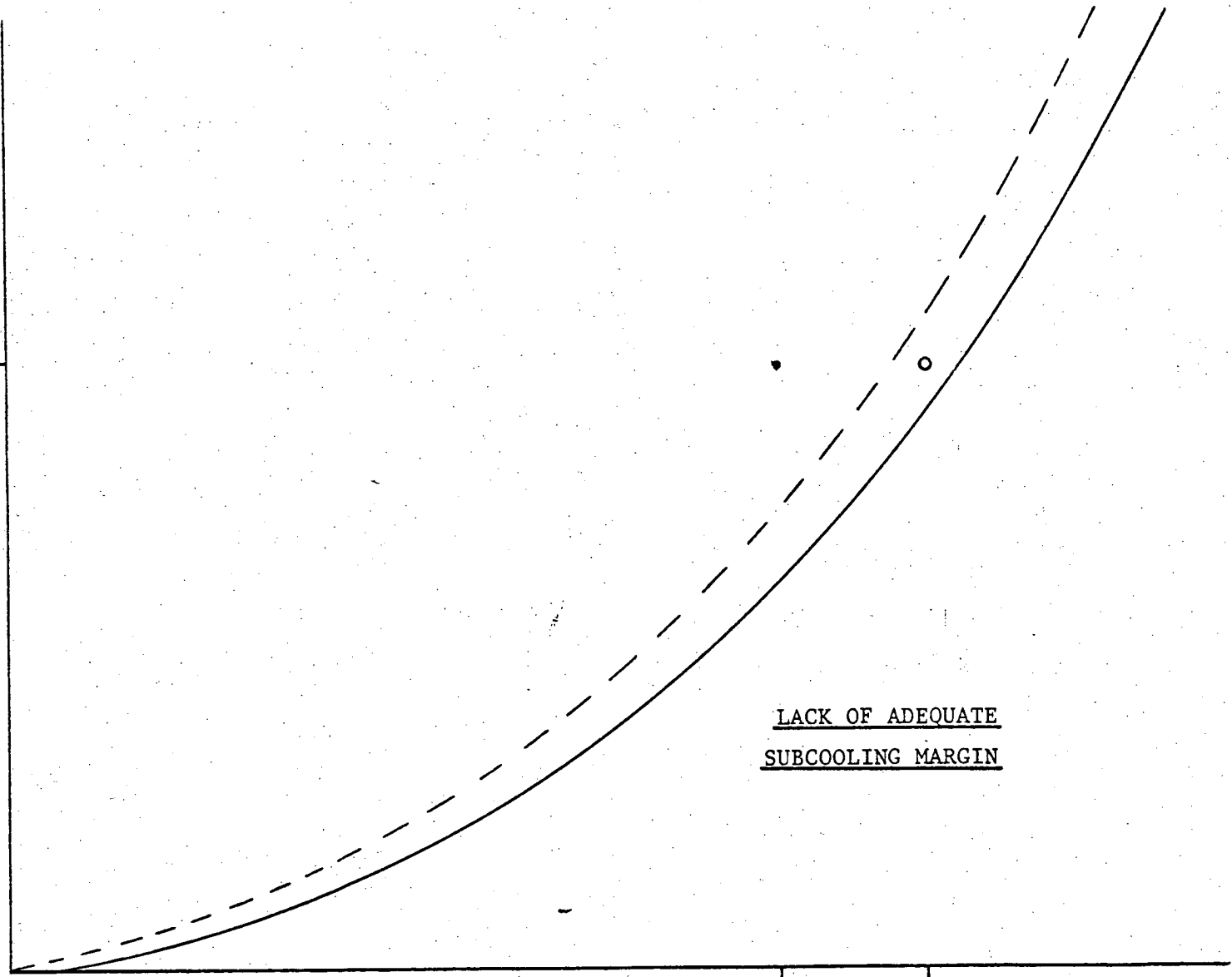
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REACTOR COOLANT SYSTEM TEMPERATURE - COLD LEG (°F)



