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U.S. Nuclear Regulatory Commission
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RESTART READINESS
HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NPF-57
DOCKET NO. 50-354

This letter forwards Hope Creek Procedure HC.ER-AP.BB-0001(Z) Rev. 0 **Reactor Recirculation Pumps/Motors Vibration Monitoring**, as requested by the NRC staff. This procedure provides for monitoring of the vibration information available for 'A' & 'B' Reactor Recirculation pumps and motors for the following purposes:

Trend the general condition of the reactor recirculation pumps and motors.

Provide an early warning of possible reactor recirculation pump shaft cracking.

Provide guidelines for gathering vibration data on reactor recirculation pumps, evaluating the data, and determining any required actions to address the condition.

Adjust acceptance criteria as pump baselines change.

In addition draft copies of the following procedures, which are being changed as a result of the installation of the new predictive vibration monitoring equipment, are included:

HC.OP-AB.RPV-0003(Q) Rev 7 **RECIRCULATION SYSTEM**

HC.OP-AR.ZZ-0008(Q) - Rev. 27 **OVERHEAD ANNUNCIATOR WINDOW BOX C1** (Attachment E-4 only)

One additional point of clarification, DCP 80062466 EPU Piping Vibration Monitoring Installation Package Rev 3 Approved 12/23/04, provided to the NRC, can be docketed.

If you have any questions or require additional information, please contact Mr. Brian Thomas at (856) 339-2022.

Christina L. Perino
Director – Licensing and Nuclear Safety

Enclosure

IE26

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HOPE CREEK
REACTOR RECIRCULATION PUMPS/MOTORS
VIBRATION MONITORING

HC.ER-AP.BB-0001(Z) REV. 0

PROCEDURE SPONSOR: Engineering Programs

REVISION SUMMARY Biennial Review Required: Yes __ No X

1. Initial Issue.

IMPLEMENTATION REQUIREMENTS Effective date: 1/4/05

Approved: Steve Loy 1/4/05

Engineering Programs Manager Date

HOPE CREEK
REACTOR RECIRCULATION PUMPS/MOTORS
VIBRATION MONITORING

TABLE OF CONTENTS

1.0 PURPOSE

Monitor the vibration information available for 'A' & 'B' Reactor Recirculation pumps and motors for the following purposes:

- Trend the general condition of the reactor recirculation pumps and motors.
- Provide an early warning of possible reactor recirculation pump shaft cracking.
- Provide guidelines for gathering vibration data on reactor recirculation pumps, evaluating the data, and determining any required actions to address the condition.
- Adjust acceptance criteria as pump baselines change.
- Support emergent evaluation for shaft cracking initiated by overhead alarm C1-E4, REACTOR RECIRC PUMP VIB HI.

2.0 SCOPE

2.1 This procedure is limited to the Hope Creek Reactor Recirculation Pumps and Motors. It will be used to monitor the overall condition of the reactor recirculation pumps and motors, and specifically for early detection of pump shaft cracks.

2.2 The usage of this procedure will be controlled by the station's Preventative Maintenance program, and by the operations alarm response procedure HC.OP-AR.ZZ-0008(Q).

3.0 RESPONSIBILITIES

3.1 Manager Engineering Programs

Oversee the Reactor Recirculation pump/motor vibration data collection and analysis. Ensure it is being routinely collected and analyzed by knowledgeable personnel.

3.2 Component Engineering Supervisor

Ensure knowledgeable engineering resources are available to review the vibration data in a timely manner after it is collected.

3.3 Responsible Engineer

- Review the collected vibration data provided against the acceptance criteria, provided in this procedure, and general component and vibration experience.
- Initiate the actions specified in this procedure
- Document the results in a retrievable format.
- Obtain a peer review for any data collection or determinations performed under this procedure.

4.0 BACKGROUND/PROCESS DESCRIPTION

4.1 Reactor Recirculation Pump Description:

The Hope Creek Reactor Recirculation pumps are Byron-Jackson (now Flowserve) Type DVSS Size 28x28x35, vertical, single stage pumps. Vibration data is collected by two orthogonal proximity probes located on the pump coupling assembly.

4.2 Pump Shaft Vibration Instrumentation Description:

Two proximity probes (X & Y directions), FLOC's: H1BB–1BBVE-7910A(B)1/2, are mounted on the pump coupling assembly to detect shaft radial vibration. The vibration signal is alarmed in the control room via overhead alarm C1-E4, REACTOR RECIRC PUMP VIB HI and digital points D5351/D5352. The vibration signal is also indicated and alarmed in the plant computer via analog points A2601/A2603.

4.3 Reactor Recirculation Motor Description:

The Hope Creek Reactor Recirculation pump motors are General Electric (GE) variable speed, 7500 HP motors. Vibration data is collected by a velocity meter and in the case of 'B' Reactor Recirculation pump motor also by five accelerometers.

4.4 Motor Radial Vibration Description:

One Velocity meter is installed on the upper edge of the motor upper bearing bracket to detect motor radial vibration, FLOC: H1BB–1BBVE-7910A(B)4. The vibration signal is alarmed in the control room via overhead C1-E4, "REACTOR RECIRC PUMP VIB HI" and digital points D5351/D5352. The vibration signal also is indicated and alarmed in the plant computer via analog points A2602/A2604.

In addition, 'B' Reactor Recirculation pump motor contains three accelerometers (Horizontal, Vertical, and Axial directions) at the upper edge of the upper motor bearing bracket, and two accelerometers (Horizontal, Vertical directions) on the lower motor bearing bracket. This data is recorded in a data acquisition cabinet located in the reactor building, 102' elevation.

4.5 **Continuous Pump Vibration Spectrum Monitoring System:**

Hope Creek Station is currently installing upgraded reactor recirculation pump vibration processing and alarm equipment per Design Change Package (CP) 80077512.

CP 80077512 replaces existing Hope Creek Recirculation Pumps/Motors vibration monitoring probes, proximeters, extension cables, and electronic equipment with new probes, proximeters, extension cables and state-of-the-art Bently Nevada (BN) 3500 Monitoring System. The new system will improve the reliability, and resolve the replacement parts and service related problems. The new system will also provide additional digital outputs to enhance the diagnostics capability of the vibration monitoring system. These pump and motor vibration sensors will allow continuous monitoring and provide alarms in the Control Room for necessary operator action. The new 3500 Monitoring System will be installed in Rack C of cabinet 1BC374. Existing system equipment located in Rack B of cabinet 1BC374 will be removed.

The new system will permit the control room operators to have continuous 1X and 2X vibration peak and associated phase angle monitoring with audible alarms.

4.6 **Process:**

See Figure 1 for Flowchart.

5.0 PROCESS

5.1 General Instructions

5.1.1 The evaluation of potential shaft cracks is time critical. The Detailed Vibration Review of step 5.3.2.B, and recommendation to the control room must be completed within 4 hours.

5.1.2 If this procedure is used to support the control room response to overhead C1-E4 REACTOR RECIRC PUMP VIB HI, go directly to step 5.3.2.B, Detailed Vibration Data Review. The applicable recirculation pump will be at reduced speed in accordance with HC.OP-AB.RPV-0003(Q), Recirculation System.

5.1.3 The reactor recirculation pumps have resonance frequencies at specific operating speeds. Data collected at these speeds is erroneously high and is of no trending value. Avoid collecting data at the following pump speeds:

'A' Reactor Recirculation Pump	720-800 RPM
	1040-1090 RPM
'B' Reactor Recirculation Pump	700-760 RPM
	1150-1200 RPM
	1444-1484 RPM

5.1.4 Continuous monitoring of the pump and motor overall vibration levels are indicated and alarmed in the control room. The operators have an approved procedure in place (HC.OP-AR.ZZ-0008(Q), Overhead Annunciator Window Box C1) with the necessary guidance in the event of elevated vibration levels. The purpose of the data collected in this procedure is to provide guidance to engineering to evaluate the vibration data. The vibration analysis includes the evaluation of vibration peaks and phase angle shifts.

5.1.5 The following information is provided to assist engineering in evaluating the reactor recirculation pump and motor vibration data. The engineer performing the evaluation remains responsible to review the overall operating condition of the pump, and if necessary collect data outside this procedure, to determine the condition of the component.

5.1.6 Notify the Engineering Programs Manager within one hour of receiving a valid reactor recirculation pump alarm.

5.1.7 Reactor recirculation pump and motor conditions can change from cycle to cycle based on maintenance performed during outage periods; therefore, all vibration baseline levels will be re-evaluated after each plant startup and the baseline levels and acceptance bands revised accordingly.

5.1.8 If a single X or Y proximity probe on the B reactor recirculation pump is out of service, restore probe to service within 14 days. If both X and Y proximity probes are out of service on the B reactor recirculation pump, restore a probe to service within 72 hours. Notify the NRC Senior Resident Inspector if proximity probe(s) are out of service. If equipment cannot be restored to service within required time frame, notify Control Room to secure the applicable reactor recirculation pump. Ensure SAP notification is written to document the condition.

5.1.9 If a single X or Y proximity probe on the A reactor recirculation pump is out of service, restore probe to service within 30 days. If both X and Y proximity probes are out of service on the A reactor recirculation pump, restore a probe to service within 7 days. Notify the NRC Senior Resident Inspector if proximity probe(s) are out of service. If equipment cannot be restored to service within required time frame, contact Component Engineering to evaluate the condition. Ensure SAP notification is written to document the condition.

