Palo Verde

Station Black Out

Presentation

To The

Nuclear Regulatory Commission

May 24, 2005

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Agenda

• Introductions	Carl Churchman/ Mel Fields
• Description of Proposed Changes to Station Blackout Coping Strategy	M. Karbassian
• Closing Remarks	C. Churchman/ M. Fields

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Background

- APS Power Uprate License Amendment Request
  - Increase Power by 2.94% for U1 & U3
  - 3876 MWt to 3990 MWt
  - Currently being reviewed by NRC Staff
- June 14, 2004 Loss of Off-site Power
  - Unit 1,2 & 3
- NRC RAI to APS
  - SBO Category P3 Plant with 16 hour Coping Strategy

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Purpose

- Identify Actions Necessary to Comply With 16 Hour Coping Strategy

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What is PV's SBO Design Basis

- Alternate AC (AAC) Plant Per Reg Guide 1.155 & NUMARC 87-00
  - Ltr 161-04146-WFC/MEP, dated August 31, 1991
  - SE Dated February 11, 1992 (section 2.2.2)

- Requirement for an AAC Plant
  - Demonstrate Coping W/O Power for 1 Hour
  - 4.2 MW GTG On Line within 1 hour
  - Demonstrate Coping With GTG available for an additional 3 Hours **(Now 16 hours)**

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Existing Strategy (4 hr Coping)

- **Existing Analysis**
  - Assumes 120 GPM RCS Leak Rate
  - Uses ADVs for Heat Removal
  - Start GTG Within 1 hr
  - Load EW/SP/EC/HVAC/Battery Chargers
  - Establish Charging for Inventory Control
  - Maintain Hot Standby Using ADVs
  - Remain @ Hot Standby for the Following 3 Hours

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Credited Future Strategy (16 hr Coping)

- **Revised Analysis**
  - Assume 83 GPM RCS Leak Rate
  - Minimize Operator Action During 1st hr
  - Start GTG, Within 1 hr
  - Load EW/SP/EC/HVAC/Battery Chargers
  - Use ADV for Heat Removal
  - Use HPSI for RCS Inventory Control
  - Uses Pressurizer Vent for Pressure Control
  - Cool Down to SDC Condition in 16 hrs

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Evaluation of Design Basis RCS Inventory

- 4 hr Coping
  - Core Remains Covered
  - Credits Reflux Boiling
- 16 hr Coping
  - Core Remains Covered
  - Natural Circulation
- Reviewed by NRC
  - February 11, 1992

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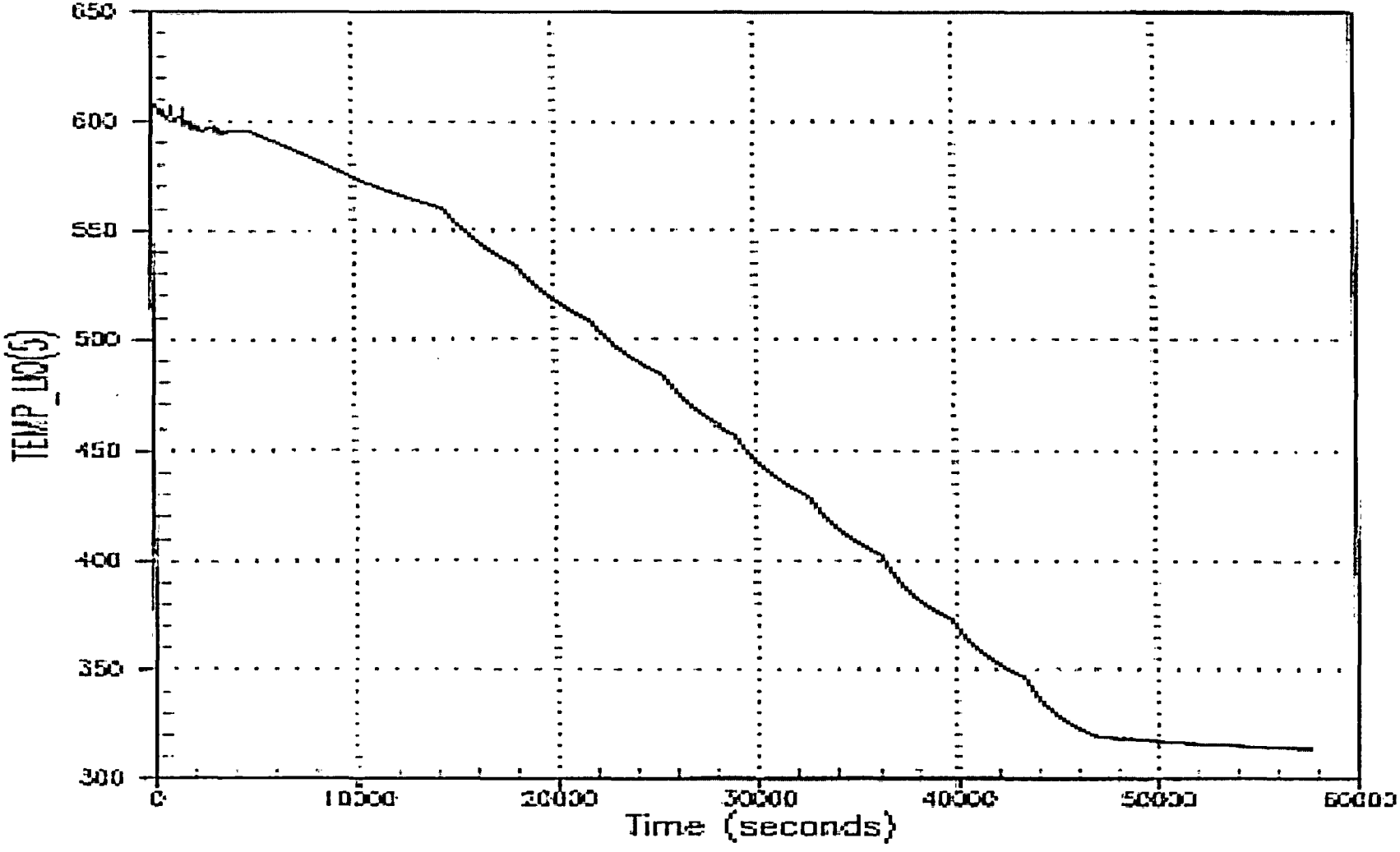
Hot Leg Temperatures
(°F)



