PSEG NUCLEAR L.L.C.
SALEM/OPERATIONS

S2.OP-AB.RC-0002(Q) - REV. 8

HIGH ACTIVITY IN REACTOR COOLANT SYSTEM

- Biennial Review Performed: Yes ___ No ✓
- Change Package(s) and Affected Document Numbers incorporated into this revision: None
- OTSC(s) incorporated into this revision: None
- OPEX(s) incorporated into this revision: None

REVISION SUMMARY:

1. The following changes are related to the same order. These changes are considered editorial in nature as described in AD-AA-101. **(70097885)**

- 3.3 - Added procedure number, NC.CH-RC.ZZ-2525(Q), Gamma Spectroscopy Analysis, for reference to the procedure that is used by Chemistry to sample the RCS for activity levels.

- 3.19 - Added procedure number, CY-AP-130-330, E-BAR, for reference to the procedure that is used by Chemistry to recalculate E-Bar.

- Technical Basis Document, Section 1, 1.2 - Added procedure numbers entered in 3.3 and 3.19 to procedure reference section.

2. 3.9, 3.20, Attachment 1, Technical Basis Document Section 2.0 - Updated to incorporate current administrative standards for personnel titles. This change is considered editorial in nature as described in AD-AA-101.

IMPLEMENTATION REQUIREMENTS Ef fective Date: **02/09/10**

- None

HIGH ACTIVITY IN REACTOR COOLANT SYSTEM

1.0 **ENTRY CONDITIONS** DATE:_____ TIME:_____

1.1 Any indication of high or rising activity in Reactor Coolant System with the Plant in Mode 1 through 5.

- ♦ R31, Letdown Line-Failed Fuel Process Rad Monitor, alarm or rising trend.
- ♦ Notification from Chemistry Department that sample analysis of RCS activity has exceeded administrative limits specified in NF-AA-400, Fuel Reliability.

2.0 **IMMEDIATE ACTIONS**

None

3.0 **SUBSEQUENT ACTIONS**

___ 3.1 **INITIATE** Attachment 1, Continuous Action Summary.

3.2 Has RCS been sampled to confirm high RCS activity?

___ NO ___ YES ——> **GO TO** Step 3.4 ____ Time

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___ 3.3 **REQUEST** Shift Chemistry Technician initiate confirmatory sample analysis of suspected rise in RCS activity. (Gamma Scan IAW NC.CH-RC.ZZ-2525(Q), Gamma Spectroscopy Analysis Using CAS.)

___ 3.4 **REQUEST** Radiation Protection initiate surveys to determine if any plant areas have abnormal radiation levels due to rise in RCS activity.

___ 3.5 **NOTIFY** Primary NEOs that high activity in RCS is suspected.

___ 3.6 **WAIT** at this point until results are reported from Chemistry on confirmatory sample analysis.

3.7 Do results of confirmatory sample analysis confirm high or increasing activity in RCS?

___ YES ___ NO ——> **GO TO** Section 4.0 ____ Time

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___ 3.8 **NOTIFY** SM/CRS to refer to the following:

- ♦ Technical Specifications
- ♦ Event Classification Guide
- ♦ NF-AA-400, Fuel Reliability

___ 3.9 **CONTINUE** procedure AND **NOTIFY** the following that elevated RCS activity exists which will require team evaluation to develop recommended course of action per NF-AA-400, Fuel Reliability:

- ♦ Shift Operations Manager / Salem Operations Director
- ♦ Reactor Engineering Department
- ♦ Operational Chemistry Supervisor

3.10 Is reactor coolant activity below Technical Specification Limits?

___ YES ___ NO ——> **GO TO** Step 3.18 ____ Time

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___ 3.11 **EVALUATE**, with assistance from Shift Chemistry Technician, maximizing Letdown flow and CVCS demineralizer lineup for maximum RCS purification.

___ 3.12 IF a change in demineralizer lineup is necessary to support additional flow, THEN **PERFORM** applicable steps IAW S2.OP-SO.CVC-0012(Q), CVCS Demineralizer-Normal Operation.