5.2 Startup Vibration Monitoring

5.2.1 Data Collection

- Prior to reactor recirculation pump start; ensure the 1X and 2X amplitude and phase angle setpoints have been raised to maximum per Section 5.5.
- Review the maintenance performed on the reactor recirculation pump since the previous pump start, and record on Attachment 1.
- Obtain a copy of Attachment 1 of this procedure from the previous start of the reactor coolant pump.
- Vibration data is collected from the Turbine Supervisory Instrument Cabinet (H1AC –10-C-366) located in the Auxiliary Panel Room #3449 on 124' elevation in the Auxiliary Building, or from the Bently Nevada System 1 computer system.
- After pump start and during its ascension to 100% pump speed, record the data specified in Attachment 1 at each of the specified pump speed intervals.
- Review the data as it is available for each pump speed interval. Do not wait until the pump has reached 100% pump speed.
- Complete data evaluation as outlined in section 5.2.2.
- Notify the control room with the results of this data collection when the pump reaches full pump speed.

5.2.2 Engineering Evaluation Criteria

Complete the initial review of the vibration data collected in Attachment 1.

A. During the first performance of this procedure, no historical vibration data is available to establish acceptance criteria.

B. During the first performance of this procedure data is collected to establish baseline data and acceptance criteria.

5.2.3 **Data Documentation**

A. Forward a copy of the completed Attachment 1 to Component Engineering.

B. Submit the completed copy of the procedure with the associated work order for permanent records retention.

5.3 Periodic Pump Vibration Monitoring

5.3.1 Data Collection

- For consistency, data is to be collected with the reactor recirculation pumps at a steady speed during the time of data collection, and record on Attachment 2.
- The setpoints provided in Attachment 4 were established using 100% pump speed conditions. If the station is operating at <95% pump speed for greater than one day establish new acceptance criteria using section 5.5.
- Vibration data is collected from the Turbine Supervisory Instrument Cabinet (H1AC –10-C-366) located in the Auxiliary Panel Room #3449 on 124' elevation in the Auxiliary Building, or from the Bently Nevada System 1 computer system.
- Review the Reactor Recirculation Pump vibration trends in System 1 or the results of previous performances of this procedure for the most recent vibration data trends.
- Complete data evaluation as outlined in section 5.3.2.
- Notify the control room with the results of this data collection.

5.3.2 Engineering Evaluation Criteria

A. Initial Vibration Data Review - Complete the initial review of the vibration data collected in Attachment 2.

1. Review the data collected in Attachment 2 against the associated criteria specified in Attachment 4.
2. If any of the following abnormal vibration indications are met perform a Detailed Vibration Data Review, step 5.3.2.B:
   a. Any parameter is found outside of its acceptance criteria.
   b. Operations receives overhead alarm C1-E4 "REACTOR RECIRC PUMP VIB HI", and elevated vibrations are noted on analog points A2601 or A2603. In the event an overhead alarm is received, Operations will have taken action to reduce pump speed per HC.OP-AB.RPV-0003(Q), Recirculation System, or removed the pump from service per HC.OP-SO.BB-0002(Q), Reactor Recirculation System Operation.
3. Obtain a peer review of the initial vibration data review.

5.3.2.A **Engineering Evaluation Criteria (Continued)**

4. Initiate a Notification in SAP if an abnormal vibration indication identified in step 5.3.2.A.2.

B. Detailed Vibration Data Review - Complete the detailed vibration evaluation of the vibration data.

> **NOTE**
> The evaluation of potential shaft cracks is **TIME CRITICAL**, and the detailed evaluation and recommendation to the Control Room must be completed **WITHIN FOUR (4) HOURS**.

1. False Indication Determination - Determine if the indication identified in step 5.3.2.A.2 is a false indication. If it is a false indication annotate Attachment 2 accordingly, and complete the data documentation section. A false indication could be determined by:
   a. There is no indication of a trend in the vibration data plot which is in Alarm.
   b. The data indicates there is an instrument problem.
   c. The pump was in a start or stop transient after which the vibration levels returned to normal.
   d. The other pump was in a start or stop transient after which the vibration levels returned to normal.
   e. The vibration data was collected with the pump in a critical frequency band.
2. Acceptance Band - Determine if pump parameters are within the acceptance band established from startup baseline data, utilizing section 5.5 and recorded values in Attachment 4 at reduced pump speed.

   IF within the acceptance band, **THEN** go to step 5.3.2.B.3.

   IF outside the acceptance band, notify the Control Room Supervisor to secure the applicable reactor recirculation pump in accordance with HC.OP-SO.BB-0002(Q).
3. Shaft Crack Determination – A shaft crack is indicated by any one of the following five scenarios.

USE WITH FIGURE 1

   a. **IF ANY** of the following five scenarios are true **IMMEDIATELY** perform step 5.3.2.B.3.c.
   b. **IF NONE** of the following five scenarios are true go to step 5.3.2.C.

5.3.2 **Engineering Evaluation Criteria (Continued)**

Scenario 1

Overall Vibration was in Alarm **AND**

EITHER:

2X Amplitude was in Alarm

OR

1X or 2X Phase Angle was in Alarm

Scenario 2

2X Amplitude was in Alarm

AND

1X or 2X Phase Angle was in Alarm.

Scenario 3

2X Amplitude was in Alarm **AND**

EITHER:

1X or 2X Phase Angle has trended outside the 25% baseline range in Attachment 4.

OR

Overall Vibration level has trended above the 25% baseline limit in Attachment 4.

Scenario 4

1X or 2X Phase Angle was in Alarm **AND**

EITHER:

2X Amplitude has trended above the 25% baseline limit in Attachment 4.

OR

Overall Vibration level has trended above the 25% baseline limit in Attachment 4.

Scenario 5

Overall Vibration level was in Alarm **AND**

EITHER:

1X or 2X Phase Angle has trended outside the 25% baseline range in Attachment 4.

OR

2X Amplitude level has trended above the 25% baseline limit in Attachment 4.

5.3.2.B.3 **Engineering Evaluation Criteria (Continued)**

c. **NOTIFY** the Control Room Supervisor to secure the applicable reactor recirculation pump in accordance with HC.OP-SO.BB-0002(Q) **AND** then go to step 5.3.3.

C. Enhanced Vibration Monitoring -

1. Install an oscilloscope to continuously monitor orbital information, and evaluate the orbital information once per 12-hour shift.
2. Review the 1X orbital plots for any indication of shaft cracking. Shaft cracks are indicated by a figure eight pattern to the orbital plot. **IF** a figure eight pattern is detected, notify the Control Room Supervisor to secure the applicable reactor recirculation pump in accordance with HC.OP-SO.BB-0002(Q) **THEN** go to step 5.3.3.
3. Increase the periodic vibration data collection and evaluation to once per 12 hour shift.
4. Initiate a Reactor Recirculation pump vibration log utilizing Form-1 of this procedure.
5. Evaluate for other possible causes of the abnormal vibration indication:
   a. Review plant conditions for any contribution to the change. (i.e. plant temperature or pressure changes, pump speed changes etc.)
   b. Review filtered and unfiltered orbitals and compare to the most recent baseline.
   c. Review history trend of each vibration peak.
   d. If possible verify the proximity probe gap voltage.
   e. Compare data to similar data from similar pumps.
   f. If available, check the loose parts system for any events.

5.3.3 **Data Documentation**

A. Forward a copy of the completed Attachment 2 to Component Engineering.

B. Submit the completed copy of the procedure with the associated work order for permanent records retention.

5.4 **Periodic Motor Vibration Monitoring**

5.4.1 **Data Collection**

A. Download the vibration data in the Data Acquisition System data onto a CD or similar storage media.

B. Record the motor accelerometer data specified on Attachment 3

C. Record the motor velocity meter data specified on Attachment 3 from the Turbine Supervisory Instrument Cabinet (H1AC –10-C-366) located in the Auxiliary Panel Room #3449 on 124' elevation in the Auxiliary Building, or from the Bently Nevada System 1 computer system.

D. Complete data evaluation as outlined in section 5.4.2.

5.4.2 **Engineering Evaluation Criteria**

A. Initial Vibration Data Review - Complete the initial review of the vibration data collected in Attachment 3.

1. Review data to ensure that all data is within the associated criteria specified in Attachment 5.
2. Review data against the data in the spreadsheet located at entdata08(M):Shared/HC Reactor Recirc Vibrations/Motors to determine if there are any unexpected trends. An unexpected trend is three successive data points progressing either higher or lower.
3. Do not begin the detailed vibration evaluation steps until the initial vibration data review is complete and reviewed.
4. If any of the following abnormal vibration indications are met, a detailed vibration evaluation is required:
   a. Any parameter is found outside of its acceptance criteria.
   b. Any unexpected trend is identified. An unexpected trend is three successive data points progressing either higher or lower with no readily known reason.
   c. Operations receives overhead alarm C1-E4 "REACTOR RECIRC PUMP VIB HI", and elevated vibrations are noted on analog points A2602 or A2604.
   d. The judgment of the reviewing or approving engineer indicates that a detailed vibration evaluation is warranted.
5. Obtain a peer review of the initial vibration data review.
6. Initiate a notification to report the indication identified in step 5.4.2.A.4.
7. If a detailed vibration evaluation is required, complete section 5.4.2.B to determine the cause of the indication identified in step 5.4.2.A.4.

