



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
REGION II
245 PEACHTREE CENTER AVENUE NE, SUITE 1200
ATLANTA, GEORGIA 30303-1257

January 27, 2014

EA-13-023
EA-13-045

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3D-C
Chattanooga, TN 37402-2801

**SUBJECT: SEQUOYAH NUCLEAR PLANT – NRC SUPPLEMENTAL INSPECTION REPORT
05000327/2013013 AND 05000328/2013013**

Dear Mr. Shea:

Prior to September 30, 2009, your staff failed to establish an adequate abnormal condition procedure to implement a successful flood mitigation strategy. The procedure was inadequate to mitigate the effects of a probable maximum flood (PMF) event, in that earthen dams located upstream of the facility could potentially overtop, causing a subsequent breach. Failure of the earthen dams during a PMF event would have resulted in onsite flooding and subsequent submergence of critical equipment. The condition existed from initial licensing until compensatory measures were put in place to prevent over-topping of the earthen portions of the Ft. Loudon Dam.

On February 15, 2013, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Sequoyah Units 1 and 2. Based on the results of this inspection, documented in NRC Inspection Report 05000327/2013009 and 05000328/2013009 on March 12, 2013, and the final significance determination documented in NRC Inspection Report 05000327/2013011 and 05000328/2013011 on June 4, 2013, the NRC assigned a white finding Action Matrix input to the mitigating systems cornerstone in the first quarter of 2013. In these reports, the NRC also documented a related Severity Level III violation of 10 CFR 50.72(b)(3)(ii)(B) for failure to report an unanalyzed condition that significantly degraded plant safety.

In addition, prior to December 15, 2012, your staff failed to ensure that the Essential Raw Cooling Water (ERCW) Pumping Station would remain dry during a design basis flood. Specifically, the lack of flood barriers (conduit seals or plugs) would cause the ERCW Pumping Station to flood. Flooding the ERCW Pumping Station would eventually cause a loss of safety function for both units' ERCW trains. Loss of all ERCW function would lead to the inability of the site emergency diesel generators (EDG) to perform their function, leading to core damage.

On February 28, 2013, the NRC completed an inspection at your Sequoyah Units 1 and 2. Based on the results of this inspection, documented in NRC Inspection Report 05000327/2013010 and 05000328/2013010 on March 18, 2013, and the final significance determination documented in NRC Inspection Report 05000327/2013011 and 05000328/2013011 on June 4, 2013, the NRC assigned a white finding Action Matrix input to the mitigating systems cornerstone in the first quarter of 2013.

In response to these Action Matrix inputs, the NRC informed you that a supplemental inspection under Inspection Procedure 95002, "Supplemental Inspection for One Degraded Cornerstone or any Three White Inputs in a Strategic Performance Area," and Inspection Procedure 92702, "Follow-up on Traditional Enforcement Actions, Including Violations, Deviations, Confirmatory Action Letters, Confirmatory Orders, and Alternative Dispute Resolution Confirmatory Orders," would be required.

On November 8, 2013, you informed the NRC that Sequoyah was ready for the supplemental inspection.

On December 13, 2013, the NRC completed the supplemental inspection and discussed the results of this inspection with Mr. Carlin and other members of your staff. The inspection team documented the results of this inspection in the enclosed inspection report.

The NRC performed this supplemental inspection to determine if: 1) the root and contributing causes for the significant issues were understood; 2) the extent of condition and extent of cause for the identified issues were understood; and 3) your completed or planned corrective actions were sufficient to address and prevent recurrence of the root and contributing causes. The NRC also conducted an independent review of the extent of condition and extent of cause for the two white findings and an assessment of whether any safety culture component caused or significantly contributed to the performance issues.

The NRC determined that your staff performed a comprehensive evaluation of both findings. Your staff's evaluation of the inadequate abnormal condition procedure identified two root causes. The first root cause was overconfidence in the accuracy of the Simulated Open Channel Hydraulics model and calculation processes which resulted in unrecognized inaccuracies in the PMF calculations. The inaccuracies in the model originated from design input errors. The second root cause was TVA Nuclear management's failure to provide effective oversight of changes to the river system and to apply safety-significant conservative decision-making for those changes affecting nuclear site PMF calculations, which demonstrated that nuclear safety during flooding conditions was not the overriding priority. The corrective actions taken and planned to prevent recurrence include, but are not limited to: 1) the development of a Flood Protection Program within the Corporate Nuclear Engineering Organization to ensure that nuclear plant critical safety systems are protected from all postulated flooding conditions; 2) the development of various implementing procedures to control the management of the Flood Protection Program; 3) the development of formal Flood Protection Program design standards and guides to control the calculation process; 4) the creation of a formal, documented risk management process for all engineering products; and 5) incorporation of industry best practices with respect to engineering technical rigor into the Conduct of the Engineering Organization procedure.

