UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-4005

July 18, 2007

Stewart B. Minahan, Vice
President-Nuclear and CNO
Nebraska Public Power District
72676 648A Avenue
Brownville, NE 68321

SUBJECT: MEETING SUMMARY FOR REGULATORY AND PREDECISIONAL ENFORCEMENT CONFERENCE

Dear Mr. Minahan:

This refers to the Regulatory and Predecisional Enforcement Conference public meeting conducted at the NRC Region IV office on July 13, 2007. This conference is related to the apparent finding documented in NRC Inspection Report 05000298/2007007. The meeting attendance list and a copy of the slides presented by you and your staff during the meeting are included as Enclosures 1 and 2.

In accordance with 10 CRR 2.390 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and its enclosures will be available electronically for public inspection in the NRC's Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this matter, we will be pleased to discuss them with you.

Sincerely,

Michael C. Hay

Michael C. Hay, Chief
Project Branch C
Division of Reactor Projects

Docket: 50-298
License: DPR-46

Enclosures:
1. Attendance List
2. Presentation Slides

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Enclosure 1

LIST OF ATTENDEES

Cooper Nuclear Station

D. Buman	System Engineering Manager
M. Colomb	General Manager of Plant Operations
P. Fleming	Licensing Manager
T. Hottovy	Equipment Reliability Manager
G. Kline	Director of Engineering
J. Larson	QA Supplier Supervisor
S. Minahan	Vice President-Nuclear and CNO
J. Olberding	Licensing Specialist
R. Rexroad	Engineer
J. Roberts	Director of Nuclear Safety Assurance, River Bend Nuclear Station
T. Slenker	Assistant Operations Manager
K. Sutton	Risk Management Supervisor

NRC

K. Smith	ACES, Region IV
M. Hay	Chief, Branch C, Division of Reactor Projects, Region IV
W. Jones	Acting Deputy Director, Division of Reactor Safety, Region IV
C. Lyon	NRR/ADRO/DORL/LPL4
M. Vasquez	Office of Enforcement, Region IV
A. Vegel	Deputy Director, Division of Reactor Projects, Region IV
S. Wong	NRR/DRA/APOB
M. Franovich	NRR/DRA/APOB
R. Pettis	NRR/ADES/DE/EQVB
M. Runyan	Senior Reactor Analyst, Region IV
D. Solario	OE/EPPOB
D. Thatcher	NRR/ADES/DE/EQVB

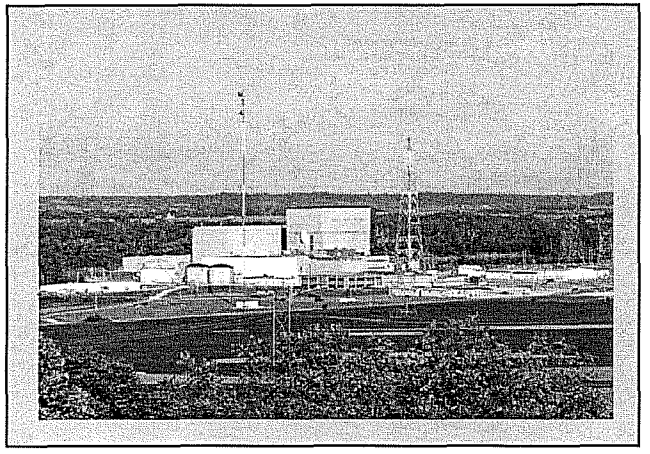
Enclosure 2

Regulatory Conference
Special Inspection
IR 2007-007

Nebraska Public Power District

Cooper Nuclear Station

July 13, 2007



Agenda

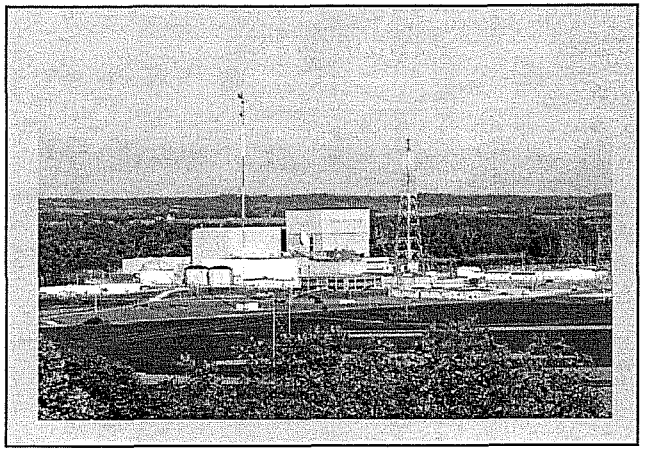
- New Information
- DG2 Trip & Updated Root Cause Evaluation
- Significance Determination Using New Information
- Regulatory Perspective
- GMPO Summary
- Closing Remarks

New Information

- Updated Root Cause Evaluation
  - "Manufacturing Defect" Associated with a Diode on Voltage Regulator (VR) Board
  - DG Failure is Random vs. Run-Time Dependent
- Self Revealing Leads to Simple Diagnosis
- Operation of DG in Manual Mode
  - Initial Training
  - Simulator Observation

