Event

1

OP-37.1 sect 8.9

8.9 Swapping Reactor Building Ventilation Fans

R
Reference
Use

8.9.1 Initial Conditions

1. Reactor Building Ventilation System is in service in accordance with Section 5.1 or 8.1. ☐

8.9.2 Procedural Steps

1. **PERFORM** the following to swap a Reactor Building Exhaust Fan:

   a. **PLACE** the selected fan control switch in *START* **AND HOLD**. ☐

   b. **ENSURE** the selected fan discharge damper opens. ☐

   c. **RELEASE** the selected fan control switch. ☐

   d. **ENSURE** the selected fan is running by observing the control switch red fan light is on. ☐

   e. **PLACE** the selected fan control switch in *STOP*. ☐

2. **PERFORM** the following to swap a Reactor Building Supply Fan:

   a. **PLACE** the selected fan control switch in *STOP*. ☐

   b. **PLACE** the selected fan control switch in *START* **AND HOLD**. ☐

   c. **ENSURE** the selected fan discharge damper opens. ☐

   d. **RELEASE** the selected fan control switch. ☐

   e. **ENSURE** the selected fan is running by observing the control switch red fan light is on. ☐

8.9.2 Procedural Steps

3. **ENSURE** *REACTOR BLDG NEG PRESSURE, VA-PI-1297*, at a minimum of 0.25 inches of water. ☐

4. **ENSURE** *MSIV PIT EXHAUST AIR CHECK DAMPER, VA-2A-CV-RB*, did **NOT** close. ☐

Event 2

APP UA-3 2-5

OI-01.02 Conduct of Ops.

AOP-16 RBCCW System Failure

RBCCW PUMP DISCH HEADER PRESS LOW

AUTO ACTIONS

NONE

CAUSE

1. RBCCW pump trip due to any of the following:
   a. Overload device.
   b. Load shed sequence for applicable emergency bus.
   c. Circuit malfunction.
2. Gross leakage or piping failure.
3. Improper valve lineup.
4. Increased heat load.
5. Circuit malfunction.

OBSERVATIONS

1. RBCCW pump indicates tripped or associated emergency 4160 volt bus has received an undervoltage or loss of off-site power signal.
2. RBCCW Pump Discharge And Header Pressure Indicator, RCC-PI-671-1, indicates less than 68 psig.
3. If RBCCW header pressure reaches 65 psig as indicated on RCC-PI-671-1, then the standby RBCCW pump should start.

ACTION

1. For RBCCW pump trip, start the standby pump if auto start has not occurred.
2. If pressure cannot be restored, refer to AOP-16.0, Reactor Building Closed Cooling Water System Failure.
3. If a circuit malfunction is suspected, ensure that a Trouble Tag is prepared.

DEVICE/SETPOINTS

Pressure switch RCC-PS-673	68 psig

POSSIBLE PLANT EFFECTS

1. Loss of RBCCW cooling capacity could result in a unit shutdown.

REFERENCES

1. LL-9353 - 35
2. AOP-16.0, RBCCW System Failure

5.10 Conservative Decision Making and Reactivity Management

5.10.6 A conservative approach shall be taken in the performance of normal and infrequent evolutions such that personnel are questioned concerning their requests to perform evolutions until satisfied that reactivity control is **NOT** compromised. Any activity that the effects on reactivity is unknown or non-conservative should be challenged.

5.10.7 If automatic actions fail to occur with valid initiation signals present, operators shall initiate associated manual actions. If the manual actions will result in an automatic reactor scram, then insert a manual reactor scram prior to performing the manual actions. Examples include:

1. Inserting manual scrams.
2. Inserting manual turbine trips.
3. Manually executing isolations (if they fail to occur or fail to complete).
4. Diesel Generator auto starts.
5. ECCS initiations

5.10.8 It is important to believe plant indications.

1. Alarms and abnormal instrument readings shall be investigated immediately, and validated for authenticity.
2. Actions should **NOT** be taken "blindly" based upon a single indication.
   a. Taking immediate action based upon a single indication is **NOT** prudent, unless the indication appears valid and no backup indication is available.

NOTE:	Some indicators fail on scale or "as is". These indicators are identified on the RTGB with the labeling of "FAI".

3. If an alarm annunciates for which immediate action is required, check available instrumentation to validate the alarm.
   a. If independent instrumentation disputes the alarm, continued investigation is required prior to taking action.
4. If an alarm is suspected to be spurious, it should be treated as valid each time it alarms, until investigation proves otherwise.

Progress Energy BRUNSWICK NUCLEAR PLANT

PLANT OPERATING MANUAL

VOLUME XXI

ABNORMAL OPERATING PROCEDURE

UNIT
0

0AOP-16.0

RBCCW SYSTEM FAILURE

REVISION 18

1.0 SYMPTOMS

1.1 *RBCCW PUMP DISCH HEADER PRESS LOW* (UA-03 2-5) in alarm

1.2 *RBCCW HEAD TANK LEVEL HI/LO* (UA-03 1-5) in alarm

1.3 *PUMP A SEAL CLOSED CLG WTR FLOW LO* (A-06 1-4) in alarm

1.4 *PUMP B SEAL CLOSED CLG WTR FLOW LOW* (A-07 6-5) in alarm

R15 1.5 *RBCCW HX OUTLET HDR TEMP HI* (UA-03 1-3) in alarm

1.6 UNIT 2 Only: *DRYWELL CHILLER TRIP* (UA-05 5-10) in alarm

1.7 High temperature alarms on equipment supplied by RBCCW.

R15 1.8 High NSW or CSW header pressure approaching pump shutoff head (approximately 90 psig).

2.0 AUTOMATIC ACTIONS

2.1 **IF** system pressure decreases to 65 psig, **THEN** the standby RBCCW pump will start. ☐

2.2 **IF** non-regenerative heat exchanger outlet temperature increases to greater than 135°F, **THEN** RWCU will isolate. ☐

2.3 **IF** Drywell Equipment Drain Sump **OR** Reactor Building Equipment Drain Tank temperature increases to 180°F, **THEN** recirculation of the affected system initiates. ☐

3.0 OPERATOR ACTIONS

3.1 Immediate Actions

None

3.0 OPERATOR ACTIONS

3.2 Supplementary Actions

NOTE: High drywell pressure and temperature alarms should be anticipated.