5.4.2 **Engineering Evaluation Criteria (Continued)**

B. Detailed Vibration Data Review - Complete the detailed evaluation of the vibration data.

1. Review the full vibration spectrum and the history of each vibration peak.
   a. Elevated vibration peaks at 0.4-0.48X is an indication of oil whirl in the motor bearing.
   b. Elevated vibration peaks 1/2X, 1/3X, or 1/4X is an indication of a rotor rub.
   c. Elevated 1X vibration peaks indicate an imbalance in the motor.
   d. Elevated 2X vibration peaks indicate misalignment in the motor.
2. Review motor bearing temperature trends. Motor bearings will continue to operate satisfactorily provided bearing temperatures remain stable.

Parameter	'A'	'B'
Thrust bearing upper face	A2991	A3001
Thrust bearing lower face	A2992	A3002
Upper guide bearing	A2993	A3003
Lower guide bearing	A2994	A3004

3. Review motor stator temperature trends.

Parameter	'A'	'B'
Motor winding A	A2995	A3005
Motor winding B	A2996	A3006
Motor winding C	A2997	A3007

4. Each of the possible motor vibration concerns are motor reliability concerns, and continued motor operation is satisfactory provided the overall vibration levels remain below the 13 mils Danger Level.

C. Data Reporting

1. Update the Reactor Recirculation motor vibration spreadsheet located at entdata08(M):/Shared/HC Reactor Recirc Vibrations/Motors with the data collected.
2. Forward a copy of the completed Attachment 3 to Component Engineering.
3. Submit the completed copy of the procedure with the associated workorder for permanent records retention.

5.5 **Establishing Acceptance Criteria**

5.5.1 Prior to the start of a reactor recirculation pump, the pump 1X and 2X amplitude and phase angle alarm setpoints should be raised to their maximum value. The setpoints should be re-established after reaching steady state full power operation."

5.5.2 Acceptance criteria is established using historical data. The following historical data is acceptable to use for calculating acceptance criteria.

A. The data has been reviewed and is representative of a steady-state condition.

B. The data does not contain a large phase angle or amplitude change related to previous maintenance activities.

C. The preferred amount of historical data is 20 days. If 20 days of historical data is not available the setpoint can be established with 12 hours of continuous data. When less than 20 days of data is used, the setpoint should be re-evaluated after 20 days.

5.5.3 Review the historical data and select the maximum and minimum values. When evaluating phase angles, **IF** the data scatter is on both sides of 360° **THEN** ensure 360° is added to low phase angles (i.e. 005°, 014°) to ensure proper comparison with the large phase angles (345°, 357°).

5.5.4 Determine the upper and the lower acceptance criteria using the following formula:

$$Acceptable\ Band = \left(\frac{\max + \min}{2}\right) \pm 1.5 * (\max - \min)$$

A. Phase angle minimum limits should be rounded down to the nearest 15°, and Phase angle maximum limits should be rounded up to the nearest 15°.

B. Amplitude minimum limits should be rounded down to the nearest 0.1 mil, and Amplitude maximum limits should be rounded up to the nearest 0.1 mil.

5.5.5 Determine the upper and the lower 25% Baseline limits using the following formulae:

$$Upper\ 25\%\ Baseline\ Limit = Upper\ Accept\ Criteria - \left(\frac{Upper\ Criteria - Lower\ Criteria}{4}\right)$$

$$Lower\ 25\%\ Baseline\ Limit = Lower\ Accept\ Criteria + \left(\frac{Upper\ Criteria - Lower\ Criteria}{4}\right)$$

A. Phase angle 25% Baseline limits should be rounded to the nearest whole degree.

B. Amplitude 25% Baseline limits should be rounded to the nearest hundredth of a mil.

5.5.6 Obtain a peer review of the new acceptance criteria and 25% Baseline limits.

5.5.7 Initiate a notification in SAP to have this procedure revised, and the new setpoints installed within four (4) days.

6.0 RECORDS

6.1 Any documentation developed will be retained IAW NC.NA-AP.ZZ-0011(Q), Record Management Program.

6.2 Data generated from this monitoring program will be trended on EXCEL spreadsheet located in entdata08:Shared/HC Reactor Recirc Vibrations/Pumps and Motors.

7.0 DEFINITIONS

None

8.0 REFERENCES

8.1 Engineering Evaluation H-1-BB-MEE-1878, Hope Creek 'B' Reactor Recirculation Pump Vibration Analysis

8.2 NUCR 70043649

8.3 P&ID M-43-1

8.4 GE SIL 459

8.5 GE SIL 459S1

8.6 GE SIL 459S2

8.7 BP 980129115

8.8 ICD cards for instruments:

H1BB–1BBVSH7910A(B)1, H1BB–1BBVSH7910A(B)4

8.9 **Cross References**

8.9.1 HC.OP-AB.RPV-0003(Q), Recirculation System

8.9.2 HC.OP-SO.BB-0002(Q), Reactor Recirculation System Operation

8.9.3 HC.OP-AR.ZZ-0008(Q), Overhead Annunciator Window Box C1

ATTACHMENT 1
STARTUP REACTOR RECIRCULATION PUMP
VIBRATION MONITORING TABLE

Reactor Recirculation Pump Maintenance since last time in service.

'A' Reactor Recirculation Pump
20% Pump Speed Vibration Data
Pump Speed _____

Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X Amplitude	mils	X		
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

'B' Reactor Recirculation Pump
20% Pump Speed Vibration Data
Pump Speed _____

Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X Peak	mils	X		
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

ATTACHMENT 1
STARTUP REACTOR RECIRCULATION PUMP
VIBRATION MONITORING TABLE

'A' Reactor Recirculation Pump 40% Pump Speed Vibration Data Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

'B' Reactor Recirculation Pump 40% Pump Speed Vibration Data Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

ATTACHMENT 1
STARTUP REACTOR RECIRCULATION PUMP
VIBRATION MONITORING TABLE

'A' Reactor Recirculation Pump 60% Pump Speed Vibration Data Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

'B' Reactor Recirculation Pump 60% Pump Speed Vibration Data Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

ATTACHMENT 1
STARTUP REACTOR RECIRCULATION PUMP
VIBRATION MONITORING TABLE

'A' Reactor Recirculation Pump 80% Pump Speed Vibration Data Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

'B' Reactor Recirculation Pump 80% Pump Speed Vibration Data Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

ATTACHMENT 1
STARTUP REACTOR RECIRCULATION PUMP
VIBRATION MONITORING TABLE

'A' Reactor Recirculation Pump 90% Pump Speed Vibration Data Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

'B' Reactor Recirculation Pump 90% Pump Speed Vibration Data Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

ATTACHMENT 1
STARTUP REACTOR RECIRCULATION PUMP
VIBRATION MONITORING TABLE

'A' Reactor Recirculation Pump Full Power Pump Speed Vibration Data Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

'B' Reactor Recirculation Pump Full Power Pump Speed Vibration Data Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

Data Collected By: _____ Date _____

Data Reviewed By: _____ Date _____

ATTACHMENT 2
PERIODIC REACTOR RECIRCULATION PUMP VIBRATION MONITORING TABLE

'A' Reactor Recirculation Pump Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

'B' Reactor Recirculation Pump Pump Speed _____				
Frequency	Amplitude	Direction	Phase Angle	Comments
1/2X	mils	X		
Peak	mils	Y		
1X	mils	X		
Peak	mils	Y		
2X	mils	X		
Peak	mils	Y		
5X	mils	X		
Peak	mils	Y		

Data Collected By: _____ Date _____

Data Reviewed By: _____ Date _____

ATTACHMENT 3
PERIODIC REACTOR RECIRCULATION MOTOR VIBRATION MONITORING TABLE

Date: _____

'A' Reactor Recirculation Motor Vibration Data			
Frequency	**Amplitude Criteria**	**Direction**	**Comments**
1X Peak	mils	Velocity Meter	To be developed after RF12
	mils	Upper Horizontal	Restart
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	
2X Peak	mils	Velocity Meter	
	mils	Upper Horizontal	
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	
3X Peak	mils	Velocity Meter	
	mils	Upper Horizontal	
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	

Note: 'A" Reactor Recirculation Motor does not have accelerators installed at this time.

