PALO VERDE
NUCLEAR GENERATING STATION

Instrumentation & Controls Training

Classroom Lesson

I&C Program	**Date: 5/8/2007**
LP Number: NIA02L000101	**Rev Author: Christopher A. Mahar**
Title: Instrument Isolation and Restoration	**Technical Review:** Reynolds, James J(Z78347) Digitally signed by Reynolds, James J(Z78347) DN: cn=Reynolds, James J(Z78347), email=James.Reynolds@aps.com Reason: I have reviewed this document Date: 2007.05.10 11:34:40 -07'00'
Duration : 5 Hours	
	Teaching Approval: Freitas, Jeffrey (Z36100) Digitally signed by Freitas, Jeffrey (Z36100) DN: cn=Freitas, Jeffrey (Z36100), email=Jeffrey.Freitas@aps.com Reason: I am approving this document Date: 2007.05.10 11:44:15 -07'00'

INITIATING DOCUMENTS:

Site Maintenance Training Program Description

REQUIRED TOPICS

NONE

CONTENT REFERENCES

TCS 97-0509 SOER 85-02 Valve Mispositioning Events involving human error

TCSAI 2905527 SER 19-90, Monitoring Plant Evolutions Using Inoperable Control Board Indications

Lesson Plan Revision Data

May 03, 2007	Chris Mahar	Record created

Tasks and Topics Covered

The following tasks are covered in Instrument Isolation and Restoration:

Task or Topic Number*	Task Statement
Lesson:	Instrument Isolation and Restoration
PRO37	Remove/restore instrument from/to service

Total tasks or topics: 1

TERMINAL OBJECTIVE:

1.1 Given the necessary tools, equipment, and references, the I&C Technician will isolate and restore instruments. Mastery will be demonstrated by successful completion of all in class exercises, Laboratory Practical

1.1.1 Identify the concerns associated with isolating and restoring a flow instrument

1.1.2 Identify the concerns associated with isolating and restoring a level instrument

1.1.3 Identify the function of each valve on a three valve manifold

1.1.4 Isolate and restore an instrument

Lesson Introduction: Instrument Isolation and Restoration

The following items are things to consider in your Lesson Introduction. They are not mandatory. You should develop your own introduction and place that material in the Program Hierarchy in the Lesson Introduction Tab or appropriate Training Unit.

CLASSROOM GUIDELINES

- If applicable, remind students of class guidelines as posted in the classroom.
- Pass the attendance sheet around and have it signed in Dark ink.
- Ensure that student materials needed for the class are available for each student.
- Emphasize student participation and remind them of your philosophy on asking and answering questions, if applicable.

ATTENTION STEP

- Give a brief statement or story to get student concentration focused on the lesson subject matter.

LESSON INTRODUCTION

- Give a brief statement that introduces the specific lesson topic. Should be limited to a single statement.

MOTIVATION

- Focus student's attention on the benefits they derive from the training. At Instructor's discretion. The need for motivation in each succeeding lesson must be analyzed by the Instructor and presented as necessary.
- Instructor should include how the STAR process can be used to improve or enhance Operator Performance, if applicable.
- Read and discuss lesson terminal objective and review lesson enabling objectives, if desired.
- If applicable, briefly preview the lesson topic outline and introduce the major points to be covered. The objective review may have been sufficient.
- REINFORCE the following PVNGS management expectations as opportunities become available:

  Nuclear Safety
  Industrial Safety Practices
  STAR and Self-Checking
  Procedure Compliance
  Communication Standards
  ALARA
  Prevent Events

Course Terminal Objective: Given the necessary tools, equipment and references the I&C technician will calibrate and troubleshoot instrumentation loops. Mastery will be demonstrated by successful completion of all in class exercises, Laboratory Practical Evaluations and scoring 80% or better on an end of course exam.

Introduce topics:
Isolating & Restoring Instruments
Foxboro coding refresher
Loop Calibration (calibration principles)
Loop Control (loop tuning)
Loop Troubleshooting
Industry Events

40 hour class

T.Obj 1.1	**Given the necessary tools, equipment, and references, the I&C Technician will isolate and restore instruments. Mastery will be demonstrated by successful completion of all in class exercises, Laboratory Practical**

EO 1.1.1	Identify the concerns associated with isolating and restoring a flow instrument

1.1.1.1 Main Idea

Standards & Expectations – ***Self Check/Peer Check:*** *Emphasize the concerns while isolating or restoring a DP flow instrument:* • *The major concern is the potential for damage to the transmitter by exposing one side to high pressure while the other side of the transmitter is at a low pressure.* • *Another concern is the potential for high energy process fluid flowing through the three valve manifold, which is not designed for very high temperature flow.* • *Another concern would be the introduction of plant perturbations or instrument failures due to improper manipulation of three valve manifold during restoration.* Flow Instruments are very sensitive, measuring only a few hundred inches of water differential pressure ***on systems that can be at thousands of pounds of system pressure***	Methods & Activities: Example; main steam flow, main feed flow, RCP DP