DG2 Trip & Updated Root Cause Evaluation

Dan Buman

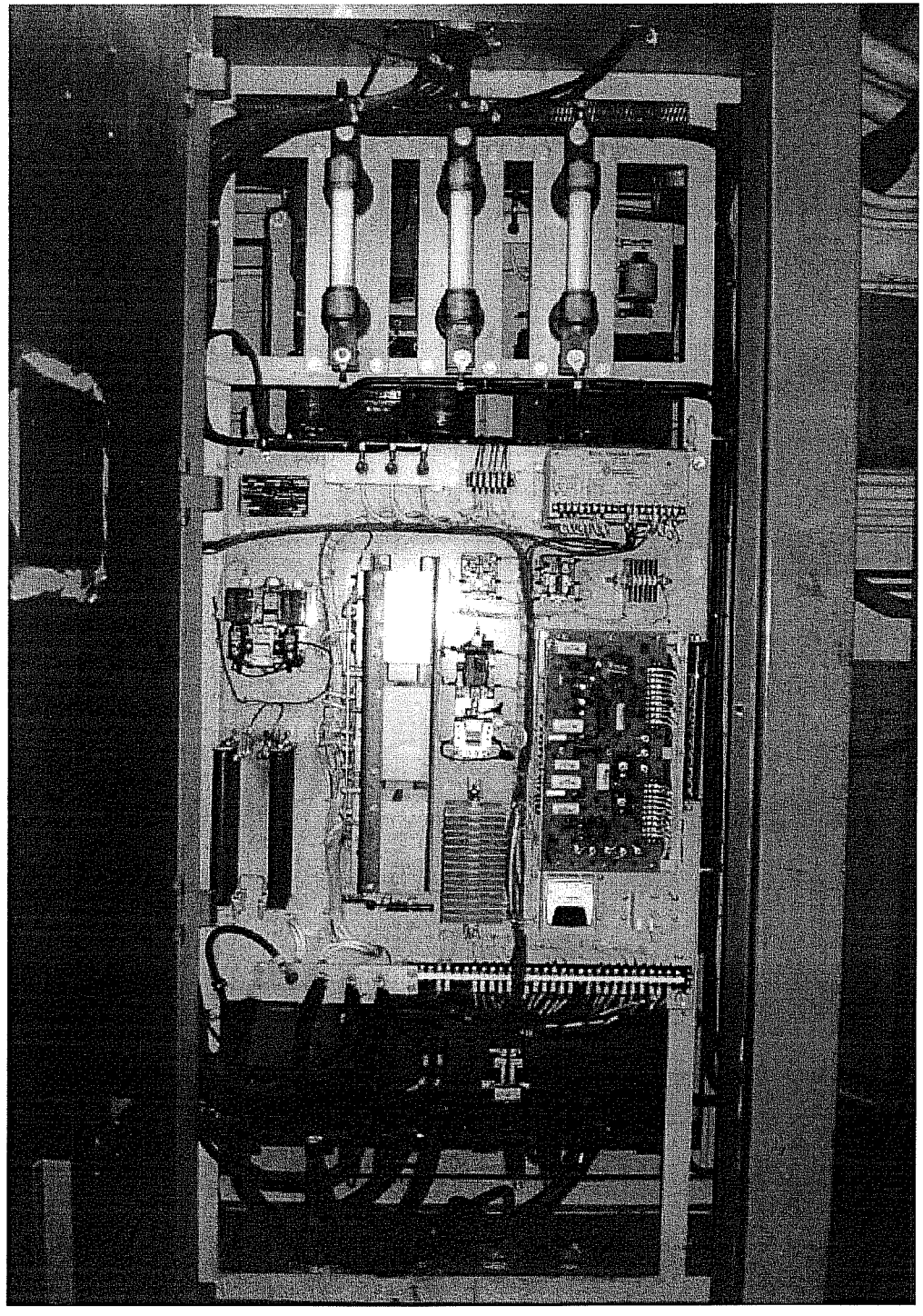


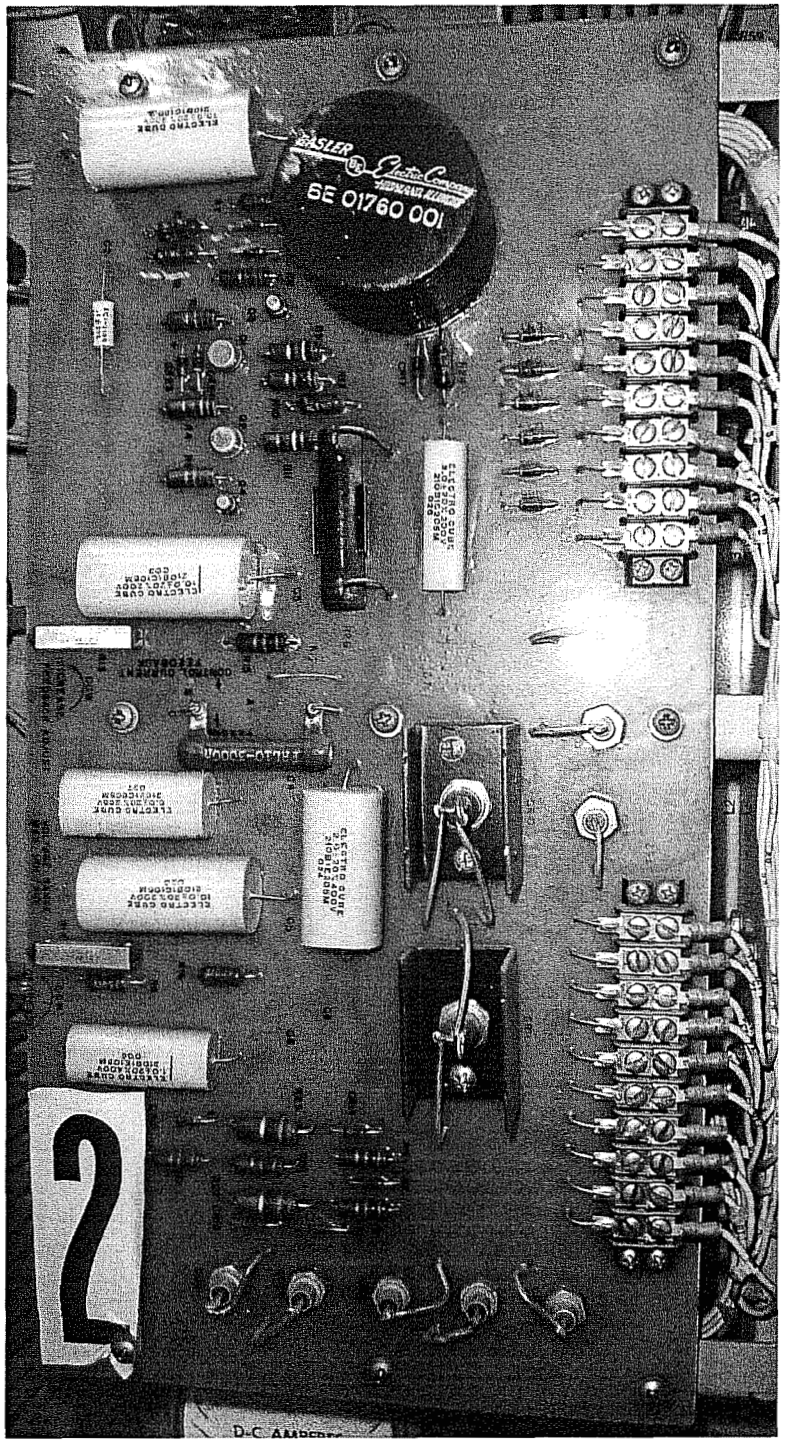
DG2 Trip (January)