ATTACHMENT 3
PERIODIC REACTOR RECIRCULATION MOTOR VIBRATION MONITORING TABLE

'B' Reactor Recirculation Motor Vibration Data			
Frequency	**Amplitude Criteria**	**Direction**	**Comments**
1X Peak	mils	Velocity Meter	
	mils	Upper Horizontal	
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	
2X Peak	mils	Velocity Meter	
	mils	Upper Horizontal	
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	
3X Peak	mils	Velocity Meter	
	mils	Upper Horizontal	
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	

Data Collected By: _____ Date _____

Reviewed By: _____ Date _____

ATTACHMENT 4
PUMP ACCEPTANCE CRITERIA/SETPOINTS
Page 1 of 7

Vibration Level	Parameter	Channel/Point#
7 mils	Reactor Recirculation motor vibration alarm.	VSH7910A4 VSH7910B4 A2602 A2604 D5351 D5352
13 mils	Reactor Recirculation motor danger limit.	VSH7910A4 VSH7910B4 A2602 A2604
11 mils	Reactor Recirculation pump vibration alarm.	VSH7910A1 VSH7910B1 A2601 A2603 D5351 D5352
16 mils	Reactor Recirculation pump danger limit.	VSH7910A1 VSH7910B1 A2601 A2603
25 mils	Reactor Recirculation pump vendor limit	TechNote 9309-08-022

'A' Reactor Recirculation Pump 20% Pump Speed Vibration Criteria				
Frequency	Amplitude Criteria	Direction	Phase Angle Criteria	Comments
1/2X Peak	mils	X		To be developed after RF12 restart
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

'B' Reactor Recirculation Pump 20% Pump Speed Vibration Criteria				
Frequency	Amplitude Criteria	Direction	Phase Angle Criteria	Comments
1/2X Peak	mils	X		To be developed after RF12 restart
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

ATTACHMENT 4
PUMP ACCEPTANCE CRITERIA/SETPOINTS

'A' Reactor Recirculation Pump 40% Pump Speed Vibration Criteria				
Frequency	**Amplitude Criteria**	**Direction**	**Phase Angle Criteria**	**Comments**
1/2X Peak	mils	X		To be developed after RF12 restart
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

'B' Reactor Recirculation Pump 40% Pump Speed Vibration Criteria				
Frequency	**Amplitude Criteria**	**Direction**	**Phase Angle Criteria**	**Comments**
1/2X Peak	mils	X		To be developed after RF12 restart
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

ATTACHMENT 4
PUMP ACCEPTANCE CRITERIA/SETPOINTS

'A' Reactor Recirculation Pump 60% Pump Speed Vibration Criteria				
Frequency	**Amplitude Criteria**	**Direction**	**Phase Angle Criteria**	**Comments**
1/2X Peak	mils	X		To be developed after RF12 restart
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

'B' Reactor Recirculation Pump 60% Pump Speed Vibration Criteria				
Frequency	**Amplitude Criteria**	**Direction**	**Phase Angle Criteria**	**Comments**
1/2X Peak	mils	X		To be developed after RF12 restart
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

ATTACHMENT 4
PUMP ACCEPTANCE CRITERIA/SETPOINTS
Page 4 of 7

'A' Reactor Recirculation Pump 80% Pump Speed Vibration Criteria				
Frequency	**Amplitude Criteria**	**Direction**	**Phase Angle Criteria**	**Comments**
1/2X Peak	mils	X		To be developed after RF12 restart
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

'B' Reactor Recirculation Pump 80% Pump Speed Vibration Criteria				
Frequency	**Amplitude Criteria**	**Direction**	**Phase Angle Criteria**	**Comments**
1/2X Peak	mils	X		To be developed after RF12 restart
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

ATTACHMENT 4
PUMP ACCEPTANCE CRITERIA/SETPOINTS

'A' Reactor Recirculation Pump 90% Pump Speed Vibration Criteria				
Frequency	**Amplitude Criteria**	**Direction**	**Phase Angle Criteria**	**Comments**
1/2X Peak	mils	X		To be developed after RF12 restart
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

'B' Reactor Recirculation Pump 90% Pump Speed Vibration Criteria				
Frequency	**Amplitude Criteria**	**Direction**	**Phase Angle Criteria**	**Comments**
1/2X Peak	mils	X		To be developed after RF12 restart
	mils	Y		
1X Peak	mils	X		
	mils	Y		
2X Peak	mils	X		
	mils	Y		
5X Peak	mils	X		
	mils	Y		

ATTACHMENT 4
PUMP ACCEPTANCE CRITERIA/SETPOINTS
Page 6 of 7

'A' Reactor Recirculation Pump						
Frequency	Direction	Amplitude Criteria (mils)	Amplitude 25% Baseline (mils)	Phase Angle Criteria (degrees)	Phase Angle 25% Baseline (degrees)	Comments
1/2X Peak	X					To be developed after RF12 restart
	Y					
1X Peak	X	2.8-3.5	3.32	120-150	128-142	Setpoints are based on Cycle 12 data and may change based on Cycle 13 baseline data.
	Y	0.8-3.9	3.12	195-225	202-218	
2X Peak	X	0.0-0.3	0.22	285-225	000-150	
	Y	0.0-0.3	0.22	225-135	292-068	
5X Peak	X	0.1-1.7	1.30	180-240	195-225	
	Y	0.8-2.4	2.00	300-345	311-334	
Overall	X	3.8-6.1	5.55	none	none	
	Y	1.0-9.0	7.00	none	none	

ATTACHMENT 4
PUMP ACCEPTANCE CRITERIA/SETPOINTS
Page 7 of 7

'B' Reactor Recirculation Pump						
Frequency	Direction	Amplitude Criteria (mils)	Amplitude 25% Baseline (mils)	Phase Angle Criteria (degrees)	Phase Angle 25% Baseline (degrees)	Comments
1/2X Peak	X					To be developed after RF12 restart
	Y					
1X Peak	X	7.0-8.2	7.90	285-300	289-296	Setpoints are based on Cycle 12 data and may change based on Cycle 13 baseline data.
	Y	7.0-8.2	7.90	000-030	008-022	
2X Peak	X	0.5-1.1	0.95	255-285	262-278	
	Y	0.2-0.5	0.42	060-150	082-128	
5X Peak	X	0.4-1.0	0.85	225-285	240-270	
	Y	1.1-1.6	1.48	315-015	330-360	
Overall	X	8.3-11.0	10.32	none	none	
	Y	9.0-11.0	11.00	none	None	

ATTACHMENT 5
MOTOR ACCEPTANCE CRITERIA/SETPOINTS
Page 1 of 2

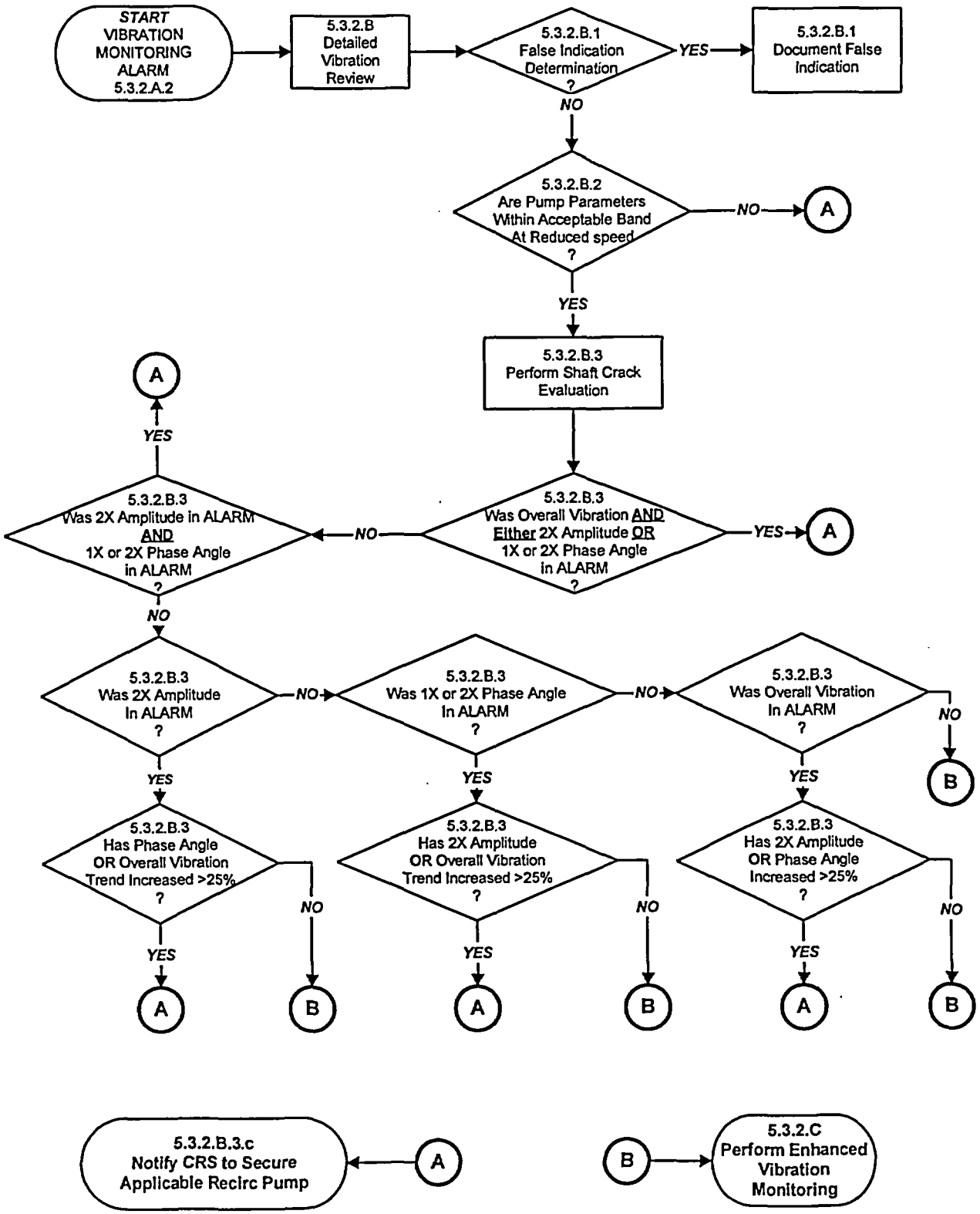
'A' Reactor Recirculation Motor Vibration Criteria			
Frequency	**Amplitude Criteria**	**Direction**	**Comments**
1X Peak	mils	Velocity Meter	**To be developed after RF12**
	mils	Upper Horizontal	**Restart**
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	
2X Peak	mils	Velocity Meter	
	mils	Upper Horizontal	
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	
3X Peak	mils	Velocity Meter	
	mils	Upper Horizontal	
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	

Note: 'A" Reactor Recirculation Motor does not have accelerators installed at this time.

