PSEG NUCLEAR L.L.C.
SALEM/OPERATIONS

SC.OP-AB.ZZ-0004(Q) - REV. 0

EARTHQUAKE

A. Biennial Review Performed: Yes___ No___ NA ✓
B. Change Packages and affected document numbers incorporated into this revision: None
C. OTSC incorporated into this revision: None

REVISION SUMMARY:

This is a new Earthquake Abnormal Operating Procedure that incorporates guidance contained within the following documents:

- EPRI NP-6695, Guidelines for Nuclear Plant Response to an Earthquake
- Regulatory Guide 1.12 - Nuclear Power Plant Instrumentation for Earthquakes
- Regulatory Guide 1.166 - Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Postearthquake Actions
- Regulatory Guide 1.167 - Restart of a Nuclear Power Plant Shutdown by a Seismic Event

The absence of clear, detailed and rational procedures for nuclear plant response to an earthquake may result in unnecessary shutdown of an operating nuclear power plant and a prolonged delay in plant startup. The guidelines contained within this procedure are intended to minimize costs related to a shutdown of the Salem Nuclear Units following an earthquake, while assuring safety in operation.
[70038189-0040]

IMPLEMENTATION REQUIREMENTS

Effective Date 12/30/04

None

APPROVED: _____ For
Operations Manager - Salem

12/23/04
Date

EARTHQUAKE

1.0 ENTRY CONDITIONS

DATE:_____ TIME:_____

1.1 Vibratory ground motion is felt on site and recognized as such by a consensus of the Control Room Operating Crew

1.2 Annunciation of **Unit 1** OHA A-37, SEIS RCDR SYS ACT

2.0 IMMEDIATE ACTIONS

2.1 None

3.0 SUBSEQUENT ACTIONS

NOTE

- It is expected that the Operating Crew responds to all alarms and immediate effects of the seismic event IAW the applicable ABs, EOPs and OPs. Operator response to maintain the plant in a safe stable condition takes precedence over this procedure.
- If vibratory ground motion exceeding that of the Operating Basis Earthquake (>0.1g) occurs, shutdown of the Salem Nuclear Power Plants will be required IAW Appendix A to 10CFR100. Prior to resuming operations, the licensee will be required to demonstrate to the Commission that no functional damage has occurred to those features necessary for continued operation without undue risk to the health and safety of the public. The guidance contained within this procedure implements the requirements of Appendix A to 10CFR100.
- If vibratory ground motion does **NOT** exceed that of the Operating Basis Earthquake (<0.1g), and no significant damage is found during Operator Walkdown inspections, then shutdown of the Salem Nuclear Plants is **NOT** considered necessary.
- A vibratory ground motion of ≤0.2g is within the Design Basis Earthquake (DBE) limitation for Systems, Structures and Components (SSCs) important to safety at the Salem Nuclear Plant.

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

NOTE

- Indication of either of the following conditions constitutes declaration of an UNUSUAL EVENT in accordance with the ECG:
  - A seismic event is felt by personnel within the Protected Area.
  - Valid Actuation of the Seismic Trigger (>0.01g) has occurred as verified by the SMA-3 Event Indicator (flag) being **WHITE** as indicated on the Salem Seismic Recorder.
- Indication of either of the above specified conditions in conjunction with a Valid Actuation of the Hope Creek Seismic Switch (>0.1g), constitutes declaration of an ALERT in accordance with the ECG.
- If the OSC is activated (optional for UNUSUAL EVENT and required for ALERT), then all in-plant repairs, evaluation activities, and damage assessments should be coordinated through the Operations Support Center (OSC). The Shift Manager (SM) should ensure that the OSC Coordinator and/or OSC Operations Supervisor implement appropriate portions of this procedure, as required.

___ 3.2 IF a seismic event is felt by personnel within the Protected Area, THEN **NOTIFY** the Shift Manager (SM) to refer to the Event Classification Guide.

NOTE

- The EVENT ALARM is illuminated when there is a seismic event (>0.01g), and the system is recording.
- The EVENT INDICATOR indicates an seismic event has been recorded. The indicator is normally **BLACK**, however, indicates **WHITE** after an event has been recorded.
- The setpoint for the Seismic Monitoring System starter unit is 0.01g. The Seismic Event Recorder will record a seismic event anytime the event is greater than 0.01g, and will continue to record for an additional 10 seconds. The Seismic Monitoring System can record a maximum of 30 minutes of data.

___ 3.3 **MONITOR** the Seismic Recorder to determine if a valid seismic event has occurred.

___ 3.4 IF a valid seismic event has NOT occurred,
THEN **PERFORM** the following:

___ A. **INITIATE** a notification for Maintenance Controls to investigate the cause of alarm and initiate corrective action.

___ B. **GO TO** Section 4.0, Completion and Review.

NOTE

- Indication of either of the following conditions constitutes declaration of an UNUSUAL EVENT in accordance with the ECG:
  - A seismic event is felt by personnel within the Protected Area.
  - Valid Actuation of the Seismic Trigger (>0.01g) has occurred as verified by the SMA-3 Event Indicator (flag) being **WHITE** as indicated on the Salem Seismic Recorder.
- Indication of either of the above specified conditions in conjunction with a Valid Actuation of the Hope Creek Seismic Switch (>0.1g), constitutes declaration of an ALERT in accordance with the ECG.
- If the OSC is activated (optional for UNUSUAL EVENT and required for ALERT), then all in-plant repairs, evaluation activities, and damage assessments should be coordinated through the Operations Support Center (OSC). The Shift Manager (SM) should ensure that the OSC Coordinator and/or OSC Operations Supervisor implement appropriate portions of this procedure, as required.

___ 3.5 If **NOT** already performed,
NOTIFY the Shift Manager (SM) to refer to the Event Classification Guide.

NOTE

- Performing a quick overall diagnosis of plant operation will assist in determining if conditions exist that require urgent attention.
- Steps 3.6 through 3.10 may be performed simultaneously, or in any order.

___ 3.6 **PERFORM** the following to provide a quick overall diagnosis of plant operation, as applicable:

___ • **MONITOR** BEACON for any indicated changes in Reactor Core Operating Parameters (e.g., AFD, Reactor Power, etc.).

___ • **MONITOR** Safety Parameter Display System (SPDS) and Critical Function Status Trees (CFSTs).

___ • **CHECK** Radiation Monitors associated with the Reactor Coolant System for indication of changes.

___ • **CHECK** Reactor Coolant System for indication of changes in with regard to flow, temperature and pressure.

___ • **CHECK** the Metal Impact Monitoring System (MIMS) for any indication of metallic sounds on the system audio speaker.

___ • **NOTIFY** Chemistry to sample the Reactor Coolant System and Secondary System for activity and chemistry, and to compare sample results to sample results obtained prior to the seismic event.

___ • **MONITOR** for ANY indications of pipe ruptures or flooding on site (e.g., fire mains, circulating water, condensate, etc.)

___ 3.7 IF Unit 1 or 2 is currently in a Refueling Outage or Outage condition, THEN **PERFORM** the following:

___ A. **NOTIFY** the Refueling SRO to suspend Core Alterations pending further evaluation of the seismic event, as applicable.

___ B. **EVALUATE** the following conditions, as applicable:

___ • Steam Generator Nozzle Dams - Failure of the Steam Generator Nozzle Dams may result in significant leakage from the Reactor Cavity. Refer to S1(2).OP-AB.FUEL-0002(Q), Loss of Refueling Cavity or Spent Fuel Pool Level, for loss of Refueling Cavity level.

___ • Reactor Cavity Seal - Failure of the Reactor Cavity Seal may result in significant leakage from the Reactor Cavity. Refer to S1(2).OP-AB.FUEL-0002(Q), Loss of Refueling Cavity or Spent Fuel Pool Level, for loss of Refueling Cavity level.

___ • Partial Loaded Reactor Core - Fuel assemblies may topple, and at worst case may cause damage to irradiated fuel. Refer to S1(2).OP-AB.FUEL-0001(Q), Fuel Handling Incident, in the event damage occurs to irradiated fuel.

CAUTION

Maintenance Controls Technicians should not attempt to readjust or recalibrate the Seismic Monitoring System until seismic data is downloaded, as this would defeat attempts to obtain post-event calibration data. Additionally, extreme caution should be utilized by Maintenance Controls during data collection and subsequent handling of data to prevent inadvertent loss of the recorded seismic data.

NOTE

- Each of the Seismic Monitoring Instruments actuated during a seismic event shall be restored to operable status within 24 hours, and a channel calibration performed within 5 days following the seismic event IAW UFSAR Section 7.7.2.12.
- Seismic Monitoring System channel calibration may require reducing reactor power and/or shutdown of **Unit 1** in order for personnel to access Seismic Monitoring equipment located within the inner bioshield (ALARA).

___ 3.8 **CONTACT** Maintenance Controls to have qualified personnel perform Attachment 7, Seismic Monitoring System Data Retrieval and Calibration (Maintenance Controls).

___ 3.9 IF it is desired to obtain updated information regarding the seismic event, THEN **CONTACT** the National Earthquake Center in Denver, Colorado utilizing one of the following contact methods:

- phone @ 303-273-8500
- e-mail @ http://earthquake.usgs.gov
- e-mail @ http://www.neic.cr.usgs.gov/
- e-mail @ http://www.mgs.md.gov/esic/seisnet/

NOTE

- Several relays in the Cardox System may be inadvertently tripped during a seismic event. These relays provide interlocks, but will not initiate a CO_2 discharge. There are nine relays per Unit (one for each DG FOST Room, one for each DG Room, one for both DFO Pump Rooms, one for each Switchgear Room, and one for the Electrical Penetration Room).
- Of immediate concern are the relays for the Diesel Generator Room. If one of these relays trip,the respective DG Area and Control Area Exhaust Fans will be tripped. These relays must be either reset or bypassed to restart the respective fans.
- The relays for each Diesel Generator Room are located in the panel below the Cardox Actuation Light.

___ 3.10 IF ANY Unit 1 or Unit 2 DG Room or Control Area Exhaust Fan has tripped, THEN **RESTORE** ventilation as follows:

___ A. IF it is desired to restore Diesel Generator Area Ventilation immediately, THEN **START** the affected fans IAW the following procedures, as applicable:

- S1.OP-SO.DGV-0001(Q), Diesel Generator Area Ventilation Operation.
- S2.OP-SO.DGV-0001(Q), Diesel Generator Area Ventilation Operation.

