NORTHEAST UTILITIES
NU
THE CONNECTICUT LIGHT AND POWER COMPANY
THE HARTFORD ELECTRIC LIGHT COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

General Offices • Selden Street, Berlin, Connecticut

P.O. BOX 270
HARTFORD, CONNECTICUT 06101
(203) 666-6911

October 5, 1981

Docket No. 50-245
A01877

RECEIVED
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U.S. NUCLEAR REGULATORY COMMISSION

Director of Nuclear Reactor Regulation
Attn: Mr. Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

References: (1) D. G. Eisenhut letter to W. G. Counsil, dated November 13, 1980.
(2) W. G. Counsil letter to D. M. Crutchfield, dated January 22, 1981.
(3) D. M. Crutchfield letter to W. G. Counsil, dated July 16, 1981.
(4) D. G. Eisenhut letter to All Power Reactor Licensees and License Applicants (Generic Letter 81-11), dated February 20, 1981.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 1
NUREG-0619
BWR Feedwater Nozzle and Control Rod
Drive Return Line Nozzle Cracking

In Reference (1), Northeast Nuclear Energy Company (NNECO) was requested to comply with the requirements contained in NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking." Reference (2) was submitted in response to Reference (1) and presented the status of NNECO's compliance with NUREG-0619. After review of Reference (2), the NRC Staff requested additional information in Reference (3). Therefore, the following information is provided in response to Reference (3).

PART I - FEEDWATER NOZZLES

1. The guidance contained in Reference (4) regarding the low flow control modifications is being considered.

2. It is anticipated that PT inspection intervals as listed in Table 2 of NUREG-0619 will be modified by the NRC Staff once the effectiveness of the on-line monitoring system has been demonstrated.

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PART II - CONTROL ROD DRIVE RETURN LINE NOZZLE

1. With regard to the pressure control station, it is still unclear as to the benefit of its addition into the control rod drive (CRD) system. Its expected performance in compensating for pressure fluctuations is already being accomplished by an existing flow control valve upstream of the drive and cooling water pressure control stations. Also, the concept of driving a rod at pressures which preclude flow in the CRD system is unlikely to occur at Millstone Unit No. 1. This is based on the fact that reactor pressure would have to increase approximately 250 psig above normal operating pressure to force the CRD return check valve closed. Millstone Unit No. 1 initiates a scram signal at a pressure of 1085 psig which is 50 psig above normal operating pressure. Therefore, all rods would have been driven prior to reaching a pressure large enough to close the check valve in the CRD exhaust piping. As a result, the addition of this pressure control station is still considered unnecessary for Millstone Unit No. 1.

2. Attachment No. 1 to this letter contains a copy of Millstone Unit No. 1 station procedures O.P. 302, S.P. 631.1, S.P. 631.2, S.P. 631.4, S.P. 631.11, S.P. 1051 and I.C. 414C. These station procedures describe the operations required to place the CRD system into service and to test for proper system operation.

3. Attachment No. 2 contains the information requested in Reference (3) regarding the 18" x 3" sweep-o-let. This attachment consists of (1) a summary of the analyses performed for the CRD reroute effort; Sections II and IX of which address the analysis performed on the 18" x 3" sweep-o-let, (2) a piping diagram of the CRD and feedwater tie-in, and (3) procedures WP-1-24, CNF-7995-4, CNF-F-FFB and CNF-FF used to weld the sweep-o-let and its associated piping.

   In reference to thermal fatigue, it is expected that the foreign reactors experiencing cracking in the feedwater system junctions are those found in Sweden. Information supplied by EPRI on these branch connections indicates that their method of system tie-in is substantially different from that in service between the CRD and feedwater systems at Millstone Unit No. 1. The typical connection used at the Swedish stations consisted of a forged tee fitting with a thermal sleeve incorporated into the smaller leg on the tee. In lieu of this connection, one station used a weld-o-let fitting with a thermal sleeve. In all instances, stainless steel material corresponding to ASTM A-304 with a maximum carbon content of 0.05% was used.

At Millstone Unit No. 1, an 18" x 3" carbon steel sweep-o-let fitting joins a 3" CRD exhaust line with an 18" feedwater line. The sweep-o-let was chosen for the specific purpose of eliminating geometric discontinuities as found in the tee fitting incorporating a thermal sleeve. This would then minimize locations of stress concentration and potential sites for crack initiation.

The above information and the attachments should provide sufficient information to substantiate our conclusion that UT surveillance of this welded connection is not necessary.

We trust that the above information adequately addresses the NRC Staff concerns identified in Reference (3).

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil

W. G. Counsil
Senior Vice President

Docket No. 50-245

Attachment No. 1

Millstone Unit No. 1

September, 1981

APPROVAL: E. J. Mroczka
Station Superintendent

DATE: 6-18-80

STATION PROCEDURE COVER SHEET

A. IDENTIFICATION

Number OP 302 Rev. 10

Title Control Rod Drive System

Prepared By J. Nowell

B. REVIEW

I have reviewed the above procedure and have found it to be satisfactory.

TITLE	SIGNATURE	DATE
DEPARTMENT HEAD	W R [signature]	7/8/81
S.S.	J. Nowell	7/7/81

C. UNREVIEWED SAFETY QUESTION EVALUATION DOCUMENTATION REQUIRED:

(Significant change in procedure method or scope as described in FSAR)
(If yes, document in PORC/SORC meeting minutes) YES [ ] NO [X]

ENVIRONMENTAL IMPACT

(Adverse environmental impact)
(If yes, document in PORC/SORC meeting minutes) YES [ ] NO [X]

D. PORC/SORC APPROVAL

PORC/SORC Meeting Number Porc 1-81-93

E. APPROVAL AND IMPLEMENTATION

The attached procedure is hereby approved, and effective on the dates below:

R Herbert — Station Superintendent/Unit Superintendent

7/8/81 — Approved Date

7/20/81 — Effective Date

SF-301
Rev. 3

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CONTROL ROD DRIVE SYSTEM

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1. OBJECTIVE

1.1 Describe the operations required to place the Control Rod Drive System in service as well as charging the Scram Accumulators and venting the Drive System.

1.2 Describe the operations required to withdraw the control rods using a single notch withdrawal mode or a notch override mode.

1.3 Describe the operations required to insert the control rods using a single notch insert mode, a notch override mode, or emergency rod in mode.

1.4 Describe the operations required to isolate a hydraulic control unit.

1.5 Describe the operations necessary to remove the Control Rod Drive System from service.

2. LICENSE REQUIREMENTS

2.1 Refer to the Millstone Nuclear Power Station Unit 1 Technical Specifications, Section 3.3, Reactivity Control, Subsections A-E, pages 53-62.

3. FSAR REFERENCES

3.1 Volume I, Section III, 5.0-5.4, "Reactivity Control Mechanical Characteristics"; 6.0-6.4, "Reactivity Control Stability Characteristics".

4. PLANT OPERATING REQUIREMENTS

4.1 The CRD hydraulic system provides the motive force to the driv s and the only source of charging water to the accumulators. Consequently, it must be in operation whenever the reactor is critical and whenever the vessel is hot to cool the drives.

4.2 The CRD hydraulic system adds makeup water to the reactor vessel and provides seal water to [illegible] recirculation pumps as well as hydrotesting the primary system. The system backup pump provides water to the head spray system.

4.3 If the CRD backup pump is out of service during a shutdown procedure, the control rod cooling water header flow can be reduced and the operating pump used to supply a limited amount of water to the reactor head spray system.

5. PREREQUISITES

5.1 4160V System is in operation. OP 341.
5.2 Breakers 14E and 14F are energized.
5.3 480V System is in operation. OP 342.
5.4 M.C.C. F3 is energized.
5.5 Vital and Instrument A.C. System is in operation. OP 343.
5.6 125 V.D.C. System is in operation. OP 344A.
5.7 Plant Air Systems are in operation. OP 333.
5.8 Nuclear Instrumentation System is in operation. OP 401-405.
5.9 Reactor Protection System is in operation. OP 408.
5.10 Condensate storage tank is in service. OP 315.
5.11 Cooling water supplied to CRD pumps TBSCCW. OP 309.

6. PRECAUTIONS

6.1 Do not operate a CRD pump unless it is primed.
6.2 Avoid repeated steps or jogs of CRD pump since the heat produced by each acceleration will greatly reduce the life of the pump motor winding insulation.
6.3 CRD pump operation shall be maintained within the following limits:
6.3.1 Minimum suction pressure - 18 inch Hg. abs.
6.3.2 Minimum oil temperature - 100°F.
6.3.3 Maximum oil temperature - 150°F.
6.3.4 Maximum Drive Water Temperature - 150°F.
6.3.5 Minimum Drive Water Temperature - 40°F.
6.3.6 Maximum Cooling Water Temperature - 100°F, located at Turbine Building Secondary Closed Cooling Water Heat Exchanger.

6.4 Do not take suction to CRD pumps from Hotwell Reject Line when possibility of condensate high conductivity exists, including but not limited to, unit startups.

6.5 The drive withdrawal isolation valve must never be closed while the inlet isolation valve is open and the accumulator charged. If a drive should be inadvertently exposed to accumulator pressure with its withdrawal isolation valve closed, the high pressures developed will damage drive internals.

7. PROCEDURE

7.1 Placing the Control Rod Drive System in Service

7.1.1 The Control Rod Drive Hydraulic System is lined up for operation in accordance with checkoff list, OPS Form 302-1.

7.1.2 Ensure closed cooling water flow through pump oil coolers by feeling the pipes.

7.1.3 Check proper oil levels in the constant level oilers associated with each bearing and also the level in oil reservoir supplying step-up gear assembly.

7.1.3.1 Outboard level - 1-1/4" below the shaft centerline.

7.1.3.2 Inboard level - 1-7/32" below the shaft centerline.

NOTE: As long as oil is visible in the glass bottles, additional oil need not be added.