Your staff's evaluation of the failure to ensure that the ERCW Pumping Station would remain dry identified two root causes. The first root cause was the ERCW penetration seals were described in general design documents, but their functional requirements were not specifically addressed. The second root cause was that TVA leadership demonstrated less than adequate sensitivity to flooding by failing to establish and implement programmatic controls of flood protection. The corrective actions taken and planned to prevent recurrence include, but are not limited to: 1) issuance of design basis documents to address the functional requirements of in-leakage paths for the ERCW Pumping Station and EDG Building; 2) implementation of design outputs to seal Shield Building penetrations on Units 1 and 2; 3) issuance of exterior flood barrier drawings for the ERCW Pumping Station and EDG Building to identify exterior flood protection boundaries and include seal details; and 4) development and implementation of the Flood Protection Program, as described in the paragraph above.

For the two white findings and the Severity Level III violation, the NRC concluded that the root and contributing causes were understood, and that the extent of condition and extent of cause were identified. In addition, the NRC concluded that the root cause evaluations appropriately considered whether safety culture components caused or significantly contributed to the findings.

The NRC has determined that completed and planned corrective actions were sufficient to address the performance that led to the white findings. Therefore, the performance issues will not be considered as an Action Matrix input after the end of the fourth quarter of 2013.

The NRC inspectors did not identify any findings or violations of more than minor significance.

In accordance with Title 10 of the *Code of Federal Regulations* 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC's Public Document Room or from the Publicly Available Records (PARS) component of the NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

/RA/

Jonathan H. Bartley, Chief
Reactor Projects Branch 6
Division of Reactor Projects

Docket Nos.: 50-327, 50-328
License Nos.: DPR-77, DPR-79

Enclosure: Inspection Report 05000327/2013013
and 05000328/2013013

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Your staff's evaluation of the failure to ensure that the ERCW Pumping Station would remain dry identified two root causes. The first root cause was the ERCW penetration seals were described in general design documents, but their functional requirements were not specifically addressed. The second root cause was that TVA leadership demonstrated less than adequate sensitivity to flooding by failing to establish and implement programmatic controls of flood protection. The corrective actions taken and planned to prevent recurrence include, but are not limited to: 1) issuance of design basis documents to address the functional requirements of in-leakage paths for the ERCW Pumping Station and EDG Building; 2) implementation of design outputs to seal Shield Building penetrations on Units 1 and 2; 3) issuance of exterior flood barrier drawings for the ERCW Pumping Station and EDG Building to identify exterior flood protection boundaries and include seal details; and 4) development and implementation of the Flood Protection Program, as described in the paragraph above.

For the two white findings and the Severity Level III violation, the NRC concluded that the root and contributing causes were understood, and that the extent of condition and extent of cause were identified. In addition, the NRC concluded that the root cause evaluations appropriately considered whether safety culture components caused or significantly contributed to the findings.

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J. Shea

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Letter to Joseph W. Shea from Jonathan H. Bartley dated January 27, 2014

SUBJECT: SEQUOYAH NUCLEAR PLANT – NRC SUPPLEMENTAL INSPECTION REPORT
05000327/2013013 AND 05000328/2013013

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.: 50-327, 50-328

License Nos.: DPR-77, DPR-79

Report Nos.: 05000327/2013013, 05000328/2013013

Licensee: Tennessee Valley Authority (TVA)

Facility: Sequoyah Nuclear Plant, Units 1 and 2

Location: Sequoyah Access Road
Soddy-Daisy, TN 37379

Dates: December 9, 2013, through December 13, 2013

Inspectors: J. Heisserer, Senior Construction Inspector, Lead Inspector
W. Deschaine, Resident Inspector
T. Hoeg, Senior Resident Inspector
C. Huffman, Construction Resident Inspector
R. Monk, Senior Resident Inspector

Approved by: Jonathan H. Bartley, Chief
Reactor Projects Branch 6
Division of Reactor Projects

Enclosure

SUMMARY

Inspection Report (IR) 05000327/2013013, 05000328/2013013; 12/09/2013 - 12/13/2013; Sequoyah Nuclear Plant, Units 1 and 2; Supplemental Inspection - Inspection Procedure (IP) 95002, Follow-up Inspection - IP 92702

This supplemental inspection was conducted by a senior construction inspector, two senior resident inspectors, a resident inspector, and a construction resident inspector. No findings were identified. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

Cornerstone: Mitigating Systems

The NRC staff performed this supplemental inspection in accordance with IP 95002, "Supplemental Inspection for One Degraded Cornerstone or Any Three White Inputs in a Strategic Performance Area," to assess the licensee's evaluations associated with a white inspection finding involving the failure to properly establish an adequate abnormal operating procedure to mitigate the impact of a probable maximum flood and a white inspection finding involving the failure to translate the design basis related to onsite flooding protection into specifications, drawings, procedures, and instructions for the Essential Raw Cooling Water (ERCW) Pumping Station. The NRC staff previously characterized these issues as having low to moderate safety significance (white), as documented in NRC IR 05000327/2013011 and 05000328/2013011 (ADAMS Accession No. ML13155A560).

