UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-8064

APR - 5 2001

J. H. Swailes, Vice President of
Nuclear Energy
Nebraska Public Power District
P.O. Box 98
Brownville, Nebraska 68321

SUBJECT: REGULATORY CONFERENCE TO DISCUSS THE RISK SIGNIFICANCE OF A POTENTIAL YELLOW FINDING AT COOPER NUCLEAR STATION

Dear Mr. Swailes:

This refers to the regulatory conference conducted in the Region IV office with video link to NRC's One White Flint on March 29, 2001, between you, your staff, and the NRC. The participants discussed the risk significance of a potential yellow finding and associated apparent violations, identified at the licensee's Cooper Nuclear Station, involving programmatic environmental qualification design, implementation, and documentation deficiencies.

The presentation included the following topics: a circuit analysis of the 125 Vdc electrical system to evaluate the impact of degraded environmental qualification treatments on the functionality of the safety-relief valves, a similar evaluation of the Cooper battery systems, the licensee's risk perspective using their probabilistic safety assessment, and the licensee's regulatory perspective on the apparent violations.

The attendance list and presentation are enclosed with this summary (Enclosures 1 and 2).

In accordance with 10 CFR 2.790 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 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/NRC/ADAMS/index.html (the Public Reading Room).

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

Sincerely,

Charles S. Marschall

Charles S. Marschall
Project Branch C
Division of Reactor Projects

Docket No.: 50-298
License No.: DPR-46

Enclosures:
1. Attendance List
2. Licensee Presentation

cc w/enclosures:

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ATTACHMENT 1

REGULATORY CONFERENCE ATTENDANCE

LICENSEE/FACILITY	**Nebraska Public Power District, Cooper Nuclear Station**	
DATE/TIME	**March 29, 2001; 1 to 5 p.m.**	
LOCATION	**Region IV Training Conference Room**	
EA NUMBER	**00-248**	
NAME (PLEASE PRINT)	**ORGANIZATION**	**TITLE**
E. Merschoff	NRC/Region IV	Regional Administrator
K. Brockman	NRC/Region IV	Director, Division of Reactor Projects
A. Howell	NRC/Region IV	Director, Division of Reactor Safety
W. Dean	NRC/NRR	Chief, Inspection Programs Branch
C. Marschall	NRC/Region IV	Chief, Project Branch C
S. Morris	NRC/OEDO	Regional Coordinator
W. Jones	NRC/Region IV	Chief, Project Branch E
D. Loveless	NRC/Region IV	Senior Project Engineer
J. Clark	NRC/Region IV	Senior Resident Inspector
J. Shackleford	NRC/Region IV	Chief, Engineering and Maintenance Branch
C. Paulk	NRC/Region IV	Senior Reactor Inspector

REGULATORY CONFERENCE ATTENDANCE

LICENSEE/FACILITY	**Nebraska Public Power District, Cooper Nuclear Station**
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LOCATION	**Region IV Training Conference Room**
EA NUMBER	**00-248**

NAME (PLEASE PRINT)	ORGANIZATION	TITLE
J. MacKinnon	JHM Associates	President
B. Horin	Nuclear Utility Group on Equipment Qualification	Counsel
P. Holzman	Star, Inc.	Consultant
R. Wachowiak	NPPD	Supervisor, Risk Management
D. Buman	NPPD	Asst. Manager, Design Engineering
D. Blanchard	Tenera	Program Manager
M. Boyce	NPPD	Regulatory Affairs Manager
A. Roby	Altran	Consultant
P. DiBenedetto	Constellation Nuclear Services	Consultant
N. Wetherell	NPPD	Senior Engineering Manager (Acting)
R. Wise	Contech	Project Manager, EQ Improvement Project
J. Peters	NPPD	Nuclear Support - Licensing
R. Stoddard	LES	Consultant

REGULATORY CONFERENCE ATTENDANCE

LICENSEE/FACILITY	**Nebraska Public Power District, Cooper Nuclear Station**
DATE/TIME	**March 29, 2001; 1 to 5 p.m.**
LOCATION	**Region IV Training Conference Room**
EA NUMBER	**00-248**

NAME (PLEASE PRINT)	ORGANIZATION	TITLE
D. Curry	LES	General Counsel
C. Markert	NPPD	ESD Manager
J. McDonald	NPPD	Plant Manager
J. Swailes	NPPD	Vice President, Nuclear

REGULATORY CONFERENCE ATTENDANCE
VIDEO CONFERENCE ATTENDEES

LICENSEE/FACILITY	**Nebraska Public Power District, Cooper Nuclear Station**
DATE/TIME	**March 29, 2001; 1 to 5 p.m.**
LOCATION	**One White Flint, Rockville, MD**
EA NUMBER	**00-248**

NAME (PLEASE PRINT)	ORGANIZATION	PHONE
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Section Chief, DRP/TSS **(PHH)**
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Jim Isom, Pilot Plant Program **(JAI)**
Sampath Malur, Pilot Plant Program **(SKM)**

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Cooper Nuclear Station

Nebraska Public Power District

Regulatory Conference

Inspection Report 50-298/00-07

Environmental Qualification (EQ)

Potential Yellow Finding

March 29, 2001

Agenda

• Overview	J. McDonald
• Risk Perspective	
– Circuit Evaluation	D. Buman
– Probabilistic Safety Assessment	R. Wachowiak
• Regulatory Perspective	J. McDonald
• Conclusions	J. Swailes

Overview
Results

- Phase 3 PSA Below GREEN/WHITE Threshold
- Only One SRV Required
- All SRVs Fully Operable on Either Power Supply With Conservative Analysis
- Both 125 VDC Power Supplies Operable With Conservative Analysis
- All Eight SRV Circuits Operable With Conservative Analysis
- Test Data Verifies Functionality of All SRVs

Overview
Circuit Analysis

- Environmental Qualification Concerns
  - SRV Operability Based on Conservative Circuits Analysis
    - Realistic Currents Much Lower
    - Comprehensive Evaluation of Potential Adverse Current Paths
    - Zero Resistance Faults Assumed Unless Other Faults Were Worst Case
    - Bounding Current Values Used
    - Reviewed Potential Interactions Between AC/125VDC/250VDC Systems
  - Analyses Reviewed by Multiple Independent Industry Experts