ATTACHMENT 5
MOTOR ACCEPTANCE CRITERIA/SETPOINTS
Page 2 of 2

'B' Reactor Recirculation Motor Vibration Criteria			
Frequency	**Amplitude Criteria**	**Direction**	**Comments**
1X Peak	mils	Velocity Meter	To be developed after RF12 restart
	mils	Upper Horizontal	
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	
2X Peak	mils	Velocity Meter	
	mils	Upper Horizontal	
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	
3X Peak	mils	Velocity Meter	
	mils	Upper Horizontal	
	mils	Upper Vertical	
	mils	Upper Axial	
	mils	Lower Horizontal	
	mils	Lower Vertical	

FIGURE 1
PROCESS FLOWCHART



FORM-1
REACTOR RECIRCULATION PUMP VIBRATION MONITORING LOG

Administrative Notes:

1. *Complete a minimum of one log page per 12-hour shift.*
2. *Maintain the log pages in a binder in a known location.*
3. *Continue the log until the pump is secured or until the indication is determined to not be a shaft cracking concern.*

Date: _____ Shift: _____

Current Condition of _____ Reactor Recirculation pump:

Current Vibration levels:

Next Administrative action level:

Current projected date to reach vibration levels 11 mils and 16 mils:

Information provided to operations during shift:

Any new observations associated with the reactor recirculation pump:

Completed By: _____

Effective Date _____

APPROVED: _____ _____
Manager - Hope Creek Operations Date

CATEGORY II

RECIRCULATION SYSTEM

ALARMS

• REACTOR RECIRC A TROUBLE	**C1-D4**
• REACTOR RECIRC B TROUBLE	**C1-D5**
• REACTOR RECIRC PUMPS TRIP	**C1-D3**
• REACTOR RECIRC PUMP VIB HI	**C1-E4**
• OPRM TRIP ENABLE	**C3-F1**
• OPRM ALARM	**C3-F2**
• OPRM TRIP	**C5-B1**

INDICATIONS

- Unexplained Change in:
  - Recirculation Pump Flow.
  - Rx Water Level.
  - Rx Power.
  - Rx Recirc Pump Seal Performance.
- Trip of EITHER Recirc Pump as indicated by:
  - Recirc Pump RPT Breaker OPEN.
  - Recirc Drive Motor Breaker OPEN.
  - Recirc MG Field Breaker OPEN.
- The indicated Recirculation loop flow differs by more than 10% from the established pump speed-loop flow characteristics.
- The indicated total core flow differs by more than 10% from the established total core flow value derived from Recirculation loop flow measurements.
- The indicated diffuser-to-lower plenum differential pressure of any individual jet pump differs from the established patterns by more than 20%.
- Fluctuating Recirculation Pump Speeds.
- Recirculation Pump Vibration Levels Rising

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IMMEDIATE OPERATOR ACTIONS

CONDITION	ACTION
No Recirc. Pumps running AND Reactor is Critical **[CD354F]** Date/Time: _____	❑ **LOCK** the Mode Switch in SHUTDOWN.

AUTOMATIC ACTIONS

NONE

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LIST OF CONDITIONS

CAUTIONS:

1. **With the operable loop drive flow near 23 Kgpm (≈48% Pump Speed), the flow through the idle loop is close to zero and will swap back and forth between forward and reverse flow. Operation in this region can cause excessive Jet Pump vibration and the potential for consequent stress fatigue of the riser brace welds to the vessel. Operation near this value should be minimized.**

NOTES:

1. Core Flow > 40% during single loop operation prevents excessive cool down of the idle loop.

ADDITIONAL INFORMATION:

Procedures:

- HC.OP-IO.ZZ-0006(Q), Power Changes During Operation.
- HC.OP-DL.ZZ-0026(Q), Surveillance Log.
- HC.SE-PR.ZZ-0003(Q), Thermal Cycle Monitoring.
- HC.RE-IO.ZZ-0001(Q), Core Operations Guidelines
- HC.OP-ST.BB-0001(Q), Recirculation Jet Pump Operability – Daily.
- HC.OP-ST.BB-0007(Q), Recirculation Jet Pump Operability Single Loop – Daily.
- HC.OP-IO.ZZ-0004(Q), Shutdown From Rated Power To Cold Shutdown.

Valves:

- 1-HV-F031A(B), Recirculation Pump Discharge Valve.

SUBSEQUENT OPERATOR ACTIONS

CONDITION	ACTION
A. Single Reactor Recirc Pump Tripped. **[T/S 3.4.1.1]** **[T/S 4.4.1.2]** Date/Time: _____	☐ A.1 **INSERT** Control Rods to clear APRM Upscale Alarms. ☐ A.2 **ENSURE** that the Recirc MG Drive Motor Breaker has TRIPPED for the tripped Pump. ☐ A.3 **CLOSE** HV-F031A(B) for approximately 5 minutes, THEN **RE-OPEN** HV-F031A(B). **[CD-976B]** A.4 **IMPLEMENT** the following: ☐ • DL.ZZ-0026 Att. 3n (as required). ☐ • DL.ZZ-0026 Att. 3v ☐ A.5 **DIRECT** the Reactor Engineer to develop a Rod Sequence to achieve an 80% Rod Line. ☐ A.6 **IMPLEMENT** IO-6 Requirements for Single Loop operations. ☐ ☆ CAUTION 1 ☆ ☐ **NOTE 1** ☐ A.7 IF core flow cannot be raised to > 40%, THEN **DIRECT** System Engineering to evaluate Single Loop operation IAW SE-PR.ZZ-0003. **[950919568]**
B. Reactor is Sub-Critical AND No Recirc. Pumps running **[CD354F]** Date/Time: _____	☐ B.1 **INSERT** all Control Rods to 00 IAW the Shutdown Sequence. (RE.ZZ-0001) (IO.ZZ-0004)
C. Suspected Jet Pump Failure. Date/Time: _____	C.1 **COMPLETE** (one) of the following: ☐ • ST.BB-0001. ☐ • ST.BB-0007.
D. ANY Jet Pump INOPERABLE AND in Operational Condition 1 or 2. **[T/S 3.4.1.2]** Date/Time: _____	☐ D.1 **COMMENCE** a unit Shutdown IAW IO.ZZ-0004.

CAUTIONS:

2. **Recirculation MG Set/Pump Oscillations have been identified during the Power Ascension program. These oscillations are a result of inherent instabilities in the Recirc Speed Control System and cannot be tuned out. Operations at these speeds may result in speed oscillations of 4 - 10%. Operation at these speeds should be minimized and may not warrant actions IAW with this procedure.**
3. **Reactor Coolant System pressure and temperature limits of Tech Spec. 3.4.6.1 should be observed.**
4. **Step H.1 supplements the level and thermal stratification direction of HC.OP-AB.ZZ-0000 (Q) REACTOR SCRAM.**

ADDITIONAL INFORMATION:

Procedures:

- HC.OP-SO.BB-0002(Q), Reactor Recirculation System Operation.

Computer Points:

- D2924 RECIRC PUMP A SEAL LKG FLOW (HIGH)
- D2926 RECIRC PUMP A SEAL STAGE FLOW (HIGH/LOW)
- D2925 RECIRC PUMP B SEAL LKG FLOW (HIGH)
- D2927 RECIRC PUMP B SEAL STAGE FLOW (HIGH/LOW)

Switches/Controllers:

- Reactor Recirculation Pump A(B) Controller

SUBSEQUENT OPERATOR ACTIONS (continued)

CONDITION	ACTION
E. Reactor Recirc Pump Seal Degradation is detected. Date/Time: _____ **[PR 970630153]**	☐ E.1 **MONITOR** seal parameters every 2 hours, to DETERMINE the severity of degradation.
F. NO.2 SEAL CAVITY PRESS (CRIDS or local) ≤300 psig OR ANY of the following CRID's points in alarm: • D2924 • D2926 • D2925 • D2927 Date/Time: _____	F.1 **NOTIFY** the following: ☐ • Director – Operations ☐ • Hope Creek Operations Manager ☐ • Hope Creek System Engineering Manager
G. Fluctuating Reactor Recirculation Pump Speed. Date/Time: _____	☐ ☆ CAUTION 2 ☆ ☐ G.1 At the discretion of the SM/CRS, **PLACE** the affected Reactor Recic Pump in MANUAL. G.2 IF Recirc Pump speed fluctuations do NOT stop, THEN At the discretion of the SM/CRS **PERFORM** the following: ☐ A. **PRESS** SCOOP TUBE TRIP A(B) Pushbutton. ☐ B. **ENSURE** SCOOP TUBE LOCKUP light comes on for the desired Motor/Generator. ☐ C. **REFER** to SO.BB-0002(Q) for continued operation with the Scoop Tube Lock Up.
H. Recirculation Flow cannot be Restored AND There is potential for vessel Thermal Stratification AND HPCI, RCIC, and Feedwater are not needed for RPV level or pressure control. Date/Time: _____	☐ ☆ CAUTION 3 ☆ ☐ ☆ CAUTION 4 ☆ ☐ H.1 SLOWLY **RAISE** RPV level to 80" to induce natural circulation. **[CD-693A]**

CAUTIONS:

1. **With the operable loop drive flow near 23 Kgpm (≈48% Pump Speed), the flow through the idle loop is close to zero and will swap back and forth between forward and reverse flow. Operation in this region can cause excessive Jet Pump vibration and the potential for consequent stress fatigue of the riser brace welds to the vessel. Operation near this value should be minimized.**

NOTES:

1. Core Flow > 40% during single loop operation prevents excessive cool down of the idle loop.
2. A Recirc Pump can be confirmed to be stopped by referencing A(B) Flow FI-R617(R613) and D/P PDI-R612A(B) indications.

