



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

JMB/6

August 8, 1984

Docket No. 50-302

LICENSEE: Florida Power Corporation

FACILITY: Crystal River Unit 3

SUBJECT: SUMMARY OF MEETING HELD ON JULY 20, 1984 WITH FLORIDA  
POWER CORPORATION REGARDING REACTOR HEAD VENTS

Members of the staff met in Bethesda, Maryland on July 20, 1984 with representatives of Florida Power Corporation (FPC), the Crystal River Unit 3 (CR-3) licensee, to discuss test results and other information related to a requested reactor head vent exemption. A list of attendees is enclosed. It was noted that except for procedural details, the discussion was also applicable to Rancho Seco.

A schedular exemption had previously been issued to defer the implementation date for installation of the head vent pending completion of tests to show that natural circulation could be maintained without a head vent even with a gas bubble in the top head. (The "candy cane" and pressurizer vents are in place). In addition, the licensee had previously been requested to respond to certain questions regarding plant procedures for such operation.

The licensee's presentation followed the enclosed meeting slides, and during the discussion the following points were raised.

1. The licensee should submit OTIS test reports to support any requested exemption.
2. Formal response by the licensee to the staff's questions of April 16, 1984 is required.
3. In order to support the exemption, it must be shown that ultimately all gas can be removed from the reactor vessel head.
4. It must be shown that OTIS (or any other) tests are applicable to CR-3, considering such matters as scaling distortions.
5. The licensee should document that its operators have been trained on differences in system response with and without non-condensibles in the RV head.
6. The licensee should verify that instructions affecting depressurization rate will not result in the generation of sufficient gas to overwhelm the installed high point vents.

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PDR ADOCK 05000302  
P PDR


FRC indicated they would respond to the above as part of their request for a permanent exemption to delete the RV head vent. This request is expected within 60 days of this meeting.

**"ORIGINAL SIGNED BY:"**

Harley Silver, Project Manager  
Operating Reactors Branch #4, DL

Enclosures:  
As Stated

cc w/enclosures:  
See next page

  
ORB#4:DL  
HSilver;cf  
8/18/84

MEETING SUMMARY DISTRIBUTION

Licensee: Florida Power Corporation

\*Copies also sent to those people on service (cc) list for subject plant(s).

Docket File

NRC PDR

L PDR

ORB#4 Rdg

Project Manager - HSilver

JStolz

BGrimes (Emerg. Preparedness only)

OELD

NSIC

EJordan, IE

JNGrace, IE

ACRS-10

NRC Meeting Participants:

RHernan

SMiner

RJones

HOornstein

PKadambi

GRivenbark

NLauben

BSheron

FLORIDA POWER CORPORATION - CRYSTAL RIVER 3REACTOR VESSEL HEAD VENT ISSUEJULY 20, 1984

<u>Name</u>	<u>Organization</u>	<u>Title</u>
Ron Hernan	NRC/NRR	Tech. Assistant
Harley Silver	NRC/DL	Project Manager
Sydney Miner	NRC/DL	Project Manager
Robert Jones	NRC/NRR	Nuclear Engineer
Hal Ornstein	NRC/AEOD	Load Systems Engineer
Prasad Kadambi	NRC/DL	Project Manager
George Rivenbark	NRC/DL	Project Manager
Norm Lauben	NRC/RSB	Section Leader
Brian Sheron	NRC/RSB	Branch Chief
Bob Dietrich	SMUD	Licensing Manager
Robert Black	B&W	Product Manager
Bob Borsum	B&W	Licensing-Bethesda
U. U. Hsu	UMCP	Professor
E. H. Davidson	FPC	Nuclear Safety Eng.
William Stephenson	FPC	Nuclear Operations Eng.
Gary Westafer	FPC	Manager Lic. & Fuel Mgmt.
Gary Boldt	FPC	Nuc. Plant Operations Mgr.
Wesley Johnson	FPC	Ass. Plant Operations Mgr.
Ron Bright	FPC	Manager, Nuclear Lic.