Overview
Circuit Analysis

- Environmental Qualification Concerns
  - Robust Design is a Significant Factor in Results
    - Batteries Remain Operable
      - 125 VDC / 250 VDC / AC Systems Design Independence
    - SRVs and SRV Circuits Remain Operable
      - SRV Redundant Power Seeking Power Supplies
      - SRV Redundant Control Circuits
      - 16 Individually Fused SRV Circuits
      - Operability of Single SRV Required

Overview
PSA Methodology

- ~50 LOCA/HELB Scenarios
- Evaluated Scenarios Separately
  - Drywell
  - Steam Tunnel
  - 10 Reactor Building HELB Zones
- Drywell EQ Treatments
  - ~ 100 EQ Treatments/ 10 Potential Risk Components
- Reactor Building HELB Zones
  - ~ 50 EQ Treatments/ ~ 10-20% Potential Risk Impacting
- Failed Questionable Treatments Absent Test Data

Overview
PSA

- Environmental Qualification Concerns
  - CNS PRA Based on Operable SRVs
  - Phase 3 PRA Based on Plant Configuration Prior to 2000 RFO
    - Accounted For All Non-Conforming EQ Treatments
    - Accounted For All Sequences That Contribute to Risk

RISK PERSPECTIVE CIRCUIT EVALUATION

D. Buman

Circuit Evaluation SRV Performance Requirements

- SRV Performance Requirement For PSA Phase 3 Analysis
  - Single SRV Functional
  - Eight Hour Mission Time Has Been Evaluated, Shorter Times Could be Justified

Circuit Evaluation
Cooper Battery Systems
Summary of Conclusions

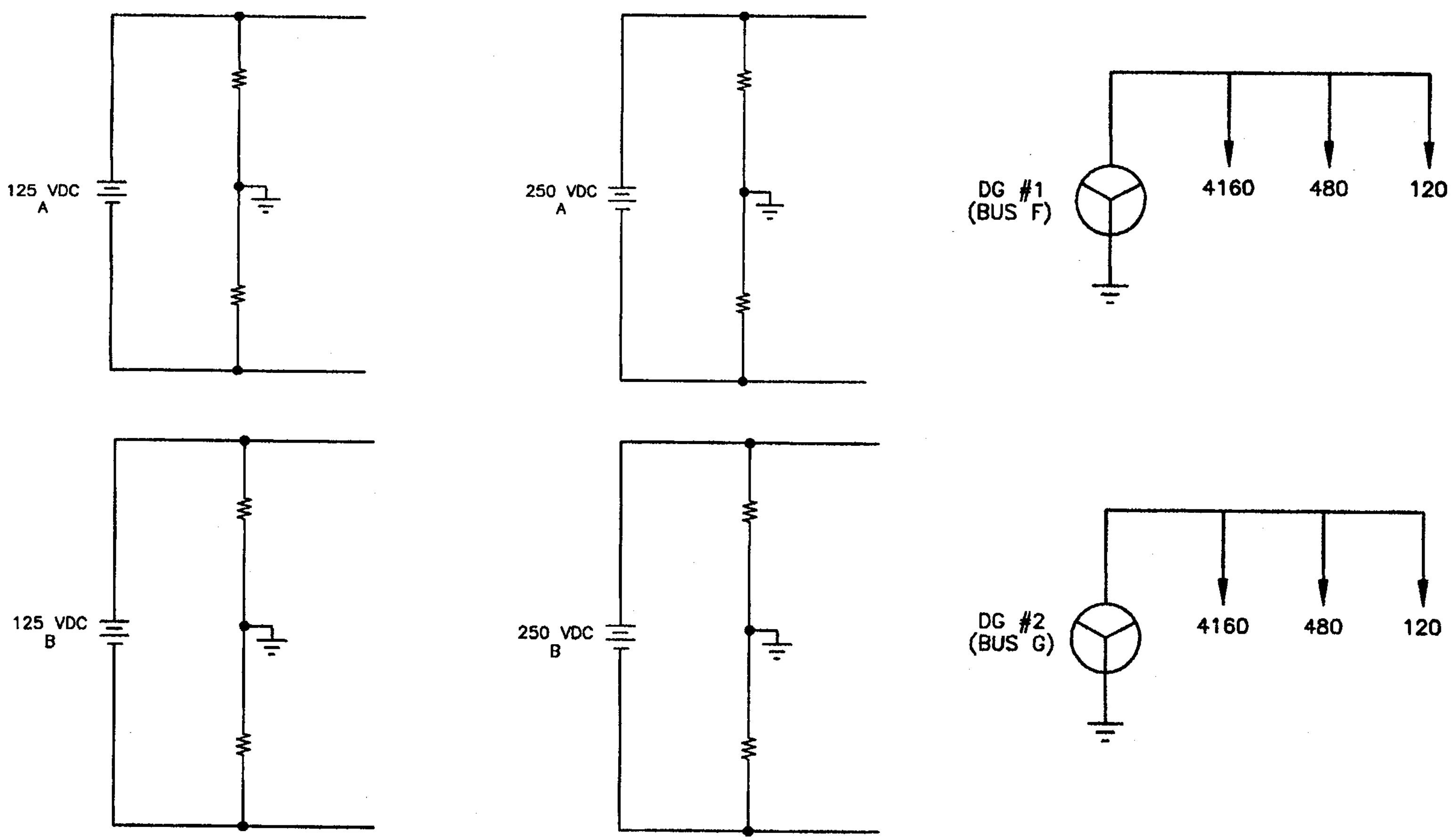
- Both SRV DC Power Supplies Remain Operable Based on Conservative Analysis
  - Only One of Two Supplies Needed For Required SRV Performance