___ B. **NOTIFY** Fire Department personnel to reset the affected Cardox System Relays.

___ C. When affected Cardox System Relays are reset, **RETURN** the Diesel Generator Area Ventilation to normal operation IAW the following procedures, as applicable:

- S1.OP-SO.DGV-0001(Q), Diesel Generator Area Ventilation Operation.
- S2.OP-SO.DGV-0001(Q), Diesel Generator Area Ventilation Operation.

NOTE

Plant walkdowns are to be completed in a timely manner following indication of an earthquake. Regulatory Guide 1.166 requires the decision to shut down the plant be made within 8 hours of the event. EPRI recommends Operator Walkdowns be completed within 4 to 8 hours of the event.

___ 3.11 **COMMENCE** Operator Walkdowns IAW Attachment 2, Operator Walkdowns.

NOTE

- Conditions may exist following a seismic event which exceeds the Operating Basis Earthquake (OBE) such that a discontinuance of power generation could result in loss of critical lifeline functions and potential loss of life. If the System Operator requests that the Salem Stations remain on line, and shutdown of the plants is required as a result of exceeding the OBE limitation, then Licensing and the NRC should be immediately consulted with to propose a plan for the timely, safe shutdown of the Salem Nuclear Plants IAW Regulatory Guide 1.166. **The need for power generation does NOT take precedence over plant Operating Procedures, or requirements of the Operating License.**
- Load reduction rates of ≥5%/minute are **NOT** recommended in Step 3.12.
- For the purpose of Step 3.12, "significant damage" is considered to be damage which has the potential to adversely affect the operability, functionality, or reliability of systems, structures or components (SSCs) required for the safe operation, including shutdown to Mode 5 (Cold Shutdown), of the nuclear power plant.

___ 3.12 IF vibratory ground motion exceeded that of the Operating Basis Earthquake (>0.1g) OR significant damage was identified during performance of the Operator Walkdowns, THEN:

___ A. IF the Reactor is in Mode 1 or 2, THEN:

___ 1. **PERFORM** Pre-Shutdown Inspections IAW Attachment 3, Pre-Shutdown Inspections.

___ 2. **COMMENCE** a normal plant shutdown IAW S1(2).OP-IO.ZZ-0004(Q), Power Operation or S1(2).OP-IO.ZZ-0005(Q), Minimum Load to Hot Standby, as applicable.

___ B. **PERFORM** Post-Shutdown Inspections and Tests IAW Attachment 4, Post-Shutdown Inspections and Tests.

NOTE

For the purpose of Step 3.13, "significant damage" is considered to be damage which has the potential to adversely affect the operability, functionality, or reliability of systems, structures or components (SSCs) required for the safe operation, including shutdown to Mode 5 (Cold Shutdown), of the nuclear power plant.

___ 3.13 IF vibratory ground motion did NOT exceed that of the Operating Basis Earthquake (<0.1g)
AND no significant damage was identified during performance of the Operator Walkdowns,
THEN:

___ A. IF the Reactor is in Mode 1 or 2,
THEN **CONTINUE** plant operation.

___ B. IF the Reactor Tripped as a result of the seismic event,
THEN:

___ 1. **PERFORM** a Post-Trip Review IAW SC.OP-DG.ZZ-0101, Salem Post-Trip Data Collection Guidelines.

___ 2. **COMMENCE** a Unit Startup IAW applicable IOPs.

___ 3.14 **GO TO** Section 4.0, Completion and Review.

4.0 COMPLETION AND REVIEW

___ 4.1 **CIRCLE** Entry Condition number in Section 1.0,
OR **EXPLAIN** Entry Condition in Comments Section of Attachment 8, Completion Sign-Off Sheet.

___ 4.2 **COMPLETE** Attachment 8, Sections 1.0 and 2.0,
AND **FORWARD** this procedure to SM/CRS for review and approval.

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

___ A. **REVIEW** this procedure with Attachments 1 through 8 for completeness and accuracy.

___ B. **COMPLETE** Attachment 8, Section 3.0.

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

END OF PROCEDURE

ATTACHMENT 1
(Page 1 of 1)

CONTINUOUS ACTION SUMMARY

1.0 IF AT ANY TIME the Reactor trips,
THEN **PERFORM** the following:

___ • **GO TO** 1(2)-EOP-TRIP-1, Reactor Trip or Safety Injection, as applicable.

___ • When conditions permit, **CONTINUE** with this procedure.

2.0 IF AT ANY TIME damage has occurred to any Structure, System or Component (SSC) that is required to safely shutdown the plant following an OBE or seismic event,
CONTACT Licensing to communicate a plan for the timely repair and/or shutdown of the Salem Nuclear Plant(s) to the Nuclear Regulatory Commission (NRC).

3.0 **REFER TO** Appendix C, Additional Considerations Following a Seismic Event,
for additional considerations following a seismic event.

ATTACHMENT 2
(Page 1 of 3)

OPERATOR WALKDOWNS

NOTE

- The purpose of Operator Walkdowns is to determine the effect of the Earthquake or seismic event on plant structures, and to provide additional guidance with regard to additional required inspections.
- As Plant Operators are the most knowledgeable with regard to their duty stations, they should take the lead in monitoring of their assigned areas. Additionally, Plant Operators may be assisted by available on-site personnel (e.g., Engineering, Maintenance, Quality Assurance, etc.) in performance of the Operator Walkdowns.
- High radiation areas, the containment building, and other areas with limited access need not be included in the initial walkdown inspections unless plant personnel have reason to suspect that there may be damage in these areas.
- If the OSC is activated (optional for UNUSUAL EVENT and required for ALERT), then all in-plant repairs, evaluation activities, and damage assessments should be coordinated through the Operations Support Center (OSC). The Shift Manager (SM) should ensure that the OSC Coordinator and/or OSC Operations Supervisor implement appropriate portions of this procedure, as required.
- Plant walkdowns are to be completed in a timely manner following indication of an earthquake. Regulatory Guide 1.166 requires the decision to shut down the plant be made within 8 hours of the event. EPRI recommends Operator Walkdowns be completed within 4 to 8 hours of the event.
- The plant itself, not damage from nearby communities, or data from remote locations, is the best indicator of the severity of the seismic event at the plant site.

___ 1.0 The Operator Walkdown Teams should be briefed on the following:

- Who to report the results of the Operator Walkdown. If the OSC is activated, the recommended point of contact would be the OSC Coordinator who will ensure the Shift Manager (SM) is briefed.
- When the Operator Walkdown teams are to report results. Based on the severity of the identified issue, consider a phone call or page when issues are discovered, followed by a face to face turnover. If the OSC is activated report results as directed in the OSC Team briefing obtained prior to team dispatch.

(continued on next page)

ATTACHMENT 2
(Page 2 of 3)

OPERATOR WALKDOWNS

1.0 (continued)

- Results of Operator Walkdowns are to be documented on Attachment 2, Section 3.0. Ensure adequate copies of Inspection Results/Comments page for each Walkdown Team.

- Use extreme caution when investigating potentially damaged equipment.

2.0 In addition to the General Tour Criteria, the following additional inspection criteria should be considered during performance of the Operator Walkdowns:

- Check for leaks in piping systems, especially at flanged or threaded connections, and branch lines.

- Check for damage to low pressure tanks (i.e., tanks vented to atmosphere), particularly ground or floor mounted vertical storage tanks (e.g., RWST, PWST, AFWST).

- Check fluid levels in tanks. Level switches may have activated due to sloshing of the respective fluid.

- Check for high vibration, high bearing temperatures, and unusual noise in rotating equipment (e.g., pumps and fans)

- Check the condition of equipment anchorage. Check for deformation or loosening of anchor bolts, pullout or shear of anchor bolts, rocking, sliding, or misalignment of equipment.

- Check for major cracks or spalling in reinforced concrete structures. **It should be noted that hair line cracks in reinforced concrete structures, even if caused by the earthquake or seismic event, are NOT considered significant unless they are large enough to result in the yielding of rebar.**

- Check for distortion of electrical and control cabinets including a brief visual check of internally mounted components such as relays and circuit breakers.

- Check for portable equipment which may have shifted, jeopardizing equipment that may be required for safe shutdown of the plant.

- Consider the use a digital camera to document identified issues.

- Consider utilizing the detailed inspection Plant Equipment Checks identified in Appendix A for additional guidance.

ATTACHMENT 2
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OPERATOR WALKDOWNS

3.0 **INSPECTION RESULTS/COMMENTS:**

Responsible Area:	Walkdown Team Members:
Date/Time:	

Inspection Results/Comments:

ATTACHMENT 3
(Page 1 of 1)

PRE-SHUTDOWN INSPECTIONS

NOTE

- In order to ascertain possible fuel and reactor internal damage, the following checks should be prior to the plant shutdown being initiated.
- Conditions may exist following a seismic event which exceeds the OBE such that a discontinuance of power generation could result in loss of critical lifeline functions and potential loss of life. If the System Operator requests that the Salem Stations remain on line, and shutdown of the plants is required as a result of exceeding the OBE limitation, then Licensing and the NRC should be immediately consulted with to propose a plan for the timely, safe shutdown of the Salem Nuclear Plants IAW Regulatory Guide 1.166. **The need for power generation does NOT take precedence over plant Operating Procedures, or requirements of the Operating License.**

___ 1.0 **CONTACT** the Electric System Operator (ESO) to determine the availability of off-site power, and the impact of removing the Salem and Hope Creek Nuclear Plants from operation, as applicable.

___ 2.0 **PERFORM** S1(2).OP-ST.RCS-0001(Q), Reactivity Control System Rod Control Assemblies, to demonstrate operability of the Control Rod Drive Mechanisms.

___ 3.0 **MONITOR** BEACON for any indicated changes in Reactor Core Operating Parameters (e.g., AFD, Reactor Power, etc.).