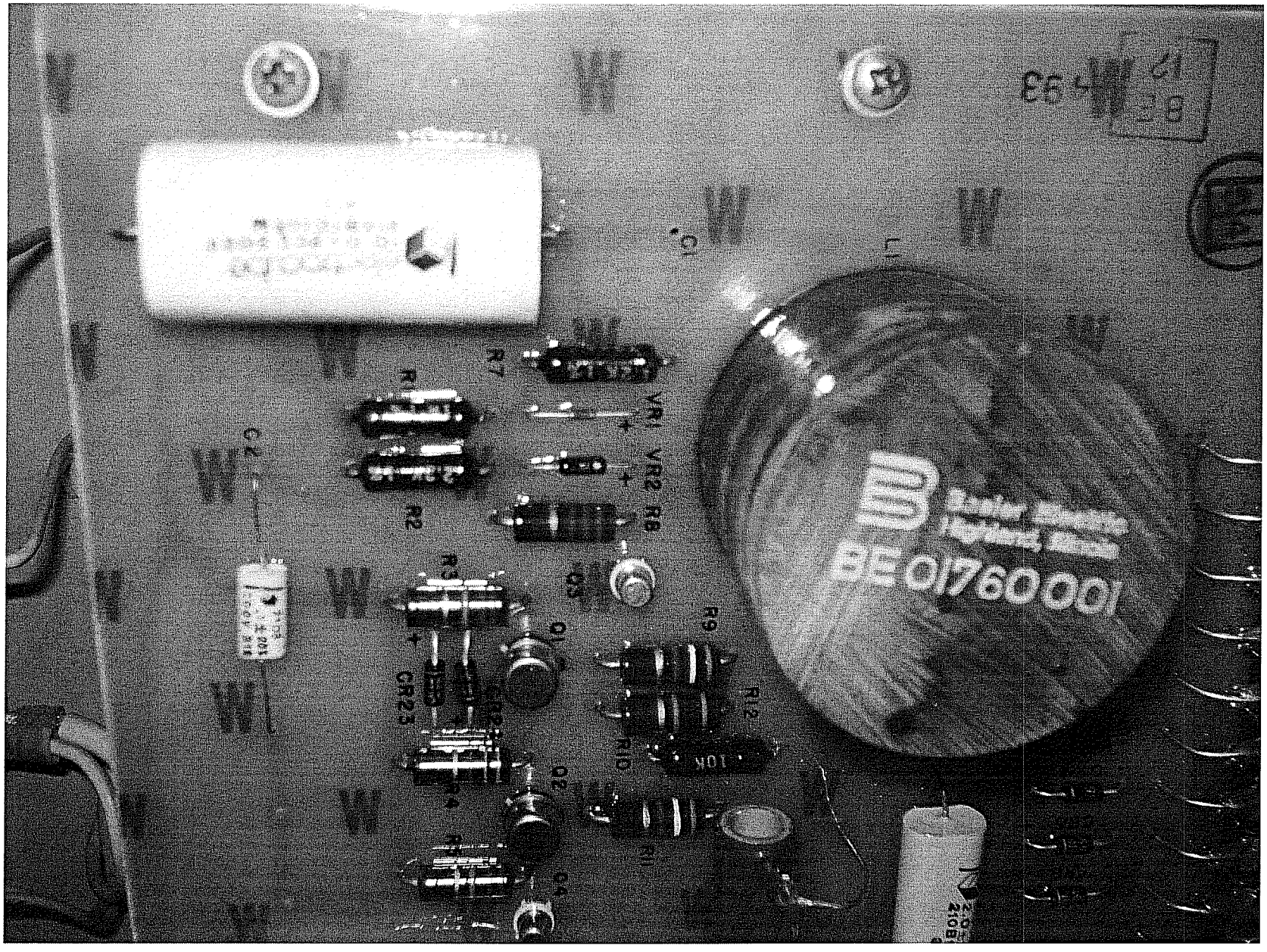
- Surveillance Run (Jan. 18, 2007)
  - DG2 Tripped
- Troubleshooting/Cause Determination
  - Isolated to Voltage Regulating Circuit
  - Change Analysis
  - FMEA, OEM Expertise, VM, OE, Fleet Input
  - Evidence Preservation
- Replaced VR Board
- Established Instrumented Confidence Runs

DG2 Trip (RE23)

- VR Tuning in RE23
  - Field Technician On Site
  - Apparent Cause Indicated Tuning Activities
    - Extensive FMEA/Operating Experience
    - Input from field technician
    - Instrumented Runs (>24 Hours)
      - Surge Test (110%)
      - Load Reject Tests (2)
      - Sequential Load
  - VR Board Tested Sat
- Updated Root Cause Reflects Additional Potential Failure Mode