3.2.1 **PERFORM** the following as necessary to maintain RBCCW discharge header pressure greater than 60 psig:

1. **START** available RBCCW pumps. ☐
2. **ISOLATE** any identified leaks due to pipe rupture. ☐

3.2.2 **IF** 2D RBCCW Pump is in service to either drywell **THEN PERFORM** the following:

1. **IF** 2D RBCCW Pump is the source of the leakage, **THEN PERFORM** the following:
   a. **SECURE** 2D RBCCW Pump. ☐
   b. **ISOLATE** the unit from the leak. ☐
2. **IF** a loss of heat sink (Unit 1 RB Chiller) has occurred, **THEN ENSURE** 2D RBCCW Pump is tripped. ☐

NOTE: A complete loss of RBCCW is defined as discharge header pressure below 60 psig, high temperature alarms on components supplied by RBCCW, and all available RBCCW Pumps running.

3.2.3 **IF** there is a complete loss of RBCCW, **THEN PERFORM** the following:

1. **TRIP** all RBCCW pumps (including 2D RBCCW Pump if operating on the affected unit). ☐
2. **CLOSE** the following valves:
   - *RBCCW TO DW ISOL VLVS, RCC-V28* ☐
   - *RBCCW TO DW ISOL VLVS, RCC-V52* ☐
3. **TRIP** RWCU pump(s). ☐

Event 3

APP A-6 3-2
2AOP-04.0 Low Core Flow
OP-02 sect. 8.3

OP-02 sect. 5.3

RECIRC FLOW A LIMIT

AUTO ACTIONS

1. If reactor water level is less than 182 inches and either A or B feedwater flow is less than 16.4%, Recirculation Pump A runs back or is limited by Speed Limiter No. 2, which is equivalent to approximately 49% pump speed.
2. If Recirculation Pump A discharge valve is not fully opened or if total feedwater flow is less than 16.4%, Recirculation Pump A runs back or is limited by Speed Limiter No. 1 to a maximum of 34% speed.

CAUSE

1. Recirc Pump A Drive Motor breaker closed and any of the following conditions:
   a. Reactor water level less than 182 inches coincident with A or B feedwater flow less than 16.4%.
   b. Recirculation Pump A discharge valve not full open.
   c. Total feedwater flow less than 16.4%.

OBSERVATIONS

1. FDWR REACTOR LVL HI/LOW (APP A-07 2-2) alarm.
2. Reactor water level indication is less than 182 inches.
3. Feedwater flow indication is less than 16.4%.
4. Recirculation Pump A discharge valve not fully open.
5. Recirc A Runback light is on (Speed Limiter No. 2 only).
6. Recirculation Pump A speed indicates less than the speed demand from the recirculation flow controller.

ACTIONS

1. If reactor water level is low, refer to AOP-23.0, Condensate/ Feedwater System Failure.
2. If the mode switch is in RUN, refer to AOP-04.0.
3. When conditions are stable, refer to OP-02, Reactor Recirculation System, to recover from a scoop tube lock or recirc runback.

DEVICE/SETPOINTS

Rx. Recirc. Aux. Relay B32-K2A	Energized
Rx. Recirc. Aux. Relay B32-K22A	Energized
Flow Switch FW-FS-175	Less than 16.4%
Flow Switch FW-FS-176	Less than 16.4%
Cond. & Feedwater Aux. Relay C32-K618	Less than 16.4%
Cond. & Feedwater Aux. Relay C32-K628	Less than 182 inches
Limit Switch B32-FO31A	Less than 90% open

POSSIBLE PLANT EFFECTS

1. Recirculation M-G Set A speed limited until problem is corrected.

REFERENCES

1. LL-9364 - 87
2. FP-5572 - 3
3. FP-5572 - 5
4. OP-02, Reactor Recirculation System
5. 0AOP-23.0, Condensate/Feedwater System Failure
6. AOP-04.0, Low Core Flow
7. APP A-07 2-2, FDWR REACTOR LVL HI/LOW

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2AOP-04.0

LOW CORE FLOW

REVISION 16

1.0 SYMPTOMS

1.1 Reduction in core flow, reactor recirculation pump motor amps, reactor power, generator output, etc.

1.2 The following alarms may also appear in particular instances:

- *RECIRC FLOW A LIMIT* (A-06 3-2)
- *RECIRC FLOW B LIMIT* (A-07 2-4)
- *SPEED CONTROL A SIGNAL FAIL* (A-06 5-I)
- *SPEED CONTROL B SIGNAL FAILURE* (A-07 4-3)
- *RECIRC M-G A DRIVE MTR TRIP* (A-06 2-3)
- *RECIRC M-G B DRIVE MTR TRIP* (A-07 1-5)
- *OPRM PBA/CDA ALARM* (A-05 5-8)
- *OPRM UPSC TRIP* (A-05 6-8)
- *APRM UPSCALE* (A-06 2-8)

2.0 AUTOMATIC ACTIONS

2.1 Reactor scram if OPRM detects instability when it is enabled

3.0 OPERATOR ACTIONS

3.1 Immediate Actions

3.1.1 **IF** the Reactor Mode Switch is in *RUN* **AND** both reactor recirculation pumps have tripped, **THEN INSERT** a manual reactor scram. ☐

3.1.2 **IF** reactor recirculation pump speed is lowering **AND** a recirculation runback has **NOT** occurred, **THEN PLACE** the affected pump(s) *SCOOP TUBE A(B) LOCK* switch to *TRIP*. ☐

3.0 OPERATOR ACTIONS

3.2 Supplementary Actions

NOTE: Reactor recirculation pump speed mismatch and jet pump loop flows should be maintained within the following limits:

- 20% speed and jet pump loop flows within 10% (maximum indicated difference 7.5 $x10^6$ lbs/hr) with total core flow less than 58 $x10^6$ lbs/hr
- 10% speed and jet pump loop flows within 5% (maximum indicated difference 3.5 $x10^6$ lbs/hr) with total core flow greater than or equal to 58 $x10^6$ lbs/hr

NOTE: Process Computer Point U2CPWTCF, when validated, is the primary indication of total core flow, and should be used for stability region compliance. U2CPWTCF is invalid, U2NSSWDP or Attachment 1 may be used as an alternate indication for total core flow.