___ 4.0 **MONITOR** Safety Parameter Display System (SPDS) and Critical Function Status Trees (CFSTs).

___ 5.0 **CHECK** Radiation Monitors associated with the Reactor Coolant System for indication of changes.

___ 6.0 **CHECK** Reactor Coolant System for indication of changes in with regard to flow, temperature and pressure.

___ 7.0 **CHECK** the Metal Impact Monitoring System (MIMS) for any indication of changes in the noise signature.

___ 8.0 **NOTIFY** Chemistry to sample the Reactor Coolant System and Secondary System for activity and chemistry, and to compare sample results to sample results obtained prior to the seismic event.

ATTACHMENT 4
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POST-SHUTDOWN INSPECTIONS AND TESTS

NOTE

Post-shutdown inspections and tests are those needed to determine the physical condition of the nuclear plant and its readiness to resume operation after being shutdown due to a seismic event. These inspections and tests are designed to provide a graded response commensurate with the type and severity of damage found. The recommended post-shutdown actions consist of the following:

a) Focused inspections by experienced engineers of a pre-selected sample of representative structures and equipment. The purpose of these inspections is to determine the need for expanded inspections and tests, and to provide data to establish the severity of the earthquake.

b) Determination of EPRI damage intensity as delineated in Appendix B. Using the information collected during focused inspections, and other observations, a group of experienced engineers will establish the EPRI damage intensity utilizing the established guidelines. Identification of the EPRI damage intensity will determine the course of actions to restart the plant.

c) If damage to the pre-selected sample of safety-related equipment and structures is found, or the EPRI damage intensity is determined to exceed a specific level, then expanded inspections are to be performed. These expanded inspections by qualified engineers are undertaken to further define evaluate potential damage to all components, systems, and structures required for operation. This information is used to (1) establish corrective actions and repairs that may be required to return the plant to a state of operational readiness, and (2) identify the need and timing for additional analytical and other engineering evaluations which may be prudent to assure the long term integrity and reliability of the plant.

d) Surveillance tests as required by Technical Specifications to verify the operability of equipment needed for plant operation.

___ 1.0 **COMMENCE** detailed visual inspections IAW with Attachment 6, Visual Inspection of Equipment and Structures Following a Earthquake.

___ 2.0 IF damage to Safety Related Equipment has occurred, THEN **GO TO** Step 9.0 of this attachment.

ATTACHMENT 4
(Page 2 of 4)

POST-SHUTDOWN INSPECTIONS AND TESTS

___ 3.0 IF damage to Seismic Monitoring Equipment has occurred, THEN **GO TO** Step 8.0 of this attachment.

___ 4.0 **PERFORM** required surveillance testing to support Reactor Startup.

___ 5.0 **PERFORM** Unit Startup IAW applicable IOPs.

NOTE

For EPRI Damage Intensities of two (2) or less, Long-Term Evaluations IAW Attachment 5 are **NOT** required to be completed prior to performing the Unit Startup, as delineated in Section 3.3 of EPRI NP-6695. If the EPRI Damage Intensity exceeds two (2), plant restart will depend on successful completion of the Long-Term Evaluations.

___ 6.0 **REQUEST** Engineering to perform Attachment 5, Long Term Evaluations.

___ 7.0 **PERFORM** the following:

___ ♦ **RETURN TO** procedure step in effect.

___ ♦ **GO TO** Section 4.0, Completion and Review.

NOTE

Appendix B should be referred to for a description of EPRI Damage Levels.

___ 8.0 IF damage is less than an EPRI Damage Intensity level of one (1), THEN **RETURN TO** Step 4.0 of this attachment.

___ 9.0 **COMMENCE** performance of Expanded Plant Inspections (i.e., expand the scope of the Appendix A inspections, for example perform valve strokes on a larger population of valves than was checked initially).

ATTACHMENT 4
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POST-SHUTDOWN INSPECTIONS AND TESTS

___ 10.0 IF damage is equal to or greater than an EPRI Damage Intensity level of three (3), THEN **GO TO** Step 20.0 of this attachment.

___ 11.0 IF damage is equal to an EPRI Damage Intensity level of two (2), THEN **GO TO** Step 16.0 of this attachment.

___ 12.0 IF damage is equal to an EPRI Damage Intensity level of one (1), THEN **GO TO** Step 13.0 of this attachment.

NOTE

Steps 13.0 and 14.0 are utilized when damage is determined to be equal to an EPRI Damage Intensity level of one (1).

___ 13.0 **INITIATE** corrective action to repair damage sustained as a result of the seismic event.

___ 14.0 **PERFORM** surveillance testing to demonstrate operability of repaired equipment, as required.

___ 15.0 **RETURN TO** Step 4.0 of this attachment.

NOTE

Steps 16.0 through 18.0 are utilized when damage is determined to be equal to an EPRI Damage Intensity level of two (2).

___ 16.0 **INITIATE** corrective action to repair damage sustained as a result of the seismic event.

___ 17.0 **PERFORM** surveillance testing of repaired equipment to demonstrate operability.

___ 18.0 **PERFORM** Containment Leak Rate Testing as directed by Engineering Programs.

___ 19.0 **RETURN TO** Step 4.0 of this attachment.

ATTACHMENT 4
(Page 4 of 4)

POST-SHUTDOWN INSPECTIONS AND TESTS

NOTE

Steps 20.0 through 29.0 are utilized when damage is determined to be equal to, or greater than an EPRI Damage Intensity level of three (3).

___ 20.0 **PLACE** the Reactor in the Defueled Mode IAW applicable IOPs.

___ 21.0 **PERFORM** inspection of Nuclear Fuel and Reactor Internals.

___ 22.0 **INITIATE** corrective action to repair damage sustained as a result of the seismic event.

___ 23.0 **PERFORM** surveillance testing to demonstrate operability of repaired equipment, as required.

___ 24.0 **PERFORM** Containment Leak Rate Testing as directed by Engineering Programs.

___ 25.0 **REQUEST** Engineering to perform Attachment 5, Long Term Evaluations.

___ 26.0 **PERFORM** surveillance testing to demonstrate operability of repaired equipment, as required.

___ 27.0 **PERFORM** required surveillance testing to support Reactor Startup.

___ 28.0 **PERFORM** Unit Startup IAW applicable IOPs.

___ 29.0 **PERFORM** the following:

___ ♦ **RETURN TO** procedure step in effect.

___ ♦ **GO TO** Section 4.0, Completion and Review.

ATTACHMENT 5
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LONG-TERM EVALUATIONS

NOTE

- Long-term evaluations are those engineering activities needed to assess the potential for hidden damage that may have occurred to safety-related equipment and structured which might degrade their long-term reliability. Long-term evaluations are not required if plant shutdown is not warranted (e.g., the OBE criteria is not exceeded).
- For EPRI Damage Intensities of 2 or less, these evaluations may be performed after the plant is restarted. If the EPRI Damage Intensity exceeds 2, plant restart will depend on successful completion of this attachment.

___ 1.0 **PERFORM** calculation of seismic loads (i.e., floor response spectra based on actual ground motion records from the seismic event.

___ 2.0 **COMPARE** calculated seismic loads with design loads at locations of interest.

___ 3.0 **PERFORM** seismic re-evaluation of equipment and structures where calculated loads may have exceeded design loads.

___ 4.0 **REFER TO** EPRI NP-6695, Guidelines for Nuclear Plant Response to an Earthquake regarding additional guidance for Long-Term Evaluation.

ATTACHMENT 6
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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

NOTE

- Attachment 6 provides a pre-selected sample of representative structures and equipment required to be visually inspected. The purpose of these inspections is to determine the need for expanded inspections and tests, and to provide required data to establish the EPRI Damage Intensity.
- The Operations Support Center (OSC) with support of the Technical Support Center (TSC) will generally be responsible for coordinating performance of Attachment 6, Sections 4.0 through 9.0, and maintaining the inspection records.

___ 1.0 **ENSURE** the assigned Walkdown Teams are briefed on the following:

- Clear expectation of the plant areas the team is expected to walkdown.
- A brief description of what equipment is expected to be walked down (i.e., walkdown all Safety Related Equipment in the assigned area).
- A brief discussion concerning the extent of the walkdown (i.e., included with the valve checks in Appendix A is a requirement to stroke valves in both directions. A possible exception to this would be to only perform valve strokes if there appears to be damage to the valve actuator.
- Proper turnover of information is critical to ensure that issues are communicated to station management, and that all areas of the plant are adequately walked down.
- Refer to Appendix A for a list of equipment to be checked.
- Refer to Appendix B for a definition of the EPRI Seismic Damage Scale.
- Results of the Walkdown/Inspections are to be documented on Section 3.0 of this attachment.

ATTACHMENT 6
(Page 2 of 21)

VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

2.0 Sections 4.0 through 9.0 of this attachment are intended to be utilized by the Operations Support Center (OSC) to provide a tracking mechanism for performance of the detailed walkdowns. Additional guidance for the individual responsible maintaining inspection records is as follows:

- In the "Instructions" column list scope of walkdown (i.e., what parts of Appendix A you want the team to accomplish). Based on the skill of the team, additional teams may be required.

- If a follow up walkdown is required, state the reason why, and any specific personnel that might be required for the follow-up assessment (e.g., Seismic Engineer required for seismic evaluation).

- If an Inspection Team is not being sent to a specific area, list the reason why. For example, no inspection team sent to CVCS HUT due to area being High Radiation Area (HRA) and no indicated damage to CVCS HUT. This should be additionally noted in the Comments Section.

- As available staffing resources increase, consider appointing a specific person to track each duty station area (i.e., Unit 1 Primary Area, Unit 2 Primary Area, etc.) similar to how Implementation Teams are structured during an Outage. It should be anticipated that these inspections will take several days to complete.

