U.S. NUCLEAR REGULATORY COMMISSION

RESPONSE TO FREEDOM OF INFORMATION ACT (FOIA) REQUEST

NRC FOIA REQUEST NUMBER(S)	FOIA — 96-351
RESPONSE TYPE	FINAL [ ] PARTIAL [X] 6th
DATE	JAN 16 1997
DOCKET NUMBER(S) (If applicable)	

REQUESTER

Mr. J. H. O'Neill, Jr. ATTN: W. R. Holloway

PART I.—AGENCY RECORDS RELEASED OR NOT LOCATED (See checked boxes)

	No agency records subject to the request have been located.
	No additional agency records subject to the request have been located.
	Requested records are available through another public distribution program. See Comments section.
	Agency records subject to the request that are identified in Appendix(es) ______ are already available for public inspection and copying at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC.
X	Agency records subject to the request that are identified in Appendix(es) M are being made available for public inspection and copying at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC, in a folder under this FOIA number.
	The nonproprietary version of the proposal(s) that you agreed to accept in a telephone conversation with a member of my staff is now being made available for public inspection and copying at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC, in a folder under this FOIA number.
	Agency records subject to the request that are identified in Appendix(es) ______ may be inspected and copied at the NRC Local Public Document Room identified in the Comments section.
	Enclosed is information on how you may obtain access to and the charges for copying records located at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC.
X	Agency records subject to the request are enclosed. Appendix M
	Records subject to the request have been referred to another Federal agency(ies) for review and direct response to you.
	Fees
	You will be billed by the NRC for fees totaling $ ______ .
	You will receive a refund from the NRC in the amount of $ ______ .
	In view of NRC's response to this request, no further action is being taken on appeal letter dated ______ , No. ______

PART II. A—INFORMATION WITHHELD FROM PUBLIC DISCLOSURE

	Certain information in the requested records is being withheld from public disclosure pursuant to the exemptions described in and for the reasons stated in Part II, B, C, and D. Any released portions of the documents for which only part of the record is being withheld are being made available for public inspection and copying in the NRC Public Document Room, 2120 L Street, N.W., Washington, DC in a folder under this FOIA number.

COMMENTS

The record listed on Appendix N is copyrighted. Therefore, it is only being made available for inspection in the NRC Public Document Room.

The review of additional records subject to your request is continuing.

FIA1 01

SIGNATURE, DIRECTOR, DIVISION OF FREEDOM OF INFORMATION AND PUBLICATIONS SERVICES

U.S. NUCLEAR REGULATORY COMMISSION

RESPONSE TO FREEDOM OF INFORMATION ACT (FOIA) REQUEST

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X	Agency records subject to the request that are identified in Appendix(es) M are being made available for public inspection and copying at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC, in a folder under this FOIA number.
	The nonproprietary version of the proposal(s) that you agreed to accept in a telephone conversation with a member of my staff is now being made available for public inspection and copying at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC, in a folder under this FOIA number.
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The record listed on Appendix N is copyrighted. Therefore, it is only being made available for inspection in the NRC Public Document Room.

The review of additional records subject to your request is continuing.

SIGNATURE, DIRECTOR, DIVISION OF FREEDOM OF INFORMATION AND PUBLICATIONS SERVICES

(Signed) Russell A. Powell

DISTRIBUTION—DFIPS Subject, Author, Branch Chief, Director of Administration, Other: PDR

OFFICE ▶	ADM/DFIPS/AUTHOR	ADM/DFIPS/FOIA BC	ADM/DFIPS/DD	ADM/DFIPS/DIR			
SURNAME ▶	CA Reed	Powell					
DATE ▶	1/10/97	1/13/97	/ /	/ /	/ /	/ /	/ /

Re: FOIA-96-351

APPENDIX M

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
1.	6/9/93	NRC Inspection Question/Response Tracking Form - (2 pgs)
2.	6/14/93	AIT for Rod Control System Question and Answer Status - (1 pg)
3.	6/16/93	Nuclear Department Work Activity Corrective Maintenance Form - (4 pgs)
4.	Undated	Handwritten Notes - (6 pgs)
5.	6/16/93	Nuclear Department Work Activity Corrective Maintenance Form - (6 pgs)
6.	6/17/93	Rod Control System - Failed Components Status - (2 pgs)
7.	6/16/93	NRC Inspection Question/Response Tracking Form - (5 pgs)
8.	6/16/93	Rod Control System - Failed Components Status (15 pgs)
9.	9/95/93	Engineering Evaluation - S-C-RCS-EEE-0822 - (18 pgs)
10.	6/15/93	SE&G Nuclear Department 10CFR50.59 Review and Safety Evaluation - (22 pgs)
11.	6/10/93	Rod Control System - Failed Components Status - (12 pgs)
12.	6/9/95	Handwritten Notes - Interview with L. Rajkowoki - (9 pgs)
13.	6/5-6/15	Document Log Rod AIT - (3 pgs)
14.	6/10/93	NRC Inspection Question/Response Tracking Form - AIT-ROD-224 -(2 pgs)
15.	6/8/93	NRC Inspection Question/Response Tracking Form - AIT-ROD-215 (3 pgs)
16.	2/1/91	Salem Unit 1/2 Operations Procedure No. SC.OP-DD.ZZ-AD46(Q)-(5 pgs)
17.	Undated	Control Rod Logic Cabinet Failure Open Items Resolution - (21 pgs)
18.	Undated	Supervisory Data Logging - (14 pgs)

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APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
19.	6/27/93	Note to L. Rajkowksi from S. Kaimian, D. Best and M. Woloski - Analysis of Transistor Failures on Signal Processing and Alarm Circuitry Cards - (29 pgs)
20.	Undated	Attachment 5 - List of Failures/Causes - (7 pgs)
21.	6/10/93	Rod Control System - Failed Components Status - (10 pgs)
22.	6/17/93	Rod Control System - Failed Components Status - (19 pgs)
23.	7/19/96	Memorandum to Salem Assessment Panel Members, from L. Nicholson - Salem Assessment Panel Meeting Minutes - (6 pgs)
24.	6/18/96	Memorandum to Salem Assessment Panel Members, from L. Nicholson - Salem Assessment Panel Meeting Minutes - (7 pgs)
25.	Undated	Power Cabinet Transistor Failure Time Line - (4 pgs)
26.	Undated	Salem Unit 2, Rod Control Documentation Index - (3 pgs)
27.	7/22/93	E-Mail from R. Summers to W. Ruland - Salem 2 Rod Control Problems (4 pgs)
28.	6/11/93	NRC Inspection Question/Response Tracking Form - AIT-ROD-401 - and Attachments - (42 pgs)
29.	Undated	Handwritten Chronology of Events - (6 pgs)
30.	5/28/93	Handwritten Chronology of Events - (7 pgs)
31.	5/29/93	Cumulative Narrative - Handwritten - (6 pgs)
32.	6/1/93	Handwritten Notes - (8 pgs)
33.	6/10/93	NRC Inspection Question/Response Tracking Form - AIT-ROD-400- (5 pgs)
34.	Undated	cc: List and USNRC, PSE&G - Notice of Consideration of Issuance of Amendment to Facility Operating License, Proposed No Significant Hazards Consideration Determination, and Opportunity for a Hearing - (10 pgs)

APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
35.	6/7/93	NRC Inspection Question/Response Tracking Form - AIT-ROD-305 (8 pgs)
36.	6/5/93	PSE&G Rod Control System Agenda - (19 pgs)
37.	6/4/93	Handwritten Notes - (4 pgs)
38.	Undated	Attendee List - NRC AIT Exit - (4 pgs)
39.	Undated	Attendee List - NRC AIT Entrance - (2 pgs)
40.	6/11/93	PSE&G Memo to File from S. Miltenberger - Rod Control System (2 pgs)
41.	6/2/93	Rod Control Problems - Root Cause - (2 pgs)
42.	3/11/92	PSE&G Ltr to J. Morris, Beta Products - SER-4100 Operation - (3 pgs)
43.	Undated	VII. Safety Signficance - (5 pgs)
44.	6/28/93	Final Draft PSE&G Attachment 5 - Rod Control System - (6 pgs)
45.	6/18/93	PSE&G Salem Unit 2 - Rod Control System - Agenda & Attachments - (51 pgs)
46.	6/17/93	Rod Control System - Failed Components Status - (19 pgs)
47.	No date	Chart for Salem Operations - Maintenance Controls Dept (2 pgs)
48.	05/08/95	Nuclear Today news letter (1 pg)
49.	No date	Chart for Salem Operations - Mechanical Department (8 pgs)
50.	04/21/95	Salem Station Work Around Items (28 pgs)
51.	06/05/95	PSE7G Nuclear review & assessment activities (4 pgs)
52.	05/08/95	Memo to General, Planning Technical, Controls Maintenance and Mechanical Maintenance Manager - Subject, Nuclear Plant Reliability Data System (NPRDS) Monthly Report: April (4 pgs)

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APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
53.	No dates	Salem 1 Monthly Repeat NPRDS Failures (7 pgs)
54.	May 1995	NBU Issue Management and Prioritized Action Plan (5 pgs)
55.	05/18/89	Nuclear Training Center Lesson Plan (45 pgs)
56.	05/18/89	Nuclear Training Center Lesson Plan (35 pgs)
57.	04/03/92	Lesson plan on Conduct of Operations (34 pgs)
58.	06/20/94	Salem Simulator Scenario guide for Startup Training (18 pgs)
59.	04/22/94	Top 20 Components with Most CM Work Orders (28 pgs)
60.	04/28/95	Memo to Brian O'Grady from Dominic Shea regarding Net Safety Gain Analysis for LA Safeguards Equipment Control power supply replacement at power (7 pgs)
61.	No date	Salem Team Inspection Plan Management Oversight (4 pgs)
62.	No date	Mgmt followup of QA Audit finding on uncontrolled Hagan module standards (6 pgs)
63.	05/01/95	Inspect Single Record Report - NRC (3 pgs)
64.	05/04/95	Memo to J. Summers from L. Cataltorno, E. Harkness/Subject Safety Tagging (1 pg)
65.	05/08/95	Salem SIT Open Question (4 pgs)
66.	05/08/95	Inspect Single Record Report - NRC (1 pg)
67.	04/20/95	Memo to Salem Station Managers from J. Summers/Subject Station Work Control Process (2 pgs)
68.	05/08/95	Inspect Single Record Report - NRC (1 pg)
69.	No date	Operating Experience Activity 1994 Charts (4 pgs)

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APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
70.	04/27/95	NRC Special Inspection Team Questions (1 pg)
71.	05/08/95	Inspect Single Record Report - NRC (1 pg)
72.	05/08/95	Inspect Single Record Report - NRC (1 pg)
73.	05/09/95	Inspect Single Record Report - NRC (1 pg)
74.	04/26/95	Inspect Single Record Report - NRC (1 pg)
75.	02/22/95	Memo for Distribution from John C. Summers, General Manager - Salem Operations/Subject Expectations (3 pgs)
76.	No date	Preliminary Leadership Flags (2 pgs)
77.	04/27/95	Inspect Single Record Report - NRC (1 pg)
78.	05/02/95	Inspect Single Record Report - NRC (1 pg)
79.	No date	Ground Excavation (3 pgs)
80.	No date	Exhibit 1 Sample Emis Tag/Instructions (3 pgs)
81.	05/02/95	Inspect Single Record Report - NRC (1 pg)
82.	05/05/05	Inspect Single Record Report - NRC (1 pg)
83.	10/23/94	Salem/Maintenance - Service Water Silt Survey (10 pgs)
84.	05/03/95	Inspect Single Record Report - NRC (1 pg)
85.	05/02/95	Inspect Single Record Report - NRC (1 pg)
86.	No date	Exhibit 1 Sample Emis Tag/Instructions (2 pgs)
87.	05/02/96	Inspect Single Record Report - NRC (1 pg)

APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
88.	04/24/95	Inspect Single Record Report - NRC (1 pg)
89.	05/02/95	Inspect Single Record Report - NRC (1 pg)
90.	04/27/95	Inspect Single Record Report - NRC (1 pg)
91.	04/27/95	Inspect Single Record Report - NRC (1 pg)
92.	04/27/95	Inspect Single Record Report - NRC (1 pg)
93.	04/27/95	Inspect Single Record Report - NRC (1 pg)
94.	05/11/95	Inspect Single Record Report - NRC (1 pg)
95.	05/09/95	Inspect Single Record Report - NRC (1 pg)
96.	05/10/95	Inspect Single Record Report - NRC (1 pg)
97.	No date	MMIS Purchase Class "4"Class Codes (3 pgs)
98.	No date	Focus info for inspecting to our team charter (1 pg)
99.	05/01/95	Interview Schedule (2 pgs)
100.	04/25/95	Salem Station Meetings (2 pgs)
101.	03/31/95	Memo to All QA/NSR Associates from J. Benjamin / Subject QA/NSR Reorganization (8 pgs)
102.	04/24/95	System Engineering Assignments (2 pgs)
103.	05/10/95	Salem SIT Open Questions (3 pgs)
104.	11/18/91	Region I Morning Report (1 page)
105.	No date	Salem & Hope Creek Generating Stations Mechanical Maintenance Audit 95-142 (144 pgs)

Re: FOIA-96-351

APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
106.	04/25/95	List of Inspection Items for Salem SIT (43 pgs)
107.	01/01/94	Significant Incident Reports (7 pgs)
108.	05/05/95	NRC Predecisional Salem SIT Observation (52 pgs)
109.	01/19/95	Memo for distribution from Nicola Conicella/Subject Restart Action Plans: Problem Statement Closure (2 pgs)
110.	12/18/95	Memo for distribution from Nicola Conicella/Subject Restart Action Plan Management and Closure (4 pgs)
111.	No date	Action Plan Change (2 pgs)
112.	03/14/96	Memo for Distribution from F. X. Thompson, Jr./Subject NRC Restart Action Plan Item Closure (2 pgs)
113.	No date	Salem Restart Plans (227 pgs)
114.	No date	SALP Functional Area Summary Bullets (1 pg)
115.	01/15/93	Memorandum from James H. Joyner to Allen R. Blough, Subject: Security and Safeguards SALP Input for Salem and Hope Creek (4 pgs)
116.	06/20/94	Enforcement Panel Briefing Form (7 pgs)
117.	04/07/94	Salem AIT - Potential Enforcement Issues (1 pg)
118.	04/07/94	Proposed enforcement issues from the April 7, 1994 Salem Event (4 pgs)
119.	08/09/94	Discussion of Salem Unit 1 restart public meeting (87 pgs)
120.	07/28/94	NRC Vistor Register (5 pgs)
121.	06/20/94	E-mail to R. J. Summers from C. S. Marschall, Subject: Salem Enforcement Panel (1 pg)

APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
122.	06/17/94	E-mail from Robert J. Summers to CLM1(C. Marco), JCS3(J. Stolz, RWC(R. Cooper), CWH(C. Hehl), JJH(J. Hayes), KDS1(K. Smith), JRW1(J. White), JTW1(J. Wiggins), Subject: Salem Enforcement Panel (1 pg)
123.	No date	General Activity and Licensee Response History (5 pgs)
124.	No date	Salem Violations (1 page)
125.	09/95	Salem significant events summary (2 pgs)
126.	01/11/96	Fax for Bill Lazarus (2 pgs)
127.	No date	Organizational effectieness assessment (24 pgs)
128.	No date	Chronology of Events for EA 94-239 (3 pages)
129.	03/22/94	Region I Plant Status Report/Facility: Salem Nuclear Generating Station Units 1 & 2 (20 pgs)
130.	No date	Salem site significant operating events (3 pgs)
131.	04/22/94	Region I Plant Status Report/Facility: Hope Creek Generating Station Units 1 & 2 (14 pgs)
132.	05/26/95	Salem Sit 5/26/95 Exit Meeting Notes (unabridged) 20 pgs)
133.	01/29/95	Plant Performance Data (20 pgs)
134.	No date	Salem Executive Summary (3 pgs)
135.	05/04/95	E-mail from Scott Barber subject/Salem Eppr Scope Reduction (1 pg)
136.	No date	Salem Operations (1 pg)
137.	No date	Salem Maintenance (1 pg)
138.	No date	Salem Engineering (1 pg)

APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
139.	No date	Salem Plant Support (1 pg)
140.	No date	Salem Safety Assessment & Quality Verification (1 pg)
141.	No date	Salem Operations (1 pg)
142.	No date	Salem Maintenance (1 pg)
143.	No date	Salem engineering (1 pg)
144.	No date	Salem Plant Support (1 pg)
145.	05/18/95	Salem Safety Assessment & Quality Verification (1 pg)
146.	03/22/95	Region I Plant Status Report Facility:Salem Nuclear Generating Station Units 1 & 2 (35 pgs)
147.	03/22/94	Region I Plant Status Report Facility:Salem Nuclear Generating Station Units 1 & 2 (21 pgs)
148.	01/95	Data summary Unit 1 (10 pgs)
149.	No date	Salem/Basis for concern (9 pgs)
150.	02/04/94	E-mail from Ed Wenzinger to W. Lanning, Subject: Events @ Salem (1 pg)
151.	No date	Memo from Ed Wenzinger Subject/Common root causes of recent significant events at Salem Generating Station (5 pgs)
152.	02/08/94	Technical Issue Summary (3 pgs)
153.	No date	Salem performance (1 pg)
154.	02/09/94	Salem events 2/9-13/04 (3 pgs)
155.	03/15/95	Region I Plant Status Report Facility/Salem Nuclear Generating Station Units 1 & 2 (28)

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APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
156.	10/13/94	Memo from John White to J. Stolz, et al., Subject: Salem Generating Station Salp Board Meeting (1 pg)
157.	10/04/94	Memo from John White to J. Stolz, et al., Subject: Salem Salp Milestones (2 pgs)
158.	No date	Salem Nuclear Generating Station Salp Cycle 13 Enforcement Summary (3 pgs)
159.	06/20/93	Salem Salp 6/20/93-11/05/94 Engineering and Tech Support (4 pgs)
160.	6/20/93	Salem Salp 6/20/93-11/5/94 forced shutdowns (2 pgs)
161.	No date	Salem Nuclear Generating Station Salp Cycle 13 Unit 1 Licensee Event Report Summary (4 pgs)
162.	No date	Salem Nuclear Generating Station Salp Cycle 13 Unit 2 Licensee Event Report Summary (3 pgs)
163.	06/20/93	Salem Salp 6/20/93-11/5/94 Maintenance/surveillance (4 pgs)
164.	06/20/93	Salem Salp 6/20/93-11/5/94 Operations (4 pgs)
165.	06/20/93	Salem Salp 6/20/93-11/5/94 Plant support (4 pgs)
166.	06/20/93	Salem Salp 6/20/93-11/5/94 Plant Trips (2 pgs)
167.	06/20/93	Salem Salp/6/20/93-11/05/94 Engineering and Tech Support (5 pgs)
168.	6/20/93	Salem Salp 6/20/93-11/5/94 Violations (3 pgs)
169.	6/20/93	Salem Salp 6/20/93-11/5/94 Plant Support (3 pgs)
170.	6/2/93	Salem Salp 6/2/93-11/5/94 Events (1 pg)
171.	6/29/93	Salem Salp 6/29/93-11/5/94 Trips (2 pgs)
172.	6/20/93	Salem Salp 6/20/93-11/5/94 Plant Support (2 pgs)

APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
173.	6/20/93	Salem Salp 6/20/93-11/5/94 Operations (3 pgs)
174.	6/20/93	Salem Salp 6/20/93-11/5/94 Maintenance/Surveillance (4 pgs)
175.	No date	MRC Five-Day Look Ahead (2 pgs)
176.	08/10/95	NRC/PSE&G meeting August 10, 1995 list of principle attendees (1 pg)
177.	No date	Management review committee restart workscope/work item diposition form (1 pg)
178.	08/01/95	Hagan controls refurbishment & replacement (R&R) project (6 pgs)
179.	No date	Restart Screening Criteria (3 pgs)
180.	08/08/95	Public service electric and gas company organization charts and biographies (14 pgs)
181.	07/14/95	Nuclear Today (2 pgs)
182.	7/31/95	MRC Five-Day Look-Ahead (1 pg)
183.	08/09/95	NRC Senior Management Plant Tour of Salem (1 pg)
184.	08/04/95	MRC Five-Day Look-Ahead (1 pg)
185.	No date	System List (6 pgs)
186.	No date	Jim Ferland & the board of directors are looking at the permanent shutdown of the Salem Generating Station (1 pg)
187.	No date	General Manager Salem Operations - Restart Meeting with NRC (1 pg)
188.	6/20/93	Salem Salp 6/20/93-11/05/94 Engineering and Tech Support (4 pgs)
189.	No date	Photos Salem (50 pgs)

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APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
190.	05/24/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (5 pgs)
191.	05/25/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (5 pgs)
192.	05/26/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (5 pgs)
193.	05/27/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (7 pgs)
194.	05/28/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (7 pgs)
195.	05/29/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (6 pgs)
196.	05/30/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (7 pgs)
197.	05/31/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (8 pgs)
198.	06/01/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (9 pgs)
199.	06/02/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (10 pgs)
200.	06/03/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (7 pgs)
201.	06/04/93	Salem Generating Station Unit II Operations Log I Control Room Narrative Log (6 pgs)
202.	06/10/93	Rod control system - failed components status (11 pgs)

APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
203.	06/14/93	Generic Assessment of the Salem Event NRC Presentation (48 pgs)
204.	06/08/93	Study of problems at Salem Unit 2 (39 pgs)
205.	06/03/93	Study of problems at Salem Unit 2 (31 pgs)
206.	12/14/92	Significant Event Team Report (4 pgs)
207.	12/29/92	Significant event response team report no. 92-05 (35 pgs)
208.	12/17/92	Telecopier data transmittal sheet sent to Craig Gordan from Kent Torch (10 pgs)
209.	05/22/92	NRC Question and answer tracking form (2 pgs)
210.	12/21/92	NRC Question and answer tracking form (2 pgs)
211.	No date	Letter to Cal Vondra from Michael Marroni Subject: Overhead Annunciator (13 pgs)
212.	12/22/92	Info for NRC AIT (7 pgs)
213.	No date	Loss of instrumentation/annunciation/communications (3 pgs)
214.	No date	Emergency coordinator log sheet (8 pgs)
215.	No date	Section 10 Loss of instrumentation/annunciation/communications (2 pgs)
216.	No date	Salem Event Classification Introduction Section 1 (15 pgs)
217.	06/06/93	Significant Event Response team 93-06 (2 pgs)
218.	No date	Last Day Briefing w/PSE&G (3 pgs)
219.	02/18/93	AIT Report references chart (4 pgs)
220.	08/11/93	NRC augmented inspection team (AIT) report nos. 50-272/93-81 and 0-311/93-81 (52 pgs)

APPENDIX M
(continued)

DOCUMENTS BEING RELEASED IN THEIR ENTIRETY

NO.	DATE	DESCRIPTION
221.	12/14/93	Sert Charter (4 pgs)
222.	07/07/93	Memorandum from James H. Joyner to Edward C. Wenzinger, Subject: Security and Safeguards (6 pgs)
223.	01/28/93	E-Mail From Ebe C. McCable to KP2WHR(W. Ruland), Subject: DRAFT Salem AIT Report (5 pgs)
224.	01/16/93	Memorandum from J. H. Joyner to A. R. Blough, Subject: Emergency Preparedness SALP (3 pgs)
225.	No date	Proposed SALP Input 05/01/89 thru 07/31/90 (3 pgs)
226.	07/19/96	E-Mail from Aniello Della Greca to GSB(Scott Barber), LEN(L. Nicholson) Subject: Restart Item (2 pgs)
227.	06/25/96	E-Mail from Larry Nicholson to jtw1(J. White), arb(A. Blough), emk (E. Kelly), whr(W Ruland), gsb(s. Barber), csm(C. Marschall), Subject: Salem Assistance (3 pgs)

Re: FOIA-96-351

APPENDIX N

COPYRIGHTED RECORDS BEING RELEASED TO THE PDR

NO.	DATE	DESCRIPTION
1.	06/08/93	Newspaper article, Today's Sunbeam, NRC sends investigators to study problems at Salem 2 (1 pg)

SHAW, PITTMAN, POTTS & TROWBRIDGE
A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS

2300 N STREET, N.W.
WASHINGTON, D.C. 20037-1128
(202) 663-8000
FACSIMILE
(202) 663-8007

JOHN H. O'NEILL, JR. P.C.
(202) 663-8148

FOIA/PA REQUEST
Case No 96-351
Date Rec'd 9-3-96
Action Off
Related Case:

August 30, 1996

Director, Division of Freedom of
Information & Publications Services
Office of Administration
U.S. Nuclear Regulatory Commission
Two White Flint North Building
11545 Rockville Pike
Rockville, MD 20852

Re: Freedom of Information Act Request Regarding the Salem Generating Station, Docket Nos. 50-272 and 50-311

Dear Sir or Madam:

This is a Freedom of Information Act request pursuant to 5 U.S.C. § 552(a)(3) and 10 C.F.R. § 9.23. We request that you make available to Shaw, Pittman, Potts & Trowbridge the documents responsive to the attached Request for Production of Documents. These documents need to be made available as soon as possible to support depositions in an accelerated legal action. In order to expedite production of the documents, we have deliberately tailored this request to be narrow in scope and straightforward in the type of documents requested. We have already obtained copies of relevant documents presently available at the N.R.C. Public Documents Room and they need not be produced again in response to this request. Of course, we agree to bear the cost of this request as per 10 C.F.R. §§ 9.23(b)(4), 9.33, 9.39, and 9.40, and we authorize you to respond to this request piecemeal as documents become available. Please contact me at (202)663-8148, or William Hollaway at (202)663-8294, at your convenience if you have any questions regarding this request.

Please direct your response, pursuant to 10 C.F.R. § 9.27, to:

William R. Hollaway, Ph.D.
Shaw, Pittman, Potts & Trowbridge
2300 N Street, N.W.
Washington, D.C. 20037-1128
(202)663-8294
Fax: (202)663-8007

9612030313 200 pp.

Thank you for your cooperation in this matter.

Sincerely,

John H. O'Neill, Jr.

Attachment

REQUEST FOR PRODUCTION OF DOCUMENTS

I. DIRECTIONS AND INSTRUCTIONS

1. The term "NRC" means the United States Nuclear Regulatory Commission, all offices and/or branches thereof specifically including, but not limited to, headquarters in Rockville, Maryland and the Region I office in King of Prussia, Pennsylvania, and also includes all employees, consultants, agents, and representatives to the maximum extent permitted by 10 C.F.R. § 9.3, unless otherwise indicated by the request.

2. The term "Salem" means one or both units of the Salem Generating Station located in Hancocks Bridge, New Jersey and operated by the Public Service Electric and Gas Company.

3. The term "SAP" means the Salem Assessment Panel that was developed in 1995 specifically to review Salem Generating Station on an ongoing basis, including all members and supervisors thereof.

4. The term "PSE&G" refers the operator of Salem, Public Service Electric and Gas Company.

5. The term "PECO Energy" refers to PECO Energy Company, formerly known as Philadelphia Electric Company.

6. The term "Delmarva" refers to Delmarva Power & Light Company.

7. The term "Atlantic Electric" refers to Atlantic City Electric Company.

8. The term "SALP" means the Strategic Assessment of Licensee Performance, a comprehensive review of plant performance, performed for each plant on an 18-month cycle. The most recent SALP review for Salem was issued on January 3, 1995.

9. The term "Enforcement Action" means a civil penalty levied by the NRC against the licensees of Salem pursuant to single or multiple violations at Salem. The most recent Enforcement Action regarding Salem was issued on October 16, 1995.

10. The term "AIT" means the Augmented Inspection Teams that performed investigations of Salem in 1992, 1993, and 1994, including all members and supervisors thereof.

11. The term "SIT" means the Special Inspection Team that performed an investigation of Salem in 1995, including all members and supervisors thereof.

12. The term "PA" means the comprehensive Performance Assessment evaluation of Salem performed in July-August, 1995 to aid in focusing future NRC inspection resources at Salem.

13. The term "Confirmatory Action Letter" means the letter from the NRC to PSE&G on June 9, 1995 confirming PSE&G commitments to take specific actions prior to the restart of Salem and confirming that failure to take these actions may result in enforcement action.

II. DOCUMENTS REQUESTED

1. All documents concerning the NRC's Salem Assessment Panel ("SAP") established on August 2, 1995, especially including but not limited to:

   a. All internal NRC discussions concerning the formation and purpose of the SAP;

   b. Transcripts, meeting minutes, summaries, and handouts of all meetings of the SAP;

   c. Lists of attendees at all meetings of the SAP,

   d. All materials presented to the SAP,

   e. All notes taken during presentations and meetings of the SAP;

   f. All reports or memoranda of the SAP;

   g. All reports or memoranda written by any members of the SAP concerning Salem.

2. All documents concerning the NRC's Systematic Assessment of Licensee Performance ("SALP") reviews of Salem from 1990 through the present, especially including but not limited to:

   a. Transcripts, meeting minutes, summaries, and handouts of all NRC meetings on the Salem SALP reports,

   b. Lists of attendees at all meetings on the Salem SALP reports;

   c. Variances, differences or changes between consecutive Salem SALP reports,

   d. Internal NRC discussions about interim drafts of the Salem SALP reports;

   e. Internal NRC discussions about final drafts of the Salem SALP reports,

f. Internal NRC discussions about variances, differences or changes between interim reports and the final Salem SALP reports;

g. The basis for each of the findings in the Salem SALP reports;

h. Region I's knowledge of issues raised in the Salem SALP reports;

i. Region I's knowledge of PSE&G's plans to address issues raised in the various Salem SALP reports;

j. Internal Region I discussions concerning the findings and conclusions expressed in the Salem SALP reports;

k. Whether NRC or Region I ever expressed any concerns about poor or declining performance or the like to PSE&G related to the Salem SALP reports;

l. Communications between NRC and Region I personnel concerning consistencies or inconsistencies between the various Salem SALP reports;

m. All documents setting forth or discussing the deliberations and considerations of the SALP boards reviewing Salem performance from 1990 to the present;

n. To the extent not covered by previous requests, all other documents regarding the Salem SALP reports.

3. All documents concerning potential and actual NRC enforcement actions regarding Salem from 1990 to the present, including but not limited to:

a. Transcripts, meeting minutes, summaries, and handouts from all Enforcement Conferences concerning Salem between NRC and PSE&G, including but not limited to meetings on February 2, 1992; April 9, 1992; April 6, 1993; February 1, 1994; July 28, 1994; February 10, 1995; June 1, 1995; June 23, 1995; July 13, 1995; and July 28, 1995;

b. Lists of attendees at all Enforcement Conferences concerning Salem between NRC and PSE&G;

c. Transcripts, meeting minutes, summaries, and handouts from all internal NRC meetings concerning enforcement actions regarding Salem;

d. Lists of attendees at all internal NRC meetings concerning enforcement actions regarding Salem;

e. Communications with PSE&G concerning potential and actual NRC enforcement actions regarding Salem;

f. Communications with others concerning potential and actual NRC enforcement actions regarding Salem, especially including but not limited to PECO Energy, Delmarva, and Atlantic Electric;

g. Internal NRC discussions concerning potential NRC enforcement actions regarding Salem;

h. Internal NRC discussions concerning actual NRC enforcement actions regarding Salem, including but not limited to the $50,000 civil penalty issued March 9, 1994; the $500,000 civil penalty issued October 5, 1994; $80,000 civil penalty issued April 11, 1995, and the $600,000 civil penalty issued ctober 16, 1995;

i. The basis and rationale for taking each of the enforcement actions regarding Salem;

j. Internal NRC discussions about drafts of the enforcement actions regarding Salem;

k. Internal NRC discussions concerning the findings and conclusions expressed in the enforcement actions regarding Salem;

l. Internal NRC discussions concerning PSE&G's responses to each of the enforcement actions regarding Salem;

4. All documents concerning meetings between the NRC and PSE&G management or Board of Directors concerning the performance of Salem from 1990 to the present, including but not limited to:

a. Transcripts, meeting minutes, summaries, and handouts from all meetings, including but not limited to meetings on June 25, 1992; July 1, 1992; October 10, 1992; July 16, 1993; July 18, 1993; August 6, 1993; May 7, 1994; March 20, 1995; March 21, 1995; April 3, 1995; June 5, 1995; and May 24, 1996;

b. Lists of attendees at all such meetings;

c. Communications with PSE&G concerning such meetings;

d. Communications with others concerning such meetings, especially including but not limited to PECO Energy, Delmarva, and Atlantic Electric;

e. Internal NRC discussions concerning such meetings.

5. All documents concerning the NRC Augmented Inspection Team ("AIT") investigations of incidents at Salem from November 11-December 3, 1991; December 14-23, 1992; June 5-28, 1993; and around April 1994, including but not limited to:

a. Transcripts, meeting minutes, summaries, and handouts from all AIT meetings regarding Salem;

b. Lists of attendees at all AIT meetings regarding Salem;

c. Communications with PSE&G concerning the AIT investigations at Salem and AIT meetings regarding Salem;

d. Communications with others concerning the AIT investigations at Salem and AIT meetings regarding Salem, especially including but not limited to PECO Energy, Delmarva, and Atlantic Electric;

e. Internal NRC discussions concerning the AIT meetings regarding Salem;

f. The reasons why the NRC decided to do the AIT investigations at Salem.

g. The basis for each of the findings in the AIT reports of investigations at Salem;

h. Notes taken by inspectors during and after the AIT investigations at Salem;

i. Internal NRC discussions about interim drafts of the AIT reports of investigations at Salem;

j. Internal NRC discussions about final drafts of the AIT reports of investigations at Salem;

k. Internal NRC discussions concerning the findings and conclusions expressed in the AIT reports of investigations at Salem.

6. All documents concerning the NRC Special Inspection Team ("SIT") review of Salem performance from March 26-May 12, 1995, including but not limited to:

a. Transcripts, meeting minutes, summaries, and handouts from all SIT meetings regarding Salem;

b. Lists of attendees at all SIT meetings regarding Salem;

c. Communications with PSE&G concerning the SIT investigation at Salem and SIT meetings regarding Salem;

d. Communications with others concerning the SIT investigation at Salem and SIT meetings regarding Salem, especially including but not limited to PECO Energy, Delmarva, and Atlantic Electric;

e. Internal NRC discussions concerning the SIT meetings regarding Salem;

f The reasons why the NRC decided to perform the SIT investigation at Salem,

g The basis for each of the findings in the SIT report regarding Salem,

h Notes taken by inspectors during the SIT investigation at Salem;

i Internal NRC discussions about interim drafts of the SIT report regarding Salem,

j Internal NRC discussions about final drafts of the SIT report regarding Salem;

k Internal NRC discussions concerning the findings and conclusions expressed in the SIT report regarding Salem

7 All documents concerning the NRC's Performance Assessment ("PA") review of Salem from July 11-August 25, 1994, including but not limited to:

a Transcripts, meeting minutes, summaries, and handouts from all meetings concerning the PA review regarding Salem;

b Lists of attendees at all meetings concerning the PA review regarding Salem,

c Communications with PSE&G concerning the PA review and PA review meetings regarding Salem;

d Communications with others concerning the PA review and PA review meetings regarding Salem, especially including but not limited to PECO Energy, Delmarva, and Atlantic Electric,

e Internal NRC discussions concerning the PA review meeting regarding Salem,

f The reasons why the NRC decided to do a PA review regarding Salem,

g The basis for each of the findings in the report regarding the PA review regarding Salem,

h Notes taken during the PA review regarding Salem;

i Internal NRC discussions about interim drafts of the PA review report regarding Salem,

j Internal NRC discussions about final drafts of the PA review report regarding Salem,

k Internal NRC dis[illegible] concerning the findings and conclusions expressed in the PA review report [illegible]ng Salem

8. All documents concerning the Confirmatory Action Letter of June 9, 1995 (CAL No. 1-95-009), including but not limited to:

   a. Communications with PSE&G concerning the Confirmatory Action Letter;

   b. Communications with others concerning the Confirmatory Action Letter, especially including but not limited to PECO Energy, Delmarva, and Atlantic Electric;

   c. Internal NRC discussions concerning the Confirmatory Action Letter;

   d. Discussions with Region I concerning non-final drafts of the Confirmatory Action Letter;

   e. Discussions with Region I concerning final drafts of the Confirmatory Action Letter,

   f. Region I's knowledge of the issues raised in the Confirmatory Action Letter,

   g. Region I's knowledge of PSE&G's plans to address issues raised in the Confirmatory Action Letter.

348574-01 DOCSDC1

Place in NUDOCS set

FOIA NO. 96-351/1-16-97 response #6

DOCUMENT NO. APPENDIX N-1

NOTE TO PDR

The attached copyrighted materials are placed in the NRC Public Document Room (PDR) for public viewing. Members of the public are not authorized to copy or receive copies of this documentation.

AIT-ROD-220

ITEM NUMBER AIT-ROD-220
DATE 6/9/93

NRC INSPECTION
QUESTION/RESPONSE TRACKING FORM.

INSPECTION SUBJECT ____________________

INSPECTION NUMBER 93-81

NRC INSPECTOR M.E LAZAROWITZ PSE&G CONTACT L RAJKOWSKI

SYSTEM RCS COMPONENT ____________________

QUESTION: ~~Please~~ provide a list of all failed components, on Relay Driver Board WSN-0133 Please address the impact of each ~~~~ failed component on all components upstream and downstream of the failure, and impact of ~~all~~ each components on the +15V Bus.

RESPONSE: ____________________

PSE&G CONTACT (*) Mark E. Woloski DATE 6/16/93

NRC ACKNOWLEDGEMENT ____________________ DATE ________

RESPONSE ACCEPTED BY NRC (Y/N) ____________________

* If response involves a commitment, have PSE&G Audit Manager sign as PSE&G contact.

June 16, 1993

NRC Question/Response ton/Response Tracking Form 93-81
Request for Failed Parts Listing for Relay Driver Board WSN-0133

Upon reviewing the data associated with WSN-0133, the only component failure encountered was the failure of Q10. Q10 is a power transistor used to activate a counter coil. 93-81 requests an analysis of the impacts to upstream and downstream components as well as to the 15 VDC bus based on the Q10 failure.

It is important to note that Q10 failed open. This failure has no detrimental effects on upstream and downstream components. The only impact is to the operation of the stepping counter which will not function since the coil cannot be activated. There is also no effect on the 15 VDC bus.

The balance of the circuit continues to operate as designed. Q9 is still able to be turned on and turned off based on the operation of its associated data logging card. The balance of the components of this circuit assist in establishing current and voltage limits and threshold values for the circuit. This operation is unaffected by the by the failure of Q10.

The failure, that Q10 experienced, does not result in any transients that affect other circuit components or the 15 VDC bus. The 15 VDC bus continues to operate as designed.

AIT FOR ROD CONTROL SYSTEM
QUESTION AND ANSWER STATUS

QUESTION NUMBER	QUESTION DESCRIPTION	PSE&G CONTACT	ST AT US	RESPONSE
✓ AIT-ROD-220	PROVIDE A LIST OF ALL FAILED COMPONENETS ON RELAY DRIVER BOARD WSND133. ADDRESS IMPACT OF EACH FAILED COMPONENT ON ALL COMPONENTS UPSTREAM AND DOWNSTREAM OF THE FAILURE, AND IMPACT OF EACH COMPONENT ON TH +15V BUS.	L. RAJKOWSKI	O	
AIT-ROD-227	DURING MAINTENANCE OUTAGE FOR RCS, POWER SUPPLY FUSES WERE REMOVED WHILE CABINET WAS DE-ENERGIZED. HOW WAS CABINET RE-ENERGIZED (WHAT ORDER)	T. CARRIER	O	?
✓ AIT-ROD-309	PROVIDE A LIST OF ALL FAILED COMPONENTS (CARDS, DIODES,TRANSISTORS) THIS LIST SHOULD ALSO INCLUDE THE ROOT CAUSE OR MORE PROBABLE ROOT CAUSE FOR EACH IDENTIFIED FAILURE. IF LIST IS AVAILABLE BY 6/15/93THE TEAM WILL BE BACK IF NOT JUST THE LEADER	L. RAJKOWSKI	O	
AIT-ROD-310	BASED ON INSPECTION FINDINGS AND RESULTS OF TROUBLESHOOTING TO DATE, WHAT ADDITIONAL INSPECTIONS AND/OR RETESTS ARE PLANNED?	L. RAJKOWSKI	O	- Visual Inspection of Power Cab CKT Boards for Trace Degradation
AIT-ROD-311	WHAT POLICY OR POLICIES COVER ROOT CAUSE DETERMINATION. IS IT NECESSARY TO KNOW THE ROOT CAUSE OF A COMPONENT/SYSTEM FAILURE PRIOR TO DECLARE THAT SYSTEM/COMPONENT OPERABLE?		O	- Complete (W) Tester Checkout of Boards Prior to installation (Logic AND Complete (W) Pwr & Logic Cab Checkout. - VSC. IC-PT. RCS-0003(

Leonard J Rajkowski
6-17-93

M/V

5076

NUCLEAR DEPARTMENT WORK ACTIVITY CORRECTIVE MAINTENANCE	ACT TYPE FW	TASK CM

W/O: 930603076 ACT: 01

SECTION 1 -- TASK DESCRIPTION

ORIGINAL

UNIT	PRI	RESP D/G	W/O SUMMARY
S2	A	SMD IC	S/D BANK "A" GR II STEP COUNTERS DISAGREE BY 10

PEG/COMP ID: ~~999~~ 2LD5892 MUC: C LOC: SYSTEM: RCS
COMPONENT ID NOT FOUND ON DATA BASE
SERIAL NBR:
ACT SUMMARY: S/D BANK "A" GR II STEP COUNTERS DISAGREE BY 10
ACT DESC-1: S/D BANKS GROUP I AND II STEP COUNTERS DISAGREE BY TEN STEPS.
PLEASE TROUBLESHOOT AND REPAIR.

SECTION 2 -- PLANNING INFORMATION

PLANNER: NPR SHIFT SUPERVISOR: RIBLEY	SAFETY RLTD NSR	SAFETY CLASS N	SEISMIC	EQ

DR# - N/A - DCR# - 00000 - N/A - PKG 00000
WORK STANDARDS: SEE W.O. 930527179
(HP W/STD):
TEMPORARY MODIFICATION # 00 0000
CODE JOB PKG

RC#: 0146
AUTH NO:
ACCT NO: E530030
PRG PLN: I00010
LOC: 1614
PLN JOB#: 578941

SECTION 3 -- SCHEDULING INFORMATION

SCHED START DATE: OVERDUE DATE:
SYSTEM OUTAGE: LCO NO: - -
SCHEDULER:
SCHEDULER COMMENTS:

ESTIMATED MANPOWER

MAN COD	NBR	DUR	EST	EST RCA
NTC	001	1.0	1.0	0.0
	000	0.0	0.0	0.0
	000	0.0	0.0	0.0
	000	0.0	0.0	0.0

TOTAL HRS: 0.0

SECTION 4 -- PERMISSION TO BEGIN

S/S PERMISSION TO BEGIN WORK: R. [signature] DATE: 6/3/93 TIME: 0400
TAGGING REQUIRED: N TAG NO:

SECTION 5 -- CLOSE OUT

PERSON COMPLETING WORK	BADGE	DATE
[signature]	03 - 295	6/7/93

WORK SUPERVISOR	BADGE	DATE
[signature]	03 - 295	6/7/93

REPEAT WORK (N) (Y/N)

ACTUAL MANHOURS
MANPOWER: NTC
MEN REQ :
DURATION:

S/S SIGNOFF: [signature] DATE: 6/7/93

M/3

ACTIVITY CLOSEOUT SHEET RT NO. 000000 TASK CM

W/O: 930603076 ACT: 01

FAILURE CAUSE AND REPAIR DESCRIPTION CODES REQUIRED

CAUSE - MECHANICAL

- { } AB - FOREIGN/INCORRECT MATERIAL (WATER IN OIL)
- { } AC - PARTICULATE CONTAMINATION (BUILDUP OF SOLIDS IN FLUID SYS.)
- { } AD - NORMAL / ABNORMAL WEAR
- { } AE - PROBLEM LUBRICATION (LACK OF / INADEQUATE)
- { } AF - WELD RELATED (FRACTURE, CRACK, HAZARD FAILURE)
- { } AG - ABNORMAL STRESS (LOAD,VIBRATION,TEMP,PRESSURE,FLOW)
- { } AV - LOOSE PARTS, CONNECTIONS, OR FASTENERS
- { } AZ - MATERIAL DEFECTIVE (FLAW)
- { } BB - MECHANICAL DAMAGE (UNKNOWN MECHANICAL FAULTS OR FAILURES)
- {X} BC - OUT OF ADJUSTMENT (LOOSE PARTS,STOPS,SETSCREWS,SETPOINTS)
- { } BD - AGING/CYCLIC FATIGUE
- { } BE - DIRTY (DEPOSITS OF EXTRANEOUS MATERIAL ON OPERATING PARTS)
- { } BF - BLOCKED/OBSTRUCTED (FLOW OR MECHANICAL MOVEMENT)
- { } BG - CORROSION-CHEMICAL REACTION-ELECTROCHEMICAL / STRESS AIDED

CAUSE - ADJUSTMENT/HUMAN-RELATED

- { } AA - FOREIGN/WRONG PART, INCLUDES POOR DESIGN AND MISAPPLICATION
- { } AL - SETPOINT DRIFT
- { } AM - PREV. REPAIR/INSTALLATION (INADEQUATE,NOT PROPER ACTION)
- { } AN - INCORRECT PROCEDURE
- { } BC - OUT OF MECH ADJUST. - NOT DUE TO DAMAGE - LOOSE LOCKNUT
- { } BH - OUT OF CALIBRATION
- { } BJ - INCORRECT ACTION - HUMAN ERROR

CAUSE - CONTROLS(ELECTRICAL/ELECTRONIC)

- { } AG - ABNORMAL STRESS (VOLTAGE SPIKES,OSCILLATIONS,ETC.)
- { } AR - INSULATION BREAKDOWN (SHORTS, ARCS, BURNED WINDINGS)
- { } AS - SHORTED / GROUNDED CIRCUITS
- { } AT - OPEN CIRCUIT
- { } AU - CONTACTS BURNED / PITTED / CORRODED
- { } AV - CONNECTION DEFECTIVE / LOOSE PARTS
- { } AW - CIRCUIT DEFECTIVE (UNKNOWN ELECTRONIC FAULTS OR FAILURES)
- { } AX - BURNED / BURNED OUT (LOCAL COMBUSTION,OVERLOAD,ELECT. FIRE)
- { } AY - ELECTRICAL OVERLOAD DUE TO UNANTICIPATED HIGH CURRENT
- { } AZ - MATERIAL DEFECT - FLAW
- { } BD - AGING/CYCLIC FATIGUE
- { } BE - DIRTY (DEPOSITS OF EXTRANEOUS MATERIAL ON OPERATING PARTS)
- { } BG - CORROSION - CHEMICAL REACTION - ELECTROCHEMICAL OR STRESS AIDED

REPAIR CODES / CORRECTIVE ACTION

- {X} AA - RECALIBRATED / ADJUSTED
- { } AC - TEMP. MODIFICATION - ACTION TO MAINTAIN FOR INTERIM PERIOD
- { } AE - MODIFY/SUBSTITUTE - CHNG/ELIMINATE OR REPLACE W/DIFF MODEL
- {X} AG - REPAIR COMPONENT/PART - RESTORE TO ORIGINAL CONFIG. BY CLEAN, POLISHING, TIGETENING, REMOVE/INSERT CIRCUIT CARDS
- { } AH - REPLACE PARTS - PIECE REPLACED IN KIND, PACKING, SEALS
- { } AK - REPLACE COMPONENT - ENTIRE COMPONENT REPLACED IN KIND

ACTIVITY CLOSEOUT SHEET

RT NO.	TASK
000000	CM

W/O: 930603076 ACT: 01

M+TE EQUIPMENT USED/NEEDED: N/A

DEFICIENCY REPORTS INITIATED: N/A

COMPONENT SERIAL #: ______ SERIAL # UPDATE __/__/__

DESCRIPTION OF WORK PERFORMED: OPENED COVER, COUNTER RESET TO ZERO 6/3/93 P W.O. LEFT OPEN PENDING ANY FURTHER PROBLEMS. 6-3-93 BALANCE OF WORK COMPLETED UNDER W.O. 930527179 ACT. 01

AS FOUND CONDITION: STEP COUNTERS DISAGREE

REPAIR ACTIONS TAKEN: SEE W.O. # 930527179

FAILURE CAUSE: OUT OF MECH ALIGNMENT

PMT PERFORMED: VERIFIED OPERATION

THURSDAY JUNE 3, 1993 0:00 TO 12:00

TROUBLESHOOTING CBB & CBD PULSE TO P/A CONVERTER, AND RIL COMPUTER.