MEETING TO DISCUSS REACTOR  
HEAD VENT EXEMPTION

PRESENTATION BY FLORIDA POWER CORPORATION  
TO  
U.S. NUCLEAR REGULATORY COMMISSION

PHILLIPS BUILDING  
BETHESDA, MD.

JULY 20, 1984

## I. INTRODUCTION

– ATTENDEES FROM FPC

– PURPOSE OF MEETING

\* TO DISCUSS OTIS TESTS AND RESULTS

\* TO COMPARE TEST CONCLUSIONS TO CR-3

INADEQUATE CORE COOLING (ICC) PROCEDURES

AND PROPOSED ENHANCEMENT

\* TO DISCUSS BASIS FOR PERMANENT EXEMPTION

FROM INSTALLATION OF REACTOR HEAD VENT IN CR-3

## II. DISCUSSION OF OTIS TESTS

### PURPOSE OF OTIS TEST I

DEMONSTRATE THAT WITH A BUBBLE OF NON-CONDENSABLE

GAS IN THE HEAD AND THE HOTLEG VENTS OPEN THE CORE CAN

BE COOLED DOWN USING NATURAL CIRCULATION.

## INITIAL CONDITIONS

### OTIS TEST I

- \* INADEQUATE CORE COOLING
  - SATURATE SYSTEM WITH NON-CONDENSABLE GAS
  - INJECT NON-CONDENSABLE GAS INTO RV HEAD
  - SIMULATE DECAY HEAT AT CONSTANT 1% POWER
- \* RCS PRESSURE BOUNDARY INTACT
- \* EMERGENCY FEEDWATER AVAILABLE TO STEAM GENERATORS
- \* HIGH PRESSURE INJECTION AVAILABLE
- \* REACTOR COOLANT PUMPS UNAVAILABLE