7.1.4 Throttle open No. 1 (2) CRD pump discharge valve 301-2A (301-2B).

7.1.5 Establish communications between the Control Room and the CRD pump room.

7.1.6 On CRP 905, set the following controls:

Switch	Position
"SCRAM VOLUME HDR VENT. & SCRAM VOLUME HDR DRAIN"	"NORMAL"

Switch	Position
"CRD FLOW CONT. SELECT" Manual Air Valve (Local)	"A-B (302-6A or (302-6B) "A-B"
"STABILIZING VALVE SELECT"	"A-B (302-13A or (302-13B)
"CRD DRIVE WATER PRESSURE CONTROL" 302-B	"Partially Open"
"CRD DRIVE COOLING WATER PRESSURE CONTROL" 302-10	"Partially Open"

NOTE: Check the indicating lights associated with each switch position illuminated.

7.1.7 Verify that all scram valves are reset by noting that the white "SCRAM" display above each rod position display on CRP 905 is extinguished.

7.1.8 Verify that all accumulators are valved to normal, assuring that Accumulator Charging Water Riser valve, "113" and Accumulator Gas Charging valve, "111" are open and Accumulator Water Cylinder Drain valve, "107", closed.

7.1.9 Place the "CRD FLOW CONTROLLER" (340-1) manual-auto switch in "MAN" and the balance potentiometer CCW for 0% (Closed) flow control valve indication.

7.1.10 Place CRD PUMP NO. A(B) control switch in the "RUN" position to start the supply pump.

7.1.11 At the CRD CONTROLLER, adjust the balance potentiometer to establish flow at 75 gpm as indicated on FI 340-15.

NOTE: The pressure at the accumulator charging header should not exceed 1510 psig.

7.1.12 Place the "CRD COOLING WATER PRESS CONTROL" (302-10) Switch in the "OPEN" or "CLOSE" position as required to establish a cooling water header pressure of 20 psid as indicated on the cooling water pressure gauge.

7.1.13 Place the "CRD DRIVE WATER PRESS. CONTROL" switch in the "OPEN" or "CLOSE" position as required to establish a drive header pressure of 250 psid as indicated on the drive water pressure gauge. In the CRD pump room, throttle the combined pump discharge valve so as not to exceed an accumulator charging header pressure of 1510 psig.

7.1.14 Close the flow control valve for 301-13A-8B and check closed isolation valves for the out-of-service stabilizing valves, i.e., 301-67B & 301-68B.

7.1.15 Adjust the flow control valve for 302-13A-8A to produce a flow of 4 gpm as indicated on flow indicator 306-66.

7.1.16 Adjust the flow control valve for 302-13A-8B to produce a flow of 2 gpm (indicated by a total flow of 6 gpm as shown on flow indicator 302-66).

7.1.17 Similarly adjust 302-13B-8A and 302-13B-8B to satisfy the same flow adjustments and then return to standby status.

7.1.18 Repeat Steps 7.1.16 and 7.1.17 if necessary.

7.1.19 At this point, any flow not being used to cool the drives will return to the reactor as indicated by flow indicator 340-10 on CRP 905.

7.1.20 With condensate demineralizer effluent below 0.1 umho supply the Control Rod Drive pump suction from the Hotwell Reject to CST header.

7.1.20.1 Establish approximately 1000 gpm reject flow from Hotwell to CST.

7.1.20.2 Open 1-CN-70A and 1-CN-70C. Do not close 1-MW-93 (Supply from CST).

7.1.21 Refer to Section 7.4 for venting air from the control rod hydraulic system.

7.1.22 Refer to Section 7.3 for accumulator charging procedures.

7.2 Removing the Control Rod Drive System From Service

7.2.1 NOTE: This system will normally always be in service with probably the only exception being shutdown for refueling.

Stop "CRD PUMP A (B)" by placing its control switch to the "STOP" position on CRP 905.

7.2.2 Leave system valve alignment and control valve adjustments in the operating position. This will permit immediate restart should a rod or rods tend to drift out.

7.2.3 Equipment to be serviced and conditions of shutdown will dictate valving and equipment isolation.

7.3 Accumulator Charging Procedure

Special Precautions and Limitations

1. Since gas expansion during initial charging results in low nitrogen temperature, the accumulator charging pressure must be set only when the temperature of the nitrogen has reached equilibrium.
2. At any time a hydraulic control unit is connected to the control rod drive hydraulic system, with the scram accumulator charged, the drive withdrawal isolation valve (102) and the scram discharge isolation valve (112) must be opened prior to opening the drive insert isolation valve (101). Conversely, valve (101) must be closed prior to closing valves (102) and (112). Serious damage to the CRD could result if a reactor scram occurred with valve (101) open and valve (102) or (112) closed.

7.3.1 Verify that Control Rod Drive System is in operation as per Section 7.1.

7.3.2 Close the drive insert isolation valve (101) and the drive withdraw isolation valve (102). Pay particular attention to Special Precaution 2.

7.3.3 Close the charging header inlet valve (113) to the accumulator to be charged.

7.3.4 Connect drain hose to threaded conn. on valve (107). Slowly crack open the accumulator vent valve (107) and discharge the water accumulator. The accumulator is fully discharged when gas pressure, as shown on the accumulator pressure gauge, remains constant. This indicates that the piston in the water accumulator has reached its mechanical stop.

7.3.5 Fully close the gas charging inlet valve (111) on the instrumentation block.

7.3.6 Loosen the nitrogen charging connection cap (P6) and allow gas pressure to bleed from the instrumentation block.

7.3.7 Remove the cap from connector P6 and connect the gas charging line to the instrumentation block.

7.3.8 Slowly open the nitrogen bottle shutoff valve and adjust the pressure regulator to provide the proper charging pressure per attached pressure-versus-ambient-temperature curve, Appendix 2.

7.3.9 Slowly open the gas charging inlet valve (111) and allow accumulator pressure to slowly increase as indicated on the accumulator pressure gauge. By permitting the nitrogen to enter slowly, it will tend to reach equilibrium temperature and establish the desired charging pressure more rapidly.

7.3.10 When correct pressure is attained, close the bottle shutoff valve and then close the gas charging inlet valve (111).

7.3.11 Bleed pressure from the gas charging line using the charging line vent valve until the accumulator pressure gauge shows zero pressure.

7.3.12 Remove the gas charging line from the instrumentation block and replace the cap on connector P6. Insure the cap seals tightly.

7.3.13 Open the gas charging inlet valve (111) and observe that the charging pressure is shown on the accumulator pressure gauge (131). This will also place pressure switch 130 and level switch 129 in service.

7.3.14 With the accumulator vent valve (107) cracked open, slowly open the charging header inlet valve (113). When all air has vented, close the vent valve (107).

7.3.15 Allow the piston in the water accumulator to compress the gas charge to double the value of the initial nitrogen charge (approximately 1150 psig as indicated on the accumulator pressure gauge).

<u>CAUTION</u>: AFTER APPROXIMATELY 30 MINUTES, RECHECK THE PRESSURE INDICATED ON THE ACCUMULATOR PRESSURE GAUGE AND VERIFY THAT IT REMAINS CONSTANT AFTER THE NITROGEN HAS COOLED. IF AFTER THIS INTERVAL PRESSURE EXCEEDS 1150 PSIG, LOOSEN THE CAP ON CONNECTOR P6 AND BLEED EXCESS PRESSURE. EXCESS ACCUMULATOR PRESSURE COULD RESULT IN INTERNAL CRD DAMAGE IN THE EVENT OF A REACTOR SCRAM.

7.3.16 To return the CRD to service, reopen the isolation valves in the following order: 102, then 101.

7.4 Control Rod Drive System Venting Procedure

7.4.1 Verify that the hydraulic system is in service and that pressures and flows are properly adjusted.

7.4.2 <u>CAUTION</u>: WATER DRAINING FROM THE CRD SYSTEM IS POTENTIALLY CONTAMINATED AND SHOULD BE MONITORED FOR RADIATION. ALL NECESSARY PROTECTIVE MEASURES MUST BE TAKEN FOR DEALING WITH A POTENTIALLY CONTAMINATED LIQUID.

Crack open vent valves at hydraulic supply system equipment and header piping high points.

Bleed all air from system starting at the pump and continuing in sequence downstream.

NOTE: The amount of venting required will depend on how extensively the system has been drained.

7.4.3 Vent the control rod drives as follows:

7.4.3.1 At the CRD valve area, select the drive to be vented and verify it is valved into service.

7.4.3.2 At the CRD Vent Valve Nest, locate the selected drive insert and withdraw line vent valves. Check the insert line vent isolation valve shut, remove the vent plug and connect the venting hose. Run the hose down into the collection trough.

7.4.3.3 Establish communication with the Control Room and have the Operator insert the drive to "FULL IN" using a continuous insert signal.

CAUTION: IF THE VENT PIPING BECOMES EXCESSIVELY WARM, REDUCE THE BLEED FLOW RATE.

7.4.3.4 Have the Control Room Operator maintain the insert signal and crack open the insert line vent isolation valve for 1 minute to completely bleed the line. Then close the valve.

7.4.3.5 In the Control Room, maintain a continuous insert signal for 3 minutes to flush the drive.

7.4.3.6 Remove the venting hose and replace the vent plug. Check for tightness and make sure there is no evidence of leakage.

7.4.3.7 Check the selected withdraw line vent isolation valve shut, remove the vent plug and connect the venting hose. Run the hose down into the collecting trough.

7.4.3.8 In the Control Room, have the Operator apply a continuous withdraw signal to the drive. When the drive stops moving, either at "FULL OUT" or any other notch, crack open the withdraw line vent isolation valve for 1 minute to bleed the line. Then close the valve.

NOTE: The above times are sufficient to completely fill the piping and drive at normal insert and withdraw flow rates. If the observed flow rates are less than normal, increase the vent and flush times proportionately.

7.4.3.9 Remove the venting hose and replace the vent plug. Check for tightness and make sure there is no evidence of leakage.