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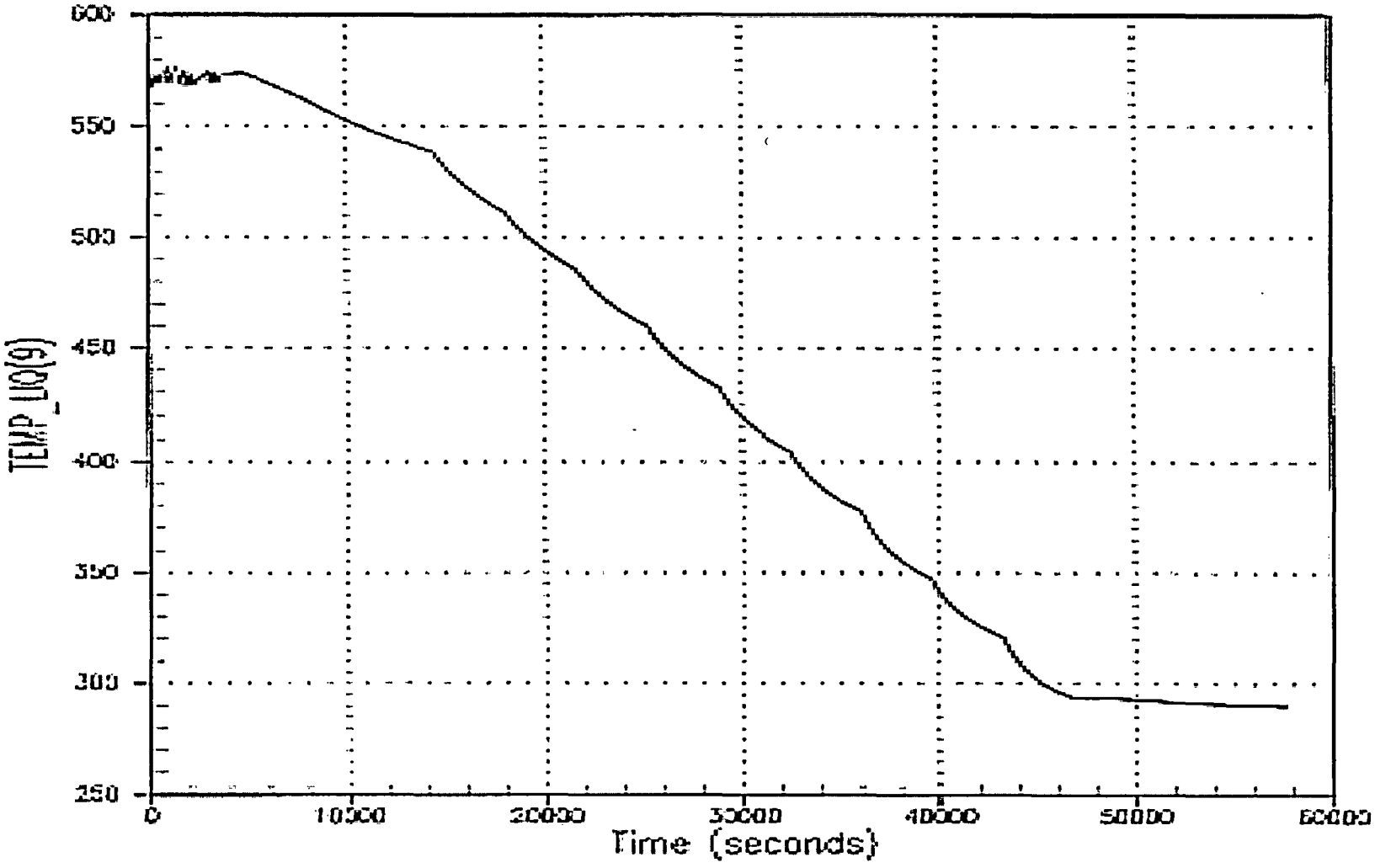
Cold Leg Temperatures
(°F)
TEMP_LOOP1(9)
600
550
500
450
400
350
300
250
0
10000
20000
30000
40000
50000
60000
Time (seconds)