ADDITIONAL INFORMATION:

Procedures:

- HC.OP-DL.ZZ-0026(Q), Surveillance Log.
- HC.OP-IO.ZZ-0006(Q), Power Changes During Operation.
- HC.SE-PR.ZZ-0003(Q), Thermal Cycle Monitoring.

Valves:

- 1-HV-F023A(B), Recirculation Pump Suction Valve.
- 1-BF-HV3800A(B), Recirc. Pump Seal Purge Valve.
- 1-BG-HV-F100, RWCU SUCT from Recirc Loop "A".
- 1-BG-HV- F106, RWCU SUCT from Recirc Loop "B".
- 1-HV-F031A(B), Recirculation Pump Discharge Valve.

SUBSEQUENT OPERATOR ACTIONS (continued)

CONDITION	ACTION
I. Multiple seal failure of a Recirculation Pump. Date/Time: _____ **[CD-813E, CD-184B, CD-219B]**	❑ I.1 **PRESS** The Pump A(B) MOTOR BRKR TRIP PB. ❑ ****NOTE 2**** ❑ I.2 WHEN the PUMP has stopped, **PRESS** the CLOSE PB on HV-F023A(B) I.3 **CLOSE** the following: ❑ • BF-HV3800A(B). ❑ • BG-HV-F100(F106). ❑ I.4 **ENSURE** HV-F023A(B) is CLOSED. ❑ I.5 **CLOSE** HV-F031A(B). ❑ I.6 **INSERT** Control Rods to clear APRM Upscale Alarms. ❑ I.7 **IMPLEMENT** the following: ❑ • DL.ZZ-0026 Att. 3n (as required). ❑ • DL.ZZ-0026 Att. 3v ❑ I.8 **DIRECT** the Reactor Engineer to develop a Rod Sequence to achieve an 80% Rod Line. ❑ I.9 **IMPLEMENT** IO-6 Requirements for Single Loop operations. ❑ ☆ **CAUTION 1** ☆ ❑ ****NOTE 1**** ❑ I.10 IF core flow cannot be raised to > 40%, THEN **DIRECT** System Engineering to evaluate Single Loop operation IAW SE-PR.ZZ-0003. **[950919568]**

NOTES:

3. The following steps are utilized to place one Reactor Recirculation Pump in service to prevent thermal stratification from occurring.
4. Normal Recirculation Set MG Lube Oil Temperature Band is 110 to 130°F, however 80-140°F is allowable for start up.

ADDITIONAL INFORMATION:

Procedures:

- HC.OP-SO.SA-0001(Q), Redundant Reactivity Control System Operation

Valves/Breakers/Controllers:

- BB-HV-F023A(B) A(B) Recirc Pump Suction Valve
- BG-HV-F100(F106) A(B) RWCU Suction Valve
- SIC-R621A(B) PUMP A(B) Speed Controller
- SIC-R620 Master Speed Controller
- 1-HV-F031A(B), Recirculation Pump Discharge Valve
- Recirc Pump Trip System A(B) Disable Keylock at 10C609(10C611)
- EOC Recirc Pump Trip AP201 Pump Motor Breakers 1AN205 AND 1CN205
- EOC Recirc Pump Trip BP201 Pump Motor Breakers 1BN205 AND 1DN205

Indications:

- REACTOR RECIRC A(B) TROUBLE C1-D4 (D5)
- D2915 (D2916) Recirc MG A(B) Drive Lube Oil Pressure
- 1BBTI-8291A(B) MG SET HYD Oil CLR A(B) Inlet Temperature

TABLE 1
RACS is in service to supply cooling water to Reactor Recirc Pump Motor Oil Coolers.
SACS is in service to supply cooling to MG Set hydraulic oil cooler.
Chilled Water System OR RACS is in service to supply cooling water to Reactor Recirc Pump Motor Winding Coolers
Motor Generator Ventilation System is in service.
CRD Hydraulic System is in service to supply seal purge water to Reactor Recirc Pumps.
Recirculation System Motor Generator A(B) Lube Oil System is in operation.

SUBSEQUENT OPERATOR ACTIONS (continued)

CONDITION	ACTION
J. BOTH Recirculation Pumps TRIPPED AND Potential exists for Thermal Stratification Date/Time: _____ **Continued on Page 15**	☐ ****NOTE 3**** ☐ J.1 **ENSURE** BOTH Reactor Recirculation Pump A AND B Motor Breakers TRIPPED. ☐ J.2 **ENSURE** systems in-service as described in Table 1. ☐ J.3 **VERIFY** BB-HV-F023A(B) AND BG-HV-F100(F106) are OPEN. ☐ J.4 **VERIFY** that PUMP A(B) LOCKOUT BUS POWER AVAILABLE light is illuminated. ☐ J.5 **VERIFY** Reactor Recirc A(B) Trouble Alarm CLEAR. J.6 **ENSURE** the following controllers are in MANUAL AND at their MINIMUM setpoints: ☐ • SIC-R621A(B) PUMP A SPD CONT ☐ • SIC-R620 MASTER SPD CONT J.7 **ENSURE** the following: ☐ A. D2915 (D2916) not in alarm. ☐ ****NOTE 4**** ☐ B. MG Set Lube Oil Temperature 80-140°F. ☐ C. High Vibration Trip RESET. ☐ D. Scoop Tube Lock Up RESET. ☐ J.8 IF required, THEN **RESET** RRCS. (SA) J.9 **ENSURE** the following switches are in BYP: ☐ • RECIRC PUMP TRIP SYSTEM A DISABLE ☐ • RECIRC PUMP TRIP SYSTEM B DISABLE ☐ J.10 **ENSURE** EOC RPT Breakers are CLOSED. **Continued on Page 15**

NOTES:

5. The next step will start the respective Motor Generator Set and Recirculation Pump. The following should be observed to occur after starting:
   A. Recirc Pump A(B) drive motor ammeter will increase to approximately 3000 amps AND THEN decrease to approximately 200 amps.
   B. Approximately 6 seconds after the MG set is started, the generator field breaker will close.
   C. The Recirc Pump speed will increase to approximately 50% of rated generator speed.
   D. The Recirc Pump speed will decrease AND settle at approximately 20% of rated speed.

ADDITIONAL INFORMATION:

Procedures:

- HC.OP-SO.BB-0002(Q), Reactor Recirculation System Operation

Valves/Breakers/Controllers:

- 1-HV-F031A(B), Recirculation Pump Discharge Valve

Indications:

- 1BBTI-8291A(B) MG SET HYD Oil CLR A(B) Inlet Temperature

SUBSEQUENT OPERATOR ACTIONS (continued)

CONDITION	ACTION
J. BOTH Recirculation Pumps TRIPPED AND Potential exists for Thermal Stratification Date/Time: _____ **Continued from Page 13**	**Continued from Page 13** ☐ J.11 **ENSURE** Differential Temperature requirements are met by completing Attachment 1. **[T/S 4.4.1.4]** ☐ J.12 **CLOSE** HV-F031A(B) for the pump to be started. ☐ J.13 IF Differential Temperature Requirements CANNOT be met, THEN **EXIT** this condition and restart a Recirculation Pump IAW the SOP. (BB) ☐ ****NOTE 5**** J.14 WITHIN 15 minutes of completing Attachment 1 **PERFORM** the following: **[T/S 3.4.1.4]** ☐ A. **PRESS** REACTOR RECIRCULATION PUMP A(B) MOTOR BRKR CLOSE PB. ☐ B. **VERIFY** BB-HV-F031A(B) opens according to jog sequence. (approximately 80 seconds for full travel) ☐ J.15 **MONITOR** MG Set Lube Oil Temperatures.

CAUTIONS:

5. **Recirculation flow mismatch requirements in Tech Specs should be observed when lowering flow to the affected Recirculation Pump. [T/S 3.4.1.3] When conditions permit, action should be taken to minimize Recirculation flow mismatch.**
6. **The Power to Flow Map should be monitored when changing power per HC.OP-IO.ZZ-0006(Q).**

NOTES:

6. The following guidance applies to the Radial PMP, ~~Axial~~ Radial MTR ALERT/DANGER alarm setpoints and digital points listed in Table 1 only. This guidance does not apply to Radial Position which also causes REACTOR RECIRC PUMP VIB HI C1-E4 to annunciate.