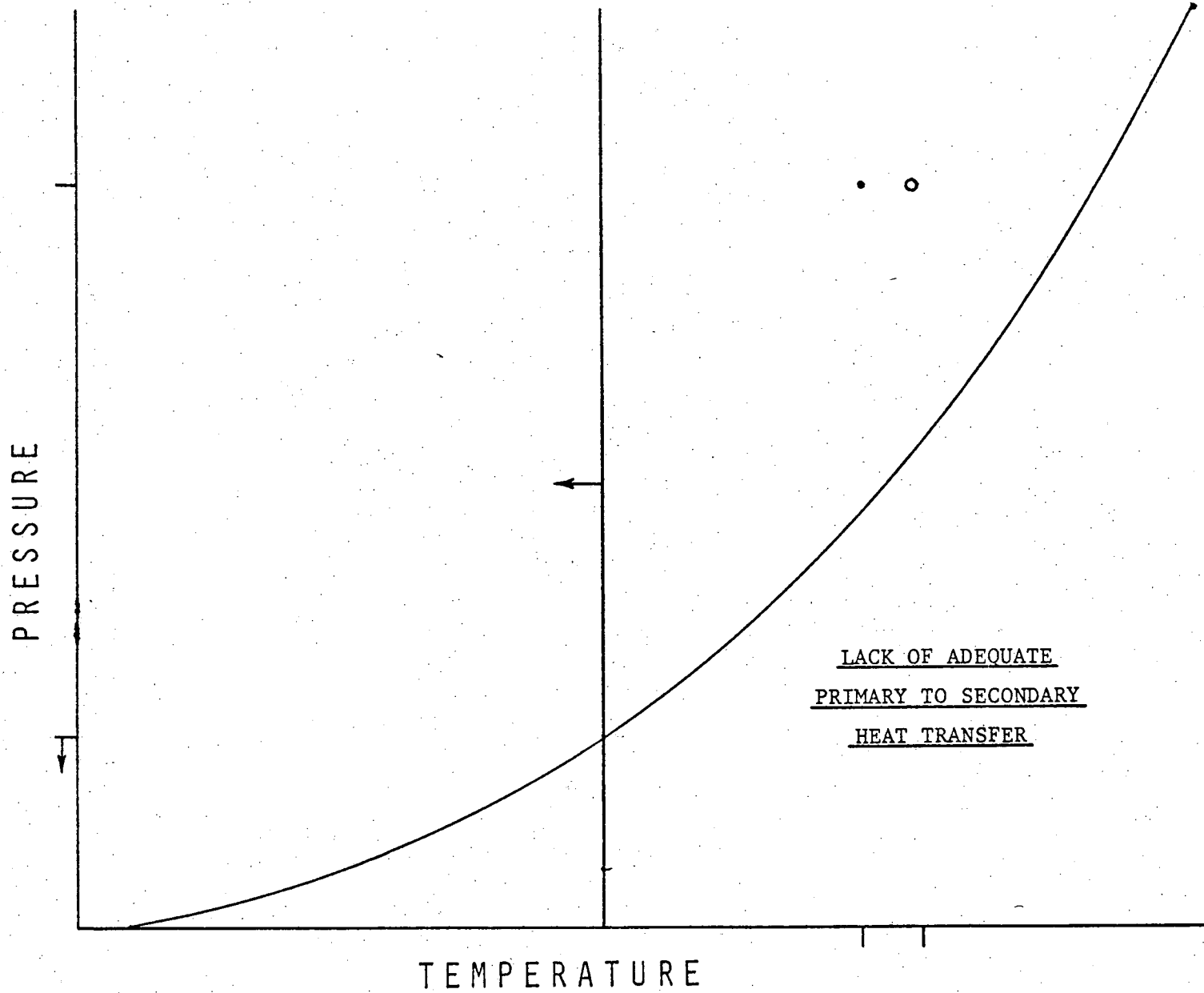


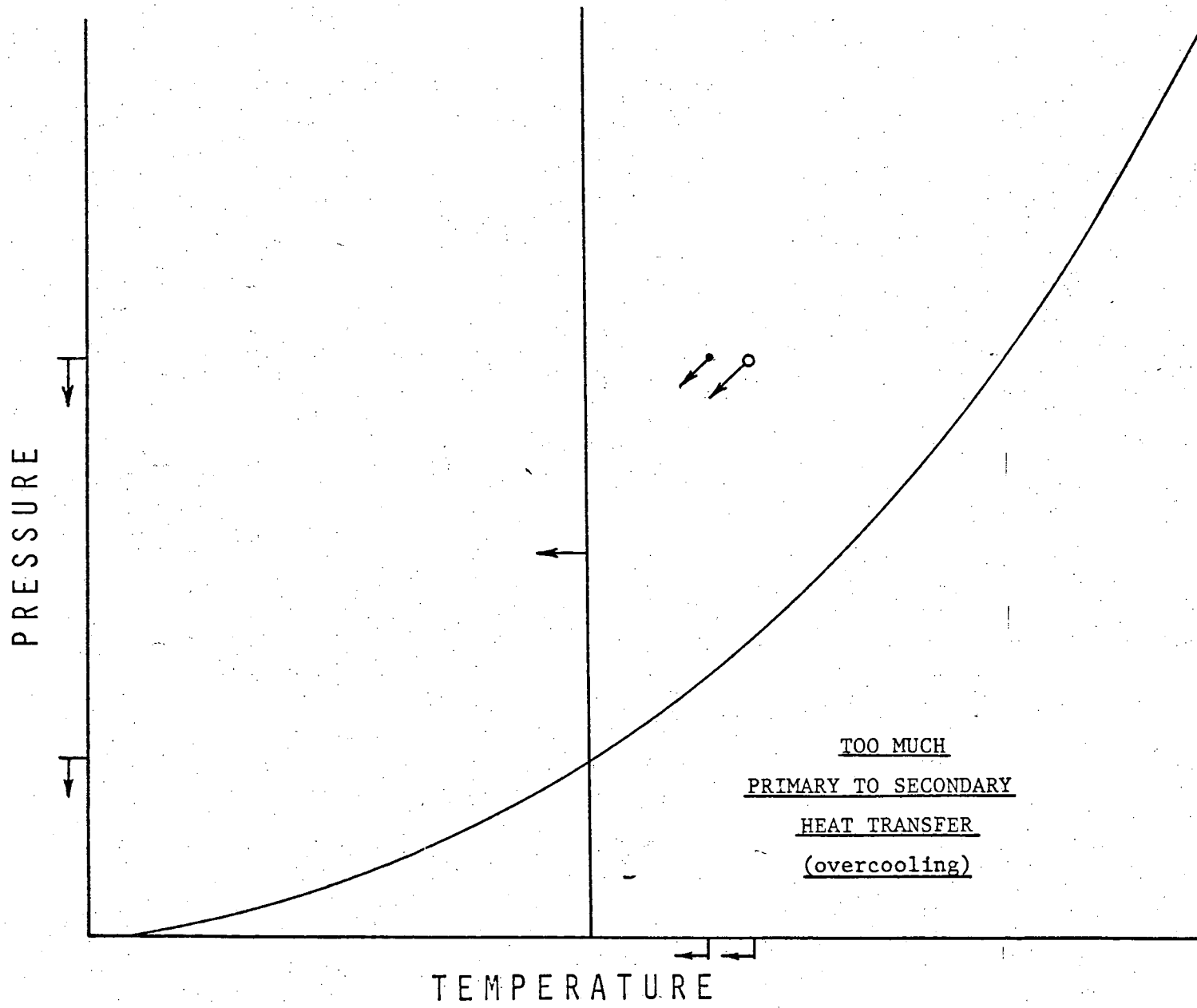
PRESSURE



TEMPERATURE

LACK OF ADEQUATE
SUBCOOLING MARGIN





B&W operating guideline concept

Part I: Procedural	Immediate actions	Actions to be taken in immediate response to a reactor trip
	Follow-up actions	Actions for treatment of lack of adequate subcooling margin, lack of primary to secondary heat transfer and too much primary to secondary heat transfer
	Long term plant recovery	Directions for appropriate follow on procedures after plant stability is achieved
Part II: Technical basis	Expected plant response and design basis	A discussion, written for operator comprehension, of the design plant response to each initiating event, potential failures and possible corrective actions. This section discusses the heat transfer from the core to the ultimate heat sink during different aspects of each transient and explains why the operator is taking each action. The format closely parallels Part I.