NOTE: As the stability region is approached, Process Computer Point B018, Total Core Flow, and recorder 2B21-PDR/FR-R613, located on H12-P603, will read lower than Process Computer Point U2CPWTCF.

NOTE: The following computer screens may be used for reference:

- 802, Power/Flow - OPRM Operable - TLO
- 803, Power/Flow - OPRM Inoperable - TLO
- 804, Power/Flow - OPRM Operable - SLO
- 805, Power/Flow - OPRM Inoperable - SLO
- 806, Power/Flow - OPRM Operable - FWTR
- 807, Power/Flow - OPRM Inoperable - FWTR.

3.2.1 **PERFORM** the following to determine the current operating point on the applicable Power-Flow Map:

1. **IF** reactor recirculation pump speed **AND** jet pump loop flow mismatch is within the allowable limits, **THEN DETERMINE** the current operating point using the applicable Power-Flow Map, as specified by 0ENP-24.0. ☐

3.0 OPERATOR ACTIONS

2. **IF** reactor recirculation pump speed **OR** jet pump loop flow mismatch is **NOT** within the allowable limits **OR** the plant is in single loop operation, **THEN PERFORM** the following:

NOTE: To compensate for signal noise, an average of several core DP readings should be used. Process Computer Point B017 or ERFIS point B21DA014 is the preferred method for obtaining this average.

a. **IF** a valid total core flow from U2CPWTCF **OR** U2NSSWDP is **NOT** available, **THEN DETERMINE** total core flow using Attachment 1. ☐

b. **DETERMINE** the current operating point using the applicable Power-Flow Map, as specified by 0ENP-24.0. ☐

3.2.2 **IF** OPRM System is operable **AND** the current operating point is in the Scram Avoidance Region, **THEN** use one of the following methods to immediately exit the region:

NOTE: When raising core flow with two reactor recirculation pumps operating, pump speeds and jet pump loop flow mismatch should be maintained within the allowable limit.

NOTE: Total core flow should **NOT** exceed 45 x 10^6 lbs/hr (58%) in single loop operation.

CAUTION

If operating in the Scram Avoidance Region, a reactor recirculation pump shall **NOT** be started to exit the region.

- **RAISE** core flow ☐
- **INSERT** control rods in accordance with 0ENP-24.0, Form 2, Immediate Reactor Power Reduction Instructions. ☐

3.0 OPERATOR ACTIONS

R1, R9

3.2.3 **IF** the temperature differential between the coolant within the dome and the bottom head drain can **NOT** be maintained less than 145°F during the performance of this procedure, **THEN INSERT** a manual reactor scram. ☐

3.2.4 **IF** OPRM System is inoperable, **THEN PERFORM** the following:

1. **IF** either of the following conditions are met, **THEN INSERT** a manual reactor scram:

   - The current operating point is in Region A ☐

NOTE: Instability may be indicated by any of the following:

- *OPRM PBA/CDA ALARM* (A-05 5-8) is in alarm
- *OPRM UPSCALE TRIP* (A-05 6-8) is in alarm
- A rise in baseline APRM noise level. SRM power level and period meters may also be oscillating at the same frequency
- LPRM and/or APRM upscale or downscale alarms being received
- Sustained reactor power oscillations with a peak to peak duration of less than 3 seconds.

R1

   - Indications of thermal hydraulic instability exist **AND** the current operating point is in Region B, the 5% Buffer Region, or the OPRM Enabled Region. ☐

3.0 OPERATOR ACTIONS

CAUTION

If operating in Region B, a reactor recirculation pump shall **NOT** be started to exit the region.

2. **IF** the current operating point is in Region B, **THEN** use one of the following methods to exit the region:

NOTE: Total core flow should **NOT** exceed 45 x 10^6 lbs/hr (58%) in single loop operation.

NOTE: When raising core flow with two reactor recirculation pumps operating, pump speeds and jet pump loop flow mismatch should be maintained within the allowable limit.

- **RAISE** core flow ☐
- **INSERT** control rods in accordance with 0ENP-24.0, Form 2, Immediate Reactor Power Reduction Instructions. ☐

NOTE: Operating time in the 5% Buffer Region should be minimized.

3. **IF** the current operating point is in the 5% Buffer Region, **THEN INCREASE** monitoring nuclear instrumentation for thermal hydraulic instability. ☐

3.2.5 **IF** both reactor recirculation pumps have tripped, **THEN PERFORM** the following:

1. **REDUCE** CRD flow to 30 gpm. ☐
2. **IF** the Reactor Mode Switch is **NOT** in *RUN,* **THEN PLACE** the plant in Mode 3 with 12 hours. ☐

3.2.6 **IF** the plant is in single loop operation, **THEN PERFORM** the following:

1. **REDUCE** CRD flow to 30 gpm. ☐

3.0 OPERATOR ACTIONS

NOTE:	Total core flow should be maintained greater than 30.8 x 10^6 lbs/hr to prevent the idle loop from cooling down and possibly exceeding the 100°F per hour cooldown rate.

R9

2. **IF** total core flow is less than 30.8 x 10^6 lbs/hr, **THEN RECORD** the following at 15 minute intervals:

   - Bottom head drain temperature ☐
   - Idle loop temperature ☐

3.2.7 **NOTIFY** the duty Reactor Engineer. ☐

3.2.8 **MONITOR** individual LPRM bar graphs from RBM ODAs or PPC for reactor power oscillations. ☐

R1

3.2.9 **MONITOR** the following for reactor power oscillations:

- APRMs ☐
- SRMs ☐
- SRM period meters ☐

3.2.10 **MONITOR** core thermal parameters **AND ADJUST** the following per the Reactor Engineer's recommendations:

- Rod position ☐
- Reactor recirculation pumps speeds ☐

3.2.11 **MONITOR** plant parameters including the following:

- Off-gas activity ☐
- Stack gas activity ☐
- Reactor recirculation pump variables ☐
- Recirculation loop temperatures ☐

3.0 OPERATOR ACTIONS

CAUTION

Operating time in the 5% Buffer Region should be minimized.