01:30 AM

SETTING UP PREPARATIONS AND APPROVAL OF TROUBLESHOOTING PROCEDURE. CONNECTED TEST RECORDER TO MONITOR CBD UP PULSES. OUTPUT OF A114 CARD AND OUTPUT OF THE RELAY DRIVER CARD A711. A711, PIN 30, 15 VDC INPUT & PIN 9, 100 VDC OUTPUT.

02:06 AM

CONNECTED RECORDER TO CBD BANK MOVED RODS 3 STEPS IN THEN OUT. NO CHANGE ON RECORDER.

02:25 AM

MOVED RECORDER TO MONITOR CBB. NO CHANGE ON RECORDER WHEN CYCLE ROD MOTION OUT THEN IN 3 STEPS.

02:45 AM

MOVED RECORDER TO MONITOR SBA, RECORDER PULSED BUT THE COMPUTER P250 INDICATION REMAIN THE SAME.

03:15 AM

CONNECTED RECORDER TO A114 TO TEST Z13 CHIP. A114 PIN 2 AND TP 1 AND A110 PIN 22. STEPPED RODS +/-3 STEPS. PIN 2 & A110 PIN 22 PULSED ON RECORDER BUT TP1 DID NOT.

03:50 AM

ALL RODS IN REMOVING A114 CARD FOR TESTING. CONTROL ROOM STEP COUNTER SBA MISSED 10 STEPS WHEN DRIVEN IN.

BENCH TEST OF CARD A114 BAD, Z13 CHIP FAILED TEST. REPLACED CHIP RETESTED CARD SAT RESULTS ON BENCH. REINSTALLED CARD FOR OPERATIONS TO RETEST.

06:30 AM

OPERATIONS WITHDREW ALL ROD BANKS +/- PULSE TO ANALOG SIGNALS ALL CONTROL BANKS SAT WITH P250 INDICATIONS.

9:14

ALL ROD WITHDRAWN (CBD AT 160)

13:59

REACTOR CRITICAL

100VDC Power short circuit to -15VDC.

all relays powered from 100VDC Drops out, light indication and AC115V input power to 100VDC power supplies blown out. Auctioneer diode on -15V Power supply failed short.

Senario 1

100VDC was shorted to -15VDC through circuit components failures (Fig 1)

In order for 100VDC short to -15VDC ~~through~~ compon failures on relay driver cards be a valid assumpti the following components need to be failed as short Q_2 transistor having collector to base shorted and Q_1 transistor at the same time must have ~~Q2~~ collector to base shorted too. when such eve takes place, the R2 resistor at the -15VDC wo limit the current flow to -15VDC from 100

M/4

(R2 = 14.76KΩ). The consequence of Q1 & Q being shorted bet base & collectors, would be:

1 – Major failures at CR2 and CR1 and Z

2 – +15VDC should see such surge, and the auctioneer diodes on this circuit would be lost too. This is due to the fact that R3 is only 1.21KΩ which would indicate the current flow to +15 would be higher at +15 than −15.

3 – for this failure to be valid I also need to loss CR24. Because with CR24 in circuit, collector to base failure would be sending all 100VDC to ground through CR24 diode.

Conclussion:

The circuit short from 100VDC to −15V through relay driver card is not a valid path and correct assumption, based on the fact that we have not experienced an major Q_2, Q_1, CR24 or R_2 failures or solid short (indications are that such failure have never taken place).

Senario 2

Failure Detection (Non-Urgent Alarm).

This is another location within this system design where +100VDC and -15VDC would be in same circuit.

In order for 100VDC and -15VDC to short circu there are two possible paths;

1- losing R9 and R5 resistors would short circ 100VDC &-15VDC.

2- having short circuit at the board terminal.

Conclussion:

there is no indication that R9 & R5 was shorted. circuit is operating properly; and was tested (as stated by engineering and found functional.

Unless fault is external, there is no indicai that such fault did take place due to the

(2)

non urgent alarm circuit failures.

Final conclusion.

Based on event senario and recorded information, possibility of 100VDC & -15VDC short circuited through any parts of the circuits is extremely low and indications are hard to be miss. Therefore there must be an external element to 100VDC and -15VDC shortcircuit theory.

Simplified Circuit For Data Logger and Relay Driver Cards

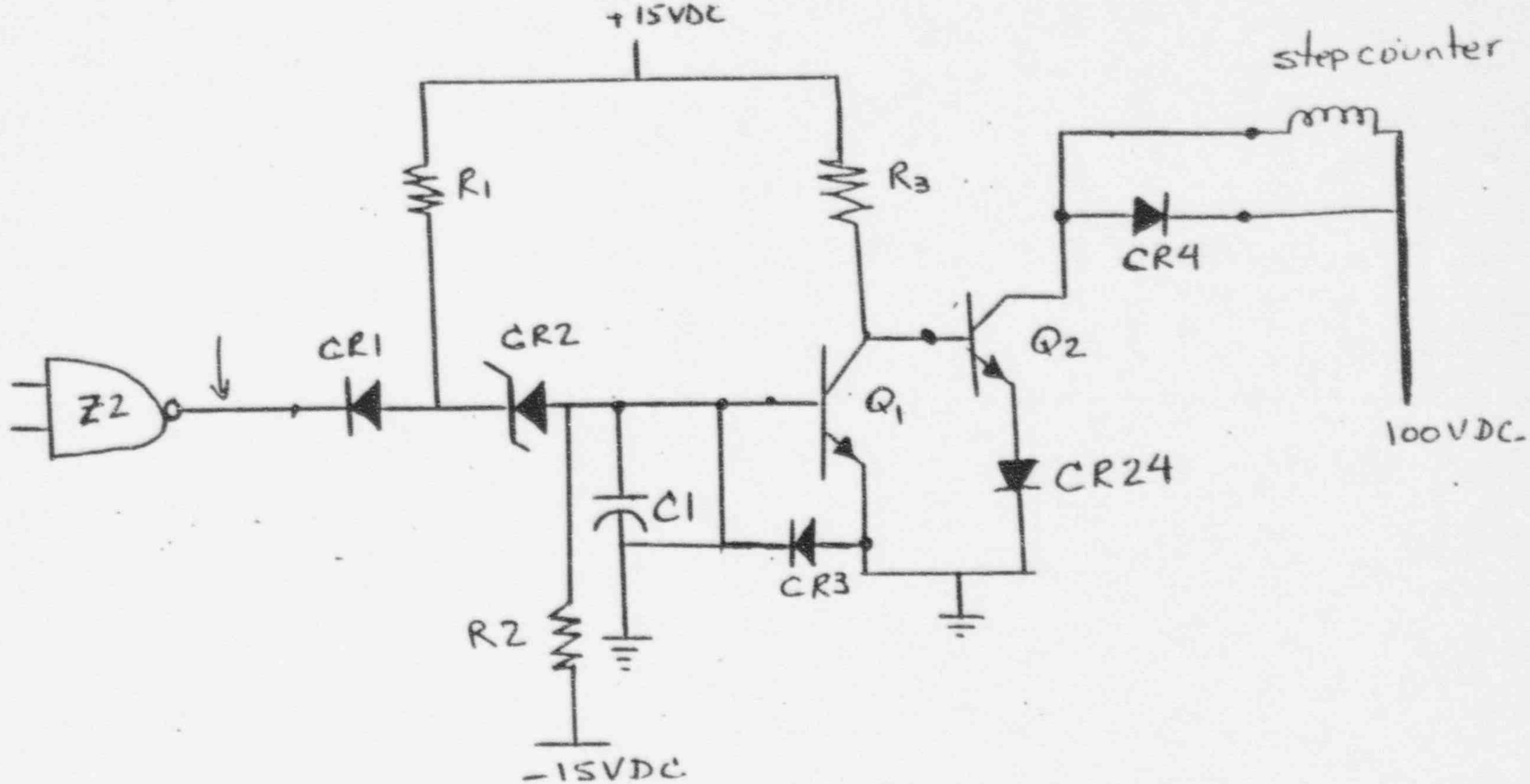


Fig 1

[redacted] PAGE 21

SECTION 1 - TASK DESCRIPTION   ORIGINAL

UNIT: S1	PRI: A	[redacted]	W/O SUMMARY: 1RCE1-CRDM WELD LEAK-INSPEC.AND REPAIR.

COMPONENT ID: 1[redacted]   SERIAL NBR:
1 REACT COOL REACTOR VESSEL
LOCATION : 05130012 REACTOR VESSEL HEAD AREA   CAN 1
ACT DESCPT: 1EA2 MAG-JACK/FAULTY/REMOVE AND REPLACE.
REMOVE 1EA2 COIL STACK AND FAULTY MAG-JACK AND REPLACE WITH SPARE.

COORDINATE WITH POLAR CRANE OPERATOR

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
DOWNIE-4397	SR	1	1	N	Y

RESP SUPERVISOR: LOWRY	DEFICIENCY REPORTS INITIATED: RWK	PLN JOB: 040096 AUTH NO: A42231
START DATE: 24FEB88	SERIAL NO. UPDATE: 449-510F091G05	ACCT NO: E530010 PRG PLN: I00010

WORK STANDARDS: Applicable section of IPD 8.2.001 / IC 1.4.003

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: M [illegible]   DATE: 2-24-88   TIME: [illegible]

DESCRIPTION OF WORK PERFORMED:

Removed Faulty mag-Jack and replaced with spare. Meggered new Mag-Jack after installation at head (Stationary 100,000 MΩ, Lift 75,000 MΩ, Movable 100,000 MΩ) and at Rod Control Cabinet (Stationary 4000 MΩ, Lift 3000 MΩ, Movable 4000 MΩ) 2-24-88 [illegible] Check resistance values of coils STA - 13.6 Ω MOV - 13.2 Ω LIFT - 2.2 Ω, 2-25-88 [illegible]

M+TE EQUIPMENT USED: SA MNT-128; SA IC 467

(Performed RPI coil resistance & megger Cks IPD 8.2.001)

CAUSE:

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK	DATE	ACTUAL MANHOURS
J Burch [illegible]	2-24-88	MANPOWER: TC 4
SIGNATURE WORK SUPERVISOR	**DATE**	
Bill Lowry	3/3/88	DURATION: 12

MB

[redacted] ACT 21

SECTION 1 - TASK DESCRIPTION

ORIGINAL

UNIT	PRI	[redacted]	W/O SUMMARY
S1	A	[redacted]	1RCE1-CRDM WELD LEAK-INSPEC.AND REPAIR.

COMPONENT ID: [redacted]
1 REACT COOL REACTOR VESSEL
SERIAL NBR:
LOCATION : 05130012 REACTOR VESSEL HEAD AREA CAN 1
ACT DESCPT: SPARE MAG-JACK/DISASSEMBLE/TRANSPORT TO CONT.130'.
A)DISASSEMBLE SPARE MAG-JACK ASSEMBLY IN U/2 TURB BLDG.100'
B)TRANSPORT TO U/1 CONTAINMENT ELV.130'.
C)RE-ASSEMBLE,PERFORM PRE INSTALLATION ELECTRICAL CHECK.

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
DOWNIE-4397	SR	1	1	N	Y

RESP SUPERVISOR: LOWRY

DEFICIENCY REPORTS INITIATED: RWK

START DATE: 24FEB88

SERIAL NO. UPDATE: 449-510F091 G03

PLN JOB: 040085
AUTH NO: A42231
ACCT NO: E530010
PRG PLN: I00010

WORK STANDARDS: IC 1.4.003 / PSBP 304982

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: [signature] DATE: 2-24-88 TIME: 0800

DESCRIPTION OF WORK PERFORMED: Crimped connectors on new mag Jack. 2.24.88 RK Reassembled mag Jack — STA to Gnd 50,000 m LIFT to Gnd 50,000 M MOV to Gnd 50,000 m. Performed ~~[illegible]~~ Polarity check on Coils checkouts sat.

(Connector PO# 102770)

M+TE EQUIPMENT USED:
Pico UMDA-HKE crimper SA-MNT-713
Daniels AFK crimper SA-MNT-715
Flukes SA IHC-573 SA IHC 572 P/S SA IHC 581

CAUSE: [initials]

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK: [signature] DATE: 2-25-88

SIGNATURE WORK SUPERVISOR: Bill Lowry DATE: 3/3/88

ACTUAL MANHOURS
MANPOWER: TIC 2
DURATION: 16

[redacted]

SECTION 1 - TASK DESCRIPTION **ORIGINAL**

UNIT	PRI	[redacted]	W/O SUMMARY
S1	B	[redacted]	SPARE MAG-JACK/OPERABILITY/ELECTRICAL CHECKS.

COMPONENT ID: [redacted]1 SERIAL NBR:
1 ROD CONTROL [redacted] BANK A ROD 1SA2 GRID D12 POSITION TMTR
LOCATION : 04100864 #2 WAREHOUSE AREA YRD
ACT DESCPT: SPARE MAG JACK/OPERABILITY/ELECTRICAL CHECKS.
PERFORM NECESSARY ELECTRICAL CHECKS ON SPARE MAG-JACK ASSEMBLY TO DETERMINE UNIT OPERABILITY.
TO BE USED AS REPLACEMENT FOR 1S LOCATION D12

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
DOWNIE-4397	NSR	N	3	N	N

RESP SUPERVISOR:	DEFICIENCY REPORTS INITIATED	PLN JOB:
LOWRY	N/A	AUTH NO:
		ACCT NO: E530010
START DATE: 19FEB88	SERIAL NO. UPDATE: N/A	PRG PLN: I00011

WORK STANDARDS: IC 1.4.003

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: [signature] DATE: 2-19-88 TIME: 1245

DESCRIPTION OF WORK PERFORMED: RESISTANCE CHECKS ACCROSS COILS ARE LIFT COIL (1TO4) = 1.45Ω, STATIONARY COIL (2TO5) = 8.99Ω, AND MOVABLE COIL (3TO6) = 8.78Ω. ALL COILS READ 10,000MΩ TO GROUND. MAG JACK IS PRESENTLY IN TGA 2 100' EL.

M+TE EQUIPMENT USED: SA-[illegible]-028; SA-[redacted]-504

CAUSE:

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK	DATE	ACTUAL MANHOURS
[signature]	2-19-88	MANPOWER: T/C
SIGNATURE WORK SUPERVISOR	**DATE**	
Bill Lowry	2/24/88	DURATION: 2

[redacted] NUCLEAR DEPARTMENT WORK ACTIVITY
CORRECTIVE MAINTENANCE

	TASK	WORK ORDER NO	ACT
	CM	880108061	19

SECTION 1 - TASK DESCRIPTION ORIGINAL

UNIT	PRI	RESP D/G	W/O SUMMARY
S1	A	[redacted]	1RCE1-CRDM WELD LEAK-INSPEC.AND REPAIR.

COMPONENT ID: 1[redacted] SE AL NBR:
1 REACT COOL REACTOR VESSEL
LOCATION : 05130012 REACTOR VESSEL HEAD AREA CAN 1
ACT DESCPT: D-12 CRDM/MISSING LOCK WIRE/REPLACE LOCK WIRE. #2 FLUX RING IS MISSING LOCK WIRE. LOCK WIRE MUST BE REPLACED PRIOR TO INSTALLATION OF MAG JACK ASSEMBLY.

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
PANKO,R-5548	SR	1	1	N	Y

RESP SUPERVISOR: Lowry-4456
DEFICIENCY REPORTS INITIATED: RWK
START DATE: N/A
SERIAL NO. UPDATE: N/A

PLN JOB: 037269
AUTH NO: A42231
ACCT NO: E530010
PRG PLN: I00010

REP # 180

WORK STANDARDS: IC 1.4.003 Vendor Manual PSBP - 304982

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: [signature] DATE: 2/9/88 TIME: 540

DESCRIPTION OF WORK PERFORMED: Installed lock wire on D-12 CRDM #2 FLUX RING. 2-9-88 SR
AS PER VENDORS MANUAL.

M+TE EQUIPMENT USED: SS WIRE 304 SOFT GAGE # FOLIO 42-5130

CAUSE:

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK: S. Ranlgo DATE: 2-9-88

ACTUAL MANHOURS
MANPOWER: TIC
DURATION: 3

SIGNATURE WORK SUPERVISOR: R. Lowry DATE: 2/24/88

05-16-1993 18:40 609 339 2749 SALEM TECH DEPT P.06

[redacted] NUCLEAR DEPARTMENT WORK ACTIVITY
CORRECTIVE MAINTENANCE

NUCLEAR DEPARTMENT WORK ACTIVITY CORRECTIVE MAINTENANCE	TASK CM	WORK ORDER NO 880108061	ACT 18

SECTION 1 - TASK DESCRIPTION

ORIGINAL

UNIT	PRI	RESP D/G	W/O SUMMARY
S1	A	S[redacted]IC	1RCE1-CRDM WELD LEAK-INSPEC.AND REPAIR.

COMPONENT ID: 1RCE1 SERIAL NBR:
1 REACT COOL REACTOR VESSEL
LOCATION :
ACT DESCPT: 1RCE1-REACTOR HEAD/11 COIL STKS-MAG JKS./REMOVE ADDITIONAL STACKS.
REMOVE ADDITIONAL 11 COIL STACKS-MAG JACKS TO PROVIDE ACCESS TO THE SUSPECTED FAULTY WELD AREA.
REFER TO ACT NO.8 FOR RE-INSTALLATION

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
DOWNIE-4397	SR	1	1	N	Y

RESP SUPERVISOR: LOWRY
DEFICIENCY REPORTS INITIATED: N/A

START DATE: 28JAN88 | SERIAL NO. UPDATE: N/A

PLN JOB: 034620
AUTH NO: A42231
ACCT NO: E530010
PRG PLN: I00043

WORK STANDARDS: IC-14.1.001 PSBP 304982

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: M. Olk DATE: 1-28-88 TIME: 1600

DESCRIPTION OF WORK PERFORMED: Removed 12 Coil stacks and Mag Jacks and 6 Dummy cans. PB 1-29-88
13'th Coil Stack Required due to Overlay Reweld on the 13th outside perimeter Space. WL 1/29/88 Mag Jack in Location D-12 was stuck required ... 2500#'s to remove found 5" piece of flux ring lock wire inside of Mag. jack.

M+TE EQUIPMENT USED:

CAUSE:

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK: J. Buckley [signature] DATE: 2-5-88

SIGNATURE WORK SUPERVISOR: Bill Lowry DATE: 2/24/88

ACTUAL MANHOURS
MANPOWER: T/C's 4 ea
DURATION: 32

[redacted] DEPARTMENT WORK ACTIVITY | TASK | WORK ORDER NO | AUX
[redacted] MAINTENANCE | [illegible] | [illegible] | 02

SECTION 1 - TASK DESCRIPTION REPRINT

INIT [redacted]	[redacted]	W/O SUMMARY
81	[redacted]	ROD CONTROL CABLES/REMOVAL-RECONNECT

COMPONENT ID: [redacted] CONTROL SERIAL NBR:
COMPONENT ID NOT FOUND ON DATA BASE
LOCATION : 01122002 NO 1 CONTROL ROOM AUX 1
ACT DESCPT: PERFORM CABLE CHECKS AND RECONNECT IN POWER CABINETS AFTER REACTOR HEAD HAS BEEN REASSEMBLED.
REINSTALL ALL 10 AMP. FUSES AND BLOWN FUSE INDICATORS.

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
PANKO, R-5548	NSR	N	N	N	N

RESP SUPERVISOR: HOUDE
DEFICIENCY REPORTS INITIATED: N/A
START DATE: 11FEB88
SERIAL NO. UPDATE: N/A

PLN JOB: 030303
AUTH NO: A42231
ACCT NO: E530010
PRG PLN: I00010

WORK STANDARDS: 1PD 5.2.002 / 1.4.003

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: [illegible] DATE: 2-11-88 TIME: 0500

DESCRIPTION OF WORK PERFORMED: Performed cable checks. Found 1C2 and 1SA2 checked below spec. Activity added to this work order to address further cable check and repair. Note: 1C2 and 1SA2 passed resistance check, failed megger check.

M+TE EQUIPMENT USED:
SA [illegible] -123
SATC - 467

CAUSE: [illegible]

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK	DATE	ACTUAL MANHOURS
[illegible] / Bill Casey	2-16-88	MANPOWER: 2 T/C
SIGNATURE WORK SUPERVISOR	DATE	DURATION: 16
Bill Casey	2/24/88	

[redacted]

[redacted] SECTION 1 - TASK DESCRIPTION ORIGINAL

UNIT:	PRI	[redacted]	W/O SUMMARY
S1	A	[redacted]	1RCE1-CRDM WELD LEAK-INSPEC.AND REPAIR.

COMPONENT ID: 1[redacted] SERIAL NBR:
1 REACT COOL REACTOR VESSEL
LOCATION : 05130012 REACTOR VESSEL HEAD AREA CAN 1
ACT DESCPT: 1F22 MAG-JACK/FAULTY/REMOVE AND REPLACE.
REMOVE 1EA2 COIL STACK AND FAULTY MAG-JACK AND REPLACE WITH SPARE.

COORDINATE WITH POLAR CRANE OPERATOR

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
DOWNIE-4397	SR	1	1	N	Y

RESP SUPERVISOR: LOWRY

DEFICIENCY REPORTS INITIATED ___ ___ ___ RWK ___ ___ ___

PLN JOB: 040096
AUTH NO: A42231
ACCT NO: E530010
PRG PLN: I00010

START DATE: 24FEB88

SERIAL NO. UPDATE: 449-510F091G05

WORK STANDARDS: Applicable section of IPD 8.2.001 / IC 1.4.003

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: [illegible] DATE: 2-24-88 TIME: 0220

DESCRIPTION OF WORK PERFORMED:

Removed FAULTY mag-JACK and Replaced with SPARE. Meggered new Mag-Jack after installation at head (Stationary 100000 MΩ, Lift 75000 MΩ, Movable 100000 MΩ) and at Rod Control Cabinet (Stationary 4000 MΩ, Lift 3000 MΩ, Movable 4000 MΩ) 2-24-88 [illegible] Check resistance values of coils STA - 13.6 Ω MOV - 13.2 Ω LIFT - 2.2 Ω, 2-25-88 [illegible]

M+TE EQUIPMENT USED: SA MNT-128; SA IC 467

(Performed RPI coil resistance & megger Cks IPD 8.2.001)

CAUSE:

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK: [signature] DATE: 2-24-88

SIGNATURE WORK SUPERVISOR: Bill Lowry DATE: 3/3/88

ACTUAL MANHOURS
MANPOWER: TK' 4
DURATION: 12

[illegible]

[redacted] ACT: 21

SECTION 1 - TASK DESCRIPTION ORIGINAL

UNIT	PRI	RE[redacted]/G	W/O SUMMARY
S1	A	S[redacted]	1RCE1-CRDM WELD LEAK-INSPEC.AND REPAIR.

COMPONENT ID: 1[redacted] SERIAL NBR:
1 REACT COOL REACTOR VESSEL
LOCATION : 05130012 REACTOR VESSEL HEAD AREA CAN 1
ACT DESCPT: SPARE MAG-JACK/DISASSEMBLE/TRANSPORT TO CONT.130'.
A)DISASSEMBLE SPARE MAG-JACK ASSEMBLY IN U/2 TURB BLDG.100'
B)TRANSPORT TO U/1 CONTAINMENT ELV.130'.
C)RE-ASSEMBLE,PERFORM PRE INSTALLATION ELECTRICAL CHECK.

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
DOWNIE-4397	SR	1	1	N	Y

RESP SUPERVISOR:	DEFICIENCY REPORTS INITIATED	
LOWRY	___ ___ ___ RWK ___ ___ ___	PLN JOB: 040085 AUTH NO: A42231
START DATE: 24FEB88	SERIAL NO. UPDATE: 449-510F091G03	ACCT NO: E530010 PRG PLN: I00010

WORK STANDARDS: IC 1.4.003 / PSBP 304982

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: [signature] DATE: 2-24-88 TIME: 0800

DESCRIPTION OF WORK PERFORMED: Crimped connectors on new mag jack 2-24-88 RK
Reassembled assembled mag jack - STAT to Gnd 50,000M LIFT to Gnd 50,000M
MOV to Gnd 50,000M RK. Performed polarity checks on Coils
checks sat.

M+TE EQUIPMENT USED:
Line 4MDA-4KR crimper SA-MNT-713 (Connector PO# 102770)
Daniels AFR crimper SA-MNT-715
Fluke SA IEC-573 SA IC 572 PK SA IEC 561

CAUSE:

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK	DATE	ACTUAL MANHOURS
[signature]	2-25-88	MANPOWER: TIC 2
SIGNATURE WORK SUPERVISOR	DATE	
Bill Lowry	3/3/88	DURATION: 16

[redacted]

SECTION 1 - TASK DESCRIPTION

ORIGINAL

UNIT	PRI	[redacted]	W/O SUMMARY
S1	B	[redacted]	SPARE MAG-JACK/OPERABILITY/ELECTRICAL CHECKS.

COMPONENT ID: [redacted] SERIAL NBR:
1 ROD CONTROL SHUTDOWN BANK A ROD 1SA2 GRID D12 POSITION TMTR
LOCATION : 04100064 #2 WAREHOUSE AREA YRD
ACT DESCPT: SPARE MAG JACK/OPERABILITY/ELECTRICAL CHECKS.
PERFORM NECESSARY ELECTRICAL CHECKS ON SPARE MAG-JACK ASSEMBLY TO DETERMINE UNIT OPERABILITY.
TO BE USED AS REPLACEMENT FOR 1SA2 LOCATION D12

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
DOWNIE-4397	NSR	N	3	N	N

RESP SUPERVISOR: LOWRY

DEFICIENCY REPORTS INITIATED: N/A

START DATE: 19FEB88

SERIAL NO. UPDATE: N/A

PLN JOB:
AUTH NO:
ACCT NO: E530010
PRG PLN: I00011

WORK STANDARDS: IC 1.4.003

SECTION 3 - ACTIVITY PERFORMANCE

N/S PERMISSION TO BEGIN WORK: [signature] DATE: 2-19-88 TIME: 1245

DESCRIPTION OF WORK PERFORMED: RESISTANCE CHECKS ACROSS COILS ARE LIFT COIL (1TO4) = 1.45Ω, STATIONARY COIL (2TO5) = 8.99Ω, AND MOVABLE COIL (3TO6) = 8.78Ω. ALL COILS READ 10,000 MΩ TO GROUND. MAG JACK IS PRESENTLY IN TGA 2 100' EL.

M+TE EQUIPMENT USED: SA-[illegible]-028; SA-[redacted]-504

CAUSE:

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK	DATE	ACTUAL MANHOURS
[signature]	2-19-88	MANPOWER: T/C
SIGNATURE WORK SUPERVISOR	**DATE**	DURATION: 2
Bill Lowry	2/24/88	

[redacted] NUCLEAR DEPARTMENT WORK ACTIVITY CORRECTIVE MAINTENANCE	TASK	WORK ORDER NO	ACT
	CM	880108061	19

SECTION 1 - TASK DESCRIPTION ORIGINAL

UNIT	PRI	RESP D/G	W/O SUMMARY
S1	A	[redacted]	1RCE1-CRDM WELD LEAK-INSPEC.AND REPAIR.

COMPONENT ID: 1[redacted] SERIAL NBR:
1 REACT COOL REACTOR VESSEL
LOCATION : 05130012 REACTOR VESSEL HEAD AREA CAN 1
ACT DESCPT: D-12 CRDM/MISSING LOCK WIRE/REPLACE LOCK WIRE. #2 FLUX RING IS MISSING LOCK WIRE. LOCK WIRE MUST BE REPLACED PRIOR TO INSTALLATION OF MAG JACK ASSEMBLY.

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
PANKO,R-5548	SR	1	1	N	Y

RESP SUPERVISOR: Lowry-4456
DEFICIENCY REPORTS INITIATED: RWK
START DATE: N/A
SERIAL NO. UPDATE: N/A
PLN JOB: 037269
AUTH NO: A42231
ACCT NO: E530010
PRG PLN: I00010

AMP # 180

WORK STANDARDS: IC 1.4.003 Vendor Manual PSBP - 304982

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: [signature] DATE: 2/9/88 TIME: 540

DESCRIPTION OF WORK PERFORMED: Installed lock wire on D-12 CRDM #2 FLUX RING. 2-9-88. AR
AS PER VENDORS MANUAL

M+TE EQUIPMENT USED: SS WIRE 304 SOFT GAGE & FOLIO 42-5130

CAUSE:

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK: S. Rankgan DATE: 2-9-88

SIGNATURE WORK SUPERVISOR: [signature] Lowry DATE: 2/24/88

ACTUAL MANHOURS
MANPOWER: TIC
DURATION: 3

05-16-1993 15:40 609 339 2749 SALEM TECH DEPT P.06

[redacted] DEPARTMENT WORK ACTIVITY
CORRECTIVE MAINTENANCE

TASK	WORK ORDER NO	ACT
CM	880108061	18

SECTION 1 - TASK DESCRIPTION

ORIGINAL

UNIT	PRI	[redacted] D/G	W/O SUMMARY
S1	A	[redacted] IC	1RCE1-CRDM WELD LEAK-INSPEC.AND REPAIR.

COMPONENT ID: [redacted] SERIAL NBR:
1 REACT COOL REACTOR VESSEL
LOCATION :
ACT DESCPT: 1RCE1-REACTOR HEAD/11 COIL STKS-MAG JKS./REMOVE ADDITIONAL STACKS. REMOVE ADDITIONAL 11 COIL STACKS-MAG JACKS TO PROVIDE ACCESS TO THE SUSPECTED FAULTY WELD AREA.
REFER TO ACT NO.8 FOR RE-INSTALLATION

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
DOWNIE-4397	SR	1	1	N	Y

RESP SUPERVISOR: LOWRY

DEFICIENCY REPORTS INITIATED: N/A

START DATE: 28JAN88

SERIAL NO. UPDATE: N/A

PLN JOB: 034620
AUTH NO: A42231
ACCT NO: E530010
PRG PLN: I00043

WORK STANDARDS: IC-14.1.001 PSBP 304982

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: M. [illegible] DATE: 1-28-88 TIME: 16[illegible]

DESCRIPTION OF WORK PERFORMED: Removed 12 Coil stacks and Mag Jacks and 6 Dummy cans. [initials] 1-29-88
12th Coil Stack Required due to Overlay Reweld on the 13th outside perimeter Space. [initials] 1/29/88 Mag Jack in Location D-12 was stuck required moly lube & 2500#'s to remove found 5" piece of flux ring lock wire inside of Mag. jack.

M+TE EQUIPMENT USED

CAUSE:

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK	DATE
[signature]	2-5-88

SIGNATURE WORK SUPERVISOR	DATE
Bill Lowry	2/24/88

ACTUAL MANHOURS
MANPOWER: T/C's 4[illegible]
DURATION: 32

[redacted] DEPARTMENT WORK ACTIVITY | TASK | WORK ORDER NO | ACT
[redacted] MAINTENANCE | [illegible] | [illegible] | 02

SECTION 1 - TASK DESCRIPTION REPRINT

[redacted] 81	[redacted]	W/O SUMMARY ROD CONTROL CABLES/REMOVAL-RECONNECT

COMPONENT ID: S [redacted] CONTROL SERIAL NBR:
COMPONENT: ID NOT FOUND ON DATA BASE
LOCATION : 01122002 NO 1 CONTROL ROOM AUX 1
ACT DESCPT: PERFORM CABLE CHECKS AND RECONNECT IN POWER CABINETS AFTER REACTOR HEAD HAS BEEN REASSEMBLED.
REINSTALL ALL 10 AMP. FUSES AND BLOWN FUSE INDICATORS.

SECTION 2 - PLANNING INFORMATION

PLANNER:	SFTY RLTD	SFTY CLASS	SEISMIC	EQ CLASS	QA REQD
PANKO,R-5548	NSR	N	N	N	N

RESP SUPERVISOR: HOUSE
DEFICIENCY REPORTS INITIATED: N/A
PLN JOB: 030303
AUTH NO: A42231
ACCT NO: E530010
PRG PLN: I00010
START DATE: 11FEB88
SERIAL NO. UPDATE: N/A

WORK STANDARDS: IPD 5.2.002 / 1.4.003

SECTION 3 - ACTIVITY PERFORMANCE

S/S PERMISSION TO BEGIN WORK: [signature] DATE: 2-11-88 TIME: 0500

DESCRIPTION OF WORK PERFORMED: Performed cable checks. Found 1C2 and 1SA2 checked below spec. Activity added to this work order to address further cable check and repair. Note: 1C2 and 1SA2 passed resistance check, failed megger check.

M+TE EQUIPMENT USED: SA [illegible] -123
STEC - 467

CAUSE:

SECTION 4 - CLOSE OUT

SIGNATURE PERSON COMPLETING WORK: [signature] Bill Lowry DATE: 2-16-88

ACTUAL MANHOURS
MANPOWER: 2 TK
DURATION: 16

SIGNATURE/WORK SUPERVISOR: Bill Lowry DATE: 2/24/88

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SLAVE CYCLER STATIONARY DECODER - GO2 (LOGIC CABINET)	0079	TB2	FAILURE -- HIGH ELECTRICAL STRESS DUE TO VOLTAGE TRANSIENT ASSOCIATED WITH STEP COUNTER BACK EMF WESTINGHOUSE ANALYSIS SHOWED RESISTIVE SHORT 200 OHMS - Z2 PIN 9 TO GND (SUBSTRATE FAILURE) Z1 SHOWED 2uA @10v BETWEEN PIN 5 TO GND (5 MEGOHMS). SPECIFICATIONS ARE 2uA AT 16v (8 MEGOHMS).	5/28/93 2:26 AM - REMOVED FROM A501, TESTED BAD ON TEST RIG.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SLAVE CYCLER MOVABLE DECODER GO3 (LOGIC CAB)	0080	TB2	FAILURE -- HIGH ELECTRICAL STRESS DUE TO VOLTAGE TRANSIENT SIMILAR TO ELECTROSTATIC DISCHARGE PRELIMINARY ANALYSIS FROM MOTOROLA (6/16 PM) SHOWS A FAILURE ON PIN 1 OF Z2	5/28/93 - REMOVED FROM A511, TESTED BAD ON TEST RIG.
FIRING CARD (POWER CAB)	0395	I&C SHOP	INTERMITTENT FAULT, TP5 INDICATED NO "PUSH" OF A PUSH-PULL AMPLIFIER. BENCH TESTED SAT, COULD NOT DUPLICATE FAILURE	5/30/93 - REMOVED FROM SLOT D1 OF POWER CABINET. INTERMITTENT FAILURE.
REGULATION CIRCUIT GRIPPER (POWER CAB)	297	I&C SHOP	SOLDER RUN DEGRADATION SHORTING THREE TRACES TOGETHER (Vcoil - Vdemand - Verr)	5/30/93 - REMOVED FROM SLOT F1. PART OF THE INTERMITTENT FAILURE CIRCUIT. REPLACED FOR RELIABILITY.

ITEM NUMBER AIT-ROD-004
DATE 6/16/93

NRC INSPECTION
QUESTION/RESPONSE TRACKING FORM

INSPECTION SUBJECT ________

INSPECTION NUMBER ________

NRC INSPECTOR S. BARR PSE&G CONTACT D. BEST

SYSTEM ________ COMPONENT ________

QUESTION: Provide drawing of lift rod and grippers, showing mechanical dimensions and tolerances. A force diagram of the above components, i.e. showing lift force of lift coil and spring/coil forces acting on movable + stationary grippers

RESPONSE:

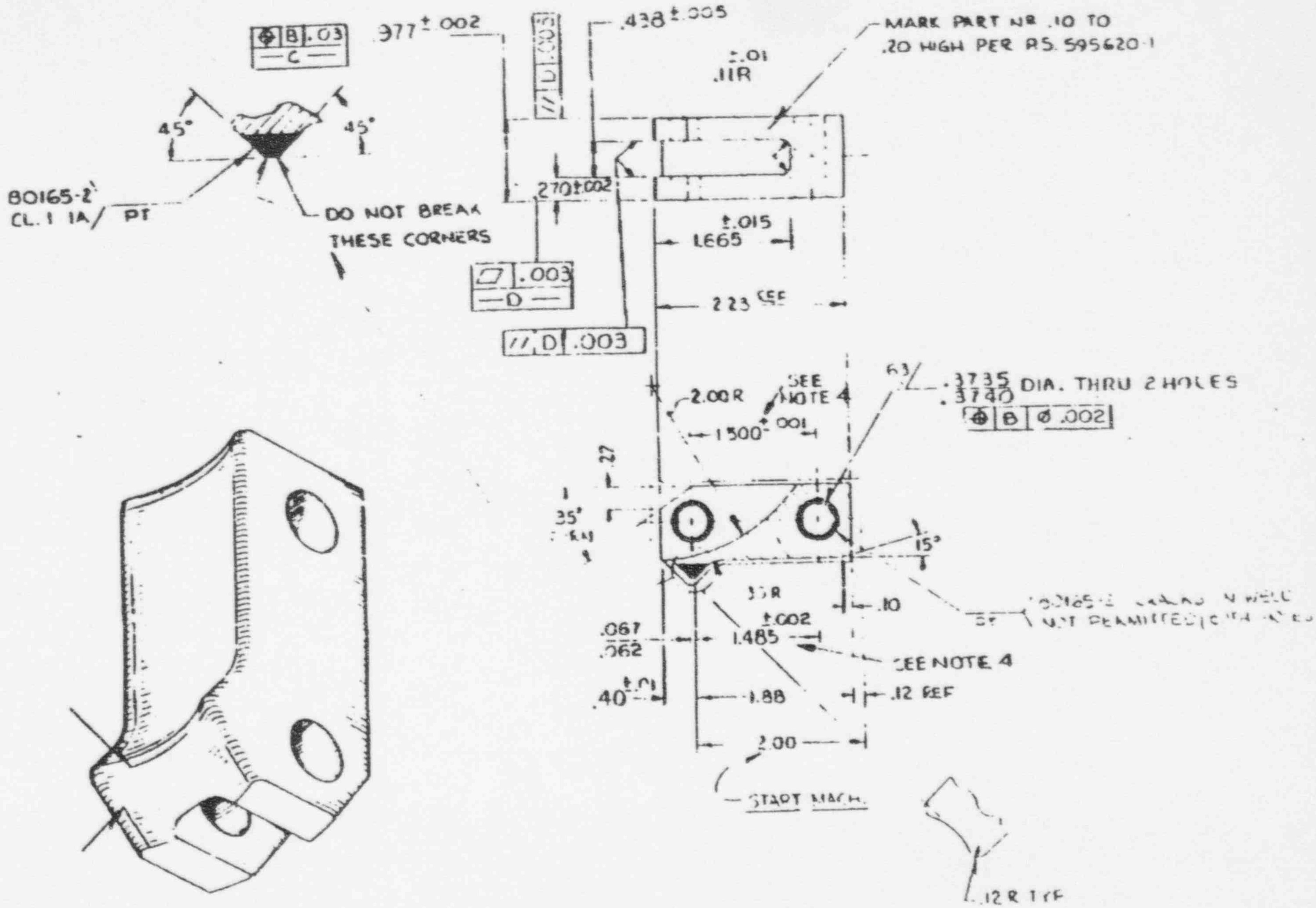
PSE&G CONTACT (*) David J Best DATE 6-17-93

NRC ACKNOWLEDGEMENT ________ DATE ________

RESPONSE ACCEPTED BY NRC (Y/N) ________

* If response involves a commitment, have PSE&G Audit Manager sign as PSE&G contact.

M17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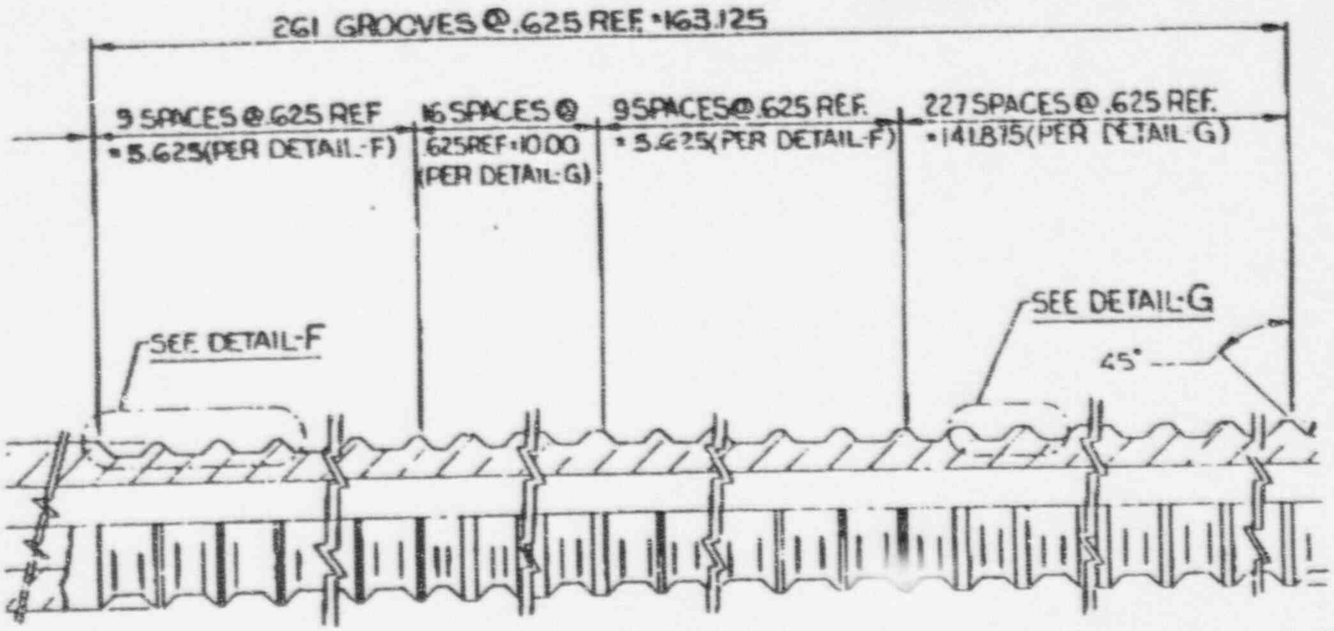
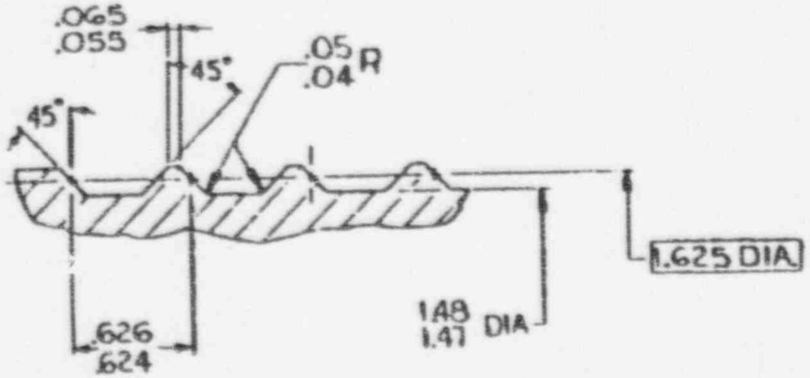
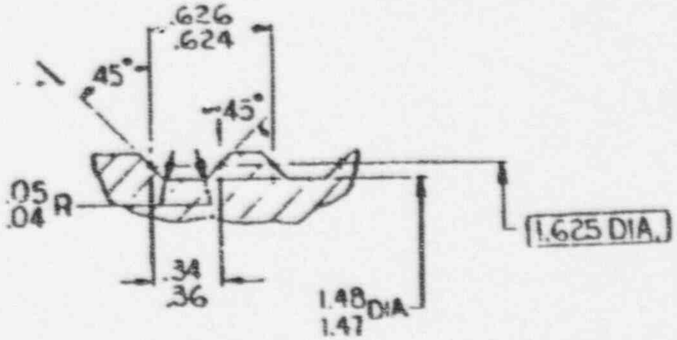
.438 ± .005
MARK PART NR .10 TO
.20 HIGH PER RS 595620-1
±.01
.11R
45°
45°
B0165-2
CL. 1 1A/ PT
DO NOT BREAK
THESE CORNERS
.270±.002
±.015
1.665
2.23 SEE
// D .003
2.00R
SEE
NOTE 4
1.500 ± .001
.3735
.3740 DIA. THRU 2 HOLES
.27
35°
15°
.10
±.002
1.485
.067
.062
SEE NOTE 4
.40 ±.01
1.88
.12 REF
2.00
START MACH.
.12 R TYP





DETAIL-F



DETAIL-G

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SLAVE CYCLER STATIONARY DECODER - GO2 (LOGIC CABINET)	0079	TB2	FAILURE -- HIGH ELECTRICAL STRESS DUE TO VOLTAGE TRANSIENT ASSOCIATED WITH STEP COUNTER BACK EMF WESTINGHOUSE ANALYSIS SHOWED RESISTIVE SHORT 200 OHMS - Z2 PIN 9 TO GND (SUBSTRATE FAILURE) Z1 SHOWED 2uA @10v BETWEEN PIN 5 TO GND (5 MEGOHMS). SPECIFICATIONS ARE 2uA AT 16v (8 MEGOHMS).	5/28/93 2:26 AM - REMOVED FROM A501, TESTED BAD ON TEST RIG.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SLAVE CYCLER MOVABLE DECODER GO3 (LOGIC CAB)	0080	TB2	FAILURE -- HIGH ELECTRICAL STRESS DUE TO VOLTAGE TRANSIENT SIMILAR TO ELECTROSTATIC DISCHARGE PRELIMINARY ANALYSIS FROM MOTOROLA (6/16 PM) SHOWS A FAILURE ON PIN 1 OF Z2	5/28/93 - REMOVED FROM A511, TESTED BAD ON TEST RIG.
FIRING CARD (POWER CAB)	0395	I&C SHOP	INTERMITTENT FAULT, TP5 INDICATED NO "PUSH" OF A PUSH-PULL AMPLIFIER. BENCH TESTED SAT, COULD NOT DUPLICATE FAILURE	5/30/93 - REMOVED FROM SLOT D1 OF POWER CABINET. INTERMITTENT FAILURE.
REGULATION CIRCUIT GRIPPER (POWER CAB)	297	I&C SHOP	SOLDER RUN DEGRADATION SHORTING THREE TRACES TOGETHER (Vcoil - Vdemand - Verr)	5/30/93 - REMOVED FROM SLOT F1. PART OF THE INTERMITTENT FAILURE CIRCUIT. REPLACED FOR RELIABILITY.

June 16, 1993

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS.