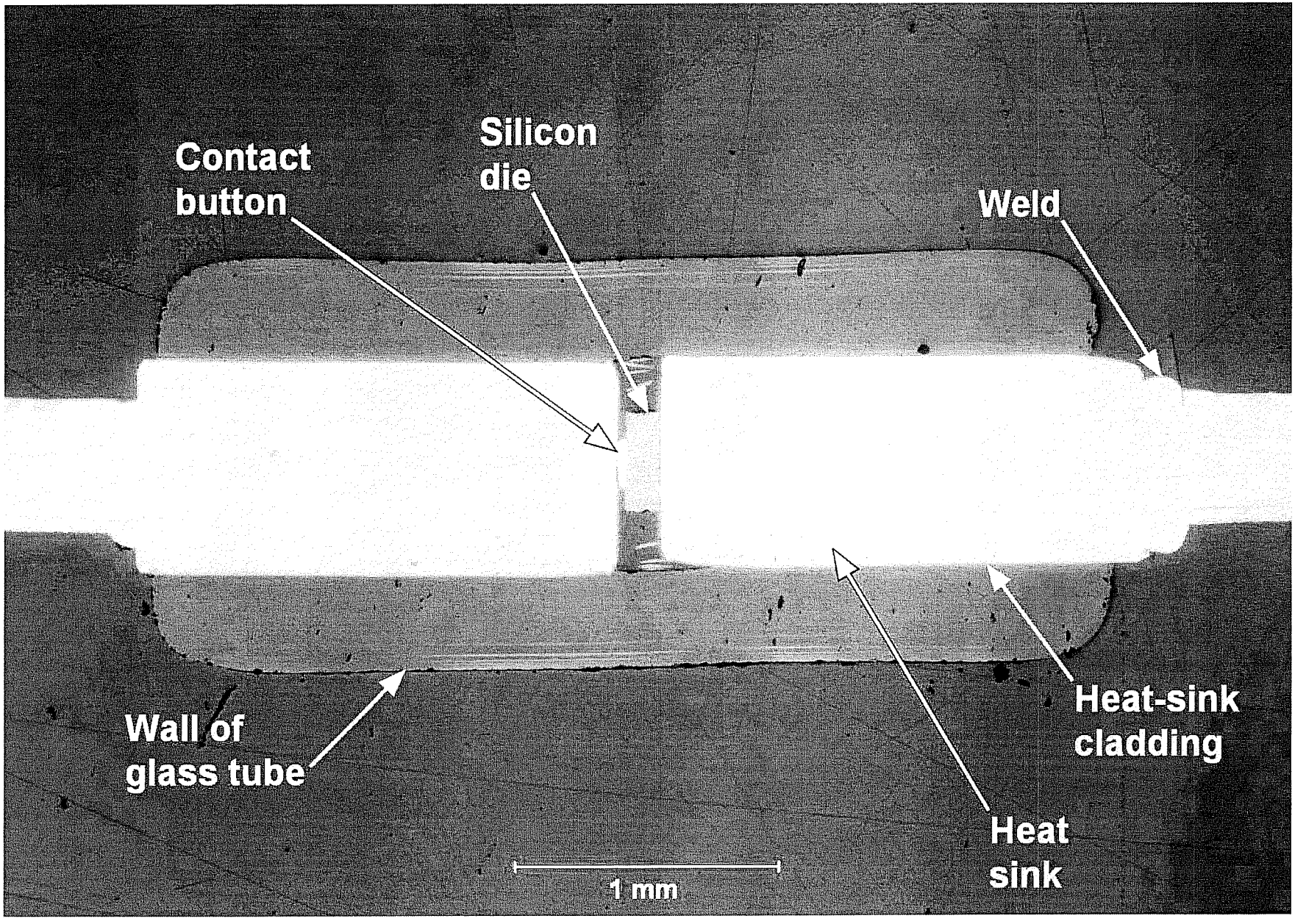


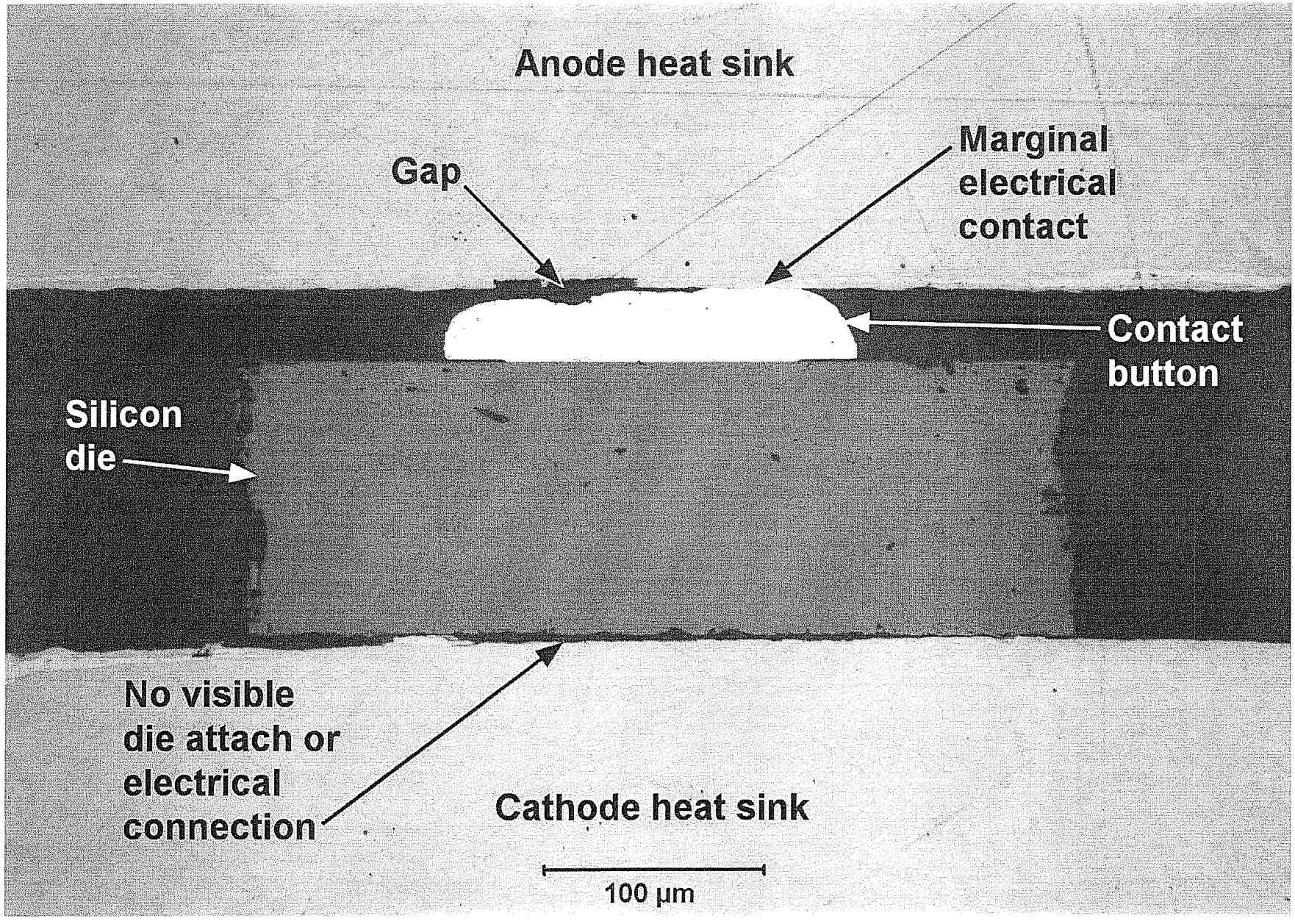

BASLER
Electric Company
SE 01760 001
2


BE 01760001
VR1
VR2
R7
R8
R9
R12
R10
R11
R2
R3
R4
CR23
Q1
Q2
Q3
Q4
C1
C2
L1

Updated Root Cause Evaluation

- Off-Site Testing, Analysis and Evaluation
  - OMAS Connectors Examined (Eliminated)
  - VR Board
    - Nondestructive Testing/Inspection (BETA Labs)
    - Operational Testing (MPR at BETA Labs)
    - Destructive Examination (Southwest Research)
- "Manufacturing Defect" in Zener Diode (VR1)
  - Intermittent Open Circuit (Automatic Mode)
  - Random Failure Mode
- Standard Test Methods Unlikely to Detect
  - Southwest Research Conclusion

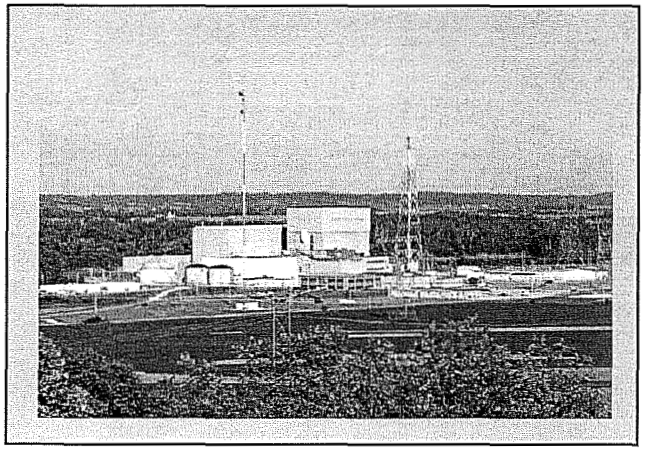

Contact button
Silicon die
Weld
Wall of glass tube
Heat-sink cladding
Heat sink
1 mm


Anode heat sink
Gap
Marginal electrical contact
Contact button
Silicon die
No visible die attach or electrical connection
Cathode heat sink
100 µm

Significance Determination Using New Information

Kent Sutton

Tim Slenker