3.2.12 **IF** OPRM System is inoperable, **AND** entry into the 5% Buffer Region is required, **THEN INCREASE** monitoring nuclear instrumentation for thermal hydraulic instability. ☐

CAUTION

Intentional entry into Region B is prohibited.

CAUTION

Following a recirculation runback or scoop tube lockout, the speed demand signal must be nulled to actual pump speed or a flow transient will result when runback or scoop tube is reset.

CAUTION

Manual control of recirculation flow should be reasonably slow to avoid rapid power changes.

3.2.13 **IF** both reactor recirculation pumps are operating, **THEN PERFORM** the following:

1. **IF** OPRM System is inoperable, **THEN ENSURE** Region B is **NOT** entered. ☐
2. **ADJUST** reactor recirculation pump speed as necessary to maintain pump speed and jet pump loop flow mismatch within required limits. ☐
3. **ENSURE** thermal limits are **NOT** violated. ☐

3.0 OPERATOR ACTIONS

3.2.14 **IF** all of the following conditions occur, **THEN DETERMINE** total core flow from U2NSSWDP **OR** Attachment 1 **AND NOTIFY** the Reactor Engineer for computer point substitution:

- The plant is in single loop operation ☐
- Reactor power is greater than or equal to 23% ☐
- Computer point U2CPWTCF is **NOT** available ☐

3.2.15 **CONFIRM** all systems and components are operating within the Precautions and Limitations Section of 2OP-02. ☐

3.2.16 **IF** 2AOP-04.0 entry was due to reactor recirculation pump trip **OR** runback, **THEN NOTIFY** NIT within 5 hours to back up OPRM data for evaluation. ☐

3.2.17 **NOTIFY** Chemistry to sample for iodine within two to six hours following a change of thermal power of more than 15% in one hour. ☐

3.2.18 **IF** entry condition for this procedure was a reactor recirculation pump trip, **THEN PERFORM** the following:

1. **REVIEW** 0GP-14 for applicability. ☐
2. **PERFORM** the following to facilitate recovery from loss of a recirculation loop: ☐

NOTE: An idle reactor recirculation pump should **NOT** be started with the discharge valve open.

a. **CONTINUE** plant operation with the idle reactor recirculation pump discharge open. ☐

b. **MAINTAIN** total core flow between 30.8 x 10^6 lbs/hr (40%) and 45 x 10^6 lbs/hr (58%) to provide adequate backflow through the idle loop. ☐

c. **IF** desired to keep the loops differential temperature less than or equal to 50°F, **THEN RAISE** the operating reactor recirculation pump speed **AND REDUCE** the seal purge flow to a minimum of 3 gpm. ☐

4.0 GENERAL DISCUSSION

Several varieties of recirculation flow system malfunctions can cause a decrease in core coolant flow. The Reactor Recirculation System creates forced circulation of reactor coolant through the core. It is a piping system designed primarily to provide driving flow for the reactor jet pumps which, in turn, provide the coolant flow through the reactor core. The system is comprised of two separate and parallel recirculation loops. The tripping of one recirculation pump will reduce core flow from l00% to approximately 60%. In this case, flow would reverse through the 10 idle jet pump diffusers, and the other 10 jet pumps would continue to function. If both recirculation pumps trip, natural circulation will provide approximately 30% of rated core flow and a gradual reduction in flow is the only result. However, due to core thermal hydraulic instability uncertainties, the reactor must be manually scrammed in response to a dual recirculation pump trip with the reactor mode switch in RUN. Recent problems identified with core flow measurement in single loop operation, and with recirculation pump speeds outside the allowable mismatch, have created the need (under some circumstances) to use core differential pressure to determine entry into the region of thermal hydraulic instability. Core differential pressure was chosen as a means to estimate core flow due to its relationship to core flow. Recirculation pumps will automatically trip on low water level +105" or high pressure 1137 psig.

The OPRM system provides alarms and automatic trips as applicable. If the OPRM System is inoperable, then Tech Specs require an alternate method to detect and suppress thermal hydraulic instability oscillations in accordance with BWR Owners Group Guidelines for Stability Interim Corrective Action, June 6 1994. This requires three stability monitoring regions (Region A - manual scram, Region B - immediate exit, and 5% Buffer).

5.0 REFERENCES

R1 5.1 NEDO-32465-A, Licensing Topical Report, Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applicability GE Nuclear Energy, August 1996.