3.13 Is a Centrifugal Charging Pump running?

___ NO ___ YES ——> **GO TO** Step 3.15 ____ Time

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___ 3.14 **TRANSFER** to a Centrifugal Charging Pump as follows:

___ 3.14.1 **ENSURE** Charging Master Flow Controller in AUTO.

___ 3.14.2 **CLOSE** 2CV55, CHARGING FLOW CONTROL VALVE.

___ 3.14.3 **START** 21 OR 22 Charging Pump.

___ 3.14.4 **PLACE** 23 Charging Pump Speed Controller in MANUAL.

___ 3.14.5 While lowering 23 Charging Pump speed to minimum,
ADJUST 2CV55 to maintain desired flow.

___ 3.14.6 When 23 Charging Pump is at minimum flow,
STOP 23 Charging Pump.

___ 3.14.7 **ADJUST** 2CV55 to control Pressurizer level.

___ 3.14.8 **PLACE** 2CV55 in AUTO OR remain in MANUAL,
until directed by the SM/CRS.

___ 3.14.9 **ENSURE** RCP Seal Injection flows are 6-12 gpm per pump,
NOT to exceed 40 gpm total RCP Seal Injection Flow.

___ 3.15 Raise Letdown flow to maximum as follows:

___ 3.15.1 Take manual control of 2CV18, NON-REGEN HX OUTLET VALVE,
AND **CONTROL** Letdown pressure at ≈300 psig,
while performing the following:

___ A. **OPEN** one 75 gpm orifice:

- ♦ 2CV4 (75 GPM ORIFICE)
- ♦ 2CV5 (75 GPM ORIFICE)

___ B. **OPEN** 2CV3, 45 GPM ORIFICE

___ C. **ENSURE** Letdown flow through Mix Bed is ≤130 gpm.

___ 3.15.2 **RETURN** 2CV18 to AUTO

3.16 Is Reactor critical?

___ YES ___ NO ——> **GO TO** Step 3.18 ____ Time

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___ 3.17 **REQUEST** Reactor Engineering Department perform Core Flux Map to assure that rod patterns and flux shapes are within normal values.

___ 3.18 **REQUEST** Shift Chemistry Technician initiate hourly sample of RCS gamma isotopic to perform dose equivalent Iodine analysis for trending until notified by Operations that samples are no longer required.

NOTE

Should coolant activity exceeds a predetermined value below Technical Specification limits, UFSAR 9.3.5.3 will require new E-Bar calculation.

___ 3.19 **NOTIFY** Operational Chemistry Supervisor that E-Bar recalculation may be required per UFSAR 9.3.5.3. (IAW CY-AP-130-330, E-BAR)

___ 3.20 **PERFORM** one of the following as conditions dictate:

- ♦ RCS activity trend indicates equilibrium reached and at acceptable level.
- ♦ Technical Specification Action Statement requires Reactor shutdown and cooldown.
- ♦ Shift Operations Manager / Salem Operations Director directs Reactor shutdown or plant cooldown.

4.0 COMPLETION AND REVIEW

___ 4.1 **CIRCLE** Entry Condition in Section 1.0,
OR **EXPLAIN** Entry Condition in Comments section of Attachment 2.0.

___ 4.2 **COMPLETE** Attachment 2, Sections 1.0 and 2.0,
AND **FORWARD** this procedure to SM/CRS for review and approval.

___ 4.3 SM/CRS **PERFORM** the following:

___ 4.3.1 **REVIEW** this procedure with Attachment 1
for completeness and accuracy.

___ 4.3.2 **COMPLETE** Attachment 2, Section 3.0.

___ 4.3.3 **FORWARD** completed procedure to Operations Staff.

END OF PROCEDURE

ATTACHMENT 1
(Page 1 of 1)

CONTINUOUS ACTION SUMMARY

___ 1.0 **IF AT ANY TIME**, Reactor Coolant activity is rising and approaching,
OR exceeded Technical Specification limits,
OR as directed by Station Management,
THEN as applicable:

- **REDUCE** Reactor Power IAW S2.OP-IO.ZZ-0004(Q), Power Operation, to attempt to establish equilibrium.
- **COMMENCE** Power Reduction IAW S2.OP-AB.LOAD-0001(Q), Rapid Load Reduction AND COOLDOWN plant to T_{avg} <500°F.
- **REDUCE** Reactor Power IAW S2.OP-IO.ZZ-0004(Q), Power Operation, at rate and to power level specified by Shift Operations Manager / Salem Operations Director.

ATTACHMENT 2
(Page 1 of 2)

COMPLETION SIGN-OFF SHEET

1.0 **COMMENTS**

(Include procedure deficiencies and corrective actions. Attach additional pages as necessary.)

ATTACHMENT 2
(Page 2 of 2)

COMPLETION SIGN-OFF SHEET

2.0 **SIGNATURES**

Print	Initials	Signature	Date

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

This procedure with Attachment 1 and 2 is reviewed for completeness and accuracy. Entry conditions and all deficiencies, including corrective actions, are clearly recorded in the COMMENTS Section of this attachment.