During this supplemental inspection, the inspectors determined that the licensee performed a comprehensive evaluation of both findings. The inspectors determined that the licensee conducted a comprehensive extent of condition and extent of cause review that sufficiently identified relevant areas for both findings. The licensee's evaluation of the inadequate abnormal condition procedure identified two root causes. The first root cause was overconfidence in the accuracy of the Simulated Open Channel Hydraulics model and calculation processes which resulted in unrecognized inaccuracies in the probable maximum flood (PMF) calculations. The second root cause was TVA Nuclear management's failure to provide effective oversight of changes to the river system and to apply safety-significant conservative decision-making for those changes affecting nuclear site PMF calculations, which demonstrated that nuclear safety during flooding conditions was not the overriding priority. The inspectors determined the licensee's corrective actions were thorough and should prevent recurrence. Corrective actions included the development of a Flood Protection Program within the Corporate Nuclear Engineering Organization, the development of various implementing procedures to control the management of the Flood Protection Program, and the development of formal Flood Protection Program design standards and guides to control the calculation process.

The licensee's evaluation of the failure to ensure that the ERCW Pumping Station would remain dry identified two root causes. The first root cause was the ERCW penetration seals were described in general design documents, but their functional requirements were not specifically addressed. The second root cause was that TVA leadership demonstrated less than adequate sensitivity to flooding by failing to establish and implement programmatic controls of flood protection. The extent of condition included the spent fuel pit cooling pump enclosure, all in-leakage paths to the ERCW Pumping Station, the emergency diesel generator (EDG) Building, Enclosure

and the Shield Building. The inspectors determined the licensee's corrective actions were thorough and should prevent recurrence. Corrective actions included issuance of design basis documents to address the functional requirements of in-leakage paths for the ERCW Pumping Station and EDG Building, and development and implementation of the Flood Protection Program, as described in the paragraph above.

Given the licensee's acceptable performance in addressing the performance that led to the white findings, the performance issues will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program."

The NRC staff also performed IP 92702, "Follow-up on Traditional Enforcement Actions Including Violations, Deviations, Confirmatory Action Letters, Confirmatory Orders, and Alternative Dispute Resolution Confirmatory Orders," to assess the licensee's evaluations associated with a failure to report within eight hours an unanalyzed condition that significantly degraded plant safety related to an increase in the postulated probable maximum flood level. The NRC staff previously characterized this issue as a Severity Level III violation, as documented in NRC IR 05000327/2013011 and 05000328/2013011.

A. NRC-Identified and Self-Revealing Findings

None.

B. Licensee-Identified Violations

None.

REPORT DETAILS

4. OTHER ACTIVITIES

4OA3 Followup of Events and Notices of Enforcement Discretion

.01 (Closed) Licensee Event Report (LER) 05000327/2012-001-00, Unanalyzed Condition Affecting Essential Raw Cooling Water System due to External Flooding

a. Inspection Scope

On December 12, 2012, Sequoyah Nuclear Plant determined that Unit 1 and Unit 2 were at risk of external flooding inundating the ERCW Pumping Station through inadequate electrical conduit penetration seals entering the ERCW Pumping Station. This condition could allow flood waters to enter the ERCW Pumping Station at a rate greater than the installed sump pump capacity, creating a condition that could result in the ERCW system being unavailable to perform its design function during a flood event above plant grade. No actual flooding condition occurred or currently exists. The licensee also determined that this condition had no impact on ERCW system operability during any non-flooding event. Upon discovery, the licensee implemented both immediate and interim corrective actions to ensure that the ERCW Pumping Station would remain dry during a flood event above plant grade. On December 12, 2012, TVA notified the NRC that the as-found condition was reportable because Sequoyah was operating outside of the current licensing basis as a result of the ERCW Pumping Station not being able to remain dry during a flood event above plant grade (elevation 705.0 feet). The licensee documented the issue in Problem Evaluation Report (PER) 655763, which included a root cause evaluation.

The inspectors discussed the event with operations, maintenance, engineering, and licensee management personnel to gain an understanding of the conditions leading up to the event and to assess licensee actions taken following the event. The inspectors independently verified the adequacy of the compensatory measures to ensure the ERCW Pumping Station would remain dry during a flood event above plant grade. Additionally, the inspectors reviewed the root cause evaluation report to assess the detail and thoroughness of the evaluation and the adequacy of the proposed corrective actions.

The inspectors reviewed the LER and PER 655763 to verify that the cause of the unanalyzed condition was identified and whether corrective actions were appropriate. The root cause of this event was determined to be that existing documentation including licensing documents and configuration controlled drawings for the ERCW Pumping Station did not contain sufficient information to identify the design basis flood barriers.

Enclosure

The inspectors concluded that the licensee's corrective actions for this event were appropriate, including:

- Installing adequate water tight seals in electrical conduit penetrations entering the ERCW Pumping Station.
- Sequoyah will issue a design basis document that will include, but not be limited to, the following: identify systems, structures and components (SSCs) which provide external flooding protection for the EDG Building and ERCW Pumping Station, ensure adequacy of identified barriers, design requirements, regulatory and licensing requirements, reference AOP-N.03," External Flooding," Revision 50, reference drawing series and test data, and develop an inspection program for flood barriers.
- An exterior flood barrier drawing series will be issued to identify the exterior flood boundaries and contain seal details. Associated drawings will be revised as applicable.

This LER is closed.

b. Findings

See Inspection Report 05000327/2013010 and 05000328/2013010 (ADAMS Accession No. ML13077A240) and Inspection Report 05000327/2013011 and 05000328/2013011 (ADAMS Accession No. ML13155A560) for regulatory issues associated with this LER.