ADDITIONAL INFORMATION:

Procedures:

- HC.ER-AP.BB-0001(Z), Hope Creek Reactor Recirculation Pumps/Motors Vibration Monitoring
- HC.OP-SO.BB-0002(Q), Reactor Recirculation System Operation~~HC.OP-IO.ZZ-0006(Q), Power Changes During Operation.~~

Valves/Breakers/Controllers:

- SIC-R621A(B) PUMP A(B) Speed Controller

Indications:

- REACTOR RECIRC PUMP VIB HI C1-E4
- D5351 RECIRC PP A VIBRATION
  Radial PMP Alert Limit - 11.0 mils, Radial Danger Limit - 16 mils
  ~~Axial~~ Radial MTR Alert Limit - 7 mils, Axial Danger Limit - ~~11~~ 13 mils
- D5352 RECIRC PP B VIBRATION
  Radial PMP Alert Limit - 11.0 mils, Radial Danger Limit - 16 mils
  Radial MTR ~~Axial~~ Alert Limit - 7 mils, Axial Danger Limit - ~~11~~ 13 mils

Table 1 (note)

A Recirculation Pump Digital Vibration Points	B Recirculation Pump Digital Vibration Points
D5940 RECIRC A PMP X PR 1X AMPLITUDE	D5950 RECIRC B PMP X PR 1X AMPLITUDE
D5941 RECIRC A PMP X PR 2X AMPLITUDE	D5951 RECIRC B PMP X PR 2X AMPLITUDE
D5942 RECIRC A PMP X PR 1X PHASE	D5952 RECIRC B PMP X PR 1X PHASE
D5943 RECIRC A PMP X PR 2X PHASE	D5953 RECIRC B PMP X PR 2X PHASE
D5944 RECIRC A PMP Y PR 1X AMPLITUDE	D5954 RECIRC B PMP Y PR 1X AMPLITUDE
D5945 RECIRC A PMP Y PR 2X AMPLITUDE	D5955 RECIRC B PMP Y PR 2X AMPLITUDE
D5946 RECIRC A PMP Y PR 1X PHASE	D5956 RECIRC B PMP Y PR 1X PHASE
D5947 RECIRC A PMP Y PR 2X PHASE	D5957 RECIRC B PMP Y PR 2X PHASE
Note: **REFER** to HC.OP-AR.ZZ-0008(Q) for actual setpoints	

SUBSEQUENT OPERATOR ACTIONS (continued)

CONDITION	ACTION
K. Recirc Pump Vibration Alarm **[T/S 3/4.4.1]** Date/Time: _____	☐ ****NOTE 6**** K.1 PRIOR to reducing Recirc Pump Speed, **PERFORM** the following:~~K.1 **REDUCE** Recirc Pump Speed as required to maintain vibrations below the ALERT limit as follows:~~ ☐ A. **ENSURE** the following controllers are in MANUAL: ☐ • SIC-R621A PUMP A SPD CONT ☐ • SIC-R621B PUMP B SPD CONT ☐ B. **RECORD** affected pump speed in the ~~Control Room~~CR Logs. ☐ ☆ **CAUTION 5** ☆ ☐ ☆ **CAUTION 6** ☆ ☐ K.2 IF Digital Point(s) in Table 2 is in alarm, THEN **REDUCE** the affected Recirc Pump Speed 10% as follows: ☐ • INTERMITTENTLY **PRESS** SIC-R621A(B) PUMP A(B) SPD CONT DECREASE push button on the affected Recirculation Pump. ☐ • **INSERT** Control Rods as required by Reactor Engineering Instructions. ☐ K.3 **DIRECT** Engineering to evaluate the condition. (ER-AP.BB-0001) ~~C.~~K.4 **MAINTAIN** the affected Pump ALERT limit on D5351(D5352) clear as follows: ☐ • INTERMITTENTLY **PRESS** SIC-R621A(B) PUMP A(B) SPD CONT DECREASE push button on the affected Recirculation Pump. ☐ • **INSERT** Control Rods as required by Reactor Engineering Instructions. ☐ K.5 IF ALERT limit on D5351(D5352) cannot be maintained clear AND the affected Recirculation Pump Speed has been lowered by ≥20% (compare to value logged in Step K.1.B), THEN **REMOVE** the affected Recirc Pump from service IAW HC.OP-SO.BB-0002, Single Loop Operation.

	☐ K.6 IF the vibration DANGER Limit on D5351(D5352) comes into alarm, THEN **TRIP** the affected Recirc Pump AND **EXECUTE** Condition A of this procedure.

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1.0 COMPLETION AND REVIEW

1.1 **EXPLAIN** the entry Condition into the abnormal in the Comments Section. _____

1.2 **ANNOTATE** in the comments section all systems affected by the implementation of this procedure
AND restoration actions (i.e. restoration line ups) completed/required. _____

1.3 **ATTACH** photocopies of any Hard Cards utilized as part of this procedure implementation to Attachment 1. _____

1.4 **ENSURE** the Exit time for any applicable conditions and this abnormal are annotated in the comment section
AND the Control Room Logs. _____

1.5 **FORWARD** completed Portions of this procedure
AND Sections 1 and 2 of Attachment 1 to SM/CRS for approval and Record Retention. _____

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ATTACHMENT 1

(Page 1 of 2)

COMPLETION AND REVIEW

1.0 COMMENTS:

ATTACHMENT 1
(Page 2 of 2)
COMPLETION AND REVIEW

2.0 **SIGNATURES:**

Print Name	Initials	Signature	Date

Completion of this attachment is annotated in the Control Room Logs:

Printed Name	SIGNATURE	/ Date/Time

3.0 **SM/CRS FINAL REVIEW AND APPROVAL:**

This procedure and Attachment 1 have been reviewed for completeness and accuracy. Entry/Exit conditions and all deficiencies, including corrective actions, are clearly recorded in the COMMENTS Section above.

Printed Name	SM/CRS	Date

4.0 **RECORDS**

4.1 **RETAIN** the following in accordance with NC.NA-AP.ZZ-0011(Q), Records Management Program:

- Procedure cover page
- Affected Conditions and Hard Cards performed
- Completion and Review section
- Attachment 1

ATTACHMENT 1
REACTOR RECIRCULATION PUMP PRE-START TEMPERATURE DIFFERENTIAL CRITERIA DETERMINATION
(Page 1 of 2)

1.0 **Reactor Vessel to Bottom Head Drain Line Differential Temperature Criteria**

A. Rx Pressure Vessel Steam Space Coolant Saturation Temperature. (Rx Pressure and Steam Tables) **(Note 1)** _____

B. Bottom Head Drain Coolant Temperature. **(Note 2)** (Computer Point A2942) _____

C. ≤ 145°F between Rx Pressure Vessel Steam Space Coolant AND Bottom Head Drain Line Coolant (A – B). **[T/S 4.4.1.4]** _____ (SAT/UNSAT)

D. Time Readings taken: _____

2.0 **Reactor Vessel to Recirculation Loop Differential Temperature Criteria**

A. Temperature of the Rx Coolant within the idle loop to be started up. **(Note 3)** _____

B. Temperature of coolant in the Rx Pressure Vessel. (RX Pressure and Steam Tables) **(Note 1)** _____

C. ≤ 50°F between the Rx Coolant within the loop not in operation AND the Coolant in the Rx Pressure Vessel (A-B). **[T/S 4.4.1.4]** _____ (SAT/UNSAT)

D. Time Readings taken: _____

Note 1: Steam Table as part of this attachment may be utilized to determine temperature rounding the numbers in a conservative fashion. For a more accurate conversion from pressure to temperature a more detailed set of steam tables should be utilized.

Note 2: RWCU Flow required for accurate Bottom Head Drain Coolant Temperature indication.

Note 3: Use TR-650-B31 Recirc Pump Suction Loop A(B) (if available)
OR if above 400° F - CRIDS points A221 and A222 for A loop (A223 and A224 for B loop).
IF below 400°F AND TR-650-B31 not available,
THEN have I&C obtain temperatures using RTD ohm values (reference RTD ohm values to calibration data in TDR using HC.OP-GP.ZZ-0008(Q))

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ATTACHMENT 1
REACTOR RECIRCULATION PUMP PRE-START TEMPERATURE DIFFERENTIAL CRITERIA DETERMINATION
(Page 2 of 2)

SATURATED STEAM TABLES

TEMP °F	ABS PRESS (PSIA)
200	11.526
212	14.696
220	17.186
228	20.015
236	23.216
244	26.826
252	30.883
260	35.427
268	40.500
276	46.147
284	52.414
292	59.350
300	67.005
308	75.433
316	84.688
324	94.826
332	105.907
340	117.992
348	131.142
356	145.424
364	160.903
372	177.648
380	195.729

TEMP °F	ABS PRESS (PSIA)
388	215.220
396	236.193
404	258.725
412	282.894
420	308.780
428	336.463
436	366.03
444	397.56
452	431.14
460	466.87
468	504.83
476	545.11
484	587.81
492	633.03
500	680.86
508	731.40
516	784.76
524	841.04
532	900.34
540	962.79
548	1028.49
556	1097.55
564	1170.10

REVISION SUMMARY
Revision 7:

1. **Order 80077345 Act 330** – Modified Note 6 and Additional Information for Section K "Recirc Pump Vibration Alarm" in support of DCP 80077345. The changes include the following:
   - Radial has been changed to Radial Pump
   - Axial has been changed to Radial MTR
   - Radial MTR Danger Vibration limit has changed from 11.0 mils to 13.0 mils.