Operating Experience **Date:**21-11-1990 **Subject:**SER 19-90, Monitoring Plant Evolutions Using Inoperable Control Board Indications SUMMARY AND CONSEQUENCES: In each of these events, the desired plant condition was not reached during changes in reactor coolant system parameters because inoperable instruments were used as the primary means of monitoring the evolution. Contributing to the difficulties encountered in establishing the desired plant conditions were: - ineffective resolution of inconsistencies in measured plant parameters - failure to employ available alternative indications of plant parameters - valve mispositionings These events are significant because evolutions involving changes in reactor coolant system inventory or pressure were conducted without satisfactory indication. Changing plant conditions, under slightly different conditions, could result in a challenge to reactor safety.	Refer to full text of OE in handout, especially the second event in the SER
Measures the D/P produced by a flow restriction of some type	
1. Flow Nozzles	
2. Orifice	
3. Elbow Taps	

EO 1.1.2	**Identify the concerns associated with isolating and restoring a level instrument**

1.1.2.1 Main Idea

Prevent Events: A major concern while isolating or restoring a DP instrument is **the potential for draining a wet reference leg or putting water in a dry reference leg.** Another concern is **placing full system pressure on one side of the transmitter and atmospheric on the other side.** The differential pressure can be over 2000 psi, which can damage the transmitter. A. Typical Level Instrument uses a Differential Pressure/DP generated between a process measurement in a tank and a reference.	Methods & Activities: Show powerpoints of wet and dry reference leg pressure measurements
1. Referenced to atmosphere	
a. Dry Leg	Methods & Activities Example: Refueling Water Tank
b. Used on systems with a vented tank	
2. **Dry Leg** Referenced to Tank	Methods & Activities Example:Condensate storage tank with a nitrogen blanket.
a. Used on systems that have a pressurized tank.	
b. Reference line is connected to the tank to apply the purge pressure to both sides of the transmitter thus canceling out the effects of the purge pressure	Methods & Activities Example: Volume Control tank has both wet and dry reference legs

	Methods & Activities ***Operating experience;*** *Ask the students what indication would be observed if the* ***Dry Leg Reference*** *were to fill to the same height as tank. ANSWER: Indication would be at or around minimum indication/zero* *Ask students how this situation could occur. ANSWER: improper manipulation of instrument valves. (Three way manifold covered in greater detail in next objective.)*
3. **Wet Leg** referenced to the tank	Methods & Activities: VCT example, Steam generators, Pressurizer, Equipment Drain Tanks
a. Used on pressurized systems with liquid and steam mixtures in the tank.	***Operating experience;*** *Ask the students what indication would be observed if the* ***Wet Leg Reference*** *were to drain to the same height as tank. ANSWER: Indication would be at or around maximum indication.* *I Ask students how this situation could occur. ANSWER: improper manipulation of instrument isolation valves. (Three way manifold covered in greater detail in next objective.)* *Ask students what indication would be observed if the* ***Wet Leg Reference*** *completely drained. ANSWER: indication would be greater than maximum, pegged high*

b. Steam in the upper portion of the tank would condense in the reference leg. Any changes in the reference leg would affect the D/P.	
c. Reference leg is filled with a fluid similar to the process fluid.	
d. Condensing pot at the top of the reference leg maintains the reference leg full.	
e. Examples: Steam Generators, Pressurizer	

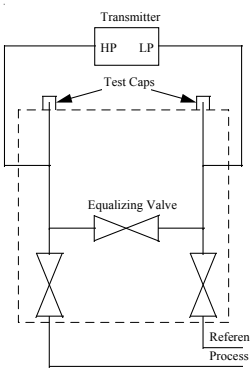
EO 1.1.3	Identify the function of each valve on a three valve manifold

1.1.3.1 Main Idea

A. The three valve manifold provides the necessary valves and test connections to allow isolation and calibration locally.

Methods & Activities: Optional

Refer to PPT presentation



Mechanical Representation of a 3 Valve Manifold

1. The equalizing valve is in the center higher up. (Note that if the manifold is mounted upside down, that it will still be the one in the center.)