.02 (Closed) LER 05000327/2013-001-00, Latent Design Input Inconsistencies Adversely Affect Probable Maximum Flood Analysis

a. Inspection Scope

On July 28, 2009, TVA identified latent design input inconsistencies in hydrological computer modeling used for PMF calculations. Upon discovery, TVA implemented both immediate and interim corrective actions to ensure the Fort Loudoun, Cherokee, Tellico, and Watts Bar dams would not overtop during an assumed PMF event. On February 6, 2013, TVA notified the NRC that due to the potential to overtop and fail earthen embankments at the four dams, Sequoyah was in an unanalyzed condition that could have resulted in an increased PMF level. The licensee documented the issue in PER 682212, which included a root cause evaluation.

The inspectors discussed the event with operations, maintenance, engineering, and licensee management personnel to gain an understanding of the conditions leading up to the event and assess licensee actions taken following the event. The inspectors independently verified the adequacy of the compensatory measures to ensure the capability of the EDGs and spent fuel pit coolant system to function under PMF conditions. Additionally, the inspectors reviewed the root cause evaluation report to assess the detail and thoroughness of the evaluation and the adequacy of the proposed corrective actions.

Enclosure

The inspectors reviewed the LER and PER 682212 to verify that the cause of the unanalyzed condition was identified and whether corrective actions were appropriate. The root causes of this event were determined to be an organizational behavior which allowed the latent input inconsistencies to go undetected and management failure to provide oversight of the impact of river system changes on the calculated value of the PMF. The inspectors concluded that the licensee's corrective actions for this event were appropriate, including development of a Flood Protection Program, development of formal Flood Protection Program Management Implementing Procedures and Design Standards/Guides, creation of a formal documented risk management process for all engineering products, formalization of the elements of engineering technical rigor, and implementation of an upper tier integrated risk management process.

This LER is closed.

b. Findings

See Inspection Report 05000327/2013009 and 05000328/2013009 (ADAMS Accession No. ML13071A253) and Inspection Report 05000327/2013011 and 05000328/2013011 (ADAMS Accession No. ML13155A560) for regulatory issues associated with this LER.

4OA4 Supplemental Inspection (95002)

.01 Inspection Scope

The NRC staff performed this supplemental inspection in accordance with IP 95002 to assess the licensee's evaluation of two white findings, which affected the mitigating systems cornerstone in the reactor safety strategic performance area. The inspection objectives were to:

- provide assurance that the root and contributing causes of risk-significant performance issues were understood;
- independently assess and provide assurance that the extent of condition and the extent of cause of risk-significant performance issues were identified;
- independently determine if safety culture components caused or significantly contributed to the risk significant performance issues; and
- provide assurance that the licensee's corrective actions for risk-significant performance issues were sufficient to address the root and contributing causes and prevent recurrence.

The licensee entered the Degraded Cornerstone Column of the NRC's Action Matrix in the first quarter of 2013 as a result of two inspection findings of low to moderate safety significance (white). The first finding was associated with the failure to establish and/or maintain an adequate abnormal operating procedure (AOP) to mitigate the effects of a PMF onsite. The PMF is the flood that may be expected from the most severe

combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area. Specifically, AOP-N.03 was inadequate to mitigate the effects of a PMF event, in that, prior to September 30, 2009, earthen dams located upstream of the facility could potentially overtop, causing a subsequent breach. Failure of the earthen dams during a PMF event would have resulted in onsite flooding and subsequent submergence of critical equipment, including EDGs, resulting in an ineffective flood mitigation strategy. As part of the corrective actions, the licensee installed HESCO barriers on the Fort Loudon, Tellico, Watts Bar, and Cherokee dams to raise the effective height of the earthen embankments. The finding was initially described in NRC IR 05000327/2013009 and 05000328/2013009 (ADAMS Accession No. ML13071A253).

The second finding was associated with the failure to translate the design basis related to onsite flooding into specifications, drawings, procedures and instructions. Specifically, Sequoyah's existing design documentation for the ERCW Pumping Station did not contain information to identify flood barriers to prevent water from flooding the building during a design basis PMF. The ERCW Pumping Station is required to remain dry during flood mode operations. Portions of the ERCW walls and penetrations are relied upon to withstand all static and dynamic forces imposed by the PMF. As a result of degraded or missing flood penetration seals, the ERCW Pumping Station would not have remained functional when subjected to the PMF and other less severe flooding events. Flooding of the ERCW Pumping Station would have resulted in submerging service water equipment relied on during PMF events which would have compromised the function of the EDGs. Failure of the EDGs would have resulted in an ineffective flood mitigation strategy to protect core cooling. As part of the corrective actions, the licensee installed additional sump pumps in the ERCW Pumping Station, sealed two open conduits, and installed new penetration seals in manhole 33. The finding was initially described in NRC IR 05000327/2013010 and 05000328/2013010 (ADAMS Accession No. ML13077A240).

Both findings were characterized as having low to moderate safety significance (white) in NRC IR 05000327/2013011 and 05000328/2013011 (ADAMS Accession No. ML13155A560).