Circuit Evaluation
Cooper Battery Systems
Significant Design Elements

- Electrical and Physical Separation Exists Between:
  - 125VDC "A" and 125VDC "B"
  - 250VDC "A" and 250VDC "B"
  - 125VDC and 250VDC Systems
  - AC System
- The 125 and 250 VDC Are Ungrounded Systems
- Ground Detection Circuitry Provided For Each Division of 125 and 250 VDC Systems
- Limited Number of Hard Faults of the Negative Bus Inside the Drywell (125 VDC)

Circuit Evaluation
Cooper Battery Systems
Significant Design Elements

Simplified Design Diagram

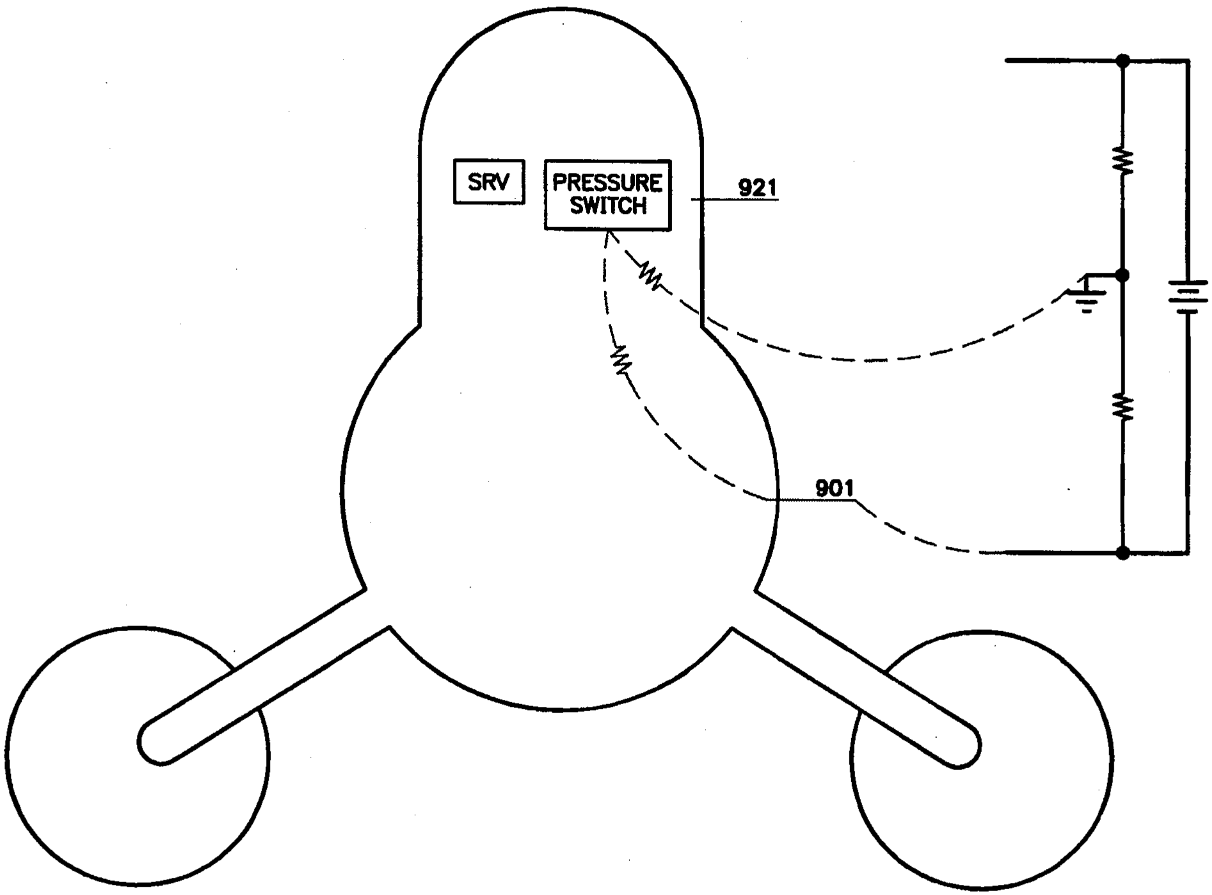


Circuit Evaluation
Cooper Battery Systems
Analytical Methodology and Findings

- Conservative Analysis
  - Simultaneous Faults For Bounding Case
  - Used Worst Case (e.g., Zero Resistance) Faults For EQ Non-Conforming Treatments
  - Assumed Continuous Currents
  - Hypothetical Fault Paths

Circuit Evaluation
Cooper SRV Circuits
Analytical Methodology and Findings

Hypothetical Fault Path



Circuit Evaluation
Cooper Battery Systems
Analytical Methodology and Findings

- Critical Characteristics of Battery System to Assure Operability
  - Sufficient Capacity
  - Sufficient Voltage
  - Intact Distribution System

Circuit Evaluation
Cooper Battery Systems
Analytical Methodology and Findings

- Sufficient Battery Capacity Maintained
  - Utilized Design Basis Load Calculation Results to Establish Base Loads
  - Reviewed Impact of Additional Loads Not Present Under Design Basis Assumptions
    - MSIVs, Accumulator Alarm Pressure Switches, Drywell Airlock Lights, Reactor Recirculation Motor Generator Breaker Logic

Circuit Evaluation
Cooper Battery Systems
Analytical Methodology and Findings

- Sufficient Battery Voltage Maintained
  - Utilized Design Basis Voltage Calculation to Establish Base Load Current
  - Reviewed Impact of Additional Loads Resulting From EQ Non-Conformances
  - Applied Results to Circuit and Battery Capacity Evaluation

Circuit Evaluation
Cooper Battery Systems
Analytical Methodology and Findings

- Distribution System Remains Intact
  - Utilized Existing Short Circuit Study
  - Assured by Fuse Coordination and Protective Function
  - Physical and Electrical Independence of AC and DC Systems Precludes System Interactions

Circuit Evaluation
Cooper Battery Systems
Analytical Methodology and Findings

- Additional Considerations
  - Assessed Multiple Positive-Side Faults
    - Single Zero Resistance Fault is Bounding
    - Multiple Faults Do Not Create Additional Current
  - Fault Induced Fire Hypothesis Not Credible in Water, Nitrogen (Drywell LOCA) Environment
    - Low Energy Circuit - I^2R
    - IEEE 383 Type Materials