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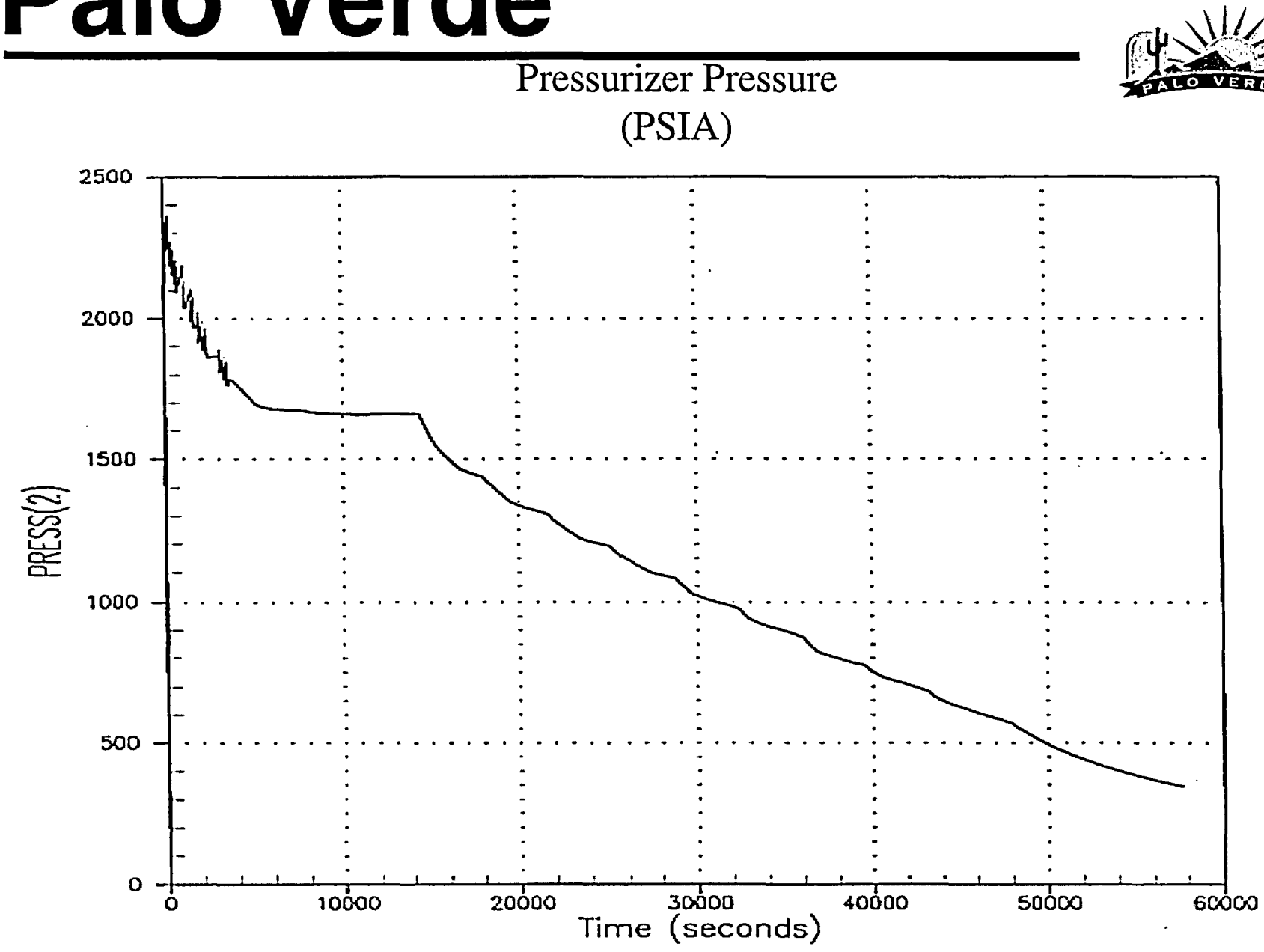
Pressurizer Pressure
(PSIA)
2500
2000
1500
1000
500
0
PRESS(2)
0
10000
20000
30000
40000
50000
60000
Time (seconds)