Significance Determination Using New Information

- CNS PRA Model
- Recovery Credit
- ΔCDF Treatment
- DG Reliability

CNS PRA Model

- Dominant Sequence
  - LOOP Event and DG1 is Unavailable
  - DG2 Fails to Run
  - HPI Available for 8 Hours
- DG2 Recovery
  - Add VR Board Failure Mode
  - Self-Revealing Condition
  - Simple Recovery Actions

Recovery Credit

- Self Revealing Diagnosis
  - Alarms and Indications
  - Procedures for Restart are Adequate
- Reasonable Recovery Actions
  - Sufficient Time to Recover
  - Vendor Manual Guidance
    - Restart and Load in Manual
    - Replace VR Board
- VR Board Failure Mode
  - Add Explicit Recovery for Failure Term

Operation's Response

- LOOP w/DG1 Unavailable
  - Emergency Procedures 5.3EMPWR and 5.3AC480
    - Operator dispatched to DG2 Room
    - Align DC Power, as needed
  - Declare NOUE and Staff TSC
- DG2 Trips on Over Voltage
  - Emergency Procedure 5.3SBO
  - Control Room Indication
    - "DIESEL GEN 2 LOCKOUT" (C-4/A-5)
      - Operator dispatched to DG2 Room
      - Flag on over-voltage Local Relay 27-59