ATTACHMENT 6
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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

3.0 **INSPECTION RESULTS/COMMENTS:**

Responsible Area: _____	Walkdown Team Members: _____
Date/Time: _____	

Inspection Results/Comments: _____

ATTACHMENT 6
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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

4.0 UNIT 1 PRIMARY AREA

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
100'Aux Bldg	Halon Hallway						
	Chemistry Lab						
	Main Hallway						
	Primary Sample Room						
	BA Evap Room						
	Demin Valve Alley						
	BAT Pump Area						
	Hallway to Hot Shop						
	Hot Shop Area						
	Hot Shop Mezzanine						
	Waste Evap Room						
100' & 122' EDG Area	1A DG Room						
	1B DG Room						
	1C DG Room						
	DG Common Control Area						

ATTACHMENT 6
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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

4.0 **UNIT 1 PRIMARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
Mechanical Penetration Area	100' Area						
	100' Stairway to 130'						
	78' Area						
	SW Valve Rooms						
	BIT Room						
	Containment APD Area						
FHB Area	130'Area						
	100' Area						
	84' Area						
122' Aux Bldg	BAST Area						
	VCT Area						
	ABV Area						
	CR HVAC Area						

ATTACHMENT 6
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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

4.0 **UNIT 1 PRIMARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
84' Aux Bldg	Spray Add Tank Area						
	11-13 Chg Pump Area						
	Chg Valve Platform						
	CS Pump Area						
	DG FOST Area						
	FO Transfer Pump Area						
	AFW Pump Area						
	Seal Water HX Room						
	Letdown HX Room						
	84' Hallway						
	12/13 CC Pump Area						
	11 CC Pump Area						
	SI Pump Area						
	SFP Hx Area						

ATTACHMENT 6
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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

4.0 **UNIT 1 PRIMARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
64' Aux Bldg	Laundry Tank Area						
	CVCS MT Area						
	WHUT Area						
	WG Comp Area						
	Gas Decay Tank Area						
	CVCS HUT Area						
	RAP Tank Pump Area						
55' Aux Bldg	General Area						
	Aux Sump Tank Area						
45' Aux Bldg	11 RHR Pump Area						
	12 RHR Pump Area						
64' Switchgear	4160 V Bus Area						
	1C 125 VDC Batt						
	ASDS Inverter						

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VISUAL INSPECTION OF EQUIPMENT
AND STRUCTURES FOLLOWING A EARTHQUAKE

4.0 **UNIT 1 PRIMARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
84' Switchgear	84' Hallway						
	460 V Bus Area						
	DC Bus Area						
100' Relay Room	Relay Room Area						
	11/12 Ess Cont Inverter						
	1A VIB Inverter						
	1B VIB Inverter						
	1C VIB Inverter						
	1D VIB Inverter						
	1A 125 VDC Batt						
	1B 125 VDC Batt						
	1A 28 VDC Batt						
	1B 28 VDC Batt						
Penetration Area	Chiller Area						
	Inner Pen Area						
	78' Electrical Area						

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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

5.0 UNIT 1 SECONDARY AREA

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
88' Turbine Bldg	Raw Water Storage Basin						
	Demin Plant Area						
	Circ Water Outlet Area						
	Circ Water Inlet Area						
	LO Storage Tank Area						
	Hot Water Tank Area						
	Heater Drain Pump Area						
	Condensate Pump Area						
100' Turbine Bldg	TAC Hx and Pump Area						
	Demin Plant Area						
	Generator Duct Work						
	Cond Pump Area						
	Heater Drain Pump Area						
	Circ Water Outlet Area						
	Circ Water Inlet Area						

ATTACHMENT 6
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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

5.0 **UNIT 1 SECONDARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
100' Turbine Bldg (continued)	HD Tank and Mezz Area						
	Chem Add Tanks/Pumps						
	4160 V Bus Area						
	230 V MCC Area						
	Stm Gen Feed Pump Area						
	SAC and Dryer Area						
120' Turbine Bldg	NH3 Tank Area						
	Main Turb LO Area						
	Stator Cooling Skid						
	BF13/19/40 Area						
	West Side Dump Valves						
	West Side of Condenser						
	East Side Dump Valves						
	Low Press FW Htr Area						

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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

5.0 **UNIT 1 SECONDARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
Turbine Deck	Turbine Crane						
	High Press FW Htr Area						
	East MSR Area						
	West MSR Area						
	HP Turbine Area						
	11/12/13 LP Turb Area						
	Generator Area						
	Aux Bldg Roof Area						

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VISUAL INSPECTION OF EQUIPMENT
AND STRUCTURES FOLLOWING A EARTHQUAKE

6.0 UNIT 2 PRIMARY AREA

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
100'Aux Bldg	Halon Hallway						
	Main Hallway						
	PASS Room						
	Count Room						
	BA Evap Room						
	Demin Valve Alley						
	BAT Pump Area						
	Solid Rad Waste Area						
100' & 122' EDG Area	2A DG Room						
	2B DG Room						
	2C DG Room						
	DG Common Control Area						

ATTACHMENT 6
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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

6.0 **UNIT 2 PRIMARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
Mechanical Penetration Area	100' Area						
	100' Stairway to 130'						
	78' Area						
	SW Valve Rooms						
	BIT Room						
	Containment APD Area						
FHB Area	130'Area						
	100' Area						
	84' Area						
122' Aux Bldg	BAST Area						
	VCT Area						
	ABV Area						
	CR HVAC Area						

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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

6.0 **UNIT 2 PRIMARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
84' Aux Bldg	Spray Add Tank Area						
	21-23 Chg Pump Area						
	Chg Valve Platform						
	CS Pump Area						
	DG FOST Area						
	FO Transfer Pump Area						
	AFW Pump Area						
	Seal Water HX Room						
	Letdown HX Room						
	84' Hallway						
	22/23 CC Pump Area						
	21 CC Pump Area						
	SI Pump Area						
	SFP Hx Area						

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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

6.0 **UNIT 2 PRIMARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
	CVCS MT Area						
	WHUT Area						
	WG Comp Area						
	Gas Decay Tank Area						
	CVCS HUT Area						
	RAP Tank Pump Area						
55' Aux Bldg	General Area						
	Aux Sump Tank Area						
45' Aux Bldg	21 RHR Pump Area						
	22 RHR Pump Area						
64' Switchgear	4160 V Bus Area						
	2C 125 VDC Batt						
	ASDS Inverter						

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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

6.0 **UNIT 2 PRIMARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
84' Switchgear	84' Hallway						
	460 V Bus Area						
	DC Bus Area						
100' Relay Room	Relay Room Area						
	21/22 Ess Cont Inverter						
	2A VIB Inverter						
	2B VIB Inverter						
	2C VIB Inverter						
	2D VIB Inverter						
	2A 125 VDC Batt						
	2B 125 VDC Batt						
	2A 28 VDC Batt						
	2B 28 VDC Batt						
Penetration Area	Chiller Area						
	Inner Pen Area						
	78' Electrical Area						

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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

7.0 UNIT 2 SECONDARY AREA

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
88' Turbine Bldg	Circ Water Outlet Area						
	Circ Water Inlet Area						
	LO Storage Tank Area						
	Heater Drain Pump Area						
	Condensate Pump Area						
100' Turbine Bldg	TAC Hx and Pump Area						
	Generator Duct Work						
	Cond Pump Area						
	Heater Drain Pump Area						
	Circ Water Outlet Area						
	Circ Water Inlet Area						

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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

7.0 **UNIT 2 SECONDARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
100' Turbine Bldg (continued)	HD Tank and Mezz Area						
	Chem Add Tanks/Pumps						
	4160 V Bus Area						
	230 V MCC Area						
	Stm Gen Feed Pump Area						
	CA Dryer Area						
	Stator Cooling Skid						
120' Turbine Hall	NH3 Tank Area						
	Main Turb LO Area						
	BF13/19/40 Area						
	West Side Dump Valves						
	West Side of Condenser						
	East Side Dump Valves						
	Low Press FW Htr Area						

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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

7.0 **UNIT 2 SECONDARY AREA** (continued)

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
Turbine Deck	Turbine Crane						
	High Press FW Htr Area						
	East MSR Area						
	West MSR Area						
	HP Turbine Area						
	21/22/23 LP Turb Area						
	Generator Area						
	Heating Water Conv						
	Aux Bldg Roof Area						

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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

8.0 CIRCULATING WATER AND SERVICE WATER AREA

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
Service Water Structure	#1 SW Bay Area						
	#1 SW Bay Ctrl House						
	#1 SW Bay Screen Area						
	#2 SW Bay Area						
	#2 SW Bay Ctrl House						
	#2 SW Bay Screen Area						
	#3 SW Bay Area						
	#3 SW Bay Ctrl House						
	#3 SW Bay Screen Area						
	#4 SW Bay Area						
	#4 SW Bay Ctrl House						
	#4 SW Bay Screen Area						
Circulating Water Structure	Unit 1 Circ Water Area						
	Unit 2 Circ Water Area						
	Circ Water Swgr						

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VISUAL INSPECTION OF EQUIPMENT AND STRUCTURES FOLLOWING A EARTHQUAKE

9.0 YARD LOCATIONS

Location		Initial Team			Follow-Up Team		
Description	Area	Dispatched	Instructions	Findings	Dispatched	Instructions	Findings
Yard Area	Gas Turbine						
	SBO Compressor						
	RAP Tanks Area						
	FOST Area						
	Switchyard Area						
	Fresh Water Storage Tanks						
	Well Water Pump House						
	Containment Exteriors						
	Mixing Bottle Areas						
	HH Boiler Area						

ATTACHMENT 7
(Page 1 of 2)

SEISMIC MONITORING SYSTEM
DATA RETRIEVAL AND CALIBRATION
(Maintenance Controls)

CAUTION

Maintenance Controls Technicians should not attempt to readjust or recalibrate the Seismic Monitoring System until seismic data is downloaded, as this would defeat attempts to obtain post-event calibration data. Additionally, extreme caution should be utilized by Maintenance Controls during data collection and subsequent handling of data to prevent inadvertent loss of the recorded seismic data.

NOTE

- Each of the Seismic Monitoring Instruments actuated during a seismic event shall be restored to operable status within 24 hours, and a channel calibration performed within 5 days following the seismic event IAW UFSAR Section 7.7.2.12.
- Seismic Monitoring System channel calibration may require reducing reactor power and/or shutdown of **Unit 1** in order for personnel to access Seismic Monitoring equipment located within the inner bioshield (ALARA).
- Magnitude results from the Seismic Monitoring System should be conveyed to the Shift Manager (SM), as soon as possible following data acquisition.

___ 1.0 **PERFORM** the following IAW SC.IC-PT.INS-0005(Q), Seismic Strong Motion Instrumentation Retrieving and Loading Cassettes:

___ A. **RETRIEVE** and **PRODUCE** a graphic seismic record of the Seismic Monitoring System data.

___ B. **ENSURE** the Seismic Monitoring System is returned to operable status within 24 hours of the seismic event IAW UFSAR Section 7.7.2.12 (Triaxial Time-History Accelographs).