5.2 Technical Specifications

5.3 2OP-02, Reactor Recirculation System Operating Procedure

R4 5.4 General Electric Service Information Letter No. 251/251, Supplement 1

5.5 General Electric Service Information Letter No. 517

5.6 Core Operating Limits Report (COLR)

5.7 0ENP-24, Reactor Engineering Guidelines

5.8 Off-Site Dose Calculation Manual (ODCM)

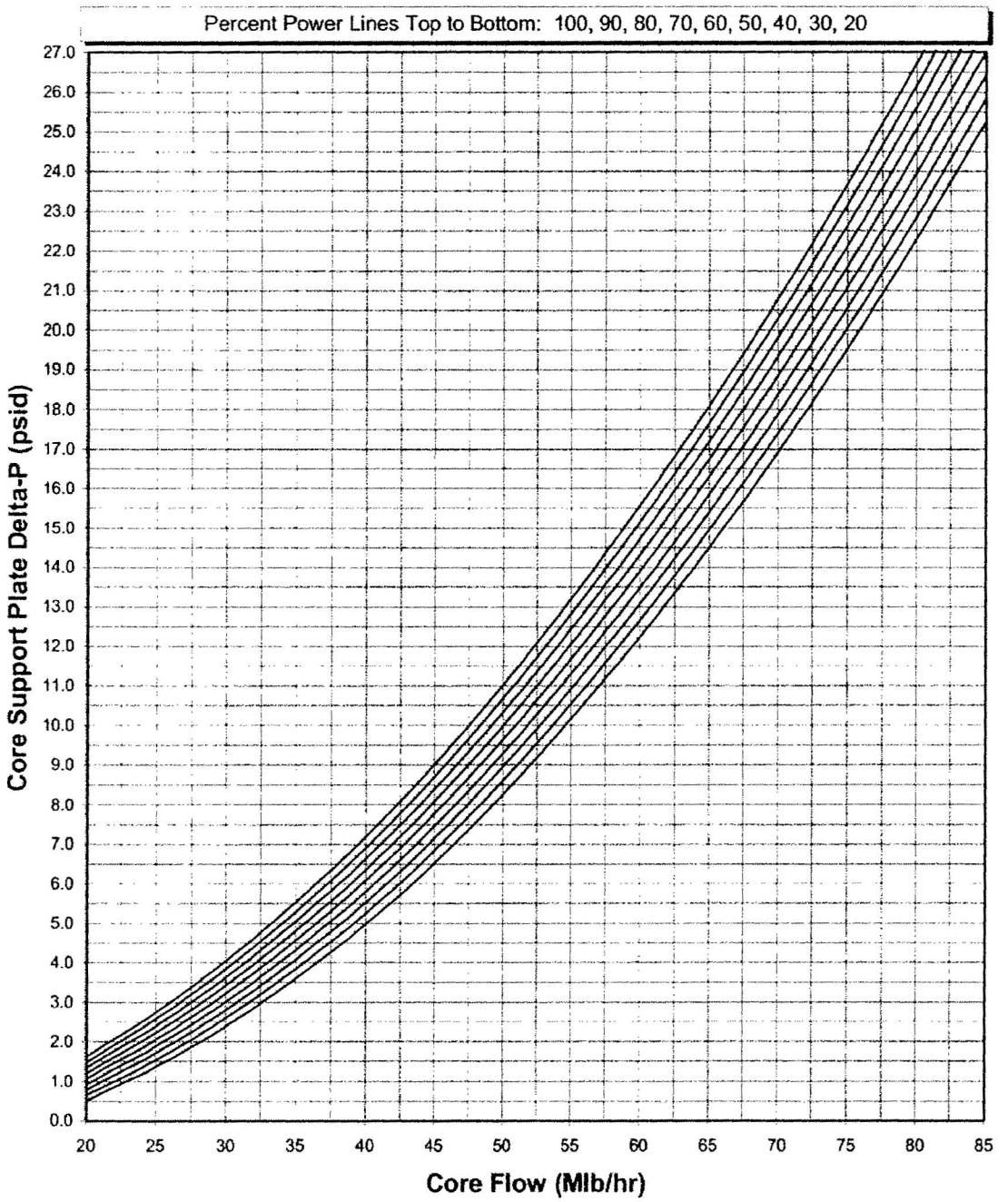
R9 5.9 LER 1-99-002 (Insertion of Manual Reactor Trip Due to Reactor Vessel Bottom Head Stratification)

5.10 0GP-14, Extended Single Recirculation Loop Operation

6.0 ATTACHMENTS

1 Estimated Total Core Flow vs.Core Support Plate Delta-P

Estimated Total Core Flow vs. Core Support Plate Delta P for B2C18



REVISION SUMMARY

Revision 16 incorporates EC 62929 by updating the title of Attachment 1 to reflect B2C18.

Revision 15 adds jet pump loop flow limit to recirc speed mismatch criteria.

Revision 14 incorporates EC 46653 (child 62488) by adding PPC point U2NSSWDP as an alternate for determining total core flow. This revision also adds a caution that an idle recirc pump may not be restarted to exit the scram avoidance region.

Revision 13 incorporates EC 50100 by updating annunciator A-05 5-8 noun name to 'OPRM PDA/CDA ALARM' and EC 56472 by updating the core flow-core d/p figure for the current fuel cycle and update map numbers. Added a step to notify NIT for backing up OPRM data.

Revision 12 – Incorporated EC 55156 which adds computer screens 811 and 812 to Note prior to Step 3.2.1 and corrected nomenclature for screens 806, 807, 808, and 809.

Revision 11– Format changes to meet the requirements of 0AP-005 and Microsoft Word XP. Steps that are not time dependant have been re-ordered to provide an easier transition. Other steps that have common sub-steps have been grouped together. These changes do NOT implement an intent change or a change in procedure methodology. Additional administrative changes classified as "editorial": are bolding action verbs, italicizing components, change of cover page logo, removal of the "bar code" from the cover page, and adding place keeping aids.

Revision 10 incorporates EC 46730 'Power Range Neutron Monitoring', EC 47907 'EPU Implementation' and EC 49331 'B2C16 Reload Core Design (figure 1).

Revision 9 incorporates ESR 00-00260 by updating Figure 1 (Core Flow vs Core Plate Differential Pressure) for cycle B2C15. This revision also deletes confusing wording in a caution and deletes a caution that was duplicated on the same page.

Revision 8 provides additional instructions for obtaining and documenting FCBB to ensure Tech Spec Compliance.

8.3 Recovery from Reactor Recirculation Pump Runback

C
Continuous
Use

8.3.1 Initial Conditions

1. Reactor Recirculation Pump operation was previously in accordance with Section 5.2. ☐

NOTE: Recirculation Pump runback to approximately 49% speed occurs when reactor water level is less than or equal to 182 inches **AND** feedwater flow A or B is less than or equal to 16.4% of rated flow. A Recirculation Pump speed runback to 34% will occur when the Recirculation Pump discharge valve is **NOT** fully open or total feedwater flow is less than 16.4% of the rated flow. Both of these conditions will require a manual reset of the runback.

2. The conditions that caused the runback have cleared. ☐

3. The system operation has stabilized. ☐

CAUTION

R23

If the OPRM system is inoperable, Then operation shall be in accordance with the applicable Power to Flow Map in the COLR with the following restrictions:

- **IF** entry into Region A occurs, **THEN** a manual scram is required.
- **IF** entry into Region B, the 5% Buffer Region, or the OPRM Enabled Region occurs **AND** indications of Thermal Hydraulic Instability exist, a manual scram is required.
- **IF** entry into Region B occurs (intentional entry is **NOT** allowed), **THEN IMMEDIATELY EXIT** by inserting control rods or increasing Recirc flow.
- Entry into the 5% Buffer Region should warrant increased monitoring of reactor instrumentation for signs of Thermal Hydraulic Instability. Time in the 5% Buffer Region should be minimized.