7.4.3.10 In the Control Room, insert the drive to "FULL IN".

7.5 Test of Rod Withdrawal - Single Notch

SPECIAL PREREQUISITES

1. Mode switch must not be in the shutdown position.
2. R.W.M. must be operable.
3. Control rod withdrawal interlock circuit must be energized (insures neutron monitoring and the components of the scram system are operable).
4. Sequential timing circuit must be operable.

SPECIAL PRECAUTIONS

1. Monitor the rod position indicators during all periods of rod motion for indication of abnormal rod motion.

Abnormal rod motion is defined as motion in the wrong direction, motion when no motion is intended or motion of a rod not selected.

2. To reduce the severity of thermal cycles imposed on the CRD the temperature should be allowed to stabilize for about three minutes following its withdrawal for a hot test scram.

7.5.1 Check the rod out "PERMISSIVE" indicating lamp illuminated and the "ROD POWER" switch "ON".

7.5.2 Select the particular rod to be withdrawn by momentarily depressing the pushbutton on the rod-select pushbutton matrix. Observe that the pushbutton illuminates and the rod selection indicator above the position display for the selected rod is illuminated.

<u>NOTE</u>: The control circuit is now set up to supply power to the selected directional control valve solenoids when the rod movement control switch is activated.

<u>CAUTION</u>: CONTINUOUSLY MONITOR NUCLEAR INSTRUMENTATION DURING ROD MOVEMENT.

7.5.3 Turn the "Rod Movement Control Switch" to the "Rod Notch Out" position momentarily and release (spring return to "OFF").

7.5.4 Approximately 8 seconds from turning the control switch, the cycle should be completed and the rod settled in the next notch out (6" from previous position). Observe that rod is latched in the even numbered positions and that it is in the latched position before the settle light goes out.

7.5.5 The timer automatically resets for the next operation if switch is returned to "OFF".

7.6 Control Rod Withdrawal, Notch Override

<u>SPECIAL PREREQUISITES</u>

1. Same as 7.5.

SPECIAL PRECAUTIONS

1. Same as 7.5.

7.6.1 Check the rod-out "PERMISSIVE" indicating lamp illuminated and the rod select power switch "ON".

7.6.2 Select the particular rod to be withdrawn by momentarily depressing the pushbutton on the rod-select pushbutton matrix. Observe that the pushbutton illuminates and the rod-selection indicator above the position display for the selected rod is illuminated.

CAUTION: REACTIVITY INCREASE MAY BE SIGNIFICANT AND WARRANTS THAT PARTICULAR ATTENTION BE DIRECTED TOWARD THE NUCLEAR INSTRUMENTATION.

7.6.3 Turn the "Rod Movement Control Switch" to the "Rod Out" position and also the "Rod Out Notch Override" switch to the "Notch Override" position simultaneously. The rod will continue to withdraw as long as both switches are held in those positions.

7.6.4 As soon as either control switch is released, the sequential timer will complete its cycle and the rod should settle into an even notch position. Observe that the rod latched before the settling light goes out.

7.7 Control Rod Insertion, Single Notch

SPECIAL PREREQUISITES

1. Same as 7.5.

SPECIAL PRECAUTIONS

1. Same as 7.5.
2. Normal drive is 250-390 PSID.

If the CRD will not insert with normal system drive pressure under the piston, it should be declared inoperable and no further attempt should be made to move the drive unless authorized by the Unit Superintendent.

Such a CRD should be electrically disarmed and hydraulically isolated to preclude the possibility of inadvertently scramming the CRD. Scramming a CRD having a separated collet retainer tube would result in unnecessary damage to the drive.

7.7.1 Check the "Rod Power" switch "ON".

7.7.2 Select the particular rod to be inserted by momentarily depressing the pushbutton on the rod-select pushbutton matrix. Observe that the pushbutton illuminates and the rod selection indicator above the position display for the selected rod is illuminated.

7.7.3 <u>CAUTION</u>: CONTINUOUSLY MONITOR NUCLEAR INSTRUMENTATION DURING ROD MOVEMENT.

Momentarily move the "Rod Control" switch to "ROD-IN" and then release the switch. Observe that the green "INSERT" indicating light comes on following switch movement. Observe that the amber "SETTLE" light comes on approximately 3.0 seconds after switch movement and remains on for approximately 5.2 seconds.

<u>NOTE</u>: The control rod will actually travel beyond the notch position but will then settle into a notch and complete the cycle.

7.7.4 Observe that the rod latches in the next even-numbered position before the "SETTLE" light goes out.

7.8 Control Rod Insertion, Notch Override

<u>SPECIAL PREREQUISITES</u>

1. Same as 7.5.

<u>SPECIAL PRECAUTIONS</u>

1. Same as 7.5.
2. Do not exceed 265 PSID.

7.8.1 Check the "Rod Power" switch "ON".

7.8.2 Select the particular rod to be inserted by momentarily depressing the pushbutton on the rod-select pushbutton matrix. Observe that the pushbutton illuminates and the rod selection indicator above the position display for the selected rod is illuminated.

7.8.3 CAUTION: CONTINUOUSLY MONITOR NUCLEAR INSTRUMENTATION DURING ROD MOVEMENT.

Move and hold the "Rod Control" switch in the "ROD-IN" position. Release the switch to the "OFF" position one digit before the desired notch position is reached.

7.8.4 Observe that the green "INSERT" indicating light comes on following switch movement and remains on for the duration of rod insertion.

7.8.5 Observe that the rod latches in the desired even-numbered position before the "SETTLE" light goes out.

7.9 Control Rod Insertion, Emergency Rod In

SPECIAL PRECAUTIONS

1. Normal drive is 250-390 PSID (refer to Appendix 1).

NOTE: The emergency rod-in mode is provided for control rod insertion in the event of a malfunction of the timer switch or any other device in the select-in or rod-in circuits.

7.9.1 Check the "Rod Power" switch "ON".

7.9.2 Select the particular rod to be inserted by momentarily depressing the pushbutton on the rod-select pushbutton matrix. Observe that the pushbutton illuminates and the rod selection indicator above the position display for the selected rod is illuminated.

7.9.3 CAUTION: CONTINUOUSLY MONITOR NUCLEAR INSTRUMENTATION DURING ROD MOVEMENT.

Move and hold the rod control switch in the "EMERG ROD-IN" position until the desired notch position is reached. Then release the switch to the "OFF" position.

7.9.4 Observe that the green "INSERT" indicating light comes on following switch movement and remains on for the duration of rod insertion.

7.9.5 Observe that the rod latches in the desired even-numbered position. "EMERG ROD-IN" stops when switch is released. Reset rod drift light and alarm.

7.10 Hydraulic Control Unit Isolation

NOTE: The following procedure isolates flow of cooling water from the HCU to the CRD. Sustained loss of cooling water when the reactor is at operating pressure and temperature will shorten the maintenance life of the CRD seals.

7.10.1 Fully close the isolation valves in the insert riser (101) first, then close the withdraw riser (102), charging riser (113), scram discharge riser (112), cooling water riser (104), drive water riser (103) and exhaust water riser (105).

7.10.2 Fully close the isolation valve (116) in the scram valve pilot air line (scram valves may open due to air leakage).

7.10.3 Open the scram valves by either:

a. Give that rod a momentary scram signal from CRP 916, then place the toggle switch back to normal and verify scram valves open, or

b. Pull fuses on RPS test panel to de-energize scram pilot air valves (117, 118).

CAUTION: This water is contaminated.

7.10.4 Connect drain hose to threaded connection on valve 107. Carefully open the water accumulator drain valve (107) to discharge the water from the accumulator.

If the CRD pumps are shutdown, fully close 107 when all water has drained. If the CRD pump is running, permit valve 107 to remain open to drain possible leakage through the charging water riser isolation valve.

7.10.5 Electrically isolate the HCU from the RMCS if required.

7.10.6 Discharge the gas side of the accumulator as follows:

7.10.6.1 Close the cartridge valve (111) on the accumulator instrument block.

7.10.6.2 Remove the charging connector (P6).

7.10.6.3 Throttle open the cartridge valve (111) to discharge through P6.

7.10.6.4 Ensure the accumulator is de-pressurized.

7.11 Control Rod Drive Stall Flow Testing

1. Objective

1.1 This procedure provides a guide for trouble shooting control rod drives and their associated hydraulic control units.

2. References

2.1 GEI-92809, Manual I-G-1-16

2.2 GEI-92807A, Manual I-G-1-18

2.3 GEI-92808A, Manual I-G-1-19

2.4 GEK-39534

2.5 Millstone Technical Specifications

3. Prerequisites

3.1 Permission from the Shift Supervisor for authorization to commence testing must be obtained prior to testing.

4. Precautions

4.1 All procedure steps shall be coordinated with the Control Room Operator.

4.2 Technical Specification requirements shall be met at all times during testing.

4.3 Nuclear instrumentation shall be continuously monitored during testing.

4.4 Testing shall be performed on one CRD unit at a time.

4.5 To prevent possible drive damage in the event the drive is scrammed during isolation or clearing, observe the following:

4.5.1 When isolating a control rod drive, close the insert header isolation valve 101 before closing the withdraw header isolation valve 102.

4.5.2 When clearing an isolated drive open the 102 valve before opening the 101 valve.

Procedure

7.11.1 Record the date on Data Sheet, OPS Form 302-2.

7.11.2 Adjust the drive water pressure to 260 $\pm$ 3 psig and record the pressure on the data sheet. (Stall flows measured at other drive water pressures have little or no value when drive trouble shooting.)

NOTE: It is important that the drive water pressure be maintained at 260 psig throughout stall flow testing.

7.11.3 Withdraw Stall Flow Testing

7.11.3.1 The withdraw stall flow test is performed to determine the condition of the internal drive seals and can be used to detect leakage past the 121 and 127 valve on the HCU.

