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S.T. BEARD

TITLE: NI-2 Count Rate Level Indication Failure Analysis

REPORT BY: Jack DeSando

PLAN NO: 15B

DATE PREPARED: June 17, 1985

PAGE: 1 of 3

## INTRODUCTION

The following report is the analysis and evaluation to support the action plan for determining the root cause for the failure of NI-2, Count Rate Level Indication. This report has been prepared in accordance with the "Guidelines to Follow when Troubleshooting or Performing Investigative Actions into the Root Cause Surrounding the June 9, 1985, Reactor Trip", Rev. 2.

## SUMMARY OF DATA

### A. Known Information and Operational Data for Conditions Prior To, During, and After the Transient

1. Prior to the transient - NI-2 indicated less than  $1 \times 10^{-1}$  counts per second with the detector high voltage deenergized. Source range detector high voltage is turned "off" when power exceeds  $1 \times 10^{-9}$  Amps as detected by both intermediate range channels (High Voltage Cutoff Bistable). A source range indication of less than  $1 \times 10^{-1}$  counts per second, in this condition is normal.
2. During the transient - As power decreased below  $1 \times 10^{-9}$  Amps, as detected by both intermediate range channels, the source range high voltage cutoff bistable reset, which, in turn, supplied high voltage to the source range detectors. At this time NI-2 indication remained at less than  $1 \times 10^{-1}$  counts per second. Under these conditions, NI-2 should have registered an on-scale indication.
3. After the transient - The I&C mechanic observed that the remote count rate level indication for NI-2, located on the control console in the Control Room, indicated abnormally low at less than  $1 \times 10^{-1}$  counts per second. He then proceeded to check the local count rate level indication, located on the count rate amplifier module in Reactor Protection System (RPS) Channel 1. Upon opening the cabinet doors for RPS Channel 1, the I&C mechanic observed a normal, on-scale indication on the local meter. He then rechecked the remote indication only to find that it was indicating normally, also. ST 5091.01 was performed to demonstrate operability on 5/9/85.

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B. Maintenance History (Taken from I&C Equipment Record and DBMMS Data)

9/20/84 - Replaced the Output Calibration Trim Potentiometers on all test modules associated with Reactor Protection System Channel 1, including the Source Range Test Module for NI-2. Trim Potentiometer replacement was in response to B&W safety concern, PSC 10-82 (SCN 75-6754). Physical replacement was performed under MWO 1-84-2846-00.

9/20/84 - Cleaned and inspected Reactor Protection System Channel 1. Removed, cleaned, and inspected all modules associated with Reactor Protection System Channel 1, including modules associated with NI-2. Cleaned and inspected all cabinet mounted hardware, including all module connector sockets, and checked all field wiring connections, at terminal strips in the bottom of the cabinets, for tightness. Inspection was performed under MWO 3-84-1966-01.

9/23/84 - Replaced connector plug, located on the back of the Source Range Detector High Voltage Power Supply Module associated with NI-2. During inspection performed per Step 2 above, two broken pins were found on Blue Ribbon Connector Plug (J1.0) for the Source Range Detector High Voltage Power Supply Module. Connector was replaced under MWO 1-84-2846-00.

3/25/85 - Source Range count rate level indication associated with NI-2 failed to less than  $1 \times 10^{-1}$  counts per second. MWO 1-85-1157-00 was generated to determine cause for NI-2 level indication failing low. Upon opening the cabinet doors for Reactor Protection System Channel 1, the count rate level indication returned to normal. ST 5091.01 was performed to prove operability. MWO 1-85-1157-00 was voided, no troubleshooting was performed.

4/13/85 - Source Range count rate level indication associated with NI-2 failed to less than  $1 \times 10^{-1}$  counts per second. MWO 1-85-1337-00 was generated to determine cause for failure. Prior to performing any troubleshooting, the I&C mechanic tapped on the front of the Count Rate Amplifier Module, associated with NI-2, and the count rate level indication returned to normal. A visual inspection of the Count Rate Amplifier Module, associated connectors, and associated wiring was performed. No discrepancies were noted. ST 5091.01 was performed to prove operability.