The licensee staff informed the NRC staff on November 8, 2013, that they were ready for the supplemental inspection. In preparation for the inspection, the licensee performed a root cause analysis (RCA) for each violation and an additional RCA to analyze the violations at both Sequoyah and Watts Bar collectively from a corporate standpoint.

The inspectors reviewed the licensee's RCAs in addition to other evaluations conducted in support and as a result of the RCAs. The inspectors reviewed corrective actions that were taken or planned to address the identified causes. The inspectors also held discussions with licensee personnel to ensure that the root and contributing causes and the contribution of safety culture components were understood and corrective actions taken or planned were appropriate to address the causes and prevent recurrence. The inspectors also independently assessed the extent of condition and extent of cause of the identified issues. In addition, the inspectors performed an assessment of whether any safety culture components caused or significantly contributed to the issues.

Enclosure

.02 Evaluation of the Inspection Requirements

02.01 Problem Identification

- a. IP 95002 requires that the inspection staff determine that the evaluation documented who identified the issue (i.e., licensee-identified, self-revealing, or NRC-identified) and under what conditions the issue was identified.
- i. Technical Specification (T.S.) 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

On July 28, 2009, the licensee identified the potential to overtop Ft. Loudoun Dam and fail its earthen embankment during evaluations performed in response to an NRC Notice of Violation (NOV) of Bellefonte Units 3 and 4 Combined Operating License Application (COLA). Similar conditions were subsequently identified at Cherokee, Tellico, and Watts Bar Dams. The overtopping and failure of the specified earthen embankments could have resulted in an increase in the PMF level at the Watts Bar, Sequoyah, and Browns Ferry Nuclear Plants. The result was that existing flood mitigation processes and procedures were inadequate to protect critical safety systems from the additional flood elevation. Sequoyah PER 740028 was initiated to document the white finding that involved the failure to properly establish an adequate abnormal operating procedure to mitigate the impact of a PMF. The abnormal operating procedures and processes were not adequate because they were established for lower PMFs. Deficiencies in the modeling of PMF, primarily associated with design inputs, resulted in the potential for overtopping of the earthen embankments at the Cherokee, Fort Loudoun, Tellico, and Watts Bar dams. The inspectors verified that this information was documented in the licensee's RCA.

- ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The licensee identified a degraded, nonconforming condition of the ERCW Pumping Station during a Near Term Task Force (NTTF) walkdown that was required to be performed in response to the Fukushima Daiichi Accident. During a walkdown of the ERCW Pumping Station on September 16, 2012, a potential leak path into the ERCW Pumping Station was identified. On December 12, 2012, TVA determined the Sequoyah Units 1 and 2 ERCW Pumping Station was in a degraded, nonconforming condition due to risk of flooding during a design basis flood. This determination resulted in an event notification to the NRC for operating outside of the current licensing basis. The inspectors verified that this information was documented in the licensee's RCA.

- b. IP 95002 requires that the inspection staff determine that the evaluation documented how long the issue existed and prior opportunities for identification.
- i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The licensee's RCA documented that the failure to properly establish an adequate abnormal operating procedure to mitigate the impact of a PMF had existed since initial

design, construction, and licensing of the plant. The hydrology software and model used to license the TVA nuclear stations was originally developed in the 1960's to late 1970's. The licensee determined that prior opportunities for identification of the error existed over the years, but due to overconfidence in the accuracy of the Simulated Open Channel Hydraulics (SOCH) model and calculation processes, the unrecognized inaccuracies in the nuclear site PMF calculations were not identified until July 28, 2009. The inspectors determined that the licensee's evaluation was adequate with respect to identifying how long the issue existed and prior opportunities for identification.

ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The licensee's RCA documented that the ERCW Pumping Station was degraded and nonconforming since Units 1 and 2 began operation in 1981 and 1982, respectively, as adequate design basis documents for clear identification of flood barriers never existed. The licensee determined that the potential leak path could have been identified prior to the NTTF walkdown in September 2012. Specifically, system modifications, conduit sealant specification changes, corrective action program entries, NRC Information Notice (IN) 2007-01, "Recent Operating Experience Concerning Hydrostatic Barriers," dated January 31, 2007, (ADAMS Accession No. ML063540449) and a previous NRC NOV were examples of opportunities that could have led to identification prior to the NTTF walkdown. The inspectors determined that the licensee's evaluation was adequate with respect to identifying how long the issue existed and prior opportunities for identification.

- c. IP 95002 requires that the inspection staff determine that the evaluation documented the plant-specific risk consequences, as applicable, and compliance concerns associated with the issues both individually and collectively.

i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The inspectors reviewed the licensee's risk evaluation as documented in the Safety Consequences section of the RCA for PER 682212. The licensee determined the annual exceedance probability of the design basis flooding event to be less than 1E-6 for Sequoyah. In the NRC's evaluation, Significance Determination Process Phase 3 Analysis, SEQ-1203.1, a precise quantitative estimate of the increase in core damage frequency from this event could not be estimated, but a range of values was determined starting from a lower bound of 8.68E-6. In addition, the RCA for PER 682212 documented the consequences of the issue given the premise that a probable maximum flood had occurred prior to identification of this previously unanalyzed condition. The licensee determined that the event would have made maintenance of core cooling impossible at Sequoyah with the prevailing procedural guidance. The inspectors concluded that the licensee appropriately documented the risk consequences and compliance concerns associated with the issue both individually and collectively.

ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The NRC determined this issue was a white finding, as documented in IR 05000327/2013010, and the licensee's RCA also documented that the finding associated with this issue had white (less than 6E-6) safety significance. In addition, the licensee's RCA documented the consequences of the issue, which included declaring the ERCW system degraded, nonconforming.

The licensee also documented that a reduced defense in depth to nuclear safety would exist in the event of a flood condition, up to and including the design basis flood, since water in-leakage into the ERCW Pumping Station could result in a loss of the ERCW system which would remove much of the capability of the residual heat removal system to perform reactor coolant system cool down. The loss of ERCW would also result in the loss of cooling to the EDGs and ultimately a failure of the emergency power source for safety-related equipment and eliminate the ability of the component cooling water system to remove and dissipate its design heat load. A loss of ERCW could also eliminate the capability of the spent fuel pit heat exchangers to remove decay heat from the spent fuel pit. The inspectors concluded that the licensee appropriately documented the risk consequences and compliance concerns associated with the issue both individually and collectively.

d. Findings

No findings were identified.

02.02 Root Cause, Extent of Condition, and Extent of Cause Evaluation

a. IP 95002 requires that the inspection staff determine that the problem was evaluated using a systematic methodology to identify the root and contributing causes.

i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The licensee used the following systematic methods to complete the RCA for PER 682212:

- Data gathering through interviews and document review
- Events and causal factor analysis
- Barrier analysis
- Change analysis
- Organizational and programmatic factors evaluation
- Management oversight and risk tree analysis
- Safety culture evaluation

The inspectors determined that the licensee evaluated the issue using a systematic methodology to identify root and contributing causes.

ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The licensee used the following systematic methods to complete the RCA for PER 655763:

- Data gathering through interviews and document review
- Timeline construction
- Event and causal factor charting
- Barrier analysis

The inspectors determined that the licensee evaluated the issue using a systematic methodology to identify root and contributing causes.

- b. IP 95002 requires that the inspection staff determine that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.

i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The licensee's RCA for PER 682212 included an extensive timeline of events and an event and causal factor tree. The licensee's RCA documented two root causes:

- Root Cause 1 (RC-1): Overconfidence in the accuracy of the SOCH model and calculation processes resulted in unrecognized inaccuracies in the nuclear site PMF calculations. These inaccuracies originated from design input errors present in the SOCH model.
- Root Cause 2 (RC-2): TVA Nuclear management's failure to provide effective oversight of changes to the river system and to apply safety-significant conservative decision-making for those changes affecting nuclear site PMF calculations demonstrated that nuclear safety during flooding conditions was not the overriding priority.

The licensee determined that the contributing causes included:

- Contributing Cause 1 (CC-1): Formal process controls have not been established that ensure the Flood Protection Program protects critical safety systems for the nuclear sites.
- Contributing Cause 2 (CC-2): TVA demonstrated less than adequate shared understanding of the applicable regulatory requirements under which the nuclear sites, as integral components of the river system, must operate.
- Contributing Cause 3 (CC-3): TVA incorrectly assumed that the corrective actions identified in the root cause and apparent cause evaluations for the Bellefonte COLA shortfalls were completed as written.

Based on the extensive work performed for this root cause evaluation, the inspectors concluded that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.

ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The licensee's RCA included an extensive timeline of events and an event and causal factor tree as discussed in the previous section. The licensee also identified that the potential water in-leakage during a flood condition was not limited to the ERCW Pumping Station, and the issue applied to other safety-related equipment. The licensee's RCA documented two root causes:

- Root Cause 1 (RC-1): ERCW Pumping Station penetration seals were not specifically addressed in original design documents.
- Root Cause 2 (RC-2): TVA leadership demonstrated less than adequate sensitivity to flooding by failing to establish and implement programmatic controls of the Flood Protection Program, which contributed to the failure to identify penetration deficiencies sooner.

The licensee determined that the contributing causes included:

- Contributing Cause 1 (CC-1): Configuration Control for design basis flood (DBF) is inadequate.
- Contributing Cause 2 (CC-2): Sequoyah practices in addressing maintenance related to activities in regard to flooding issues were not sensitive to the requirements of maintaining an adequate flood barrier during a DBF.

Based on the extensive work performed for this root cause evaluation, the inspectors concluded that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.

- c. IP 95002 requires that the inspection staff determine that the root cause evaluation included a consideration of prior occurrences of the problem and knowledge of prior operating experience (OE).

i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The licensee's RCA for PER 682212 included an evaluation of internal and external OE. During validation of the hydrology model in response to the Bellefonte NOV, and after TVA realized that there were errors in the SOCH model inputs, PER 201568 was written on September 11, 2009, and an RCA was performed. In addition, on April 29, 2010, an Apparent Cause Evaluation (ACE) documented in PER 227488 was performed and included a comprehensive review of operating experience relative to the maintenance of quality software.