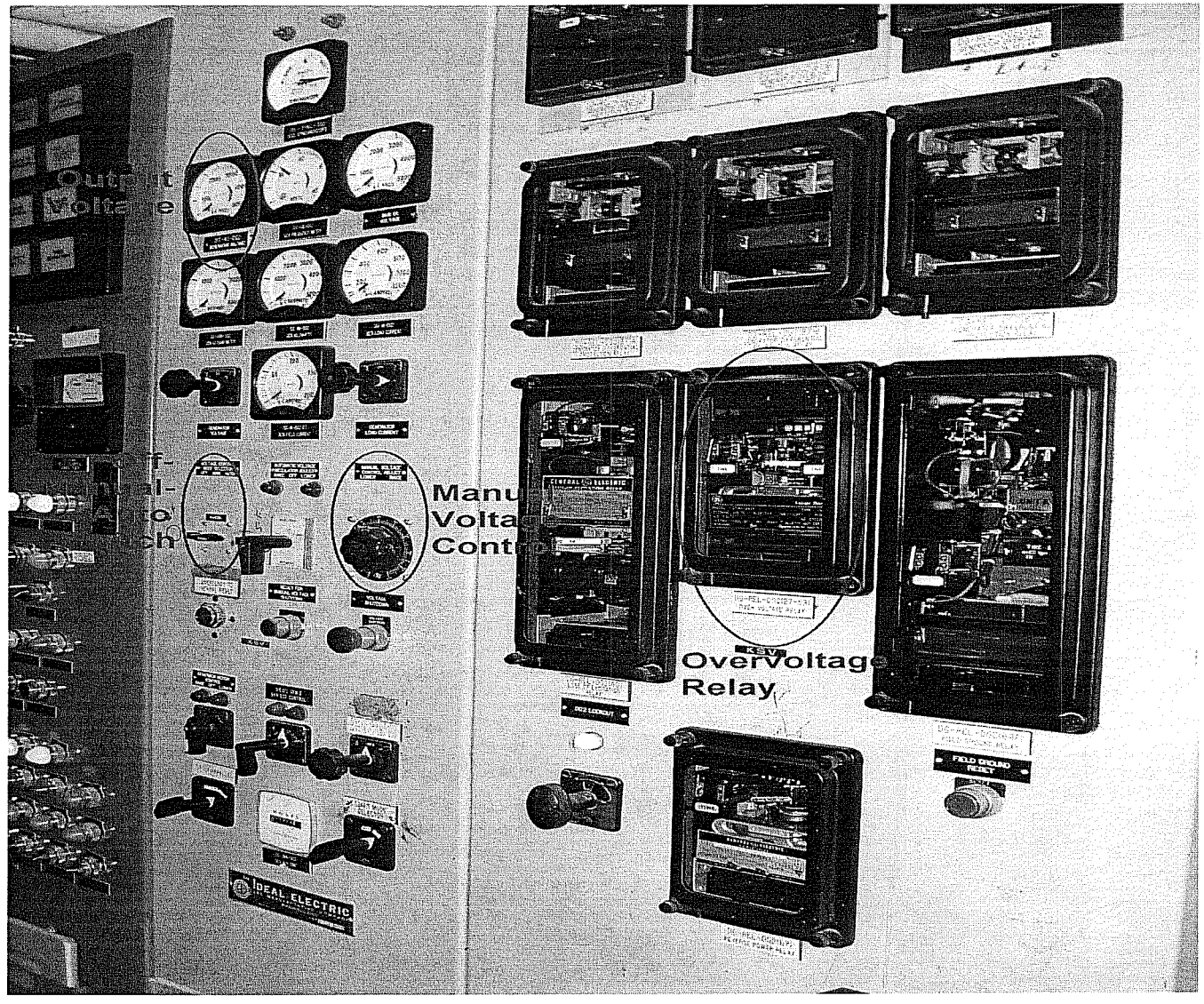
Operation's Response (cont.)

- EP 5.3SBO
  - Check Local Conditions
  - Reset Any Trip Conditions and DG2 Auto Starts
  - If DG2 Trips, Start and Load
    - Procedure 2.2.20.1 (Control Room)
  - If DG2 Trips Again, Start and Tie to Bus Locally in Isolate
    - Procedure 2.2.20.2 (DG2 Room)

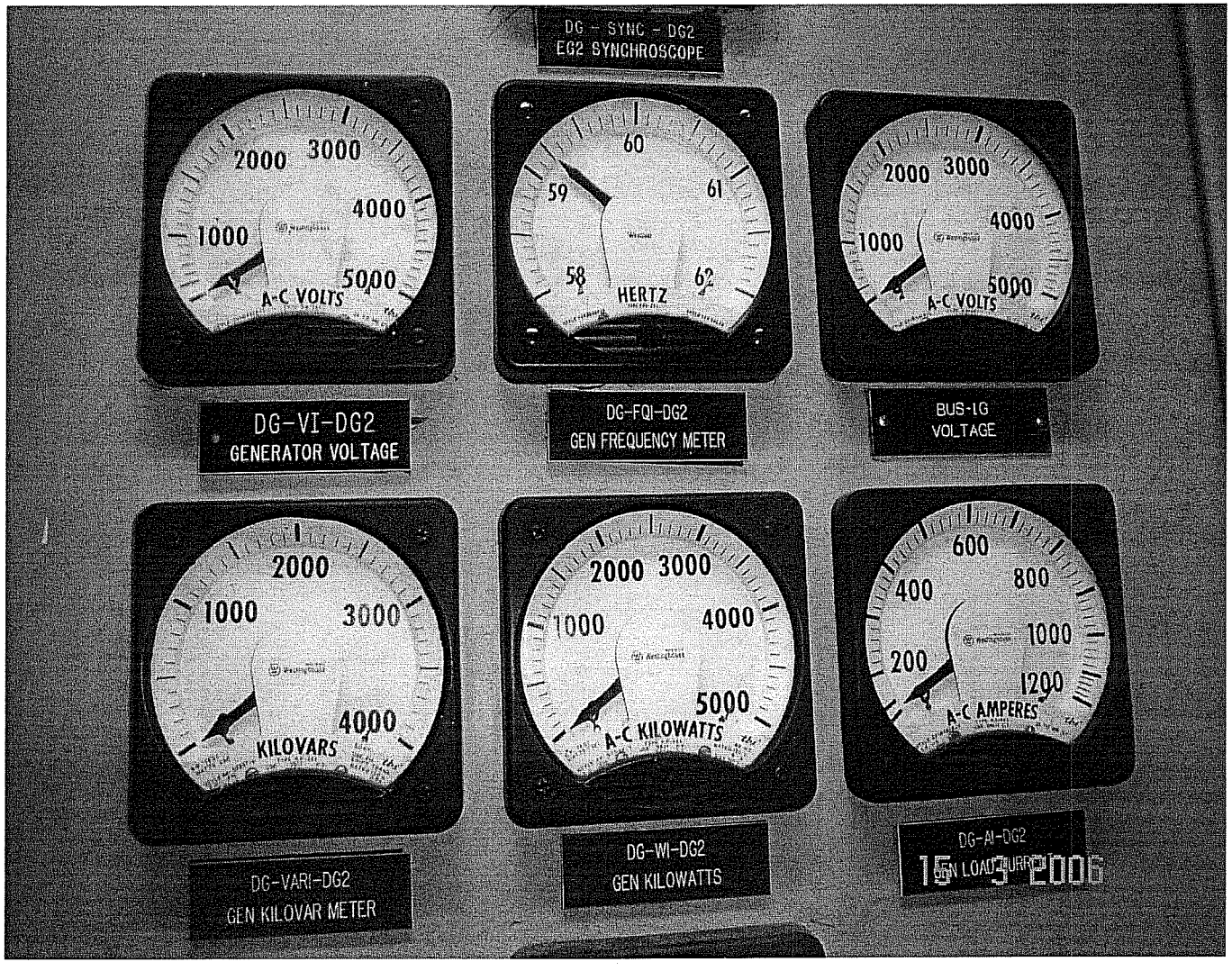
Organization Response

- TSC Troubleshooting
  - Information from Prior Starts Indicates Voltage Control Problem
  - Vendor Manual Guidance
    - Start and Operate in Manual Voltage Control Mode
  - EP Drills
- Recovery Paths
  - DG2 Operation in Manual
    - Operator adjusts voltage locally, as needed
  - Replace VR Board