7.11.3.2 The test can be performed at any rod position.

7.11.3.3 With the rod at position 48 it is ready to test as is.

7.11.3.4 If the rod is at any position other than 48 the test can be performed by electrically disconnecting the insert directional control valve (123) at the HCU. With the 123 valve disconnected, application of a notch override signal will not result in drive withdrawal because the insert signal required to unlock the collet fingers will not be applied.

7.11.3.5 The withdraw stall flow test is performed by applying a notch out override signal to the CRD while reading the drive water flow meter.

7.11.3.6 To perform a withdraw stall flow test on a CRD proceed as follows:

7.11.3.7 Establish communications between the Control Room and the CRD-HCU's involved in the testing.

7.11.3.8 At the reactor control panel select the drive to be tested.

7.11.3.9 At the HCU electrically disconnect valve 123 if required by Step 7.11.3.4.

7.11.3.10 Perform test per Step 7.11.3.5, record the drive water flow on Data Sheet, OPS Form 302-2. (The initial test is recorded as Stall Flow #1.)

7.11.3.11 If Flow #1 $\leq$ 3.5 GPM, the drive performance is considered satisfactory.

7.11.3.11.1 Restore the CRD per Step 7.11.5.

7.11.3.11.2 Mark the "Drive Performance Satisfactory" line on Data Sheet, OPS Form 302-2.

7.11.3.11.3 Further stall flow testing is not required for a drive with flow $\leq$ 3.5 GPM, proceed with testing of other drives as required.

7.11.3.12 If flow #1 $\geq$ 3.5 GPM, exercise the drive by notching the rod in and out, then repeat Step 7.11.3.10, record the observed flow on

Data Sheet, OPS Form 302-2, as Stall Flow #2.

7.11.3.13 Compare Flow #1 with Flow #2.

7.11.3.14 If the flow decreased from #1 to #2, repeat Step 7.11.3.12 until a constant flow is achieved. Record the constant flow on Data Sheet, OPS Form 302-2, Stall Flow #3.

NOTE: A decrease in flow is an indication that air was in the drive. The drive will purge out any remaining air allowing a better measurement of stall flow.

7.11.3.15 If Flow #1 = Flow #2, proceed to Step 7.11.3.16.

7.11.3.16 Isolate the drive at its HCU by closing 101 and 102 (Ref. Precaution 4.1), then repeat the withdraw stall flow test per Step 7.11.3.6. Record the observed flow on Data Sheet, OPS Form 302-2, Flow #4.

7.11.3.17 If Flow #4 is zero and the constant stall flow observed in above steps is $\geq$ 5 GPM, then drive maintenance is indicated.

7.11.3.17.1 Mark the "Drive Maintenance Indicated" line on Data Sheet, OPS Form 302-2.

7.11.3.17.2 Restore the CRD per Step 7.11.5 and then proceed with testing of other drives as required.

7.11.3.18 If Flow #4 is zero and constant flow from above steps is >3.5 but <5, further tests and data evaluation will be required to determine if drive maintenance is indicated.

7.11.3.18.1 Mark the "Further Testing Required" line on Data Sheet, OPS Form 302-2.

7.11.3.18.2 Restore the CRD per Step 7.11.5 and proceed with testing of other drives as required.

7.11.3.19 If Flow #4 is >0, a problem with the HCU is indicated (leakage past directional control valve 121 or scram outlet valve 127; if the outlet scram valve were the cause, leakage would probably result in a high CRD probe temperature. Therefore, the more likely suspect is the insert directional control valve 121.).

7.11.3.19.1 To test the 121 valve, proceed as follows:

7.11.3.19.1.1 Close the exhaust water riser isolation valve 105.

7.11.3.19.1.2 Repeat the withdraw stall flow test per Step 7.11.3.6, record the observed flow on Data Sheet, OPS Form 302-2, as Flow #5.

7.11.3.19.1.3 If Flow #5 is zero, then valve 121 is not closing properly and should be inspected. Mark the "Valve 121 Needs Inspection" line on Data Sheet, OPS Form 302-2.

7.11.3.19.1.4 If Flow #5 is > zero further testing is required. Mark the "Further Testing Required" line on Data Sheet, OPS Form 302-2.

7.11.3.20 Restore the CRD per Step 7.11.5 and proceed with testing of other drives as required.

7.11.4 Insert Stall Flow Test - Optional Test - Do only if requested to.

7.11.4.1 This test does little to determine the condition of the drive, but is useful in leak testing valve 122.

7.11.4.2 To test the 122 valve, proceed as follows:

7.11.4.2.1 Select and insert to 00 the CRD associated with the HCU to be tested.

7.11.4.2.2 Apply a continuous insert signal to the drive and observe the drive water flow. Record this flow on Data Sheet, OPS Form 302-2, as Flow #6.

7.11.4.2.3 Close the exhaust water riser isolation valve 105.

7.11.4.2.4 Apply a continuous insert signal to the drive and observe the drive water flow. Record this flow on Data Sheet, OPS Form 302-2, as Flow #7.

7.11.4.2.5 Compare Flow #6 with Flow #7.

7.11.4.2.5.1 If Flow #6 = Flow #7, 122 is not leaking.

7.11.4.2.5.2 If Flow #6 > Flow #7, then the 122 valve is not closing properly and requires inspection. Mark the "122 Valve Needs Inspection" line on Data Sheet, OPS Form 302-2.

7.11.4.2.6 Open the exhaust water riser isolation valve 105.

7.11.5 Restoration

7.11.5.1 Restore valves to operational alignment.

7.11.5.2 Reconnect electrically disconnected directional control valves.

7.11.6 Attachments

7.11.6.1 Data Sheet, OPS Form 302-2

7.12 Control Rod Drive Accumulator Piston Seal Exercising

1. Reference

1.1 General Electric SIL No. 294.

2. Background

The accumulator requires servicing when the seal around the piston allows excessive water to leak into the nitrogen system. The need for maintenance may be indicated by a high level alarm which trips when sufficient water has collected in the nitrogen charging line. This water accumulation can be due to normal leakage over a long period of time or the rapid leakage indicative of a seal problem. Consequently, the first action is to remove the accumulated water and observe how long it takes the high level alarm to reappear. If it is relatively soon (less than one week), seal maintenance is indicated. If seal maintenance is indicated, exercising the piston seal may cause it to [illegible], reduce leakage and make maintenance unnecessary. The following procedure has been used successfully to reseat the seal. (Refer to figure 10.3)

Procedure

7.12.1 Isolate the HCU by closing the isolation valves in the following order: 101, 102, 113, 103, 104, 105, 112.

7.12.2 Remove the water accumulation by closing valve 111 and opening P6 to drain the water. Slowly crack open valve 111 to blow out residual water and then close

111. Recharge with nitrogen if excessive loss of nitrogen occurs in this maneuver and then close P6. Reopen valve III.

7.12.3 Slowly open valve 107 and drain to radwaste. This relieves the pressure on the top of the piston and moves it to the top of the accumulator.

7.12.4 Close the 107 valve and then open the 113 valve. This repositions the accumulator piston.

7.12.5 Close the 113 valve.

7.12.6 Repeat steps 7.12.3 through 7.12.5 two times.

7.12.7 Slowly open the valves in the following order: 112, 113, 102, 101, 104, 105, 103.

7.12.8 Log the date when the procedure is completed. The success of this procedure will be indicated by the period of time it takes the high level alarm to appear again. If the leakage is not sufficiently reduced, proceed with the normal maintenance action per the HCU Operation and Maintenance Manual.

7.13 Control Rod Drive High Operating Temperature Trouble Shooting.

7.13.1 <u>Reference</u>

7.13.1.1 General Electric SIL No. 173.

7.13.2 <u>Background</u>

7.13.2.1 A number of operating BWR plants have questioned the basis for setting the Control Rod Drive (CRD) high cooling water temperature alarm at 250°F. The purpose of this SIL is to briefly discuss the reasons for this temperature alarm setting to outline the major conditions which can cause or indicate high CRD operating temperature and to recommend corrective actions when high CRD temperature is experienced or temperature alarms occur.

7.13.3 <u>Discussion</u>

7.13.3.1 CRD temperatures above 250°F can shorten graphitar seal life and increase CRD drive maintenance and CRD temperatures 350°F-550°F will result in a significant reduction in strength of the graphitar seals. As a result of high CRD temperatures, higher wear/breakage rates can be anticipated when operating hot drives. Quantitative definition of this rate of degradation is not available because of the complexity of the factors involved relative to CRD operating history while hot.

Temperatures over 350°F may also result in a measurable delay in scram response times. An increase to 400°F could result in up to a 0.150 second increase in the 90% insertion time for an otherwise normally-performing CRD. However, this increase should not effect a normally performing CRD's ability to meet technical specification limits. There are four common causes for CRD high cooling water cooling water temperature alarms:

1. A leaking scram discharge valve. This is of concern as the CRD runs hot due to reactor water passing down through the drive and out the line to the scram discharge volume, and will continue to run hotter as the scram discharge valve seat continues to erode. Eventually this could interfere with normal drive movement.
2. Low cooling water flow.

CRD process diagrams specify a cooling water setting of reactor pressure + 12 psi to reactor pressure +25 psi. Low cooling water flow can be increased by adjustment of the cooling water pressure regulator. A low pressure setting may cause one or more CRD's to alarm on high temperature.

3. A defective Thermocouple circuit. In this case the drive may not actually be running hot. Suspect circuits may be verified by following standard plant procedures.

4. A plugged cooling water orifice. This will reduce flow to the individual drive and cause it to run hot. A special flushing technique (7.14) may assist in clearing the orifice.

"Recommended action of General Electric when high CRD temperature alarms are received:"

1. Verify that other CRD operating temperatures are normal. A low cooling water pressure regulator setting will result in higher than normal CRD temperatures. Adjustment of the pressure regulator to increase flow should correct the problem.