2. The two valves at the same level are for isolation of the process and reference leg.

3. The general rule for Process and Reference leg with respect to a DP cell/transmitter:

   I. Typically the process is connected to the HIGH side of the DP cell.

   II. Typically the reference leg is connected to the LOW side of the DP cell.

PREVENT EVENTS; Stop when unsure; *Not true for all application, just most of them.*
Palo Verde has DP cells/transmitters which do ***not*** *follow* **Process = High side, Reference = Low side** *convention.*

I. *Example: Pressurizer level transmitters, Barton model 764's- Process connected to Low side, Reference Leg connected to High side.*

PREVENT EVENTS TOOLS: *Have the students discuss PE Tools that can be used to ensure proper identification of high side and reference leg**

I. ***Two minute drill –*** *Identify and use approved identification labeling/stampings;*

Methods for identifying the High Pressure and Low Pressure Valves

a. Rosemount Transmitters ***H*** *and* ***L*** *cast into casing*

b. Barton Transmitters ***HP*** *and* ***LP*** *stamped onto transmitter*

c. Barton Flow Indicators ***HP*** *and* ***LP*** *stickers on the casing*

d. Alternate Method for flow instruments.

i. Determine direction of flow in process line.

ii. High Pressure tap is the up stream tap.

II. If High side/Low side cannot be determined; **Stop**

PREVENT EVENTS: *What is the expectation at PVNGS when performing any type of maintenance in the field, and the worker is uncertain how to proceed?*

> ***STOP when unsure*** *- Have a questioning attitude. If the answer is not known as to how to proceed, stop work and get the answers by either further research, SMEs and/or team leaders*

4. When the instrument is isolated, both isolation valves are shut and the equalizing valve is open.

5. When the instrument is in service, both isolation valves are open and the equalizing valve is shut.

EO 1.1.4	Isolate and restore an instrument

1.1.4.1 Main Idea

Reference: LPE on 3 valve manifolds

A. Removal From Service

Two minute drill: *emphasize to students the importance of a slow, methodical manipulation of the three way manifold valves during removal of service to avoid shocking instrument. No rush*

1. Shut HP Isolation Valve
2. Open the Equalizing Valve
3. Shut LP Isolation Valve

Prevent Events-Self check/Peer Check: *Ask students what configuration instrument valves should be in during a calibration and why.*

Answer: HP Isolation valve shut, LP isolation valve shut, and Equalizing valve shut. In order to be able to pressurize the instrument through its test ports. If equalizer was left open, no DP could be generated by M&TE source.

B. Return To Service

1. Verify both isolation valves are shut and the equalizing valve is open.

Prevent Events-Self check/Peer Check: *Ask students why the equalizer was reopened after calibration but prior to restoration of instrument back to service.*

Answer: If equalizer was left shut after calibration and LP isolation valve was then opened, LP side of transmitter would receive full system pressure to its low side only. Possibly shocking or even damaging the instrument.

Two minute drill; *Again emphasize to students the importance of methodically performing removal or restoration of DP instrument to service.*

2. Open the LP Isolation Valve

3. Shut the equalizing Valve

4. Open the HP Isolation Valve

Two minute drill; *Emphasize that neither the "remove from service", nor the "return to service" steps allow for the three valves to be open at the same time.*

Using a wet reference leg xmitr as an example, ask students what would happen to the loop indication if the High, Low, and Equalizing isolation valves were open at the same time. Answer: the loop indication would read around full scale (or greater depending on the calibration data used)

C. Recent problems during removal and calibration of transmitters.

1. Wet Leg Vs. Dry Leg: most dry leg transmitters have labels to identify them. Need to keep dry legs dry and wet legs full.

2. Failure to return transmitter to service. Configuration issue.

2. Where to connect the pressure source when calibrating DP's.

   a. Rosemounts, variable leg is always the high pressure connection.

   b. Bartons, the high pressure connection is always the connection that will receive the highest pressure. If wet leg, LP is process. If dry leg HP is process.

3. Ensure that the manifold is full prior to and following calibration. Use a squirt bottle, water bottles or a backfill rig to fill to the top of the test caps.

5. Work order will provide direction on whether to inspect or replace o-rings and provide a torque value if needed.

Stop when unsure: *Agreement with operations is to leave instrument valves as found. Notify team leader if instrument is found isolated.*

SUMMARY OF MAIN PRINCIPLES

The following items are things to consider in your lesson summary. They are not mandatory. You should develop your own summary.,

Objectives Review

Review the Lesson Objectives

Topic Review

Restate the main principles or ideas covered in the lesson. Relate key points to the objectives. Use a question and answer session with the objectives.

Questions and Answers

Oral questioning

Ask questions that implement the objectives. Discuss students answers as needed to ensure the objectives are being met.

Problem Areas

Review any problem areas discovered during the oral questioning, quiz, or previous tests, if applicable. Use this opportunity to solicit final questions from the students (last chance).

Concluding Statement

If not done in the previous step, review the motivational points that apply this lesson to students needs. If applicable, end with a statement leading to the next lesson.

You may also use this opportunity to address an impending exam or practical exercise.

Should be used as a transitional function to tie the relationship of this lesson to the next lesson. Should provide a note of finality.