DG2 Local Control Panel



DG2 Local Indication

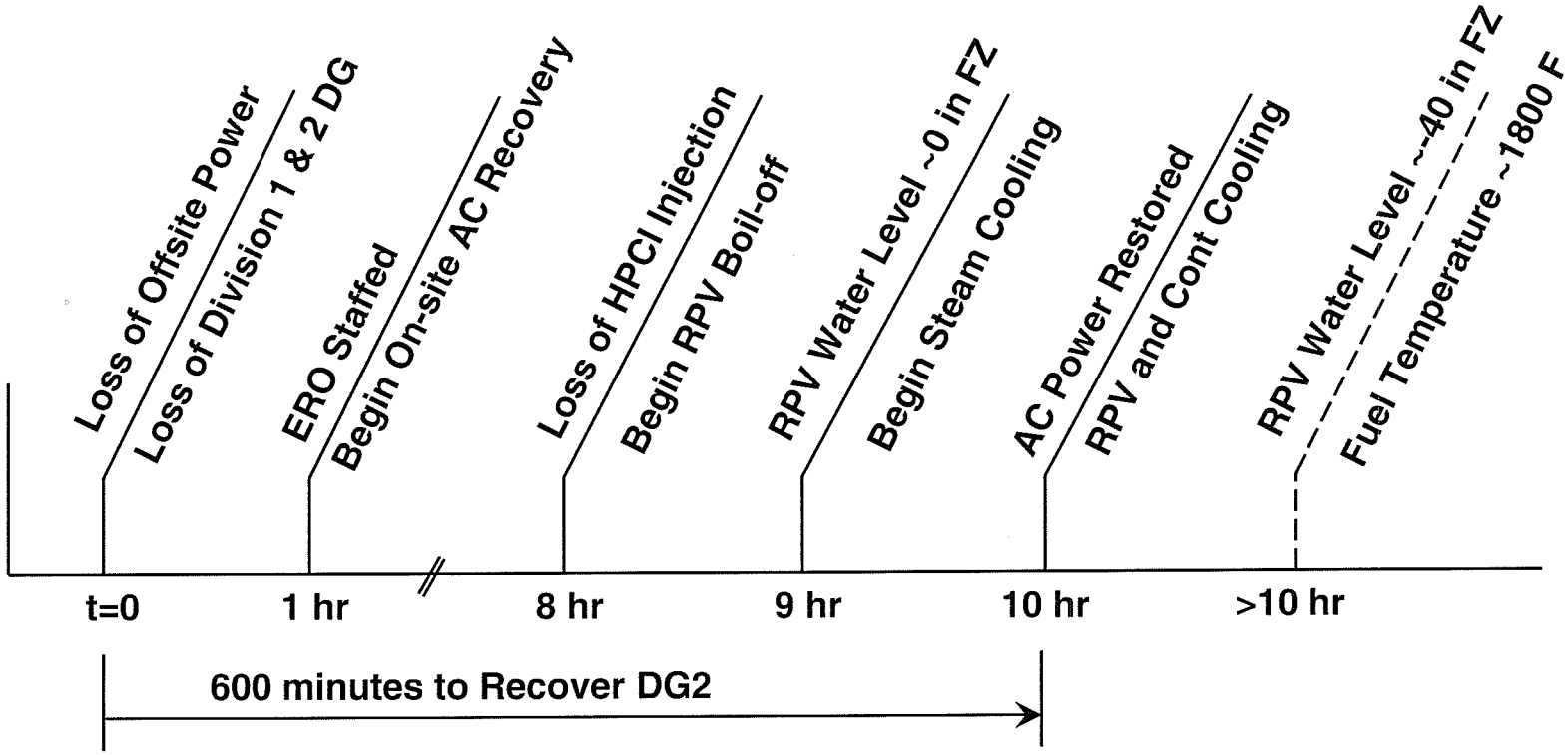


Decision to Recover DG2

- EP 5.3SBO makes AC Restoration Top Priority
  - Cues from Alarms and Indications
  - Unique Flag Condition (27-59 Relay)
  - Knowledge and Training (Manual Operation)
    - Initial Training (NLO)
  - Operator Diagnosis and Organization Response
    - VM directs DG Manual Operation, troubleshoot voltage regulator
    - Execution error during manual operation is fully recoverable
- EP 5.3SBO Directs DG Restart after Failure
  - Simulator Observation

Sufficient Time to Recover

Expected Timeline of Major Events



// denotes time jump, time not to scale

Operational Response

- Conclusion
  - Diagnosis is Simple Given Repeat Flags for Condition
  - Time Available is Long for Diagnosis and Execution
  - Execution Errors are Recoverable

ΔCDF Treatment

- SDP Risk: Delta CDF is Determined
  - $(CDF_{Cond} - CDF_{Base})$ * Exposure Time
  - Apply Recovery Credit to Condition
  - At Power Exposure Time
- Key Factors Affecting Dominant Sequences
  - DG Recovery
  - Diode Failure Probability

DG Recovery - Operate in Manual Mode

- NPPD Analysis
  - $(HEP * CDF_{Cond} - CDF_{Base}) * \text{Exposure Time}$
  - Recovery HEP of 0.03, Simple Diagnosis
  - Constrained Non-Informative Prior
    - 1 failure in 36 hours
  - Exposure Time is 56 Days
- $\Delta CDF = 1.35E\text{-}08$