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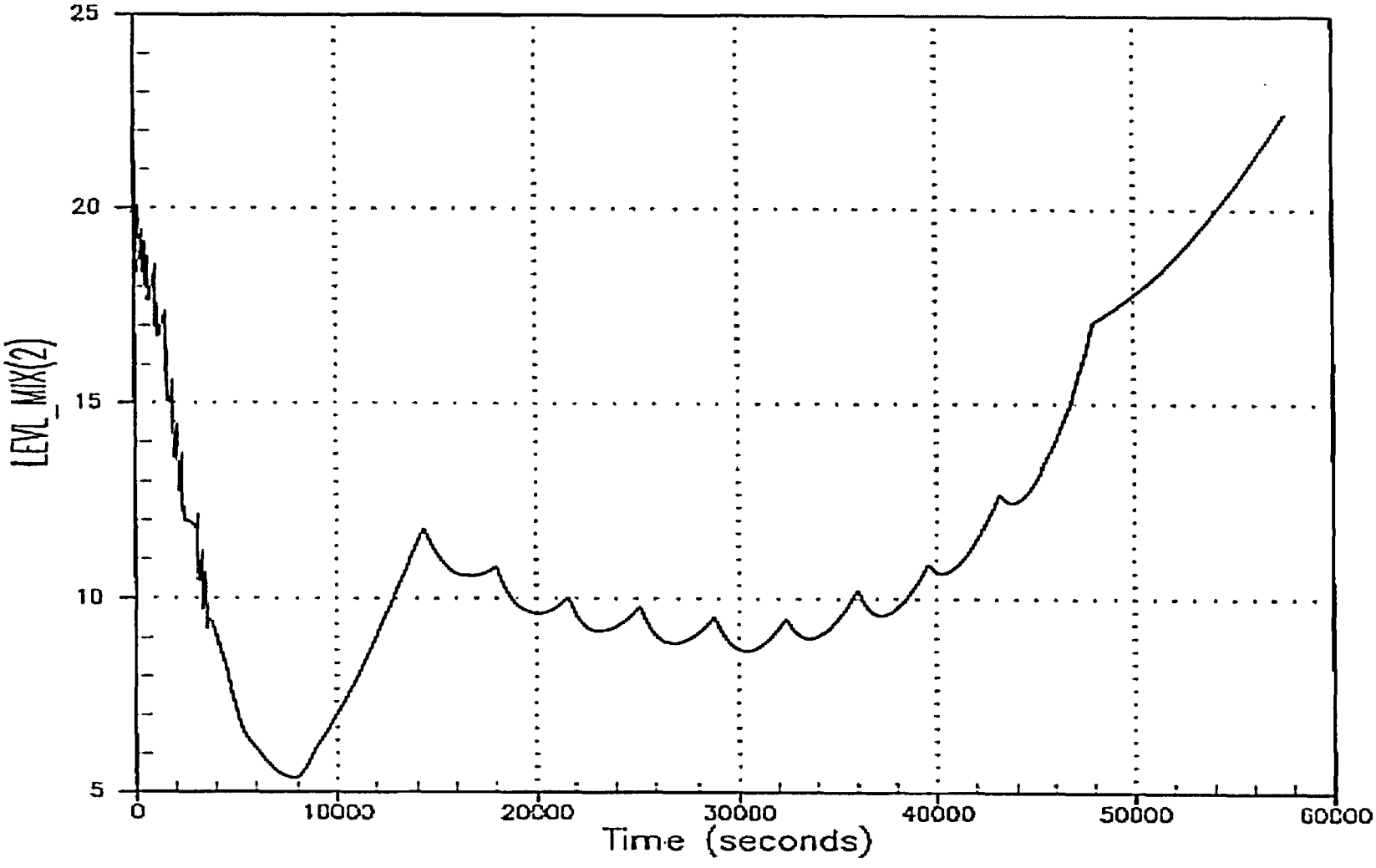
Pressurizer Level
(ft)
LEVL_MIX(2)
25
20
15
10
5
0
10000
20000
30000
40000
50000
60000
Time (seconds)