8.3.2 Procedural Steps

CAUTION

The OPRM System monitors LPRMs for indication of thermal hydraulic instability (THI). **WHEN** ≥ 25% power **AND** ≤ 60% recirculation flow, alarms and automatic trips are initiated upon detection of THI. Pump operations shall be within the limits of the applicable Power-Flow Map, as specified in the COLR. Care should be taken to avoid the Scram Avoidance Region.

R23

CAUTION

Following a Recirculation Pump runback, manual control of pump speed must be established prior to resetting the runback or a flow transient can result when the reset runback push button is depressed. The controller can be adjusted to obtain any pump speed below the runback limit. If desired, I&C can assist in adjusting the controller.

1. **ADJUST** the potentiometer on *RECIRC PUMP 2A(B) CONTROL* lowering the speed demand signal until the speed signal shows a slight decrease in pump speed using multiple indicators. ☐

2. **MONITOR** Recirculation Pump speed and be prepared to manually lock out the scoop tube if speed increases rapidly. ☐

3. **RESET** the recirculation runback for Reactor Recirculation Pump A(B) as follows:

   a. **DEPRESS** the *RECIRC RUNBACK RESET* push button for Reactor Recirculation Pump A(B). ☐

   b. **ENSURE** reactor power and flow are stabilized. ☐

4. **ADJUST** flow as directed by the Unit SCO. ☐

5.3 Speed/Power Increases Using the Recirculation Pump A(B) Speed Control

R
Reference
Use

5.3.1 Initial Conditions

1. Reactor Recirculation Pumps in operation in accordance with Section 5.2. ☐

2. Feedwater flow is greater than 16.4% **AND** Recirculation Pump flow limits are cleared. ☐

5.3.2 Procedural Steps

NOTE: Recirculation Pump speed changes are performed when directed by 0GP-04 and 0GP-12. Other operating procedures are used simultaneously with this procedure as directed by 0GP-04, 0GP-12, or the Unit SCO. Speed changes are accomplished by slowly turning the potentiometer clockwise for increases and counterclockwise for decreases.

NOTE: Speed limiters number 1 and 2 must be manually reset prior to increasing pump speed above the respective speed limit setpoint.

NOTE: The following indications should be observed to ensure proper response to increased speed demand from a Recirculation Pump speed controller:
a. Recirculation Pump speed increases.
b. Recirculation loop flow increases.
c. Reactor power increases.

CAUTION

The OPRM System monitors LPRMs for indication of thermal hydraulic instability (THI). **WHEN** $\geq$ 25% power **AND** $\leq$ 60% recirculation flow, alarms and automatic trips are initiated upon detection of THI. Pump operations shall be within the limits of the applicable Power-Flow Map, as specified in the COLR. Care should be taken to avoid the Scram Avoidance Region.

R23

CAUTION

WHEN increasing or decreasing recirculation pump speeds with Recirculation Pump A (B) speed control potentiometer, small changes of 2% to 4% should be made. With core flow less than 58×10^6 lbs/hr, pump speeds are to be maintained within 20% and jet pump loop flows are required within 10% (maximum indicated difference 7.5×10^6 lbs/hr). With core flow greater than or equal to 58×10^6 lbs/hr, pump speeds are to be maintained within 10% and jet pump loop flows are required within 5% (maximum indicated difference 3.5×10^6 lbs/hr).

5.3.2 Procedural Steps

CAUTION

Attempting to increase pump speed past the high speed electrical stops can cause controller saturation and result in large power transients during subsequent reduction in pump speed (OE-7476).

CAUTION

The 2A Reactor Recirc Pump speed controller has exhibited speed spikes of 0.5% to 2.0% (both up and down) predominately in the upper range of operation, resulting in unexpected reactivity changes.

CAUTION

Operation of the Recirc Pumps with greater than approximately 2% speed mismatch at the upper end of the controller range could result in exceeding the normal limit for individual loop flow specified in Section 6 (49,000 gpm). The guidelines provided in this section do **NOT** allow exceeding normal operating limits. If normal operating limits are or will be exceeded, the mismatch must be reduced.

CAUTION

If the OPRM system is inoperable, Then operation shall be in accordance with the applicable Power to Flow Map in the COLR with the following restrictions:

- **IF** entry into Region A occurs, **THEN** a manual scram is required.
- **IF** entry into Region B, the 5% Buffer Region, or the OPRM Enabled Region occurs **AND** indications of Thermal Hydraulic Instability exist, a manual scram is required.
- **IF** entry into Region B occurs (intentional entry is **NOT** allowed), **THEN IMMEDIATELY EXIT** by inserting control rods or increasing Recirc flow.
- Entry into the 5% Buffer Region should warrant increased monitoring of reactor instrumentation for signs of Thermal Hydraulic Instability. Time in the 5% Buffer Region should be minimized.

R23

1. **INCREASE** Recirculation Pump speed in increments as directed by the Unit SCO by slowly turning the *RECIRC PUMP 2A(2B) SPEED CONTROL* potentiometer in the clockwise direction. ☐

Event 5

APP UA-24 1-3

PEN X 49A ELEV 86'-0" AZIMUTH 225°

AUTO ACTIONS

1. The following excess flow check valve for the broken instrument line will close:
   a. B21-IV-2456(X49A-A) - excess flow check valve on Instrument Line B21-7014 for B21-LT-NO26B.

CAUSES

1. Pipe Break in any of the above instrument lines.
2. Circuit malfunction.

OBSERVATIONS

1. Amber line break indicating light for Penetration X49A-A on RTGB Panel XU2 (Control Switch Module RIP-CS-1230) will be on for the broken instrument line.
2. Valve closed indicating light for Penetration X49A-A on RTGB Panel XU2 (Control Switch Module RIP-CS-1230) will be on for the excess flow check valve on the broken instrument line.

ACTIONS

1. Investigate the abnormal condition per 0OI-44.
2. If the cause of the annunciator is an instrument line break or a circuit malfunction is suspected, ensure that a WR/WO is prepared.

DEVICE/SETPOINTS

Excess Flow Check Valve B21-IV-2456 1.5 - 3.0 gpm

POSSIBLE PLANT EFFECTS

1. Release of radioactivity into the secondary containment.
2. Invalid initiation signals and indications from the instruments supplied by the affected instrument line.
3. Excess flow check valve closure may result in a technical specification LCO.