The root cause identified in PER 201586 was the failure to establish a PMF procedure or process which could be used to train River Operations personnel on how to perform, revise, and maintain accurate PMF calculations. Because there was no procedure or process, there was also no requirement to consider the effects of changes in the TVA River System on PMF calculations. The root cause of this event was organizational and programmatic deficiencies caused by organizational breakdowns and inadequate communication within and between River Operations and Nuclear Power Group (NPG). Contributing causes included inadequate information, inadequate training, unfamiliarity with information availability, misjudgment, wrong assumptions, human errors, and inadequate self-verification processes. The ACE from PER 227488 concluded that this was a recurring event and proposed a single point of contact to ensure that all software used for hydrology met regulatory requirements. TVA-IGA-09.002, "TVA Intergroup Agreement (IGA) Nuclear Power Group and River Operations & Renewables," Revision 1, establishes the Manager-NPG Corporate Civil/Mechanical Engineering as responsible for ensuring that all affected organizations comply with the requirements of the Nuclear Quality Assurance Plan.

The licensee's RCA concluded that lessons learned from OE identified in RCA PER 201568 and ACE PER 227488 may have resulted in identifying the shortfalls in the hydrologic model SOCH sooner, but would not have prevented this event. Based on the licensee's detailed evaluation and conclusions, the inspectors determined that the licensee's RCA included a consideration of prior occurrences of the issue (none) and knowledge of prior OE.

ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The licensee's RCA included an evaluation of internal and external OE and considered similar prior occurrences. As a result of this review, the licensee determined that OE from all sources was not evaluated thoroughly since there was no single point of contact that would periodically review OE for programmatic flooding issues. Some OE was reviewed by individuals that performed various tasks related to flooding, but no one reviewed OE with a sense of accountability and ownership for the Flood Protection Program as a whole. This explains why none of the OE (internal and external) noted in the licensee's RCA prompted a deeper look into the Flood Protection Program and its basis documents. A single point of contact was created by Corrective Action to Prevent Recurrence (CAPR)-2-02 to perform tasks for the Flood Protection Program including required periodic OE review. Actions 682212-003 and 682212-004 created formal process controls for the Flood Protection Program which will drive OE review as well. The inspectors reviewed procedures for the Flood Protection Program and training for the single point of contact position. The Flood Protection Program will have a health report that requires OE review, periodic self-assessments and industry interaction. The licensee's RCA concluded that OE did not exist at the time of construction and could not have prevented this event. However, the licensee's RCA acknowledges that opportunities existed to identify the nonconformance sooner.

Based on this review, the licensee and inspectors were able to make conclusions regarding weaknesses in its OE program. Some of the more pertinent conclusions included:

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- OE244763 (Three Mile Island) had similar implications to this event in that inadequate documentation of the flood barrier system design was coupled with a station insensitive to the risk significance of external flooding. This OE was not formally acted upon by Sequoyah, as no corrective action program record exists addressing this OE. Sequoyah cause determinations and corrective actions are similar to those stemming from OE244763. This OE was identified on August 21, 2010, and could have aided Sequoyah in identifying this issue sooner;
 - Corrective actions from CA QR SQP8714447 were ineffective in identifying the need for qualification of materials as flood barriers. The licensee's RCA indicated this was likely due to the absence of a cause evaluation being performed at that time;
 - The NRC inspectors observed inconsistent treatment of the applicability for internal flooding in the licensee's RCA. The extent of condition excludes internal flooding from its scope due to capture of internal flooding issues in other programs but OE examples (PER 120915, 227296) indicate that they are applicable; and OE items from NRC IN 2007-01 (2006 events) reviewed by the licensee (PER 120915) prior to this event and during the licensee's RCA failed to recognize generic implications of internal and external flooding affecting safety related equipment due to lack of detailed barrier seal basis documents, degraded seals and a lack of seal inspections.
- d. IP 95002 requires that the inspection staff determine that the root cause evaluation addresses the extent of condition and the extent of cause of the problem.
- i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The licensee's RCA identified two conditions as part of the review for extent of condition. Condition 1 was the potential to overtop and fail earthen embankments at the Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams. This was viewed as a physical condition. Condition 2 was for an indeterminate period, the processes and procedures for calculating, quantifying, and mitigating flood events, up to and including a 100 percent PMF event, have been less than adequate to protect specific plant equipment at Watts Bar and Sequoyah. This was viewed as a programmatic condition. The extents of these two conditions are addressed below:

- The Extent of Condition 1 was the potential for the failed embankments at the Cherokee, Fort Loudoun, Tellico, Watts Bar, Chickamauga, Nickajack, and Guntersville Dams to have resulted in affecting equipment at Browns Ferry prior to the completion of the compensatory actions described above.
- The Extent of Condition 2 was the potential that programmatic weaknesses in the control of PMF calculations and for the configuration of the river system could impact other NPG processes.

The licensee conducted an extent-of-cause review for each identified root and contributing cause. In the evaluation of the extent of the root causes, the licensee concluded that the causes have the potential to result in additional deficiencies and to impact performance in other areas. Below is a summary of the extent of cause for the two root causes identified in the RCA:

- The Extent of Cause for Root Cause 1 was the potential for overconfidence in processes of other engineering programs inside and outside of TVA that are important to nuclear safety but not subject to rigorous oversight controls which could have inaccuracies in them.
- The Extent of Cause for Root Cause 2 was the potential that existing TVA processes for the consideration of risk in decision-making may not adequately establish nuclear safety as the overriding priority.