## PROCEDURE USED IN

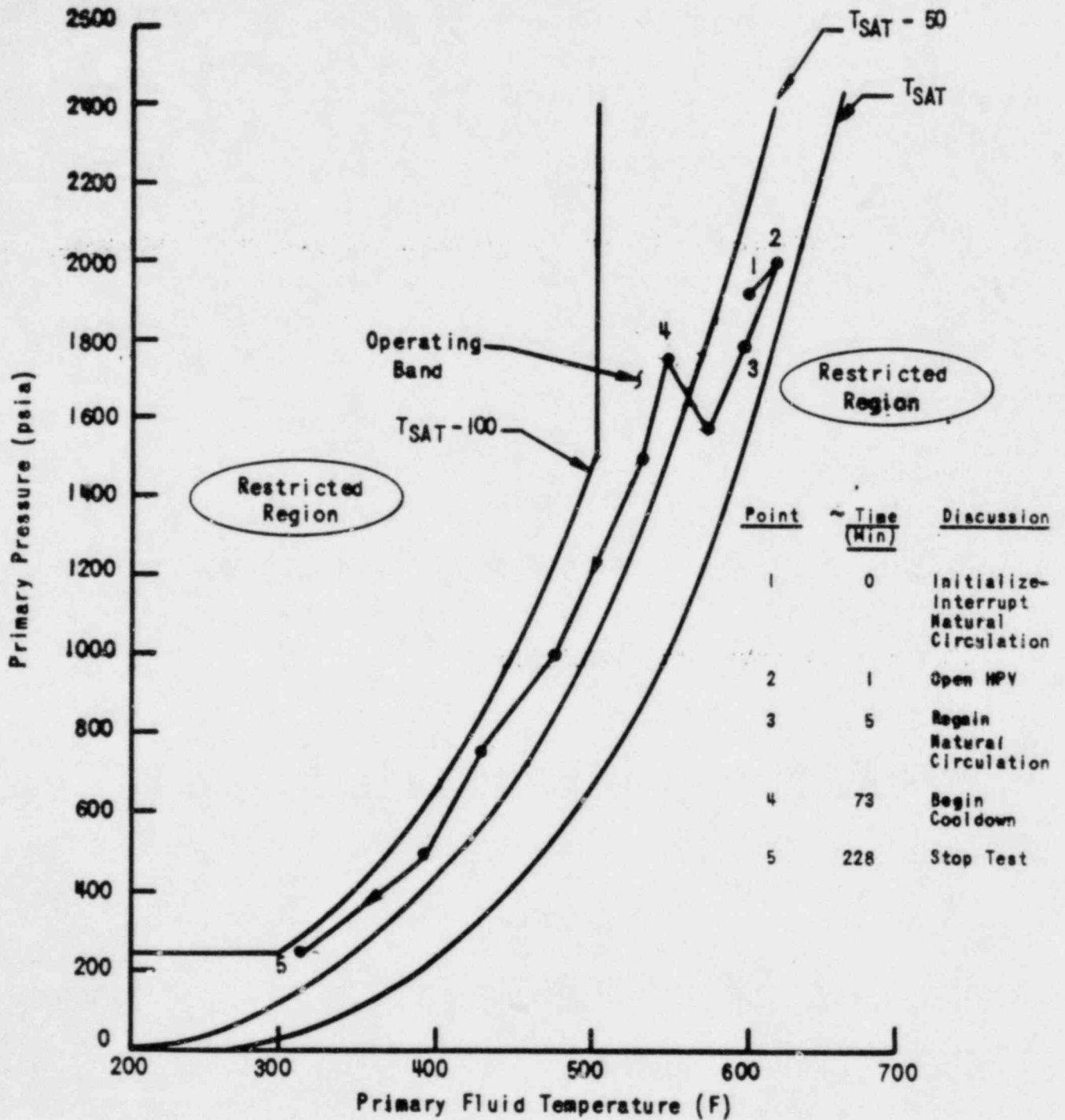
### OTIS TEST I

1. ESTABLISH NATURAL CIRCULATION COOLING OF CORE.
2. INTERRUPT NATURAL CIRCULATION BY INJECTING NON-CONDENSABLE AT HOTLEG HIGH POINT VENT (HLHPV).
3. OPEN HLHPV, REGAIN NATURAL CIRCULATION, AND KEEP HLHPV OPEN DURING TEST.
4. DEPRESSURIZE AND COOL SYSTEM TO 284 psig AND 280°F USING NATURAL CIRCULATION WITH A 50 TO 100°F COOLDOWN RATE AND APPROPRIATE SUBCOOLING MARGIN.

## RESULTS OF OTIS TEST I

1. NATURAL CIRCULATION COOLING OF CORE IS NOT INTERRUPTED WITH HLHPV CONTINUOUSLY OPEN DURING COOLDOWN AND DEPRESSURIZATION.
2. COOLDOWN RATES OF 50°F/HR TO 100°F/HR WERE EASILY CONTROLLED.
3. ADEQUATE SUBCOOLING MARGIN (50-100°F) WAS EASILY MAINTAINED THROUGHOUT SYSTEM COOLDOWN.
4. THE NON-CONDENSABLE GAS BUBBLE IN THE HEAD HAD NO EFFECT ON THE ABILITY TO COOLDOWN.

TEST-240100-OTIS NONCONDENSABLE GAS TEST  
 CONTINUOUS VENTING THROUGH  
 HIGH POINT VENT



## PURPOSE OF OTIS TEST II

DEMONSTRATE THAT IF NATURAL CIRCULATION COOLING IS INTERRUPTED BY NON-CONDENSABLES, THE CORE CAN BE COOLED BY THE HPI/PORV (FEED AND BLEED) TECHNIQUE.