IMPLEMENTATION REQUIREMENTS

1. DCP 80077345 Installed

ATTACHMENT E4

REACTOR RECIRC PUMP VIB HI	Window Location C1-E4

OPERATOR ACTION:

1. ENSURE Reactor Recirculation Pump is NOT running at a critical speed.

1AP201		1BP201	
RPM	%SPEED	RPM	%SPEED
720-800	43-48	700-760	42-46
1040-1090	62-65	1150-1200	69-72
		1444-1484	90

2. REFER to digital alarm response ~~for Digital Point D5351 and/or D5352 of this attachment for controlling Reactor Recirculation Pump speed.~~for appropriate action.
3. VERIFY proper oil level on the respective Recirc Pump Motor, [CRIDS point D2922 and/or D2923].
4. ENSURE compliance with Technical Specifications 3.4.1.1 and 3.4.1.3.

INPUTS

Digital Point/ Indication	Nomenclature/Condition	Automatic Action
D5351	RECIRC PUMP AP201 VIBRATION	Alarm only
D5352	RECIRC PUMP B VIBRATION	Alarm only
D5940	RECIRC A PMP X PR 1X AMPLITUDE	Alarm only
D5941	RECIRC A PMP X PR 2X AMPLITUDE	Alarm only
D5942	RECIRC A PMP X PR 1X PHASE	Alarm only
D5943	RECIRC A PMP X PR 2X PHASE	Alarm only
D5944	RECIRC A PMP Y PR 1X AMPLITUDE	Alarm only
D5945	RECIRC A PMP Y PR 2X AMPLITUDE	Alarm only

Continued Next Page

ATTACHMENT E4
(Continued)

Digital Point/ Indication	Nomenclature/Condition	Automatic Action
D5946	RECIRC A PMP Y PR 1X PHASE	Alarm only
D5947	RECIRC A PMP Y PR 2X PHASE	Alarm only
D5950	RECIRC B PMP X PR 1X AMPLITUDE	Alarm only
D5951	RECIRC B PMP X PR 2X AMPLITUDE	Alarm only
D5952	RECIRC B PMP X PR 1X PHASE	Alarm only
D5953	RECIRC B PMP X PR 2X PHASE	Alarm only
D5954	RECIRC B PMP Y PR 1X AMPLITUDE	Alarm only
D5955	RECIRC B PMP Y PR 2X AMPLITUDE	Alarm only
D5956	RECIRC B PMP Y PR 1X PHASE	Alarm only
D5957	RECIRC B PMP Y PR 2X PHASE	Alarm only

REFERENCES: J-43-0, Sht. 9
M-43-1, Sht. 2
CD-191F
CD-921E

ATTACHMENT E4

DIGITAL ALARM POINT D5351

NOMENCLATURE	RECIRC PP A VIBRATION	SETPOINT	Radial PMP Alert Limit = 11.0 mils Radial PMP Danger Limit = 16.0 mils Radial MTR ~~Axial~~ Alert Limit = 7.0 mils ~~Axial~~ Radial MTR Danger Limit = ~~11~~13.0 mils Radial Position = +/- 5.5 mils
DESCRIPTION	High Vibration on Reactor Recirculation Pump AP201	ORIGIN	VE-7910A1 (Radial PMP Shaft~~PMP Shaft~~) VE-7910A4 (~~Axial~~Radial MTR)

AUTOMATIC ACTION:

Alarm only

OPERATOR ACTION:

1. **MONITOR** A Reactor Recirculation Pump radial ~~and axial~~ vibration, Analog Computer Points A2601 & A2602.
2. IF Alarm is due to Radial Position, THEN **INITIATE** a notification to report the alarm AND **DIRECT** I&C to RE-ZERO the alarm card at the smart monitor. **[70036063]**
3. IF radial ~~or axial~~ vibration ALERT or DANGER limit is reached, THEN **ENTER** HC.OP-AB.RPV-0003(Q), Recirculation System abnormal.
4. **CONTACT** Engineering to obtain AND assess vibration data IAW HC.ER-AP.BB-0001(Z).

CAUSE	CORRECTIVE ACTION
1. Damaged bearing caused by low lube oil level.	1A. **REQUEST** the CRS to initiate corrective action.
2. Reactor Recirculation Pump AP201 cavitating	2A. During Reactor startup, **ENSURE** Reactor water level, temperature, AND Recirculation Pump speed are within limits to provide pump NPSH requirements.

REFERENCES:

J-43-0, Sht. 9
M-43-1, Sht. 2
CD-191F, CD-921E
70001425 - B Reactor Recirculation Pump Vibration
70036063 - A Recirc Pump Alarm
70043561 - Review Rx Recirc Pump Vibratoion Limits

ATTACHMENT E4

DIGITAL ALARM POINT D5352

NOMENCLATURE	RECIRC PP B VIBRATION	SETPOINT	Radial PMP Alert Limit = 11.0 mils Radial PMP Danger Limit = 16.0 mils ~~Axial~~ Radial MTR Alert Limit = 7.0 mils ~~Axial~~ Radial MTR Danger Limit = ~~11~~13.0 mils Radial Position = +/- 5.5 mils
DESCRIPTION	High Vibration on Reactor Recirculation Pump BP201	ORIGIN	VE-7910B1 (Radial PMP Shaft) VE-7910B4 (Radial MTR~~Axial~~)

AUTOMATIC ACTION:

Alarm only

OPERATOR ACTION:

1. **MONITOR** B Reactor Recirculation Pump radial and ~~axial~~ vibration, Analog Computer Points A2603 & A2604.
2. IF Alarm is due to Radial Position, THEN **INITIATE** a notification to report the alarm AND **DIRECT** I&C to RE-ZERO the alarm card at the smart monitor. **[70036063]**
3. IF radial ~~or axial~~ vibration ALERT or DANGER limit is reached, THEN **ENTER** HC.OP-AB.RPV-0003(Q), Recirculation System abnormal.
4. **CONTACT** Engineering to obtain AND assess vibration data IAW HC.ER-AP.BB-0001(Z).

CAUSE	CORRECTIVE ACTION
1. Damaged bearing caused by low lube oil level.	1A. **REQUEST** the CRS to initiate corrective action.
2. Reactor Recirculation Pump BP201 cavitating.	2A. During reactor startup, **ENSURE** Reactor water level, temperature, AND Recirculation Pump speed are within limits to provide pump NPSH requirements.

REFERENCES:

J-43-0, Sht. 9
M-43-1, Sht. 2
CD-191F, CD-921E
70001425 - B Reactor Recirculation Pump Vibration
70036063 - A Recirc Pump Alarm
70043561 - Review Rx Recirc Pump Vibratoion Limits

ATTACHMENT E4

DIGITAL ALARM POINT D5940 - D5947

NOMENCLATURE See Table **SETPOINT** See Table

DESCRIPTION A Recirculation Pump Vibration Alarm(s) **ORIGIN** Multiple

AUTOMATIC ACTION:

None

Table

Digital Pt	Nomenclature	Setpoint Min/Max
D5940	RECIRC A PMP X PR 1X AMPLITUDE	2.8/3.5 mils
D5941	RECIRC A PMP X PR 2X AMPLITUDE	0.0/0.3 mils
D5942	RECIRC A PMP X PR 1X PHASE	120/150°
D5943	RECIRC A PMP X PR 2X PHASE	285/225° (See Note)
D5944	RECIRC A PMP Y PR 1X AMPLITUDE	0.8/3.9 mils
D5945	RECIRC A PMP Y PR 2X AMPLITUDE	0.0/0.3 mils
D5946	RECIRC A PMP Y PR 1X PHASE	195/225°
D5947	RECIRC A PMP Y PR 2X PHASE	225/135° (See Note)

Note: The value of the maximum limit is less than the minimum limit because the acceptable operating band passes through 360 degrees. In the case of the 2X vibration from the X probe, the 225 maximum limit is actually 360+225=585.

OPERATOR ACTION:

1. **VERIFY** alarming condition (either below min or above max) utilizing System 1 AND/OR CRIDS Page ** (TBD)

2. ONCE the alarm condition has been validated, THEN **ENTER** HC.OP-AB.RPV-0003(Q), Reactor Recirculation.

CAUSE	CORRECTIVE ACTION
1. High Vibration	1A. Same as above.

REFERENCES: M-43-1, Sht. 2

ATTACHMENT E4

DIGITAL ALARM POINT D5950 - D5957

NOMENCLATURE See Table **SETPOINT** See Table

DESCRIPTION B Recirculation Pump Vibration Alarm(s) **ORIGIN** Multiple

AUTOMATIC ACTION:

None

Table

Digital Pt	Nomenclature	Setpoint Min/Max
D5950	RECIRC B PMP X PR 1X AMPLITUDE	7.0/8.2 mils
D5951	RECIRC B PMP X PR 2X AMPLITUDE	0.5/1.1 mils
D5952	RECIRC B PMP X PR 1X PHASE	285/300°
D5953	RECIRC B PMP X PR 2X PHASE	255/285°
D5954	RECIRC B PMP Y PR 1X AMPLITUDE	7.0/8.2 mils
D5955	RECIRC B PMP Y PR 2X AMPLITUDE	0.2/0.5 mils
D5956	RECIRC B PMP Y PR 1X PHASE	000/030°
D5957	RECIRC B PMP Y PR 2X PHASE	060/150°

OPERATOR ACTION:

1. **VERIFY** alarming condition (either below min or above max) utilizing System 1 AND/OR CRIDS Page ** (TBD)

2. ONCE the alarm condition has been validated, THEN ENTER HC.OP-AB.RPV-0003(Q), Reactor Recirculation.

CAUSE	CORRECTIVE ACTION
1. High Vibration	1A. Same as above.

REFERENCES: M-43-1, Sht. 2