DESCRIPTION	WSN	PRESENT STATUS	FAILURE	REMARKS (REPAIR & INTALLATION)
SUPERVISORY DATA LOGGING (LOGIC CABINET)	183	A114	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RESTEST - BENCH TEST, ROD MOVEMENT	5/16/93 - REMOVED FROM A113. REPAIRED ??? 5/31/93, 13:00 - INSTALLED IN A114. 13:30 - CBA GRP 2 NOT MOVING, REPLACED Z3. REINSTALLED TO A114. 6/3/93 3:50 AM - P/A CONVERTER AND PLANT COMPUTER FAILED TO INDICATED FOR CBB, SBB, REPLACED Z13. RETEST SAT.

6/16/93

SUPERVISORY DATA LOGGING (LOGIC CABINET)	216	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RESTEST - STEPPING OF CBB, CBD, AND SBB STEP COUNTERS, REMOVED FROM SYSTEM 5/31	5/16/93 - INSTALLED IN A114 REPLACED Z3. 5/27/93, 8:40AM - REMOVED FROM A114, REPLACED Z2,Z5, Z3. 15:30 - REINSTALLED TO A114. 5/31/93, 10:45 - REMOVED FROM A114 AND BENCH TESTED, REPLACED Z3.
SUPERVISORY DATA LOGGING (LOGIC CABINET)	217	???	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RESTEST - STEPPING ALL RODS TO 228 STEPS, REMOVED FROM SYSTEM 5/24	5/16/93 - INSTALLED IN A113. REPLACED Z8, Z9, Z12. 5/24/93 - REMOVED FROM A113. REPAIR ????

SUPERVISORY DATA LOGGING (LOGIC CABINET)	6014	A113	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RESTEST - STEPPING OF STEP COUNTERS TO 228, B.O. TEST, RETEST WITH ROD MOVEMENT 6/3	5/24/93 - INSTALLED IN A113 5/26/93 - REMOVED FROM A113 REPLACED Z3 & Z6. INTALLED BACK TO A113. REPLACED Z2, Z5 & Z8. REINSTALLED TO A113. REMOVED FROM A113, REPLACED Z2, Z5 & Z6. REINSTALLED TO A113. REMOVED FROM A113 AND TAKEN TO TRAINING CENTER FOR TESTING. FOUND Z3 BAD. REPLACED Z3, RETEST SAT. 5/27/93 - INSTALLED IN A113. RESTEST SAT. MOVE CBA, CBC GRP1 NO PULSE. REPLACED Z3 & Z6. REINSTALLED TO A113. 5/31/93, 10:45 REMOVED FROM A113 AND BENCH TESTED, REPLACED Z3 & Z5, RETEST SAT. REINSTALLED TO A113. 13:30 - CBA GRP2 NOT

SUPERVISORY DATA LOGGING (LOGIC CABINET)	0039	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/14	5/26/93 - INSTALLED IN A113. REMOVED FROM A113, REPLACED Z3, Z2, Z8. INSTALLED IN A113 AGAIN. REPLACED Z2. FAIL AGAIN, REPLACED Z2 & Z3. INSTALLED IN A113, REMOVED FROM A113 AND TAKEN TO TRAINING CENTER FOR TESTING, FOUND Z3 BAD. REPLACED Z3, RETEST SAT. 5/27/93 - REINSTALLED IN A113. FAILED AGAIN, REMOVED FROM A113 REPLACED Z3. INSTALLED IN A114, MOVE ROD FOR CBB NO PULSE, REPLACED Z3. RETEST SAT. 15:30 - REMOVED FROM A114, REPLACED Z3.

I/O RELAY DRIVERS (LOGIC CABINET)	132	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/14	5/16/93 - REMOVED FROM A713. 5/28/93 - BENCH TESTED FOUND CR1, CR5, & CR9 SHORTED. REPLACED THE SHORTED DIODES, RETEST - SAT.
I/O RELAY DRIVER (LOGIC CABINET)	139	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/14	5/16/93 - REMOVED FROM A714. 5/28/93 - BENCH TESTED FOUND CR1 SHORTED - REPLACED CR1, RETEST - SAT.

I/O RELAY DRIVER (LOGIC CABINET)	120	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/27	5/16/93 - INSTALLED IN A713. 5/26/93 - REMOVED FROM A713. 23:50 - INSTALLED IN A713. 5/27/93 5:00 AM - REMOVED FROM A713. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1, CR9, CR17 SHORTED. REPLACED SHORTED DIODES, RETEST - SAT.
I/O RELAY DRIVER (LOGIC CABINET)	133	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/26	5/16/93 - INSTALLED IN A714. 5/26/93 - REMOVED FROM A714. SUSPECTED BAD INPUT DIODE. 6/9/93 - BENCH TESTED FOUND Q10 OPEN.

I/O RELAY DRIVER (LOGIC CABINET)	695	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/26	5/26/93, 2:00AM - NEW FROM FOLIO, INSTALLED TO A714. 8:00 AM - REMOVED FROM A714. INSTALLED IN A714. 23:50 - REMOVED FROM A714. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1 SHORT, REPLACED CR1 - RETEST SAT.

I/O RELAY DRIVER (LOGIC CABINET)	681	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/27	5/26/93 - NEW FROM FOLIO, INSTALLED TO A714. SWAPPED WITH S/N 695 - NO CHANGE. RESTORED TO A714. REMOVED FROM A714 AND INSTALLED IN A713. 23:50 - INSTALLED IN A714. 5/27/93, 5:00 AM - REMOVED FROM A714. SUSPECT BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR5, CR17 SHORTED. REPLACED CR5, CR17 - RETEST SAT.

I/O RELAY DRIVER (LOGIC CABINET)	701	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/26	5/26/93, 8:00 AM - NEW FROM FOLIO, INSTALLED TO A713. REMOVED FROM A713. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1 SHORT. REPLACED CR1, RETEST SAT.
I/O RELAY DRIVER (LOGIC CABINET)	345	A713	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/31	RETRIEVED FROM TRAINING CENTER, AND INSTALLED TO A713.

SLAVE CYCLER STATIONARY DECODER - GO2 (LOGIC CABINET)	0079	TB2	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE. RESISTIVE SHORT 200 OHMS - PIN 9 TO GND, 2uA @10v BETWEEN PIN 5 TO GND. SPECIFICATIONS 2 uA AT 16v.	5/28/93 2:26 AM - REMOVED FROM A501, TESTED BAD ON TEST RIG.
SLAVE CYCLER MOVABLE DECODER GO3 (LOGIC CAB)	0080	TB2	AWAITING ANALYSIS FROM MOTOROLA. FRELIMINARY ANALYSIS SHOWS FAILURE IS THE RESULT OF HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE	5/28/93 - REMOVED FROM A511, TESTED BAD ON TEST RIG.
FIRING CARD (POWER CAB)	0395	I&C SHOP	INTERMITTENT FAULT, TP5 INDICATED NO "PUSH" OF A PUSH-PULL AMPLIFIER. BENCH TESTED SAT, COULD NOT DUPLICATE FAILURE	5/30/93 - REMOVED FROM SLOT D1 OF POWER CABINET. INTERMITTENT FAILURE.

Not catastrophic failure

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REGULATION CIRCUIT GRIPPER (POWER CAB)	297	I&C SHOP	SOLDER RUN DEGRADATION SHORTING THREE TRACES TOGETHER	5/30/93 - REMOVED FROM SLOT F1. PART OF THE INTERMITTENT FAILURE CIRCUIT. REPLACED FOR RELIABILITY.
I/O AC AMPLIFIER (LOGIC CAB)	144	A803 -- A814	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93, 2:45 AM - BENCH TESTED SAT. INSTALLED IN A803. 19:51 - REMOVED FROM A803, REPLACED Q13, Q14 - STILL DEFECTIVE. REPAIRED ???
I/O AC AMPLIFIER (LOGIC CAB)	142	A814	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93 - BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A814.

I/O AC AMPLIFIER (LOGIC CAB)	147	A808 -- SPARE	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93 - BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A808.
I/O AC AMPLIFIER (LOGIC CAB)	149	A812 -- A808	HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93 - REMOVED FROM A812 BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A812.
I/O AC AMPLIFIER (LOGIC CAB)	150	A813 -- SPARE	HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93 - REMOVED FROM A813, BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A813.

I/O AC AMPLIFIER (LOGIC CAB)	107	A802	HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	
I/O AC AMPLIFIER (LOGIC CAB)	121	A801	HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	
I/O AC AMPLIFIER (LOGIC CAB)	108	A804	HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	

I/O AC AMPLIFIER (LOGIC CAB)	0660	A805	HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	
I/O RECEIVER (LOGIC CAB)	28	A809	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RESTEST - BENCH TEST, ROD MOVEMENT SINCE [illegible] 31	5/30/93 - REMOVED FROM A809, BENCH TESTED FOUND DEFECTIVE, REPLACED Q12. REINSTALLED TO A809.
SLAVE CYCLER LOGIC (LOGIC CAB)	80	I&C SHOP	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/31/93 21:35 - REMOVED FROM A514; BENCH TESTED UNSAT. FOUND PIN 8 LOW, SHOULD BE HIGH (12.5 - 15 VDC).

P/O BANK OVERLAP LOGIC (LOGIC CAB)	14	I&C SHOP	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RESTEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	6/01/93 19:10 - REMOVED FROM A207, BENCH TESTED UNSAT. FOUND PIN 10 LO SHOULD BE HIGH (12.5 - 15 VDC).
100 POWER POWER SUPPLY (LOGIC CAB)			REPLACED 100V POWER POWER SUPPLY BECAUSE IT WAS READING 113V AS PROACTIVE STEP	5/26/93 - REPLACED 100VDC AUX POWER POWER SUPPLY
FUSES (POWER CABINET)			FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY	5/30/93 - REPLACED 2 FUSES, F11, F6. 6/9/93 - BENCH TESTED INCONCLUSIVE.
AUCTIONEER DIODE (LOGIC CAB)			FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY	5/30/93 - REPLACED 1 NEGATIVE 15 VDC AUCTIONEER DIODE (SHORTED). 6/9/93 - BENCH TESTED FOUND AUCTIONEER DIODE SHORTED.
LOW VOLTAGE POWER POWER SUPPLY FILTERS			REPLACED AS A PRECAUTIONARY MEASURE	5/30/93 - REPLACED 2 FILTERS, A16 FL1 & FL2

Engineering Evaluation S-C-RCS-EEE-0822

JUSTIFICATION FOR SGS UNITS 1 AND 2 RESTART AND OPERATION

ROD CONTROL SYSTEM FAILURES

APPROVALS:

Kent M. O'Hara / W McTigue	6/15/93 / 6/15/93
Prepared By	Date
TK Ross	6-15-93
Reviewer	Date
RS Kent / E. S. Rosenfeld	6/15/93
Manager - Nuclear Fuels	Date
[signature]	6/15/93
Nuclear Electrical Engineering Manager	Date
Philip J. O'Donnell	6/15/93
Salem Operations Manager	Date
[signature] 93-053	6/15/93
SORC Chairman	Meeting #
[signature]	6/15/93
General Manager - Salem Operations	Date

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JUSTIFICATION FOR SGS UNITS 1 AND 2 RESTART AND OPERATION

ROD CONTROL SYSTEM FAILURES

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JUSTIFICATION FOR SGS UNITS 1 AND 2 RESTART AND OPERATION

ROD CONTROL SYSTEM FAILURES

1.0 INTRODUCTION

A failure in the Salem Generating Station (SGS) Unit 2 Rod Control System has been recently identified, which, coincident with a rod motion command, could result in abnormal operation of the Rod Cluster Control Assemblies (RCCA's).

On May 27, 1993, a failure in the rod control system caused a single rod to withdraw from the core 15 steps while the operator was applying a rod insertion signal. The failure, an integrated circuit on a slave cycler decoder card, disrupted the normal sequence of pulses that the rod control system sends to the rods in the selected bank. Normally on insert demand, the pulses are staggered in a sequence that leads to rod insertion. With the failure, the rod control system periodically sent simultaneous pulses to the movable gripper coil, lift coil, and stationary coil for each of the rods in the selected bank. Under these conditions, based on the preliminary investigation, each rod in the bank may either remain where it is or withdraw from the core when a rod movement demand occurs. When the rod control system is in the automatic mode of operation, a rod movement demand is generated automatically in response to changes in the turbine load and changes in the average reactor coolant temperature. Rod movement then occurs without any operator action until the demand is satisfied. When the rod control system is in the manual mode of operation, a rod movement demand is generated only in response to operator manipulation of the raise-lower pushbuttons, given no failures in the demand circuit. true

The identified failure could potentially result in operation of the plant outside the design basis. Evaluation of the identified failure in accordance with 10 CFR 50.59 (Ref.8) has concluded that this potential single failure would be an Unreviewed Safety Question. The purpose of this evaluation is to ensure safe restart and continued operation of Salem Units 1 and 2 with the Rod Control System placed in the manual mode given the potential for this failure to occur.

The Salem Generating Station (SGS) Updated Final Safety Analysis Report (UFSAR) Sections 4.3 and 15.3.5.1 presently state that multiple failures would be required for a single rod withdrawal to occur. The single rod withdrawal event is generally treated as an ANSI N18.2 Condition III event (Infrequent Faults), for which the acceptance criteria allow a small percentage of fuel failure based on a low probability of occurrence.

The basis for this justification includes an evaluation of the licensing basis safety analyses to account for the effects of the identified failure. This evaluation conservatively demonstrates that no fuel design limits are exceeded for the affected transients, which is consistent with Condition II events (Events of Moderate Frequency), and 10CFR50 Appendix A, General Design Criterion (GDC) 25.

This safety analysis evaluation is predicated on the following:

- The failure does not affect the ability of the Reactor Protection System to perform its intended safety function. Reactor trip is not affected by the Rod Control System logic.

- The failure is detectable based on periodic surveillance testing and control operator verification of rod position. Although this failure is detectable with the rod control system in automatic, manual operation and modified surveillance testing during subcriticality provide further assurance of detecting the failure. Detectability and its significance relative to the safety analyses is discussed further in Section 4.0.

- Although not credited in the analysis, alarms, administrative controls and compensatory measures implemented specifically in response to this event (Section 6.0) provide further assurance that the discovered failure will not result in any consequences adverse to public health and safety.

- This evaluation bounds all of the possible rod movements described in Section 2.0

This justification for restart and operation conservatively assumes that the Rod Control System is placed in the manual mode of operation.

In light of continuing activities, this justification for restart and operation is an interim document. Further investigations are underway to pursue long term resolution of the issue. Likewise, analyses are continuing to demonstrate the acceptability for Rod Control operation in the automatic mode as well as the manual mode. In addition, industry initiated investigations may provide additional insights. As these activities yield conclusive results, this justification for restart and operation will be revised to reflect the most current information and analyses.

2.0 DESCRIPTION OF ROD CONTROL SYSTEM FAILURE MODES

On May 27, 1993, a failure in the rod control system caused a single rod to withdraw while the operator applied a rod insertion motion command to the Shutdown Bank A (SDBA). The remainder of the SDBA RCCA's remained stationary. The rod withdrawal was observed by the operator on the Individual Rod Position Indicator.

The Rod Control System logic is designed to provide an insertion or withdrawal direction command to the selected rod bank(s). The direction command establishes the sequence of Control Rod Drive Mechanism (CRDM) coil operation. When combined with a motion command, the direction command is designed to result in the proper number and sequence of RCCA steps. It is now known that a card failure in the rod control system logic can result in an undesired "insert" or an undesired "withdraw" direction command.

It has been determined that the logic failure could result in rod motion only if a rod motion command exists. The following rod movements are possible, given the presence of the discovered failure coincident with a motion command (Ref. 6):

1. Case 1 - Single failure that gives an insert direction command.

   When a rod insertion motion command is given, all rods in the selected bank(s) will insert normally.

   When a rod withdraw motion command is given, each rod in the selected bank(s) may either not move, or may withdraw. No rod will be capable of stepping in.

2. Case 2 - Single failure that gives a withdraw direction command.

   When a rod insertion motion command is given, each rod in the selected bank(s) may either not move, or may withdraw. No rod will be capable of stepping in.

   When a rod withdraw motion command is given, all rods in the selected bank(s) will withdraw normally.

3. Case 3 - A single gate failure that result in insertion and withdraw direction commands being present. (This is the case that existed in Salem Unit 2.)

   Irrespective of whether an insertion or withdraw command is given, each rod in the selected bank, or banks if in overlap, may either not move, or may withdraw. No rod will be capable of stepping in.

For each of these cases the logic failure does not affect the reactor trip function.

3.0. DISCUSSION OF SALEM LICENSING BASIS

A potential single failure that could cause a single or multiple rod withdrawal event without an urgent failure alarm involves a change to the current licensing basis for Salem Units 1 and 2. The scope of the proposed change is limited to operation with the Rod Control System placed in the manual mode.

UFSAR Section 15.3.5.1 states that a single RCCA withdrawal at power would result in an "urgent failure" and a rod "deviation alarm" on the control room console. An "urgent failure" annunciates in the control room and inhibits further rod withdrawal through the affected cabinet. During the actual failure, a "deviation alarm" was generated but an "urgent failure" was not received. Evaluation has concluded that for the experienced failure, the conditions for an "urgent failure" alarm were not satisfied. That is, the "urgent failure" should not have (and did not) actuate. No credit is taken in the safety analyses for the "urgent failure" alarm or its termination of rod movement. As discussed in Section 6.2, operators have been briefed that abnormal rod movement may occur without resulting in an "urgent failure" alarm.

UFSAR Sections 4.3 and 15.3.5.1 describe single rod withdrawal events, based on the assumption that multiple failures would be required for a single rod withdrawal to occur. Multiple rod withdrawals are not considered in the present SNGS licensing basis (except for the bank withdrawal events).

UFSAR Section 15.3.5.1 classifies the single RCCA withdrawal at power accident as an ANSI N18.2 Condition III Event (Infrequent Fault). This classification is based on the assumption that multiple independent equipment failures are required for a single RCCA withdrawal to occur. The current UFSAR RCCA withdrawal at power analysis indicates, based on F-delta-H calculations, that localized Departure From Nucleate Boiling would result. This is consistent with acceptance criteria for Condition III events (i.e., a small fraction of fuel may exceed its design limits). Based on the assumption that a single failure of the rod control system may cause a single or multiple RCCA withdrawal event to occur, the RCCA withdrawal at power events have been conservatively evaluated, based on explicit DNBR calculations, against the criteria for a Condition II event. This is accomplished by demonstrating that the Departure From Nucleate Boiling Ratio (DNBR) limit is not exceeded and, therefore, fuel design limits are maintained.

Per UFSAR Section 3.1, SNGS is committed to the intent of the General Design Criteria (GDC) of 10 CFR 50 Appendix A. General Design Criterion 25 states: "The protection system shall be designed to assure that specified acceptable fuel design limits are not exceeded for any single malfunction of the reactivity control systems, such as accidental withdrawal (not ejection or dropout) of control rods."

Based on the previous assumption that multiple independent failures would be required to have a single rod withdrawal event, GDC 25 compliance is addressed in the UFSAR (Section 4.3.1.4 and 15.2) by demonstrating that a rod bank withdrawal would not result in exceeding any fuel design limits. The new assumption that a potential single failure can cause misoperation of a single or multiple RCCAs necessitates a reevaluation of compliance with GDC 25. The analyses summarized in Section 5.0 ensured continued compliance with GDC 25.

4.0 ROD CONTROL SYSTEM SINGLE FAILURE ASSUMPTIONS/DETECTABILITY

Consistent with Westinghouse safety analysis methodology, control systems are not assumed to mitigate any UFSAR Chapter 15 transient. Random single failures of control systems are not considered provided they are detectable during normal operation or surveillance testing. This is based on the low probability of an initiating event coincident with a random single failure.

For the purposes of evaluating the UFSAR Chapter 15 safety analyses, the identified rod control system logic failure is defined as a detectable failure, based on the following.

The logic failure does not affect individual rod position indication, which is a direct measurement of the rods physical location. Therefore, comparison of the group step demand counter with the individual rod position indication is a means of verifying that the rods have responded per the motion command. Technical Specification Surveillance 4.1.3.1.2 is applicable in MODES 1 and 2. It requires each full length rod not fully inserted in the core, to be moved at least 10 steps in either direction at least once per 31 days. The surveillance procedure requires an insertion of between 10 and 20 steps of motion, followed by a comparison of group step counter indication and individual rod position indication. The procedure then requires a withdrawal to the original position, followed by a final comparison of group step counter indication and individual rod position.

Technical Specification surveillance 4.1.3.2.2 is applicable in MODES 3, 4, and 5, with the reactor trip system breakers in the closed position. It requires at least 10 steps of rod motion to verify that group step counter indication is consistent with the individual rod position. This test is required every 31 days for each bank that is not fully inserted.

Prior to each startup, a modified surveillance test will be performed at SNGS 1 and 2, to ensure that the failure does not exist. The test will be performed for all shutdown and control banks, and will begin from the fully inserted position (although Technical Specifications do not require testing for fully inserted banks). Each bank will be tested after the trip breakers are closed and the rod drive motor-generator sets are energized, prior to withdrawing the banks for startup. The test will be performed by sequentially withdrawing and inserting each of the shutdown and control banks a minimum of ten steps, with the operator verifying that individual rod position matches group demand. While the test is being performed, current order traces will be taken from the logic cabinet. These traces will indicate abnormalities if the failure is present. If the failure is present, the condition will be corrected and evaluated prior to commencing startup.

During normal surveillance testing, the only way the test would not detect the failure in the logic would be if all rods (i.e., all shutdown and control banks) operated normally despite the presence of an undesired insert direction command. If this is the case, the logic failure has no adverse affect on rod motion. Therefore, normal 31 day surveillance testing is capable of detecting the ability of a logic failure to adversely affect rod motion.

The failure is also detectable during normal rod control system operation. The control operator compares the individual rod position indication to the demand counter whenever rods are moved. In accordance with the control room logs, individual rod position indication is also compared to group step demand once every four hours when the rod deviation alarm is inoperable. In the unlikely event the control operator does not detect a misalignment during rod motion with the failure present, it can be observed during this four hour check, subsequent to the rod motion that caused the misalignment.

Detectable control system failures are typically assumed to initiate events of moderate frequency. As a result, the rod control system single failure of concern in these events is considered to be an initiating event. However, as a detectable failure, the rod control system single failure of concern need not be considered in addition to, or instead of, the protection system single failure assumed in any of the UFSAR Chapter 15 safety analyses.

5.0 SAFETY ANALYSES

I SAR Chapter 15 accident events were examined for adverse impact resulting from the postulated rod control system single failure. Based on this review the only events that are potentially impacted are Rod Ejection (UFSAR Section 15.4.7), RCCA Misalignment (Dropped Rod) (UFSAR Section 15.2.3), Single RCCA Withdrawal At Power (UFSAR 15.3.5), Uncontrolled Boron Dilution (UFSAR Section 15.2.4), RCCA Bank Withdrawal At Power (UFSAR Section 15.2.2) and RCCA Bank withdrawal From Subcritical (UFSAR Section 15.2.1). In addition, a multiple asymmetric RCCA withdrawal both at power and from subcritical has been evaluated based upon the postulated failure scenario.

5.1 Key Assumptions

Based on the PSE&G and Westinghouse investigations into the effects of the identified failure summarized above, the evaluations of the UFSAR accident events are based on the following key assumptions:

Alarm Response - Consistent with the present UFSAR analysis assumptions, no analyses performed for this evaluation take additional credit for any alarms that may occur. The RCCA static misalignment event continues to credit Technical Specification 3/4.1.3.1, which prescribes surveillances and corrective measures for misaligned rods.

Single Failure of Control Systems - The identified rod control system logic failure that may cause single or multiple rod withdrawal has not been considered in addition to (or instead of) the protection system single failure assumed in any of the UFSAR Chapter 15 accident analyses. As a detectable failure (See Section 4.0), it is not assumed to pre-exist at the onset of any transient.

RCCA position will be maintained consistent with reactor coolant system Tavg measurements, within the rod speed controller deadband of +/-1.5 degree F of reference Tavg, consistent with the Precautions, Limitations, and Setpoints Document (Ref. 11).

Reactor Protection System Functions - No RPS functions are adversely affected by the identified rod control system logic failure.

Technical Specifications - The present Technical Specification Limiting Conditions of Operation (e.g., Power Distribution Limits, Rod Insertion Limits) establish the initial conditions for the evaluated transients.

5.2 Evaluation Results

5.2.1 Rod Ejection

As described in UFSAR Section 15.4.7, a rod ejection is caused by a mechanical failure of the control rod drive mechanism (CRDM) pressure housing which results in the instantaneous ejection of an RCCA and drive shaft. Neither single nor multiple failures in the rod control system can initiate a rod ejection event. Therefore, the UFSAR analysis and conclusions are unaffected and remain valid considering the postulated single failure which may cause erratic RCCA withdrawal.

5.2.2 RCCA Misalignment

UFSAR Section 15.2.3 describes the Condition II events of static misalignments and dropped RCCAs, groups, and banks. The static misalignment is not a concern given this failure since the Salem Technical Specifications prescribe recovery actions for a static misalignment. Since inadvertent RCCA insertion is not a consequence of this failure, there is no impact on the UFSAR dropped RCCA analyses. Any dynamic misalignments would continue to be addressed and bounded by the current dropped RCCA analyses presented in this UFSAR section.

In summary, this single failure will not result in any RCCA misalignment (static or dynamic) which is worse than that already analyzed for the Salem licensing basis.

5.2.3 Uncontrolled Boron Dilution

UFSAR Section 15.2.4 describes the Condition II event of an uncontrolled boron dilution. The dilution will result in a positive reactivity insertion and the power and temperature will rise until the reactor reaches the overtemperature delta T setpoint. This single failure will not change the reactivity insertion rate or the time at which the overtemperature delta T trip occurs, which is obtained from the UFSAR RCCA bank withdrawal at power analysis. Therefore, the boron dilution results presented in the UFSAR remain valid.

5.2.4 RCCA Bank Withdrawal At Power (Symmetric)

UFSAR Section 15.2.2 describes the Condition II event of an uncontrolled RCCA bank withdrawal occurring at various power levels (e.g., representative cases at 10%, 60% and 100% rated thermal power). A wide range of reactivity insertion rates are assumed which bound the maximum number of RCCAs that can withdraw.

The high neutron flux and overtemperature delta T trip functions continue to provide automatic protection over the entire power and reactivity insertion ranges described in the UFSAR. The resulting minimum DNB ratios are always greater than the limit value. In summary, a single failure causing a symmetric RCCA withdrawal at all power levels is within Salem's current licensing basis and the UFSAR conclusions remain valid.

5.2.5 Single RCCA Withdrawal At Power

This event is described in UFSAR Section 15.3.5 as withdrawal of a single RCCA from the inserted D-bank at full power operation. As part of the current accident description, it is noted that no single electrical or mechanical failure in the rod control system can result in a accidental withdrawal of a single RCCA. The current UFSAR also states that in all cases it is not possible to provide assurance that the core safety limits are not violated.

It has been determined for Salem that, a potential single failure could cause a single (or multiple asymmetric) RCCA to withdraw. A single RCCA withdrawal at power has been conservatively evaluated to meet the Condition II acceptance criteria. Thus, for this transient, fuel safety limits are shown to be met by demonstrating that the DNBR limit value is met.

Based on explicit analyses performed for Salem Units 1 and 2, the single RCCA withdrawal at power event was determined to be bounded by a multiple RCCA withdrawal of two adjacent D-bank RCCAs (one from each group) at full-power. This analysis, now termed Multiple RCCA Withdrawal at Power (Asymmetric), is discussed below.

5.2.6 Multiple Asymmetric RCCA Withdrawal At Power Case

Given the potential single failure, any number of RCCAs (up to 17) can experience uncontrolled withdrawal.

1. Above 68% power, any number of the nine group 1 and 2 D-bank RCCAs could withdraw on an insert or withdraw demand. The maximum number of RCCAs which are not bounded by the RCCA Bank Withdrawal at Power analysis is 8 (one less than a complete bank withdrawal). For this scenario, the most limiting case is the withdrawal of two adjacent D-bank RCCAs (one from each group). The basis for this statement is due to the core physics response. If more than two RCCAs are withdrawn, the maximum peaking factor will be reduced as a result of the flattened power distribution.

2. Between 15% and 68% power, any combination of the nine D-bank and eight C-bank RCCAs could withdraw on an insert or withdraw signal. The maximum number of RCCAs which are not bounded by the RCCA Bank Withdrawal at Power analysis is 16 (one less than the two complete banks). Since the DNB benefit gained

by the reduction in power more than offsets the increased peaking factors, there is no combination of asymmetric withdrawals at these power levels that is more limiting than item 1 above. This has been confirmed by explicit analyses for Units 1 and 2.

3. Below 15% power, the worst scenario - all RCCAs at their insertion limits - is that any combination of the eight C-bank RCCAs and the B-bank RCCAs (4 four Unit 1 and 8 for Unit 2) could withdraw on an insert or withdraw signal. The maximum number of RCCAs which are not bounded by the RCCA Bank Withdrawal at Power analysis is 11 for Unit 1 and 15 for Unit 2 (one less than the two complete banks) Again, since the DNB benefit gained by the reduction in power more than offsets the increased peaking factors, there is no combination of asymmetric withdrawal at these power levels that is more limiting than item 1 above. This has been confirmed by explicit analyses for Units 1 and 2.

Salem Unit 1 and 2 analyses were performed to address the RCCA withdrawal at power case. The standard NRC-approved method described in WCAP-9272 was employed. A 1.08 design allowance (consistent with WCAP-7308) was made for the hot rod F-delta-H calculations. Consistent with the current licensing-basis analysis in UFSAR Section 15.3.5, no rod deviation or rod control urgent failure alarm or operator action was assumed. The analyses concluded that the DNB design basis continued to be met for the limiting case, and thus, there were no fuel failures given the rod control system failure.

In conclusion, based on the explicit analyses performed for Units 1 and 2, an asymmetric RCCA withdrawal at any power level would not result in any fuel failures at Salem. This is in compliance with GDC-25.

5.2.7 Symmetric RCCA Bank Withdrawal From Subcritical Case

UFSAR Section 15.2.1 discusses this Condition II event, the uncontrolled addition of reactivity to the reactor core caused by withdrawal of RCCAs resulting in a power excursion. This transient could be caused by a single malfunction in the rod control system at subcritical, hot zero power, or at power. The at power case is presented above in the RCCA Bank Withdrawal At Power section.

The maximum reactivity insertion rate analyzed in the UFSAR is greater than that occurring from a simultaneous withdrawal of the combination of two control banks having the maximum combined worth at maximum speed (rod speed is not affected by this failure). The neutron flux response to a continuous reactivity insertion is characterized by a very fast rise terminated by the reactivity feedback effect of the negative Doppler coefficient. This limits the power to a tolerable level during the delay time for protection action. The transient will be terminated by an automatic feature of the reactor protection system.

In summary, a single failure causing a symmetric RCCA withdrawal from subcritical or hot zero power conditions is within Salem's current licensing basis and the UFSAR conclusions remain valid.

5.2.8 Asymmetric RCCA Withdrawal From Subcritical Case

This is defined as a single or multiple asymmetric withdrawal of RCCAs from subcritical or hot zero power conditions. The rod control system is maintained in the manual mode while the reactor is subcritical. The UFSAR Section 15.2 analysis for an uncontrolled bank withdrawal is based on a single malfunction of the rod control system or control rod drive system, and shows that DNBR would remain above the design limit. It is judged extremely unlikely that any single failure could result in a spurious motion demand coincident with the direction command logic failure. However, if one were to assume that such a failure did occur and an asymmetric rod withdrawal resulted, it is reasonable to conclude that operator action would be expeditiously taken to prevent challenging fuel integrity. The worst case scenario would be for the rod withdrawal to occur at the point when the reactor is critical. At the point when the operator takes the reactor critical, motion continues with no demand (i.e., the rod direction pushbutton is released). Since rod speed is not affected by the failures, the rods step out at a rate of 48 steps per minute.

Identification would be almost immediate due to the continuous observation of the IRPI's and the bank demand counters changing both audibly and visually. The action taken would be to trip the reactor as required by the Abnormal Operating Procedure S1(2).OP-AB.ROD-0003(Q), "Continuous Rod Motion," and reinforced by training exercises.

5.3 Summary of Safety Analyses

UFSAR Chapter 15 accident analyses have been evaluated to account for the possible effects of the failure. The evaluation considered the failure to be a single failure, and applied the criteria of 10CFR50, Appendix A General Design Criterion 25.

The evaluation concluded that the DNB design limits for the fuel continued to be met.

6.0 ADDITIONAL CONSIDERATIONS FOR RESTART AND OPERATION

6.1 Rod Control System Alarms and Indications

The following alarms are designed to provide the operator with indications of abnormal rod control system operation. No analyses performed specifically for this evaluation take credit for any alarms that may occur or resulting operator action.

However, credit can be taken for operators to ensure alignment within the ± 12 step Technical Specification allowance.

Reactor Coolant Temperature Deviation Alarms - The alarms listed below are annunciated on the control console and provide indication that asymmetric bank movement might have occurred in a particular region of the core resulting in an uneven increase in Reactor Coolant temperature.

RC Loop D/T Deviation

RC Loop Tavg Deviation

Tavg RC Tavg - Tref Deviation

The Tavg and (Tavg - Tref) alarms also annunciate if rod position is not maintained consistent with Tavg.

Deviation Alarm - A rod deviation alarm is provided on the Overhead Annunciator (OHA) Windows. OHA Window E-24, "ROD DEV OR SEQ" is generated if any two rods in a given bank are more than 12 steps apart or if any rod deviates from the bank position by 12 steps. No automatic actuations are associated with this alarm. If a rod deviation does occur, the operator is alerted and responds in accordance with alarm response procedures (S1 or S2.OP-AR.ZZ-0005(Q) for E OHAs). These procedures ensure the operator investigates, takes corrective actions, and enters Technical Specification action statements as required. Technical Specification LCO 3.1.3.1 requires each rod to be operable and positioned to within 12 steps of its group step counter demand position within one hour after rod motion.

Individual Rod Position Indication (IRPI) - Visual indication of rod position is provided to the operators via the Individual Rod Position Indication (IRPI) system. The IRPI's are not affected by the rod control system failure mechanism under consideration. Each indicator is derived from a signal based on the rods' actual physical location rather than the demanded position.

Rod Insertion Limit (RIL) Alarms - RIL alarms give the operator advance warning of bank insertion demand in excess of rod insertion limits. The failure does not affect the demand sent to the RIL circuits. The Rod Insertion Limits for Control Banks B, C and D are given in Technical Specification Table 3.1-1. Control Bank A is withdrawn when the reactor is critical. The computer uses the difference in reactor coolant system temperature across the core to calculate the RIL. This delta-T is a direct correlation to reactor power and thus can be used to compare against the Technical Specification limit. The calculated limit is compared to actual bank demanded position as determined by the pulse to analog converter from the data logging cards.

Two OHA rod insertion limit alarms are provided. OHA E-8, "ROD INSERT LMT LO" alarms if one or more control banks are within 10 steps of the insertion limit. OHA E-16, "ROD INSERT LMT LO-LO" alarms if one or more control banks are at the insertion limit. Operators respond to these alarms in accordance with alarm response procedures (S1 or S2.OP-AR.ZZ-0005(Q) for E Windows). For a "ROD INSERT LMT LO" alarm, the operator is directed to identify the affected rod bank and determine if it is a dropped rod or rod misalignment event. For a "ROD INSERT LMT LO-LO" alarm, the operator is directed to identify the affected rod bank and commence rapid boration in accordance with the procedure. Both alarm procedures refer the operator to Technical Specifications.

Determination of rod position for the insertion limit alarms is based on position demanded, not by the physical position as determined by the individual rod position indicators. Therefore, the RIL alarms will be received if an insertion demand exceeds the alarm setpoints, regardless of whether the RCCAs are moving as demanded.

Symptoms of misaligned rods also include abnormal variations in axial flux distribution (AFD) and quadrant power distribution. AFD is indicated on the control console with alarm annunciation when flux distribution is outside the allowable band. The quadrant power tilt ratio (QTPR) is continuously monitored by the upper section/lower section deviation alarm by comparing the difference in the detected power range flux. If the overhead deviation alarm is received, a hand calculation is performed to verify QPTR. Depending on the symmetry of the misaligned rod(s), it is possible to have significant misalignment that would not satisfy the alarm conditions. However, these alarms provide an additional means of detecting any rod misalignment that would result in abnormal AFD or QPTR. In addition, monthly core-Flux mapping surveillances provide an additional opportunity to detect severe RCCA misalignments.

6.2 <u>Operator Training</u>

Reactivity manipulations are a key element in the training of reactor operators. Operators are trained to confirm any movement of rods either in auto or manual with the anticipated plant response. The operator's primary focus during manual rod motion is on the actual rod position, (i.e., IRPI), versus the bank demand. Both of these indications are directly in front of the operator when depressing the raise-lower pushbuttons that initiate rod movement. Heightened awareness during startup is emphasized with the operating crew during startup training conducted at the Training Center, as well as just prior to the actual plant startup. Continuous comparison of bank demand versus actual position is performed during the approach to criticality as well as administrative stops to compare these indications. The operators are required to stop rod movement should any deviation from the anticipated response occur and enter the appropriate procedure, (eg., Abnormal, alarm response, etc.).

The active control room operating crews, and operations staff personnel, have been briefed on the potential for misoperation of the rod control system. An Operations Department temporary standing order directs the operator to maintain the rod control system in manual, and to carefully monitor rod position during any manual rod movements, noting that withdrawal may occur instead of insertion, or that less than the full group or bank may

withdraw upon a withdrawal command. The temporary standing order prohibits placing the rod control system in automatic in response to a loss of load transient. The temporary standing order will also state that abnormal rod movement may occur without resulting in an urgent failure alarm. Each supervisor and control operator will review the actions of the standing order prior to assuming the watch.

Startup training is performed on the simulator at the Nuclear Training Center prior to unit startup. This training is provided for licensed personnel that participate in the actual plant startup and will include the potential effects of this failure. Emphasis will be placed on the importance of readily identifying and taking the appropriate actions for any abnormal response of the RCCA's. These actions will include reference to the appropriate Abnormal Operating Procedure as outlined below.

6.3 Procedures

Control Operators enter Abnormal Operating Procedure S2.OP-AB.ROD-0001(Q), "Immovable/Misaligned Rods," on any indication that one or more rods are not responding to demand signals, or are misaligned by 12 or more steps from the respective bank. This procedure provides the direction necessary to:

a. Stabilize plant conditions in the event that one or more control rods indicate misalignment or the inability to move,

b. Determine if a rod position indication failure has occurred or if rods are actually misaligned,

c. Determine if a control system malfunction has occurred which prevents rod motion in the absence of an Urgent Failure Alarm,

d. Maintain plant control with an Urgent Failure Alarm,

e. Realign a mispositioned control rod,

f. Comply with Technical Specification requirements, as appropriate.

This procedure has been reviewed and determined to provide adequate guidance to ensure adequate diagnostics and subsequent actions are taken should any rod movement occur that is indicative of a logic failure. Other related procedures have been reviewed and are not impacted by a failure in the rod control logic.

In accordance with the current operating procedure, the rod bank selector switch is positioned to Shutdown Bank A (SDBA) prior to energizing the rod control system. It is maintained in that position after the rod drive system is energized and before any rod withdrawal prior to startup or testing. By keeping the selector switch on SDBA, the potential for rods to inadvertently withdraw in any bank other than SDBA is reduced. With the plant in the condition with rod control energized capable of moving rods and all control banks inserted, the operator can initially focus on SDBA should he be alerted to a spurious rod withdrawal. This selector switch is sequenced through the shutdown banks until all shutdown rods are out, then placed in manual for the remainder of the reactor startup.

6.4 Testing

Prior to startup for each unit, a modified version of surveillance test 4.1.3.2.2 will be performed prior to control rod withdrawal in order to detect and correct the failure prior to startup. This test is described in more detail in Section 4.0.

For Salem Unit 2, Surveillance Test 4.1.3.1.2 will be performed weekly for two weeks, biweekly for two cycles, and monthly thereafter. This will provide an added level of confidence that this failure is not present.

7.0 ROD CONTROL SYSTEM OPERABILITY

Technical Specification 3/4.1.3, Movable Control Assemblies, establishes operability and surveillance requirements for control rods and their position indicating systems. The bases for these Technical Specifications include assurance that fuel integrity is maintained for Condition I (Normal Operation) and Condition II (Incidents of Moderate Frequency) events. Fuel integrity is maintained by demonstrating that DNBR in the core remains greater than or equal to the design limit following such events. This evaluation demonstrates that the Condition II criteria are met for rod withdrawal events based on the present plant operating conditions.

8.0 CONCLUSIONS

The potential single failure has been conservatively evaluated against the criteria for a Condition II event. This failure is detectable via surveillance testing and normal operation, and is treated as such in the evaluation. Based on this evaluation, the DNBR design limit is met. Compensatory measures relative to testing and operator training, combined with existing alarms and procedures, provide assurance that should the failure occur, it would be readily detected and corrected. Therefore, startup and continued operation of Salem Units 1 and 2 would not result in any condition adverse to safety.

9.0 REFERENCES

1. 10CFR50, Appendix A, General Design Criterion 25

2. ANSI N18.2-1973, "Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants," 1973.

3. SGS Updated Final Safety Analysis Report

4. Salem Unit 1 Technical Specifications up to and including Amendment 138-I.

5. Salem Unit 2 Technical Specifications up to and including Amendment 118-II.

6. Westinghouse Letter PSE-93-631 dated June 11, 1993, "Results of Control Rod System Failure Investigation for Use in Salem Startup Justification."

7. Westinghouse Letter ET-NSL-OPL-II-93-274 dated June 10, 1993, "Public Service Electric and Gas Company, Salem Units 1 and 2 Safety Evaluation for Safe Startup and Operation".

8. 10 CFR 50.59 Evaluation for DEF DES-93-0146

9. Engineering Discrepancy DES-93-0146

10. Precautions, Limitations, and Setpoints Document, Revision 19, 1/3/91.

I.D. NO. DES-93-0146

REF. NO. ______________

APPLICABILITY:

SALEM 1 OR COMMON TO SALEM 1 & 2	XX
SALEM 2	
SALEM 3 (GAS TURBINE)	
HOPE CREEK	
HOPE CREEK AND SALEM COMMON	

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
NUCLEAR DEPARTMENT
10CFR50.59 REVIEW AND SAFETY EVALUATION
COVER SHEET

Page No.

Rev. No.

Rev.	Revision Summary	Preparer/ Date	Peer Review /Date	Mgmt. Approval/ Date	SORC Review & Mtg. No.	Station G.M./ Date
0	Original Issue	DA Rothrock 6/15/93	TK Ross 6-15-93	RS Kent/ E. J. Rosendale 6/15/93	[signature] 93-053	[signature] 6/15/93

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I.D. NO. DES-93-0146

REF. NO. ______________

10CFR50.59 REVIEW AND SAFETY EVALUATION

1.0 DESCRIPTION - Describe the Proposed Facility/Procedure Change or Test or Experiment (use continuation sheet if required) [If it involves a change to the Fire Protection Program or Radioactive Waste Treatment Systems, ensure that Sections 1.2 or 1.3 of Exhibit 1, as applicable, are reviewed]:

(See Continuation Sheets.)

2.0 10CFR50.59 REVIEW - Does 10CFR50.59 apply to the proposal?

a. Does the proposal change the facility as described in the SAR?

YES XX NO ____

b. Does the proposal change procedures as described in the SAR?
YES ____ NO XX

c. Does the proposal involve a test or experiment not described in the SAR?

YES ____ NO XX

Discuss the bases for the determinations and identify the pertinent SAR sections that were reviewed to make the determinations (use continuation sheets if required).

(See Continuation Sheet.)

If ALL answers in Section 2.0 are "NO", 10CFR50.59 does NOT apply, and completion of Section 3 of this form is NOT required (Section 4 and 5 must still be completed).

I.D. NO. DES-93-0146

REF. NO. ______________

10CFR50.59 REVIEW AND SAFETY EVALUATION (CONTINUED)

3.0 USQ DETERMINATION - Is an Unreviewed Safety Question (USQ) involved?

3.1 May the proposal:

a. Increase the probability of an accident previously evaluated in the SAR?

YES XX NO ___

b. Increase the consequences of an accident previously evaluated in the SAR?

YES ___ NO XX

c. Increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the SAR?

YES XX NO ___

d. Increase the consequences of a malfunction of equipment important to safety previously evaluated in the SAR?

YES ___ NO XX

Discuss the bases for determination and identify the pertinent SAR sections that were reviewed to make the determination (use continuation sheets if required):

(See Continuation Sheet.)

I.D. NO. DES-93-0146

REF. NO. ______________

10CFR50.59 REVIEW AND SAFETY EVALUATION (CONTINUED)

3.2 May the Proposal:

a. Create the possibility of an accident of a different type than any previously evaluated in the SAR?

YES ____ NO XX

b. Create the possibility of a malfunction of a different type than any previously evaluated in the SAR?

YES ____ NO XX

Discuss the bases for the determinations and identify the pertinent SAR sections that were reviewed to make the determinations (use continuation sheets if required):

(See Continuation Sheet.)

I.D. NO. DES-93-0146

REF. NO. ______________

10CFR50.59 REVIEW AND SAFETY EVALUATION (CONTINUED)

3.3 Does the proposal reduce the margin of safety as defined in the basis for any Technical Specification?

YES ____ NO XX

Discuss the bases of the determination and identify the pertinent Technical Specification sections that were reviewed to make the determination (use continuation sheets if required):

(See Continuation Sheet.)

If ALL answers in Section 3 ar "NO", the proposal does NOT involve a USQ.

If ANY answer in Section 3 is "YES", the proposal involves a USQ.

I.D. NO. DES-93-0146

REF. NO. ______________

10CFR50.50 REVIEW AND SAFETY EVALUATION (CONTINUED)

4.0 TECHNICAL SPECIFICATION REVISION DETERMINATION - Does the proposal involve a Technical Specification change?

YES ____ NO XX

Identify the pertinent Technical Specification sections that were reviewed to make the determination:

(See Continuation Sheet.)

5.0 CONCLUSION

	YES	NO	N/A
Does 10CFR50.59 apply? (Section 2)	XX		
Is a USQ involved? (Section 3) (Check N/A if 10CFR50.59 does not apply).	XX		
Is a Technical Specification change required (Section 4)		XX	

If a USQ is involved and/or a Technical Specification change is required, obtain assistance from Licensing for additional processing.

LCR Number: 93-021

10CFR50.59 REVIEW AND SAFETY EVALUATION

1.0 BACKGROUND

During startup of Salem Unit 2 following the Cycle 7/8 refueling outage, the reactor operator observed a discrepancy in the movement of Shutdown Bank A (SDA). More specifically, the analog rod position indication (RPI) system showed no movement of the SDA rod cluster control assemblies (RCCA) when the operator tried to manually raise the bank. Moreover, when the operator manually inserted SDA, the RPI system showed that one RCCA was moving out. It was confirmed that one SDA RCCA had withdrawn in that when the CRDM was de-energized, the RPI confirmed that the rod dropped back to the bottom of the core. Movement of this one RCCA at Salem has been attributed to a ~~single~~ failure in two rod control system (RCS) card chips. This safety evaluation does not address the RCCA characteristics influencing whether individual RCCA's will misoperate in the presence of the RCS card chip failure. Rather, this safety evaluation addresses the entire range of potential RCCA misoperation combinations. This evaluation is supported by the Westinghouse-supplied safety analysis documented in NFSI-93-321 (PSE-93-623, June 10, 1993.)