ATTACHMENT 7
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SEISMIC MONITORING SYSTEM
DATA RETRIEVAL AND CALIBRATION
(Maintenance Controls)

___ 2.0 **PERFORM** the following IAW SC.IC-PT.INS-0001(Q), Peak Recording Accelograph:

___ A. **RETRIEVE** and **DEVELOP** accelograph plates from the Peak Recording Accelographs.

___ B. **ENSURE** the Peak Recording Accelographs are returned to operable status within 24 hours of the seismic event IAW UFSAR Section 7.7.2.12 (Triaxial Peak Accelographs).

___ 3.0 **PERFORM** channel calibration of the Seismic Monitoring System within 5 days of the seismic event IAW one of the following channel calibration procedures:

- SC.IC-PT.INS-0002(Q), Seismic Strong Motion Instrumentation Channel Calibration *(18 Month Full Channel Calibration Procedure)*
- VSC.IC-CC.INS-0001(Q), Strong Motion Time-History Acceleration Recorder *(Vendor Full Channel Calibration Procedure)*

ATTACHMENT 8
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COMPLETION SIGN-OFF SHEET

1.0 **COMMENTS:**

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

ATTACHMENT 8
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COMPLETION SIGN-OFF SHEET

2.0 **SIGNATURES:**

Print	Initials	Signature	Date

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

This procedure with Attachments 1-8 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

APPENDIX A
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PLANT EQUIPMENT CHECKS

BATTERY RACKS	
Recommended Equipment Checks	Verified By
Check battery rack anchorage for damage; e.g., stretching or loosening of anchor bolts or nuts; evidence of rocking or sliding of battery racks.	
Check for distortion of battery rack structure.	
Check for evidence of rocking or sliding of batteries on the racks, buckling or distortion of the bus bars, condition of the spacers between the batteries.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check buses/cables/ground straps for damage, distortion or chafing.	
Check local alarms, breakers and protective devices for actuations or trips.	

STATIC INVERTERS AND BATTERY CHARGERS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for distortion of cabinet structure.	
Open cabinet and verify that internally mounted components are secure and undamaged.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

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PLANT EQUIPMENT CHECKS

TRANSFORMERS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check oil reservoir level.	
Check associated fire suppression systems for damage; e.g., nitrogen blanketing system, fire deluge system.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

MOTOR CONTROL CENTERS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for distortion of cabinet structure.	
Open cabinet and verify that internally mounted components, including relays and breakers, are secure and undamaged.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

APPENDIX A
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PLANT EQUIPMENT CHECKS

LOW VOLTAGE SWITCHGEAR	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for distortion of cabinet structure.	
Open cabinet and verify that internally mounted components, including relays and breakers, are secure and undamaged.	
Reset any trips. Any additional trips after initial reset should be investigated.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

MEDIUM VOLTAGE SWITCHGEAR	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for distortion of cabinet structure.	
Open cabinet and verify that internally mounted components, including relays and breakers, are secure and undamaged.	
Reset any trips. Any additional trips after initial reset should be investigated.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

APPENDIX A
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PLANT EQUIPMENT CHECKS

DISTRIBUTION PANELS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for distortion of cabinet structure.	
Open cabinet and verify that internally mounted components, including relays and breakers, are secure and undamaged.	
Reset any trips. Any additional trips after initial reset should be investigated.	
Check for damage due to impact or earthquake induced flooding or spraying.	

MOTOR GENERATORS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to pump due to seismic loads imposed by attached piping.	
Check pump and motor bearings for indications of overheating, and lubrication.	
Check for evidence of excessive motor-generator vibration and/or noise. Evidence of excessive vibration and/or noise may be an indication of misalignment between the motor and generator shafts.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

APPENDIX A
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PLANT EQUIPMENT CHECKS

ENGINES AND GENERATORS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Open cabinet and verify that internally mounted components, including relays and breakers, are secure and undamaged.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

FANS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for damage or distortion to fan housing or tearing of fabric noise eliminators due to seismic loads imposed by attached ducts.	
Check for evidence of excessive fan vibration and/or noise. Evidence of excessive fan vibration and/or noise may be an indication of misalignment between the motor and fan shafts.	
Check for clearance between the fan wheel and housing.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check for belt tightness and/or slippage; e.g., belt smoking or odor.	
Check local alarms, breakers and protective devices for actuations or trips.	

APPENDIX A
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PLANT EQUIPMENT CHECKS

AIR HANDLERS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for damage to air handler due to seismic loads imposed by attached ducts or tearing of fabric noise eliminators.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check for belt tightness and/or slippage; e.g., belt smoking or odor.	
Check local alarms, breakers and protective devices for actuations or trips.	

AIR HANDLING DUCTS	
Recommended Equipment Checks	Verified By
Check for deformation of dead weight supports and sway bracing.	
Check for damage to ducts at building joints and interfaces between buildings.	
Check for damage to ducts at joints.	
Check that instruments mounted to the rack are secure and undamaged.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check for tearing of fabric transitions/noise eliminators.	
Check for damage to internal filters and racks.	

APPENDIX A
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PLANT EQUIPMENT CHECKS

CHILLERS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for refrigerant leakage.	
Check for damage to chiller due to seismic loads imposed by attached ducts or piping.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check for belt tightness and/or slippage; e.g., belt smoking or odor.	
Check local alarms, breakers and protective devices for actuations or trips.	

AIR COMPRESSORS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for air leaks if compressor is running continuously rather than cycling on and off.	
Check for evidence of excessive air compressor vibration and/or noise. Evidence of excessive vibration and/or noise may be an indication of misalignment between the motor and air compressor shafts.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check for belt tightness and/or slippage; e.g., belt smoking or odor.	
Check local alarms, breakers and protective devices for actuations or trips.	

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PLANT EQUIPMENT CHECKS

VERTICAL PUMPS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check casing below base plate for damage due to ground settlement/movement.	
Check for damage to pump due to seismic loads imposed by attached piping.	
Check for damage to shaft housing.	
Check pump and motor bearings for indications of overheating, and lubrication.	
Check for evidence of excessive pump vibration and/or noise. Evidence of excessive vibration and/or noise may be an indication of misalignment between the motor and pump shafts.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

HORIZONTAL PUMPS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for damage to pump housing due to seismic loads imposed by attached piping.	
Check pump and motor bearings for indications of overheating, and lubrication.	
Check for evidence of excessive pump vibration and/or noise. Evidence of excessive vibration and/or noise may be an indication of misalignment between the motor and pump shafts.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

APPENDIX A
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PLANT EQUIPMENT CHECKS

LOW PRESSURE STORAGE TANKS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached piping and ground straps.	
Check for buckling of tank walls; e.g.,"elephant foot" buckling.	
Check for cracking or leakage at the base plate to cylindrical shell connection.	
Check for damage due to impact or earthquake induced flooding or spraying.	

HIGH PRESSURE TANKS AND HEAT EXCHANGERS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached piping and ground straps.	

AIR AND MOTOR OPERATED VALVES	
Recommended Equipment Checks	Verified By
Check for damage or distortion at attachment of valve operator to valve body.	
Check for damage to attached conduit and ground straps.	
Stroke valve in both directions to check operation.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

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PLANT EQUIPMENT CHECKS

INSTRUMENT RACKS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for distortion of cabinet structure.	
Check that instruments mounted to the rack are secure and undamaged.	
Reset any trips. Any additional trips after initial reset should be investigated.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

SENSORS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Verify sensor operation utilizing readout check at local/control room indicators.	

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PLANT EQUIPMENT CHECKS

CONTROL AND INSTRUMENTATION CABINETS	
Recommended Equipment Checks	Verified By
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of equipment.	
Check for damage to attached conduit and ground straps.	
Check for distortion of cabinet structure.	
Check cabinet to verify instrument gauges, controls, and other equipment mounted to cabinets are secure and undamaged.	
Reset any trips. Any additional trips after initial reset should be investigated.	
Check for damage due to impact or earthquake induced flooding or spraying.	
Check local alarms, breakers and protective devices for actuations or trips.	

PIPING	
Recommended Equipment Checks	Verified By
Check for snubber damage; e.g., snubbers pulled loose from foundation bolts, evidence of excessive travel, jam up of inertia mechanism/leakage of hydraulic fluid and bent piston rods.	
Check for damage at rigid supports; e.g., deformation of support structure, deformation of pipe due to impact with support structure.	
Check for damage or leakage of pipe at rigid connections; e.g., anchor points with other equipment and structures.	
Check for damage to pipe at building joints and interfaces between buildings.	
Check for damage or leakage of piping and branch lines.	
Check for damage due to impact or earthquake induced flooding or spraying.	

APPENDIX A
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PLANT EQUIPMENT CHECKS

ELECTRICAL RACEWAYS	
Recommended Equipment Checks	Verified By
Check for deformation of dead weight supports and sway bracing.	
Check for damage to cables at building joints and interfaces between buildings.	
Check for damage to ground straps of electrical raceways.	
Check for damage due to impact or earthquake induced flooding or spraying.	

STEEL FRAMED STRUCTURES	
Recommended Equipment Checks	Verified By
Check for damage at bolted or welded connections.	
Check equipment anchorage/isolation mounts for damage; e.g., stretching or loosening of anchor bolts or nuts; rocking or sliding of base plates on concrete.	
Check for distortion or buckling of braces and other compression members.	

REINFORCED CONCRETE STRUCTURES	
Recommended Equipment Checks	Verified By
Check for new open (>0.06 inches) cracks, spalling of concrete. It should be noted that minor cracks, even if caused by the earthquake, are not considered significant unless large enough to result in yielding of rebar.	
Check for evidence of ground settlement.	
Check for evidence of differential horizontal and vertical movement between adjacent and/or interconnecting buildings and structured.	

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PLANT EQUIPMENT CHECKS

PRIMARY COOLANT SYSTEM	
Recommended Equipment Checks	Verified By
Check for Reactor Coolant System leakage at flanged joints; e.g., CRD Mechanism.	
Check for condition of supports and snubbers for large components; e.g., reactor coolant pumps, steam generators, pressurizer.	
Check for condition of the CRDM support structure.	