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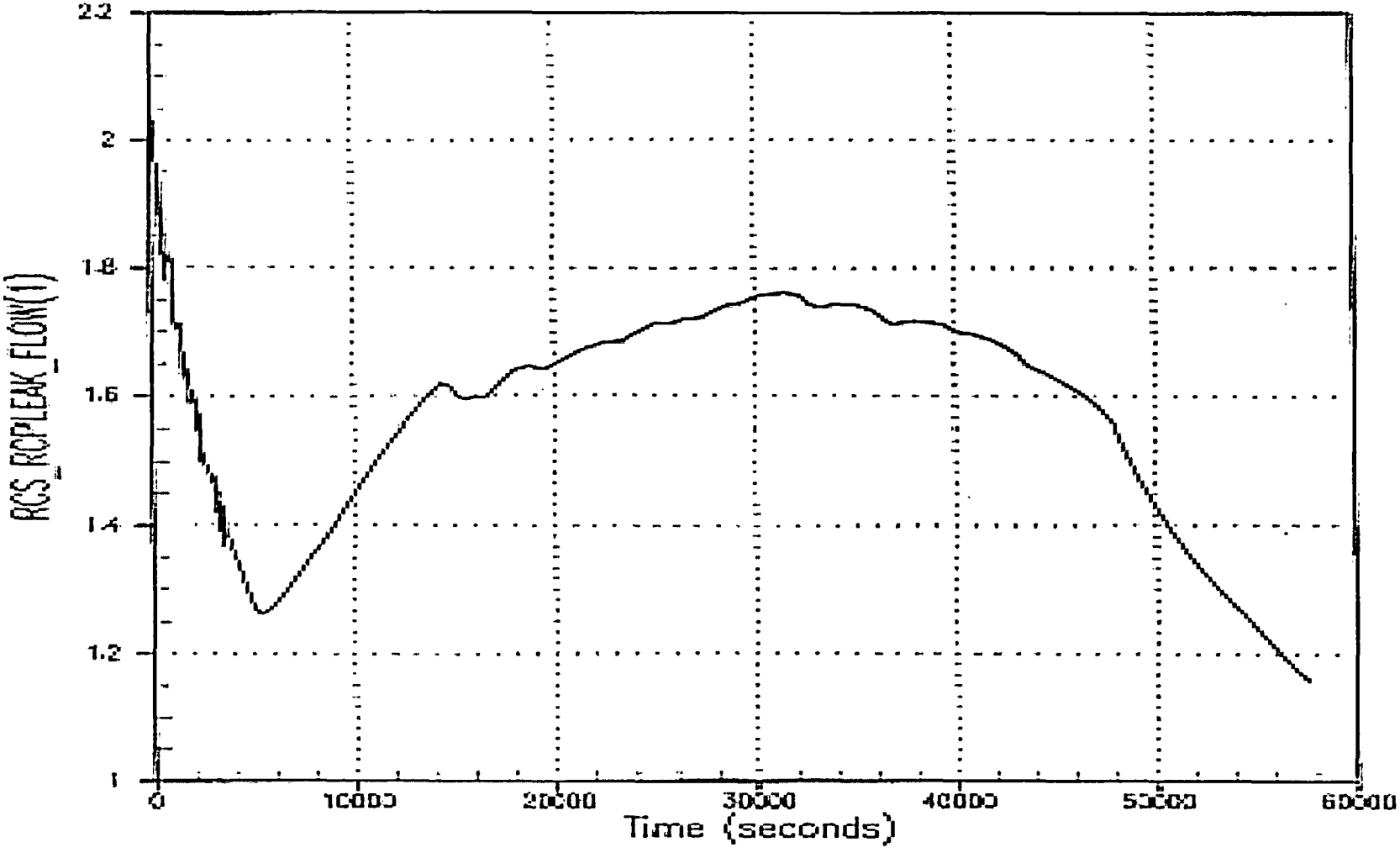
Leak Flow (per RCP)
(lbm/sec)



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Evaluation of Condensate Inventory

- 4 hr Coping
- Required Condensate
  - 156000 gallons
  - Decay Heat
  - Sensible Heat
  - SG Inventory Recovery
- Per NUMARC Guidelines
- Reviewed By NRC
  - February 11, 1992

- 16 hr Coping
- Required Condensate
  - 266000 gallons
  - Decay Heat (ANSI + 2σ)
  - Sensible Heat
  - RSG Inventory Recovery
- Analyzed Using CENTS Code
- Methodology Change