TKP 6-15-93

While supporting the ongoing root-cause evaluation, a single failure coupled with a demand signal for movement has been identified which could allow the following RCCA movement:

1. *all demanded RCCAs would stay stationary (no movement)*

2. *any number of RCCAs demanded to move out would move out (while the others remained stationary)*

3. *any number of RCCAs demanded to move in would move out (while the others remained stationary)*

4. *all demanded RCCAs could, ~~although extremely unlikely~~, move in the demanded direction (all in or all out)* TKR 6-15-93

This asymmetric rod withdrawal can only occur if a direction command logic failure exists coincident with a demand for rod motion. This is judged to be extremely unlikely to result from a single failure. However, such spurious and asymmetric RCCA withdrawal has been conservatively bounded in the evaluations of asymmetric RCCA withdrawal at power.

The normal movements, defined as those movements consistent with the demanded direction, are not a concern with respect to this evaluation. Further, all or some demanded RCCAs remaining stationary is not a concern. However, complete or partial RCCA withdrawal given the coincident presence of an insert or withdraw command is a potential concern and is the subject of this evaluation. The specific configurations are discussed in the section titled Multiple Asymmetric RCCA Withdrawal at Power.

PURPOSE

The purpose of this evaluation is to provide justification for startup and operation of Salem Units 1 and 2 given all feasible scenarios that could be caused by the identified single failure. Although not specifically credited in this safety evaluation, it is conservatively assumed that the reactors remain in manual RCCA control during Mode 1 operation. It is expected that the operator will maintain cognizance of any rod movement and Tavg within the rod speed controller deadband of +/-1.5°F, consistent with the Precautions, Limitations, and Setpoints Document.

REGULATORY BASIS

10CFR50 Appendix A contains the General Design Criteria for Nuclear Power Plants. Criterion 25 states that, "The protection system shall be designed to assure that specified acceptable fuel design limits are not exceeded for any *single malfunction of the reactivity control systems, such as accidental withdrawal (not ejection or dropout) of control rods."*

The ANSI N18.2 - 1973 Classification of Accident Events prescribes the acceptance criteria for Condition II faults - events of moderate frequency. One criterion for this event classification is that there can be no consequential loss of function of any fission product barrier (no fuel rod failures). Westinghouse conservatively demonstrates that fuel rod failures are precluded by satisfying the DNB design basis. Asymmetric rod withdrawal can only occur if a direction command logic failure exists coincident with a demand for rod motion. This is judged to be extremely unlikely to result from a single failure. Thus, the conservative interpretation being applied to Salem is that a single RCS failure can result in spurious and asymmetric RCCA withdrawal. Therefore, the RCCA withdrawal events will be evaluated to satisfy the Condition II acceptance criteria.

As defined by IEEE-279 and IEEE-379, the single failure criteria specifies that the reactor protection system (RPS) must be capable of performing the protective actions required to accomplish a protective function in the presence of any single detectable failure within the RPS concurrent with all identifiable but nondetectable failures, all failures occurring as a result of the single failure and all failures which may be caused by the design basis event requiring the protective function. As a result of the direct application of this criteria, the single failure assumed in the safety analyses is limited to a single active failure in that portion of the safety system that is required to actuate on demand to mitigate the initiating event.

When modelling control systems in the safety analyses, Westinghouse methodology consistently stipulates that these systems are assumed not to operate unless operation results in more severe consequences. There is no requirement for assuming random independent failures of control systems provided they are detectable during normal operation or surveillance testing. The reason for this is the probability of a random control system failure *occurring at the same time as a transient is considered low enough in order for it not to be considered.*

While detectable control system failures need not be assumed in the safety analyses, they are typically assumed to initiate events of moderate frequency. As a result, the RCS failure of concern in this evaluation will be considered an initiating event; however, it need not be considered in addition to (or instead of) the protection system single failure assumed in any of the UFSAR Chapter 15 safety analyses.

SALEM UNIT 1 CYCLE 11 AND UNIT 2 CYCLE 8 JUSTIFICATION FOR STARTUP AND OPERATION

To provide justification for Salem Unit 1 and 2 startup and operation, all UFSAR Chapter 15 events were examined for adverse impact given the identified failure. The bounding scenarios resulting from this failure have been identified as presented in the RCCA Withdrawal at Power section.

AFFECTED ANALYSES

Based on the UFSAR Chapter 15 licensing-basis event review, the only events which are potentially impacted are Rod Ejection (UFSAR 15.4.7), RCCA Misalignment (UFSAR 15.2.3), Uncontrolled Boron Dilution (UFSAR 15.2.4), RCCA Bank Withdrawal at Power (UFSAR 15.2.2), Single RCCA Withdrawal at Power (UFSAR 15.3.5), and RCCA Bank Withdrawal From Subcritical (UFSAR 15.2.1). It is important to note that previously unanalyzed RCCA withdrawal cases (multiple asymmetric RCCA withdrawals) have been postulated (refer to Standard Review Plan section 15.4.3 for definition of control rod misoperation). The evaluation of each of these is discussed below.

ACCIDENT ANALYSES

Rod Ejection

As described in UFSAR section 15.4.7, a rod ejection is caused by a mechanical failure of the control rod drive mechanism (CRDM) pressure housing which results in the instantaneous ejection of an RCCA and drive shaft. Neither single nor multiple failures in the RCS can initiate a rod ejection event. Therefore, the UFSAR analysis and conclusions are unaffected and remain valid considering the postulated single failure which may cause erratic RCCA withdrawal.

RCCA Misalignment

UFSAR section 15.2.3 describes the Condition II events of static misalignments and dropped RCCAs, groups, and banks. The static misalignment is not a concern given this failure since the Salem Technical Specifications prescribe recovery actions for a static misalignment. Since inadvertent RCCA insertion is not a consequence of this failure, there is no impact on the UFSAR dropped RCCA analyses. Any dynamic misalignments would continue to be addressed and bounded by the current dropped RCCA analyses presented in this UFSAR section.

In summary, this single failure will not result in any RCCA misalignment (static or dynamic) which is worse than that already analyzed for the Salem licensing basis.

Uncontrolled Boron Dilution

UFSAR section 15.2.4 describes the Condition II event of an uncontrolled boron dilution. The dilution will result in a positive reactivity insertion and the power and temperature will rise until the reactor reaches the overtemperature ΔT setpoint. This single failure will not change the reactivity insertion rate or the *time at which the overtemperature ΔT trip occurs, which is obtained from the UFSAR RCCA bank withdrawal at power analysis. Therefore, the boron dilution results presented in the UFSAR remain valid.*

RCCA Bank Withdrawal at Power (Symmetric)

UFSAR section 15.2.2 describes the Condition II event of an uncontrolled RCCA bank withdrawal occurring at various power levels (e.g., representative cases at 10%, 60% and 100% rated thermal power). A wide range of reactivity insertion rates are assumed which bound the maximum number of RCCAs that can withdraw.

The high neutron flux and overtemperature ΔT trip functions continue to provide automatic protection over the entire power and reactivity insertion ranges described in the UFSAR. The resulting minimum DNB ratios are always greater than the limit value.

In summary, a single failure causing a symmetric RCCA withdrawal at all power levels is within Salem's current licensing basis and the UFSAR conclusions remain valid.

Single RCCA Withdrawal at Power

This event is described in UFSAR section 15.3.5 as withdrawal of a single RCCA from the inserted D-bank at full power operation. As part of the current accident description, it is noted that no single electrical or mechanical failure in the RCS can result in a accidental withdrawal of a single RCCA. The current UFSAR also states that in all cases it is not possible to provide assurance that the core safety limits are not violated.

Asymmetric rod withdrawal can only occur if a direction command logic failure exists coincident with a demand for rod motion. This is judged to be extremely unlikely to result from a single failure. However, such spurious and asymmetric

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RCCA withdrawal will be evaluated for this event.

A single RCCA withdrawal at power will be conservatively evaluated to meet the Condition II acceptance critoria. Thus, for this transient, fuel safety limits are shown to be met by demonstrating that the DNBR limit value is met.

Based on explicit analyses performed for Salem Units 1 and 2, the single RCCA withdrawal at power event was determined to be bounded by a multiple RCCA withdrawal of two adjacent D-bank RCCAs (one from each group) at full-power. This analysis, now termed, Multiple RCCA Withdrawal at Power (Asymmetric), is discussed below.

Multiple RCCA Withdrawal at Power Case (Asymmetric)

Asymmetric rod withdrawal can only occur if a direction command logic failure exists coincident with a demand for rod motion. This is judged to be extremely unlikely to result from a single failure. However, such spurious and asymmetric RCCA withdrawal will be evaluated for this event. As discussed in the ***BACKGROUND*** *section, any number of RCCAs (up to 17) can experience uncontrolled withdrawal.*

1. *Above 68% power, any number of the nine group 1 and 2 D-bank RCCAs could withdraw on an insert or withdraw demand. The maximum number of RCCAs which are not bounded by the RCCA Bank Withdrawal at Power analysis is 8 (one less than a complete bank withdrawal). For this scenario, explicit analyses for Units 1 and 2 have demonstrated that the most limiting case is the withdrawal of two adjacent D-bank RCCAs (one from each group). The basis for this statement is due to the core physics response. If more than two RCCAs are withdrawn, the maximum peaking factor will be reduced as a result of the flattened power distribution.*

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2. *Between 15% and 68% power, any combination of the nine D-bank and eight C-bank RCCAs could withdraw on an insert or withdraw signal. The maximum number of RCCAs which are not bounded by the RCCA Bank Withdrawal at Power analysis is 16 (one less than the two complete banks). Since the DNB benefit gained by the reduction in power more than offsets the increased peaking factors, there is no combination of asymmetric withdrawals at these power levels that is more limiting than item 1 above. This has been confirmed by explicit analyses for Units 1 and 2.*

3. *Below 15% power, the worst scenario - all RCCAs at their insertion limits - is that any combination of the eight C-bank RCCAs and the B-bank RCCAs (4 for Unit 1 and 8 for Unit 2) could withdraw on an insert or withdraw signal. The maximum number of RCCAs which are not bounded by the RCCA Bank Withdrawal at Power analysis is 11 for Unit 1 and 15 for Unit 2 (one less than the two complete banks). Again, since the DNB benefit gained by the reduction in power more than offsets the increased peaking factors, there is no combination of asymmetric withdrawal at these power levels that is more limiting than item 1 above. This has been confirmed by explicit analyses for Units 1 and 2.*

Salem Unit 1 and 2 analyses were performed to address the asymmetric RCCA withdrawal at power case. The standard NRC-approved method described in WCAP-9272 was employed. A 1.08 design allowance (consistent with WCAP-7308) was made for the hot rod FΔH calculations. Consistent with the current licensing-basis analysis in UFSAR section 15.3.5, no rod deviation or rod control urgent failure alarm or operator action was assumed. The analyses concluded that the DNB design basis continued to be met for the limiting case, and thus, there were no fuel failures given the RCS failure.

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In conclusion, based on the explicit analyses performed for Units 1 and 2, an asymmetric RCCA withdrawal at any power level will not result in any fuel failures at Salem. This is in compliance with GDC-25.

RCCA Bank Withdrawal From Subcritical (Symmetric)

UFSAR section 15.2.1 discusses this Condition II event, the uncontrolled addition of reactivity to the reactor core caused by withdrawal of RCCAs resulting in a power excursion. This transient could be caused by a single malfunction in the RCS at subcritical, hot zero power, or at power. The 'at power' case is presented above in the RCCA Bank Withdrawal at Power section.

The maximum reactivity insertion rate analyzed in the UFSAR is greater than that occurring from a simultaneous withdrawal of the combination of two control banks having the maximum combined worth at maximum speed (note that the speed is not affected by this failure). The neutron flux response to a continuous reactivity insertion is characterized by a very fast rise terminated by the reactivity feedback effect of the negative Doppler coefficient. This limits the power to a tolerable level during the delay time for protection action. The transient will be terminated by an automatic feature of the RPS.

In summary, a single failure causing a symmetric RCCA withdrawal from subcritical or hot zero power conditions is within Salem's current licensing basis and the UFSAR conclusions remain valid.

RCCA Withdrawal From Subcritical (Asymmetric)

This is defined as a single or multiple asymmetric withdrawal of RCCAs from subcritical or hot zero power conditions. Asymmetric rod withdrawal can only occur if a direction command logic failure exists coincident with a demand for rod motion. This is judged to be extremely unlikely to result from a single failure. However, such spurious and asymmetric RCCA withdrawal will be

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conservatively evaluated for this event.

The RCS is first energized with the core in a subcritical condition with all rods inserted. In this condition, SDA is selected per normal procedure. Due to shutdown margin requirements, an uncontrolled asymmetric RCCA withdrawal in this condition would not result in achieving criticality. Since subcriticality is maintained, the DNBR limit is not challenged.

Prior to ~~the next~~ each startup, a modified surveillance test will be performed at Units 1 and 2, to determine whether the logic failure exists. The test will be performed for all shutdown and control banks, and will begin from the fully inserted position (although Technical Specifications do not require testing for fully inserted banks). Each bank will be tested after the trip breakers are closed and the rod drive motor-generator sets are energized, prior to withdrawing the banks for startup. The test will be performed by sequentially withdrawing and inserting each of the shutdown and control banks a minimum of ten steps, with the operator verifying that individual rod position matches group demand. While the test is being performed, traces will be taken from the logic cabinet. This trace will indicate current abnormalities if the failure is present. If the failure is present, the condition will be corrected and evaluated prior to commencing startup.

The operators maintain the RCS in the SDA selected condition (except during RCS testing) until the actual approach to criticality maneuver is initiated. Individual shutdown bank withdrawals during an approach to criticality, even if asymmetrical, will again not result in achieving criticality due to shutdown margin and K_{eff} requirements.

Spurious asymmetric RCCA movement, sufficient to bring the reactor to a critical condition, can therefore only occur during the withdrawal of the control banks in manual overlap mode. The switch to the control bank overlap mode is made by the operator only when this manual control bank motion is desired to achieve criticality. This motion is therefore being continuously monitored and *controlled by the operator during the ~~assent~~ ascent to criticality process.* TKR 6-15-93

It is noted that this normal approach to criticality includes the generation of inverse count rate ratio (ICRR) data which is obtained during periodic control bank movements. These periodic movements involve moving the control rods a specified number of steps, followed by a hold to collect ICRR data. Continuous operator cognizance during this control bank movement is assured, so any asymmetric rod movement would be detected.

Therefore, an uncontrolled, asymmetric RCCA withdrawal from subcritical, sufficient to achieve criticality, would be detected by the operator and terminated. Since inadvertent criticality in an asymmetric RCCA configuration is avoided, the DNBR design basis continues to be satisfied.

CONCLUSION

It has been demonstrated that Salem Units 1 and 2 continue to meet all safety limits, in the presence of the identified single failure. It is important to note that, should the RCS failure event manifest itself, safe shutdown capability is maintained.

2.0(a) ***YES****. UFSAR Section 3.1 states that SGS complies with the General Design Criteria of 10 CFR 50, Appendix A. GDC 25 states:*

> *"The protection system shall be designed to assure that specified acceptable fuel design limits are not exceeded for any single malfunction of the reactivity control systems, such as accidental withdrawal (not ejection or dropout) of control rods."*

UFSAR Section 4.3.1.4 states that the maximum reactivity insertion rate is limited for an accidental withdrawal of a control bank (or banks), such that peak heat generation rate and DNBR do not exceed the allowable limits, thereby satisfying GDC 25.

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UFSAR Section 15.2 classifies inadvertent withdrawal of a control rod bank is as a Condition II event (Moderate Frequency), which at worst would result in plant shutdown with the plant capable of returning to power. UFSAR Section 15.3 classifies inadvertent withdrawal of a single RCCA as a Condition III event (Infrequent Fault), which by definition may result in a small fraction of failed fuel, which could require considerable outage time and corrective actions prior to resuming plant operation.

UFSAR Section 15.3.5.1 states, "No single electrical or mechanical failure could cause the accidental withdrawal of a single RCCA from the inserted bank at full power operation." and "In the extremely unlikely event of simultaneous electrical failures which could result in single RCCA withdrawal, rod deviation and rod control urgent failure would both be displayed on the plant annunciator . . . The urgent failure alarm also inhibits automatic rod motion in the group in which it occurs."

The preceding UFSAR statements are affected by the assumptions that a single failure could cause a single RCCA withdrawal, and that an urgent failure alarm might not result from a single RCCA withdrawal. As such, the facility as described in the UFSAR has been changed.

2.0 (b) ***NO****. There are no plant procedures associated with this issue to be changed that have not been / will not be addressed under their own evaluation.*

2.0 (c) ***NO****. This evaluation addresses the as-built condition of the RCS by making conservative assumptions relative to system failure modes. It does not involve any tests or experiments.*

3.1 (a) ***YES****. UFSAR Chapter 15 accidents which may be affected by the observed RCS failure causing inadvertent RCCA withdrawal have been identified. This failure is conservatively assumed to cause a Single RCCA Withdrawal at Power (15.3.5). Since it had previously been expected that only multiple failures could cause this event, the probability of occurrence as*

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reflected in the UFSAR is considered to be increased and therefore, the more stringent criteria of GDC 25 is being applied (which is consistent for any ANS Condition II event).

The ***Analyses Affected*** *section of this safety evaluation describes the behavior and analytical results if a single RCCA withdrawal event were to occur while at full power (the limiting power case). The results of this analysis showed that there would be no rods-in-DNB for either unit. This complies with the requirements of GDC 25.*

Thus, although the probability of this event has theoretically increased, there is no increase in the risk to the public health and safety since the analysis results show that the Condition II acceptance criteria are met (i.e., although the probability of the event has increased, the consequences meet the more stringent Condition II acceptance criteria).

3.1 (b) ***NO****. Based on the discussions presented above, all of the applicable UFSAR and regulatory design basis acceptance criteria are met for the impacted events. The single RCCA withdrawal event, given a single failure in the RCS, shows no adverse impact on any fission barrier (given that no rods will experience DNB) nor does it change, degrade, or prevent the response of any safety-related system or component to accident scenarios, as described in UFSAR Chapter 15. In addition, this failure does not affect the integrity of the reactor coolant system, secondary systems, or balance of plant systems such that their functions in the control of radiological consequences are affected. Thus, the postulated scenario does not alter any assumption previously made in the radiological consequence evaluations nor affect the mitigation of the radiological consequences of an accident described in the UFSAR. Therefore, the consequences of an accident previously evaluated in the UFSAR will not be increased.*

3.1 (c) ***YES****. As stated in Nuclear Administrative Procedure NC.NA-AP.ZZ-0059, equipment important to safety includes equipment that is non-safety* *related, but whose failure could prevent accomplishment of the safety functions specified for safety-related components. As a control system whose failure could initiate a reactivity transient, the RCS is considered to be important to safety, although its operation is not relied upon to mitigate any licensing basis event.*

The proposal would allow an increase in probability of a failure resulting in a rod withdrawal event. The discovered failure is therefore considered to be an increase in probability of malfunction, it is demonstrated that this increase in probability is offset by a reduction in consequences (see 3.1a).

3.1 (d) ***NO***. *The performance and integrity of the reactor coolant system, secondary system, and balance of plant systems are not affected such that the control of radiological consequences is altered. The postulated failure does not result in a different response of safety-related systems and components to accident scenarios than that postulated in the UFSAR. No new equipment malfunctions have been introduced that will affect fission product barrier integrity.*

Therefore, the postulated failure and subsequent single RCCA withdrawal will not increase the consequences of a malfunction of equipment important to safety previously evaluated in the UFSAR.

3.2 (a) ***NO***. *A spectrum of RCCA withdrawal events is documented in the Salem licensing basis. A symmetric RCCA group/bank withdrawal event from subcritical is analyzed and presented in UFSAR section 15.2.1 and a symmetric RCCA group/bank withdrawal at power is analyzed and presented in UFSAR Section 15.2.2. The single RCCA withdrawal event is analyzed and presented in Section 15.3.5 of the Salem UFSAR but assumes that initiation can only occur as a result of multiple failures. This event, although now potentially caused by a single failure, is not considered to be an event which is different than already evaluated in the UFSAR.*

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Given that this failure could cause the asymmetric withdrawal of more than one RCCA, which is not currently analyzed for the UFSAR, new RCCA withdrawal cases have been postulated. However, based on the guidelines of the Standard Review Plan (section 15.4.3), this postulated scenario only represents a variation of the reactivity and power distribution anomalies that are currently addressed in the Salem licensing basis and is not considered to be a new event of a different type. Thus, although it requires reanalysis of the RCCA withdrawal event, the assumed single failure does not create the possibility of an accident that is different than that already in the UFSAR.

3.2 (b) ***NO***. *As stated in 3.1(c), the RCS is considered important to safety, although its operation is not relied upon to mitigate any licensing basis event. The reactivity transients caused by the postulated RCS failure would result in a malfunction of equipment that has been previously evaluated in the spectrum of RCCA withdrawal events contained in the UFSAR. Therefore, it does not create the possibility of a malfunction of equipment important to safety different than previously evaluated in the UFSAR.*

3.3 ***NO***. *This RCS failure and subsequent RCCA withdrawal will have no affect on the availability, operability, or performance of any safety-related equipment required for accident mitigation. As demonstrated above, the regulatory design criteria and subsequent dose limits will continue to be satisfied. In addition, the requirements of GDC 25 will continue to be satisfied. Therefore, any potential radioactive releases, resulting from RCCA withdrawals, will be based on the steady-state Technical Specification allowable coolant activity levels and will remain within both Part 20 and Part 100 limits (the ultimate bases for the Technical Specifications). Thus, there is no reduction in the margin to safety as defined in the bases of the Salem Technical Specifications.*

4.0 ***NO***. *Technical Specification 3/4.1.3, Movable Control Assemblies, establishes operability and surveillance requirements for control rods and their position indicating systems. The bases for these Technical Specifications* *include assurance that fuel integrity is maintained for Condition I (Normal Operation) and Condition II (Incidents of Moderate Frequency) events. Fuel integrity is maintained by demonstrating that DNBR in the core remains greater than or equal to the limiting value following such events. This evaluation demonstrates that the Condition II criteria continues to be met for rod withdrawal events.*

6/10/93
1700

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS.

DESCRIPTION	WSN	PRESENT STATUS	REMARKS (REPAIR & INTALLATION)
SUPERVISORY DATA LOGGING (LOGIC CABINET)	183	A114	5/16/93 - REMOVED FROM A113. REPAIRED ??? 5/31/93, 13:00 - INSTALLED IN A114. 13:30 - CBA GRP 2 NOT MOVING, REPLACED Z3. REINSTALLED TO A114. 6/3/93 3:50 AM - P/A CONVERTER AND PLANT COMPUTER FAILED TO INDICATED FOR CBB, SBB, REPLACED Z13. RETEST SAT.
SUPERVISORY DATA LOGGING (LOGIC CABINET)	216	I&C SHOP	5/16/93 - INSTALLED IN A114 REPLACED Z3. 5/27/93, 8:40AM - REMOVED FROM A114, REPLACED Z2,Z5, Z3. 15:30 - REINSTALLED TO A114. 5/31/93, 10:45 - REMOVED FROM A114 AND BENCH TESTED, REPLACED Z3.
SUPERVISORY DATA LOGGING (LOGIC CABINET)	217	???	5/16/93 - INSTALLED IN A113. REPLACED Z8, Z9, Z12. 5/24/93 - REMOVED FROM A113. REPAIR ????

m/ll

SUPERVISORY DATA LOGGING (LOGIC CABINET)	6014	A113	5/24/93 - INSTALLED IN A113 5/26/93 - REMOVED FROM A113 REPLACED Z3 & Z6. INTALLED BACK TO A113. REPLACED Z2, Z5 & Z8. REINSTALLED TO A113. REMOVED FROM A113, REPLACED Z2, Z5 & Z6. REINSTALLED TO A113. REMOVED FROM A113 AND TAKEN TO TRAINING CENTER FOR TESTING. FOUND Z3 BAD. REPLACED Z3, RETEST SAT. 5/27/93 - INSTALLED IN A113. RESTEST SAT. MOVE CBA, CBC GRP1 NO PULSE. REPLACED Z3 & Z6. REINSTALLED TO A113. 5/31/93, 10:45 REMOVED FROM A113 AND BENCH TESTED, REPLACED Z3 & Z5, RETEST SAT. REINSTALLED TO A113. 13:30 - CBA GRP2 NOT MOVING, REPLACED Z3. REINSTALLED TO A113. FAILED AGAIN, REPLACED Z3 RETEST SAT.

SUPERVISORY DATA LOGGING (LOGIC CABINET)	0039	I&C SHOP	5/26/93 - INSTALLED IN A113. REMOVED FROM A113, REPLACED Z3, Z2, Z8. INSTALLED IN A113 AGAIN. REPLACED Z2. FAIL AGAIN, REPLACED Z2 & Z3. INSTALLED IN A113, REMOVED FROM A113 AND TAKEN TO TRAINING CENTER FOR TESTING, FOUND Z3 BAD. REPLACED Z3, RETEST SAT. 5/27/93 - REINSTALLED IN A113. FAILED AGAIN, REMOVED FROM A113 REPLACED Z3. INSTALLED IN A114, MOVE ROD FOR CBB NO PULSE, REPLACED Z3. RETEST SAT. 15:30 - REMOVED FROM A114, REPLACED Z3.
I/O RELAY DRIVERS (LOGIC CABINET)	132	I&C SHOP	5/16/93 - REMOVED FROM A713. 5/28/93 - BENCH TESTED FOUND CR1, CR5, & CR9 SHORTED. REPLACED THE SHORTED DIODES, RETEST - SAT.
I/O RELAY DRIVER (LOGIC CABINET)	139	I&C SHOP	5/16/93 - REMOVED FROM A714. 5/28/93 - BENCH TESTED FOUND CR1 SHORTED - REPLACED CR1, RETEST - SAT.
I/O RELAY DRIVER (LOGIC CABINET)	120	I&C SHOP	5/16/93 - INSTALLED IN A713. 5/26/93 - REMOVED FROM A713. 23:50 - INSTALLED IN A713. 5/27/93 5:00 AM - REMOVED FROM A713. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1, CR9, CR17 SHORTED. REPLACED SHORTED DIODES, RETEST - SAT.

I/O RELAY DRIVER (LOGIC CABINET)	133	I&C SHOP	5/16/93 - INSTALLED IN A714. 5/26/93 - REMOVED FROM A714. SUSPECTED BAD INPUT DIODE. 6/9/93 - BENCH TESTED FOUND Q10 OPEN.
I/O RELAY DRIVER (LOGIC CABINET)	695	I&C SHOP	5/26/93, 2:00AM - NEW FROM FOLIO, INSTALLED TO A714. 8:00 AM - REMOVED FROM A714. INSTALLED IN A714. 23:50 - REMOVED FROM A714. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1 SHORT, REPLACED CR1 - RETEST SAT.
I/O RELAY DRIVER (LOGIC CABINET)	681	I&C SHOP	5/26/93 - NEW FROM FOLIO, INSTALLED TO A714. SWAPPED WITH S/N 695 - NO CHANGE. RESTORED TO A714. REMOVED FROM A714 AND INSTALLED IN A713. 23:50 - INSTALLED IN A714. 5/27/93, 5:00 AM - REMOVED FROM A714. SUSPECT BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR5, CR17 SHORTED. REPLACED CR5, CR17 - RETEST SAT.
I/O RELAY DRIVER (LOGIC CABINET)	701	I&C SHOP	5/26/93, 8:00 AM - NEW FROM FOLIO, INSTALLED TO A713. REMOVED FROM A713. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1 SHORT. REPLACED CR1, RETEST SAT.
I/O RELAY DRIVER (LOGIC CABINET)	845	A713	RETRIEVED FROM TRAINING CENTER, AND INSTALLED TO A713.

I/O RELAY DRIVER (LOGIC CABINET)	342	A714	RETRIEVED FROM TRAINING CENTER AND INSTALLED TO A714.
SLAVE CYCLER STATIONARY DECODER - GO2 (LOGIC CABINET)	0079	TB2	5/28/93 2:26 AM - REMOVED FROM A501, TESTED BAD ON TEST RIG.
SLAVE CYCLER STATIONARY DECODER - GO2 (LOGIC CAB)	0083	A501	5/28/93 - BENCH TESTED SAT. INSTALLED IN A501 (22AC STATIONARY).
SLAVE CYCLER MOVABLE DECODER GO3 (LOGIC CAB)	0080	TB2	5/28/93 - REMOVED FROM A511, TESTED BAD ON TEST RIG.
SLAVE CYCLER MOVABLE DECODER GO3 (LOGIC CAB)	0072	A511	5/28/93 - BENCH TESTED SAT. INSTALLED IN A511 (22BD SLAVE DECODER MOVABLE.
FIRING CARD (POWER CAB)	0395	I&C SHOP	5/30/93 - REMOVED FROM SLOT D1 OF POWER CABINET. INTERMITTENT FAILURE.
FIRING CARD (POWER CAB)	6120	POWER CAB D1	5/30/93 - NEW FROM FOLIO, BENCH TESTED SAT. INSTALLED IN SLOT D1.
PHASE CONTROL (POWER CAB)	366	I&C SHOP	5/30/93 - REMOVED FROM SLOT E1. PART OF THE INTERMITTENT FAILURE CIRCUIT. REPLACED FOR RELIABILITY.
PHASE CONTROL (POWER CAB)	364	POWER CAB E1	5/30/93 - NEW FROM FOLIO, BENCH TESTED SAT. INSTALLED IN SLOT E1.

REGULATION CIRCUIT GRIPPER (POWER CAB)	297	I&C SHOP	5/30/93 - REMOVED FROM SLOT F1. PART OF THE INTERMITTENT FAILURE CIRCUIT. REPLACED FOR RELIABILITY.
REGULATION CIRCUIT GRIPPER (POWER CAB)	6053	POWER CAB F1	5/30/93 - NEW FROM FOLIO, BENCH TESTED SAT. INSTALLED IN SLOT F1.
I/O AC AMPLIFIER (LOGIC CAB)	372	I&C SHOP	5/30/93 - REMOVED FROM A803.
I/O AC AMPLIFIER (LOGIC CAB)	144	??	5/30/93, 2:45 AM - BENCH TESTED SAT. INSTALLED IN A803. 19:51 - REMOVED FROM A803, REPLACED Q13, Q14 - STILL DEFECTIVE. REPAIRED ???
I/O AC AMPLIFIER (LOGIC CAB)	122	A803	5/30/93, 20:40 - INSTALLED TO A803.(THIS CARD WAS PRIVOUSLY REPAIRED BY VARTEK).
I/O AC AMPLIFIER (LOGIC CAB)	146	??	5/30/93 - SPARE CARD, TESTED UNSAT.
I/O AC AMPLIFIER (LOGIC CAB)	142	A814	5/30/93 - BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A814.
I/O AC AMPLIFIER (LOGIC CAB)	147	A808	5/30/93 - BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A808.
I/O AC AMPLIFIER (LOGIC CAB)	149	A812	5/30/93 - REMOVED FROM A812 BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A812.
I/O AC AMPLIFIER (LOGIC CAB)	150	A813	5/30/93 - REMOVED FROM A813, BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A813.

I/O RECEIVER (LOGIC CAB)	28	A809	5/30/93 - REMOVED FROM A809, BENCH TESTED FOUND DEFECTIVE, REPLACED Q12. REINSTALLED TO A809.
SLAVE CYCLER LOGIC (LOGIC CAB)	80	I&C SHOP	5/31/93 21:35 - REMOVED FROM A514, BENCH TESTED UNSAT. FOUND PIN 8 LOW, SHOULD BE HIGH (12.5 - 15 VDC).
SLAVE CYCLER LOGIC (LOGIC CAB)	82	A514	5/31/93 - BENCH TESTED SAT. INSTALLED IN A514.
P/O BANK OVERLAP LOGIC (LOGIC CAB)	14	I&C SHOP	6/01/93 19:10 - REMOVED FROM A207, BENCH TESTED UNSAT. FOUND PIN 10 LO SHOULD BE HIGH (12.5 - 15 VDC).
P/O BANK OVERLAP LOGIC (LOGIC CAB)	81	A207	6/01/93 19:16 - BENCH TEST SAT. INSTALLED IN A207.
POWER SUPPLY (LOGIC CAB)			5/26/93 - REPLACED 100VDC AUX POWER SUPPLY
FUSES (POWER CABINET)			5/30/93 - REPLACED 2 FUSES, F11, F6. 6/9/93 - BENCH TESTED INCONCLUSIVE.
AUCTIONEER DIODE (LOGIC CAB)			5/30/93 - REPLACED 1 NEGATIVE 15 VDC AUCTIONEER DIODE (SHORTED). 6/9/93 - BENCH TESTED FOUND AUCTIONEER DIODE SHORTED.
LOW VOLTAGE POWER SUPPLY FILTERS			5/30/93 - REPLACED 2 FILTERS, A16 FL1 & FL2

NOTE: The spare parts, chips and diodes (1N4148), are availalbe in the I&C shop for replacement.

STEP COUNTERS

MODEL WHITTAKER	SERIAL NO	PRESENT STATUS	COMMENTS
127FD100A S/3	*20721	I&C SHOP	NEW ARRIVED FROM COMMONWEALTH ED. 6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 600 OHMS, SUB COIL 600 OHMS, RESET COIL 83 OHMS, ADD+SUB 1.2 K OHMS
127FD100A S/3	20698	I&C SHOP	5/16/93 - NEW ARRIVED FROM FLORIDA POWER & LIGHT, INSTALLED TO CBB GRP1. 5/25/93 - REMOVED FROM CBB GRP 1. 6/9/93 - CONTINUITY CHECK FOUND : ADD COIL 629 OHM, SUB COIL 605 OHMS, RESET COIL 81.5 OHMS, ADD+SUB COILS 1.2 K OHMS
127FD110A S/3	*8795	I&C SHOP	6/9/93 - CONTINUITY CHECK FOUND: ADD+SUB 3.4 M OHMS, RESET COIL 86.4 OHM, COMMON OPEN.
127FD100A S/3	8831	I&C SHOP	5/14/93 - REMOVED FROM CBB GRP 1. 6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 913 OHMS, SUB COIL 914 OHM, RESET COIL 87.4 OHMS, AD+SUB COIL 1.8 K OHMS

127FD100A S/3	20702	I&C SHOP	5/16/93 - NEW ARRIVED FROM FLORIDA POWER & LIGHT, INSTALLED IN CBC GRP 1 6/9/93 - CONTINUITY CHECK FOUND: AD COIL 816.6 OHMS, SUB COIL OPEN, RESET COIL 81.6 OHMS,
127FD100A S/3	8818	I&C SHOP	5/14/93 - REMOVED FROM SBA GRP 2. 6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 902.5 OHMS, SUB COIL 909 OHMS, RESET COIL 84.9 OHMS.
127FD110A S/3	* 20183	I&C SHOP	6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 820 OHMS, SUB COIL 813 OHMS, RESET 81.5 OHMS.
127FD100A S/3	20719	I&C SHOP	6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 627.7 OHMS, SUB COIL 608.7 OHMS, RESET COIL 81.5.
127FD110A S/3	* 20182	I&C SHOP	6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 806.2 OHM, SUB COIL 812.4 OHMS, RESET COIL 81 OHMS.
127FD100A S/3	20696	CONTR CONSOL E	5/16/93 - NEW ARRIVED FROM FLORIDA POWER & LIGHT, INSTALLED IN CBA GRP 1.
127FD110A S/3	20730	CNTR CNSOL	5/16/93 - NEW FROM FOLIO 37-7001, INSTALLED TO SBA GRP 2.
127FD100A S/3	8830	CNTR CNSOL	5/14/93 - REMOVED FROM CBB GRP 1. 5/25/93 - INTALLED BACK TO CBB GRP 1.

127FD100A S/3	8837	CNTR CNSOL	5/14/03 - RMOVED FORM CBC GRP 1. 5/25/93 - INTALLED BACK TO CBB GRP 2.

* These counters have a problem with lable.

Interview with 6-9-93

Engineering & Plant Betterment

Name : Len Rajkowski E&P ~~B~~ B

PSEG → 8 yrs Sr. Project Engineer
last two years

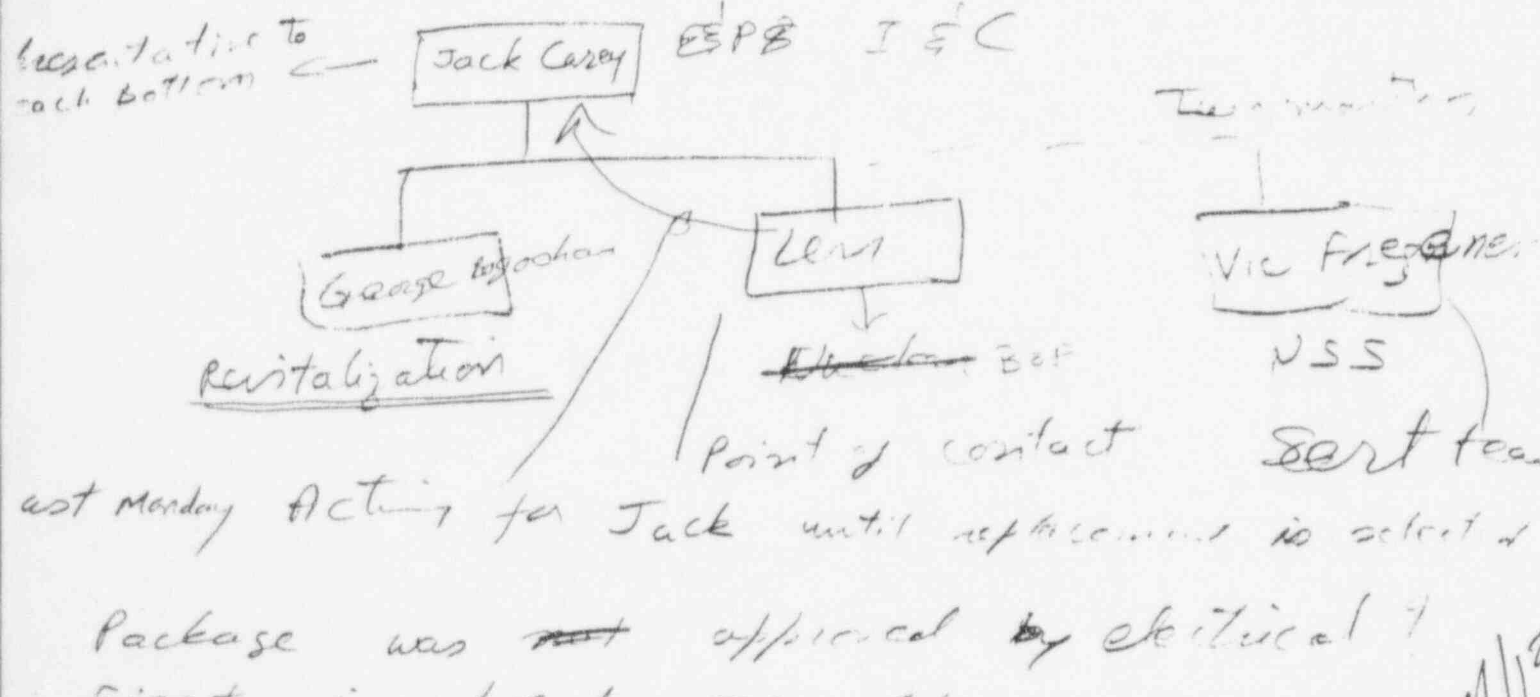
6 yrs system Engineers I&C

Stone & Webster 4 1/2 yrs.

Responsibility → Focus of contact if called upon

Licensing and computer →

Power supply modification was prepared by E&PB
was done by revitalization group.



last Monday Acting for Jack until replacement is selected

Package was ~~not~~ approved by electrical?
First involved on 6/3
Stayed with Gene to solve any concern
Previous involvement → Dave Best
one engineer who was

M/12

hired just ~~too~~ on April 26 was here on 5/26 to see if he can help although there was no request.

Try to determine the root cause of the failure [illegible] CRD

~~[illegible]~~ [illegible] team support headed by Roy Chrzanowski

Organize all technical capabilities in rod control [illegible] team include

T. [illegible] ← B. Lowry
J. [illegible] 4
D. Best → Joe [illegible]
V. Fresgenas → Bob Stan[illegible]
W

He ~~did not~~ believed on Friday that a single failure ~~with~~ could result in rod withdrawal

6-8-93

~~Dan~~ interview with Dan Laughman

2 YRS with PSE&G → System Engineer
12 yrs with GE I&C

Shift coverage memorial day weekend
Fri May 28 —— 1600 - 2400]
30 —— 1200 - 2400]

Control Board C group 1. presented as May 29
however according to Dan it happened on May 28, 18:15

David Lyons → Group lead.
Had no involvement with this system prior to ~~the~~ May 28.
Kim Mai is the responsible system engineer
Kim came in that evening after occurrence
~~Dec~~ decided that SEAT should be involved.
Talk to Kesic of W what could ~~be~~ have happened to the system
Call Ted Baird at home W sales rep → to let him ~~know~~ know we need additional W people.
Replacement card availability
and another card tester.
Call Dave Lyon → 1830 - 19:00 just after talking to Kim.
Don't remember Dave Lyon instructing him. to do anything
Kept in touch with Ted Baird about the progress
very little involvement with this at present
just helping other

Bill Lowry was the system engineer before
Kim Mai

May 30 → They were working ~~on~~ power supply
Mostly took note of what was happening

Ron Heater } → They were investigating and
Kosic } trouble shooting
Fuller } They also decided ~~to~~ about
The pulling card when cabinet
was energized.

~~Mostly~~
Was with W while testing I/O Amp
card → also learned that tester does not
test everything on the card.
Up until his shift W was testing each
of logic circuit

6/8/95

Interview with Kim Mai

~~Kim~~ PSE&G — 3 years

Kim Mai → 6 month ago → No trainin
2 weeks General PWR
7 months → PWR Train → at Training Center

Maintenance decided about card testing, all decision with maintenance and pre-op testing is done by — Maintenance & Operation
Involved with the system — on 5/24 as an observer

- Kim feels relay driver card are causing failure as data logging card.

Cert is taking the lead to resolve The issue.

Does not have the lead
Maintenance Work under The general troubleshooting procedure.
Were about 4 to 5 people
Went at the cabinet to observe and response to any question.
Bill Conry was involved in Memorial day weekend after The rod dropped on 5/28.
W is still under contract with maintenance

. meeting / Interview.

June 7, 93

Lynn Miller — SERT Lead.

Vic Fregonese — member SERT Team

John RONAFALVY — SERT member

ext. maybe this P.M.

Joe Pysnic
Bob Stanny } (W)
Tony Baker

Dave Vann
ME LAZAROWITZ

Talked with ~~Joe~~ Dave Katz,

1) Bob's view of the mech. with the problem.

Bob sketched the basic mech · similar to book drawing

IRPI accuracy is ±4 steps per Tony Baker for indication and Volt meter readings -

one step takes 780 msec

±5 coil polarity would/could

Bob says looked at Salem's traces, and they don't look normal.

mov Gripper looks sort of normal but lift and stationary occured also.

What happened · 2 theories.

Movable hits then lift - rod lifts

8 rods

Question of when the lift engages - matter of chance if rod moves Lift coil is the key to the probability Problem - if only chance on this rod, it should have moved out on out signal but it didn't. Unknown item

Vic said that operators think rod moved out much faster than the steps would have driven
(W) says it could go out at 72 SPM, faster is incredible

clarity — Tony believes a rod moved - only need one failure

Lift coil heating may help ~~cause~~ cause the total amount of out motion.

CORE is to change the timing slightly

Final Analysis - It can happen with a single failure Key Point.

Other rods might have moved one or two steps

Rod withdraw at S/U can also be a limiting case different failure mode.

What caused the chip failure -
Tony Doesn't feel that diode caused the failure - he feels that diode could have been failed for years.

When they coded step 1, they didn't (possibly) use the diode ~~coded~~ coding but derived it from somewhere else, so timing may be a problem. (W) will look at
Lynn raised question of could the maintenance (resoldering etc) cause the problem? (W) can't answer right now.

6/7/93 interview continued

Logic cabinet is most trouble free part of system
(W) has done this 25 times no problems as such to day
No evidence that this has occured before
FMEA was done but this failure was not covered nor required by the codes of the day - down to sort of board level but not individual line failures - static not dynamic analysis

Request document.

Need (W) copy FMEA WCAP 8976

6/3/77 dated

Current trace. "Westinghouse Maintenance "summary" document.

2962

X 2995
Howard

SERT 93-06 INTERVIEW SCHEDULE

1100 hrs: Westinghouse CRDM Specialists Operations Dept. Conference Room

Dave Katz going back to Pittsburg

Joe Pysnic - How many years exp

CD Control Division

Bob Staney Electromech Div

Tony Baker NATD

Div advanced

1) Single Failure - any new thoughts

A) Stationary card output = same whether in or out signal

B) Anything else that could be wrong - i.e. mechanical

2) Any new data on failures - ? excessive #, ? chip susceptability,

3) Any other plant failures that could shed a light on the failures here.

DOCUMENT LOG
ROD AIT

DATE	ITEM	DOCUMENT DESCRIPTION	GIVEN TO
6/5	1	NCO LOGS 5/24 - 6/4	S. BARR
6/5	2	TROUBLE SHOOTING CHRONOLOGY	S. BARR
6/6	3	SERT Plan, status, EC&F	me
6/6	4	Failure analysis of control sys	me
6/7	5	WESTINGHOUSE MAINTENANCE SUMMARY	H. GARG
6/7	6	RCS SIGNAL FLOW DIAGRAM	E. LAZAROWITZ
6/7	7	WCAP - 8976	E. LAZAROWITZ
6/7	8	Current traces for failed card	E. LAZAROWITZ
6/8	9	Timeline from SERT	me
6/8	10	RCS training information	me
6/8	11	RCS diagrams	me
6/8	12	JCO	me
6/10	13	(W) RASO	me
6/10	14	Temporary Standing Order	
6/10	15	MHTL Integrated Circuits	
6/10	16	2R7 Work Orders & Documentation	
6/8	17	TODAY'S SUNBEAM Article	
6/9	18	Event Notifications FAX	
6/8	19	CARD DESIGN ↔ Names FAX from PSE&G	
6/10	20	INFO. NOTICE 93-46	
6/15	21	(W) OG Mtg slides	me
6/15	22	Failed Component Status	me

M/13

ITEM NUMBER AIT-RCD-227
DATE 6/11

NRC INSPECTION
QUESTION/RESPONSE TRACKING FORM

INSPECTION SUBJECT ______________________

INSPECTION NUMBER ______________________

NRC INSPECTOR E LAZAROWITZ PSE&G CONTACT T. CARRIER

SYSTEM ______________________ COMPONENT ______________________

QUESTION: DURING MAINTENANCE OUTAGE FOR RCS, POWER SUPPLY FUSES WERE REMOVED WHILE CABINET WAS DE-ENERGIZED. HOW WAS CABINET REENERGIZED (WHAT ORDER)

RESPONSE: After interviewing Maintenance and the Westinghouse field Engineer, there is no way to determine the order of reinstalling fuses or the order of reenergizing the Cabinet

PSE&G CONTACT (*) [signature] DATE 6/15/93

NRC ACKNOWLEDGEMENT ______________________ DATE __________

RESPONSE ACCEPTED BY NRC (Y/N) ______________________

* If response involves a commitment, have PSE&G Audit Manager sign as PSE&G contact.

ITEM NUMBER AIT-ROD-223
DATE 6/9

NRC INSPECTION
QUESTION/RESPONSE TRACKING FORM

INSPECTION SUBJECT ______________________

INSPECTION NUMBER ______________________

NRC INSPECTOR E ZAZAROWITZ PSE&G CONTACT E. ROBINSON

SYSTEM ______________________ COMPONENT ______________________

QUESTION: DID ANY CARDS IN LOGIC CABINET TEST GOOD AT NTC AND TEST BAD AT STATION

RESPONSE: DID NOT FIND ANY CARDS THAT DID NOT WORK AT STATION THAT DID WORK AT NTC

PSE&G CONTACT (*) ______________________ DATE __________

NRC ACKNOWLEDGEMENT ______________________ DATE __________

RESPONSE ACCEPTED BY NRC (Y/N) ______________________

* If response involves a commitment, have PSE&G Audit Manager sign as PSE&G contact.