REACTOR TRIP

ADEQUATE CORE COOLING

- I. IMMEDIATE ACTIONS
- II. VERIFICATION OF KEY PLANT PARAMETERS AND VITAL EQUIPMENT STATUS.
 - A. CORRECTIVE ACTIONS (IF NECESSARY)
 - B. ALTERNATE ACTIONS (IF NECESSARY)
- III. IDENTIFICATION OF FOLLOWUP ACTIONS
 - A. "NORMAL" PLANT RESPONSE - FURTHER ACTIONS (RETURN TO POWER/COOLDOWN) AT PLANT MANAGER'S DISCRETION
 - B. LACK OF ADEQUATE SUBCOOLING MARGIN
 - C. LACK OF PRIMARY TO SECONDARY HEAT TRANSFER
 - D. TOO MUCH PRIMARY TO SECONDARY HEAT TRANSFER (OVERCOOLING)

IV. ACTIONS FOR LACK OF ADEQUATE SUBCOOLING MARGIN

A. INITIAL ACTIONS

B. IF INITIAL ACTIONS REGAINED SUBCOOLING TREAT OTHER SYMPTOMS OR COOLDOWN/HEATUP PLANT

C. IF INITIAL ACTIONS DID NOT REGAIN SUBCOOLING START HPI (IF NOT ALREADY AUTO-INITIATED)

D. IF SUBCOOLING IS REGAINED TREAT OTHER SYMPTOMS OR COOLDOWN PLANT.

E. IF SUBCOOLING IS NOT REGAINED FOLLOW ACTIONS FOR A LOCA (IF DEPRESSURIZED FAR ENOUGH) OR GO TO NEXT SECTION (IF NECESSARY) OR COOLDOWN PLANT.