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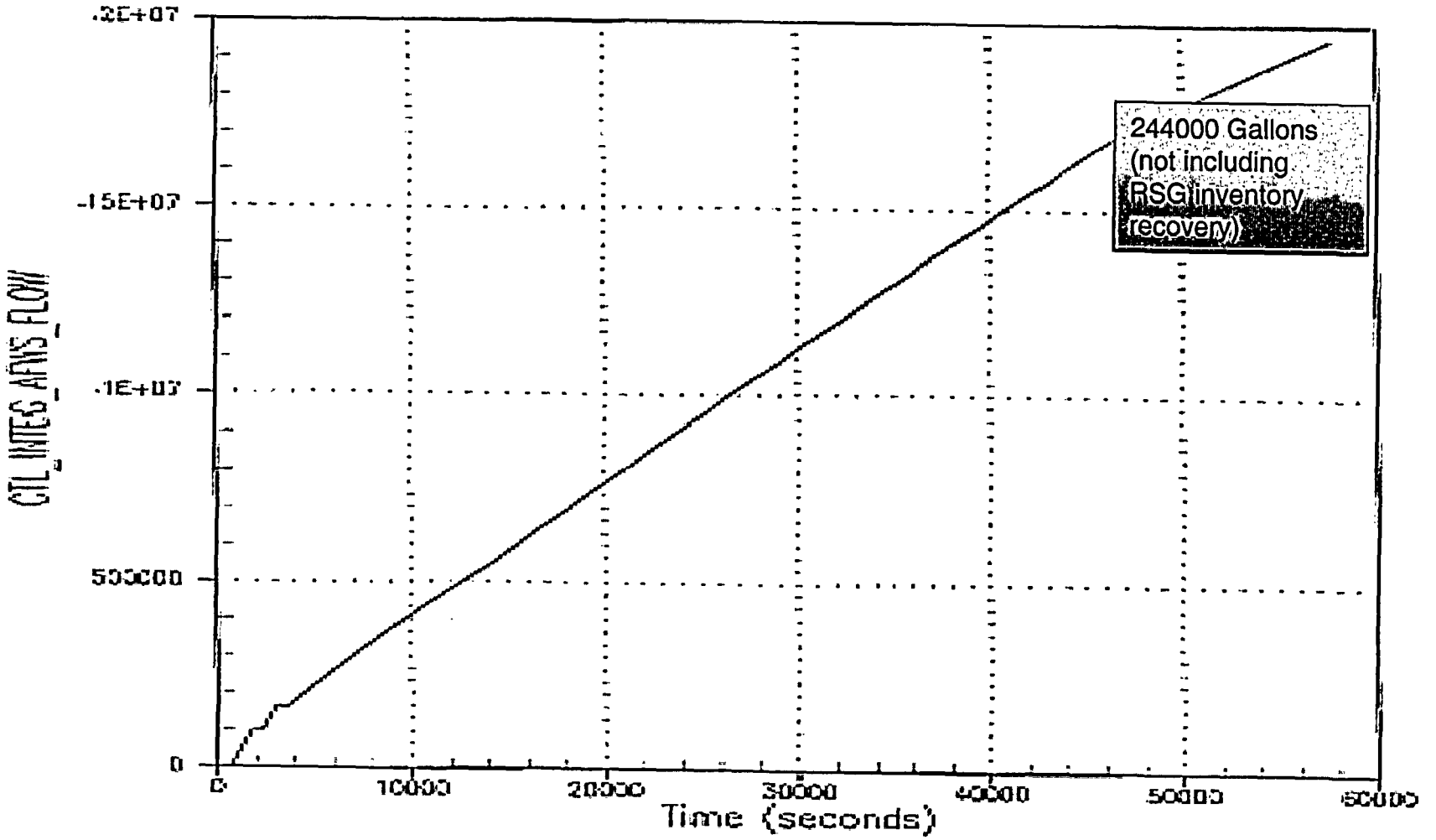
Integrated AFWS Flow
(lbm)



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Evaluation of Condensate Inventory

- Available Condensate Inventory
  - CST 300,000 gallons (Minimum Tech Spec)
  - RMWT 300,000 gallons Available (Not Tech Spec)

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Evaluation of Class IE Battery Capacity

- No Effect on Class 1E Battery Capacity From 16 hr Coping
  - Battery Chargers are Loaded on to GTG Within 1 hr
  - Original Analysis Sized the Batteries to Support SBO for 2 Hours
  - Equipment Credited in the First Hour Remains Bounding

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Evaluation of Compressed Air Capacity

- 4 hr Coping
  - ADVs
    - Nitrogen Accumulator
  - RCP Seal Bleedoff
    - Nitrogen Backup
      - 3082 gallon Tank
      - 65000 ft^3 HP Cylinder to Support 1 hr Duration
- Reviewed By NRC
  - July 28, 1992
  - April 13, 1994

- 16 hr Coping
  - ADVs
    - Insufficient Margin with Nitrogen Accumulator.
    - Portable Diesel Driven Air Compressor Will be Available for Connection to Instrument Air Header
  - RCP Seal Bleedoff
    - No Change to IA Backup

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Evaluation of Loss of Ventilation Control, AFWP, DC Equip and Battery Rooms

- 4 hr Coping
  - Cooling is Loaded on to GTG for the Following Rooms Within 1 hr.
    - Control Room
    - AFWP Room
    - DC Equipment Room
    - Switchgear Room
    - Battery Room
- Reviewed by the NRC
  - Feb 11, 1992
  - July 28, 1992

- 16 hr Coping
  - No Effect on the Heat loads Due to 16 hr Coping or Power Uprate
  - Cooling will Be Loaded on to the GTG within 1 hr.
- No Effect Due to 16 hr Coping Strategy Change

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Evaluation of Loss of Ventilation
Charging Pump Room and MSSS Bldg Upper Elev.

- 4 hr Coping
- No Credit was Given for Room Cooling for the Following:
  - Charging Pump Room
  - MSSS Upper Elevation
- Review by the NRC
  - Feb 11, 1992
  - July 28, 1992

- 16 hr Coping
  - No Credit is Given for Room Cooling for the Identified Rooms,
  - Steady State Temperature in Chg Pump Room & MSSS Building Remains Below Equipment Qualification Temperature Criteria

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Evaluation of Loss of Ventilation Containment

- 4 hr Coping
- Containment
  - In house Code
  - Utilizes NUMARC Criteria
  - Heat Sinks Per NUMARC
  - Perform Temperature Transient Analysis Vs Steady State Solution
  - Results Demonstrate Containment P/T remains bounded by the LOCA P/T