Signature: _____ Date:_____
SM/CRS

HIGH ACTIVITY IN REACTOR COOLANT SYSTEM
TECHNICAL BASIS DOCUMENT

1.0 REFERENCES

1.1 Technical Documents

- Salem Generating Station Updated Safety Analysis Report:
  - Section 9.3.5.3, Failed Fuel Detection System
  - Section 11.4.2.2, Process Radiation Monitoring System Channel Description
- Salem Generating Station Technical Specifications - Unit 2:

  3.4.9, RCS Specific Activity
- Configuration Baseline Documentation:

  None

1.2 Procedures

- CY-AP-130-330, E-BAR
- NC.CH-RC.ZZ-2525(Q), Gamma Spectroscopy Analysis Using CAS
- NF-AA-400, Fuel Reliability
- S2.OP-AB.LOAD-0001(Q), Rapid Load Reduction
- S2.OP-SO.CVC-0012, CVCS Demineralizers - Normal Operations
- S2.OP-IO.ZZ-0004(Q), Power Operations

1.3 Others

- DCP 80029150 And 80029155, CVCS Cross-Tie
- DCP 80065299, Restoration of the PDP to Normal Operation

2.0 DISCUSSION

2.1 This procedure provides direction for appropriate response to high activity in the RCS during all operating modes except Mode 6, Refueling. This procedure attempts to reduce high activity to acceptable levels before a Reactor shutdown is required.

This discussion provides the reasoning used in the development of the procedure and is not intended to provide additional direction.

2.2 Entry Conditions - Entry into this procedure may be from rising level or alarm on the letdown failed fuel monitor (2R31 alarm on OHA A-6 or 2RPI-A7), or when informed by Chemistry that higher than normal RCS activity exists.

This procedure is not written for, and the Technical Specification does not apply to, the unique conditions that exist in Mode 6. High RCS activity that originates in Mode 6 constitutes a fuel handling incident and should be addressed by that procedure. It is assumed that the procedure user knows this and will refer to the Fuel Handling Incident AB procedure when the Unit is in Mode 6.

2.3 Immediate Actions - There are no immediate actions for high RCS activity.

2.4 Subsequent Actions - Step 3.1 initiates action in the Continuous Action Summary to direct the Operator to reduce Reactor Power IF AT ANY TIME management or the operating license requires it. Action is included to comply with UFSAR 9.3.5.3 which requires a power level reduction if activity is rising and approaching a T/S limit. Several items that need to be considered in determining whether a power level reduction is required are:

1) Power must be held constant in order to perform the flux map.

2) Activity levels - may be only slightly elevated, have already stabilized, or may be rapidly rising.

3) Grid load demand/alternate power availability.

4) ALARA considerations

Step 3.2 asks whether or not a confirmatory sample has been obtained by Chemistry. If it has, the Operator is directed to Step 3.4. If not, Step 3.3 requests Chemistry to initiate a confirmatory sample analysis.

Step 3.4 requests Radiation Protection perform surveys to identify Plant areas that may have a higher radiation level due to the high activity. For low RCS activity, Plant radiation levels would not appreciably rise, but for high activity, prompt identification and subsequent notification of Plant personnel is ensured.

Step 3.5 notifies the Primary NEOs that high activity in the RCS is suspected.

At this point, Step 3.6 directs the Operator to wait for the results of the confirmatory sample analysis. For very low activity levels, this will take approximately one hour. For higher levels, an estimated activity should be obtained in approximately 15 minutes. For situations where this procedure was initiated as a result of a Chemistry sample, then there is no requirement to wait.

When the results of the confirmatory sample analysis are available, Step 3.7 asks the Operator what the results of the analysis indicate. If activity levels are not elevated, the Operator is directed to Section 4.0 and the procedure is subsequently exited. This path could be due to a spurious radiation monitor 2R31A alarm.

Step 3.8 directs the Operator to notify the SM/CRS to refer to Technical Specifications, the Event Classification Guide, and the Fuel Integrity Program procedure.

At this point, Step 3.9 directs the Operator to commence notifying the Shift Operations Manager / Salem Operations Director, Reactor Engineering, and the Operational Chemistry Supervisor of the situation. Notifications are initiated after the confirmatory sample analysis so that individuals are not notified for a spurious alarm. The step is written to "continue with the procedure" so there will be no delay (such as on backshifts and weekends) in performing the remaining steps of the procedure. This group will collectively determine the course of action for the Plant. Unless a reactor shutdown is required by T/S or an acceptable equilibrium RCS activity level is reached.

Step 3.10 ask if activity level is below Technical Specification limits. When RCS activity is elevated but below Technical Specification limits, operators can initiate action to maximize RCS purification.