Circuit Evaluation
Cooper Battery Systems
Analytical Methodology and Findings

- Conclusions
  - Battery Systems Remain Operable
    - No Fault(s) Will Fail 125 or 250 VDC Batteries
      - Additional Loads Do Not
        - » (1) Degrade Voltage or (2) Exceed Capacity
      - Adequate Fusing and Coordination Exist
    - No Credible Fault(s) of AC or 250 VDC Systems Can Fail 125 VDC System
      - Electrical and Physical Independence
      - All DC Systems Are Ungrounded
      - Adequate Fusing and Coordination Exist

Circuit Evaluation
Cooper AC Systems

- AC Systems Remain Operable
  - No Fault(s) of AC Systems Can Fail AC Systems
    - Adequate Fusing and Coordination Exist
  - No Fault(s) of DC Systems Can Fail AC Systems
    - Electrical and Physical Independence

Circuit Evaluation
Cooper SRV Circuits
Summary of Conclusions

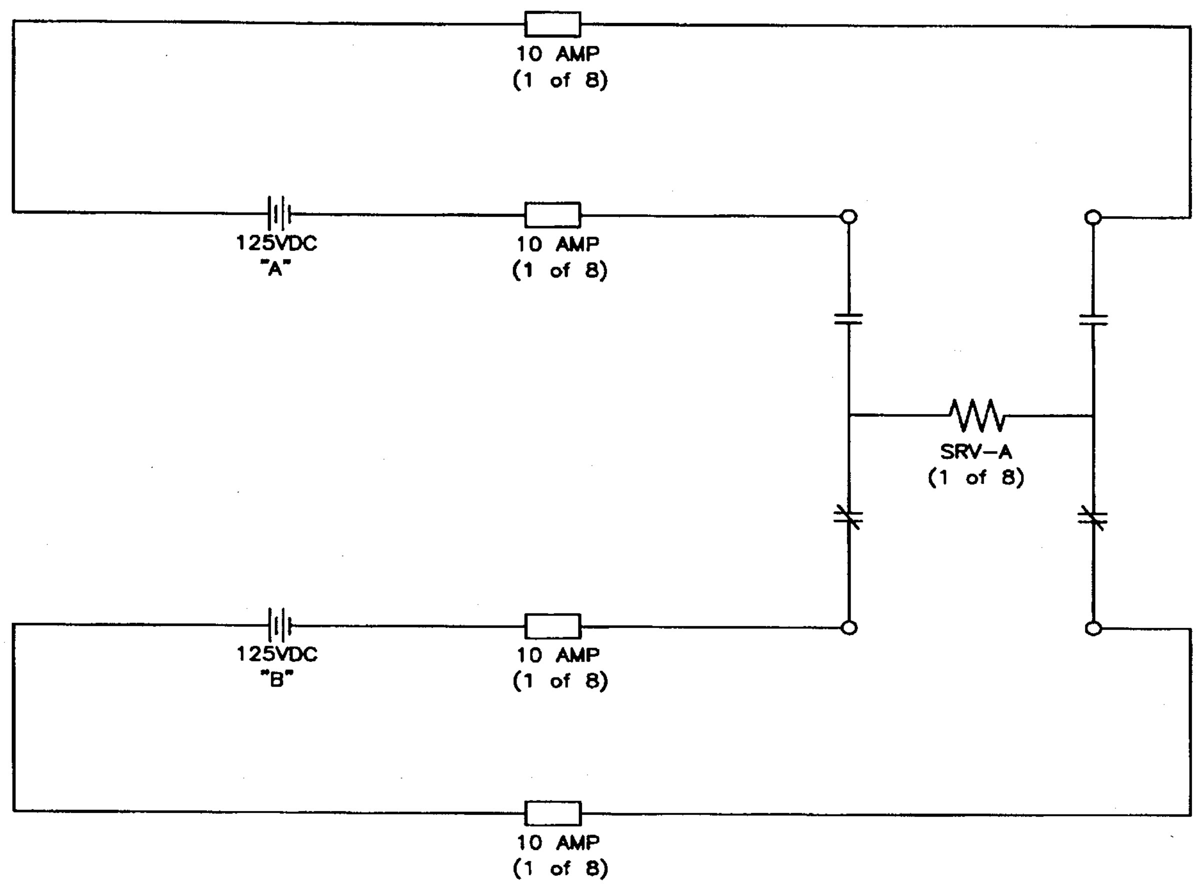
- Only One of Eight SRVs Actually Needed to Demonstrate Low Risk Significance
- All SRV Circuits Operable With Conservative Analysis
- All SRV's Fully Operable on Either Power Supply

Circuit Evaluation
Cooper SRV Circuits
Significant Design Elements

- Eight Sets of Fuses Normally Power the SRVs
  - One Set (2) For Each SRV
  - Normally Powered From 125 VDC "A"
- Eight Redundant Sets of Fuses Provide Backup
  - One Set (2) For Each SRV
  - Each SRV Circuit Will Auto Transfer to 125 VDC "B" Upon Loss of Power in 125 VDC "A" SRV Circuit

Circuit Evaluation
Cooper SRV Circuits
Significant Design Elements

Simplified SRV Circuit Diagram



Circuit Evaluation
Cooper SRV Circuits
Analytical Methodology and Findings

- Conservative Analysis
  - Multiple Faults Assumed to Occur at Once
  - Faults Assumed to be Sustained
  - Faults Assumed to Impact Only One SRV
    - Additional Margin if Distributed to All Eight SRVs
    - Worst Case (e.g., Zero Resistance) Faults Used For Non-Conforming EQ Treatments
  - Transfer to Backup Power Supply Not Expected
    - Resulting Fault Current For Division B Significantly Less if Transfer Occurs
  - Hypothetical Fault Paths

Circuit Evaluation
Cooper SRV Circuits
Analytical Methodology and Findings

- Critical Characteristics of SRV Circuits to Assure SRV Operability
  - Provide and Maintain Minimum Pickup Voltage
  - Maintain Intact Circuit Path
    - Intact Fuses
    - Intact Logic and Control Components
    - Intact Wiring