ITEM NUMBER ATT-RCD-224
DATE 6/10

NRC INSPECTION
QUESTION/RESPONSE TRACKING FORM

INSPECTION SUBJECT ____________________

INSPECTION NUMBER ____________________

NRC INSPECTOR E LAZAROWITZ PSE&G CONTACT T. CARRIER

SYSTEM ____________________ COMPONENT ____________________

QUESTION: 17 failures have been noted on Z3 11 were in A113 slot. What (demand/saint +) counter is driven by Z3 in A113? What is the maintenance history of that counter + Relay Driver locations.

RESPONSE: Z3 on A113 drives the step counter for C/B-A2 (Control Bank A Group 2.) through Relay Driver A713. On Monday 5/24 C/B-A2 counter "did not move on demand and gave an urgent failure alarm." This was linked to the blown lift coil resistor caused by the lamp socket. It was never replaced or suspected of mechanical difficulties throughout this troubleshooting effort. – see over –

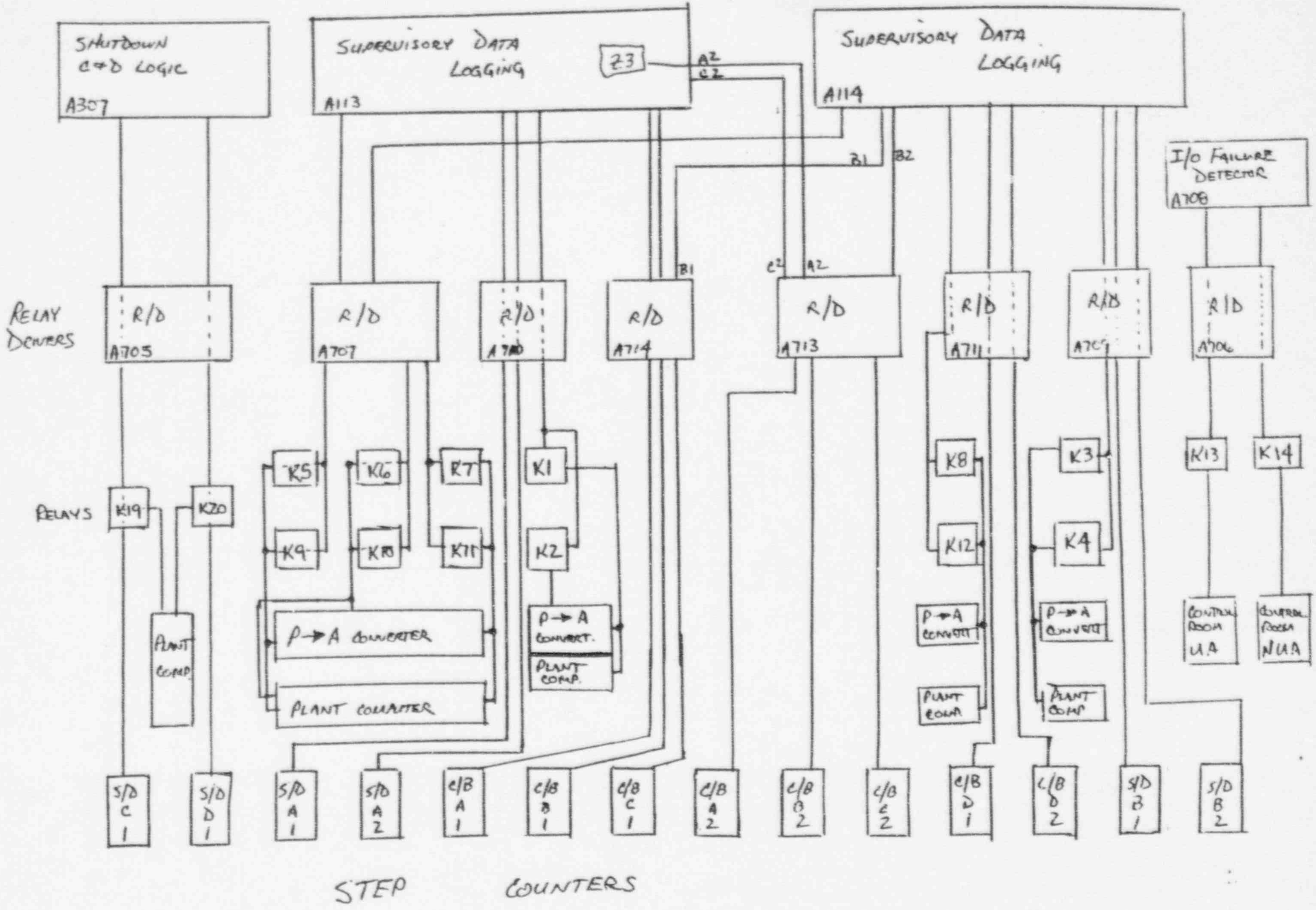
PSE&G CONTACT (*) Tom Carr DATE 6/11/93

NRC ACKNOWLEDGEMENT ____________________ DATE ________

RESPONSE ACCEPTED BY NRC (Y/N) ____________________

* If response involves a commitment, have PSE&G Audit Manager sign as PSE&G contact.

M/14



SHUTDOWN C&D LOGIC
A307
SUPERVISORY DATA LOGGING
A113
Z3
A2
C2
SUPERVISORY DATA LOGGING
A114
B1
B2
I/O FAILURE DETECTOR
A708
RELAY DRIVERS
R/D
A705
R/D
A707
R/D
A710
R/D
A714
R/D
A713
R/D
A711
R/D
A709
R/D
A706
RELAYS
K19
K20
K5
K6
K7
K9
K10
K11
K1
K2
K8
K12
K3
K4
K13
K14
PLANT COMP
P → A CONVERTER
PLANT COUNTER
P → A CONVERT.
PLANT COMP.
P → A CONVERT
PLANT COMP
CONTROL ROOM U.A
CONTROL ROOM N.U.A
S/D C 1
S/D D 1
S/D A 1
S/D A 2
C/B A 1
C/B B 1
C/B C 1
C/B A 2
C/B B 2
C/B C 2
C/B D 1
C/B D 2
S/D B 1
S/D B 2
STEP COUNTERS

ITEM NUMBER AIT-ROD-215
DATE 6/8

NRC INSPECTION
QUESTION/RESPONSE TRACKING FORM

INSPECTION SUBJECT ______

INSPECTION NUMBER 93-81

NRC INSPECTOR E. LAZAROWITZ PSE&G CONTACT T. CARRIER

SYSTEM ______ ______ COMPONENT ______

QUESTION: TIME LINE FOR ROD CONT SYS WORK DONE 2R - WESTINGHOUSE, DCP, MG BALANCING

RESPONSE: see attached.

PSE&G CONTACT (*) Tom Carrier DATE 6/8/93

NRC ACKNOWLEDGEMENT ______ DATE ______

RESPONSE ACCEPTED BY NRC (Y/N) ______

* If response involves a commitment, have PSE&G Audit Manager sign as PSE&G contact.

m/13

TKL
6/3/93
1506

2R7 ROD CONTROL TIME LINE

3/17 2R7 BEGINS

3/22 WESTINGHOUSE'S TOM KING & BUDDY WHEATON ON SITE

3/26 I&C SUPERVISOR ROBIN RISLEY SIGNS ONTO TAGS IE. WE KNOW THE MAIN & AUX POWER IS OFF AT THIS DATE. INITIATE A TEMPORARY RELEASE FOR AUX PWR

3/26 LOGIC CABINET TEST BOX PARTIALLY INSTALLED, EXCEPT FOR ROD SPEED SIGNAL. NOTED THAT POWER CABINET FUSES HAD BEEN REMOVED BY OTHERS. FUSE REPLACEMENT OPTION NOT PURCHASED BY CUSTOMER. BEGAN CKT CARD INSPECTIONS.

3/27 AUX PWR ON (AUX SUPPLY BKR) VIA TEMP RELEASE, BUT EACH POWER CABINET HAD PWR TAGGED OFF AT 0100 FOR PWR SUPPLY DCP.

3/29 COMPLETED TEST BOX HOOK UP.
DCP WORK BEGINS

4/1 KING DISCUSSED NEED FOR MAIN & AUX PWR WITH HEATON NOT SURE IF AUX SUPPLY BKR IS OPEN AGAIN OR JUST THAT DCP IS NOT DONE. WE'RE TRYING TO GET SOME TRIS INFO TO CLEAR THIS UP.

4/3 BUDDY WHEATON'S LAST DAY ON SITE.

CARDOX DUMP IN OUTER PENETRATION ROOM ADJACENT TO RELAY ROOM. 4 HOUR DELAY.

4/5 DISCUSSED RETURN OF PWR WITH HEATON. KING EXPRESSED THAT HE HAD OTHER COMMITMENTS COMING UP.

4/6 STARTED MG MAINTENANCE SERVICE
AUX PWR STILL NOT AVAILABLE. REQUEST MADE FOR CLEARANCE OF MAIN & AUX PWR FUSE TAGS.

4/7 AUX PWR STILL NOT AVAILABLE. 2BD CABINET IS ONLY ONE WITH FUSES INSTALLED.

COMPLETED MG SET INSPECTIONS AND RELAY TESTING.

4/9 DECIDED NOT TO WAIT ANY LONGER. BEGAN PREPS TO LEAVE SITE FOR NEXT JOB.

4/10 TO 5/10 WESTINGHOUSE OFF SITE.

5/10 TAGS STILL HANGING FOR RTBs, MG SETs & MAIN AC

5/11 MAIN AC AND 3 PHASE PWR STILL NOT AVAILABLE.
CKT CARD INSPECTION SIGNED OFF. ALL CARDS ARE REINSTALLED. THE FOLLOWING WAS NOTED OR PERFORMED

2/2

TKC
6/8/93
1506

DURING THE CKT CARD INSPECTION, ALL OF WHICH OCCURRED DURING THE FIRST PART OF THE SERVICE:

SUPERVISORY DATA LOGGERS

A113	S/N0183	OK
A114	0216	NO OUTPUT AT J1 PIN 10 (Z12 PIN8) REPLACED Z12 WITH MC660, TESTED OK

RELAY DRIVERS

A705	S/N0135	OK
A706	0680	OK
A707	0402	RESOLDERED C3, TESTED OK
A709	0136	RESOLDERED CARD CONNECTOR @PIN 7, TESTED OK
A710	0370	OK
A711	0134	OK
A713	0132	FAILED STEP 4 OUTPUT @ PIN 7 READ 3.5V MIN TO 15.3V MAX (REQ'D 0 TO 1.5V MIN AND 12.5 TO 15.5V MAX) TIGHTENED MOUNTING SCREWS FOR Q6 TESTED OK
A714	0139	OK

SLAVE CYCLER DECODERS
15 CKT CARDS TESTED; ALL OK EXCEPT ONE
A509 S/N0071 (STATIONARY) REPLACED CR41 - ANODE VOLTAGE WAS 10.4VDC (REQ'D 7.0 TO 9.0VDC), TESTED OK.

5/11 CONDUCTED STEP COUNTER VERIFICATIONS WHILE WAITING FOR POWER. 2 COUNTERS FAILED; 2 OTHERS PASSED MARGINALLY.

5/12 3 PHASE POWER AVAILABLE. TESTED DC HOLD CABINET, MAIN & AUX PWR. (CO-ORDINATED WITH DCP GROUP) DCP WORK COMPLETE.

2AC MUX VERIFICATION FAILED FOR GP A. BULB PROBLEM.

5/13 PERFORMED SOME TESTS ON RELAY DRIVERS FOR BAD STEP COUNTERS, RESULTS INCONCLUSIVE.

WITH DUMMY COILS CONNECTED TO CABINET 2AC, A LIFT REGULATION ERROR OCCURS DURING REQUESTED MOTION. REPLACED I2 FAILURE DETECTION CARD (S/N 0132) WITH NEW ONE (S/N 0148). LOCATED IN POWER CABINET.

DURING CHECKS ON CABINET SCD, VARIED PS-2 VOLTAGE WITH PS-1 OF TO OBTAIN INFO ON EFFECTS OF VC CVS. REGULATION. VOLTAGE VARIED FROM +20 TO +26.5 VDC.

5/14 REPLACED BAD BULB SOCKET.

CONTINUED ON TIME LINE BEGINNING ON JUNE 7, 1993.

5/23 COMPLETED OPERABILITY CHECKS FOR RDMG BALANCING PM

SALEM UNIT 1/2 /OPERATIONS
PROCEDURE NUMBER SC.OP-DD.ZZ-AD46(Q) - REV. 0

PROCEDURE NAME
TROUBLESHOOTING ABNORMAL PLANT CONDITIONS

SPONSOR ORGANIZATION: SALEM OPERATIONS

USE CATEGORY: III

REVISION SUMMARY: Initial issue, 3 pages of text. The procedure was written to comply with LER 272/90-030-00, Reactor Trip on # 13 S/G Low-Low Level Due to Personnel Error. The procedure defines the actions to be taken in support of troubleshooting abnormal plant conditions(s) not addressed by existing procedures.

INFO ONLY

IMPLEMENTATION REQUIREMENTS

NONE REQUIRED

APPROVED: V J Polizzi 2/1/91
Operations Manager - Salem Date

m/16

1.0 **PURPOSE**

To provide general guidelines for the troubleshooting of abnormal plant conditions not addressed by existing procedures and which does not require an immediate response.

2.0 **SCOPE**

The text of this procedure describes the process to be used by Operations Department personnel to ensure personnel safety and protect plant equipment.

3.0 **RESPONSIBILITIES**

3.1 The Operating Engineers are responsible for authorizing any testing and/or troubleshooting identified by this procedure.

3.2 The Senior Nuclear Shift Supervisor shall:

3.2.1 Ensure that adequate precautions are taken to ensure personnel safety and protect plant equipment.

3.2.2 Ensure that when testing and/or troubleshooting is in-progress, the plant is maintained in a safe condition.

4.0 **PROCEDURE**

4.1 The Senior Nuclear Shift Supervisor should:

4.1.1 Make a preliminary evaluation of the abnormal plant condition.

4.1.2 Contact the System Engineer to discuss the abnormal plant condition.

4.1.3 Notify the appropriate Operating Engineer for the affected unit.

4.1.4 Write a Work Request to identify the problem in accordance with NC.NA-AP.ZZ-0009(Q), Work Control Process. Initiate a NO-Plan Work Order, if repairs are to begin immediately due to operating conditions, radiological conditions, etc.

4.1.5 Determine if an existing procedure should be changed to address the present condition or if an additional procedure or guideline is required.

a. If a new procedure or procedure revision is not warranted by the situation, Attachment 1 shall be used for documenting the instructions necessary for any troubleshooting.

4.1.6 Ensure that the System Engineer:

a. Researches the abnormal condition (review vendor manuals, background documents, discussion with vendor, etc.).

b. Analyzes all circuits which could be effected during the troubleshooting to ensure that no inadvertent starts, trips or actuations of other equipment or circuits are caused by the lifting of leads, using jumpers, or removing/replacing fuses.

c. Discusses any findings with the Operating Engineer, Senior Nuclear Shift Supervisor and the Procedure Writer.

4.2 The Operating Engineer, Senior Nuclear Shift Supervisor and the System Engineer will review any preliminary procedure/instruction, to ensure adequate precautions are taken to ensure personnel safety and protect plant equipment.

4.3 If, during the course of the troubleshooting effort, the operator performing the procedure determines that the procedure is not adequate, the troubleshooting will be stopped and the Senior Nuclear Shift Supervisor shall be consulted for additional guidance.

5.0 **DEFINITIONS**

NONE

6.0 **REFERENCES**

LER 272/90-030-00, Reactor Trip on #13 S/G Lo Lo Level Due to Personnel Error (Operations File Number 900090)

ATTACHMENT 1
TROUBLESHOOTING DOCUMENTATION

The following information shall be recorded on these sheets:

1. Seniors name and date
2. Brief description of reason for this troubleshooting.
3. Signature of System Engineer, or name, time and date System Engineer was notified.
4. Numbers (if available) and names of all references used. These can be provided by the System Engineer.
5. Steps for troubleshooting or step references from other documentation.
6. Operating Engineer's approval.

ATTACHMENT 1 (Cont'd)
TROUBLESHOOTING DOCUMENTATION

Control Rod Logic Cabinet Failure Open Items Resolution

Root Cause of Q10 Transistor Failure

Attachment 1 shows a basic one line diagram of part of the relay driver card and its associated step counter coil. Q10 (Q2 in this figure), the failed component in question, is the power transistor which turns the counter coil on and off. This on-off operation results in the generation of high amplitude short duration transients. These transients have been measured at greater than 500 volts peak to peak.

This Q10 transistor is a 2N3739 power transistor(see Attachment 2). Information provided by Motorola (see Attachment 3) demonstrates that if this power transistor experiences voltage transients greater than the stated specification, the risk of failure is high. Once the transistor is exposed to this type of transient, its ability to withstand failure is dependent on manufacturing tolerances.

Slave Cycler Moveable Decoder (G03)

This particular card was analyzed by Motorola. Motorola stated that the cause of the chip failure was due to high Electrostatic Discharge (ESD) or a high voltage spike with short duration. Motorola qualified their statement by saying that a short duration means less than 1 msec.

The plausible cause of a high voltage spike of short duration is similar to other failures seen in the system such as the other slave cycler moveable decoder card analyzed by Westinghouse. This plausible cause is also compatible with the disconnected pin 4 scenario which resulted in the removal of the suppression diode from the circuit.

Slave Cycler Logic Card

Failure of the slave cycler logic card is due to the application of 100VDC onto the -15VDC supply. With application of 100 VDC to the -15 VDC supply, a path exists to pin 11 of chip Z8D via the two diodes (CR15 and CR16). See Attachment 4. According to Motorola, if 100 VDC is applied at the output while the Nand gate is turned off, the Nand gate can definitely fail. See Attachment 5.

An issue that needs to be addressed is why other components did not fail in the circuit. The answer to this is timing. It becomes a race condition between the fuses blowing due to such a fault and the ability for the components in the circuit to withstand the electrical stress.

m/17

P/O Bank Overlap Logic Card

A thorough review has been performed regarding the failure pin 9 on Z1C of this card. A root cause has not be established for this failure at this time. Components to be sent to manufacturer for analysis.

Step Counter Failure

On May 14, 1993, a new step counter was installed for SBA Group 2. This step counter was a Neuron Model 127FD110AS/3, Serial Number 20730 manufactured by Whittiker Corporation. This step counter remained in service from May 14 through June 2 and experienced no problems. On June 3, 1993, the counter exhibited a problem by missing 10 steps.

Work order 930603076 (Attachment 6) was issued and the source of the problem was determined to be a purely mechanical failure. The counter was reworked, tested and returned to service.

There were no electrical concerns regarding this counter. Furthermore, there were no relay driver or datalogger card failures associated with the misoperation of this counter.

Attachment 1

Simplified Circuit For
Data Logger and Relay Driver Cards

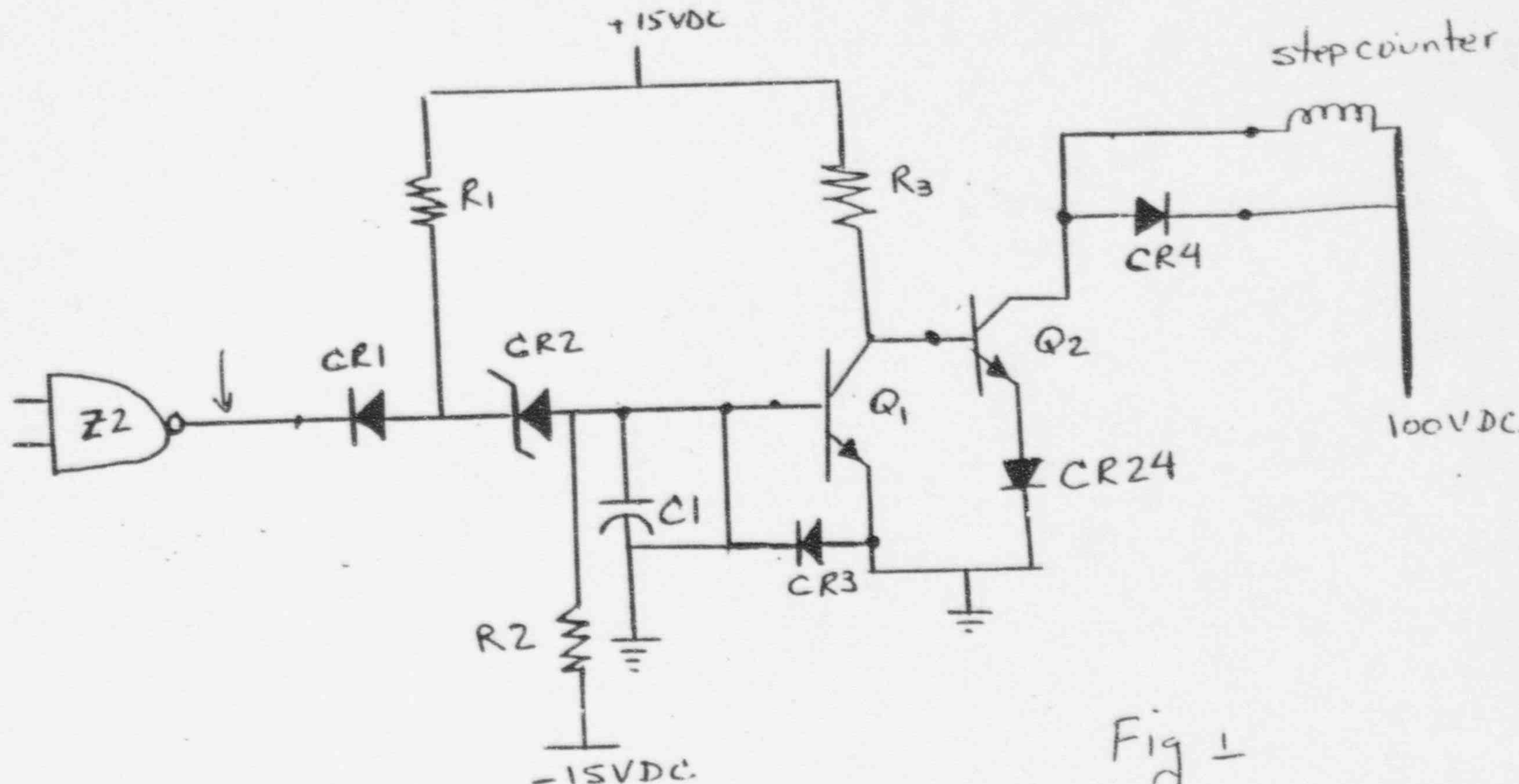


Fig 1

Attachment 2

2N3738, 2N3739 NPN (SILICON)
2N6424, 2N6425 PNP

HIGH VOLTAGE COMPLEMENTARY SILICON POWER TRANSISTORS

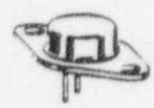
. . . designed for high-speed switching, linear amplifier applications, high-voltage operational amplifiers, switching regulators, converters, inverters, deflection stages and high fidelity amplifiers.

- Collector-Emitter Sustaining Voltage —
  $V_{CEO(sus)}$ = 225 Vdc @ I_C = 5.0 mAdc (2N3738, 2N6424)
  = 300 Vdc @ I_C = 5.0 mAdc (2N3739, 2N6425)
- DC Current Gain —
  h_{FE} = 40-200 @ I_C = 100 mAdc
- Current-Gain — Bandwidth Product —
  f_T = 10 MHz (Min) @ I_C = 100 mAdc
- $I_{S/b}$ Rated to 2.0 Amperes

1.0 AMPERE

POWER TRANSISTORS COMPLEMENTARY SILICON

225, 300 VOLTS
20 WATTS



4

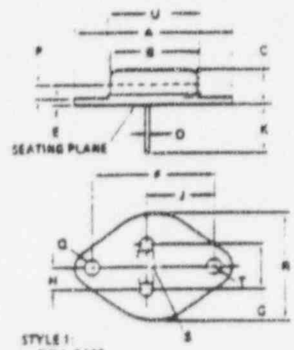
*MAXIMUM RATINGS

Rating	Symbol	2N3738 2N6424	2N3739 2N6425	Unit
Collector-Emitter Voltage	V_{CEO}	225	300	Vdc
Collector-Base Voltage	V_{CB}	250	325	Vdc
Emitter-Base Voltage	V_{EB}	6.0		Vdc
Collector Current — Continuous — Peak	I_C	1.0 2.0		Adc
Base Current — Continuous — Peak	I_B	0.50 1.0		Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	20 0.133		Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	7.5	°C/W

*Indicates JEDEC Registered Data



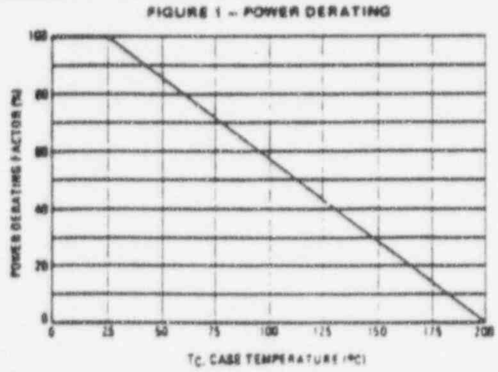
STYLE 1:
PIN 1. BASE
2. EMITTER
CASE: COLLECTOR

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	11.94	12.70	0.470	0.500
C	6.35	8.64	0.250	0.340
D	0.71	0.86	0.028	0.034
E	1.27	1.91	0.050	0.075
F	24.33	24.43	0.958	0.962
G	4.83	5.33	0.190	0.210
H	2.41	2.67	0.095	0.105
J	14.48	14.99	0.570	0.590
K	9.14	–	0.360	–
P	–	1.27	–	0.050
Q	3.61	3.86	0.142	0.152
R	–	8.89	–	0.350
S	–	3.68	–	0.145
U	–	15.75	–	0.620

All JEDEC Dimensions and Notes Apply.

CASE 80-02
TO-66

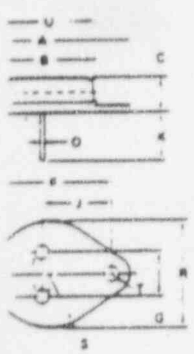
FIGURE 1 — POWER DERATING



AMPERE

TRANSISTORS
NTARY SILICON

300 VOLTS
0 WATTS



ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Max	Unit
***OFF CHARACTERISTICS**					
Collector-Emitter Sustaining Voltage (1)		$V_{CEO(sus)}$			Vdc
(I_C = 6.0 mAdc, I_B = 0)	2N3738, 2N6424		225	–	
	2N3739, 2N6425		300	–	
Collector-Emitter Cutoff Current		I_{CEO}			mAdc
(V_{CE} = 125 Vdc, I_B = 0)	2N3738, 2N6424		–	0.25	
(V_{CE} = 200 Vdc, I_B = 0)	2N3739, 2N6425		–	0.25	
Collector-Base Cutoff Current		I_{CBO}			mAdc
(V_{CB} = 250 Vdc, I_E = 0)	2N3738, 2N6424		–	0.1	
(V_{CB} = 325 Vdc, I_E = 0)	2N3739, 2N6425		–	0.1	
Collector Cutoff Current		I_{CEV}			mAdc
(V_{CE} = 250 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N3738, 2N6424		–	0.5	
(V_{CE} = 300 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N3739, 2N6425		–	0.5	
(V_{CE} = 125 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 100°C)	2N3738, 2N6424		–	1.0	
(V_{CE} = 200 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 100°C)	2N3739, 2N6425		–	1.0	
Emitter-Base Cutoff Current		I_{EBO}			mAdc
(V_{EB} = 6.0 Vdc)			–	0.1	
***ON CHARACTERISTICS**					
DC Current Gain (1)		h_{FE}			–
(I_C = 50 mAdc, V_{CE} = 10 Vdc)			30	–	
(I_C = 100 mAdc, V_{CE} = 10 Vdc)			40	200	
(I_C = 250 mAdc, V_{CE} = 10 Vdc)			25	–	
Collector-Emitter Saturation Voltage (1)		$V_{CE(sat)}$			Vdc
(I_C = 250 mAdc, I_B = 25 mAdc)			–	2.5	
Base-Emitter "ON" Voltage (1)		$V_{BE(on)}$			Vdc
(I_C = 100 mAdc, V_{CE} = 10 Vdc)			–	1.0	
SMALL SIGNAL CHARACTERISTICS					
Current-Gain – Bandwidth Product (2)		f_T			MHz
(I_C = 100 mAdc, V_{CE} = 10 Vdc, f = 10 MHz)			10	–	
*Output Capacitance		C_{ob}			pF
(V_{CB} = 100 Vdc, I_E = 0, f = 100 kHz)			–	20	
*Small-Signal Current Gain		h_{fe}			–
(I_C = 100 mAdc, V_{CE} = 20 Vdc, f = 1.0 kHz)			35	–	

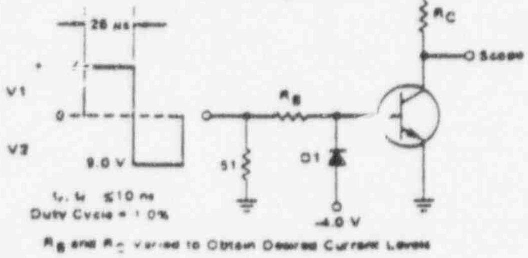
*Indicates JEDEC Registered Data

(1) Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2%.

(2) f_T = | h_{fe} | • frequency

FIGURE 2 – SWITCHING TIMES TEST CIRCUIT

D1 Must Be Fast Recovery Type, e.g.
MSD6300 Used Above I_B = 100 mA
MSD6100 Used Below I_B = 100 mA



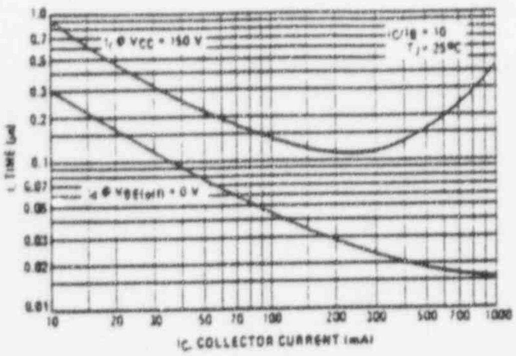
R_B and R_C Varied to Obtain Desired Current Levels

For t_d and t_r, D1 is disconnected and V2 = 0
For PNP test circuit, reverse diode and voltage polarities.

NPN
2N3738, 2N3739

PNP
2N6424, 2N6425

FIGURE 3 – TURN-ON TIME



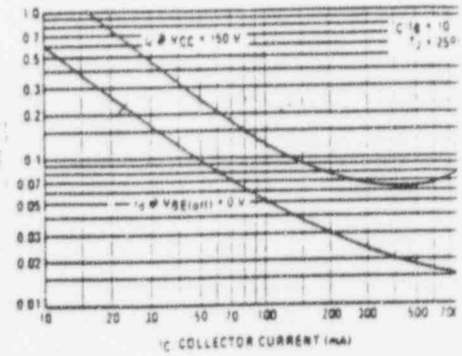
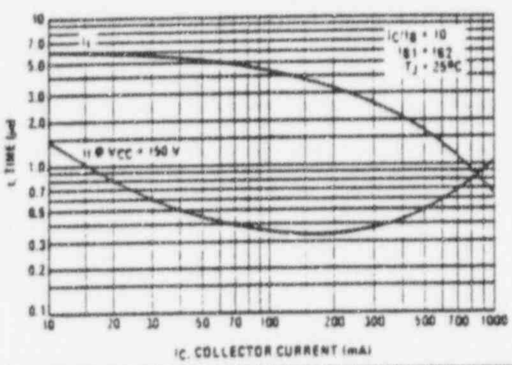


FIGURE 4 – TURN-OFF TIME



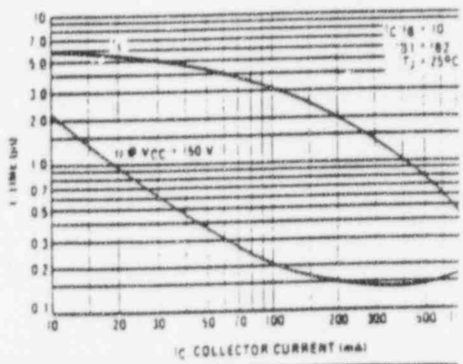


FIGURE 5 – CURRENT-GAIN – BANDWIDTH PRODUCT

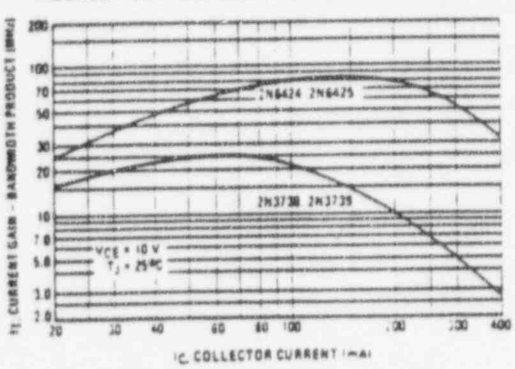
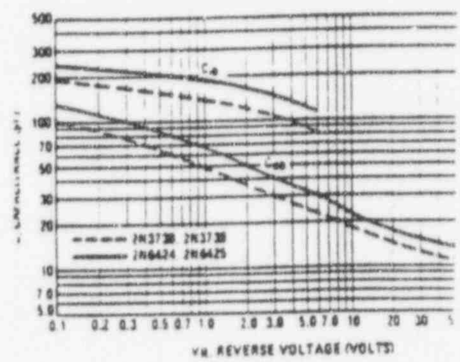
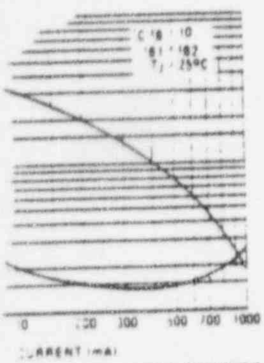


FIGURE 6 – CAPACITANCE



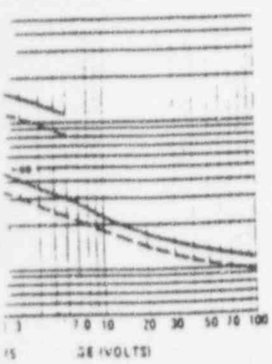
N6425

RRENT (mA)



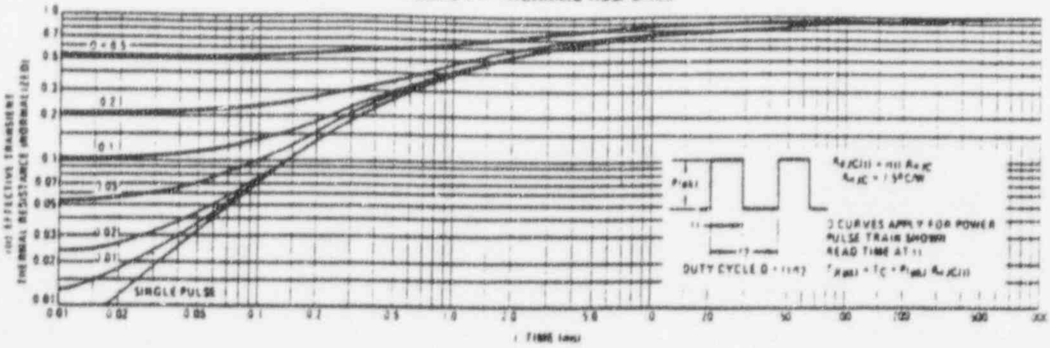
URRENT (mA)

CAPACITANCE



GE (VOLTS)

FIGURE 7 – THERMAL RESPONSE



ACTIVE-REGION SAFE OPERATING AREA

FIGURE 8 – 2N3738, 2N3739

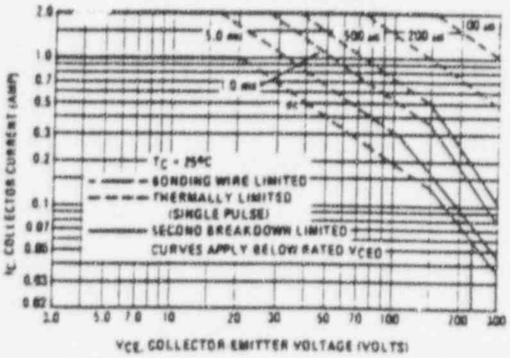
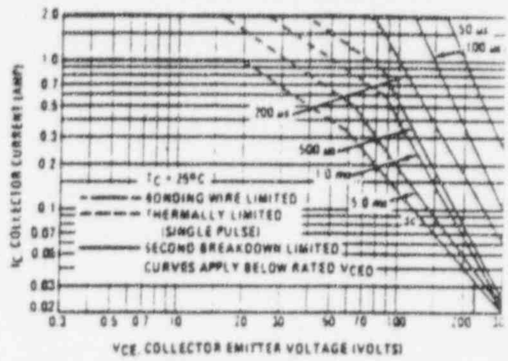


FIGURE 9 – 2N6424, 2N6425



There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figures 8 and 9 is based on $T_C = 25°C$. $T_{J(pk)}$ is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 175°C$. $T_{J(pk)}$ may be calculated from the data in Figure 7. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown. Second breakdown limitations do not derate the same as thermal limitations. Allowable current at the voltages shown on Figures 8 and 9 may be found at any case temperature by using the appropriate curve on Figure 1.

NPN 2N3738, 2N3739 | PNP 2N6424, 2N6425

FIGURE 10 – DC CURRENT GAIN

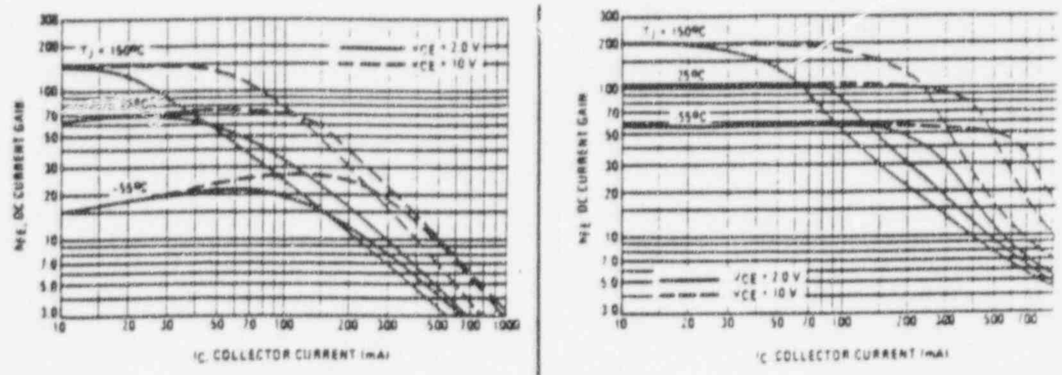


FIGURE 11 – COLLECTOR SATURATION REGION

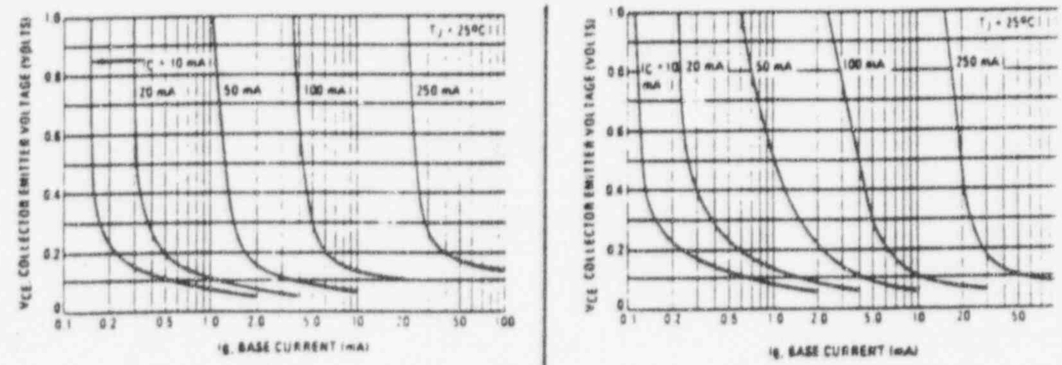
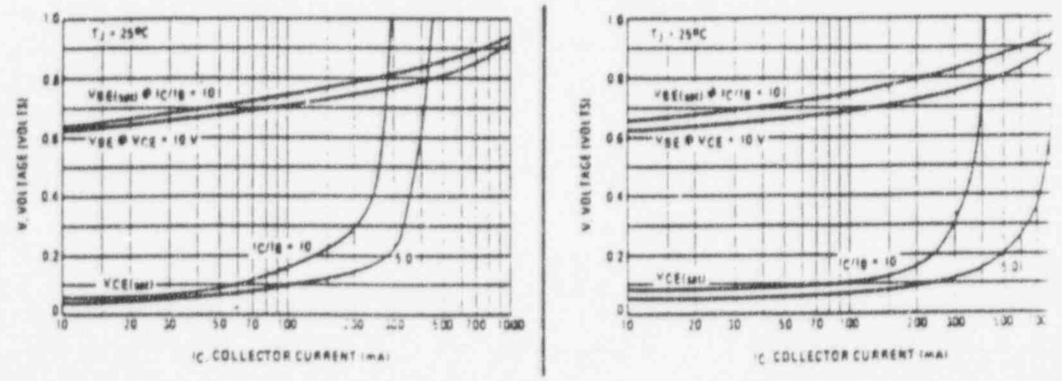
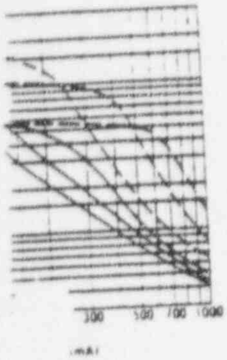
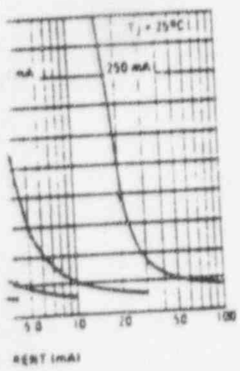


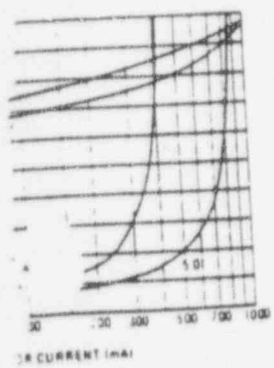
FIGURE 12 – "ON" VOLTAGE



25







NPN 2N3738, 2N3739	PNP 2N6424, 2N6425

FIGURE 13 – TEMPERATURE COEFFICIENTS

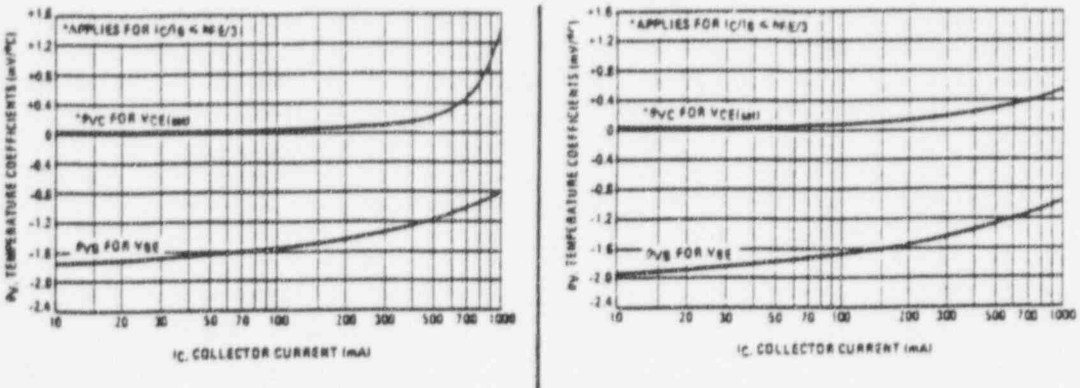


FIGURE 14 – COLLECTOR CUTOFF REGION

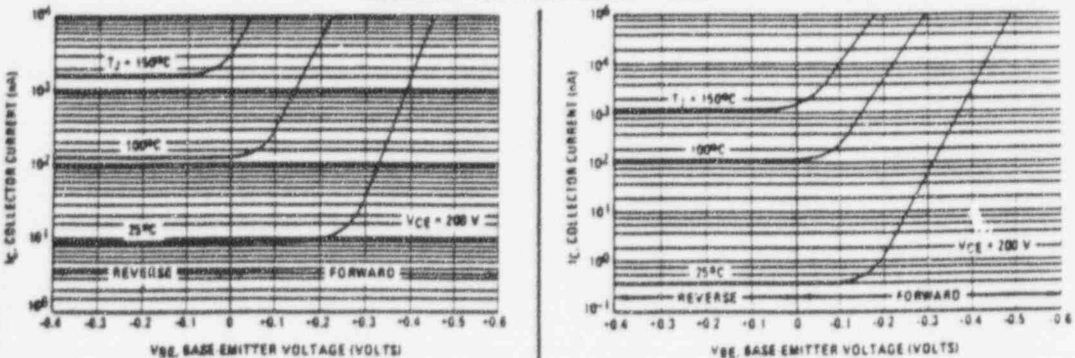
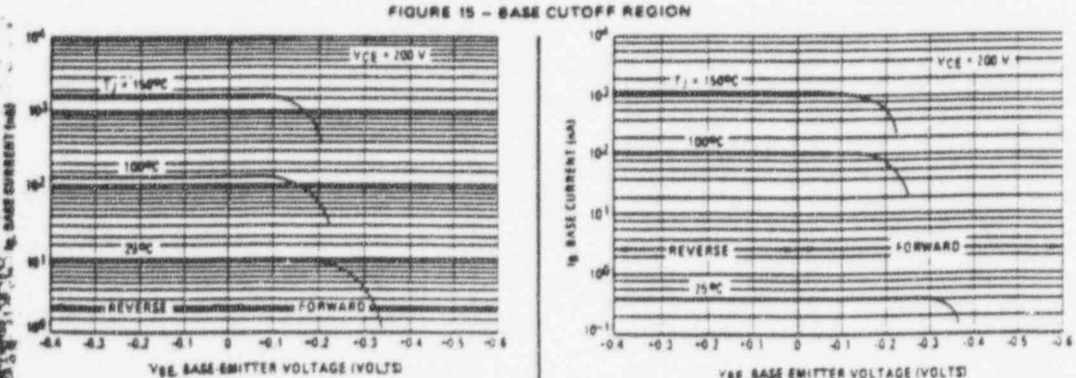


FIGURE 15 – BASE CUTOFF REGION



Attachment 3

Telephone Conversation Record

Participants: <u>PSE&G</u>	<u>Motorola</u>
Mark E. Woloski	Jim Benzer(Product Engineer

Subject: Failure Modes of the 2N3739

Date June 17, 1993 Time: 16:30 P.M.