2. Check to determine if the scram discharge valve for the CRD in question is leaking. This will be indicated by an elevated temperature at Hydraulic Control Unit (HCU) valve 102. If the scram discharge valve is

determined to be at fault, repair, adjust or replace in accordance with the HCU Operation and Maintenance Instruction Manual. (Submit M.R. for maintenance and management planning)

3. Next determine if the thermocouple circuit fo. the CRD is defective. (Submit M.R. for I&C dept. investigation)

4. If low cooling water flow, a leaking scram discharge valve or a defective thermocouple circuit are not determined to be at fault, it may be presumed that the CRD cooling water orifice is plugged. The flushing procedure presented in 7.14 is recommended for flushing a plugged cooling water orifice. This procedure must be performed with the reactor in the cold shutdown condition.

5. Normal drive maintenance criteria continues to apply to "high temperature" CRDs (i.e., leakage rate, scram time, etc.). Be certain to thoroughly apply the criteria to CRDS which stabilize at temperatures above 350°F and schedule maintenance appropriately.

6. Do not attempt to correct CRD temperature alarms by applying repeated drive signals. This will only temporarily cool the drive with the effect of putting undesirable temperature cycles on the CRD. High temperature annunciators for a drive

or drives may be acceptably patched-out providing the temperatures are checked on a resonable frequency such as once a week.

7.14 Flushing of CRD Mechanisms

7.14.1 Purpose:

The purpose of this procedure is to delineate a recommended step by step procedure for flushing contaminats from both the drive mechanism cooling water orifice area and the associated Hydraulic Control Unit (HCU) directional control valve block withdraw filter (c135) area.

7.14.2 Initial Conditions:

7.14.2.1 The CRD to be flushed has been identified as having excessive drive temperatures during reactor operation and/or sluggish withdrawal motion. This is indicative of a plugged 135 filter caused by particulates in the drive mechanism drawn down into HCU following a scram and subsequent rod withdrawal.

7.14.2.2 The reactor shall be in the cold shutdown condition.

7.14.2.3 The Control Rod Drive Hydraulic System is in operation with normal flows and differential pressures established.

7.14.3 Procedure:

CAUTIONS

1. Observe proper HCU valving order when isolating or valving in HCU to prevent potential damage to CRD.
2. Observe radiological precautions when flushing. Direct all water to floor drains and note flush cloths could be highly contaminated.

7.14.3.1 Valve out HCU according to 7.10.1 and leave water side of accumulator vented through accumulator valve 107.

7.14.3.2 Commence static flush from both insert and withdraw risers by connecting vent tubing to vent valve blocks F101 and F102, directing flow to floor drains for minimum of 45 minutes or until clean filter cloths result (if used). Reclose vent valves F101 and F102.

7.14.3.3 Remove and inspect filters 134 and 136, replacing if necessary using new O-ring gaskets.

7.14.3.4 Remove filter 135 and install a substitute P3 plug fabricated to accept a tygon tubing drain which is directed to the floor drains.

7.14.3.5 Crack open insert riser isolation valve 101 and flush through P3 connection for approximately 5 minutes or until clean filter cloths results (if used).

7.14.3.6 With valve 101 shut, crack open cooling water riser isolation valve 104 and flush through P3 connection for approximately 5 minutes. (If little or no flow is observed, inspect cooling water check valve 138).

7.14.3.7 Reinstall plug P3 with new filter 135 and O-ring gaskets.

7.14.3.8 REturn HCU to normal, verifying proper N_2 precharge prior to opening charging water isolation valve 113.

7.14.3.9 Functionally check CRD operation by stroking and timing rod. If further CRD venting and CRD speed adjustment does not cure sluggish operation, take oscilliscope traces to evaluate other problems.

7.14.3.10 Monitor drive temperatures upon return to hot operating condition. If drive continues to run hot, a plugged cooling water orifice within CRD mechanism may be indicated. Once this is determined, the foreign material can normally only be removed with the drive out of the reactor.

7.14.3.11 Removal of the CRD for maintenance should be accomplished at the next planned maintenance outage.

7.15 Inadvertent Control Rod Withdrawal

7.15.1 Reference

7.15.1 General Electric SIL No. 292.

7.15.2 Background

7.15.2.1 Several operating BWRs have experienced malfunctions in the control rod drive system that caused a control rod to continue to withdraw after the operator had terminated the rod withdraw command. The purpose of this section is to discuss these occurrences and to present recommended procedural guidelines for operator response.

7.15.3 Discussion

7.15.3.1 Evidence indicates that the withdraw control valve, No. 122, failed to close after the withdraw signal was terminated. This failure could have resulted from either an electrical or mechanical malfunction causing the control rod to continue to drive out.

7.15.4 Procedural Guidelines

7.15.4.1 Prior to planned insertion of fully withdrawn control rods during rod exercising or sequence change insert the rod to position 44 then withdraw to position 46. Upon verification of proper setting at position 46 the rod may be withdrawn to 48. If the rod should fail to settle at position 46 and continue to drive out to position 48 this indicates possible failure of valve No. 122 and further verification and corrective action may be necessary.

7.15.4.2 If an inadvertent control rod drive-out should occur during normal operation (i.e., the control rod continues to withdraw after the operator terminates the withdraw command), proceed as follows:

1. If a timer malfunction alarm is observed, immediately initiate control rod insert by actuating the emergency insert switch. If a timer malfunction alarm is not observed, use the normal control rod insert switch to insert the control rod.
2. If the control rod drive does not respond, initiate a single control rod scram to insert the control rod.
3. If the drive continues to demonstrate occurrences of inadvertent withdrawal, the control rod should be inserted to position 00 and the drive should be valved out of service until the fault is located and corrected.

7.16 Stuck CRD Collet

7.16.1 Procedure for Verifying a Stuck Collet - Ref. SIL 310

7.16.1.1 If a drifting control rod is encountered, a stuck collet can be verified by driving to the full-in position and holding a continuous insert signal until the isolation valves 101 and 102 can be closed. If the drive drifts while isolated, the collet assembly is at fault. Reopen valves 101 and 102.

CAUTION: The operating status of the plant should be such that the drive could drift full out without causing a problem as there might be a delay in reopening valves.

~~7.16.2 Freeing a Stuck Collet~~

7.16.2.1 If the reactor is at an elevated pressure, an individual rod scram may free the collet. If, as is more likely, the drift is occuring after a scram (with the reactor at low or ambient pressure) the collet area may be flushed as follows:

7.16.2.1.1 Drive out to position 48.

7.16.2.1.2 Elevate the CRD Drive Water Pressure to Reactor Pressure +450-500 psi.

~~7.16.2.1.3 Give the drive repeated~~ continuous withdraw signals, one or two minutes each.

7.16.2.1.4 Following 20 or 30 such withdraw signals, notch the rod

back in to check collet operation.

7.16.2.1.5 Repeat if necessary until the CRD latches and unlatches reliably.

"CAUTION"

Control Rod Drives with unlatched collets cannot be held at the inserted position without a CRD pump in operation. In the event that flushing does not correct the unlatched collet problem, refer to Tech. Spec. 3.3.A.2 which requires "Cold Shutdown" within 48 hours.

B. ALARMS AND MALFUNCTIONS

B.1 "CRD Accum Low Pressure/Hi Level"

B.1.1 Panel 905, Section A-2, Window 2-4, CWD 579

B.1.2 Initiating Device: PS-130, LD-129

B.1.4 Automatic Action: 2nd Accumulator alarm is Rod Block.

B.1.5 Initial Operator Action:

1. Dispatch PED to determine if low press or high level.
2. Recharge accumulator or drain thru P6.

B.1.6 Subsequent Operator Action:

1. None

B.2 "Discharge Volume Hi Water Level"

B.2.1 Panel 905, Section A-2, Window 7-4, CWD 555

B.2.2 Initiating Device: LS 302-82A (B,C,D)

B.2.3 Setpoint: 39 gal. in the scram disch. volume.

B.2.4 Automatic Action: Reactor Scram

B.2.5 Initial Operator Action:

1. Carry out Emergency Procedure #5D2.

B.2.6 Subsequent Operator Action:

1. Bypass disch volume high level scram signal with bypass switch on CRP 905.

8.3 "CRD Filter High Differential Pressure"

8.3.1 Panel 905, Section A-1, Window 9-2, CWD 498

8.3.2 Discharge filter of CRD Pp., PS 302-52

8.3.3 Setpoint: dp _ 20 PSID

8.3.4 Automatic Action: None

8.3.5 Initial Operator Action:

1. Shift filters.

8.3.6 Subsequent Operator Action:

1. Change and clean dirty filter.

8.4 "CRD Pump A(B) Low Suction Pressure"

8.4.1 Location: Panel 905, Section A-1, Window 5-2

8.4.2 Initiating Device: PS 302-51A(302-51B)

8.4.3 Setpoint: Suct. press. 18" Hg Vac

8.4.4 Automatic Action: None

8.4.5 Initial Operator Action:

1. Check pressure and suction filter ΔP.
2. If abnormal-shift pumps and change filter.
3. If not abnormal, check valve line up and CST level.

8.5 "Charging Water Low Pressure"

8.5.1 Panel 905, Section A-2, Window 8-2

8.5.2 Initiating Device: PT 306-55

8.5.3 Setpoint: 1400 psig

8.5.4 Automatic Action: None

8.5.5 Initial Operator Action:

Restore Pressure

1. Check pump running.
2. Check system flow and FCV.
3. Check valve lineup.

If alarm from shifting pumps, then combined disch may have to be throttled. Alarm may be from accumulators charging (after a scram).

8.5.6 Subsequent Operator Action:

1. None

8.6 "Scram Pilot Air Header High/Low Pressure"

8.6.1 Location: Panel 905, Section A-2, Window 2-2, CWD 579

8.6.2 Initiating Device: 302-81

8.6.3 Setpoint: Air Header Press High 75 psi, Air Header Press Low 70 psi.

8.6.4 Automatic Action: None

NOTE: If pressure gets low enough control rod scram valves will start drifting open resulting in control rods going into the core.