Circuit Evaluation
Cooper SRV Circuits
Analytical Methodology and Findings

- Minimum Pickup Voltage is Assured
  - Incorporated Existing Design Basis Voltage Drop Calculation
  - Reviewed Available Margin Between Minimum Calculated Voltage and Operating Voltage
  - Compared Additional Current Against Margin

Circuit Evaluation
Cooper SRV Circuits
Analytical Methodology and Findings

- Intact Circuit Path is Maintained
  - Performed Fuse Analysis
  - Assured Logic and Control Current Component Ratings Protected by 10 Amp Fuses
- Intact Wiring is Maintained
  - Performed Short Circuit Study to Assure Wiring Protected by Fuses
  - Fully Qualified Path to SRV Solenoids

Circuit Evaluation
Cooper SRV Circuits
Analytical Methodology and Findings

- Additional Considerations
  - Fault Induced Fire Hypothesis
    - Low Energy Circuit - I^2R
    - IEEE 383 Type Materials
    - Fire Potential Not Credible in Water, Nitrogen (Drywell LOCA) Environment
    - Even With Hypothetical Fire at the Tailpipe Pressure Switch
      - Will Not Disable SRV Circuit
      - Does Not Impact Transfer

Circuit Evaluation
Cooper SRV Circuits
Analytical Methodology and Findings

- Results

SRV Pressure Switch	Insulation Resistance (ohms)	Total Fault Current (amps)
Bounding Analysis	0	6.85
Performance Testing (8 hours) Upper Lower	 > 40,000 >15,000	 0.003* 0.008**

* Performance Maintained for Test Duration (24 hours)
** Performance Maintained for 9 hours

Circuit Evaluation
Cooper SRV Circuits
Analytical Methodology and Findings

- Conclusions
  - SRVs Remain Operable
    - No Fault(s) of AC or 250 VDC Systems Can Cause Opening of SRV Fuses
      - Electrical and Physical Independence
      - All DC Systems Are Ungrounded
      - Adequate Fusing and Coordination Exist
      - SRV Circuits Individually Routed in Separate Conduits/Terminal Boxes

Circuit Evaluation
Cooper SRV Circuits
Analytical Methodology and Findings

- Conclusions
  - SRVs Remain Operable
    - Cumulative Effect of EQ Non-Conformances Will Not Cause Opening of SRV Fuses
      - 125 VDC Circuit Analysis Demonstrates Maximum Current is Below Continuous Rating
    - Testing Substantiates Conservative Nature of Previous Conclusions as Well as Tailpipe Pressure Switch Functionality

RISK PERSPECTIVE
PROBABILISTIC SAFETY ASSESSMENT

R. Wachowiak

Probabilistic Safety Assessment General Assumptions

- Methodology
  - Identify Affected Equipment
  - Identify Scenarios That Could Cause Failure
  - Determine Frequency of Scenarios
  - Determine Reliability of Remaining Mitigation Capability
  - Calculate Increase in CDF and LERF

Probabilistic Safety Assessment General Assumptions

- Performance of Equipment
  - Non-EQ Equipment in the Area Fails
  - Non-Conforming Treatments in the Area Are Affected
    - Performance is Based on Test Data
    - Where No Data Available, Treatment Fails
  - Adjacent Areas Can be Affected, But Not Sufficient to Impact Functionality of Adjacent Area Equipment
  - Operator Actions in the Building Not Credited

Probabilistic Safety Assessment Results

- Core Damage Frequency (CDF) Increase is 2.6×10^{-7} per Year
  - 80% Steam Tunnel
  - 8% Drywell
  - 3% Unisolated HELB
  - 9% Other Isolated HELBs
- Large Early Release Frequency (LERF) Increase is 9×10^{-9} per Year
  - >90% Unisolated HELB
  - Balance Due to ATWS

Probabilistic Safety Assessment Summary of Analysis

HELB Area	Number of Treatments	Affected Trains	Remaining Trains
Steam Tunnel	16 Splices 1 Non-EQ Valve 4 Components	HPCI Inj RCIC Inj RCIC Outboard Isol MSL Drain	8 SRVs 4 RHR 2 LPCS 3 Condensate CRD SW Injection Hard Pipe Vent
Drywell	100 Splices & Terminal Blocks 44 on TEs 25 Components 13 were TEs	Inboard MSIV MSL Drain Inbd RWCU Isol Some Temp Ind RR Isolation Valves HPCI/RCIC Inbd Isol 4 Fan Coil Units	HPCI RCIC 8 SRVs 4 RHR 2 LPCS 3 Condensate CRD SW Injection Hard Pipe Vent

Probabilistic Safety Assessment
Summary of Analysis

HELB Area	Number of Treatments	Affected Trains	Remaining Trains
Torus Area	169 Splices 90 on TEs 2 Non-EQ 39 Components 16 are TEs 8 are in PRA	HPCI Inj RCIC Inj SW to REC HX SW Backup to REC 2 LPCS Hard Pipe Vent 2 RHR Pumps	Condenser 2 Feedwater 8 SRVs 2 RHR 3 Condensate SW Injection
NE Quad	15 Splices 11 Non-EQ Comp 14 Components	RCIC 1 LPCS	Condenser 2 Feedwater HPCI 8 SRVs 4 RHR 1 LPCS 3 Condensate CRD SW Injection Hard Pipe Vent

Probabilistic Safety Analysis Sensitivity Studies

- HELB Areas Outside Containment Combined For Larger, Unisolated Breaks
  - Change in CDF Remained Below the GREEN/WHITE Threshold
- Investigated Operator Potential Misinformation Resulting From Instrumentation Affected by HELB Conditions
  - Always Had Redundant and Diverse Information Available
- Investigated Importance of the SRV Transfer to the Other Power Supply
  - Does Not Affect Reliability of Depressurization

Probabilistic Safety Assessment Conclusion

- Changes in CDF and LERF Are Below GREEN/WHITE Threshold
- Risk is Low Because Multiple and Diverse Trains of Equipment Remain Functional For All HELB/LOCA Locations