Phone Number: (602) 962-2621

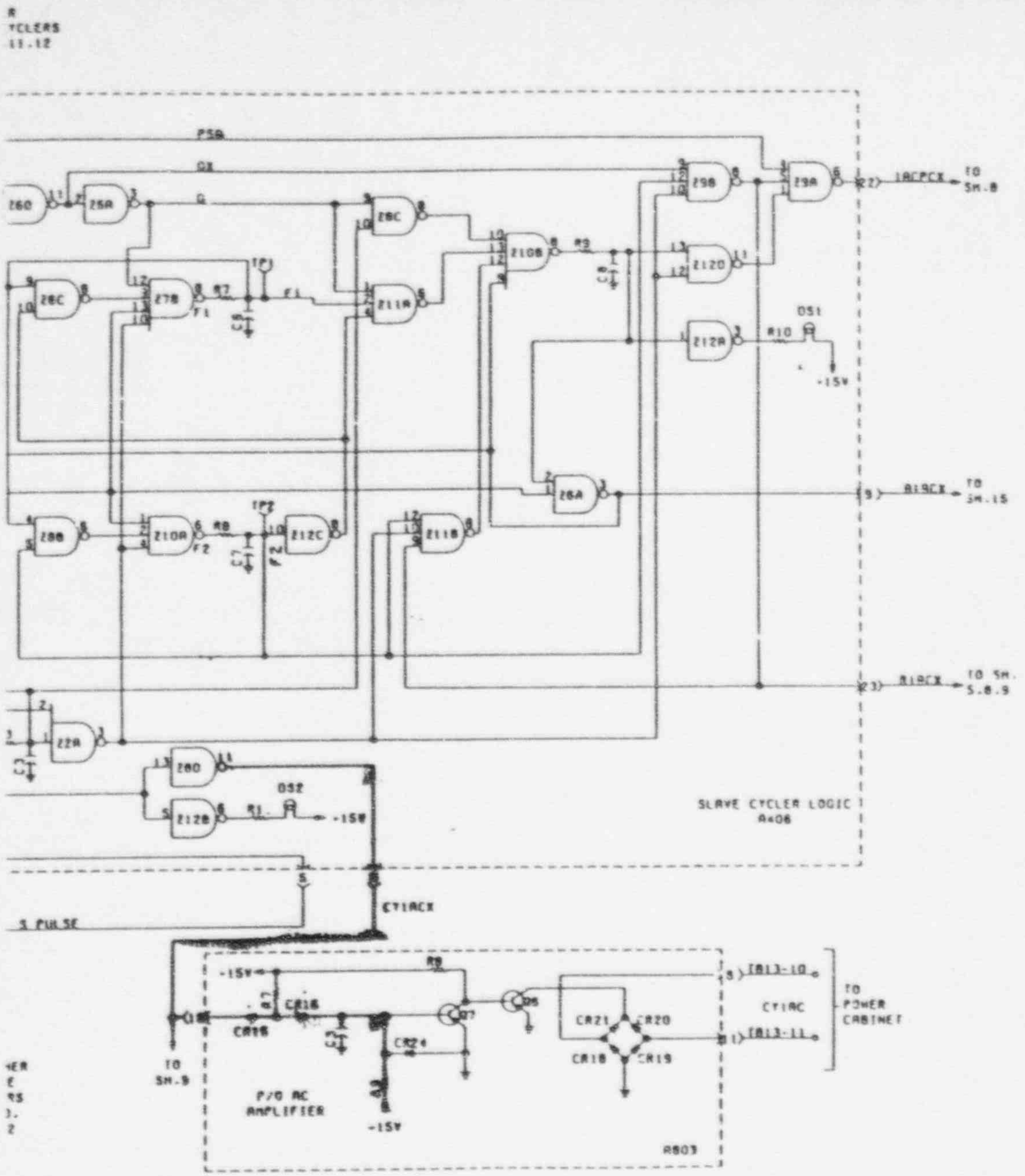
Discussion Details

Mr. Woloski asked Mr. Benzer about the impact of short duration voltage spikes about 400-500 Volts in amplitude and 1 microsecond in duration on the 2N3739 power transistor. Mr. Benzer stated that such spikes can definitely cause catastrophic failures in power transistors. As a matter of fact any transient above the maximum ratings can result in degradation or failure.

Mr. Benzer further stated that, in general, current transients are more forgiving on power transistors than voltage transients. Voltage transients can do significant damage to these components.

By: Mark E. Woloski

Attachment 4



SIZE	CODE IDENT NO	DWG NO.	REV
D	04804	C056001	G
SCALE — / —		SHEET 7	

Attachment 5

Telephone Conversation Record

Participants	PSE&G	Westinghouse	Motorola
	Ray Chranowski	Joe Pysnik	Paul Shockman (Product Engineer-MC668)
	Len Rajkowski		Ken Fergus (Manager-Assembly/Reliabilty)
	Bill Lowery		
	Tom Carrier		
	Seyavash Karimian		
	Dave Best		
	Mark Woloski		

Subject: Failure Modes of the MC668 Nand Gate Chips

Date: June 16, 1993 Time: 12:00 P.M.

Phone Number: (602) 962-2841

Discussion Details

Mr. Karimian asked Mr. Shockman if high voltage spikes, for example 100 Volts, with low available current and short duration, is capable of producing the type damage that Motorola is seeing in the chips they have analyzed. Mr. Shockman stated that spikes of that order of magnitude can definitely cause the type of failures.

Bill Lowery asked if voltage transients can migrate to chips upstream and cause failures. Mr. Lowery further stated that the type of failures, that Salem has been experiencing, involves failures of Nands several gates upstream from the source of the transient. Mr. Shockman stated that, although this may sound strange, Motorola has seen unusual failure patterns on multiple gate boards. Motorola has found that depending on the "on-off" states of the gates, the failures that have already taken place and the circuit trace layout, failures of other gates can take place upstream of the transient source leaving chips in between intact. Motorola has determined that the method of propagation of these transients is via the ground or Vcc Pins.

Mr. Chranowski asked Mr. Shockman if 25 Volt spikes superimposed on Vcc represented a potential source of failure. Mr. Shockman stated that, although this type of effect is not catastrophic, it was not healthy for the chips. This type of transient would eventually cause failures in the order of parts per thousand.

By: Mark E. Woloski

Attachment 6

5096

NUCLEAR DEPARTMENT WORK ACTIVITY CORRECTIVE MAINTENANCE	ACT TYPE FW	TASK CM

W/O: 930603076 ACT: 01

SECTION 1 -- TASK DESCRIPTION ORIGINAL

UNIT	PRI	RESP D/G	W/O SUMMARY
S2	A	SMD IC	S/D BANK "A" GR II STEP COUNTERS DISAGREE BY 10

PEG/COMP ID: ~~999~~ ZLD5892 MUC: C LOC: SYSTEM: RCS
COMPONENT ID NOT FOUND ON DATA BASE
SERIAL NBR:
ACT SUMMARY: S/D BANK "A" GR II STEP COUNTERS DISAGREE BY 10
ACT DESC-1: S/D BANKS GROUP I AND II STEP COUNTERS DISAGREE BY TEN STEPS.
PLEASE TROUBLESHOOT AND REPAIR.

SECTION 2 -- PLANNING INFORMATION

PLANNER: NPR SHIFT SUPERVISOR: RIBLEY	SAFETY RLTD NBR	SAFETY CLASS N	SEISMIC	EQ

DR# - N/A - DCR# - 00000 - N/A - PKG 00000
WORK STANDARDS: SEE W.O. 930527179
(HP W/STD):
TEMPORARY MODIFICATION # 00 0000
CODE JOB PKG

RC#: 0146
AUTH NO:
ACCT NO: E530030
PRG PLN: I00010
LOC: 1614
PLN JOB#: 578941

SECTION 3 -- SCHEDULING INFORMATION

SCHED START DATE: OVERDUE DATE:
SYSTEM OUTAGE: LCO NO: - -
SCHEDULER:
SCHEDULER COMMENTS:

ESTIMATED MANPOWER

MAN COD	NBR	DUR	EST	EST RCA
NTC	001	1.0	1.0	0.0
	000	0.0	0.0	0.0
	000	0.0	0.0	0.0
	000	0.0	0.0	0.0

TOTAL HRS: 0.0

SECTION 4 -- PERMISSION TO BEGIN

S/S PERMISSION TO BEGIN WORK: R. Mu[signature] DATE: 6/3/93 TIME: 0800
TAGGING REQUIRED: N TAG NO:

SECTION 5 -- CLOSE OUT

PERSON COMPLETING WORK	BADGE	DATE	ACTUAL MANHOURS
[signature]	03 - 795	6/7/93	MANPOWER: NTC
WORK SUPERVISOR	BADGE	DATE	MEN REQ :
[signature]	03 - 795	6/7/93	DURATION:
REPEAT WORK (N) (Y/N)			

S/S SIGNOFF: [signature] DATE: 6/7/93

ACTIVITY CLOSEOUT SHEET	RT NO.	TASK
	000000	CM

W/O: 930603076 ACT: 01

FAILURE CAUSE AND REPAIR DESCRIPTION CODES REQUIRED

CAUSE - MECHANICAL

- [ ] AB - FOREIGN/INCORRECT MATERIAL (WATER IN OIL)
- [ ] AC - PARTICULATE CONTAMINATION (BUILDUP OF SOLIDS IN FLUID SYS.)
- [ ] AD - NORMAL / ABNORMAL WEAR
- [ ] AE - PROBLEM LUBRICATION (LACK OF / INADEQUATE)
- [ ] AF - WELD RELATED (FRACTURE, CRACK, HAZARD FAILURE)
- [ ] AG [illegible]BNORMAL STRESS (LOAD,VIBRATION,TEMP,PRESSURE,FLOW)
- [ ] AV [illegible]SE PARTS, CONNECTIONS, OR FASTENERS
- [ ] AZ [illegible]ERIAL DEFECTIVE (FLAW)
- [ ] BB [illegible]HANICAL DAMAGE (UNKNOWN MECHANICAL FAULTS OR FAILURES)
- [X] BC - OUT OF ADJUSTMENT (LOOSE PARTS,STOPS,SETSCREWS,SETPOINTS)
- [ ] BD - AGING/CYCLIC FATIGUE
- [ ] BE - DIRTY (DEPOSITS OF EXTRANEOUS MATERIAL ON OPERATING PARTS)
- [ ] BF - BLOCKED/OBSTRUCTED (FLOW OR MECHANICAL MOVEMENT)
- [ ] BG - CORROSION-CHEMICAL REACTION-ELECTROCHEMICAL / STRESS AIDED

CAUSE - ADJUSTMENT/HUMAN-RELATED

- [ ] AA - FOREIGN/WRONG PART, INCLUDES POOR DESIGN AND MISAPPLICATION
- [ ] AL - SETPOINT DRIFT
- [ ] AM - PREV. REPAIR/INSTALLATION (INADEQUATE,NOT PROPER ACTION)
- [ ] AN - INCORRECT PROCEDURE
- [ ] BC - OUT OF MECH ADJUST. - NOT DUE TO DAMAGE - LOOSE LOCKNUT
- [ ] BH - OUT OF CALIBRATION
- [ ] BJ - INCORRECT ACTION - HUMAN ERROR

CAUSE - CONTROLS(ELECTRICAL/ELECTRONIC)

- [ ] AG - ABNORMAL STRESS (VOLTAGE SPIKES,OSCILLATIONS,ETC.)
- [ ] AR - INSULATION BREAKDOWN (SHORTS, ARCS, BURNED WINDINGS)
- [ ] AS - SHORTED / GROUNDED CIRCUITS
- [ ] AT - OPEN CIRCUIT
- [ ] AU - CONTACTS BURNED / PITTED / CORRODED
- [ ] AV - CONNECTION DEFECTIVE / LOOSE PARTS
- [ ] AW - CIRCUIT DEFECTIVE (UNKNOWN ELECTRONIC FAULTS OR FAILURES)
- [ ] AX - BURNED / BURNED OUT (LOCAL COMBUSTION,OVERLOAD,ELECT. FIRE)
- [ ] AY - ELECTRICAL OVERLOAD DUE TO UNANTICIPATED HIGH CURRENT
- [ ] AZ - MATERIAL DEFECT - FLAW
- [ ] BD - AGING/CYCLIC FATIGUE
- [ ] BE - DIRTY (DEPOSITS OF EXTRANEOUS MATERIAL ON OPERATING PARTS)
- [ ] BG - CORROSION - CHEMICAL REACTION - ELECTROCHEMICAL OR STRESS AIDED

REPAIR CODES / CORRECTIVE ACTION

- [X] AA - RECALIBRATED / ADJUSTED
- [ ] AC - TEMP. MODIFICATION - ACTION TO MAINTAIN FOR INTERIM PERIOD
- [ ] AE - MODIFY/SUBSTITUTE - CHNG/ELIMINATE OR REPLACE W/DIFF MODEL
- [X] AG - REPAIR COMPONENT/PART - RESTORE TO ORIGINAL CONFIG. BY CLEAN, POLISHING, TIGHTENING, REMOVE/INSERT CIRCUIT CARDS
- [ ] AH - REPLACE PARTS - PIECE REPLACED IN KIND, PACKING, SEALS
- [ ] AK - REPLACE COMPONENT - ENTIRE COMPONENT REPLACED IN KIND

ACTIVITY CLOSEOUT SHEET	RT NO.	TASK
	000000	CM

W/O: 930603076 ACT: 01

M+TE EQUIPMENT USED/NEEDED: N/A

DEFICIENCY REPORTS INITIATED: N/A

COMPONENT SERIAL #: ______ SERIAL # UPDATE __/__/__

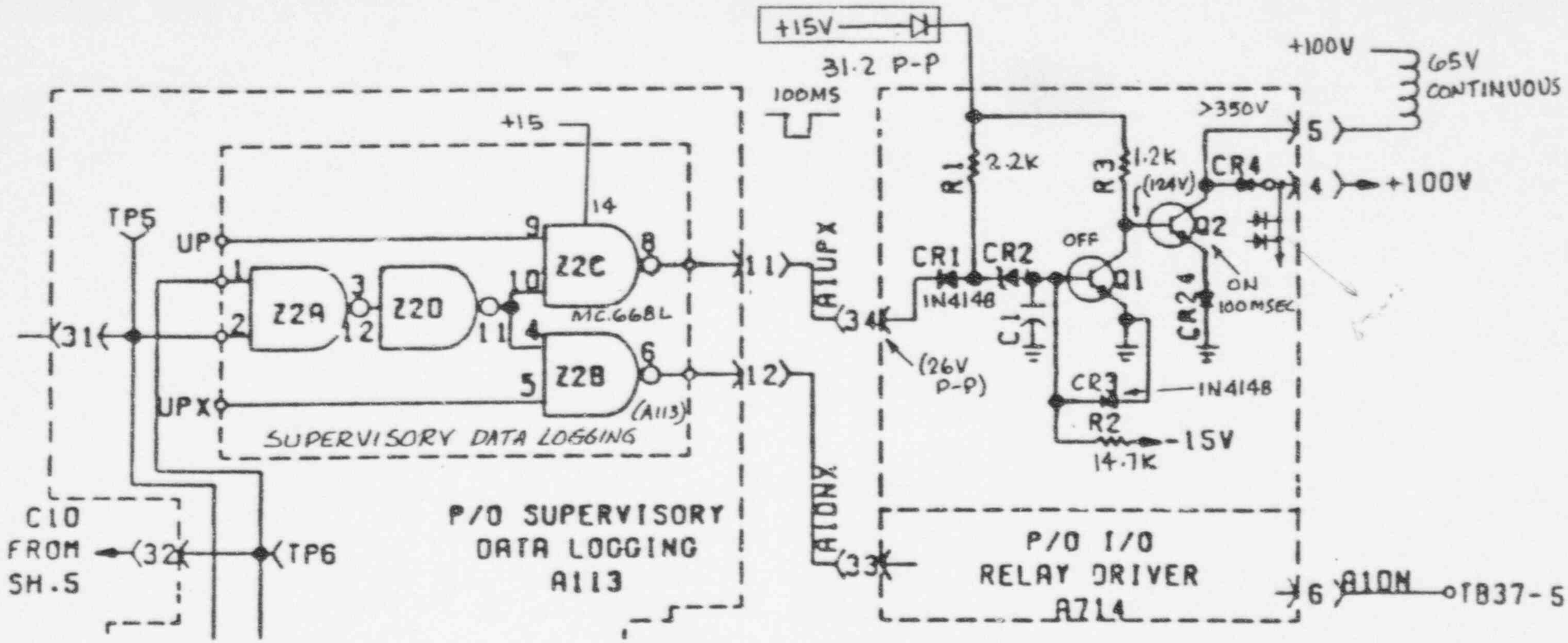
DESCRIPTION OF WORK PERFORMED: OPENED COVER, COUNTER RESET TO ZERO 6/3/93 W.O. LEFT OPEN PENDING ANY FURTHER PROBLEMS. 6-3-93 BALANCE OF WORK COMPLETED UNDER W.O. 930527179 ACT. 01

AS FOUND CONDITION: STEP COUNTERS DISAGREE

REPAIR ACTIONS TAKEN: SEE W.O. # 930527179

FAILURE CAUSE: OUT OF MECH ALIGNMENT

PMT PERFORMED: VERIFIED OPERATION



A. Replacement of 4 step counters - CBA1, CBB1, CBC1, SBA2 (later replaces CBB1 & CBB2)

1. Repeated Failures of (Z2C & Z2B)
2. Several (7) failures of blocking diodes (CR1) shorted (NTC and bench test proves short does not affect function nor cause Z2 failure) Note: NTC does not have 100V power supply
3. One failure of output transistor found (Q10) open
4. New Counter Resistance = 512 OHMS vs old coil 900 OHMS
5. W/O surge protection (CR4)
   New counter back EMF [361V (>450)] Q2 Saturates & conducts (Condensation on Counter) Counter fails
   Old counter back EMF [251V (>510)] Counter works properly
6. During field trouble shooting (condensation was seen on one counter)
7. Repeated failures stopped & (adjusted/tightened Pins) and replaced blocking diodes and A713, A71 relay driving boards.
8. Logic cabinet power supply isolated via auctioneered diode (Can't regulate downstream spikes)
9. 668 chip not recommended for voltage $\geq$ 18 Volts
10. Q2 (Q10) Motorola Specification for (2N3739 NPN) Base-Collector max [325V] Base-Emitter Max [300V]

M/S

PARTS ANALYSIS

SUPERVISORY DATA LOGGING

MC 668L NAND GATE CHIP
(MOTOROLA)

- One Chip-Pin 2 (Input) Short To Ground
  Cause: Electrical Stress Degradation or
  Electrostatic Discharges

- One Chip Pin 6 and 8 (Output) Leakage
  Cause: Electrical Overstress

- One Chip Pin 8 (Output) Leakage
  Cause: Electrical Overstress

Appears overstress caused a short to the substrate.

PARTS ANALYSIS

RELAY DRIVER

1N4148 BLOCKING DIODE
(PHILIPS)

- One Diode found SAT
  Ir,Vf,AND,Vbr meet specification

- Two Diodes found with degraded
  reverse characteristics
  (Very high reverse leakage, partially shorted)
  Result of electrical overstress.

PARTS ANALYSIS

SLAVE CYCLER DECODER
(3359C62 G02/WSN0079

MC 668L - 6951 NAND GATE CHIP
(WESTINGHOUSE)

- Chip Z2, Pin 9 has 200 ohms to ground leakage through substrate (insulation breakdown)

- Chip Z1, Pin 5 leakage to ground
  2 Microamps at 10 Volts
  (Specification calls for 2Microamps at 16V
  Deprocessing the die to the metal level and use of SEM revealed a damage site about 4 um in diameter from the pin 9 metal to the input isolation well edge.

The most likely cause for this failure is a voltage transient in excess of device capability resulting in oxide breakdown and the resultant "short".

From (W) PCD Quality Assurance Services
WIN 241-3712
Date 16 June 1993
Subject FA-3018 - MC668, DC6927

To J. Pysnik

cc: A. Sahasrabudhe
L. Kamenicky
E. Torres

Preliminary results of failure analysis for an MC668 (Z2) verify failure at input Pin 9 which can be characterized as a 200 ohm "short" to GND.

Deprocessing the die to the metal level and use of SEM revealed a damage site about 4 um in diameter from the pin 9 metal to the input isolation well edge.

The most likely cause for this failure is a voltage transient in excess of device capability resulting in oxide breakdown and the resultant "short".

Regards,

R.M. Roth

R.M. Roth
Quality Assurance Services

/nis
PCD QA93-821

PHILIPS

Philips Semiconductors

Philips Components
Discrete Products Division
Discrete Semiconductor Group

June 8, 1993
GK93-138

Dr. Sam Karimian
PSE&G
Nuclear Department
PO Box 235, N32
Hancocks Bridge, NJ 08038

Dear Dr. Karimian,

Regarding the three 1N4148 diodes which you sent for analysis, we are pleased to report the following:

- One diode (S/N #1) test good. It's I_R, V_F and V_{BR} meet the published specification for 1N4148 (specification included.)
- Two devices (#2, #3) show degraded reverse characteristics (very high reverse leakage, actually partially shorted). This appears to be the result of electrical overstress.
- All diodes are of Unitrode manufacture (note "U" logo on S/N2), NOT Philips
- All devices show evidence of poor assembly quality. Note the large voids around the semiconductor die and the non-concentric placement of the leads.

I've included some Philips 1N4148 diodes for the inspection.

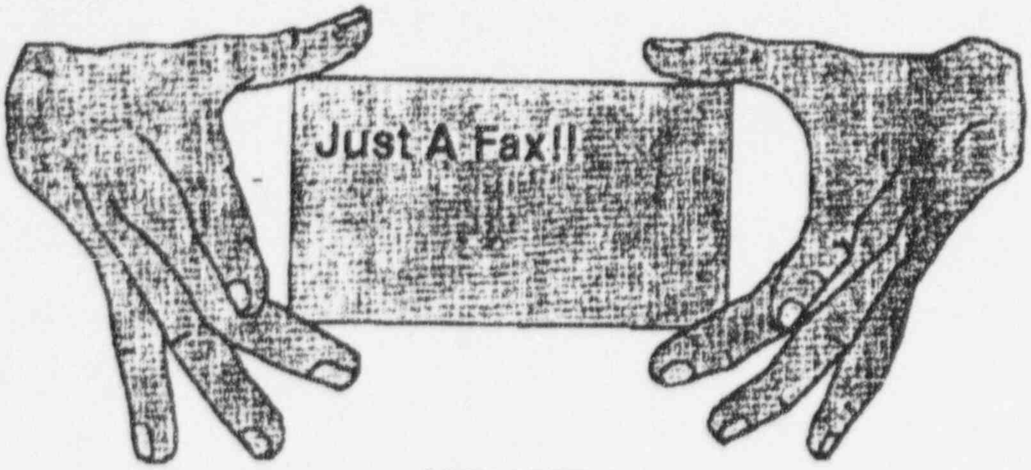
Best regards,

Gene Kelly

mmd

100 Providence Pike, Slatersville, RI 02876 • TEL: (401) 762-3800 • FAX: (401) 767-4497
A North American Philips Company

MOTOROLA



LOGIC DIVISION
RELIABILITY AND QUALITY ASSURANCE
2200 WEST BROADWAY ROAD
MESA, AZ 85202
MAIL DROP: M420
TELEPHONE: (602)962-2668
FAX: (602) 898-5719

DATE: 6/15/93

TO: DR SEYAVASH KARIMAIN

FAX:

FROM: KEN FEROUS TELEPHONE:

SUBJECT: MC668

NO. OF PAGES INCLUDING HEADER: 8

COMMENTS:

MOTOROLA INC.

Semiconductor Products Sector

Winner 1988 Malcolm Baldrige National Quality Award

LOGIC AND ANALOG
TECHNOLOGIES GROUP

PRODUCT ANALYSIS LABORATORY
F.A. REPORT #

9143

SUBMITTER'S NAME: JACK FINNEY
DATE SUBMITTED: 06/14/93

EXTENSION: 3030

DEVICE TYPE: MC668L
SOURCE TYPE: MC668
CUSTOMER PART NO.: N/A
CUSTOMER REF. NO.: N/A

WAFER LOT # : N/A
LOT ID: N/A
A.O.#: N/A
DEVICES SUBMITTED: 3

CUSTOMER:

SOURCE OF FAIL: CUSTOMER
COMMENT: N/A
SUBMITTING GROUP: RMR
COMMENT:
N/A

POINT OF FAIL: FLD

SUMMARY

QA CONTACT: JACK FINNEY
ANALYST: JUDY SORDIA
DEVICES EVALUATED: 3

PHONE: (602)962-2166

DATE COMPLETED: 06/14/93

FAILURE MECHANISMS:

1 ESD/VEOS
2 EOS

RESULTS

SN	FAILURE MODE	FAILURE MECHANISM
11	IR	ESD/VEOS
12	VOL	EOS
13	VOL	EOS

SERIAL #: 11 ASSEMBLY CODE: NA

DATE CODE: 7123

TOP MARKING:

MC668L
7123

BOTTOM MARKING:

NA

FAILURE MODES: IR

S/N 11-13) INCOMING PMS2K DATA INDICATED FUNCTIONAL, IR, VOL/H, AND ISC TEST FAILURES. PIN 2 FAILED ON S/N 11, PINS 6,8 ON S/N 12, AND PIN 8 ON S/N 13.

CURVE TRACE TESTING SHOWED PIN 2 TO BE SHORTED TO GROUND ON S/N 11. S/N 12 AND 13 SHOWED LEAKAGES ON THE FAILING PINS.

DECAPSULATION AND MICROSCOPIC INSPECTION REVEALED THE CAUSE OF FAILURE ON S/N 12 AND 13 TO BE ELECTRICAL OVERSTRESS AT THE FAILING OUTPUTS. THIS OVERSTRESS DOES NOT APPEAR TO BE ESD RELATED (SEE FIGURES 1-3).

MICROSCOPIC INSPECTION OF S/N 11 INDICATES AN OVERSTRESS DUE TO ESD (SEE FIG.4). AFTER REMOVAL OF THE GLASSIVATION AND METAL, THE OVERSTRESS COULD BE SEEN MORE CLEARLY (SEE FIG.5).

FURTHER DEPROCESSING TO SILICON, FOLLOWED BY SEM EXAMINATION SHOWS THE OVERSTRESS MORE CLEARLY (SEE FIG.6). IT APPEARS THE OVERSTRESS CAUSED A SHORT TO THE SUBSTRATE.

DEVICE DAMAGE DUE TO ESD OR EOS CAN ORIGINATE FROM A VARIETY OF SOURCES (PHYSICAL HANDLING, APPLICATIONS, TEST EQUIPMENT, ETC.). IN MOST CASES, IT IS NOT POSSIBLE TO DETERMINE THE EXTERNAL SOURCE OF DAMAGE.

SERIAL #: 12 ASSEMBLY CODE: NA

DATE CODE: 8621

TOP MARKING:

MC668L
8621

BOTTOM MARKING:

KOREA
UREC 668T

FAILURE MODES: VOL

SEE S/N 11

SERIAL #: 13 ASSEMBLY CODE: VTEFI

DATE CODE: 8649

TOP MARKING:

MC668L
8649

BOTTOM MARKING:

KOREA
VTEFI 668L

FAILURE MODES: VOL

SEE S/N 11

MOTOROLA INC.
Standard Logic & Analog
Integrated Circuits Group

I.C. QUALITY ASSURANCE DEPARTMENT
FAILURE ANALYSIS

PAGE ___ OF ___

REPORT # 9143

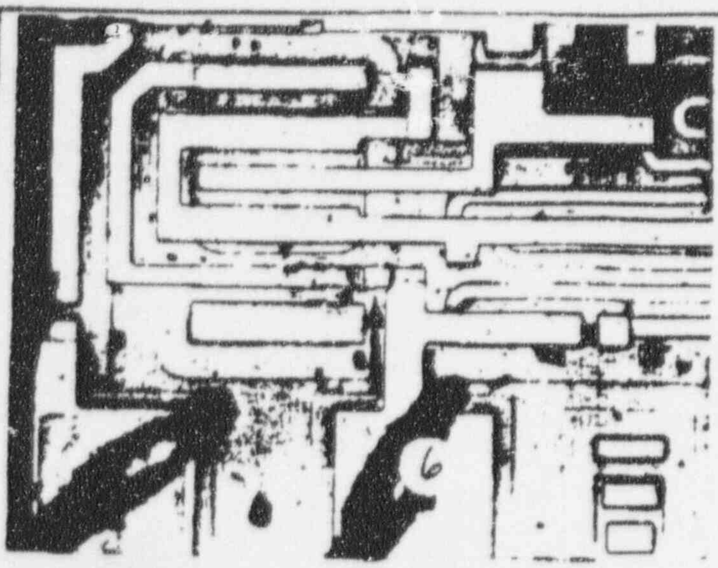


FIG. 1
S/N 12 PAD 6
ELECTRICAL OVERSTRESS

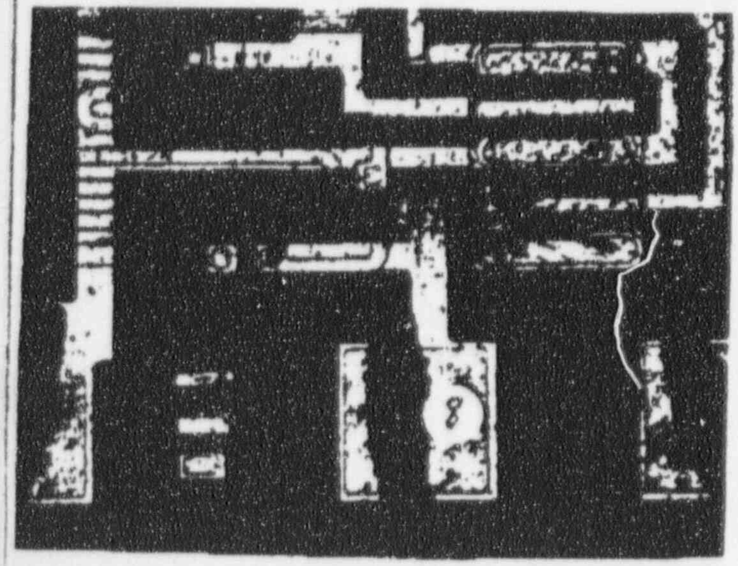


FIG. 2
S/N 12 Pad 8
ELECTRICAL OVERSTRESS

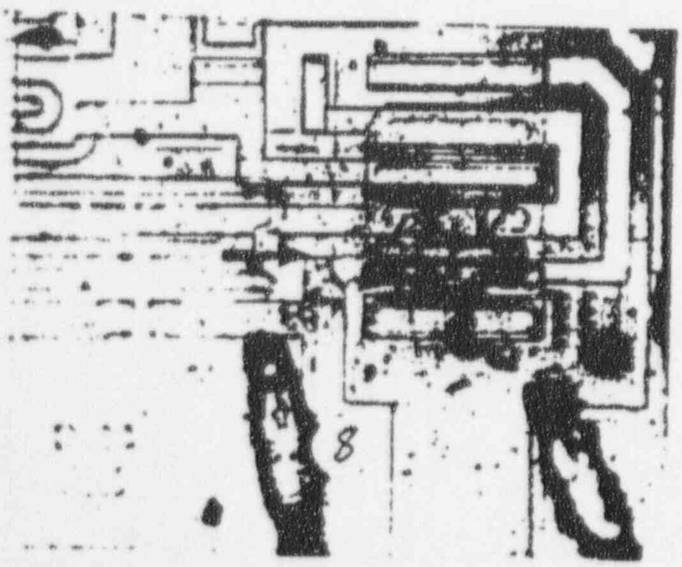


FIG. 3
S/N 13 PAD 8
ELECTRICAL OVERSTRESS

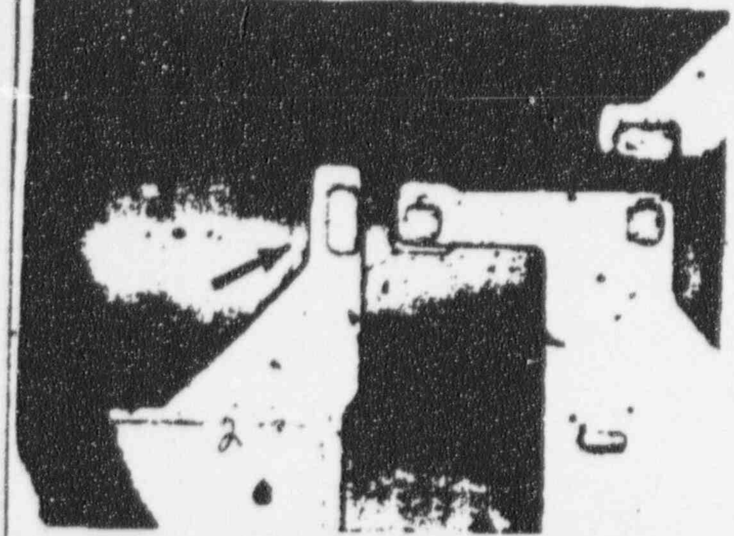


FIG. 4
S/N 11 PAD 2

INDICATIONS OF ELECTRICAL OVERSTRESS DUE TO ESD

FIG. 5
S/N 11 PAD 2

AFTER REMOVAL OF THE GLASSIVATION AND METAL, THE OVERSTRESS IS SEEN MORE CLEARLY

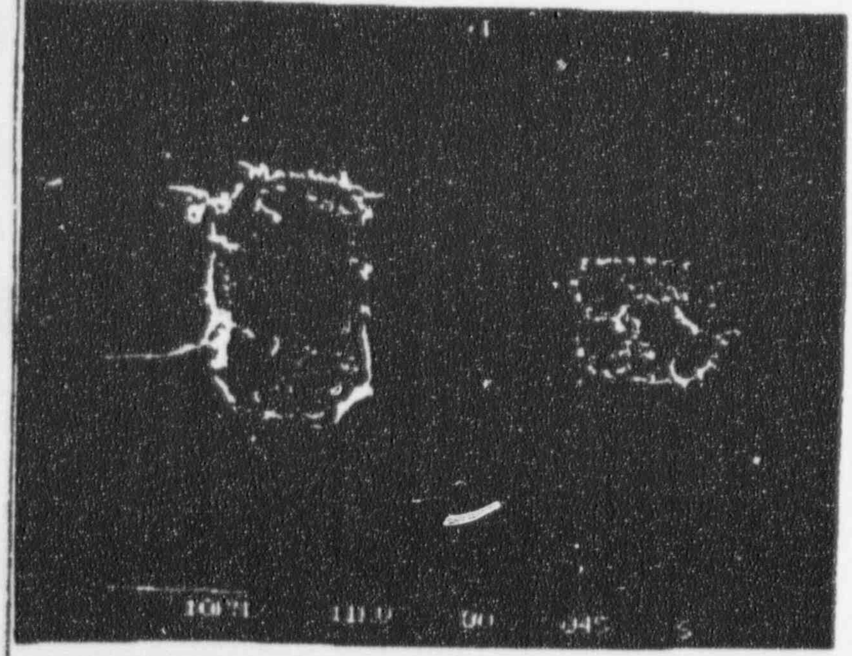


FIG. 6
S/N 11

AFTER DEPROCESSING TO SILICON, SEM EXAMINATION SHOWS THE OVERSTRESS.

To: Len Rajkowski

From: S. Karimian
D. Best
M. Woloski

Subject: Analysis of Transistor Failures on Signal Processing and Alarm Circuitry Cards

Date: June 27, 1993

Introduction

During Westinghouse testing of the CRD power cabinets, failures were noted on the above-referenced cards. Diagnostic tests were performed and a single transistor on each card was determined to be the source of the failure. A root cause investigation performed by E&PB determined that the most probable cause of the failures was due to technician error.

Description of Incident

Westinghouse personnel were executing Westinghouse Procedure Number NSID-EIS-85-11, Full Length Rod Control System Maintenance. In preparation for testing, two Failure Detector cards were removed from slots J1 and I2 for all five power cabinets per procedure step 9.1.1.2. Two jumpers were then installed on pins one and three on the card edge connectors of both slots in all power cabinets per procedure step 9.1.1.3. The purpose of adding these two jumpers is to simulate the failure detector cards being installed in their appropriate slots; thus defeating the card interlock alarm. It is important to note that the removal of the Failure Detector cards and the installation of the jumpers are only part of the Westinghouse maintenance service and is not part of PSE&G rod control system surveillance testing.

Westinghouse had completed procedure steps for three of the five power cabinets-1BD, 2BD and 2AC. Prior to testing the SCD cabinet, the interlock jumpers were removed and the Failure Detector cards reinstalled in the SCD power cabinet. Current traces were taken on the SCD cabinet with dummy coils. The stationary coil bus duct switches were opened and one phase fuse was pulled. The stationary bus duct switch was then closed and the reset switch was depressed. This should have generated three stationary phase failures.

It was noted that the stationary phase failures did not occur. Similar testing was then performed on the moveable circuitry with similar results. Diagnostics was performed and it was determined that the Signaling Process card had failed. The card was repaired (transistor Q9 replaced) and reinstalled. The phase failure, regulation failure and urgent alarms then became operable.

m/19

Testing then continued and a logic error indicator was found inoperable. An Alarm Circuitry card was determined to be the cause. The card was repaired (transistor Q9 replaced) and reinstalled. The logic error indicator then became operable as well.

Analysis of Failures

The Signaling Process card which failed was located in slot J2; the Alarm Circuitry card which failed was located in slot K1. Both cards are located in the SCD cabinet. It is important to note that the cards that failed were located immediately to the right of the locations where the Failure Detector cards were removed and the jumpers were installed. The traces, on the non- component side of the failed cards, are not insulated and are exposed to the technicians that tried to install or remove the test jumpers.

E&PB has reviewed the work method associated with the installation of the jumpers. The method used by Westinghouse to install or remove the jumpers involves the technician placing his hand in a "hand-shaking" position. The jumper is then placed between two of the fingers. The technician then places his hand in the empty slot where the Failure Detector card was located, between two existing cards, and attempts to position the jumper on the appropriate two pins. Because the workplace is confined, the risk of connecting two of the wrong pins or shorting out traces on an adjacent card is possible. The potential for a mishap exists during the installation or removal of the test jumpers. Therefore, E&PB has concluded that, during installation or removal of the jumpers, in two separated occasions, pins on the cage connectors or traces on the exposed card were momentarily cross-connected resulting in specific transistor failures.

The most probable cause of failure of the Q9 transistor on the Signaling Process card was due to the inadvertent contact shorting of pins 5 and 6 on the Failure Detector card cage connector or the corresponding traces on the Signal Process card, while removing the jumper from pins 1 and 3 on the Failure Detector card cage connector(see attachment 1). Approximately 24 VDC was momentarily applied directly to the collector of the Q9 transistor on the Signal Processing card while Q9 was turned on. This caused the collector-emitter current to exceed the rating of the transistor because there was no current limiting resistor, thus resulting in the failure. Wiring between the Failure Detector card and the Signaling Process card can be found on attachment 2.

The most probable cause of failure of the Q9 transistor on the Alarm Circuitry card was due to the inadvertent cross-connection of traces on that card(see attachment 3). The 24 VDC bus trace and the trace for the anode of CR27 were momentarily shorted on the Alarm Circuitry card with the Q9 transistor turned on (see attachment 4). This caused the base-emitter current to exceed the rating of the transistor because there is no current limiting resistor between the 0.47 mfd capacitor and the Q9 transistor. Even after the capacitor is discharged, there is only an 11 ohm resistor limiting the current to Q9 under a shorted condition. This resulted in the failure.

Other probable scenarios were considered but none had the potential for causing the seen damage to the two Q9 transistors.

An independent root cause analysis was also performed by Westinghouse Corporation. Westinghouse arrived at the same conclusions as evidenced by the letter sent to PSE&G as found in attachment 5.

Analysis of Failed Components

The failed components have been sent to a testing laboratory experienced in transistor failure analysis. They have inspected and tested the failed components using X-raying, Particle Impact Testing, Hermeticity Testing, Curve tracing and high power microscopic visual inspection.

Their findings (see telecon in attachment 6) show that the failure of the transistors was attributed to a high current fault through the device. Since only the emitter wire and the silicon die was damaged, the fault in both components could have come from either a high collector-to-emitter current or a high base-to-emitter current. This type of damage is not considered the result of aging or degradation. Attachment 7 shows photographs of the damage internal to the transistors. Transistor #1 is from the Signaling Process card and transistor #2 is from the Alarm Circuitry card.

Validation of the Failures

Two tests were performed to validate the failures seen on the two cards. Circuits were created which duplicated the equivalent circuits under the fault conditions. Six 2N1711 transistors were used. Three transistors were used to validate the Alarm Circuitry card failure with a collector- to-emitter short for Test #1. Then three transistors were used to validate the Signaling Process card failure with a base-to-emitter current limited fault for test #2.

In all cases, the transistors under test failed lending further credence to the proposed failure scenarios. A summary of both tests can be found in Attachments 8 and 9.

Impact on Other Equipment

Review of the wiring found in attachment 2 and 5 shows that the faults created by the inadvertent shorting Pins 5 and 6 on the Failure Detector card cage connector or the corresponding traces on the Signal Process card(attachment 1), Alarm Circuitry Card(attachment 4), Multiplex Error Detector card(attachment 10) and the 24 VDC supplies. Damage occurred only to the Signaling Process card because all other cards have 1N4148 blocking diodes. Therefore only the Signaling Process card is affected.

The 24 VDC supplies are Lambda Model Number LME-24 which are high quality linear regulated supplies. Since these supplies are fuse protected and current limited, no damage occurred to the supplies. However, the supplies are not current limited enough to protect the transistors from exceeding their specifications. Damage is limited to only the Q9 transistors on these specific cards.

The shorting of the traces on the Alarm Circuitry card only affected the card itself. A path was created from the +24 VDC through the Q9 transistor directly to ground. Therefore no other cards were affected.

Recommended Action

Based on the above, E&PB recommends that only the Signal Processing and Alarm Circuitry Cards in SCD panel be replaced with new cards from folio. If any of those cards are not available from folio, E&PB recommends that the transistors on the existing cards be replaced with new transistors.

Note: As a conservative measure, Maintenance has replaced 13 of the 20 Power Cabinet circuit cards. The five Firing cards and the two Simulator cards were not replaced as they would not be affected by the original postulated event.

Long Term Recommendations

Based on E&PBs review, this represents an isolated incident. However, a recommendation is being made that extender cards be used for access to all rear connectors and board components. This will limit component exposure to transients, shorts and inadvertent connections. Furthermore, where possible, connections made as a part of DCP implementation and general testing should be accomplished with power to the cabinets turned off.

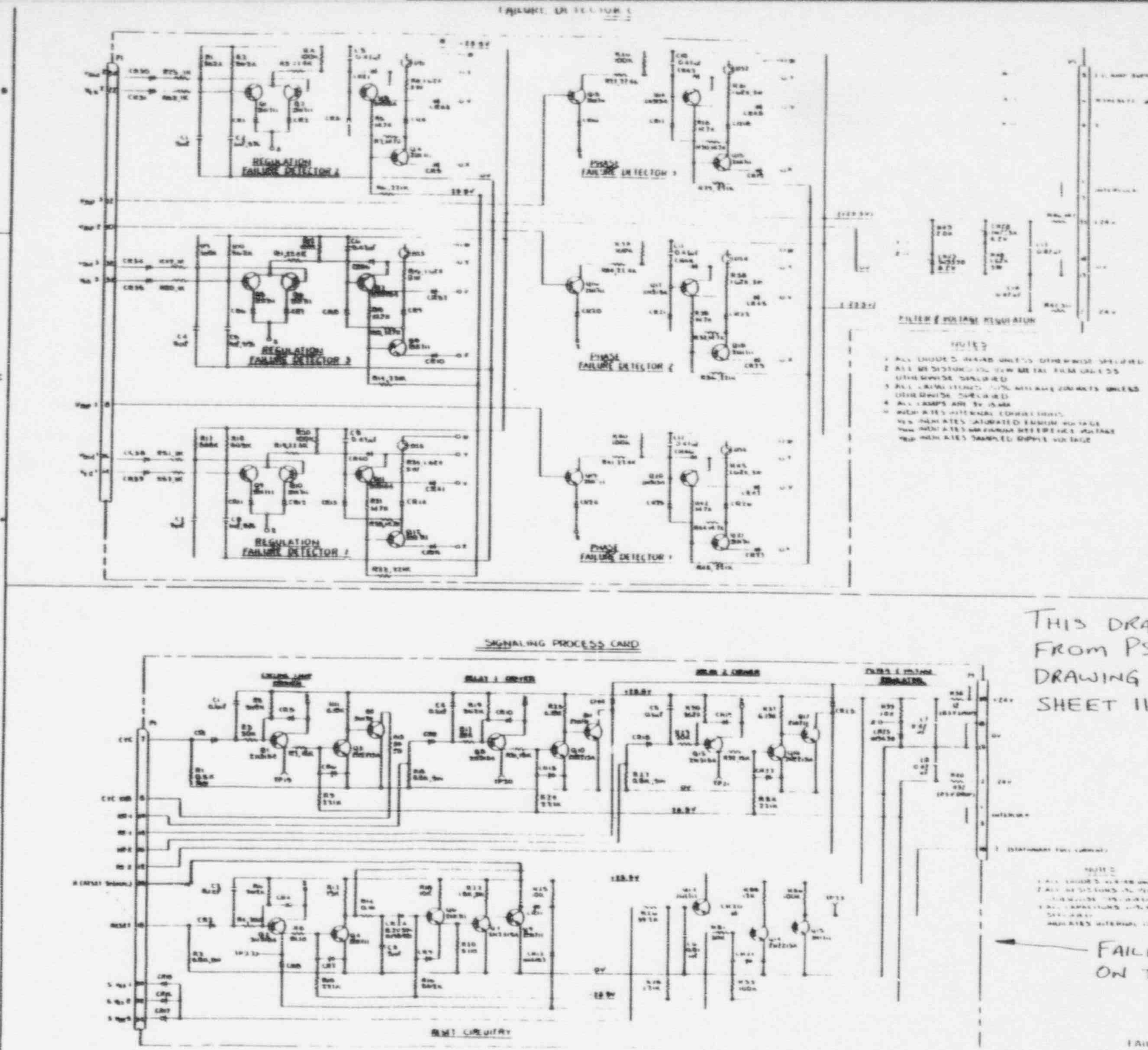
Safety Significance

The failure of the Signaling Process card noted will block Urgent alarm signals to the card edge indicators. Alarms to the Main Control Room and Power Cabinet red Urgent Alarm light will operate. Also, with this failure, the seal-in function is lost. Therefore the Urgent Alarm will clear without the operator depressing the reset push-button.

The failure of the Alarm Circuitry card noted will not allow logic error detection.

In either of the above cases, the failure is with the alarm detection circuitry only and will not, by itself, cause failure of the Control Rod System. The protective trip function of the Control Rod System is always available for automatic or operator action.