8.6.5 Initial Operator Action:

1. Determine cause. If entire inst. air system pressure is low, start standby air compressor.

8.6.6 Followup Action:

1. If rods have commenced to scram individually into core, manually scram reactor.

8.7 "CRD High Temperature"

8.7.1 Panel 905, Section A-1, Window 7-2, CWD 515

8.7.2 Initiating Device: Panel 921 Recorders
34D-16A
16B
16C

8.7.3 Setpoint: Temp of 250°F reached

8.7.4 Automatic Action: None

8.7.5 Immediate Operator Action: (Refer to Appendix)

1. Identify CRD with high temp.
2. Check CRD cooling water flow.
3. Do not cool a hot CRD by giving it repeated drive signals. After checking for possible discharge scram valve leakage, a CRD with a high temperature alarm should be left HOT.
4. Check valve lineup on CRD alarming.

8.7.6 Subsequent Operator Action:

1. If temp still climbs after above, seals on CRD may be lost and rod may be inoperable.
2. Refer to step 7.13.

8.8 "CRD Pump "A" (B) Bkr Tripped by Overload"

8.8.1 Panel 905, Section A-1, Window 6-2, CWD 545

8.8.2 Initiating Device: Relay 51B

8.8.3 Setpoint: 390 amps

8.8.4 Automatic Action: Pump Stops

8.8.5 Initial Operator Action:

1. Shift flow controller to manual and reduce output to 40%.
2. Start "B" (A) pump. If CRD accumulators are charging wait until all are charged, then shift flow control to auto.
3. After reason for trip is determined, shift back to "A" (B) pump running after waiting at least 20 minutes for motor to cool.

8.8.6 Subsequent Operator Action:

1. If pump trips a second time, turn in MR to have Maintenance check it out.
2. If accumulators are charging and/or sys. has been shutdown, pump discharge valve will have to be throttled until system is up to full pressure.

8.9 "Discharge Volume Not Drained"

8.9.1 Panel 905, Section A-2, Window 9-2, CWD 579

8.9.2 Initiating Device: FS 302-B2F

8.9.3 Setpoint: Accumulation of 3 gal. water in scram Discharge Volume

8.9.4 Automatic Action: Alarm only

8.9.5 Initial Operator Action:

1. If cause of alarm was not an occurrence of a Reactor Scram, verify SDV vents and drains open.

8.9.6 Subsequent Operator Action:

1. Inspect the individual Control Rod Scram Valves for evidence of leakage past the seat to the Scram Discharge Volume.

8.10 "CRD A(B) High Filter D/P"

8.10.1 Panel 903, Section A-3, Window 8-8 (9-8), CWD 759 and 784

8.10.2 Initiating Device: Suction Filter Barton Gauge DP 1 302-100A (DP 1 302-100B)

8.10.3 Setpoint: Filter D/P _ 13 PSID

8.10.4 Automatic Action: Alarm only

8.10.5 Initial Operator Action:

1. Dispatch operator to verify high d/p condition.
2. Shift to standby CRD pump.

8.10.6 Subsequent Operator Action:

1. Change filter elements and restore filter to normal standby condition.

8.11 "Rod Drift"

8.11.1 Panel 905, Section A-2, Window 4-1, CWD 526

8.11.2 Initiating Device: Relay 134A (B,C,D)

8.11.3 Setpoint: Rod moving from even numbered position that is not selected and being driven.

8.11.4 Automatic Action: None

8.11.5 Immediate Action:

1. Select Drifting Rod and return it to desired position.

8.11.6 Subsequent Operator Action:

1. Investigate cause.
2. Check for excessive cooling water flow.
3. Refer to 7.15 and 7.16.

8.12 "Rod Overtravel"

8.12.1 Panel 905, Section A-2, Window 6-1, CWD 526 (719E 534 SH. 5)

8.12.2 Initiating Device: Relay 136

8.12.3 Setpoint: Control Rod withdrawal beyond indicated position 48.

8.12.4 Automatic Action: None

8.12.5 Initial Operator Action:

1. Insert Control Rod to attempt to recouple the Rod and to perform a coupling check.

8.12.6 Subsequent Operator Action:

1. If Rod cannot be coupled, insert Rod fully to position "00" and electrically disarm it.

8.13 CRD Fails to Unlatch

8.13.1 Location: None

8.13.2 Initiating Device: None

8.13.3 Setpoint: None

8.13.4 Automatic Action: None

8.13.5 Initial Operator Action: (Refer to Appendix)

1. May be caused by excessive air trapped in ~~hydraulic piping. Operator should first try~~ pulsing drive with insert signals to flush the air out. If this fails, vent insert - withdraw lines from local high point vent valves.
2. May be caused by plugging of small filters number 134, 135 or 136 located in hydraulic control unit control valve cluster. These are easily removed for cleaning.
3. Failure to unlatch in the withdraw direction may be caused by a leaking scram inlet valve. Note that pressure test points P1, P2, P3 and P4 may be used for trouble shooting a troublesome drive.

8.14 "CRD Drifting In"

8.14.1 Location: None

8.14.2 Initiating Device: None

8.14.3 Setpoint: None

8.14.4 Automatic Action: None

8.14.5 Initial Operator Action:

1. Check for excessive cooling water pressure. This could occur if cooling water pressure reached approximately 70 psig above reactor pressure.
2. Check for leaking scram inlet valve.

8.15 Low Drive Water and/or Cooling Water Pressure

8.15.1 Location: None

8.15.2 Initiating Device: None

8.15.3 Setpoint: None

8.15.4 Automatic Action: None

8.15.5 Initial Operator Action:

1. Normally may be controlled with pressure control valves.
2. Check for failure of flow control valve or controller.
3. Switch to manual control or alternate flow control system.
4. Check for low instrument air pressure in 30 psig air supply to flow control station.

8.16 "Rod Drop"

8.16.1 Indications to Operator:

1. Sudden unexpected and otherwise unaccountable increase in neutron flux on Panel 905. Rapid step change in neutron flux monitoring recorder traces on Panel 905.
2. Change in major plant parameters as a result of the resulting power excursion as indicated by a vessel level transient, vessel pressure increase, feedwater flow increase, steam flow increase as indicated on Panel 905, or electrical output increase at the Computer Select Console in the Control Room.
3. LPRM's or IRM's in the vicinity of the dropped rod initiating in high flux alarms.

4. Rod position indicator gives evidence of rod motion.
5. Possible reactor scram.
6. With local fuel damage or melting, possible steam line, off-gas, and stack gas radiation alarms on Panel 904.
7. With plant at less than 10% power, the Rod Worth Minimizer will indicate a rod out of sequence.

B.16.2 *Setpoint:* *CRD system failure resulting in a rod drop.*

B.16.3 Automatic Action:

NOTE: The following automatic actions are based on worst case conditions. The degree of the transient will vary widely depending on initial conditions and proper system functioning.

1. ~~Reactor scram at IRM level of 96% full scale, or~~ APRM flow biased scram.
2. With a significant fission product release, the following will occur:
   A steam line high radiation (7 times normal full power background level) will scram the reactor, close the main steam isolation valves, trip the mechanical vacuum pump and close the vacuum pump suction valve.

B.16.4 Immediate Operator Action:

1. If a Reactor Scram occurs, carry out the actions of Emergency Procedure 502, Emergency Shutdown.
2. If the rod drop has not resulted in a Reactor Scram, select and drive the affected rod to the fully inserted position and electrically disarm its associated directional control valves.

B.16.5 Subsequent Action.

1. Maintain constant surveillance of primary coolant activity to aid in the evaluation of the extent of possible fuel damage.
2. If a Reactor Scram has resulted, continue shutdown in accordance with Emergency Procedure 502, Emergency Shutdown.
3. If necessary, monitor for background radiation to verify a high steam line radiation condition.
4. Notify the Unit Superintendent or his designee, who will provide instructions for further actions.

B.17 "Abnormal Control Rod Motion"

B.17.1 Indications to Operator:

1. "Rod Drift" alarm on Panel 905 in the Control Room.
2. Rod position indicator gives evidence of rod drive drift-in following an insert signal.
3. Rod position indicator gives evidence of rod drive drift-out following a withdraw signal.
4. Rod position indicator gives evidence of rod motion with no motion intended.
5. Indication of a single rod scram.
6. IPRM high alarm, possible APRM high flux, neutron monitoring system trip, Rod Block, IRM High, or Reactor Channel A(B) Scram on Panel 905.
7. Unaccountable change in local neutron flux and major plant parameters such as reactor pressure, reactor level, feedwater flow, steam flow, generator output as a result of the reactivity change.

B.17.2 Setpoint: CRD system failure resulting in control rod motion in the wrong direction, control rod motion when it is not intended or motion of a nonselected rod.

8.17.3 Automatic Action:

NOTE: Abnormal motion may be such that no trip occurs or that a power reduction occurs.

1. Reactor Scram (IRM or APRM trip) on Rod withdrawal.
2. IRM or APRM rod block on local high flux conditions.

8.17.4 *Immediate Operator Action:*

1. If unintended rod withdrawal is indicated, attempt to stop the motion with an insert signal. If rod motion continues, scram the rod from Control Room Panel 916.
2. If unintended rod insertion is indicated, allow the rod to insert until motion stops or the "00" position is reached.
3. ~~Reduce reactor recirculation flow to maintain rated power at less than 2011 MWT.~~ ~~Do not~~ exceed Rx Power/Recirc. Flow limitations.
4. If a rod drift alarm occurs, immediately select the drifting rod (the rod status display has a "Drift" light for each individual rod) and pulse it with an insert signal. This should correct the drift and allow the CRD to settle into an even-numbered position.
5. If a malfunction has resulted in an individual control rod scram, dispatch an operator to the CRD hydraulic area to survey for structural or piping failure.
6. If the CRD double-notches during single-notch movement, if notch movement is slow or erratic, or the CRD fails to settle or settles slowly, discontinue further rod movement, check for normal supply flow, drive water pressure, and cooling water pressure and adjust as necessary.