V. ACTIONS FOR TREATMENT OF LACK OF PRIMARY TO SECONDARY
HEAT TRANSFER

A. FEED OTSGs TO APPROPRIATE LEVEL IF NECESSARY

B. IF HEAT TRANSFER IS REGAINED GO TO APPROPRIATE
COOLDOWN/HEATUP PROCEDURE

C. IF HEAT TRANSFER IS NOT REGAINED

1. INITIATE HPI (IF NOT AUTO-INITIATED)

2. IF OTSGs CANNOT BE FED THEN COOLDOWN

3. IF OTSG LEVELS ARE CORRECT BUMP RC PUMPS

D. IF HEAT TRANSFER IS REGAINED THEN COOLDOWN WITH
OTSGs

E. IF HEAT TRANSFER CANNOT BE REGAINED CONTINUE HPI
COOLING

VI. ACTIONS FOR TREATMENT OF TOO MUCH PRIMARY TO SECONDARY
HEAT TRANSFER

A. REACTOR BUILDING TEMPERATURE/PRESSURE INCREASING

1. NO SLBIC ACTUATION

- A. ACTIONS TO STOP COOLDOWN
- B. COOLDOWN PLANT

2. SLBIC ACTUATION

- A. ACTIONS (STOP COOLDOWN IF SLBIC DIDN'T)
- B. COOLDOWN PLANT

B. REACTOR BUILDING TEMPERATURE/PRESSURE NORMAL

1. INITIAL ACTIONS

2. NO SLBIC ACTUATION

- A. ACTIONS TO STOP COOLDOWN
- B. PLANT HEATUP/COOLDOWN AT DISCRETION OF PLANT
MANAGEMENT

3. SLBIC ACTUATION

- A. ACTIONS (STOP COOLDOWN IF SLBIC DIDN'T)
- B. PLANT HEATUP/COOLDOWN AT DISCRETION OF PLANT
MANAGEMENT

ATOG GUIDELINES

PART II

SECTION 1. FUNDAMENTALS OF REACTOR CONTROL FOR ACCIDENTS

INTRODUCTION

- A. BASIC HEAT TRANSFER
- B. ABNORMAL ACCIDENT DIAGNOSIS AND MITIGATION
- C. POST-ACCIDENT SYSTEM STABILITY DETERMINATION
- D. FOLLOWUP ACTIONS

APPENDIX A - SUPERHEAT, SATURATION, SUBCOOLING

APPENDIX B - NATURAL CIRCULATION

SECTION 2. GUIDELINES FOR SELECTED ACCIDENTS WITH MULTIPLE EQUIPMENT FAILURES

- A. EXCESSIVE MAIN FEEDWATER
- B. SLB
- C. STR
- D. LOSS OF A/C POWER
- E. LOSS OF MAIN FEEDWATER
- F. SBLOCA

"FOLDOUT" SUMMARIES

- I. - BASIC HEAT TRANSFER RELATIONSHIPS
- DIAGNOSIS AND MITIGATION
- II. - EXCESSIVE FEEDWATER
- LOHFW
- STR
- LOSS OF A/C POWER
- SLB

PART II

Section 1. FUNDAMENTALS OF REACTOR CONTROL FOR ACCIDENTS

INTRODUCTION

A. Basic Heat Transfer

- Steam Generator Pressure Control
- Steam Generator Inventory Control
- Reactor Coolant Inventory Control
- Reactor Coolant Pressure Control

B. Abnormal Accident Diagnosis and Mitigation

- Immediate actions (2 to 3 minutes)
- Quick followup actions (Equipment Status)
- Abnormal? (ATOG or not)
 - a) P-T plot description
 - b) Pre-trip discussion
 - c) Normal post trip transient
 - d) Abnormal post trip transient
- Subcooling rule
 - a) with over-heating
 - b) with over-cooling
- Backup methods of cooling
 - a) HPI
 - b) LPI
 - c) Condensate Pump
 - d) Auxiliary Feedwater Pump
- Cause Wheels
- Preferred method of equipment operation
 - a) RCP's
 - b) HPI Throttling
 - c) Termination of MFW

C. Post Accident System Stability Determination

- Checklist for defining stability
- Measure of successful termination of transient

D. Followup Actions

- Decide long term plant disposition
- Transfer to appropriate procedure

Appendix A - Superheat, Saturation, Subcooling

Appendix B - Natural Circulation

Section 2. GUIDELINES FOR SELECTED ACCIDENTS WITH MULTIPLE EQUIPMENT FAILURES

A. Excessive Main Feedwater

- One page summary-

1. General Transient Description Operator Action Summary

- a. Identify the accident
- b. Corrective action
- c. Schematic summary of operator action

2. Excessive Main Feedwater with Other Plant Failures

- Reactor Pressure
- Reactor Inventory
- Steam Pressure
- Steam Generator Inventory