Attachment 1
Failure Detector Card
Signal Process Card



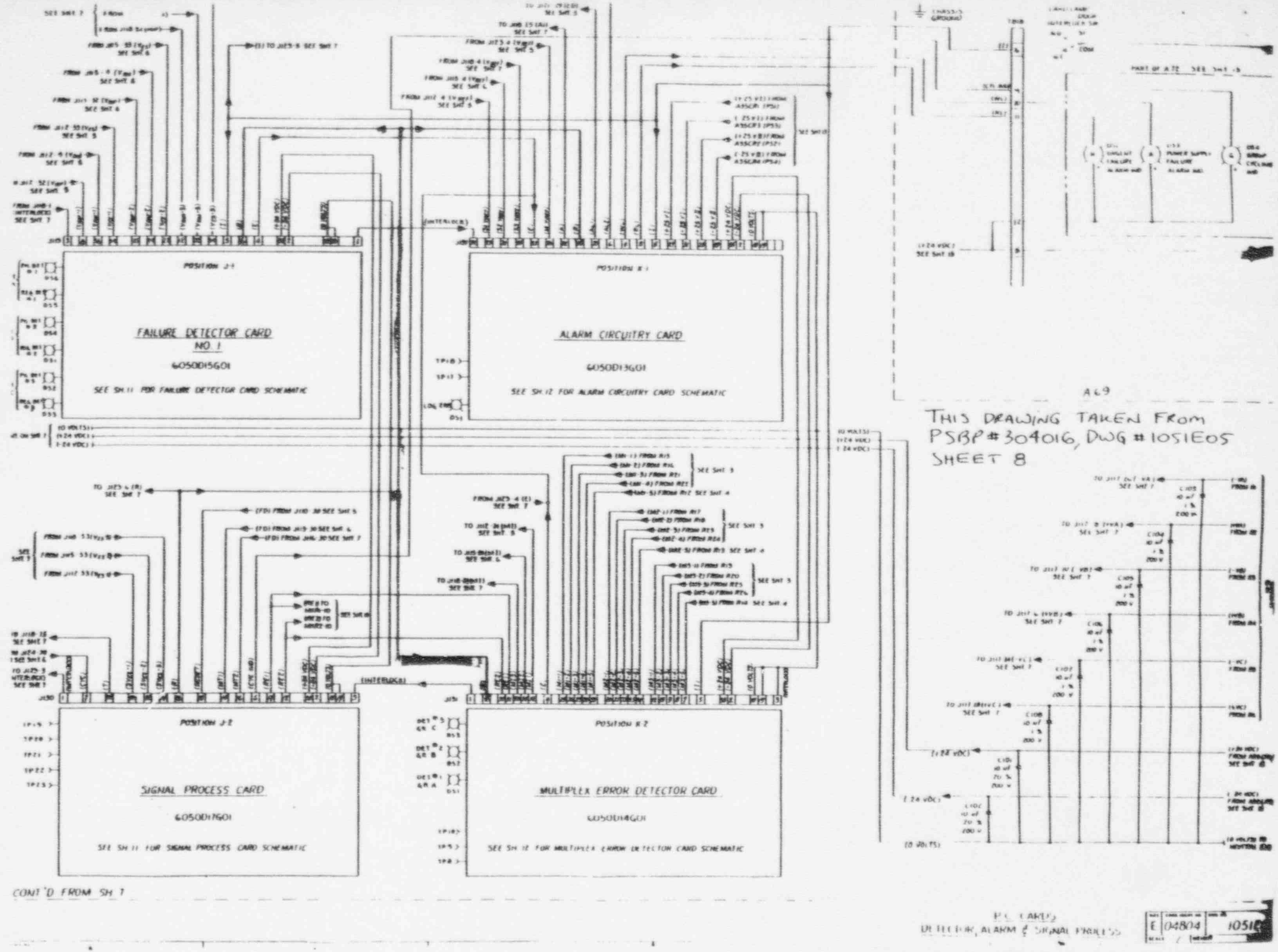
WIRED TO +24VDC

2 PIN 6 OF MATING ELCO CONNECTOR IS WIRED TO PIN 26 OF SIGNALING PROCESS CARD SHOWN BELOW. JUMPERING OF PINS 5 AND 6 ON FAILURE DETECTOR CARD APPLIES +24VDC DIRECTLY TO THE COLLECTOR OF Q9 ON THE SIGNALING PROCESS CARD.

THIS DRAWING TAKEN FROM PSBP# 304C16, DRAWING NUMBER 105IE05 SHEET 11

FAILED Q9 LOCATED ON THIS CARD

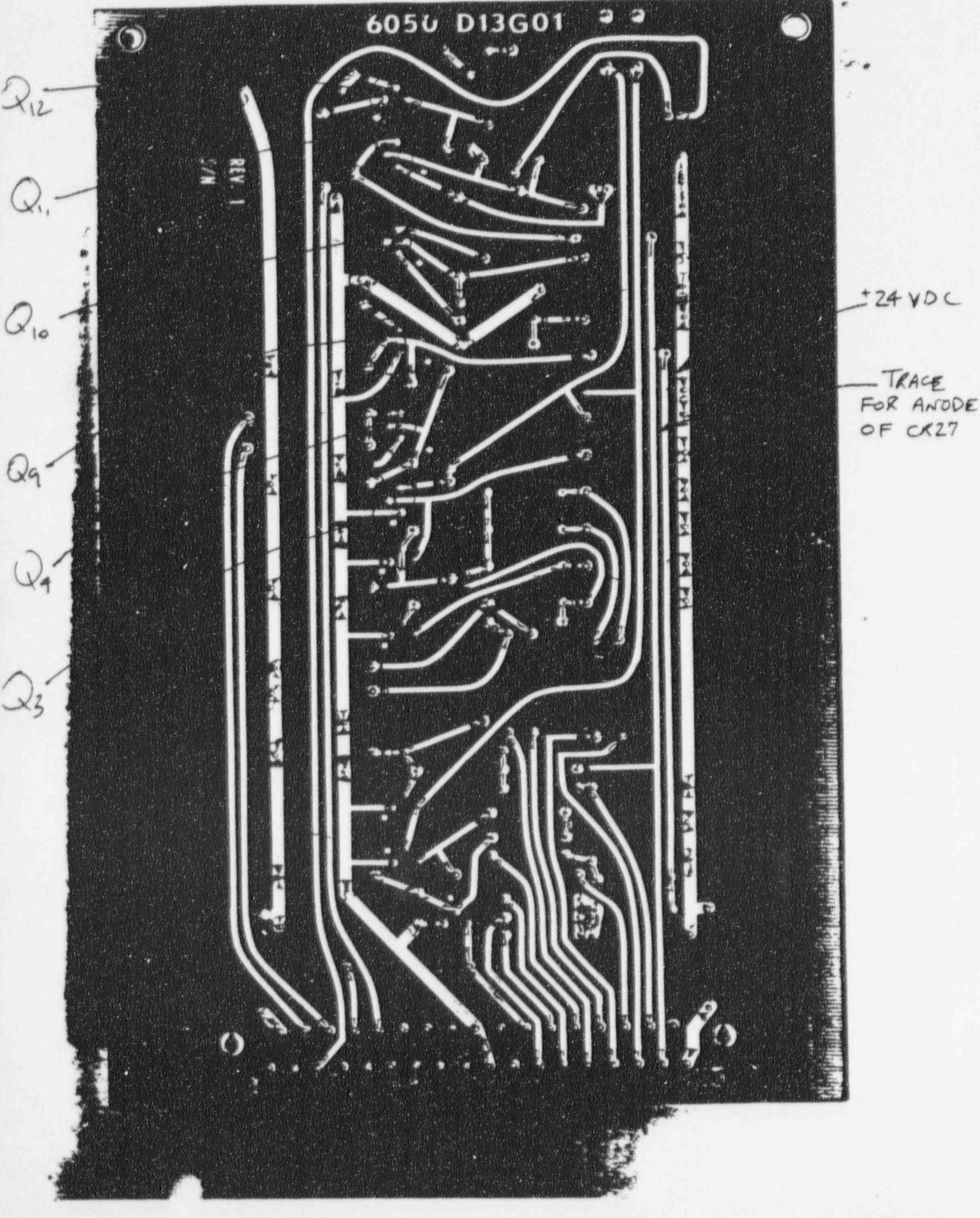
Attachment 2
Signal Process Card - interconnections



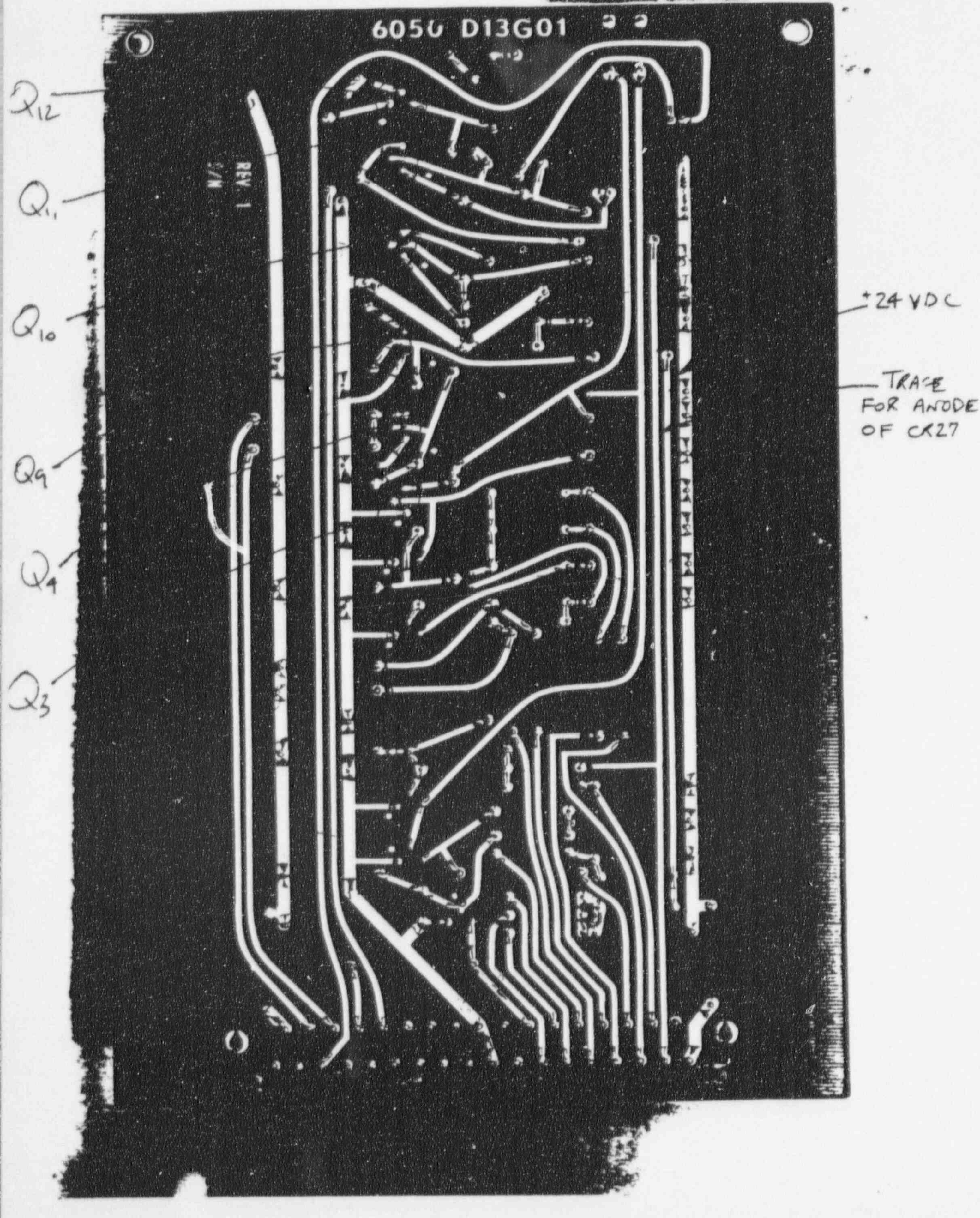
POSITION J-1
FAILURE DETECTOR CARD
NO. 1
6050D15G01
SEE SH.11 FOR FAILURE DETECTOR CARD SCHEMATIC
POSITION K-1
ALARM CIRCUITRY CARD
6050D13G01
SEE SH.12 FOR ALARM CIRCUITRY CARD SCHEMATIC
POSITION J-2
SIGNAL PROCESS CARD
6050D17G01
SEE SH.11 FOR SIGNAL PROCESS CARD SCHEMATIC
POSITION K-2
MULTIPLEX ERROR DETECTOR CARD
6050D14G01
SEE SH.12 FOR MULTIPLEX ERROR DETECTOR CARD SCHEMATIC
(INTERLOCK)
PART OF A72 SEE SHT 16
A69
THIS DRAWING TAKEN FROM
PSBP#304016, DWG#1051E05
SHEET 8
CONT'D FROM SH 7
P.C. CARDS
DETECTOR, ALARM & SIGNAL PROCESS
E 04804

Attachment 3
Alarm Card - trace side

ALARM CARD

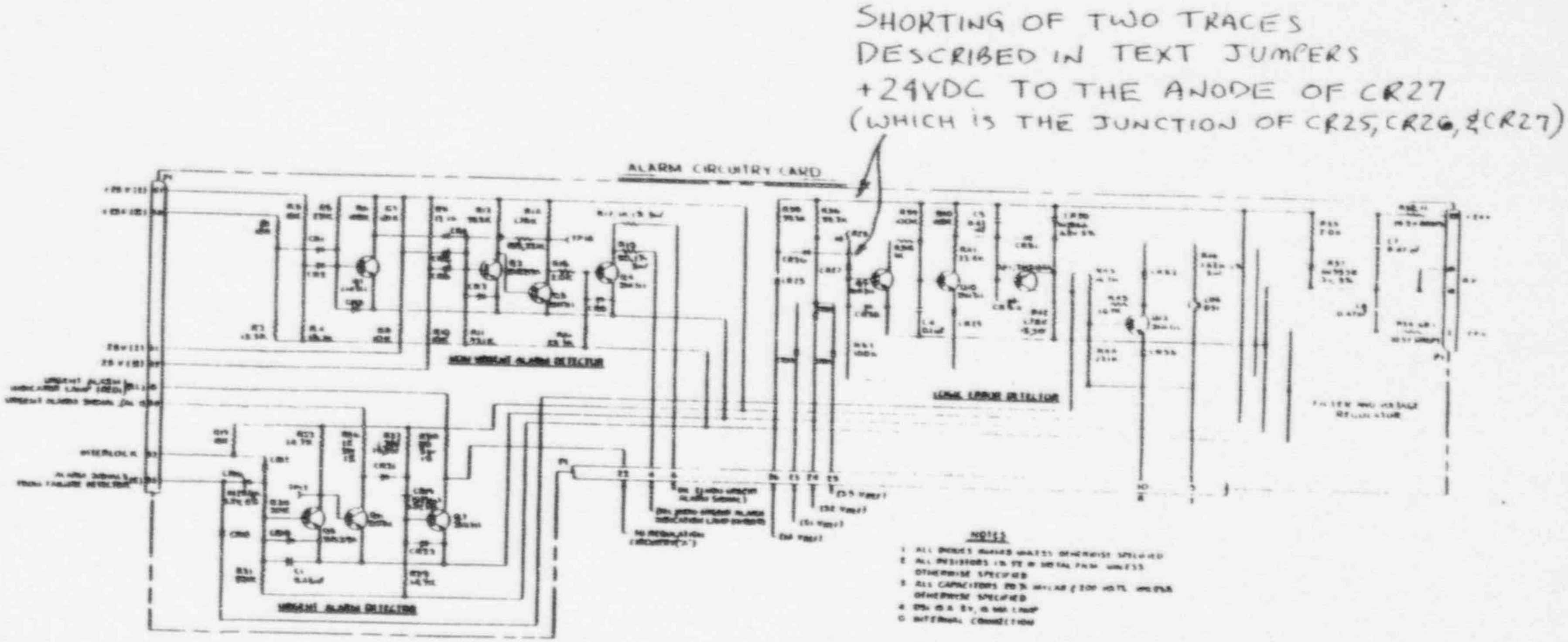

6050 D13G01
REV 1
S/N
Q12
Q11
Q10
Q9
Q4
Q3
+24 VDC
TRACE FOR ANODE OF CR27

ALARM CARD



6050 D13G01
REV. 1
S/N
Q12
Q11
Q10
Q9
Q4
Q3
+24 VDC
TRACE FOR ANODE OF CR27

Attachment 4
Alarm Card - schematic



ALARM CIRCUITRY CARD SCHEMATIC TAKEN FROM PSBP # 304016, DRAWING NUMBER 1051E05 SHEET 12

Attachment 5
Westinghouse Corp. Evaluation

To: Len Rajkowski
PSE&G

Subject: Transistor Q9 Failure on Alarm Circuitry Card (6050D13G01) and Signal Process Card (6050D17G01

SI/SPA(93)-160

Based on the events that have been forwarded for Power Cabinet SCD failures at Salem Unit #2 during alarm performance checks, and a postulation that transistor Q9 is burned out on the Alarm card, a best estimate of cause for the damage is that a momentary short occured from the +24 VDC (on card) to the anode of CR27. The reasoning is that the solder runs for the +24 VDC and anode of CR27 parallel each other for approximately 4-1/2 inches at a spacing of .1 inch. The short could possibly have been caused when a jumper used during system functional testing was removed from the card edge connector at the backplane. Due to the configuration of the jumper and the confined space available for removing the jumper, potential exists for a short to occur at the solder runs mentioned. Many other scenarios were considered without having the potential for causing the damage postulated.

When the short is first applied, very high current is present due to energy stored in C7 (.47 microfarad charged to 24 VDC). The current will quickly decrease to about 2.2 amperes which will probably burn out Q9. Resistor R53 limits the final power supply current to 2.2 amperes.

For the Signal Process Card, it is reasonable to postulate that if the shorting jumper discussed above momentarily connected pins 5 & 6 when being inserted into the Failure Detector card edge connector on the backplane, 24 VDC could be applied directly to the collector of Q9 causing damage to Q9.

It is believed that the above postulations will be supported by failure analysis. If not, further consultation would be available.

Regards,

Joe Pyznik
Joe Pyznik 6/25/93

Attachment 6
General Testing Laboratory - telecon

Telephone Conversation Record

Participants: PSE&G — M. L. Bursztein, S. Karimian, A. Kapp(in Sunnyvale, CA), M. Woloski

General Testing Laboratory(Sunnyvale, CA) — B. Townsend, N. Derkovits

Subject: Failure Analysis of Two 2N1711 Transistors from Signal Processing and Alarm Circuitry Cards

Date: June 26, 1993 Time: 1:15 P.M.

Phone Number: (408) 245-7100

Discussion Details

A telephone conversation was held between the above parties to get a status of the analysis of the two failed transistors. These transistors were hand carried to the testing lab by Mr. A. Kapp who also participated in this discussion. Mr. Townsend stated that the two transistors had been X-rayed, undergone particle impact testing, hermiticity tested (fine leak and gross leak), had been placed on curve tracer and had undergone visual inspection. The visual inspection involved careful removal of the transistor can and inspection of the die under a stereo-zoom and high power optical microscope.

Mr. Townsend informed us that the original conclusion, based on the X-ray, that the collector had failed, was incorrect. The visual inspection revealed that both transistors had undergone severe electrical stress in the form of an overcurrent condition. This was evidenced by the vaporization of the gold emitter wire which ties the emitter post to metalized emitter pad. Mr. Townsend further stated that this condition can be caused by any overcurrent condition such as excessive collector-to-emitter current or excessive base-to-emitter current. When this type of overcurrent condition exists, the weakest link in the transistor current path will fail.

Furthermore, both transistor failures were caused by an incident external to the components. The components did not fail due to aging or some internal degradation.

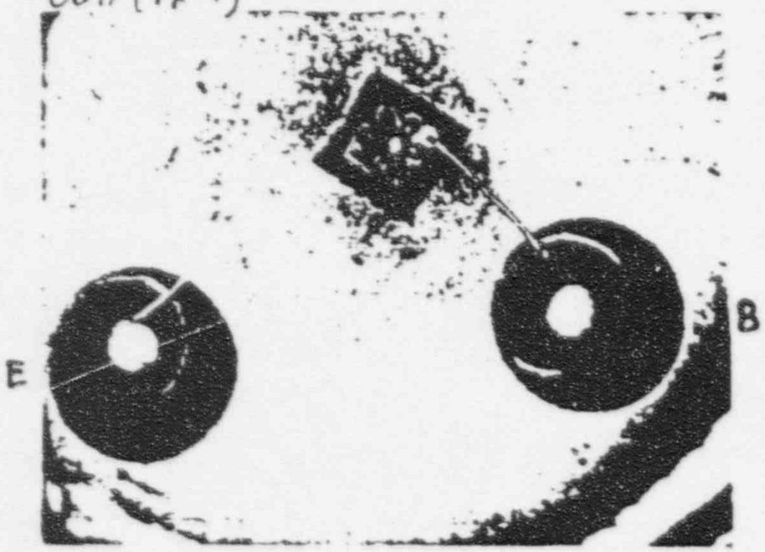
By: Mark E. Woloski

TELCON02.DOC

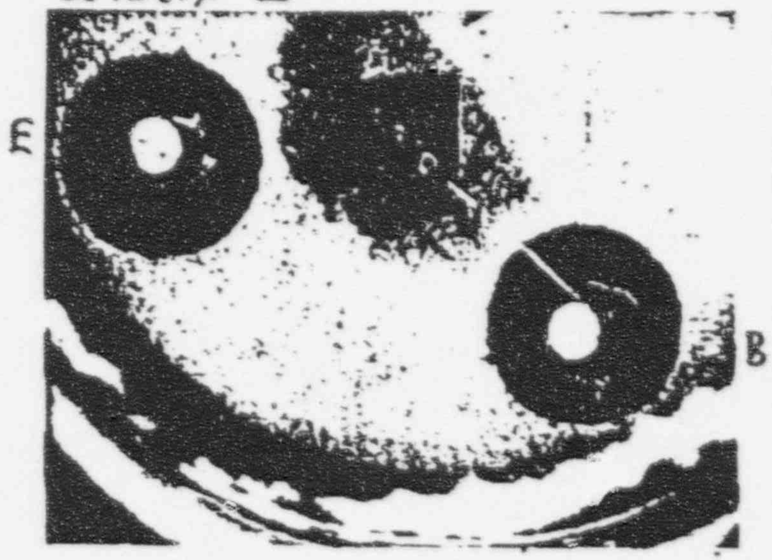
Attachment 7

Transistor damage photographs

#0541 (TX#1)

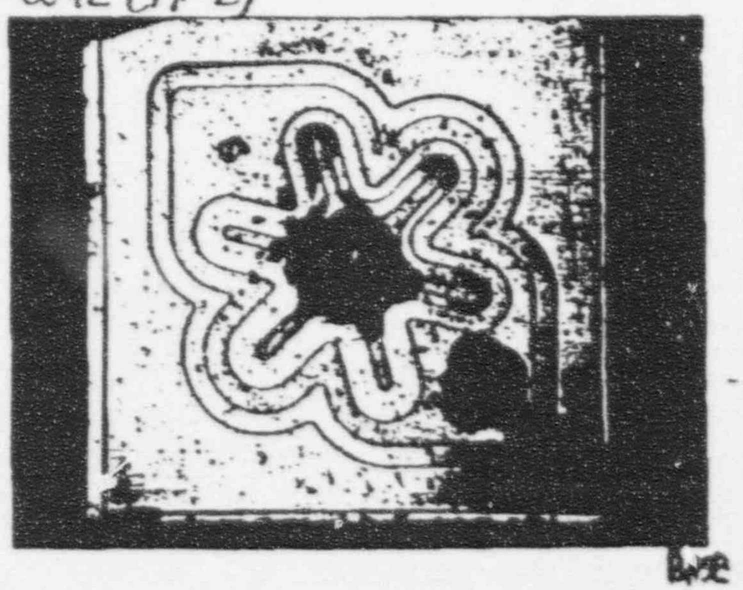


#0592 (TX#2



#0591 (TX#1)

#0592 (TX#2)



Attachment 8
Alarm Circuitry Card
Q9 Transistor failure validation

Validation of Transistor Failures on Alarm Circuitry Card

Introduction

During Westinghouse testing of the CRD power cabinets, a failure was noted on the above-referenced card. Diagnostic tests were performed and the Q9 transistor was determined to be the source of the failure.

The potential cause of failure of the Q9 transistor on the Alarm Circuitry card was due to the inadvertent jumpering of traces on that card. The 24 VDC bus trace and the trace for the anode of CR27 was momentarily shorted on the Alarm Circuitry card with the Q9 transistor turned on. This caused the base-emitter current to exceed the rating of the transistor.

This report describes the test used to validate the failure on the Alarm Circuitry card. This test was performed on June 26,1993.

Test Setup

Figure A shows the test circuit which was used to validate the Alarm Circuitry Card failure. The Alarm Circuitry Card equivalent circuit is conservative because the actual circuit card has a 0.47 mfd capacitor at the output of the 11 ohm resistor which upon shorting provided much higher current at the initial stages of the fault. Also, a 10 ohm resistor was used for test purposes.

The test setup used a Lambda power supply model LME-24 which is a 24 VDC supply equivalent to the supply installed in the power cabinet. The test was performed three times. Thus three transistors were used to validate the Alarm Circuitry Card failure.

All resistance measurements were taken using a Fluke Model 45 multi-meter, Serial Number 565003 last calibrated 12/3/92. No other test equipment was required.

All testing was performed under the auspices of S. Karimian of PSE&G.

Test Baseline

Initially, the six transistors were baselined. This was because three transistor were used for the Alarm Circuitry card failure validation and three transistors were used for the Signaling Process card failure validation. The baseline data was as follows:

Junction	Transistor #1(Ohms)	Transistor #2(Ohms)	Transistor #3(Ohms)	Transistor #4(Ohms)	Transistor #5(Ohms)	Transistor #6(Ohms)
B-E	4.3M	4.3M	4.6M	4.3M	4.3M	4.3M
B-C	4.35M	4.3M	4.5M	4.0M	4.1M	4.1M
E-B	High	High	High	High	High	High
E-C	High	High	High	High	High	High
C-B	High	High	High	High	High	High
C-E	High	High	High	High	High	High

A high indicates resistance so high it is off scale of the meter.

Transistors 1 through 3 were used for the Alarm Circuitry card test and transistors 4 through 6 were used for the Signaling Process card test.

Alarm Circuitry Card Failure Validation

This test was performed by setting up the circuit shown in Figure A. To valid ate the short that occurred in the field, the wire from the ten ohm resistor was brushed against the base of the transistor for each of the three test cases. The following were the results of this test:

Junction	Test Transistor #1 (Ohms)	Test Transistor #2 (Ohms)	Test Transistor #3 (Ohms)
B-E	High	High	High
B-C	High	1.6M	4.12M
C-E	High	High	High
E-C	High	High	High
E-B	High	High	High
C-B	High	High	High

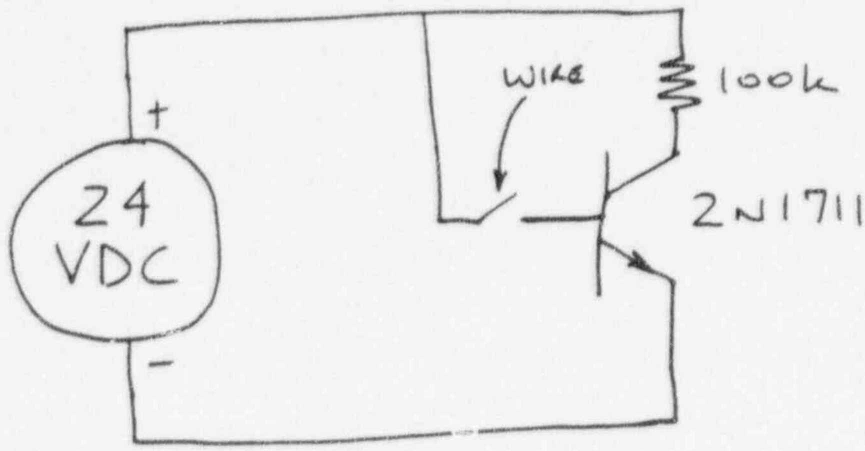
Test Conclusions

All transistors failed during the validation test. This is readily seen by comparing the test results with the baseline data taken prior to the testing. It is important to note that this gives credibility to the proposed failure scenario

FIGURE A

VALIDATION OF ALARM CIRCUITRY CARD FAILURE

EQUIVALENT CIRCUIT



Attachment 9
Signal Processing Card
Q9 Transistor failure validation

Validation of Transistor Failures on Signal Processing Card

Introduction

During Westinghouse testing of the CRD power cabinets, a failure was noted on the above-referenced card. Diagnostic tests were performed and the Q9 transistor was determined to be the source of the failure.

The most probable cause of failure of Q9 on the Signaling Process card was due to the inadvertent jumpering of pins 5 and 6 on the Failure Detector card cage connector(see attachments 1 and 2). Approximately 24 VDC was momentarily applied directly to the collector of Q9 on the Signal Processing card while Q9 was turned on. This caused the collector-emitter current to exceed the rating of the transistor because there was no current limiting resistor, thus resulting in the failure.

This report describes the test used to validate the failure on the Signaling Process card. This test was performed on June 26,1993.

Test Setup

Figure A shows the test circuit which was used to validate the Signaling Process Card failure. The Signaling Process Card equivalent circuit is the same as the circuit on the card during the postulated fault condition.

The test setup used a Lambda power supply model LME-24 which is a 24 VDC supply equivalent to the supply installed in the power cabinet. The test was performed three times. Thus three transistors were used to validate the Signaling Process Card failure.

All resistance measurements were taken using a Fluke Model 45 multi-meter, Serial Number 565003 last calibrated 12/3/92. No other test equipment was required.

All testing was performed under the auspices of S. Karimian of PSE&G.

Test Baseline

Initially, the six transistors were baselined. This was because three transistor were used for the Alarm Circuitry card failure validation and three transistors were used for the Signaling Process card failure validation. The baseline data was as follows:

Junction	Transistor #1(Ohms)	Transistor #2(Ohms)	Transistor #3(Ohms)	Transistor #4(Ohms)	Transistor #5(Ohms)	Transistor #6(Ohms)
B-E	4.3M	4.3M	4.6M	4.3M	4.3M	4.3M
B-C	4.35M	4.3M	4.5M	4.0M	4.1M	4.1M
E-B	High	High	High	High	High	High
E-C	High	High	High	High	High	High
C-B	High	High	High	High	High	High
C-E	High	High	High	High	High	High

A high indicates resistance so high it is off scale of the meter.

Transistors 1 through 3 were used for the Alarm Circuitry card test and transistors 4 through 6 were used for the Signaling Process card test.

Signaling Process Card Failure Validation

This test was performed by setting up the circuit shown in Figure A. To validate the short that occurred in the field, the wire from the -24VDC supply was brushed against the emitter of the transistor for each of the three test cases. Note that this is equivalent to the technician jumpering +24VDC to the collector of the transistor which is what happened in the field. The following were the results of this test:

Junction	Test Transistor #4 (Ohms)	Test Transistor #5 (Ohms)	Test Transistor #6 (Ohms)
B-E	High	High	High
B-C	High	13.3	6.3
C-E	High	13.3	6.3
E-C	High	High	High
E-B	High	High	High
C-B	High	High	High

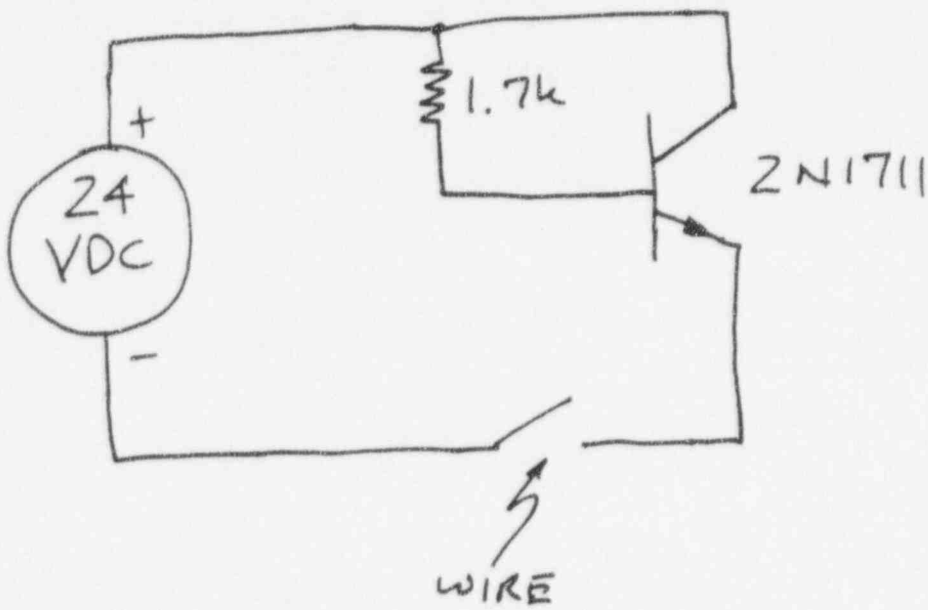
Test Conclusions

All transistors failed during the validation tests. This is readily seen by comparing the test results with the baseline data taken prior to the validation testing. It is important to note that this gives credibility to the proposed failure scenarios.

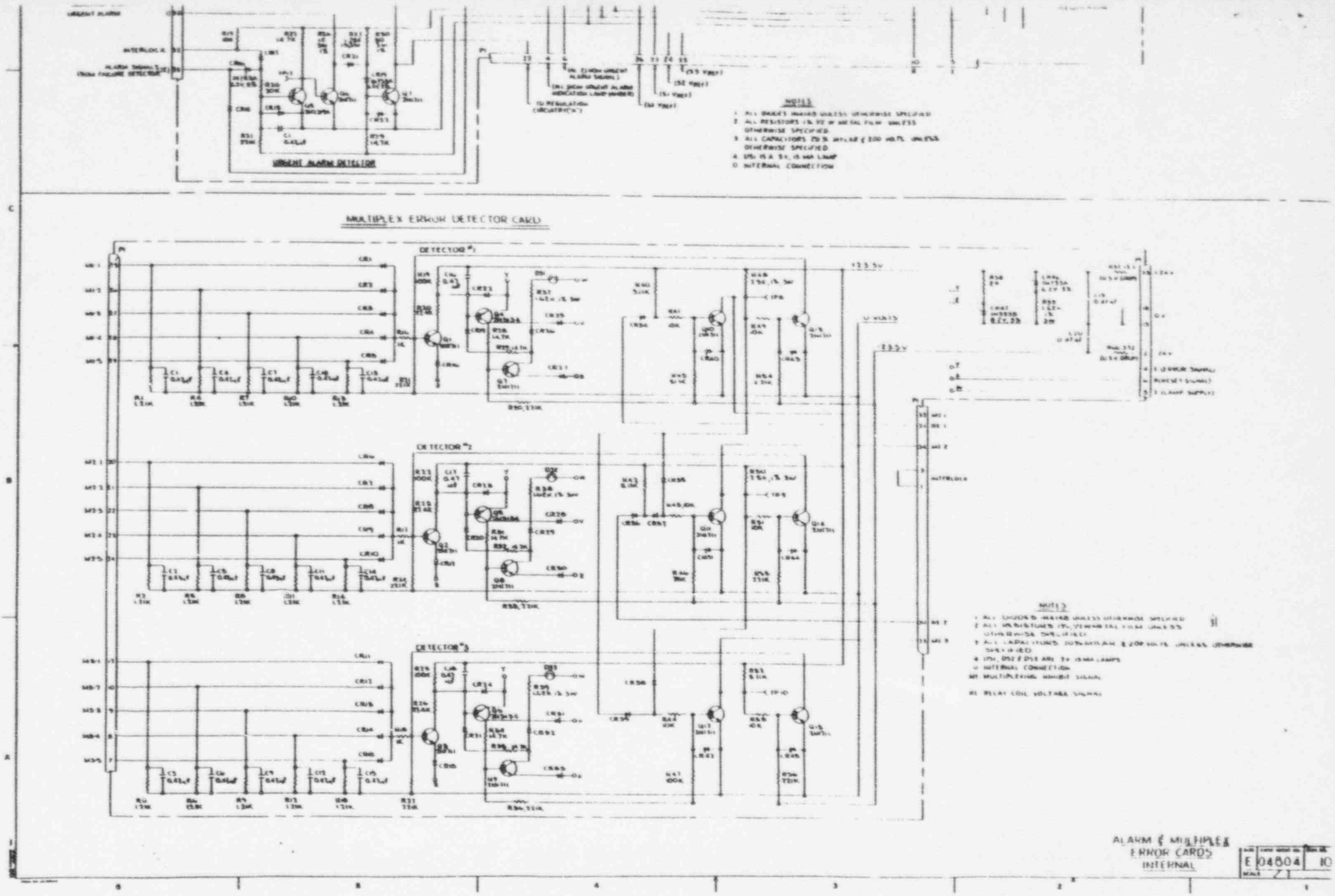
FIGURE A

VALIDATION OF SIGNALING
PROCESS CARD FAILURE

EQUIVALENT CIRCUIT



Attachment 10
Multipex Error Detector Card



PSBP#: 304016

Figure 4-31. Power Cabinet, Schematic Diagram 1051E05 (Sheet 12 of 14)

ATTACHMENT 5

LIST OF FAILURES/CAUSES

---LARRY TO REWORK---

NO.	DATE/TIME OF FAILURE	FAILED COMP.	STATUS	LICENSEE EVALUATION	NRC ACCEPTANCE
(1)	May 14	CBA-GR1, CBB-GR1, CBC-GR1 and SBA-GR2 A113 and A114	Replaced with new one Repaired A114 (Z3) replaced A113, A713 and A714 Repaired A113 - Z8, Z9 & Z12	Westinghouse identified problem Westinghouse identified problem	
(2)	May 24, during operation surveillance	CBA Group 2 did not move and CBC Group 1 failed to move out A113 failed (Supervisory data logger)	--	Caused by blown resistor R1 in 22AC power cabinet which was caused by short light bulb (Group A select light). Light socket was replaced with the wrong type. Correct light socket was installed on 6/2/93 Supervisory card A113 was replaced	Was this the cause of shorted light bulb?
(3)	May 25, during calibration	CBB Group 1 and 2 step counter	Replaced	Replaced with the old counters which were taken by Westinghouse earlier as a protective step	

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(4)	May 26, 02:00 a.m.	CBC Group 1 failed to step out A714 failed (relay drivers)	 Replace A714 to A713 Replace A714 from stock	 Problem shifted to CBC Group 2	
(5)	8:00 a.m.	A113 failed	Replaced with WSN 0039		
(6)	8:00 a.m.	A713, A714 failed A113 failed	Replaced the card Repaired spare and put in replaced chip (Z3, Z6, Z2, Z5, Z8) Repaired the original card (Z2, Z3, Z8)		Why the repeated failure of chips
(7)	8:00 a.m. 23:50	CBA Group 1 not step in CBA Group 2 no pulse for counter CBA Group 1 not step in, CBA Group 2 out voltage reduced	Repaired A113 (Z2) Repaired A113 (Z2, Z3) Repaired	 A714, A113 failed	
(8)	May 27, 5:00 a.m.	CBA Group 2 not step in	Swapped A713 and A714	A713, A714 failed	
(9)	5:00 a.m.	A113 failed	Replaced with spare 6014		

(10)	8:40 a.m.	CBB did not count for out direction	Replaced with spare, still problem repaired, replaced Z3	A114 failed	
		CBA Group 2, CBC Group 2 not step in or out	Repaired, replaced Z3 and Z6	A113 failed	
(11)	13:05	A710 relay driver card failed	Replace 1 bad diode		
(12)	14:30 to 15:30	CBA Group 2, step in only	Replaced with WSN 216	A114 -- suspect bad chip	
(13)	18:44	Rod 1SA3 moved 15 steps up while other stayed in bottom			
	May 28 - 00	A511 and A501 Slave cycler decoder	Replaced with new cards		

(14)	May 29	Control bank C - Group 1 dropped		Perform testing to determine the cause	
	May 30, 2:40 a.m.		Replaced firing card slot D1, phase card slot E1, regulator card slot F1		
	2:45 a.m.		Replace I/0 ac amp card slot A803		
	2:55 a.m.			Adjustments were made to many cards for potential tension problem	
(15)	3:00 a.m.	Discovered fuse FU11 and FU6 blown on 100 V DC power		During investigation somehow it got shorted	
		Main feed connector in cabinet 21AC was loose (slightly)	Tightened	Checked and tightened in all cabinets	
	7:00 a.m.	(15VDC) (-) Auctioneering diode was found blown	Replaced voltage filtering circuit		
	15:15		Auctioneering diode replaced		

(16)	16:30	Current orders were not correct	Interchanged card from A803 to A805	Problem with faulty transistor circuits. This fixed the problem for A803, but others were not consistent	
(17)	19:51	Old card in A803 -- S/N 0144	Replaced transistor, but still defective		
(18)	20:40	Spare card S/N 0146 failed in test		Was okay previously in test on 3/91	
(19)	22:40 23:30	Card S/N 0142, 0147, 0149, 0150 - defective on test rig.	Card S/N 0144 repaired Card S/N 0142 repaired		
(20)	May 31, 2:45 a.m.	Card A809 tested unsatisfactory	Replaced transistor Q12		
(21)	8:40 a.m.	CBA Groups 2, CBB Group 2, CBC Group 1 did not count in the out direction			
(22)	9:00	Relay MXR2 did not pick up	Spread pin associated with signal processor card in slot J2, Cabinet 22BD	Retested MXR2 relay satisfactory	

(23)	10:45 a.m.	Card A114, S/N 0216 failed Card A113 bad	Trashed Repaired, replaced bad chips	Z3 bad Trace lifted during soldering Z3 and Z5 bad	
(24)	13:00 13:30	CBA Group 2 - no out motion CBB Group 2 - no in and out motion	Replaced Z3 chip of A113 & A114	Suspect chip Z3 of A113 Suspect chip Z3 of A114	
(25)	13:30	Female pin of A713 slightly open	Closed the pins		
(26)	15:10	CBA - no group 2 out CBB - Group 2 - no ins or out	Replaced Z3 on A113		
(27)	21:35	Card A514 S/N WSN 0080 tested bad	Replaced with spare S/N 0082		
(28)	June 1, 06:05	CBA Group 2 not counting up CBB group 2 not counting up	Chip Z3 of A113 & A114 were replaced	Suspected chip Z3 on A113 and A114	
(29)	19:15	Card A207 S/N 0014 found bad on tester	Replaced with S/N - 0081		

(30)	June 3	P/A converter and the RIL computer did not provide any indication during rod motion	A114 bad Z3 chip failed - replaced	Suspected chip Z3 on A114	

6/10/93
1700

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS.

DESCRIPTION	WSN	PRESENT STATUS	REMARKS (REPAIR & INTALLATION)
SUPERVISORY DATA LOGGING (LOGIC CABINET)	183	A114	5/16/93 - REMOVED FROM A113. REPAIRED ??? 5/31/93, 13:00 - INSTALLED IN A114. 13:30 - CBA GRP 2 NOT MOVING, REPLACED Z3. REINSTALLED TO A114. 6/3/93 3:50 AM - P/A CONVERTER AND PLANT COMPUTER FAILED TO INDICATED FOR CBB, SBB, REPLACED Z13. RETEST SAT.
SUPERVISORY DATA LOGGING (LOGIC CABINET)	216	I&C SHOP	5/16/93 - INSTALLED IN A114 REPLACED Z3. 5/27/93, 8:40AM - REMOVED FROM A114, REPLACED Z2,Z5, Z3. 15:30 - REINSTALLED TO A114. 5/31/93, 10:45 - REMOVED FROM A114 AND BENCH TESTED, REPLACED Z3.
SUPERVISORY DATA LOGGING (LOGIC CABINET)	217	???	5/16/93 - INSTALLED IN A113. REPLACED Z8, Z9, Z12. 5/24/93 - REMOVED FROM A113. REPAIR ????

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SUPERVISORY DATA LOGGING (LOGIC CABINET)	6014	A113	5/24/93 - INSTALLED IN A113 5/26/93 - REMOVED FROM A113 REPLACED Z3 & Z6. INTALLED BACK TO A113. REPLACED Z2, Z5 & Z8. REINSTALLED TO A113. REMOVED FROM A113, REPLACED Z2, Z5 & Z6. REINSTALLED TO A113. REMOVED FROM A113 AND TAKEN TO TRAINING CENTER FOR TESTING. FOUND Z3 BAD. REPLACED Z3, RETEST SAT. 5/27/93 - INSTALLED IN A113. RESTEST SAT. MOVE CBA, CBC GRP1 NO PULSE. REPLACED Z3 & Z6. REINSTALLED TO A113. 5/31/93, 10:45 REMOVED FROM A113 AND BENCH TESTED, REPLACED Z3 & Z5, RETEST SAT. REINSTALLED TO A113. 13:30 - CBA GRP2 NOT MOVING, REPLACED Z3. REINSTALLED TO A113. FAILED AGAIN, REPLACED Z3 RETEST SAT.

SUPERVISORY DATA LOGGING (LOGIC CABINET)	0039	I&C SHOP	5/26/93 - INSTALLED IN A113. REMOVED FROM A113, REPLACED Z3, Z2, Z8. INSTALLED IN A113 AGAIN. REPLACED Z2. FAIL AGAIN, REPLACED Z2 & Z3. INSTALLED IN A113, REMOVED FROM A113 AND TAKEN TO TRAINING CENTER FOR TESTING, FOUND Z3 BAD. REPLACED Z3, RETEST SAT. 5/27/93 - REINSTALLED IN A113. FAILED AGAIN, REMOVED FROM A113 REPLACED Z3. INSTALLED IN A114, MOVE ROD FOR CBB NO PULSE, REPLACED Z3. RETEST SAT. 15:30 - REMOVED FROM A114, REPLACED Z3.
I/O RELAY DRIVERS (LOGIC CABINET)	132	I&C SHOP	5/16/93 - REMOVED FROM A713. 5/28/93 - BENCH TESTED FOUND CR1, CR5, & CR9 SHORTED. REPLACED THE SHORTED DIODES, RETEST - SAT.
I/O RELAY DRIVER (LOGIC CABINET)	139	I&C SHOP	5/16/93 - REMOVED FROM A714. 5/28/93 - BENCH TESTED FOUND CR1 SHORTED - REPLACED CR1, RETEST - SAT.
I/O RELAY DRIVER (LOGIC CABINET)	120	I&C SHOP	5/16/93 - INSTALLED IN A713. 5/26/93 - REMOVED FROM A713. 23:50 - INSTALLED IN A713. 5/27/93 5:00 AM - REMOVED FROM A713. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1, CR9, CR17 SHORTED. REPLACED SHORTED DIODES, RETEST - SAT.

I/O RELAY DRIVER (LOGIC CABINET)	133	I&C SHOP	5/16/93 - INSTALLED IN A714. 5/26/93 - REMOVED FROM A714. SUSPECTED BAD INPUT DIODE. 6/9/93 - BENCH TESTED FOUND Q10 OPEN.
I/O RELAY DRIVER (LOGIC CABINET)	695	I&C SHOP	5/26/93, 2:00AM - NEW FROM FOLIO, INSTALLED TO A714. 8:00 AM - REMOVED FROM A714. INSTALLED IN A714. 23:50 - REMOVED FROM A714. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1 SHORT, REPLACED CR1 - RETEST SAT.
I/O RELAY DRIVER (LOGIC CABINET)	681	I&C SHOP	5/26/93 - NEW FROM FOLIO, INSTALLED TO A714. SWAPPED WITH S/N 695 - NO CHANGE. RESTORED TO A714. REMOVED FROM A714 AND INSTALLED IN A713. 23:50 - INSTALLED IN A714. 5/27/93, 5:00 AM - REMOVED FROM A714. SUSPECT BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR5, CR17 SHORTED. REPLACED CR5, CR17 - RETEST SAT.
I/O RELAY DRIVER (LOGIC CABINET)	701	I&C SHOP	5/26/93, 8:00 AM - NEW FROM FOLIO, INSTALLED TO A713. REMOVED FROM A713. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1 SHORT. REPLACED CR1, RETEST SAT.
I/O RELAY DRIVER (LOGIC CABINET)	845	A713	RETRIEVED FROM TRAINING CENTER, AND INSTALLED TO A713.

I/O RELAY DRIVER (LOGIC CABINET)	342	A714	RETRIEVED FROM TRAINING CENTER AND INSTALLED TO A714.
SLAVE CYCLER STATIONARY DECODER - GO2 (LOGIC CABINET)	0079	TB2	5/28/93 2:26 AM - REMOVED FROM A501, TESTED BAD ON TEST RIG.
SLAVE CYCLER STATIONARY DECODER - GO2 (LOGIC CAB)	0083	A501	5/28/93 - BENCH TESTED SAT. INSTALLED IN A501 (22AC STATIONARY).
SLAVE CYCLER MOVABLE DECODER GO3 (LOGIC CAB)	0080	TB2	5/28/93 - REMOVED FROM A511, TESTED BAD ON TEST RIG.
SLAVE CYCLER MOVABLE DECODER GO3 (LOGIC CAB)	0072	A511	5/28/93 - BENCH TESTED SAT. INSTALLED IN A511 (22BD SLAVE DECODER MOVABLE.
FIRING CARD (POWER CAB)	0395	I&C SHOP	5/30/93 - REMOVED FROM SLOT D1 OF POWER CABINET. INTERMITTENT FAILURE.
FIRING CARD (POWER CAB)	6120	POWER CAB D1	5/30/93 - NEW FROM FOLIO, BENCH TESTED SAT. INSTALLED IN SLOT D1.
PHASE CONTROL (POWER CAB)	366	I&C SHOP	5/30/93 - REMOVED FROM SLOT E1. PART OF THE INTERMITTENT FAILURE CIRCUIT. REPLACED FOR RELIABILITY.
PHASE CONTROL (POWER CAB)	364	POWER CAB E1	5/30/93 - NEW FROM FOLIO, BENCH TESTED SAT. INSTALLED IN SLOT E1.