BURIED PIPE	
Recommended Equipment Checks	Verified By
Check for damage or leakage at pipe interface with buildings and tanks.	
Check for indication of fire main leakage as evidenced by excavation and/or actuation of fire pumps.	
Fire mains, service and circulating water piping, especially dead legs, are susceptible to buildups of corrosion and growths which are knocked loose by earthquake motion. These loosened accumulations can clog screens and small diameter pipes such as fire hydrants. Check for clogging and flush pipe mains, as necessary.	

APPENDIX B
(Page 1 of 1)

EPRI SEISMIC DAMAGE SCALE FOR NUCLEAR POWER PLANT FACILITIES

EPRI Damage Intensity	Maximum Damage Description
0	No damage to seismically designed structures and equipment. Some displacement of panels in wire hung suspended ceiling. Some tipping, displacement, and spilling of contents of book cases and storage racks without lateral bracing or positive anchorage. Some cracking of windows, plaster, and un-reinforced masonry walls in non-seismically designed structures designed and built to commercial standards, such as administration buildings, warehouses, and shops. Tripping of some non-seismically designed vibration monitoring instrumentation and vibration sensitive instruments.
1	No damage to seismically designed structures and equipment. Some falling of panels in wire hung suspended ceilings. General tipping and some overturning of book cases, file cabinets, and storage racks without lateral bracing or positive anchorage. Widespread cracking of windows, plaster, masonry, and concrete in structures built to commercial standards such as the turbine hall; some such cracking in industrial structures (1). Some rubbing or displacement of insulation on non-seismic piping. Tripping of non-seismically designated vibration monitoring and vibration sensitive instrumentation. Slight damage to low pressure storage tanks.
2	Widespread breaking of windows. Depending on design basis and available seismic margins, widespread cracking of walls in seismically designated structures can be expected. Some leakage of flanged and threaded joints in non-seismically designed and seismically designed piping may be expected. Some permanent deformation of non-seismically designed and seismically designed distribution systems (raceways, pipe, and ducts). Many instances of damaged insulation on piping. General failure of wire hung suspended ceilings and light fixtures. General overturning of unrestrained book cases, storage racks, filing cabinets, and furniture. Un-reinforced brick, tile, and block walls thrown out of line. Partial collapse of commercial construction. Trips and vibration alarms for non-seismically designed vibration monitoring and vibration sensitive instruments requiring significant resetting. Some shifting of unanchored equipment on their foundations and some permanent deformation of walls and leakage of contents of non-seismically designed and seismically designed tanks. Possible leakage of contents of non-seismically designed tanks.
3	Some spalling of concrete walls and permanent deformations of structural steel joints in both non-seismically and seismically designed industrial buildings. Un-reinforced masonry and block walls generally thrown out of plumb in seismically designed structures. Significant leakage and occasional rupture of non-seismically designed piping with bolted flanges and threaded joints, and breaking of cables in non-seismically designed raceway, particularly at or near construction joints. Some failure of non-seismically designed piping, duct, and raceway supports. Permanent deformation and yielding of seismically designed piping, raceway and duct supports, and impacts with adjacent structure and equipment. Permanent deformation and yielding of seismically designed mechanical and electrical equipment. Some anchorage failures. Severe damage and collapse of commercial construction. Moderate damage to industrial construction. Slight damage to seismic Category 1 construction. Widespread damage of ceramic isolators. Debris and rubble may limit access. General failure of non-seismically designed and seismically designed tanks and non-seismically designed underground nonwelded steel piping.

(1) Slight or hairline cracking of concrete walls and slabs in seismic Category 1 structures does not constitute meaningful damage.

APPENDIX C
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ADDITIONAL CONSIDERATIONS FOLLOWING A SEISMIC EVENT

NOTE

The following may require additional consideration following a seismic event.

___ ♦ Provisions for the delivery of fuel oil from outside suppliers may need to be factored into the recovery plan. Refer to NC.EP-EP.ZZ-0201(Q), TSC - Integrated Engineering Response, for additional guidance.

___ ♦ The System Operator should be contacted to understand the effects on the grid, and grid stability.

___ ♦ Availability of water for secondary system cooling may be limited which would require a more rapid cooldown than is desired. Availability of secondary water system water sources must be carefully monitored to ensure adequate cooling water is available to support attaining Cold Shutdown.

___ ♦ The plant is designed such that equipment required to take the plant to Hot Shutdown (Mode 3) is seismically qualified. An assessment of equipment availability/operability should be performed prior to commencing RCS cooldown and depressurization.

___ ♦ Should a loss of offsite power occur, the potential exists for RCS void formation if a rapid RCS cooldown is required.

___ ♦ Operations personnel should be alert for a loss of Station and Instrument Air. If a loss of Instrument Air occurs, refer to S1(2).OP-AB.CA-0001(Q), Loss of Control Air, as applicable.

___ ♦ Impaired lighting conditions may exist in the plant. Compensatory actions should be discussed, as required.

___ ♦ OE has demonstrated that impaired communications may exist in the plant, and from the plant to the outside. Compensatory actions should be discussed, as required.

___ ♦ Communications with the NJ, DE and the Coast Guard will be necessary to determine if any other accidents on the river could affect Salem Nuclear Power Plants (e.g., a refinery is discharging a large amount of oil into the river.

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APPENDIX C
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ADDITIONAL CONSIDERATIONS FOLLOWING A SEISMIC EVENT

(continued)

___ ♦ The status of the EOF and ENC should be evaluated

___ ♦ Possible damage to roads and bridges in the surrounding area may limit the availability of outside assistance for an extended period of time (e.g., site access road). If transportation systems are damaged, consider the ability of NJ and DE to perform protective actions (evaluations), if required. The ability of PSEG personnel to respond to an emergency callout should be considered. The TSC or EOF should contact state and local Emergency Management personnel for status of roads, and infrastructure concerns.

___ ♦ The ability to effectively implement the provisions of the PSEG, NJ, and DE Emergency Plans should be assessed as part of the unit startup preparations.

As a minimum the following should be reviewed/assessed:

- Ingress and Egress capabilities within the 10 mile Emergency Planning Zone (EPZ), in NJ and DE.
- NJ and DE Emergency Preparedness capabilities and facilities status.
- Status of the Alert Notification System (ANS), also referred to as the offsite Emergency Planning Zone (EPZ) sirens, and status of Backup Public Notification options in place in areas of failed sirens.

EXHIBIT 1
(Page 1 of 1)

BRIEFING SHEET

NOTE

The following items are a list of potential topics which should be covered during the briefing at SM/CRS discretion.

1) **SAFETY**

- Use extreme caution when investigating potentially damaged equipment.

2) **TECHNICAL SPECIFICATION and ECGs**

- 3.8.1.1, AC Sources Operating
- 3.8.1.2, AC Sources Shutdown
- Event Classification Guide, Attachment 9.5, Seismic Event

3) **PARAMETERS TO BE MONITORED**

- BEACON for any indicated changes in Reactor Core Operating Parameters (e.g., AFD, Reactor Power, etc.).
- Safety Parameter Display System (SPDS) and Critical Function Status Trees (CFSTs).
- Radiation Monitors associated with the Reactor Coolant System for indication of changes.
- Reactor Coolant System for indication of changes in with regard to flow, temperature and pressure.
- Metal Impact Monitoring System (MIMS) for any indication of metallic sounds on the system audio speaker.
- Changes in Reactor Coolant System and Secondary System activity and chemistry.
- Indications of pipe ruptures or flooding on site (e.g., fire mains, circulating water, condensate, etc.)

4) **CONTINGENCIES**

- IF OBE was exceeded (>0.1g)
  OR damage is identified,
  THEN **CONSIDER** briefing the Operating Crew on the Reactor Shutdown.

- The Operating Crew should **RESPOND** to all alarms and immediate effects of the seismic event IAW the applicable ABs, EOPs and OPs. Operator response to maintain the plant in a safe stable condition takes precedence over this procedure.

- **REFER TO** Appendix C, Additional Considerations Following a Seismic Event, for additional considerations.

EARTHQUAKE
TECHNICAL BASES DOCUMENT

1.0 REFERENCES

1.1 Technical Documents:

A. Salem Generating Station Updated Final Safety Analysis Report:

1. Section 2.5, Geology and Seismology
2. Section 7.7.2.12, Seismic Monitoring Instrumentation
3. Section 8.3.1.5, Standby Power Supplies
4. Section 9.4.5, Diesel Generator Area Ventilation
5. Table 7.7-3, Seismic Monitoring Instruments
6. Table 7.7-4, Seismic Monitoring Instrumentation Surveillance Requirements

B. Technical Specifications:

1. 3.8.1.1, AC Sources Operating
2. 3.8.1.2, AC Sources Shutdown

C. Event Classification Guide, Attachment 9.5, Seismic Event

1.2 Procedures:

A. NC.EP-EP.ZZ-0201(Q), TSC - Integrated Engineering Response
B. NC.NA-AP.ZZ-0011(Q), Records Management Program
C. S1.OP-AB.CA-0001(Q), Loss of Control Air
D. S2.OP-AB.CA-0001(Q), Loss of Control Air
E. S1.OP-AB.FUEL-0001(Q), Fuel Handling Incident
F. S2.OP-AB.FUEL-0001(Q), Fuel Handling Incident
G. S1.OP-AB.FUEL-0002(Q), Loss of Refueling Cavity or Spent Fuel Pool Level
H. S2.OP-AB.FUEL-0002(Q), Loss of Refueling Cavity or Spent Fuel Pool Level
I. S1.OP-AR.ZZ-0001(Q), Overhead Annunciators Window A
J. S2.OP-AR.ZZ-0001(Q), Overhead Annunciators Window A
K. S1.OP-IO.ZZ-0004(Q), Power Operation
L. S2.OP-IO.ZZ-0004(Q), Power Operation
M. S1.OP-IO.ZZ-0005(Q), Minimum Load to Hot Standby
N. S2.OP-IO.ZZ-0005(Q), Minimum Load to Hot Standby
O. S1.OP-SO.DGV-0001(Q), Diesel Generator Area Ventilation Operation
P. S2.OP-SO.DGV-0001(Q), Diesel Generator Area Ventilation Operation
Q. S1.OP-ST.RCS-0001(Q), Reactivity Control System Rod Control Assemblies
R. S2.OP-ST.RCS-0001(Q), Reactivity Control System Rod Control Assemblies