## INITIAL CONDITIONS

### OTIS TEST II

(Same as Test I)

- \* INADEQUATE CORE COOLING
  - SATURATE SYSTEM WITH NON-CONDENSABLE GAS
  - INJECT NON-CONDENSABLE GAS INTO RV HEAD
  - SIMULATE DECAY HEAT AT CONSTANT 1% POWER
  
- \* RCS PRESSURE BOUNDARY INTACT
  
- \* EMERGENCY FEEDWATER AVAILABLE TO STEAM GENERATORS
  
- \* HIGH PRESSURE INJECTION AVAILABLE
  
- \* REACTOR COOLANT PUMPS UNAVAILABLE

## PROCEDURE INTENDED FOR

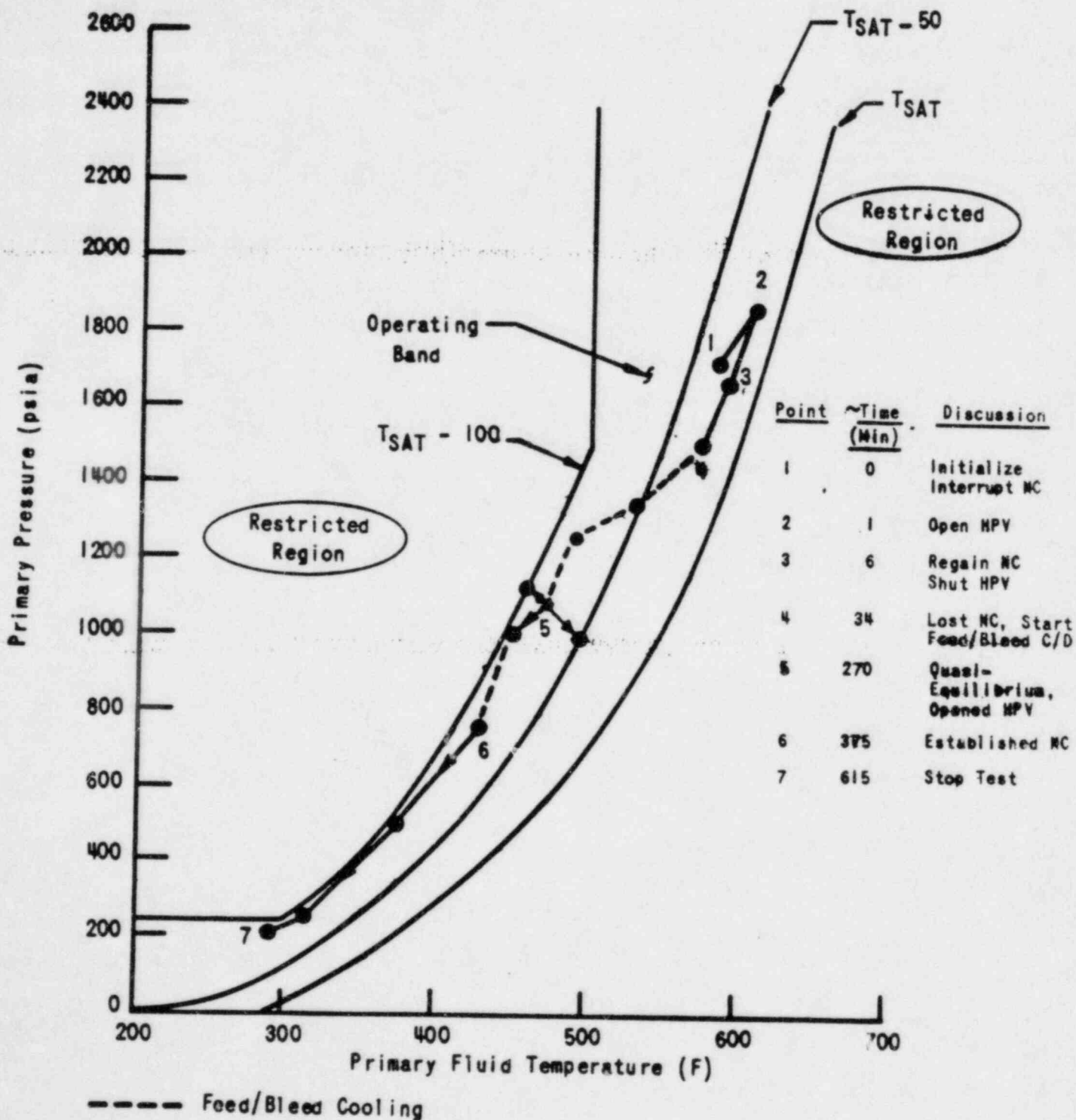
### OTIS TEST II

1. ESTABLISH NATURAL CIRCULATION COOLING OF CORE.
2. INTERRUPT NATURAL CIRCULATION BY INJECTING NON-CONDENSABLES AT HLHPV.
3. OPEN HLHPV TO RESTORE NATURAL CIRCULATION COOLDOWN OF CORE.
4. CLOSE HLHPV, CONTINUE COOLDOWN AND DEPRESSURIZATION UNTIL NON-CONDENSABLES INTERRUPT NATURAL CIRCULATION.
5. TRANSFER COOLDOWN OF CORE FROM NATURAL CIRCULATION TO FEED/BLEED COOLING USING HPI/PORV.
6. DEPRESSURIZE AND COOL SYSTEM TO 284 psig AND 280°F.

## RESULTS OF OTIS TEST II

1. NATURAL CIRCULATION WAS INTERRUPTED AFTER CLOSING HLHPV.
2. COOLDOWN OF CORE WAS TRANSFERRED FROM NATURAL CIRCULATION TO FEED/BLEED COOLING BY ADDING HPI AND OPENING PORV.
3. THE FEED/BLEED HEAT REMOVAL METHOD REACHED AN EQUILIBRIUM CONDITION BEFORE COMPLETE COOLDOWN COULD BE OBTAINED.