CHANGE ANALYSIS

According to the maintenance history, taken from I&C equipment records and from Davis-Besse Maintenance Management Systems data, and according to past operational experience, it is apparent that the failure of NI-2 was first experienced on 3/25/85. Just prior to this, during the 1984 refueling outage, all RPS modules were removed, cleaned, and inspected. This inspection revealed two bad pins on the blue ribbon connector plug on the source range detector high voltage power supply module associated with NI-2. This connector was replaced and all modules were reinstalled on 9/23/84. It is possible that during the cleaning or reinstallation of

these modules, damage was done to cause an intermittent contact or connection and/or possibly a loose component.

#### HYPOTHESES

Hypothesis for Failure of Count Rate Level Indication Associated with NI-2 to Less than .1 Counts Per Second

Based on the information received during the transient and information obtained from equipment records and DBMMS data, it appears that the high voltage to the Source Range Detector or the input signal to the Count Rate Amplifier Module is being interrupted by a bad contact, loose wiring and/or loose components. There are several areas that should be investigated:

1. Loose or intermittent connection and/or component on Count Rate Amplifier Module.
2. Loose or intermittent connection and/or component on Source Range Detector High Voltage Power Supply Module.
3. Failure of Relay K1.0 in the Count Rate Amplifier Module.

bj b/1

## ACTION PLAN

ID: 84.7

TITLE

Rev 0

15B

1

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## NI-2 Failure Analysis

6-15-85

J. DeSando

To determine root cause for Count Rate level indication associated with NI-2 failing low.

STEP NUMBER	ACTION STEPS	WHO TO DO	WHO TO	START DATE	FINISH DATE	DATE COMPLETED
	ALL STEPS OF THIS ACTION PLAN ARE TO BE PERFORMED IN ACCORDANCE WITH THE LATEST REVISION OF "GUIDELINES TO FOLLOW WHEN TROUBLESHOOTING OR PERFORMING INVESTIGATIVE ACTIONS INTO THE ROOT CAUSES SURROUNDING THE JUNE 9, 1985, REACTOR TRIP".					
1.	Measure and record all Source Range NI-2 instrumentation string voltages at test jacks on associated modules, also, note all associated switch positions and Potentiometer settings.	J. DeSando	J. DeSando T. Isley			
2.	Remove the Count Rate Amplifier Module from the RPS cabinet and inspect and troubleshoot for loose wiring and/or components. Also, check for proper mating between module plug and cabinet socket. Inspect wiring at cabinet socket for loose connection. Reinstall Count Rate amp module. (Hypothesis Step 1)	J. DeSando	J. DeSando T. Isley			
3.	Repeat inspection/troubleshooting described in Step 2 for Source Range Detector High Voltage Power Supply module associated with NI-2. (Hypothesis Step 2)	J. DeSando	J. DeSando T. Isley			

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Rev 0

PLAN NUMBER: 11

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2 of 2

DATE PREPARED \_\_\_\_\_

PREPARED BY

6-15-85

J. DeSando

## NI-2 Failure Analysis

### SPECIFIC OBJECTIVE

To determine root cause for Count Rate level indication associated with NI-2 failing low.

[illegible]

J.T. BEARD

TITLE: NI-2 Count Rate Level Indication Failure Analysis

REPORT BY: Jack DeSando

PLAN NO: 15B

DATE PREPARED: June 17, 1985

PAGE: 1 of 3

## INTRODUCTION

The following report is the analysis and evaluation to support the action plan for determining the root cause for the failure of NI-2, Count Rate Level Indication. This report has been prepared in accordance with the "Guidelines to Follow when Troubleshooting or Performing Investigative Actions into the Root Cause Surrounding the June 9, 1985, Reactor Trip", Rev. 2.