REGULATORY PERSPECTIVE

J. McDonald

Regulatory Perspective

- Significant Programmatic Concern
  - CNS Aggressively Addressing
    - EQ Improvement Project
- Large Number of Components Affected
  - Many Replaced Components May Have Been Qualifiable, But Conservatively Replaced to Expedite Resolution
  - Some Replaced Components Exhibited No Non-Conformances
- Detailed Risk Analysis Required
  - As Intended in Revised Reactor Oversight Process

Regulatory Perspective

- Apparent Violation
  - 10 CFR 50.49, "Environmental Qualification..."
    - Failure to Properly Qualify Components
    - Failure to Maintain Qualification
    - Failure to Document Qualifications in Auditable Form
  - CNS Generally Agrees With Basis For Proposed Violation, But Not Third Example

Regulatory Perspective

- Apparent Violation
  - 10 CFR 50, Appendix B, Criterion XVI, "Corrective Action"
    - Failure to Identify EQ Issue Until Specifically Identified by NRC
    - Failure to Include Issues in Corrective Action Program
  - CNS Generally Agrees With Basis For Proposed Violation

Regulatory Perspective

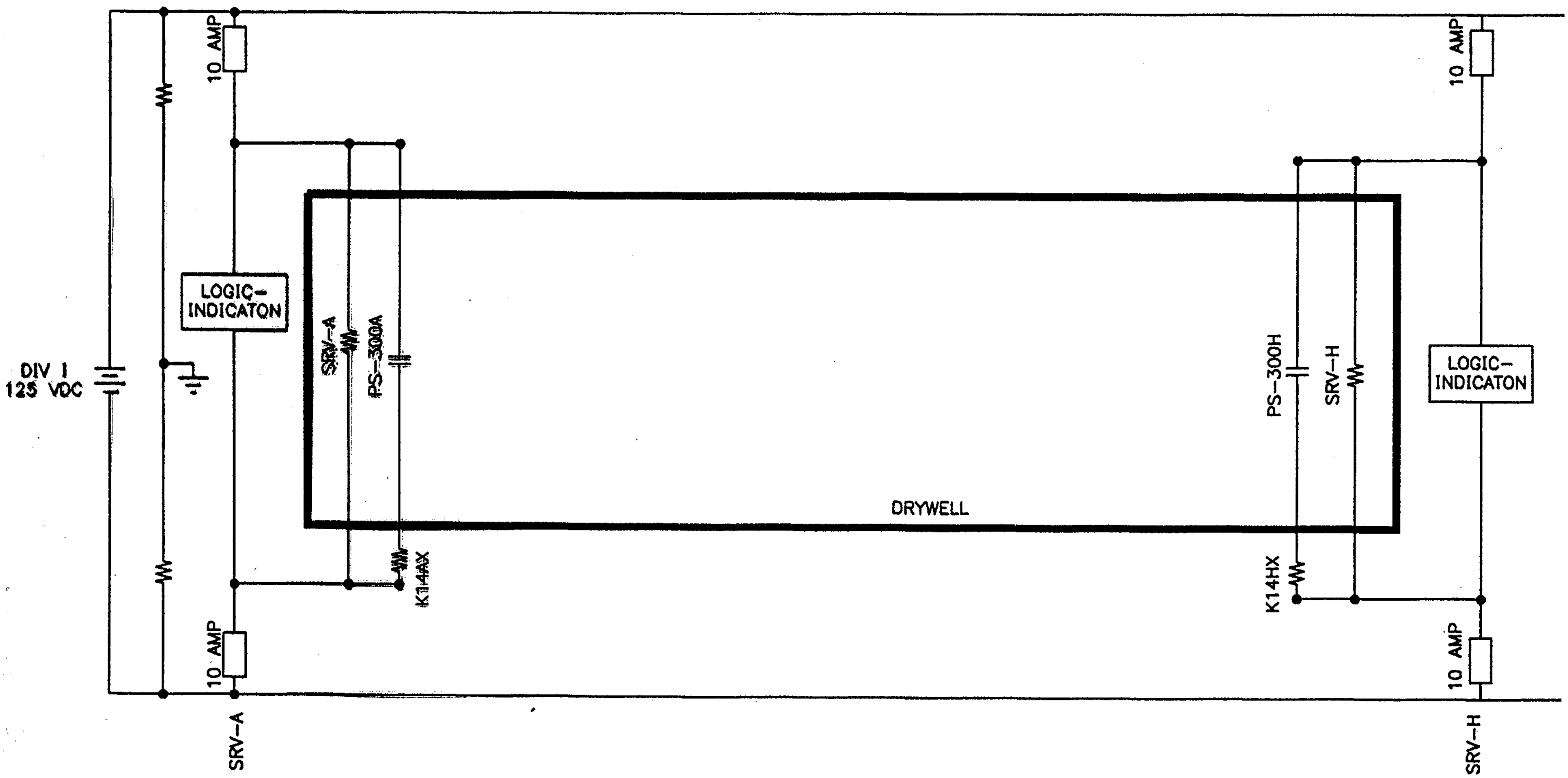
- Apparent Violation
  - 10 CFR 50, Appendix B, Criterion III, "Design Control"
    - T-Drains For Equipment Enclosures
    - Containment Spray Valves Not in MOV Program and Undersized
    - 125 VDC Non-Essential and Non-EQ Loads in Drywell Powered From Essential Buses
  - CNS Generally Agrees With Basis For Proposed Violation