4. TO CONTINUE COOLDOWN, HLHPV WAS ALSO OPENED TO INCREASE FLOW THROUGH CORE.
5. PRIOR TO REACHING NEW FEED/BLEED AND DECAY HEAT POWER EQUILIBRIUM, A TRANSITION WAS MADE FROM FEED/BLEED COOLING TO NATURAL CIRCULATION COOLING.
6. COOLDOWN CONTINUED TO 284 psig, 280°F.

TEST 240200-OTIS NONCONDENSABLE GAS TEST  
 NATURAL CIRCULATION-FEED/BLEED-  
 NATURAL CIRCULATION COOLDOWN  
 TRANSITIONS





### III. SUMMARY AND CONCLUSIONS OF TESTING

IF THE LOW PROBABILITY EVENT OF INADEQUATE CORE COOLING OCCURRED AND THE COOLANT WERE SATURATED WITH NON-CONDENSABLES WITH A BUBBLE IN THE RV HEAD:

- \* TWO MECHANISMS ARE AVAILABLE FOR CORE COOLING;
  - NATURAL CIRCULATION
  - HPI/PORV (FEED/BLEED)

THE TWO MECHANISMS ARE COMPLEMENTARY AND INTERCHANGEABLE IN SEQUENCE.

- \* NON-CONDENSABLES WHICH REMAIN IN THE RV HEAD DO NOT AFFECT CORE COOLING.
- \* NON-CONDENSABLE GASES IN THE REACTOR COOLANT CAN BE VENTED THROUGH THE REACTOR COOLANT SYSTEM HPV'S AND DO NOT AFFECT CORE COOLDOWN.
- \* NATURAL CIRCULATION COOLING CAN BE MAINTAINED WITH HLHPV'S ALWAYS OPEN.
- \* IF INTERMITTENT OPERATION OF THE HLHPV'S WERE DESIRED TO MINIMIZE RELEASE OF H<sub>2</sub> TO THE CONTAINMENT, NATURAL CIRCULATION COULD BE RESTORED IF INTERRUPTED.