8.17.5 Subsequent Operator Action:

1. If a control rod is determined to be stuck, proceed as follows:
   a. Disarm the rod electrically in accordance with Operating Procedure 302.
   b. Notify the Unit Superintendent or his designee for instructions for further action.
2. If the CRD double-notches during single-notch movement, investigate the following:
   a. Excessive drive header pressure; adjust with drive pressure control switch on Panel 905 and check for proper supply flow, pressure, and stabilizing valve operation.
   b. Air in hydraulic control lines, vent in accordance with Operating Procedure 302.
3. Check for normal cooling water header pressure (approximately 33 psi above reactor pressure). If excessive, adjust the cooling water pressure control switch on Panel 905 to obtain the proper pressure. If the system does not respond, dispatch an operator to the pressure control station to take local-manual control.
4. If the above corrective action is unsuccessful, notify the Unit Superintendent or his designee for instructions for further action.

8.18 "Loss of Rod Control"

8.18.1 Indications to Operator:

1. Rod-select pushbutton does not illuminate when depressed.
2. [illegible] individual selected control rod can be inserted but not withdrawn.
3. No movement indication (based on in-core flux monitors and rod position indicators) for an individual selected control rod.

4. "Rod-out Permissive", "Rod Out", or "Rod In" lights do not illuminate during attempted rod movement.
5. One or more of the following annunciated alarms on Panel 905 in the Control Room.
   (a) "Rod Out Block" with associated rod block display illuminated.
   (b) "CRD Water Pump A(B) Low Suction Pressure".
   (c) "CRD Water Pump A(B) Breaker Tripped by Overload".
   (d) "Charging Water Low Pressure".
   (e) "CRD Filter High DP".
   (f) "Scram Pilot Air Header High/Low Pressure".

B.18.2 Setpoint: CRD System failure resulting in a loss of a control rod.

B.18.3 Automatic Action:

1. The CRD pump will trip on low suction pressure (18" Hg Abs) and pump overload (390 amps).

B.18.4 Immediate Operator Action:

1. If loss of rod control results from a rod block, check the Rod Block Display to determine its cause and follow the corrective action delineated in the Alarm Book.
2. Attempt to move the rod with increased drive pressure by adjusting the Drive Pressure Valve at Panel 905 in the Control Room. Do not exceed a pressure of 390 psi above reactor pressure.
3. If a loss of power to the rod control circuits is indicated, check the "Rod Select Power" switch located on Panel 905 on the "On" position.
4. If a low or loss of pressure in the hydraulic system supply header is indicated, take the following action:

a. If the operating CRD pump has tripped off on loss of power, low suction or overload, start the standby pump and verify normal system operation.

b. If neither CRD pump can be started, decrease power by reducing recirculation flow to a minimum and manually scram the reactor.

c. Trip of the standby pump on low suction pressure would indicate a low level/or high temperature in the condensate storage tank or a plugged supply filter.

NOTE: If a low pressure is accompanied by a supply filter high differential pressure, dispatch an operator to open the filter bypass until the other pump can be placed in service or the filter is changed.

d. At the flow control station, verify a proper flow of 75 gpm. If the flow is abnormal, dispatch an operator to check for low instrument air pressure in the 30 psig air supply. Attempt to re-establish proper flow with the flow controller while monitoring drive header pressure and drive cooling header pressure. If the flow control valve fails to respond, dispatch an operator to isolate it and place the standby unit in service.

e. Dispatch an operator to check the system for possible leakage, especially at accumulator drain valves.

5. If a drive fails to unlatch and withdraw (or if withdrawal is interrupted by possible collet locking), proceed as follows:
   a. Cause may be excessive air trapped in the hydraulic piping. Attempt to flush the drive by using two consecutive insert signals.
   b. Check for normal (approximately 30 psi above reactor pressure) cooling water pressure. If excessive, adjust the cooling water pressure control valve to obtain the proper pressure. If the cooling water pressure control valve fails to respond, isolate it and place the manual pressure control valve in service.
6. If loss of rod control occurs after a scram, check that all scram valves have closed after reset by noting that the red "Scram" display above the selected rod's position is not illuminated.

B.18.5 Subsequent Operator Action:

1. If a control rod is determined to be inoperable, proceed as follows:
   a. Any control rod which fails to move after all attempts to correct the malfunction have failed should be treated as an inoperable rod and disarmed electrically in accordance with Operating Procedure 302. The final position of the rod will depend on the conditions of the failure.
   b. Notify the Unit Superintendent or his designee for further instructions.
2. Check that the isolation shutoff valves in the hydraulic lines serving the drive in question are full open.

3. If low instrument air supply pressure is indicated, check the air filter for possible clogging with foreign matter. Clean filters as necessary.

4. If low pressure was due to supply filter high differential pressure, have the filter cleaned or replaced and returned to service.

8.19 "Rod-to-Drive Coupling Failure"

8.19.1 Indications to Operator:

1. "Rod Overtravel" alarm on Panel 905 with rod position display of uncoupled rod going dark during a coupling check.

2. Changing rod position indication with no local flux response.

8.19.2 Setpoint: Coupling failure resulting in the separation of a control rod from its associated drive.

8.19.3 Automatic Action: None

8.19.4 Immediate Operator Action:

1. If a "Rod Overtravel" alarm occurs while the reactor is critical, attempt to establish the position of the control rod using the nuclear instruments on Panel 905 in the Control Room.

2. If it can be definitely established that the control rod is fully withdrawn, insert the drive two or three notches and then withdraw it to the full-out position. Hold the rod switch on "Rod-Out-Notch" and the notch-override switch on "Notch-Override" and observe that the rod position display maintains a readout of "48" with red backlighting and the "Rod Overtravel" alarm remains silent.

3. If there is an indication that the control rod is not fully withdrawn, insert the CRD one notch at a time until a local flux response is

observable or the mechanism is stopped by the control rod.

8.19.5 Subsequent Operator Action:

1. If the CRD is fully withdrawn and cannot be coupled after several attempts, fully insert and electrically disarm the CRD in accordance with Operating Procedure 302.
2. If the control rod was not fully withdrawn and upon inserting the CRD, a local flux response indicated that the control rod and CRD were in contact, apply a withdraw signal to determine if the rod and drive have successfully coupled. If the CRD cannot be coupled after three attempts, electrically disarm the CRD in accordance with Operating Procedure 302.
3. If the control rod was not fully withdrawn and cannot be inserted by CRD movement, notify the ~~Unit Superintendent or his designee for further~~ instructions.

8.20 "Scram System Failure"

8.20.1 Indications to Operator:

1. The following will indicate the reduction or loss of ability to initiate a full emergency scram:
   a. "CRD Accumulator Low Pres/High Level" alarm Panel 905 and resultant "Rod Block" alarm.
   b. "Discharge Volume Not Drained" alarm (3 gallons) Panel 905.
   c. "Discharge Volume High Level" alarm (19 gallons) on Panel 905 and resultant "Rod Block" alarm.
   d. "Discharge Volume High Water Level" alarm (39 gallons) and resultant reactor scram alarm Panel 905.

2. The following will indicate that a full scram has failed to initiate:

   a. Scram display above rod position display does not illuminate or position indication does not change after a scram indicating a CRD has failed to respond to a scram signal.

   b. Position indicator reveals a control rod(s) has not fully inserted following a reactor scram.

8.20.2 Setpoint: Scram system failure resulting in the reduction or loss of ability to initiate a full emergency scram or failure of a scram to be completed.

8.20.3 Automatic Action:

1. Reactor will scram on a discharge volume high water level (39 gallons).

2. CRD Accumulator low pressure or high level alarm, or a discharge volume high level alarm will initiate rod blocks.

   NOTE: If accumulator pressure drops below reactor pressure, the insert port ball-check valve will shift allowing reactor water to provide full-scram capability.

8.20.4 Immediate Operator Action:

1. If a control rod(s) fails to fully insert following a reactor scram, select the affected rod(s) and insert to the "00" position. Make a notation in the Control Rod Surveillance Log.

2. If a "CRD Accumulator Low Pressure and/or High Level" alarm occurs, dispatch an operator to check the accumulator monitor racks to determine the affected accumulator.

3. If a "Discharge Volume Not Drained" or "Discharge Volume High Level" alarm occurs, check the position (open during normal reactor operation) of the discharge volume drain and vent valves by noting the indicating lamps on Panel 905. Check the "Discharge Volume Isolation Test" switch in "Normal".

8.20.5 Subsequent Operator Action:

1. If an individual control rod has failed to respond to a scram signal, investigate possibility that one or both scram valves have failed to open.
2. If an accumulator low pressure condition is indicated, check for leaks at the hydraulic control unit, especially the gas charging connection. Recharge the accumulator as necessary in accordance with Operating Procedure 302.
3. If an accumulator water leak is indicated, the alarm could have been initiated by water leaking by an accumulator piston. Proceed as follows:
   a. Close valve 111 on accumulator instrumentation block.
   b. Slowly loosen and then remove the cap at connection P6.
   c. Carefully reopen valve 111 to blow out moisture, then close valve 111.
   d. Replace cap at P6 and then reopen valve 111.
4. Notify the Unit Superintendent or his designee for instructions for further action.

9. CHECKOFF LISTS

9.1 OPS Form 302-1, Valve Checkoff List

9.2 OPS Form 302-2

10. FIGURES

10.1 Accumulator Precharge Nitrogen Pressure Versus Ambient Temperature

10.2 CRD HCU Accumulator Piston Seal Maintenance Checkout Procedure.

JN:ws

APPENDIX 1

Control Rod Collet Retainer Tube Cracking

During an inspection of a disassembled control rod drive (CRD) at a domestic GE BWR, cracking of a collet retainer tube (referred to as the collet housing in the CRD maintenance manual, GE part number 104B 1967P2) was observed. The cracking noted to date has been found to begin on the outer surface of the collet retainer tube approximately six inches down the tube.