REFERENCES

1. LL-9361 - 23
2. Technical Specification 3.6.1.3
3. 0OI-44, Excess Flow Check Valve Position Indication Evaluation

Event 6

APP UA-45 2-1
APP UA-45 2-2
APP UA-48 5-4

DISCHARGE H_2 CONC HIGH-HIGH

AUTO ACTIONS

NONE

> **NOTE:** DISCHARGE H2 CONC HIGH (UA-45 2-2) causes AOG isolation and bypass to the stack at 2% H_2 concentration.

CAUSES

> **NOTE:** The H_2/O_2 Analyzer takes approximately 145 seconds to complete one analysis cycle on one stream.

1. Hydrogen concentration greater than or equal to 4%.
2. H_2/O_2 Analyzer 2-OG-AIT-4284 Stream 2 H_2 **OR** 2-OG-AIT-4324 Stream 1 H_2 fails high.
3. Improper operation of off-gas train.
4. Recombiner low temperature ≤ 250°F.
5. Circuit malfunction
6. Low HWC SJAE oxygen injection flow (with HWC System in service).

OBSERVATIONS

1. 2-OG-AR-6089 Pen 1 **OR** Pen 2 indicates greater than or equal to 4% hydrogen concentration.
2. OG-TIB-4322 indicates increasing off-gas temperature.
3. DISCHARGE H2 CONC HIGH (UA-45 2-2).
4. PRE-HEATER COND LEVEL HIGH (UA-45 6-2).
5. HWC SJAE O_2 Injection Isolation Valve to SJAE Train B, 2-HWCO-SV-5749, indicates open on 2H12-P603 (if HWC System is in service).
6. HWC SYSTEM TROUBLE (A-04 6-3).

ACTIONS

1. **ENSURE** AOG isolated (XCV-148, 147, 143, 142, and 141 closed) and bypassed (HCV-102 open).
2. **IF** malfunction of the HWC system is the cause for high hydrogen concentration, **THEN TRIP** the system using the HWC Trip/Reset Control Switch, HWCH-CS-5721, on Control Room Panel 2H12-P603.
3. **IF** annunciator caused by malfunction of Off-Gas train component, **THEN PLACE** Train A in Full Load **AND SECURE** Train B in accordance with 2OP-30.
4. **IF** necessary, **THEN REDUCE** unit load.
5. **CHECK** H_2/O_2 Analyzer 2-OG-AIT-4284 Stream 2 H_2 **AND** 2-OG-AIT-4324 Stream 1 H_2 for proper operation.

ACTIONS (Conitnued)

NOTE:	High hydrogen concentrations in the off-gas train present the possibility of a fire or explosion if the concentration reaches 4% by volume. Low recombiner temperatures can indicate that the recombiner catalyst has become wet due to a failure of the preheater or its drain system rendering the recombiner essentially useless.

6. **CHECK** recombiner temperature on TR-4320 points 1, 2, and 3 on XU-80:
   a. **ENSURE** Recombiner Strip Heater, OG-EH-4307 and OG-EH-4308, control switches on XU-80 are in AUTO.
   b. **IF** recombiner temperature is less than 550°F on OG-TIB-4307 and OG-TIB-4308, **THEN ENSURE** recombiner strip heaters are on.
   c. **IF** catalyst is wet, **THEN PLACE** preheat mode in service.
7. **CHECK** the preheater drain system for proper operation:
   a. **CHECK** UA-45 (6-2) for a high level in the preheater (greater than 36 inches).
   b. **ENSURE** Preheater B Condensate Drain Bypass Valve, 2-0G-SV-4305, open as necessary to drain the Preheater to minimum levels.
8. **PURGE** the off-gas train of hydrogen in accordance with 2OP-30 in order to eliminate the possibility of a fire or explosion in the off-gas piping.
9. **MONITOR** the following indications of a fire in the piping:
   a. Condenser off-gas flow recorder, OG-FR-4323, indication very unstable.
   b. Higher than normal temperatures of the off-gas downstream of the After Condenser, (UA-45 3-3).
   c. Higher than normal recombiner outlet temperatures, (UA-45 3-1)
10. **WHEN** conditions permit, **THEN PLACE** warmup mode in service.
11. **REFER TO** ODCM Sections 7.3.2 Function 5, 7.3.10, and 7.3.12 for Compensatory Measures.

DEVICE/SETPOINTS

1. H_2/O_2 Analyzer 2-OG-AIT-4284 Stream 2 H_2 4% H_2 by volume
2. H_2/O_2 Analyzer 2-OG-AIT-4324 Stream 1 H_2 4% H_2 by volume

POSSIBLE PLANT EFFECTS

1. Increase in plant radiation release rate due to AOG isolation.
2. Fire or explosion hazard due to increased hydrogen content.

REFERENCES

1. F-3941-14
2. F-3942 - 14
3. LL-9371 - 6
4. F-2148
5. F-2166
6. APP-UA-52 (1-7), SJAE O_2 INJECTION FLOW LOW
7. ODCM Sections 7.3.2 Function 5, 7.3.10, and 7.3.12
8. 2OP-30, Condenser Air Removal and Off-Gas Recombiner System

DISCHARGE H2 CONC HIGH

AUTO ACTIONS

1. Isolation to AOG System. (Closes XCV-148, 147, 142, 143, 141.)
2. Open AOG-HCV-102.

CAUSES

NOTE:	The H_2/O_2 Analyzer takes approximately 145 seconds to complete one analysis cycle on one stream.

1. Hydrogen concentration greater than or equal to 2%.
2. Improper operation of off-gas train.
3. Recombiner failure (temperature ≤ 250°F).
4. Low HWC SJAE oxygen injection flow (while HWC System in service).
5. Preheater drain system failure.
6. Circuit malfunction.
7. H_2/O_2 Analyzer 2-OG-AIT-4284 Stream 2 H_2 **OR** 2-OG-AIT-4324 Stream 1 H_2 fails high.

OBSERVATIONS

1. 2-OG-AR-6089 Pen 1 or Pen 2 indicates greater than or equal to 2% hydrogen.
2. PRE-HEATER COND LEVEL HIGH (UA-45 6-2).
3. HWC SJAE O_2 Injection Isolation Valve to SJAE Train B, 2-HWCO-SV-5749, indicates open on 2H12-P603 (if HWC System is in service).
4. HWC SYSTEM TROUBLE (A-04 6-3).