#### IV. APPLICATION OF OTIS TESTS TO CR-3 PLANT PROCEDURES

## INITIAL CONDITIONS

- \* INADEQUATE CORE COOLING
  - FUEL IN REACTOR PARTIALLY OR COMPLETELY UNCOVERED
  - FUEL CLADDING TEMPERATURE GREATER THAN 1400°F
  - GROSS AMOUNTS OF HYDROGEN IN REACTOR COOLANT SYSTEM
- \* RCS PRESSURE BOUNDARY INTACT
- \* EMERGENCY FEEDWATER AVAILABLE TO STEAM GENERATORS
- \* HIGH PRESSURE INJECTION AVAILABLE
- \* REACTOR COOLANT PUMPS UNAVAILABLE

IMMEDIATE ACTIONS UPON DETERMINATION OF  
INADEQUATE CORE COOLING

EXISTING PROCEDURES

PROPOSED CHANGE

ENSURE FULL HPI FLOW

ENSURE CORE FLOOD TANK  
OUTLET VALVES OPEN

USE PORV/HOTLEG VENTS TO  
MAINTAIN RCS PRESSURE  
LESS THAN 2300 PSI

ENSURE STEAM GENERATOR  
LEVELS AT 95%

REDUCE STEAM GENERATOR  
PRESSURE

ACTIONS WHEN GAS PRODUCTION IS INDICATED

EXISTING PROCEDURES

PROPOSED CHANGE

OPEN HOTLEG VENTS

FURTHER REDUCE STEAM  
GENERATOR PRESSURE

ACTIONS WHEN CORE COOLING IS ESTABLISHED

EXISTING PROCEDURES

PROPOSED CHANGE

MAINTAIN ALL COOLING METHODS  
UNTIL REQUIRED SUBCOOLING  
MARGIN IS RESTORED

WHEN SUBCOOLING MARGIN IS RESTORED  
CLOSE PORV AND HOTLEG VENTS

MAINTAIN HOTLEG VENTS OPEN,  
CLOSE PORV

MAINTAIN SUBCOOLING MARGIN  
WITHIN REQUIRED BAND BY  
THROTTLING HPI FLOW

ESTABLISH NATURAL CIRCULATION

## NATURAL CIRCULATION

### EXISTING PROCEDURE

ENSURE STEAM GENERATOR LEVELS  
AT 95%

VERIFY NATURAL CIRCULATION