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S. SC.IC-FT.INS-0003(Q), Seismic Strong Motion Instrumentation *(6 Month Functional Test of Seismic Monitoring System)*
T. SC.IC-PT.INS-0001(Q), Peak Recording Accelograph *(Mechanical Accelograph Instructions)*
U. SC.IC-PT.INS-0002(Q), Seismic Strong Motion Instrumentation Channel Calibration *(18 Month Full Channel Calibration Procedure)*
V. SC.IC-PT.INS-0004(Q), Seismic Strong Motion Instrumentation Channel Check *(31 Day Channel Check Procedure)*
W. SC.IC-PT.INS-0005(Q), Seismic Strong Motion Instrumentation Retrieving and Loading Cassettes
X. SC.IC-PT.INS-0006(Q), Seismic System Field Device Calibration Triaxial Time - History Accelerometers 1TMTR-14240, 1TMTR-14241 and 1TMTR-14242 *(Calibration Procedure for the Triaxial Accelerometers)*
Y. VSC.IC-CC.INS-0001(Q), Strong Motion Time-History Acceleration Recorder *(Vendor Full Channel Calibration Procedure)*
Z. VSC.IC-PT.INS-0001(Q), Strong Motion Time-History Acceleration Recorder *(Vendor Functional Test Procedure)*
AA. SC.OP-DG.ZZ-0101, Salem Post-Trip Data Collection Guidelines

1.3 **Drawings:**

A. 219398, No. 1 & 2 Units Seismic Sensing & Recording System
B. 231926, No. 1 & 2 Units - Fire Protection System Diesel Fuel Oil Pump Rooms & Tank Rooms
C. 304854, Kinemetrics Operating Instructions for SMP-1 Magnetic Tape Playback System

1.4 **Commitments:**

None

1.5 **Industry Concerns:**

None

1.6 **Seismic Monitoring System Vendor Information:**

Kinemetrics Incorporated
222 Vista Avenue
Pasadena, CA 91107
Telephone: (626)795-2220
E-mail: www.kinemetrics.com

1.7 **Other:**

A. EPRI NP-6695, Guidelines for Nuclear Plant Response to an Earthquake
B. Regulatory Guide 1.12 - Nuclear Power Plant Instrumentation for Earthquakes
C. Regulatory Guide 1.166 - Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Postearthquake Actions
D. Regulatory Guide 1.167 - Restart of a Nuclear Power Plant Shutdown by a Seismic Event
E. L.P. No. 0300-000.00S-SEISMIC-00, Seismic Monitoring Instrumentation
F. NOTF 20184342, Salem Response to an OB Earthquake
G. Order 70026223, Salem Procedure/Actions After Earthquake
H. Order 70026209, Emergency Response to Earthquake
I. 10CFR50, Appendix A to Part 50 -- General Design Criteria for Nuclear Power Plants
J. 10CFR100, Appendix A to Part 100 -- Seismic and Geologic Siting Criteria for Nuclear Power Plants

2.0 DISCUSSION

2.1 This procedure is not intended to combat the consequences of an earthquake; however the appropriate Abnormal Operating Procedures (AOPs) and Emergency Operating Procedures (EOPs) serve that function. Instead, the intent of this procedure is to provide the necessary guidance to Control Room Operating personnel to:

- Assess the consequences of an earthquake to determine if a shutdown is required, or continued operation is acceptable.
- Provide the direction necessary for the Salem Operations Department personnel to respond to the consequences of an earthquake.
- Assist the Salem Operations Department in identifying the extent of testing required following a earthquake induced forced shutdown.

2.2 It is expected that the Operating Crew responds to all alarms and immediate effects of the seismic event IAW the applicable ABs, EOPs and OPs. Operator response to maintain the plant in a safe stable condition takes precedence over this procedure.

2.3 This discussion provides the reasoning behind the logic and flowpath of the procedure. It is not intended to provide additional direction to the procedure.

2.4 This Earthquake Abnormal Operating Procedure incorporates guidance contained within EPRI NP-6695 and Regulatory Guides 1.12, 1.166 and 1.167. The absence of clear, detailed and rational procedures for nuclear plant response to an earthquake may result in unnecessary shutdown of an operating nuclear power plant(s) and a prolonged delay in plant startup. The guidelines contained within this procedure are intended to minimize costs related to a shutdown of the Salem Nuclear Units following an earthquake, while assuring safety in operation.

2.5 **Entry conditions**

This procedure is initiated when any of the following conditions are recognized:

- Vibratory ground motion is felt on site and recognized as such by a consensus of the Control Room Operating crew
- Annunciation of OHA A-37, SEIS RCDR SYS ACT

2.6 **Immediate Actions**

There are no immediate actions associated with this procedure.

2.7 **Subsequent Actions**

Step 3.1 NOTE - Indicates if vibratory ground motion exceeds that of the Operating Basis Earthquake (>0.1g) occurs, shutdown of the Salem Nuclear Power Plants will be required IAW Appendix A to 10CFR100. Prior to resuming operations, the licensee will be required to demonstrate to the Commission that no functional damage has occurred to those features necessary for continued operation without undue risk to the health and safety of the public. This guidance is consistent with guidance provided in EPRI NP-6695 and Reg Guide 1.166.

Step 3.1 NOTE - Indicates if vibratory ground motion does NOT exceed that of the Operating Basis Earthquake (<0.1g), and no significant damage is found during Operator Walkdown inspections, then shutdown of the Salem Nuclear Plants is NOT considered necessary. This guidance is consistent with guidance provided in EPRI NP-6695 and Regulatory Guide 1.166.

Step 3.1 initiates Attachment 1, Continuous Action Summary.

Step 3.2 NOTE identifies the conditions requiring ECG Notification. Indication of either of the following conditions constitutes declaration of an UNUSUAL EVENT in accordance with the ECG: (1) A seismic event is felt by personnel within the Protected Area, or (2) Valid Actuation of the Seismic Trigger (>0.01g) has occurred as verified by the SMA-3 Event Indicator (flag) being WHITE as indicated on the Salem Seismic Recorder. Additionally, indication of either of the above specified conditions in conjunction with a Valid Actuation of the Hope Creek Seismic Switch (>0.1g), constitutes declaration of an ALERT in accordance with the ECG.

Step 3.2 indicates if a seismic event is felt by personnel within the Protected Area, then the Shift Manager (SM) is to be notified to refer to the Event Classification Guide. IAW the ECG, classification of the event is required to be performed within 15 minutes.

Step 3.3 NOTE - Contains specific information regarding operation of the Seismic Monitoring System.

Step 3.3 directs the Operator to monitor the Seismic Recorder to determine if a valid seismic event has occurred. This information will be utilized in determining if continued performance of this procedure is warranted.

Step 3.4 provides specific guidance if it is determined that a valid seismic event has NOT occurred.

Step 3.5 NOTE identifies the conditions requiring ECG Notification. Indication of either of the following conditions constitutes declaration of an UNUSUAL EVENT in accordance with the ECG: (1) A seismic event is felt by personnel within the Protected Area, or (2) Valid Actuation of the Seismic Trigger (>0.01g) has occurred as verified by the SMA-3 Event Indicator (flag) being WHITE as indicated on the Salem Seismic Recorder. Additionally, indication of either of the above specified conditions in conjunction with a Valid Actuation of the Hope Creek Seismic Switch (>0.1g), constitutes declaration of an ALERT in accordance with the ECG.

Step 3.5 indicates if not already performed, then the Shift Manager (SM) is to be notified to refer to the Event Classification Guide. IAW the ECG, classification of the event is required to be performed within 15 minutes.

Step 3.6 performs a quick overall diagnosis of plant operation will assist in determining if other conditions exist that may require urgent attention. It is expected that the Operating Crew will respond to all alarms and immediate effects of the seismic event IAW the applicable ABs, EOPs and OPs. Operator response to maintain the plant in a safe stable condition takes precedence over performance of this procedure.

Step 3.7 evaluates if Unit 1 or 2 is currently in a Refueling Outage or Outage condition. Special consideration should be given to Steam Generator Nozzle Dam(s), Reactor Cavity Seal(s), and Partial Loaded Reactor Core(s) in the event a seismic event occurs. The applicable ABs are identified should the indicated condition exist.

Step 3.8 CAUTION - Indicates Maintenance Controls Technicians should NOT attempt to readjust or recalibrate the Seismic Monitoring System until seismic data is downloaded, as this would defeat attempts to obtain post-event calibration data. Also, caution indicates extreme caution should be utilized during data collection and subsequent handling of data to prevent inadvertent loss of the data. This caution was incorporated to highlight the need to exercise extreme care during data collection.

Step 3.8 NOTE - UFSAR Section 7.7.2.12 is referenced indicating that each of the Seismic Monitoring Instruments actuated during a seismic event shall be restored to operable status within 24 hours, and a channel calibration performed within 5 days following the seismic event. Additionally, with regard to Unit 1, Seismic Monitoring System channel calibration may require reducing reactor power and/or shutdown (Unit 1 only) in order for personnel to access Seismic Monitoring equipment located within the inner bioshield due to ALARA concerns.

Step 3.8 contacts Maintenance Controls to have qualified personnel perform Attachment 7, Seismic Monitoring System Data Retrieval and Calibration. Performance of Attachment 7 will provide data for determining subsequent procedural actions, and ensures compliance with UFSAR 7.7.2.12.

Step 3.9 identifies contact numbers for the National Earthquake Center, for obtaining updated information regarding the seismic event, if desired.

Step 3.10 and NOTE - Indicates that several relays in the Cardox System may be inadvertently tripped during a seismic event. These relays provide interlocks, but will not initiate a CO_2 discharge. There are nine relays per Unit (one for each DG FOST Room, one for each DG Room, one for both DFO Pump Rooms, one for each Switchgear Room, and one for the Electrical Penetration Room). Of immediate concern are the relays for the Diesel Generator Room. If one of these relays trip,the respective DG Area and Control Area Exhaust Fans will be tripped. These relays must be either reset or bypassed to restart the respective fans. Specific guidance is provided to start the diesel room exhaust fans, should this condition exist. This incorporates guidance that was previously contained in S1(2).OP-AR.ZZ-0001(Q).