## SUMMARY OF DATA

### A. Known Information and Operational Data for Conditions Prior To, During, and After the Transient

1. Prior to the transient - NI-2 indicated less than  $1 \times 10^{-1}$  counts per second with the detector high voltage deenergized. Source range detector high voltage is turned "off" when power exceeds  $1 \times 10^{-9}$  Amps as detected by both intermediate range channels (High Voltage Cutoff Bistable). A source range indication of less than  $1 \times 10^{-1}$  counts per second, in this condition is normal.
2. During the transient - As power decreased below  $1 \times 10^{-9}$  Amps, as detected by both intermediate range channels, the source range high voltage cutoff bistable reset, which, in turn, supplied high voltage to the source range detectors. At this time NI-2 indication remained at less than  $1 \times 10^{-1}$  counts per second. Under these conditions, NI-2 should have registered an on-scale indication. **SV RATE IND.**
3. After the transient - The I&C mechanic observed that the remote count rate level indication for NI-2, located on the control console in the Control Room, indicated abnormally low at less than  $1 \times 10^{-1}$  counts per second. He then proceeded to check the local count rate level indication, located on the count rate amplifier module in Reactor Protection System (RPS) Channel 1. Upon opening the cabinet doors for RPS Channel 1, the I&C mechanic observed a normal, on-scale indication on the local meter. He then rechecked the remote indication only to find that it was indicating normally, also. ST 5091.01 was performed to demonstrate operability on 7/9/85.

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B. Maintenance History (Taken from I&C Equipment Record and DBMMS Data)

9/20/84 - Replaced the Output Calibration Trim Potentiometers on all test modules associated with Reactor Protection System Channel 1, including the Source Range Test Module for NI-2. Trim Potentiometer replacement was in response to B&W safety concern, PSC 10-82 (SCN 75-6754). Physical replacement was performed under MWO 1-84-2846-00.

9/20/84 - Cleaned and inspected Reactor Protection System Channel 1. Removed, cleaned, and inspected all modules associated with Reactor Protection System Channel 1, including modules associated with NI-2. Cleaned and inspected all cabinet mounted hardware, including all module connector sockets, and checked all field wiring connections, at terminal strips in the bottom of the cabinets, for tightness. Inspection was performed under MWO 3-84-1966-01.

9/23/84 - Replaced connector plug, located on the back of the Source Range Detector High Voltage Power Supply Module associated with NI-2. During inspection performed per Step 2 above, two broken pins were found on Blue Ribbon Connector Plug (J1.0) for the Source Range Detector High Voltage Power Supply Module. Connector was replaced under MWO 1-84-2846-00.

3/25/85 - Source Range count rate level indication associated with NI-2 failed to less than  $1 \times 10^{-1}$  counts per second. MWO 1-85-1157-00 was generated to determine cause for NI-2 level indication failing low. Upon opening the cabinet doors for Reactor Protection System Channel 1, the count rate level indication returned to normal. ST 5091.01 was performed to prove operability. MWO 1-85-1157-00 was voided, no troubleshooting was performed.

4/13/85 - Source Range count rate level indication associated with NI-2 failed to less than  $1 \times 10^{-1}$  counts per second. MWO 1-85-1337-00 was generated to determine cause for failure. Prior to performing any troubleshooting, the I&C mechanic tapped on the front of the Count Rate Amplifier Module, associated with NI-2, and the count rate level indication returned to normal. A visual inspection of the Count Rate Amplifier Module, associated connectors, and associated wiring was performed. No discrepancies were noted. ST 5091.01 was performed to prove operability.

CHANGE ANALYSIS

According to the maintenance history, taken from I&C equipment records and from Davis-Besse Maintenance Management System data, and according to past operational experience, it is apparent that the failure of NI-2 was first experienced on 3/25/85. Just prior to this, during the 1984 refueling outage, all RPS modules were removed, cleaned, and inspected. This inspection revealed two bad pins on the blue ribbon connector plug on the source range detector high voltage power supply module associated with NI-2. This connector was replaced and all modules were reinstalled on 9/23/84. It is possible that during the cleaning or reinstallation of

these modules, damage was done to cause an intermittent contact or connection and/or possibly a loose component.