Step 3.11 through 3.15 direct the Operator to initiate maximum RCS purification flow as required by UFSAR 9.3.5.3. The Nuclear Technician-Chemistry is consulted to determine optimum demineralizer lineup. The best demineralizer lineup will depend on resin depletion factor and load history. The flowrate will depend on the demineralizer lineup and use of the centrifugal charging pump to maximize flow. This step was put at this point in the procedure to expedite cleanup for a valid elevated RCS activity.

Step 3.16 asks the Operator if the Reactor is critical. If it is, Step 3.17 directs the Operator to request Reactor Engineering perform a Core Flux Map (as required by UFSAR 9.3.5.3). This will determine core flux distribution and may aid in determining the cause of the high activity. In an extreme case, it may require a prompt shutdown due to a core flux profile abnormality. If the Reactor is not critical, the Operator is directed to go to Step 3.18.

Once a confirmatory sample analysis indicates a rise in activity, there are many actions that need to be initiated. The intent of the procedure is to initiate Steps 3.7 through 3.17 as soon as possible. Step 3.9 directs the Operator to commence notifying certain individuals. When the Reactor is critical, Step 3.17 requests Reactor Engineering perform a Core Flux Map. Even though the Salem Operations Director may not have been located and notified at this point in the procedure, actions are being taken to comply with the UFSAR.

If activity levels are elevated, Step 3.18 requests the Shift Chemistry Technician perform hourly analysis of the RCS activity for trending. For activity levels that are below T/S limits, UFSAR 9.3.5.3 only requires daily sampling until trends are clearly established. For activity levels that exceed T/S limits, only four hour samples are required. However, with as little as six hours of continued operation allowed, more frequent samples will provide better trending data for Nuclear Fuels and Reactor Engineering. Hourly intervals were selected since that is the maximum length of time that may be required to complete an analysis.

A note at Step 3.19 is included as a reminder to Chemistry Department that E-Bar may need recalculating per UFSAR 9.3.5.3. Step 3.19 directs the Operator to inform the Operational Chemistry Supervisor of this possible requirement. Guidance for determining if E-Bar recalculation is required is provided in Chemistry Department procedures. The types and relative amounts of nuclides in the coolant will change after a fuel failure. If activated corrosion products were the primary contributor to the original value of E-Bar, the redistribution, (with fission fragments now contributing a larger proportion of the nuclides), will cause E-Bar to change. Therefore, E-Bar will probably need to be recalculated. The determination of whether or not to recalculate E-Bar, is the responsibility of the Chemistry Department. If E-Bar is recalculated, and if it changes, the 100/E-Bar limit of the T/S will also change. The limit may go up or down based on the newly calculated E-Bar. Therefore, the actual RCS activity level may now be above or below the new limit, which may or may not be different than the previously determined status.

If RCS activity exceeds the current E-Bar T/S limit, then T/S Action Statement time limits will be followed. The Plant will have been shutdown long before the new E-Bar is calculated as it must be sent to an offsite facility to analyze for Strontium-90.
Should the new E-Bar show that RCS activity no longer exceeds T/S limits, conservative action would have been taken. Therefore, this procedure is written to always use the E-Bar value at the time that entry into the procedure was directed.

If RCS activity did not exceed the original 100/E-Bar T/S limit, then time limits never were imposed. The Reactor is either shut down or remains critical. In either case the procedure is completed. If the new calculation of E-Bar shows that RCS activity now exceeds the 100/E-Bar T/S limit and the Reactor is shut down, no additional actions are required. If the Reactor is critical, then the T/S Action Statement shall be entered and appropriate actions shall be followed. Additional conservative actions may have already been taken by this procedure. If the procedure has been completed, it may be recommenced due to meeting the entry conditions.

Step 3.20 directs the Operator to wait until one of three conditions occur;
1) RCS activity returns to, or reaches equilibrium at, an acceptable level;
2) T/S Action Statement requires a Reactor shutdown;
3) Shift Operations Manager / Salem Operations Director, directs a Reactor shutdown.

If RCS activity has returned to an acceptable level, then the procedure allows the Shift Operations Manager / Salem Operations Director to determine the course of action. If a Reactor shutdown is not required, then the procedure is exited.

If a T/S limit requires or the Shift Operations Manager / Salem Operations Director directs a Reactor shutdown/cooldown, it will be performed IAW applicable IOPs and Reactor Engineering Department recommended cooldown rates. If the Reactor is already shut down & cooled down, then no action will be required. In either case, the procedure is exited.

END OF DOCUMENT