ACTIONS

1. **ENSURE** AOG System isolated and Bypass Valve, AOG-HCV-102, open.
2. **IF** malfunction of the HWC system is the cause for high hydrogen concentration, **THEN TRIP** the system using the HWC Trip/Reset Control Switch, HWCH-CS-5721, on Control Room Panel 2H12-P603.
3. **ENSURE** off-gas train proper operation (i.e., valve alignment, temperatures and pressures).
4. **CHECK** H_2/O_2 analyzer 2-OG-AIT-4284 Stream 2 H_2 and/or 2-OG-AIT-4324 Stream 1 H_2 for proper operation.

ACTIONS (Continued)

NOTE: High hydrogen concentrations in the off-gas train present the possibility of a fire or explosion if the concentration reaches 4% by volume. Low recombiner temperatures can indicate that the recombiner catalyst has become wet due to a failure of the preheater and/or its drain system rendering the recombiner essentially useless.

5. **ENSURE** recombiner temperature on TR-4280 points 1, 2, and 3 on XU-80.
   a. **CHECK** Recombiner Strip Heater, OG-EH-4307 and OG-EH-4308, control switches on XU-80 are in AUTO.
   b. **IF** recombiner temperature on OG-TIB-4307 and OG-TIB-4308 is less than 550°F, **THEN ENSURE** recombiner strip heaters on.
   c. **IF** catalyst is wet, **THEN PLACE** the preheat mode in service.
6. **CHECK** the preheater drain system for proper operation:
   a. **CHECK** UA-45 (6-2) for a high level in the preheater (greater than 36 inches).
   b. **ENSURE** Preheater B Condensate Drain Bypass Valve 2-OG-SV-4305, open as necessary to drain the preheater to minimum levels.
7. **IF** hydrogen continues to increase, **THEN PREPARE** to place Train A to Full Load and secure Train B in accordance with 2OP-30.
8. **IF** necessary, **THEN REDUCE** unit load.
9. **REFER TO** ODCM Sections 7.3.2 Function 5 and 7.3.10 for Compensatory Measures.

DEVICE/SETPOINTS

1. H_2/O_2 Analyzer 2-OG-AIT-4284 Stream 2 H_2 — 2% H_2 by volume
2. H_2/O_2 Analyzer 2-OG-AIT-4324 Stream 1 H_2 — 2% H_2 by volume

POSSIBLE PLANT EFFECTS

1. Increased plant radiation release rate due to bypass of AOG system.
2. Possibility of a fire or hydrogen explosion in the off-gas train if 4% hydrogen concentration is attained.

REFERENCES

1. F-3941 - 14
2. F-3942 - 14
3. F-2148
4. F-2166
5. ODCM Sections 7.3.2 Function 5 and 7.3.10
6. APP UA-52, (1-7) SJAE O2 INJECTION FLOW LOW
7. 2OP-30, Condenser Air Removal and Off-Gas Recombiner System

AOG SYSTEM BYPASS

AUTO ACTIONS

1. *AOG SYSTEM BYPASS VALVE, AOG-HCV-102,* opens

CAUSES

1. High hydrogen - Train A
2. High hydrogen - Train B
3. High-high cooler condenser condensate level
4. High-high off-gas flow
5. Circuit failure

OBSERVATIONS

1. *DISCHARGE H_2 CONCENTRAT'N HIGH* (UA-44 2-2) alarm
2. *DISCHARGE H_2 CONCENTRAT'N HIGH* (UA-45 2-2) alarm
3. *AOG SYSTEM OUT FLW/TEMP HIGH* (UA-48 5-3) alarm
4. *COOLER CNDSR DRN LEVEL HI AOG SYS BYP* (UA-48 1-4) alarm
5. High condensate level indicated on *2-AOG-LI-007* on local AOG control panel
6. High off-gas flow indicated on *2-AOG-FI-035* on local AOG control panel or *UR-157* on RTGB XU-80

ACTIONS

1. **IF** high hydrogen, Train A, **THEN PERFORM** *DISCHARGE H2 CONCENTRAT'N HIGH* (UA-44 2-2).
2. **IF** high hydrogen, Train B, **THEN PERFORM** *DISCHARGE H2 CONCENTRAT'N HIGH* (UA-45 2-2).
3. **IF** cooler condenser condensate level is high-high, **THEN PERFORM**, *COOLER CNDSR DRN LEVEL HI AOG SYS BYP* (UA-48 1-4).
4. **IF** off-gas flow is high-high, **THEN PERFORM** *AOG SYSTEM OUT FLW/ TEMP HIGH* (UA-48 5-3).
5. **IF** an equipment or circuit malfunction exists, **THEN ENSURE** a WO is submitted.

DEVICE/SETPOINTS

H_2/O_2 Analyzer OG-AIT-4284 Stream 1 H_2	2% H_2 by volume
H_2/O_2 Analyzer OG-AIT-4284 Stream 2 H2	2% H_2 by volume
H_2/O_2 Analyzer OG-AIT-4324 Stream 1 H2	2% H_2 by volume
H_2/O_2 Analyzer OG-AIT-4324 Stream 2 H2	2% H_2 by volume
AOG-LSHH-007C	95%
AOG-FSHH-035	150 scfm

POSSIBLE PLANT EFFECTS

1. Bypassing the AOG System may cause high stack gas radiation and may result in ODCM Required Compensatory Measures.
2. **IF** *AOG SYSTEM BYPASS VALVE, AOG-HCV-102,* is open, **THEN** indicated off-gas flow rate will **NOT** be accurate.

REFERENCES

1. LL-3293, sheet 7
2. LL-03308, sheet 1
3. F-2313
4. ODCM 7.3.10
5. 2APP UA-44 2-2, *DISCHARGE H_2 CONCENTRAT'N HIGH*
6. 2APP UA-45 2-2, *DISCHARGE H_2 CONCENTRAT'N HIGH*
7. 2APP UA-48 5-3, *AOG SYSTEM OUT FLW/TEMP HIGH*
8. 2APP UA-48 1-4, *COOLER CNDSR DRN LEVEL HI AOG SYS BYP*