#### HYPOTHESES

Hypothesis for Failure of Count Rate Level Indication Associated with NI-2 to Less than .1 Counts Per Second

Based on the information received during the transient and information obtained from equipment records and DBMMS data, it appears that the high voltage to the Source Range Detector or the input signal to the Count Rate Amplifier Module is being interrupted by a bad contact, loose wiring and/or loose components. There are several areas that should be investigated:

1. Loose or intermittent connection and/or component on Count Rate Amplifier Module.
2. Loose or intermittent connection and/or component on Source Range Detector High Voltage Power Supply Module.
3. Failure of Relay K1.0 in the Count Rate Amplifier Module.

bj b/1



## ACTION PLAN

FD 6478

TITLE

## NI-2 Failure Analysis

Rev 0

15B

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6-15-85

J. DeSando

To determine root cause for Count Rate level indication associated with NI-2 failing low.

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
	ALL STEPS OF THIS ACTION PLAN ARE TO BE PERFORMED IN ACCORDANCE WITH THE LATEST REVISION OF "GUIDELINES TO FOLLOW WHEN TROUBLESHOOTING OR PERFORMING INVESTIGATIVE ACTIONS INTO THE ROOT CAUSES SURROUNDING THE JUNE 9, 1985, REACTOR TRIP".					
1.	Measure and record all Source Range NI-2 instrumentation string voltages at test jacks on associated modules, also, note all associated switch positions and Potentiometer settings.	J. DeSando	J. DeSando T. Isley			
2.	Remove the Count Rate Amplifier Module from the RPS cabinet and inspect and troubleshoot for loose wiring and/or components. Also, check for proper mating between module plug and cabinet socket. Inspect wiring at cabinet socket for loose connection. Reinstall Count Rate amp module. (Hypothesis Step 1)	J. DeSando	J. DeSando T. Isley			
3.	Repeat inspection/troubleshooting described in Step 2 for Source Range Detector High Voltage Power Supply module associated with NI-2. (Hypothesis Step 2)	J. DeSando	J. DeSando T. Isley			

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## NI-2 Failure Analysis

### SPECIFIC OBJECTIVE

PLAN NUMBER:

15B

DATE PREPARED

6-15-85

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PREPARED BY

J. DeSando

To determine root cause for Count Rate level indication associated with NI-2 failing low.

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TITLE: NI-2 Count Rate Level Indication Failure Analysis  
REPORT BY: Jack DeSando PLAN NO: 15B  
DATE PREPARED: June 17, 1985 PAGE: 1 of 3

## INTRODUCTION

The following report is the analysis and evaluation to support the action plan for determining the root cause for the failure of NI-2, Count Rate Level Indication. This report has been prepared in accordance with the "Guidelines to Follow when Troubleshooting or Performing Investigative Actions into the Root Cause Surrounding the June 9, 1985, Reactor Trip", Rev. 2.

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3. Failure of Relay K1.0 in the Count Rate Amplifier Module.

bj b/1

ACTION PLAN  
ED 6408  
TITLE

NI-2 Failure Analysis

Rev 0

15B	1 of 2
6-15-85	J. DeSando

To determine root cause for Count Rate level indication associated with NI-2 failing low.

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
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3.	Repeat inspection/troubleshooting described in Step 2 for Source Range Detector High Voltage Power Supply module associated with NI-2. (Hypothesis Step 2)	J. DeSando	J. DeSando T. Isley			



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## NI-2 Failure Analysis

#### SPECIFIC OBJECTIVE

Rev 0

PLAN NUMBER: 14

15B

DATE PREPARED

6-15-85

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PREPARED BY

J. DeSando

To determine root cause for Count Rate level indication associated with NI-2 failing low.

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