- 16 hr Coping

  Containment
  - COPPATA Code
    - NRC Approved
    - Used for Containment P/T analysis for LOCA
    - Heat Sinks Per UFSAR 6.2
  - Results Demonstrate containment P/T remains bounded by the LOCA
  - Methodology Change

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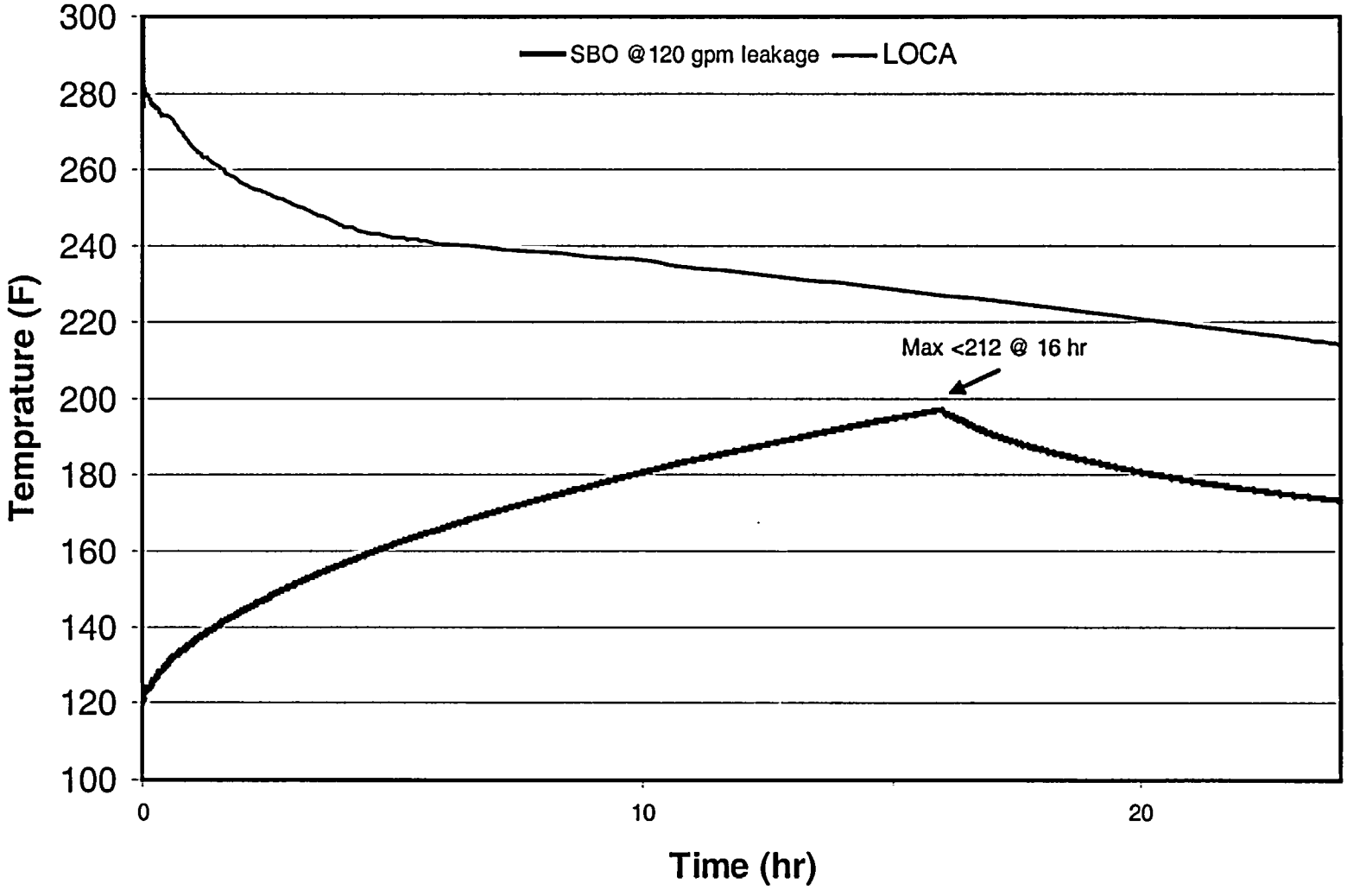
Comparson of Containment Vapor temperature
SBO and limiting LOCA