Step 3.11 and NOTE - Step commences Operator Walkdowns IAW Attachment 2. None indicates Plant walkdowns are to be completed in a timely manner following indication of an earthquake. Regulatory Guide 1.166 requires the decision to shut down the plant be made within 8 hours of the event. EPRI recommends Operator Walkdowns be completed within 4 to 8 hours of the event. The plant itself, not damage from nearby communities, or data from remote locations, is the best indicator of the severity of the seismic event at the plant site. This guidance is consistent with guidance provided in EPRI NP-6695 and Regulatory Guide 1.166.

Step 3.12 NOTE - Indicates conditions may exist following a seismic event which exceeds the OBE such that a discontinuance of power generation could result in loss of critical lifeline functions and potential loss of life. If the System Operator requests that the Salem Stations remain on line, and shutdown of the plants is required as a result of exceeding the OBE limitation, then Licensing and the NRC should be immediately consulted with to propose a plan for the timely, safe shutdown of the Salem Nuclear Plants IAW Regulatory Guide 1.166. It should be noted, the need for power generation does NOT take precedence over plant Operating Procedures, or the requirements of the Operating License. Additionally, Load reduction rates of $\geq$5%/minute are **NOT** recommended during performance of Step 3.12, and "significant damage" is defined.

Step 3.12 - Step indicates that if vibratory ground motion exceeded that of the Operating Basis Earthquake (>0.1g), or damage was identified during performance of the Operator Walkdowns, then if not already shutdown, shutdown the Reactor following performance of pre-shutdown inspections IAW Attachment 3. Following shutdown Post-Shutdown Inspections and Tests are performed IAW Attachment 4. This guidance is consistent with guidance provided in EPRI NP-6695 and Regulatory Guide 1.166.

Step 3.13 and NOTE - Step indicates that if vibratory ground motion did NOT exceed that of the Operating Basis Earthquake (<0.1g), or damage was NOT identified during performance of the Operator Walkdowns, then operation may continue, or the unit started up if shutdown. This guidance is consistent with guidance provided in EPRI NP-6695 and Regulatory Guide 1.166, and "significant damage" is defined.

Attachment 1 - Continuous Action Summary

Step 1.0 provides guidance to the Operator to transition to 1(2)-EOP-TRIP-1, Reactor Trip or Safety Injection, in the event of a Reactor Trip as a result of the seismic event. The Operator is then directed to continue with Step 3.3 of this procedure, when conditions permit.

Step 2.0 indicates if damage has occurred to any Structure, System or Component (SSC) that is required to safely shutdown the plant following an OBE or seismic event, then Licensing should be contacted to communicate a plan for the timely repair and/or shutdown of the Salem Nuclear Plant(s) to the Commission.

Step 3.0 references Appendix C, Additional Consideration Following a Seismic Event, for additional post-seismic event concerns.

Attachment 2 - Operator Walkdowns

When the plant is stable and personnel are available, operators should perform walkdowns of the plant similar to those performed during their normal daily rounds.

The purpose of Operator Walkdowns is to determine the effect of the earthquake or seismic event on plant structures, and to provide additional guidance with regard to additional required inspections.

As Plant Operators are the most knowledgeable with regard to their duty stations, they should take the lead in monitoring of their assigned areas. Additionally, Plant Operators may be assisted by available on-site personnel (e.g., Engineering, Maintenance, Quality Assurance, etc.) in performance of the Operator Walkdowns.

High radiation areas, the containment building, and other areas with limited access need not be included in the initial walkdown inspections unless plant personnel have reason to suspect that there may be damage in these areas.

Plant walkdowns are to be completed in a timely manner following indication of an earthquake. Regulatory Guide 1.166 requires the decision to shut down the plant be made within 8 hours of the event. EPRI recommends Operator Walkdowns be completed within 4 to 8 hours of the event.

The plant itself, not damage from nearby communities, or data from remote locations, is the best indicator of the severity of the seismic event at the plant site.

Attachment 3 - Pre-Shutdown Inspections

Following the decision to shutdown the plant, but prior to initiating the shutdown, visual inspections of essential safe shutdown equipment should be performed to determine its readiness. Other factors outside of the of the plant that could affect the timing of the shutdown (e.g., availability/reliability of off-site power), should also be evaluated at this time.

In order to ascertain possible fuel and reactor internal damage, the indicated checks should be prior to the plant shutdown being initiated.

When plant capability to safely shutdown has been verified, normal shutdown should proceed.

The need for power generation does NOT take precedence over plant Operating Procedures, or the requirements of the Operating License. Conditions may exist following a seismic event which exceeds the OBE such that a discontinuance of power generation could result in loss of critical lifeline functions and potential loss of life. If the System Operator requests that the Salem Stations remain on line, and shutdown of the plants is required as a result of exceeding the OBE limitation, then Licensing and the NRC should be immediately consulted with to propose a plan for the timely, safe shutdown of the Salem Nuclear Plants IAW Regulatory Guide 1.166. It should be noted, the need for power generation does NOT take precedence over plant Operating Procedures, or the requirements of the Operating License.

Attachment 4 - Post-Shutdown Inspections and Tests

Post-shutdown inspections and tests are those needed to determine the physical condition of the nuclear plant and its readiness to resume operation after being shutdown due to a seismic event. These inspections and tests are designed to provide a graded response commensurate with the type and severity of damage found. The recommended post-shutdown actions consist of the following:

a) Focused inspections by experienced engineers of a pre-selected sample of representative structures and equipment. The purpose of these inspections is to determine the need for expanded inspections and tests, and to provide data to establish the severity of the earthquake.

b) Determination of EPRI damage intensity. Using the information collected during focused inspections, and other observations, a group of experienced engineers will establish the EPRI damage intensity utilizing the established guidelines. Identification of the EPRI damage intensity will determine the course of actions to restart the plant.

c) If damage to the pre-selected sample of safety-related equipment and structures is found, or the EPRI damage intensity is determined to exceed a specific level, then expanded inspections are to be performed. These expanded inspections by qualified engineers are undertaken to further define evaluate potential damage to all components, systems, and structures required for operation. This information is used to (1) establish corrective actions and repairs that may be required to return the plant to a state of operational readiness, and (2) identify the need and timing for additional analytical and other engineering evaluations which may be prudent to assure the long term integrity and reliability of the plant.

d) Surveillance tests as required by Technical Specifications to verify the operability of equipment needed for plant operation.

Attachment 5 - Long-Term Evaluations

Long-term evaluations are those engineering activities needed to assess the potential for hidden damage that may have occurred to safety-related equipment and structured which might degrade their long-term reliability. Long-term evaluations are not required if plant shutdown is not warranted (e.g., the OBE criteria is not exceeded).

For EPRI Damage Intensities of 2 or less, these evaluations may be performed after the plant is restarted. If the EPRI Damage Intensity exceeds 2, plant restart will depend on successful completion of the long-term evaluations.

The recommended long-term evaluations consist of the following:

- Determine of Actual Seismic Loads - This includes the calculation of floor response spectra using the actual earthquake ground motion records. For those plants with design floor spectra, a comparison of the calculated and design spectra would be made. Measured spectral accelerations may be used in place of calculated floor response spectra where such information is available from seismic instruments installed in the plant.

- Seismic Re-evaluation - Where the original design spectra may have been exceeded by a seismic event, selected equipment and structures should be further evaluated to establish the nature of any exceedance and its potential to cause damage. The seismic re-evaluations make use of original design information, modern analytical techniques, seismic capacity data and, where necessary, special nondestructive examinations and functional tests.

Attachment 6 - Visual Inspection of Equipment and Structures Following a Earthquake

Attachment 6 provides a pre-selected sample of representative structures and equipment required to be visually inspected. The purpose of these inspections is to determine the need for expanded inspections and tests, and to provide required data to establish the EPRI Damage Intensity.

Refer to Appendix A for a list of equipment to be checked.

Refer to Appendix B for a definition of the EPRI Seismic Damage Scale.

The Technical Support Center (TSC) will generally be responsible for coordinating performance of Attachment 6, and maintaining the inspection records.

Attachment 7 - Seismic Monitoring System Data Retrieval and Calibration (Maintenance Controls)

CAUTION - Maintenance Controls Technicians should not attempt to readjust or recalibrate the Seismic Monitoring System until seismic data is downloaded, as this would defeat attempts to obtain post-event calibration data. Additionally, extreme caution should be utilized by Maintenance Controls during data collection and subsequent handling of data to prevent inadvertent loss of the recorded seismic data.

NOTE - Each of the Seismic Monitoring Instruments actuated during a seismic event shall be restored to operable status within 24 hours, and a channel calibration performed within 5 days following the seismic event IAW UFSAR Section 7.7.2.12.

NOTE - Seismic Monitoring System channel calibration may require reducing reactor power and/or shutdown of **Unit 1** in order for personnel to access Seismic Monitoring equipment located within the inner bioshield due to ALARA concerns.

NOTE - Magnitude results from the Seismic Monitoring System should be conveyed to the Shift Manager (SM), as soon as possible following data acquisition.

Step 1.1 retrieves, produces a graphic image of the Triaxial Time-History Accelograph, then ensures the Seismic Monitoring System is returned to operable status within 24 hours of the seismic event IAW UFSAR Section 7.7.2.12.

Step 1.2 retrieves and develops accelographs plates from the Triaxial Peak Accelographs, then ensures the Peak Recording Accelographs are returned to operable status within 24 hours of the seismic event IAW UFSAR Section 7.7.2.12.

Step 1.3 ensures a channel calibration of the Seismic Monitoring System is performed within 5 days of the seismic event IAW UFSAR Section 7.7.2.12.

Attachment 8 - Completion Sign-off Sheet

Appendix A - Plant Equipment Checks

The equipment identified in Appendix A should is required to be included in the focused post-earthquake inspection IAW Section 5.3.2.1 of EPRI NP-6695.

Appendix B - EPRI Seismic Damage Scale for Nuclear Power Plant Facilities

The EPRI Seismic Damage Intensity Scale is delineated (EPRI-1, EPRI-2 and EPRI-3) as identified in EPRI NP-6695.

Appendix C - Additional Considerations Following A Seismic Event

Exhibit 1 - Briefing Sheet

Items that could be potentially discussed at a Shift Briefing are identified.

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