REGULATION CIRCUIT GRIPPER (POWER CAB)	297	I&C SHOP	5/30/93 - REMOVED FROM SLOT F1. PART OF THE INTERMITTENT FAILURE CIRCUIT. REPLACED FOR RELIABILITY.
REGULATION CIRCUIT GRIPPER (POWER CAB)	6053	POWER CAB F1	5/30/93 - NEW FROM FOLIO, BENCH TESTED SAT. INSTALLED IN SLOT F1.
I/O AC AMPLIFIER (LOGIC CAB)	372	I&C SHOP	5/30/93 - REMOVED FROM A803.
I/O AC AMPLIFIER (LOGIC CAB)	144	??	5/30/93, 2:45 AM - BENCH TESTED SAT. INSTALLED IN A803. 19:51 - REMOVED FROM A803, REPLACED Q13, Q14 - STILL DEFECTIVE. REPAIRED ???
I/O AC AMPLIFIER (LOGIC CAB)	122	A803	5/30/93, 20:40 - INSTALLED TO A803.(THIS CARD WAS PRIVOUSLY REPAIRED BY VARTEK).
I/O AC AMPLIFIER (LOGIC CAB)	146	??	5/30/93 - SPARE CARD, TESTED UNSAT.
I/O AC AMPLIFIER (LOGIC CAB)	142	A814	5/30/93 - BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A814.
I/O AC AMPLIFIER (LOGIC CAB)	147	A808	5/30/93 - BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A808.
I/O AC AMPLIFIER (LOGIC CAB)	149	A812	5/30/93 - REMOVED FROM A812 BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A812.
I/O AC AMPLIFIER (LOGIC CAB)	150	A813	5/30/93 - REMOVED FROM A813, BENCH TESTED FOUND DEFECTIVE, REPAIRED. REINSTALLED TO A813.

I/O RECEIVER (LOGIC CAB)	28	A809	5/30/93 - REMOVED FROM A809, BENCH TESTED FOUND DEFECTIVE, REPLACED Q12. REINSTALLED TO A809.
SLAVE CYCLER LOGIC (LOGIC CAB)	80	I&C SHOP	5/31/93 21:35 - REMOVED FROM A514, BENCH TESTED UNSAT. FOUND PIN 8 LOW, SHOULD BE HIGH (12.5 - 15 VDC).
SLAVE CYCLER LOGIC (LOGIC CAB)	82	A514	5/31/93 - BENCH TESTED SAT. INSTALLED IN A514.
P/O BANK OVERLAP LOGIC (LOGIC CAB)	14	I&C SHOP	6/01/93 19:10 - REMOVED FROM A207, BENCH TESTED UNSAT. FOUND PIN 10 LO SHOULD BE HIGH (12.5 - 15 VDC).
P/O BANK OVERLAP LOGIC (LOGIC CAB)	81	A207	6/01/93 19:16 - BENCH TEST SAT. INSTALLED IN A207.
POWER SUPPLY (LOGIC CAB)			5/26/93 - REPLACED 100VDC AUX POWER SUPPLY
FUSES (POWER CABINET)			5/30/93 - REPLACED 2 FUSES, F11, F6. 6/9/93 - BENCH TESTED INCONCLUSIVE.
AUCTIONEER DIODE (LOGIC CAB)			5/30/93 - REPLACED 1 NEGATIVE 15 VDC AUCTIONEER DIODE (SHORTED). 6/9/93 - BENCH TESTED FOUND AUCTIONEER DIODE SHORTED.
LOW VOLTAGE POWER SUPPLY FILTERS			5/30/93 - REPLACED 2 FILTERS, A16 FL1 & FL2

NOTE: The spare parts, chips and diodes (1N4148), are availalbe in the I&C shop for replacement.

STEP COUNTERS

MODEL WHITTAKER	SERIAL NO	PRESEN T STATUS	COMMENTS
127FD100A S/3	*2072 1	I&C SHOP	NEW ARRIVED FROM COMMONWEALTH ED. 6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 600 OHMS, SUB COIL 600 OHMS, RESET COIL 83 OHMS, ADD+SUB 1.2 K OHMS
127FD100A S/3	20698	I&C SHOP	5/16/93 - NEW ARRIVED FROM FLORIDA POWER & LIGHT, INSTALLED TO CBB GRP1. 5/25/93 - REMOVED FROM CBB GRP 1. 6/9/93 - CONTINUITY CHECK FOUND : ADD COIL 629 OHM, SUB COIL 605 OHMS, RESET COIL 81.5 OHMS, ADD+SUB COILS 1.2 K OHMS
127FD110A S/3	*8795	I&C SHOP	6/9/93 - CONTINUITY CHECK FOUND: ADD+SUB 3.4 M OHMS, RESET COIL 86.4 OHM, COMMON OPEN.
127FD100A S/3	8831	I&C SHOP	5/14/93 - REMOVED FROM CBB GRP 1. 6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 913 OHMS, SUB COIL 914 OHM, RESET COIL 87.4 OHMS, AD+SUB COIL 1.8 K OHMS

127FD100A S/3	20702	I&C SHOP	5/16/93 - NEW ARRIVED FROM FLORIDA POWER & LIGHT, INSTALLED IN CBC GRP 1 6/9/93 - CONTINUITY CHECK FOUND: AD COIL ~~816.6~~ OHMS, ~~SUB COIL OPEN,~~ RESET COIL 81.6 OHMS,
127FD100A S/3	8818	I&C SHOP	5/14/93 - REMOVED FROM SBA GRP 2. 6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 902.5 OHMS, SUB COIL 909 OHMS, RESET COIL 84.9 OHMS.
127FD110A S/3	* 20183	I&C SHOP	6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 820 OHMS, SUB COIL 813 OHMS, RESET 81.5 OHMS.
127FD100A S/3	20719	I&C SHOP	6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 627.7 OHMS, SUB COIL 608.7 OHMS, RESET COIL 81.5.
127FD110A S/3	* 20182	I&C SHOP	6/9/93 - CONTINUITY CHECK FOUND: ADD COIL 806.2 OHM, SUB COIL 812.4 OHMS, RESET COIL 81 OHMS.
127FD100A S/3	20696	CONTR CONSOL E	5/16/93 - NEW ARRIVED FROM FLORIDA POWER & LIGHT, INSTALLED IN CBA GRP 1.
127FD110A S/3	20730	CNTR CNSOL	5/16/93 - NEW FROM FOLIO 37-7001, INSTALLED TO SBA GRP 2.
127FD100A S/3	8830	CNTR CNSOL	5/14/93 - REMOVED FROM CBB GRP 1. 5/25/93 - INTALLED BACK TO CBB GRP 1.

127FD100A S/3	8837	CNTR CNSOL	5/14/03 - RMOVED FORM CBC GRP 1. 5/25/93 - INTALLED BACK TO CBB GRP 2.

* These counters have a problem with lable.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SUPERVISORY DATA LOGGING (LOGIC CABINET)	183	A114	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RETEST - BENCH TEST, ROD MOVEMENT	5/16/93 - REMOVED FROM A113. REPAIRED ??? 5/31/93, 13:00 - INSTALLED IN A114. 13:30 - CBA GRP 2 NOT MOVING, REPLACED Z3. REINSTALLED TO A114. 6/3/93 3:50 AM - P/A CONVERTER AND PLANT COMPUTER FAILED TO INDICATED FOR CBB, SBB, REPLACED Z13. RETEST SAT.

June 17, 1993

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ETW

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SUPERVISORY DATA LOGGING (LOGIC CABINET)	216	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RETEST - STEPPING OF CBB, CBD, AND SBB STEP COUNTERS, REMOVED FROM SYSTEM 5/31	5/16/93 - INSTALLED IN A114 REPLACED Z3. 5/27/93, 8:40AM - REMOVED FROM A114, REPLACED Z2,Z5, Z3. 15:30 - REINSTALLED TO A114. 5/31/93, 10:45 - REMOVED FROM A114 AND BENCH TESTED, REPLACED Z3.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SUPERVISORY DATA LOGGING (LOGIC CABINET)	217	???	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RETEST - STEPPING ALL RODS TO 228 STEPS, REMOVED FROM SYSTEM 5/24	5/16/93 - INSTALLED IN A113. REPLACED Z8, Z9, Z12. 5/24/93 - REMOVED FROM A113. REPAIR ????

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SUPERVISORY DATA LOGGING (LOGIC CABINET)	6014	A113	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE RETEST - STEPPING OF STEP COUNTERS TO 228, B.O. TEST, RETEST WITH ROD MOVEMENT 6/3	5/24/93 - INSTALLED IN A113 5/26/93 - REMOVED FROM A113 REPLACED Z3 & Z6. INSTALLED BACK TO A113. REPLACED Z2, Z5 & Z8. REINSTALLED TO A113. REMOVED FROM A113, REPLACED Z2, Z5 & Z6. REINSTALLED TO A113. REMOVED FROM A113 AND TAKEN TO TRAINING CENTER FOR TESTING. FOUND Z3 BAD. REPLACED Z3, RETEST SAT. 5/27/93 - INSTALLED IN A113. RETEST SAT. MOVE CBA, CBC GRP1 NO PULSE. REPLACED Z3 & Z6. REINSTALLED TO A113. 5/31/93, 10:45 REMOVED FROM A113 AND BENCH TESTED, REPLACED Z3 &

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SUPERVISORY DATA LOGGING (LOGIC CABINET)	0039	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/14	5/26/93 - INSTALLED IN A113. REMOVED FROM A113, REPLACED Z3, Z2, Z8. INSTALLED IN A113 AGAIN. REPLACED Z2. FAIL AGAIN, REPLACED Z2 & Z3. INSTALLED IN A113, REMOVED FROM A113 AND TAKEN TO TRAINING CENTER FOR TESTING, FOUND Z3 BAD. REPLACED Z3, RETEST SAT. 5/27/93 - REINSTALLED IN A113. FAILED AGAIN, REMOVED FROM A113 REPLACED Z3. INSTALLED IN A114, MOVE ROD FOR CBB NO PULSE, REPLACED Z3. RETEST SAT. 15:30 - REMOVED FROM A114, REPLACED Z3.

ROD CON.ROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
I/O RELAY DRIVERS (LOGIC CABINET)	132	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/14	5/16/93 - REMOVED FROM A713. 5/28/93 - BENCH TESTED FOUND CR1, CR5, & CR9 SHORTED. REPLACED THE SHORTED DIODES, RETEST - SAT.
I/O RELAY DRIVER (LOGIC CABINET)	139	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/14	5/16/93 - REMOVED FROM A714. 5/28/93 - BENCH TESTED FOUND CR1 SHORTED - REPLACED CR1, RETEST - SAT.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
I/O RELAY DRIVER (LOGIC CABINET)	120	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/27	5/16/93 - INSTALLED IN A713. 5/26/93 - REMOVED FROM A713. 23:50 - INSTALLED IN A713. 5/27/93 5:00 AM - REMOVED FROM A713. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1, CR9, CR17 SHORTED. REPLACED SHORTED DIODES, RETEST - SAT.

June 17, 1993

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
I/O RELAY DRIVER (LOGIC CABINET)	133	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/26	5/16/93 - INSTALLED IN A714. 5/26/93 - REMOVED FROM A714. SUSPECTED BAD INPUT DIODE. 6/9/93 - BENCH TESTED FOUND Q10 OPEN.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
I/O RELAY DRIVER (LOGIC CABINET)	695	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/26	5/26/93, 2:00AM - NEW FROM FOLIO, INSTALLED TO A714. 8:00 AM - REMOVED FROM A714. INSTALLED IN A714. 23:50 - REMOVED FROM A714. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1 SHORT, REPLACED CR1 - RETEST SAT.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
I/O RELAY DRIVER (LOGIC CABINET)	681	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/27	5/26/93 - NEW FROM FOLIO, INSTALLED TO A714. SWAPPED WITH S/N 695 - NO CHANGE. RESTORED TO A714. REMOVED FROM A714 AND INSTALLED IN A713. 23:50 - INSTALLED IN A714. 5/27/93, 5:00 AM - REMOVED FROM A714. SUSPECT BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR5, CR17 SHORTED. REPLACED CR5, CR17 - RETEST SAT.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
I/O RELAY DRIVER (LOGIC CABINET)	701	I&C SHOP	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/26	5/26/93, 8:00 AM - NEW FROM FOLIO, INSTALLED TO A713. REMOVED FROM A713. SUSPECTED BAD INPUT DIODE. 5/28/93 - BENCH TESTED FOUND CR1 SHORT. REPLACED CR1, RETEST SAT.
I/O RELAY DRIVER (LOGIC CABINET)	345	A713	FAILURE -- HIGH ELECTRICAL STRESS DUE TO DISCONNECT OF SURGE SUPPRESSION DIODE REMOVED FROM SYSTEM 5/31	RETRIEVED FROM TRAINING CENTER, AND INSTALLED TO A713.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SLAVE CYCLER STATIONARY DECODER - GO2 (LOGIC CABINET)	0079	TB2	FAILURE -- HIGH ELECTRICAL STRESS DUE TO PROBABLE VOLTAGE TRANSIENT DURING MAINTENANCE ACTIVITIES ASSOCIATED WITH STEP COUNTER BACK EMF WESTINGHOUSE ANALYSIS SHOWED RESISTIVE SHORT 200 OHMS - Z2 PIN 9 TO GND (SUBSTRATE FAILURE) Z1 SHOWED 2uA @10v BETWEEN PIN 5 TO GND (5 MEGOHMS). SPECIFICATIONS ARE 2uA AT 16v (8 MEGOHMS).	5/28/93 2:26 AM - REMOVED FROM A501, TESTED BAD ON TEST RIG.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
SLAVE CYCLER MOVABLE DECODER G03 (LOGIC CAB)	0080	TB2	FAILURE -- HIGH ELECTRICAL STRESS DUE TO PROBABLE VOLTAGE TRANSIENT DURING MAINTENANCE ACTIVITIES ASSOCIATED WITH STEP COUNTER BACK EMF PRELIMINARY ANALYSIS FROM MOTOROLA (5/16 FM) SHOWS A FAILURE ON PIN 1 OF Z2 FAILURE -- HIGH ELECTRICAL STRESS DUE TO ELECTROSTATIC DISCHARGE	5/28/93 - REMOVED FROM A511, TESTED BAD ON TEST RIG.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
FIRING CARD (POWER CAB)	0395	I&C SHOP	INTERMITTENT FAULT, TP5 INDICATED NO "PUSH" OF A PUSH-PULL AMPLIFIER. BENCH TESTED SAT, COULD NOT DUPLICATE FAILURE	5/30/93 - REMOVED FROM SLOT D1 OF POWER CABINET. INTERMITTENT FAILURE.
REGULATION CIRCUIT GRIPPER (POWER CAB)	297	I&C SHOP	SOLDER RUN DEGRADATION SHORTING THREE TRACES TOGETHER (Vcoil - Vdemand - Verr)	5/30/93 - REMOVED FROM SLOT F1. PART OF THE INTERMITTENT FAILURE CIRCUIT. REPLACED FOR RELIABILITY.
I/O AC AMPLIFIER (LOGIC CAB)	144	A803 -- A814	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RETEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93, 2:45 AM - BENCH TESTED SAT. INSTALLED IN A803. 19:51 - REMOVED FROM A803, REPLACED Q13, Q14 - STILL DEFECTIVE. REPAIRED ???

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
I/O AC AMPLIFIER (LOGIC CAB)	142	A814 -- A813	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RETEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93 - BENCH TESTED FOUND DEFECTIVE, REPAIRED.
I/O AC AMPLIFIER (LOGIC CAB)	147	A808 -- SPARE	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RETEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93 - BENCH TESTED FOUND DEFECTIVE, REPAIRED.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
I/O AC AMPLIFIER (LOGIC CAB)	149	A812 -- A808	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RETEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93 - REMOVED FROM A812 BENCH TESTED FOUND DEFECTIVE, REPAIRED.
I/O AC AMPLIFIER (LOGIC CAB)	150	A813 -- SPARE	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RETEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93 - REMOVED FROM A813, BENCH TESTED FOUND DEFECTIVE, REPAIRED.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
I/O RECEIVER (LOGIC CAB)	28	A809	FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY RETEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/30/93 - REMOVED FROM A809, BENCH TESTED FOUND DEFECTIVE, REPLACED Q12. REINSTALLED TO A809.
SLAVE CYCLER LOGIC (LOGIC CAB)	80	I&C SHOP	FAILURE -- SHORT BETWEEN 100V SUPPLY AND -15VDC SUPPLY (-15V ON THE I/O AC AMP) RETEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	5/31/93 21:35 - REMOVED FROM A514, BENCH TESTED UNSAT. FOUND PIN 8 LOW, SHOULD BE HIGH (12.5 - 15 VDC).
P/O BANK OVERLAP LOGIC (LOGIC CAB)	14	I&C SHOP	LIFE CYCLE FAILURE RETEST - BENCH TEST, ROD MOVEMENT SINCE 5/31	6/01/93 19:10 - REMOVED FROM A207, BENCH TESTED UNSAT. FOUND PIN 9 LO SHOULD BE HIGH (12.5 - 15 VDC).

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
R1 IN THE POWER CABINET GROUP A MULTIPLEXING CIRCUIT		WRONG LIGHT SOCKET INSTALL	R1 REPLACED	120VAC WITH 39 OHM (25 WATT) RESISTOR YIELDS 3.07 AMPS, 367 WATTS ON THE 25 WATT RESISTOR BLOWS IT UP
100 POWER SUPPLY (LOGIC CAB)			REPLACED 100V POWER SUPPLY BECAUSE IT WAS READING 113V AS PROACTIVE STEP	5/26/93 - REPLACED 100VDC AUX POWER SUPPLY
FUSES (POWER CABINET)			FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY	5/30/93 - REPLACED 2 FUSES, F11, F6. 6/9/93 - BENCH TESTED INCONCLUSIVE.
AUCTIONEER DIODE (LOGIC CAB)			FAILURE -- SHORT BETWEEN 100V POWER SUPPLY AND -15VDC POWER SUPPLY	5/30/93 - REPLACED 1 NEGATIVE 15 VDC AUCTIONEER DIODE (SHORTED). 6/9/93 - BENCH TESTED FOUND AUCTIONEER DIODE SHORTED.

ROD CONTROL SYSTEM - FAILED COMPONENTS STATUS

DESCRIPTION	WSN	PRESENT STATUS	MOST PROBABLE CAUSE	REMARKS (REPAIR &INSTALLATION)
LOW VOLTAGE POWER SUPPLY FILTERS			REPLACED AS A PRECAUTIONARY MEASURE	5/30/93 - REPLACED 2 FILTERS, A16 FL1 & FL2
STEP COUNTER MISSTEPPING		OPERATI ONAL	WORK ORDER 930603076 DETERMINED MECHANICAL BINDING CTR RESET, RETEST WITH ROD MOVEMENT	MISSED 10 STEPS ON 6/3

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

JUN 0 5 1993

Docket Nos. 50-272; 50-311
License Nos. DPR-70; DPR-75
CAL No. 1-93-007

Office of
JUN 0 9 1993
Vice President and
Chief Nuclear Officer

Mr. Steven E. Miltenberger
Vice President and Chief Nuclear Officer
Public Service Electric and Gas Company
P.O. Box 236
Hancocks Bridge, New Jersey 08038

Dear Mr. Miltenberger:

SUBJECT: CONFIRMATORY ACTION LETTER 1-93-007

On June 4, 1993, you were informed of our decision to dispatch an Augmented Inspection Team (AIT) to review and evaluate the circumstances and safety significance of the Rod Control System problems that were encountered during the restart of Salem Unit-2. The AIT was initiated since the Rod Control System malfunctions appeared complicated and difficult to understand; the root cause of the system performance failures was unknown; and the events involved possible adverse generic implications involving other Westinghouse-designed facilities. The AIT, led by William Ruland of our office, briefed your staff and commenced their activities at Salem Unit-2 on June 5, 1993.

In accordance with your discussions with Mr. Ruland during the AIT entrance meeting on June 5, 1993, we understand that you have agreed to:

1. Maintain the plant in a shutdown condition (not to exceed Mode 3) until the AIT has completed all of its on-site inspection and investigation efforts;

2. Assure the AIT leader is cognizant of, and agrees to, any Rod Control System equipment operation, testing, or troubleshooting efforts while the AIT is in progress.

In accordance with our discussion on June 8, 1993, we also understand the following:

3. Your staff will complete a Justification for Continued Operation (JCO) for Salem Unit-1 and confirm that reactor operations will be performed in accordance with that JCO. You will submit that JCO to this office for review by June 9, 1993.

4. Upon completion of the AIT's on-site efforts, you will advise me of the results of your assessment and corrective measures and gain my agreement prior to restart of Unit-2.

Pursuant to Section 182 of the Atomic Energy Act, 42 U.S.C. 2232, and 10 CFR 2.204, you are hereby required to:

1. Notify me immediately if your understanding differs from that set forth above.

2. Notify me, if for any reason, you cannot maintain or require modification of any of these agreements.

Issuance of this Confirmatory Action Letter does not preclude issuance of an Order formalizing the above commitments or requiring other actions on the part of the licensee, nor does it preclude the NRC from taking enforcement action if violations of NRC regulatory requirements are identified through the actions of the AIT. In addition, failure to take the actions addressed in this Confirmatory Action Letter may result in enforcement action.

The responses directed by this letter are not subject to the clearance procedures of the Office of Management and Budget as required by the Paperwork Reduction Act of 1980, Pub.L. 96-511.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter will be placed in the NRC Public Document Room.

Sincerely,

Thomas T. Martin,
Regional Administrator

cc:
J. J. Hagan, Vice President, Nuclear Operations
C. Schaefer, External Operations - Nuclear, Delmarva Power & Light Co.
C. Vondra, General Manager - Salem Operations
F. Thomson, Manager, Licensing and Regulation
R. Swanson, General Manager - QA and Nuclear Safety Review
J. Robb, Director, Joint Owner Affairs
A. Tapert, Program Administrator
R. Fryling, Jr., Esquire
M. Wetterhahn, Esquire
J. Isabella, Director, Generation Projects Department,
Atlantic Electric Company
Consumer Advocate, Office of Consumer Advocate
Tom Dwyer, Public Safety Consultant, Lower Alloways Creek Township
K. Abraham, PAO
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NRC Resident Inspector
State of New Jersey

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REGION I
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KING OF PRUSSIA, PENNSYLVANIA 19406-1415

July 19, 1996

MEMORANDUM TO: Salem Assessment Panel Members

FROM: Larry E. Nicholson, Chief
Projects Branch 3
Division of Reactor Projects

SUBJECT: SALEM ASSESSMENT PANEL (SAP) MEETING MINUTES

Attached for your reference are the minutes from Salem Assessment Panel Meeting No. 96-06 held on July 1, 1996. Additionally, I have attached the chronological outline of the Salem 2 Restart Process that was approved by the SAP.

Docket Nos. 50-272/311

Attachments:
1. SAP Meeting Minutes
2. SALEM 2 Restart Process

cc:
L. Nicholson, DRP
C. Marschall, DRP
S. Barber, DRP
J. Stolz, NRR
L. Olshan, NRR
G. Kelly, DRS

m/23

Attachment 1

SALEM ASSESSMENT PANEL MEETING

July 1, 1996

Meeting #96-06

SAP MEMBERS:

C. Marschall, DRP
G. Barber, DRP
J. Stolz, NRR
L. Olshan, NRR
E. Kelly, DRS

OTHERS:

R. Cooper, DRP
N. Della Greca, DRS
R. DePriest, DRP
C. Cowgill, DRP
J. Linville, DRP

DISCUSSION:

The Salem Assessment Panel (SAP) met on July 1, 1996, from 1:00 p.m. to 4:00 p.m.

Open Items from the SAP Action Item Matrix were presented by Robert E. DePriest. The presentation informed the SAP of the open items in the Matrix and prompted discussions on updating the Matrix. Each member of the SAP was asked to review the Matrix and provide comments to Robert DePriest by 7/03/96.(96-06-01)

OLD BUSINESS:

Charlie Marschall discussed his review of the Salem restart transition from Unit 1 to Unit 2 to determine if any issues or concerns had been dropped. Mr. Marschall's review determined that nothing had been dropped from the transition. This action closes out Action Item (96-05-05)

Gene Kelly discussed the results of Larry Nicholson's meeting with Salem discussing their Integrated Test Plan. This discussion closes out Action Item 96-05-04.

NEW BUSINESS:

1. Charlie Marschall summarized the Salem site visit by Mr. Hubert Miller the week of June 10, 1996. Mr. Miller stressed the following points:

- There were concerns with the extensive number of equipment problems Salem has had, and the difficulty the site has had in correcting these problems.

- He was concerned whether Salem could maintain their conservative approach to restart activities in spite of scheduling pressures.

- Stressed the importance of a good Integrated Test Program.

- Mr. Miller was concerned with the potential for schedule pressure on the Salem Operators, and expressed a concern in maintaining a big picture look at the Operations staff.

- Mr. Miller was aware of the resource problems the Region is having with respect to Salem activities.

John Stolz committed to acquire and present the list of fundamental items that Mr. Miller believes should be addressed prior to restart. Mr. Stolz agreed to acquire this list by July 8, 1996.(96-06-02)

2. Scott Barber discussed the status of Restart Inspections to date. Mr. Barber identified eleven items that were in the backlog of restart items. NRR assistance is needed to review these backlogged issues.

   John Stolz committed to establishing a list of NRR personnel that will be available to assist on these inspections. The list will be provided to the Regional contacts, Larry Nicholson or Scott Barber, by July 3, 1996 (96-06-03)

   Scott Barber was tasked with reviewing the inspection backlog and providing the list to NRR to establish resource needs by July 8, 1996. (96-06-04)

3. Charlie Marschall informed the SAP that there is a revised Salem restart schedule coming out by July 5, 1996. However, the SAP expressed concerns regarding the accuracy of the published restart schedule.

4. Gene Kelly summarized some of the licensee's answers to the 16 Licensing Basis questions from the recent Salem inspections. A management meeting is scheduled with PSE&G for July 2, 1996, to discuss additional concerns with four of the answers. PSE&G has recently added significant work to their schedule to ensure the FSAR is being updated and well managed.

5. The SAP briefly discussed the Salem 2 Restart process and agreed it was appropriate. The SAP also discussed the Salem 2 Restart Process letter that is being reviewed by Mr. Martin.

   The SAP discussed the Salem Integrated Restart Assessment (SIRA) that was performed by PSE&G. This was PSE&G's inspection to review restart readiness. **Charlie Marschall** was tasked with reviewing the SIRA and present the results of his review at the next SAP meeting. (96-06-05)

   The SAP opened an action item to task **Scott Barber** with adding the Integrated Test Program programmatic review to the 0350 Checklist by July 8, 1996. (96-06-06)

6. Neil Della Greca discussed restart item T-41. Steam generator tube integrity. The SAP agreed that a closure package by PSE&G will be necessary for review, and that NR should assign personnel to perform this review.

Curtis Cowgill discussed some of the logistics and makeup of the NRC RATI scheduled for Salem. Mr. Cowgill as team manager, will have an eleven person team, consisting of inspectors from different regions and headquarters. The team will be broken down into three persons in operations, two in maintenance, two in engineering, two in management, and two covering plant support.

The discussion of the backlog of NRC inspection items mentioned in Item No. 2 of the minutes was also discussed as a resource load issue. The action item generated is an attempt to address some of the resource constraints of the Region.

7. **Critique**

Suggestions related to maintaining control over the meeting and ensure that time constraints and subject matter is maintained within the agenda is necessary. Mr. Robert DePriest has been assigned as time keeper and facilitator.

Some members suggested that the agenda and associated documents to be discussed at the SAP meeting be distributed to the SAP members two to three days prior to the SAP.

A suggestion was made to establish Resource Loading, RATI, and Backlog of NRC inspection activities as standing items for discussion in the SAP agenda.

Another suggestion was made to have the Agenda rearranged to discuss Old Business items last to prevent overlap of New Items discussions prior to reaching that point in the agenda.

SALEM 2 RESTART PROCESS

PSE&G conduct an operational readiness review. (CAL Item #4)

PSE&G submits letter stating actions to support restart done with exception of ... and requests NRC RATI to start.

Meeting at site for PSE&G to describe basis for concluding they are ready for RATI. Meeting open for public observation. (CAL Item #5)

NRC conducts meeting at night in Delaware for public to question the NRC process and express concerns regarding restart. Meeting to be transcribed. Copies of the above PSE&G letter and meeting slides to be provided.

NRC conducts RATI. Entrance open for public observation, exit with opportunity for public Q & A afterwards.

PSE&G submits letter affirming the resolution of all restart items and stating their readiness for restart. (CAL Item #6)

SAP meets to agree on restart and concur on CAL supplement.

SAP Chairman briefs RA/NRR etc on readiness for restart conclusions.

CAL amended to allow unit 2 restart. (CAL Item #7)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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KING OF PRUSSIA, PENNSYLVANIA 19406-1415

June 18, 1996

MEMORANDUM TO: Salem Assessment Panel Members

FROM: Larry E. Nicholson, Chief
Projects Branch 3
Division of Reactor Projects

SUBJECT: SALEM ASSESSMENT PANEL (SAP) MEETING MINUTES

Attached for your reference are the minutes from Salem Assessment Panel Meeting #96-05 held on May 29, 1996 and the Guidance for Salem Restart Action Plan Assessments.

Docket Nos. 50-272/311

Attachments:
1. SAP Meeting Minutes
2. Guidance for Salem Restart Action Plan Assessments

cc:
L. Nicholson, DRP
C. Marschall, DRP
S. Barber, DRP
J. Stolz, NRR
L. Olshan, NRR
G. Kelly, DRS

M/24

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8pp.

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J. Zwolinski, NRR
S. Varga, NRR
D. Chawaga, ORA
M. Callahan, OCA
W. Russell, NRR
R. Zimmerman, NRR

Attachment 1

SALEM ASSESSMENT PANEL MEETING

May 29, 1996

Meeting #96-05

SAP MEMBERS:

L. Nicholson, DRP
C. Marschall, DRP
S. Barber, DRP
J. Stolz, NRR
L. Olshan, NRR
G. Kelly, DRS

OTHERS:

W. Kane, DRA
R. Cooper, DRP
T. Fish, DRP
J. Schoppy, DRP
R. DePriest, DRP
W. Ruland, DRS
D. Limroth, DRS
S. Barr, DRS
N. Della Greca, DRS

DISCUSSION:

The Salem Assessment Panel (SAP) met on May 29, 1996, from 1:00 p.m. to 5:30 p.m.

Introduction of the SAP Action Item Matrix was done by Larry Nicholson. The presentation informed the SAP that the purpose of the Matrix was to track actions that were assigned during the SAP meetings, to ensure that items were appropriately tracked and closed. Each member of the SAP was asked to review the Matrix and provide comments to Robert DePriest by 6/10/96.(96-05-01)

OLD BUSINESS:

The SAP determined that an acknowledgement letter for CAL Item #1 would be sent out by 6/28/96, and this would be accomplished by Scott Barber. This action is part of Action Item 96-04-01.

Larry Nicholson informed the SAP that he has acquired contractor support from headquarters. The SAP discussed several possibilities as to how the contractors would be most efficiently used. The acquisition of the contractors closes 96-04-03.

NRR SAP representatives confirmed the receipt of the allegation list requested by 96-04-04.

Gene Kelly briefly discussed the results of the licensing basis team inspection. The inspection report will be out in the next few weeks. The performance of the inspection closes 96-05-05.

NEW BUSINESS:

The SAP was informed that the Layup inspection for Salem Unit 1 is scheduled to be performed on July 22, 1996. The inspector will incorporate lessons learned from IP3, into the inspection plan.

NRC inspection of Salem Restart plans was discussed by the SAP. The SAP determined that **Scott Barber** would track the inspections (96-05-02). Individual inspections would be performed pending the licensees schedule.

1. Larry Nicholson summarized the key points from the recent EDO/RA visit to the Island.
   - There was a major concern over the need to conduct an extensive Integrated Test Program (ITP). Concern that extensive control mods will work.
   - Stressed the importance of correcting long standing equipment issues (e.g. Station Air)
   - Asked if any restart activities were dropped during the transition from Unit 1 to Unit 2.
   - EDO stated that he would have to answer to the commission as to what assurance NRC has that the Salem sites are within their Licensing Basis.
   - EDO was pleased with the elements of change that were observed.

   The SAP determined that the ITP should be included in the Restart Action Plan (RAP) as a programmatic issue. **Gene Kelly** was tasked with developing an inspection plan to address the ITP, by 6/28/96.(96-05-03) As a result of this decision **Larry Nicholson** was tasked to set up a meeting with Salem's Test Program manager to discuss the ITP by 6/7/96. (96-05-04)

   Charlie Marschall was tasked to perform a review of the licensee restart items between Unit 1 and Unit 2 to determine if any items had been overlooked. This action is to be completed by 6/28/96.(96-05-05)

   SAP determined that only 1 public meeting will be held for the Salem RATI. The SAP determined the meeting would be held in Delaware based on the previous public meeting was held in New Jersey.

   Scott Barber was tasked to revise the 0350 checklist and present the revision at the next SAP meeting (96-05-06). The revision is to include the Licensing Basis requirement/FSAR discrepancies specifically including the Service Water system design & reliability.

2. The SAP briefly discussed the status of MRC closure and the rejection rate of packages being presented to the MRC. The SAP expressed concern regarding the number of packages that will be coming to the MRC and the amount of resources required to review these packages prior to restart.

The SAP discussed how the upcoming inspections that will be reviewing closure of restart activities would be documented. The SAP determined that DRS and DRP reports would be separate to ensure timeliness and effectiveness. All reports will have DRP Branch Chief concurrence. The SAP determined that these inspection efforts could continue to provide feeders to the resident report or they can be developed into stand alone reports. Charlie Marschall requested that the residents be notified when a feeder would be provided to the resident report within an appropriate time frame.

3. The SAP began the roundtable discussion with respect to the inspection plans being developed for inspecting the PSE&G RAP. The intent of the discussion was to ensure completeness and consistency when the inspections of the 9 RAP plans is completed. During this discussion it became apparent that the level of detail, and expectations of the purpose of the inspection between the owners of the individual plans differed.

   To assist the owners that will inspect the PSE&G RAPs **Randy Blough** agreed to develop guidance for inspection/assessment of the PSE&G RAP (96-05-07). This was completed prior to the end of the SAP and the guidance is included in the minutes as Attachment 1.

   The SAP agreed that good communication between plan owners is crucial to ensure that the appropriate overlap of issues are addressed, (i.e. Operations RAP owner communicated to Training RAP owner to incorporate Operations department training issues in the Training RAP owners inspection plan).

4. Larry Nicholson discussed where the SAP was in reference to the activities that the SAP is currently performing and activities that will need to be accomplished prior to establishing the appropriate level of assurance the SAP will need to approve the restart of Salem Unit 2. This discussion was centered around the resource loading and if these resources are being used efficiently. Richard Cooper discussed the potential of resource problems that could occur within the Region pending the status of the Millstone Units.

   The SAP also discussed the potential for resource problems for the resident inspectors. The issue is of concern to the SAP, however no resolution was made. The SAP agreed to continue to address this and other resource issues at a later date. **Larry Nicholson** was tasked to coordinate a discussion with NRR, DRP, and DRS to discuss how resources throughout the agency could be incorporated to assist in the Salem restart activities (96-05-08). The discussion is to be scheduled by 6/7/96.

5. The SAP discussed the 5/24/96 management meeting between PSE&G and NRC with respect to Salem's restart program and their progress. The SAP discussed Mr. Martin's points of interest, which included concerns with the ITP, chronic equipment problems, and the licensing basis teams inspection findings.

The SAP discussed the disconnect between the work the licensee has left to accomplish and their schedule. The SAP has concerns that the licensee is being driven by schedule pressures, and with the potential impact these pressures could have on the activities being completed. The SAP also discussed the concern that the PSE&G Restart Schedule does not appear to incorporate any NRC activities.

Larry Nicholson agreed to address the schedule and it's apparent lack of realism to PSE&G management in light of current MRC rejection rates, issues being raised by DRS & the residents, licensee identified issues, and issues raised by the licensing basis inspection.

The SAP also decided that slips in the schedule and continued MRC package rejections should be addressed in Inspection Reports to establish a database.

6. Gene Kelly summarized the issues that were encompassed in the TIA on the Fuel Handling Building Ventilation (FHBV) issues. The two concerns are as follows:

   - Potential issue with the FHBV exhaust fans not being designed as single failure proof.
   - Potential problems with the offsite dose calculations in the event of a fuel handling accident in the fuel handling building.

   The Region is requesting assistance from NRR to determine the validity of the issues and the subsequent actions needed to correct them.

7. The SAP critiqued the 96-05 SAP meeting. The meeting was very informative for others that do not attend the SAP meetings on a regular basis. The time credibility of the agenda was mentioned, however it was agreed the SAP meetings are an open forum in which time restraints are breached to encourage full discussions on pertinent issues.

The meeting was adjourned at 5:30 pm.

Attachment 2

Guidance (groundrules) for Salem Restart Action Plan Assessments

Review and assess the licensee's bases for concluding that the plan has been satisfactorily completed.

Verify on a sampling basis that the licensee has completed the actions as described in their plan -- sample the actions across each relevant problem statement.

Conduct observations, interviews, and other inspection activities to determine whether (1) the licensee actions have resulted in the expected performance improvements, (2) that the current performance level is acceptable, and (3) that the licensees ongoing measures in this area provide reasonable expectation of continued acceptable performance.

Each NRC "owner" of the review responsibility should have an assessment plan that meets the above groundrules and is tailored to that action plan. Detailed assessment results will be published in NRC inspection reports. Also, each NRC "owner" will provide a brief assessment summary (one page or less) for eventual inclusion in the NRC's CAL closeout or restart letter.

POWER CABINET TRANSISTOR FAILURE TIME LINE

The attached time line was developed to determine how long the transistor (Q9) failures existed and to assist in developing a root cause of the failures. The transistor failure supplied a continuous reset to the power panel local alarm light and some card edge indicators. Each of the five power cabinets have a local Urgent Failure alarm on the front of the individual cabinet. Any single alarm will generate a control room alarm on the BETA system.

The time line starts on Saturday 6/19 just before noon when the main, auxiliary, and three phase power was off. This cleared the urgent failure alarm on the BETA. The alarm was clear until Tuesday 6/22 at 0029. This was confirmed by a review of the BETA system historical printout. At this time, the auxiliary power was restored putting all the power cabinets into an urgent alarm condition. The Senior I&C Supervisor looked at all the power cabinets and determined that all indications matched one another.

The Westinghouse testing was initiated on the power cabinets at that time and the alarms came in and cleared numerous times in accordance with the procedure. Testing continued by taking current traces for each control bank groups.

When the test on shutdown C was performed on Wednesday 6/23 at approximately 0030, proper indications, including a local urgent failure alarm were not received and the investigation was initiated.

In summary, it can be concluded based on observation that the cabinet lights agreed and the urgent failure was indicated on the BETA on Tuesday the 22nd that the transistor failure was not present before this time.

M/25

ROD CONTROL SYSTEM
TRANSISTOR FAILURE TIMELINE
Revision 2 - 6/27/93

SATURDAY 6/19/93

MAIN AND 3 PHASE POWER IS OFF. TAGGING REQUEST INITIATED TO TURN AUX PWR OFF.

1159 URGENT FAILURE ALARM CLEARS ON BETA (aux pwr off).

SUNDAY 6/20/93 & MONDAY 6/21/93

REPLACED CKT CARDS IN LOGIC CABINET.
INSPECTED/REPAIRED/REPLACED CKT CARDS IN THE POWER CABINET.
INSTALLED THE DCP PUTTING DIODES ON THE COUNTERS.
REPLACED CAP & FILTERS IN LOGIC CABINET.
CONNECTED STORAGE SCOPES TO =/-15 & 100VDC P/S.

TUESDAY 6/22/93

0029 AUX POWER ON.

0130 OBTAINED STORAGE SCOPE DATA FOR AUX PWR ON TRANSIENT.

CHECKED AUX PWR SUPPLIES.

FRANK MEKULSIA OBSERVES ALL PWR CABINET ALARM LIGHTS ARE THE SAME.

Should have urgent alarm

NON-URGENT ALARMS CLEAR.

0140 OBTAINED STORAGE SCOPE DATA FOR MAIN PWR ON TRANSIENT.

CHECKED MAIN PWR SUPPLIES BY PULLING FUSES FOR AUX.

OPERATOR REPORTS 22RDMG IN SERVICE.

FAILURE DETECTION CARDS REMOVED AND REPLACED BY JUMPERS

0203 URGENT FAILURE ALARM CLEARS ON BETA (indicates time of last jumper being installed in place of Failure Detect Cards).

MISC PORTIONS OF WESTINGHOUSE SERVICE TESTING (Beta indicates 14 cycles of Urgent Failure Alarm over next hour).

0300 BEGIN STEP COUNTER VERIFICATION.

1400 COMPLETE DISCONNECTING LEADS, PULLING FUSES AND SETTING UP DUMMY COILS.

1500 BEGINNING SERIES OF TESTS ON EACH GROUP THAT CONSISTS OF CURRENT TRACE RECORDINGS, PHASE FAILURE TESTS, AND LOGIC ERROR TESTS, ETC. TIMES ARE FROM ASTRO-MED RECORDING OF TRACES.

1507 CONTROL BANK B GROUP 1.
1537 CONTROL BANK D GROUP 1. 21BD
1755 SHUTDOWN B GROUP 1.
1826 CONTROL BANK B GROUP 2.

TOM KING TURNS OVER TO JIM KESIC.

2053 CONTROL BANK D GROUP 2.
2111 SHUTDOWN B GROUP 2.
2141 CONTROL BANK A GROUP 2. 22AC
2258 CONTROL BANK C GROUP 2.
2305 SHUTDOWN A GROUP 2.

(note: more detail in the following 5 hours)

MOVING INTO SCD CABINET. RECORDER, DUMMY COILS, MUX JUMPER CONNECTED.
REMOVED CARD INTERLOCK JUMPERS AND REPLACED FAILURE DETECTION CARDS.

WEDNESDAY 6/23/93

0013 SHUTDOWN C

0030 (approx) DURING FAILURE TESTS ON STATIONARY COILS, NO INDICATORS LIT ON J1 FAILURE DETECT. CARD

PUSHED RESET P/B SEVERAL TIMES. NO CHANGE

CYCLED BUS DUCT DISCONNECTS. NO CHANGE

PULLED J1 FAILURE DETECTOR CARD AND REINSTALLED NO CHANGE.

PULLED J1 AND INSPECTED FOR SPREAD PINS. LOOKS OK. REINSTALLED. NO CHANGE

WENT ON TO MOVABLES. SAME PROBLEM.

PULLED I2 FAILURE DETECT CARD AND REINSTALLED. NO CHANGE

PULLED I2 CARD AND INSPECTED FOR SPREAD PINS. LOOKED OK. REINSTALLED. NO CHANGE

PUSHED RESET SEVERAL TIMES. OBSERVED CABINET URGENT FAILURE ALARM & CARD EDGE INDICATORS ON ONLY WHEN RESET BUTTON HELD. URGENT FAILURE LIGHTS ON WHEN RESET HELD AND BUT REMAINED DIMLY LIT WHEN RESET P/B RELEASED. (INFORMATION SURFACED ON SECOND INTERVIEW WITH TECHNICIAN. TECHNICIAN BELIEVED HE SAW LIGHT DIMLY LIT WHEN HE CUPPED HAND AROUND BULB)

SWAPPED FAILURE DETECT CARD FROM 22AC CABINET. NO CHANGE. SWAPPED BACK

SWAPPED SIGNAL PROC. CARD FROM 22AC. LOOKS GOOD. SWAPPED BACK.

BAD CARD TESTS BAD IN LOGIC TESTER.

REPLACED SUSPECTED BAD DIODE. STILL BAD. DIODE CHECKS OUT GOOD.

REPLACED SUSPECTED BAD Q9. LOOKS GOOD. Q9 BASE TO COLLECTOR SHORTED. CARD PASSES BENCH TESTS.

REINSTALLED SIGNAL PROC. CARD IN SCD CABINET. TESTS GOOD. CONTINUED TESTING.

NEXT STEP, LOGIC ERROR TEST, FAILS. INDICATOR LIGHTS FAIL TO COME ON.

SWAP ALARM CARD FROM 22AC. LOOKS GOOD. SWAP BACK.

BAD ALARM CARD TESTS BAD IN LOGIC TESTER.

REPLACED SUSPECTED BAD Q9. TESTS GOOD.

REINSTALLED ALARM CARD IN SCD CABINET. TESTS GOOD.

0430 (approx)	CONTINUED TESTING.
0456	SHUTDOWN BANK D. REMOVED FAILURE DETECTOR CARDS AND REINSTALLED INTERLOCK JUMPERS IN THE SCD CABINET.
0522	CONTROL BANK A GROUP 1.
0553	CONTROL BANK C GROUP 1.
0602	SHUTDOWN BANK A.
0630 (approx)	COMPLETED WESTINGHOUSE SERVICE TESTING. REMOVED JUMPERS AND REINSTALLED FAILURE DETECTION CARDS.

Salem Unit 2
Rod Control Documentation Index

Date[i]	Subject
931018	Enforcement Panel Briefing Form
930811	IR No. 50-272/93-81 and 50-311/93-81 (Draft and Official record copy)
930707	Exit Meeting slides
930701	Closeout of Confirmatory Action Letter 1-93-007
930628	Meeting with WOG on Rod Control System
	SERT 93-06 Attachment 5 - Rod Control system Chronology
930627	Rod control system transistor failure timeline
	Control Rod System Presentation Supporting Information
	Analysis of Transistor Failures on Signal Processing and Alarm Circuitry Cards
930625	Salem 2 P250 Shutdown Bank C Counter
930618	PSE & G Presentation Slides
930617	E & PB Root Cause Closure Questions
	Request for emergency License Amendment Rod Control System
	Power Cabinet Card Activity Closeout Sheet

Date	Subject
930616	Rod Control System - Failed Components Status
	Parts Analysis
930615	10 CFR 50.59 Review and Safety Evaluation
	Justification for SGS Units 1 and 2 Restart and Operation Rod Control System Failures
930614	Motorola Inc. - Failure Analysis Report #9143
930610	Rod Control System - Failed Component Status
930609	Confirmation Action Letter 1-93-007
	B. Ruland's Personal Notes
930607	AIT Charter
930606	B. Ruland's Personal Notes
930504	Copied Notes from Carl Berlinger
930121	Salem Procedure Revision

Other Related Documents

Management Assessment

Notice of violation/ IR No. 50-271/93-10 (Vermont Yankee, May 12, 1993)

Comments from MORT/AI Exit

Impedance: Separation of Power and Logic Cabinets

Why More Than Expected Urgent Alarms During Testing of the SCD Power Cabinets

Last Day Briefing w/PSE & G

Other Related Documents

Vendor drawings and traces

Salem 2 Rod Control System Corrective Actions

[1] The date most likely is not the date the document was generated.