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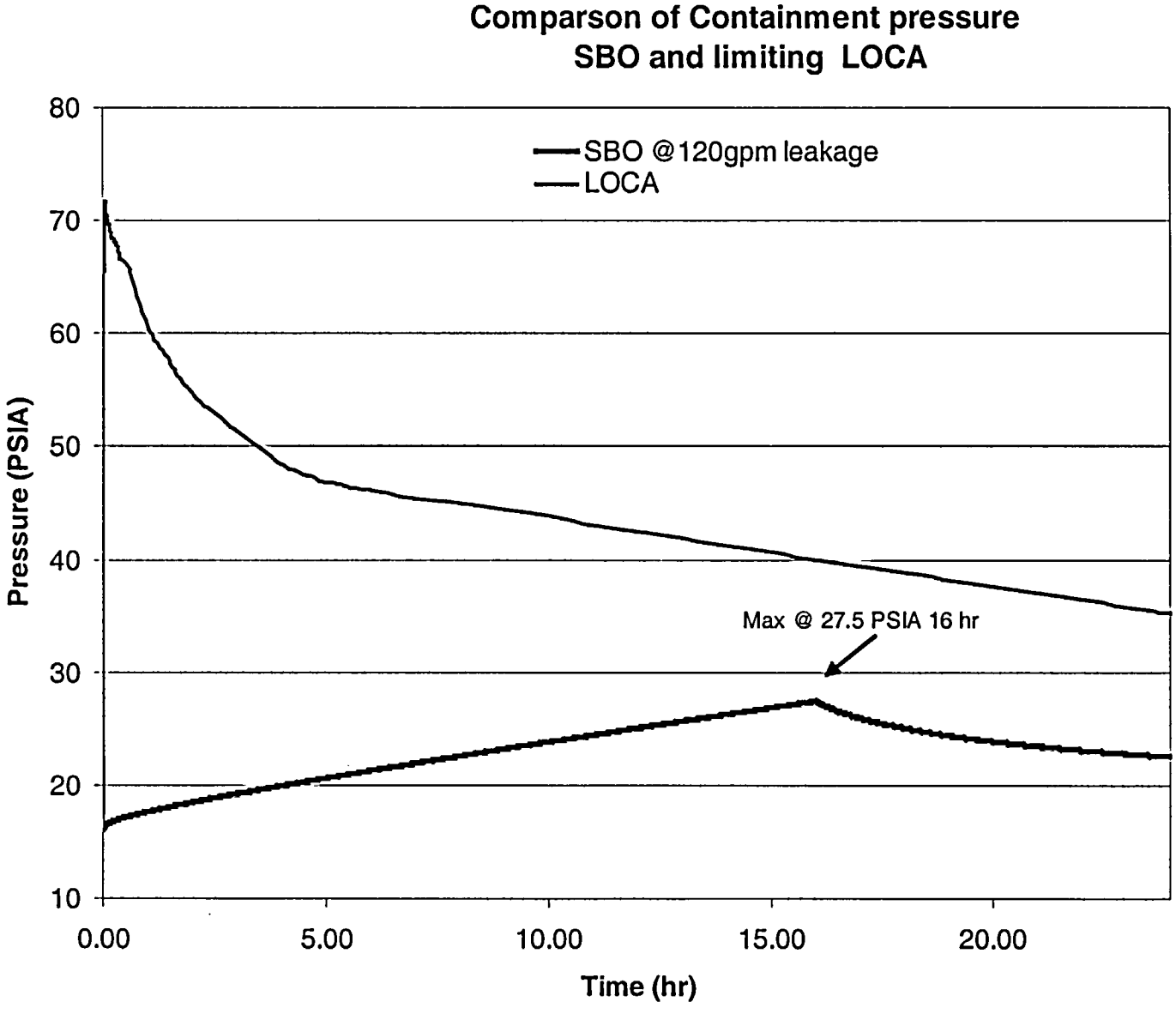
Comparson of Containment pressure
SBO and limiting LOCA
SBO @120gpm leakage
LOCA
Max @ 27.5 PSIA 16 hr
Pressure (PSIA)
Time (hr)
80
70
60
50
40
30
20
10
0.00
5.00
10.00
15.00
20.00

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Evaluation of Containment Isolation

- 4 hr Coping
- Containment Isolation Valves Were reviewed for the applicability or exclusion to NUMARC 87-00 Criteria and found acceptable
- Located in UFSAR Tables 6.2.4-1 & 6.2.4-2
- Reviewed by the NRC
  - April 13, 1994

- 16 hr Coping
- Will Not Reach RAS at 16 hrs
- No Impact to the Containment Isolation capability due to PUR Or 16 hr Coping

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Evaluation of Communication

- EPABX (Telephone) 8 hr battery
- Plant 2 Way Radio 4 hr battery, Transfer Switch
- Sound Power Phones

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Evaluation of Communication

- 4 hr Coping
- Primary Modes of Communication
  - EPABX Telephone
  - Sound Power Phone
  - Radios
- Reviewed by the NRC
  - April 13, 1994

- 16 hr Coping
- Primary Mode of Communication
  - EPABX Telephone
    - (8 hr Battery back-up)
  - Radios
    - (4 hr Battery back-up)
    - (Transfer Switch)
  - Sound Power Phone
- Sufficient Battery Back-up to Cope for 1 Hour Until GTG Loads the Radio System

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Summary

- Regulatory Guide 1.155 Acceptance Criteria for 16 hr Coping Can Be Successfully Demonstrated
- Methodology Changes Will Be Introduced for Consistency With the Current Safety Analysis Methods
- New Equipment and Procedure Changes Are Necessary for Implementation of the 16 hr Coping Strategy