CONCLUSIONS

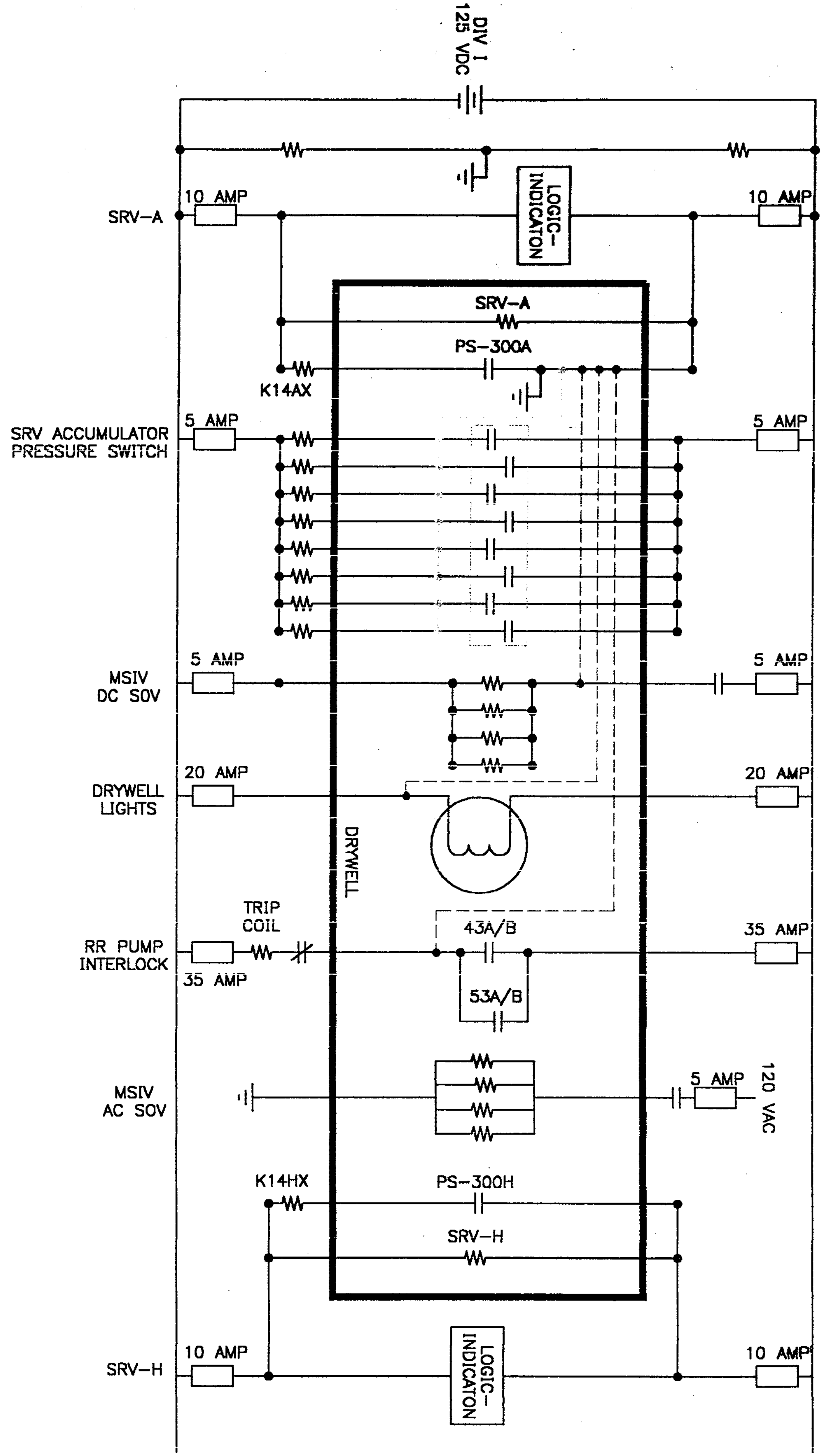
J. Swailes

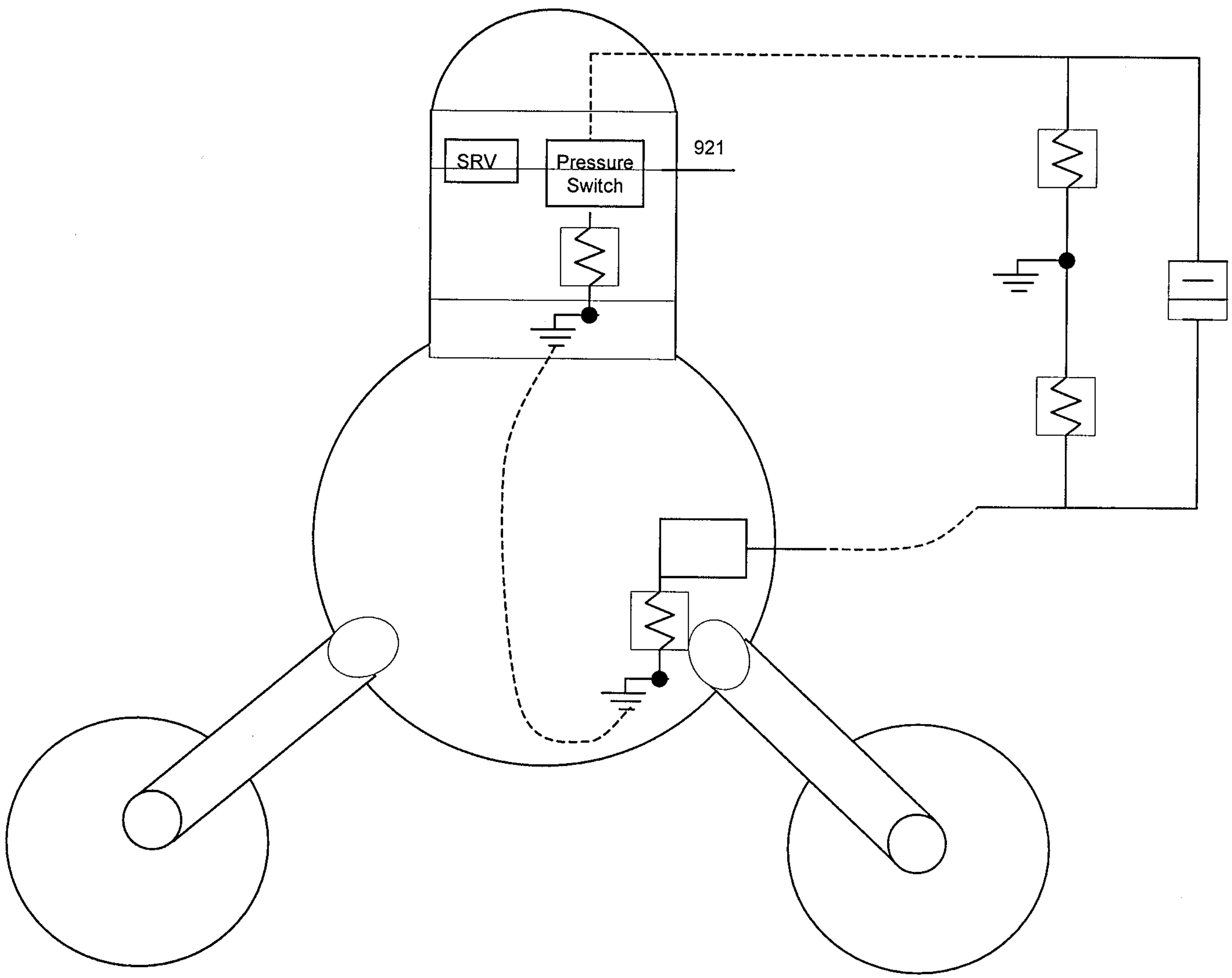
Conclusions

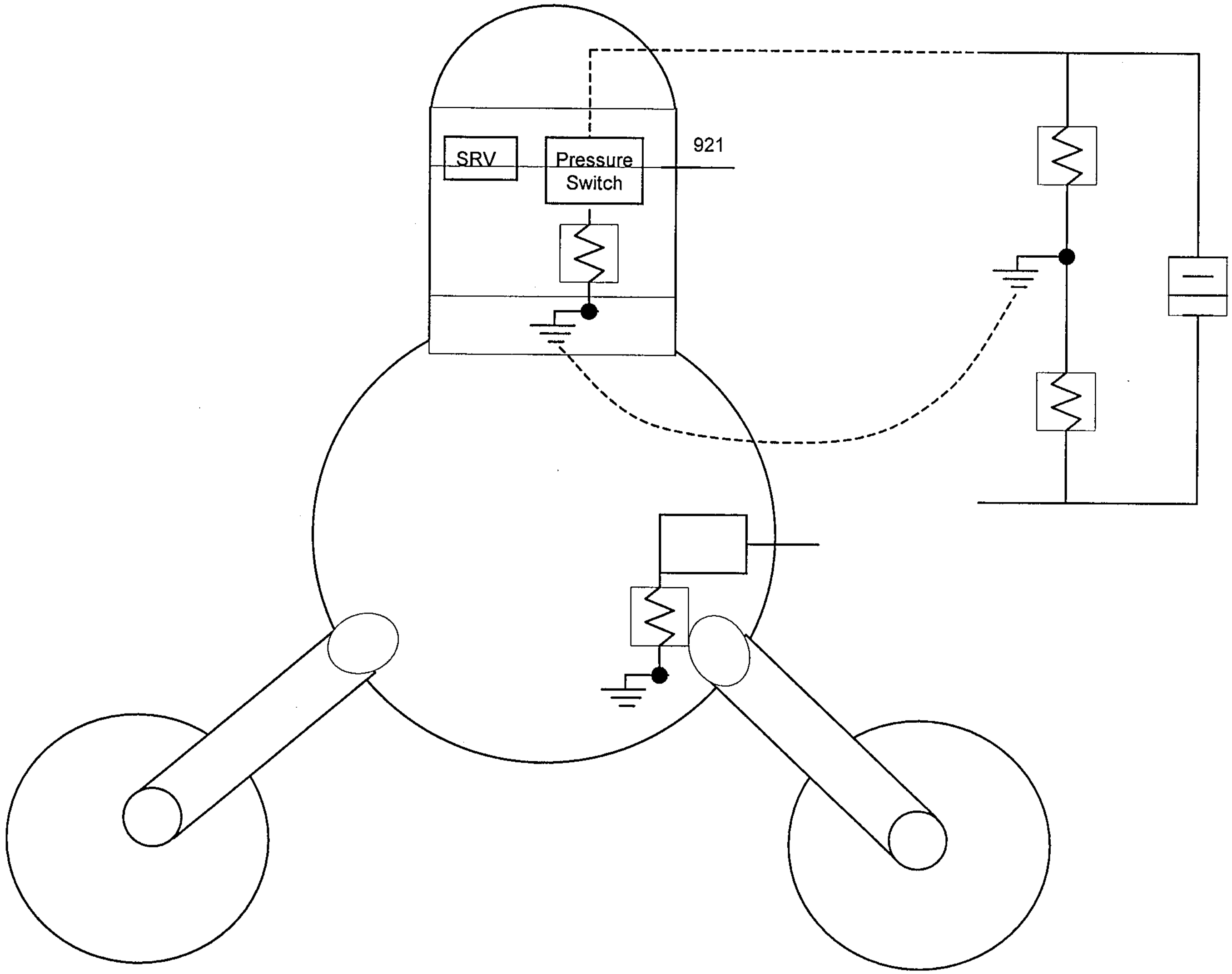
- Program Improvements Needed
- Low Impact on CDF, LERF
  - Detailed Analysis and Testing of Specific Deficiencies Does Not Support "Substantial Safety Significance"
- Aggressively Pursuing Resolution



DIV I
125 VDC
10 AMP
10 AMP
LOGIC-INDICATON
SRV-A
PS-300A
K14AX
DRYWELL
PS-300H
SRV-H
K14HX
LOGIC-INDICATON
10 AMP
10 AMP
SRV-A
SRV-H


DIV I
125 VDC
LOGIC-INDICATON
SRV-A
10 AMP
10 AMP
SRV-A
PS-300A
K14AX
SRV ACCUMULATOR PRESSURE SWITCH
5 AMP
5 AMP
MSIV DC SOV
5 AMP
5 AMP
DRYWELL LIGHTS
20 AMP
20 AMP
DRYWELL
RR PUMP INTERLOCK
TRIP COIL
35 AMP
43A/B
53A/B
35 AMP
MSIV AC SOV
5 AMP
120 VAC
K14HX
PS-300H
SRV-H
SRV-H
10 AMP
10 AMP
LOGIC-INDICATON


SRV
Pressure Switch
921


SRV
Pressure Switch
921