Delta CDF Insights

- Evaluation of Key Contributors
  - Number of Failures
  - Recovery Credit
- Calculated ΔCDF is <1E-06 given:
  - 1 or 2 Failures in 36 Hours with no Recovery Credit for DG2 (4.5E-07 and 7.4E-07, respectively)

DG Reliability

- NPPD Analysis
  - (HEP * CDF_{Cond} – CDF_{Base}) * Exposure Time
  - Recovery HEP of 0.03, Simple Diagnosis
  - Zero Prior
    - 2 failures in 36 hours
  - Exposure Time is 56 days
  - Application of Weighted LOOP Recovery
    - DG failure assumed at t=0
    - LOOP recovery credit for run time
- ΔCDF = 1.0E-07

DG Recovery

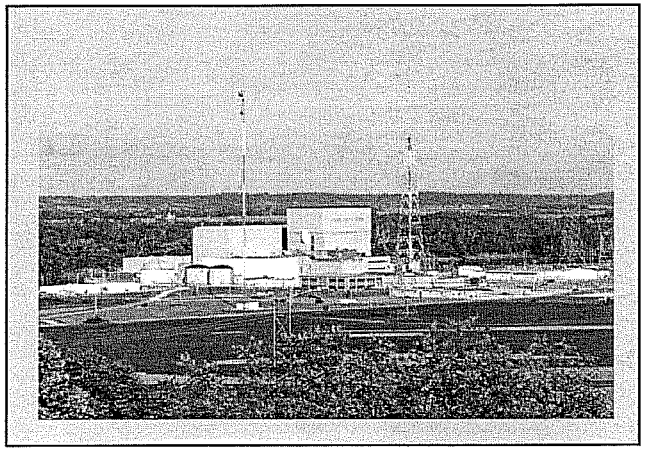
- NRC SDP Analysis (SPAR)
  - ΔCDF = 5.6E-06, No Recovery
    - (HEP * CDF_{Cond} – CDF_{Base}) * Exposure Time
  - ΔCDF = 5.8E-07, Using 0.3 All Sequences
- NPPD Analysis
  - Modified Phase 2 Evaluation
  - Recovery Credit of 0.1
  - ΔCDF <1.E-06

Significance Determination Summary

- Site Specific Analysis
  - Modified for Condition
  - Operator Recovery
- Very Low Safety Significance
  - Random Failure Treatment
  - Reasonable Recovery Credit

Regulatory Perspective

Paul Fleming



Identified Performance Deficiency

- Inadequate Procurement of Voltage Regulator (VR) Board (1973)
- Insights from Generic Communications and Past Inspection
- No Procedure to Evaluate Stored Components (Pre-1990)
  - Installed Part Having "Indeterminate Quality"
- Resulted in Failure of DG2

VR Board Procurement

- Procured Essential
- Original Equipment Manufacturer (OEM)
- Same Part Number as the Original
- QA Review for Documentation Requirements
- Installed Boards of Same Vintage

Generic Communications

- SECY-90-304
  - NUMARC Paper
    - Focus on Commercial Dedication
    - Forward Looking
      - No backfit
      - If technical deficiency, then investigate
  - Stated Future Inspection Guidance would be Developed (1996, IP 38703)
  - Identified New Generic Letter Being Developed (GL 91-05)

Generic Communications (cont.)

- GL 91-05
  - Commercial-Grade Procurement & Dedication
  - Identified Indeterminate Quality Parts Installed
  - NUMARC 90-13
  - Staff Position:
    - Not Expected to Review All Past Procurements
    - If During Current Procurement Activities
      - Shortcomings in vendor products
      - Failure experience or current information for installed or stored items, then use CAP

Past Inspection

- IR 92-201
  - Purpose and Scope of Inspection
    - Implementation of NUMARC Initiative
    - Post 1990 dedication activities
  - Key Finding
    - Failed to properly dedicate certain Commercial Grade Items (CGIs) for use in safety related applications
  - Action Plan was Included/Attached and was Forward Looking
- Subsequent Meeting – Issues Resolved
- IR 95-03 – Closed Follow-up Items

Procedure to Evaluate Pre-1990 Procurements

- No Requirement or Commitment to Look Backward (Inventory or Installed)
- No Backfit Implied or Expressed
- If a Problem is Identified using Current Process, Resolve using CAP
- Proposed Application Example – Next Slide

Proposed Application Example

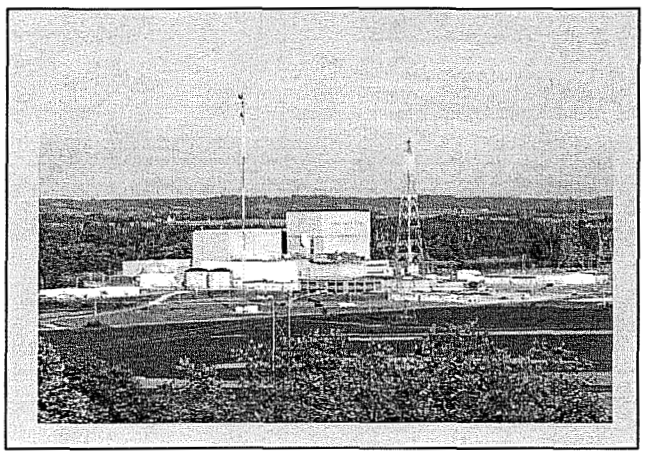
- Pre-1990 Purchase Review Form
  - Obtained from Different Utility
    - Screening criteria applied
    - Would still install
- Apply a Board Burn-In
  - Not a Vendor Recommendation
  - Would Still Install
- No Reasonable Non-Destructive Method Would Have Identified VR Board Defect
  - Conclusion in Southwest Report

GMPO Summary

- Updated Root Cause
- Very Low Safety Significance
  - Reasonable Recovery Credit
- No Performance Deficiency
  - Procured VR Board Essential
  - Regulatory Framework
  - No Reasonable Means for Detection
- Possible Generic Implications

GMPO Summary (cont.)

- DG Failure Taken Very Seriously
- Obtaining Additional Information to Determine If Other Actions Are Appropriate for Inventory
- Activities to Improve Overall DG Reliability

Closing Remarks

Stu Minahan