General Electric has attributed this cracking to thermal cycles during hot scram, followed by exposure to oxygenated CRD cooling water which can be aggressive to sensitized materials. In CRD's examined thus far, the cracking is generally shallow and confined to the area where the tube wall changes thickness. This tube has a very low mechanical loading and the probability of complete failure is extremely remote. However, should the cracking progress to a point of complete circumferential separation the CRD would be rendered inoperable.

The following General Electric recommendations shall be implemented:

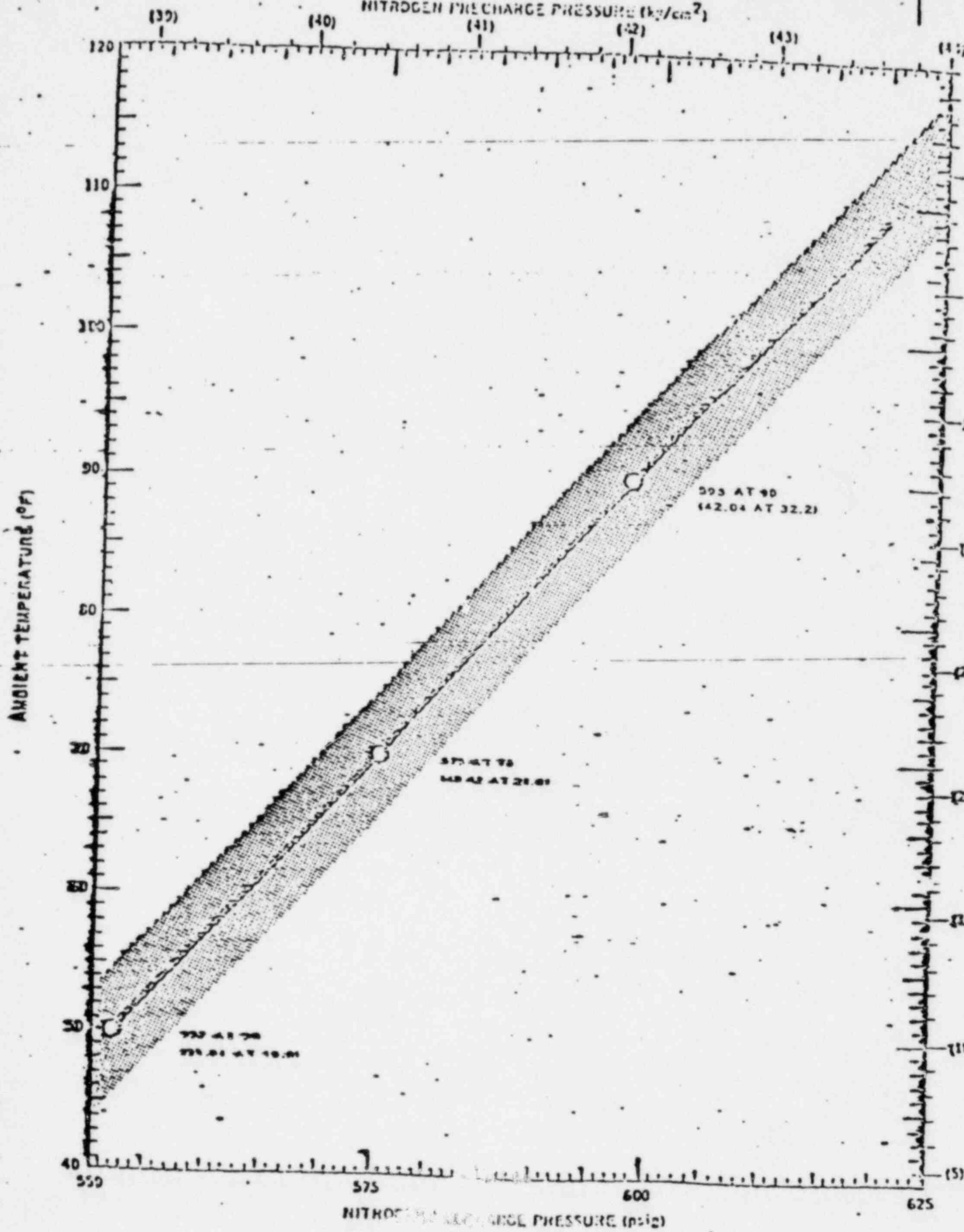
1. If a CRD fails to respond to the normal insert command (reactor pressure plus 250 to 300 psi).
   a. Install the dp instrumentation and verify that hydraulic pressures are being applied to the CRD drive piston.
   b. If the CRD will not insert with normal system drive pressure under the piston, it should be declared inoperable and no further attempt should be made to move the drive unless authorized by the Unit Superintendent. Such a CRD should be electrically disarmed and hydraulically isolated to preclude the possibility of inadvertently scramming the CRD. Scramming a CRD having a separated collet retainer tube would result in unnecessary damage to the drive.

APPENDIX 1

2. To reduce the severity of thermal cycles imposed on the CRD the temperature should be allowed to stabilize for about three minutes following its withdrawal for a hot test scram.

3. Do not cool a hot CRD by giving it repeated drive signals. After checking for possible discharge scram valve leakage, a CRD with a high temperature alarm should be left HOT. Schedule such a CRD for maintenance during the next refueling outage.

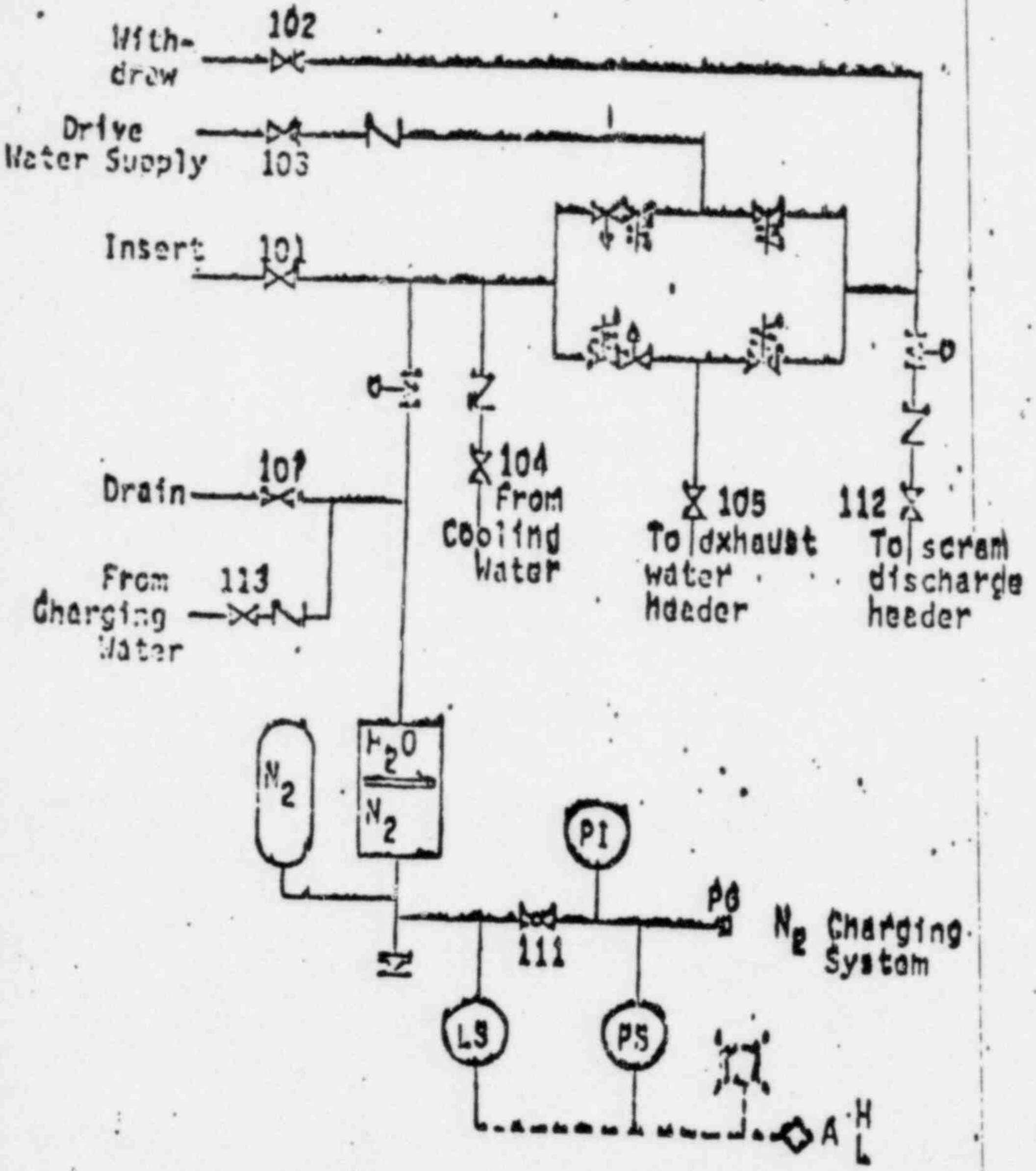
For further details on the control rod collet retainer tube cracking refer to GE SIL 139 of 7/25/75.



Accumulator Precharge Nitrogen Pressure Versus Ambient Temperature

Figure 10.1

Figure 10.2



CRD HCU ACCUMULATOR

PISTON SEAL MAINTENANCE CHECKOUT PROCEDURE

PROCEDURE

1. Isolate HCU - close valves in following order: 101, 102, 113, 103, 104, 105, 112.
2. Remove accumulated water by closing 111, opening P6 and cracking 111 open to blow out residual water. Recharge with nitrogen if needed and leave P6 closed and 111 open.
3. Slowly open 107 and drain to clean radwaste. This moves the piston to the top of the accumulator.
4. Close 107 and open 113 - this repositions the piston.
5. Close 113.
6. Repeat steps 3 through 5 two to three times.
7. Slowly open the valves in the following order: 112, 113, 102, 101, 104, 105, 103.
8. Log the date when this procedure is completed. If the level alarm reappears soon, piston seal maintenance is appropriate.