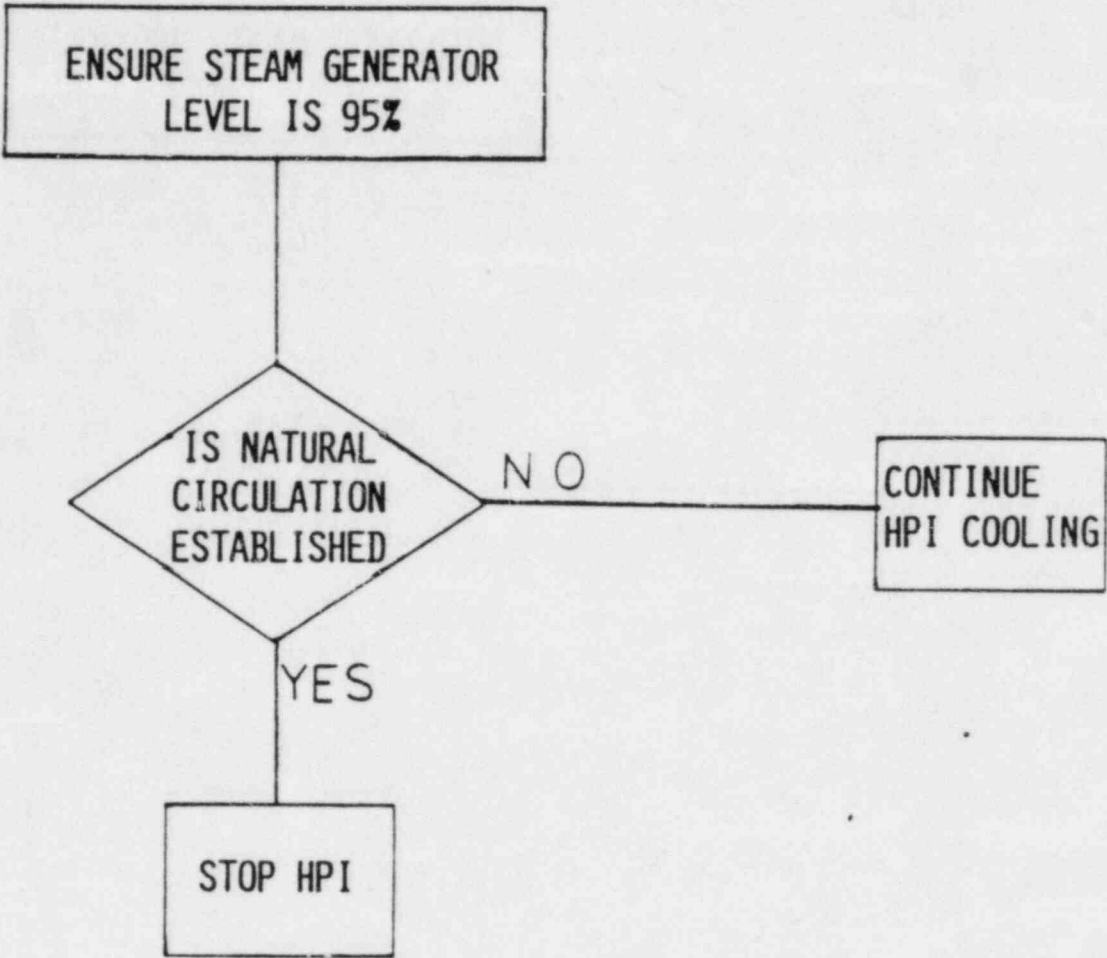
STOP HPI

CHECK FOR PTS

ESTABLISH BUBBLE IN  
PRESSURIZER

BEGIN COOLDOWN

### PROPOSED CHANGE





## HIGH POINT VENT CLOSURE

### EXISTING PROCEDURES

### PROPOSED CHANGE

WHEN CORE COOLING IN DECAY  
HEAT REMOVAL MODE IS ESTAB-  
LISHED, CLOSE HIGH POINT  
VENTS

OR

WHEN NATURAL CIRCULATION  
IS COOLING THE CORE AND  
RCS TEMPERATURE IS APPROXI-  
MATELY 212°F, CLOSE HIGH  
POINT VENTS

## END CONDITIONS

- \* REACTOR COOLANT AVERAGE TEMPERATURE APPROXIMATELY 212°F
  
- \* REACTOR COOLANT PRESSURE NEAR ATMOSPHERIC
  
- \* CORE COOLING PROVIDED BY:
  - NATURAL CIRCULATION
- OR
- DECAY HEAT REMOVAL SYSTEM
  
- \* HIGH POINT VENTS CLOSED

## V. DISCUSSION OF EXEMPTION

FPC BELIEVES A HEAD VENT IS NOT NECESSARY AT CR-3 FOR COOLING THE CORE FOLLOWING AN INADEQUATE CORE COOLING EVENT BECAUSE:

- \* NON-CONDENSABLES CAN BE VENTED THROUGH HPV'S.
- \* NON-CONDENSABLES REMAINING IN HEAD DO NOT AFFECT THE ABILITY TO COOLDOWN.
- \* NATURAL CIRCULATION COOLING CAN BE ESTABLISHED AND RE-ESTABLISHED IF INTERRUPTED.
- \* FEED/BLEED COOLING OF THE CORE IS AVAILABLE AS A SUFFICIENT AND COMPLEMENTARY METHOD.
- \* ADEQUACY OF FEED/BLEED COOLING OF THE CORE WAS DEMONSTRATED AT CR-3 DURING INCIDENT OF FEBRUARY 1980.
- \* THE COSTS (\$ MILLIONS) ASSOCIATED WITH THE INSTALLATION OF THE REACTOR VESSEL HEAD VENT CANNOT BE JUSTIFIED BY ANY ADDED BENEFIT.