The inspectors concluded that the licensee's RCA addressed the extent of condition and extent of cause of the problem through the reviews conducted and the designated corrective actions.

ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The licensee's evaluation considered the extent of condition associated with potential in-leakage paths as a result of external flooding. The licensee performed a "Same-Same, Same-Similar" methodology to determine the affected population of systems or structures. The licensee determined that the issue of in-leakage during external flooding was not limited to the ERCW Pumping Station. The licensee's RCA concluded that the systems and structures potentially affected by design basis external flooding in-leakage were:

- All other ERCW Pumping Station penetrations;
- EDG Building;
- Shield Building; and
- Spent Fuel Pool Cooling Pump Enclosure.

The evaluation determined that this extent of condition may also be applicable to Browns Ferry and Watts Bar. A functional evaluation was completed as a result of the extent of condition that determined the ERCW Pumping Station and Shield Building were nonconforming.

The licensee's evaluation also considered the extent of cause (2 root causes) associated with potential in-leakage paths as a result of external flooding. The first root cause (RC-1), "ERCW penetration seals were described in general design documents, but their functional requirements were not specifically addressed in original design documents," had the potential to affect other areas of site design. The licensee examined Appendix A of 10 CFR 50, Appendix A, "General Design Criteria," and narrowed the extent of cause to those issues listed in Criterion 2, "Design bases for protection against natural phenomena." RC-1 was extended from inadequate design basis documents for flooding

related events to potentially inadequate design basis documents for all external events. PER 690276 was generated to review documentation for external hazards and develop a design basis document for external hazards.

The second root cause (RC-2), "TVA leadership demonstrated less than adequate sensitivity to flooding by failing to establish and implement programmatic controls of the Flood Protection Program, which contributed to the failure to identify penetration deficiencies sooner," is potentially applicable to any program important to nuclear safety where there is less than adequate sensitivity to establishment of programmatic controls. The root cause team was not able to verify that each program had appropriate programmatic controls. An action was created in Sequoyah 682212-028 to review potentially affected programs and processes. The licensee's RCA notes that the review should give consideration to the following:

- Licensing basis requirements;
- Importance to nuclear safety;
- Depth of available expertise (e.g., TVA Subject Matter Expert, availability of outside resources);
- Quality of documentation and resources;
- Verification and validation performed on software where appropriate; and
- Results of recent assessments, internal or external (i.e., program health).

The inspectors concluded that the licensee's RCA addressed the extent of condition and the extent of cause of the problem.

e. Findings

No findings were identified.

02.03 Corrective Actions

- a. IP 95002 requires that the inspection staff determine that appropriate corrective actions are specified for each root and contributing cause or that the licensee has an adequate evaluation for why no corrective actions are necessary.
- i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The inspectors found that a systematic methodology, and evaluation level of detail, identified appropriate corrective actions for the root and contributing causes as previously discussed in paragraph 02.02.2.a.i In addition, the reviews for extent of condition and extent of cause resulted in additional corrective actions being developed, or additional analysis to determine if appropriate corrective actions existed. Below are the corrective actions the licensee developed to prevent reoccurrence:

CAPR 682212-003 addressed RC-1 and CC-1 by revising the Conduct of the Engineering Organization procedure (currently NEDP-20), to include a Flood Protection Program within the Corporate Nuclear Engineering Organization with the primary function to ensure that the nuclear plant critical safety systems are protected from all postulated flooding conditions.

CAPR 682212-004 addressed RC-1, CC-1, and CC-2 by developing formal Flood Protection Program Management Implementing Procedures to:

- Define the Flood Protection Program policy, “To ensure that the nuclear plant critical safety systems are protected from all postulated flooding conditions”.
- Appoint Single-point ownership
- Define Roles & Responsibilities
- Identify the nuclear regulatory requirements
- Establish Governance & Oversight expectations for:
 - River Operations river system changes impacting nuclear plant flood protection
 - Dam modifications impacting nuclear plant flood protection
 - Flood warning methodology and procedures
 - Flood calculations
 - Vendor oversight requirements
 - Plant AOP integration with critical hydrology inputs
- Periodic benchmarking and self-assessment of the Flood Protection Program
- Benchmarking and maintenance of the calculation methodology
- Establish training and qualification requirements in accordance with the SAT process
- Institute a Flood Protection Change Control Board process
- Implement a Program Health Report for Flood Protection

CAPR 682212-005 addressed RC-1, CC-1, and CC-2 by developing formal Flood Protection Program Design Standard(s) or Design Guide(s) in accordance with NEDP-6, to control the flood protection calculation process.

CAPR 682212-010 addressed RC-1, RC-2, and CC-1 by creating a formal documented risk management process for all engineering products, informed by INPO 12-008, Excellence in Integrated Risk Management, which includes flood-related issues to evaluate:

- River system operation changes
- Nuclear plant design changes
- Design input changes
- Procedure changes impacting flood protection
- Environmental/NEPA
- Project Management

CA 682212-013 addressed CC-1, CC-2, and CC-3 by revising the TVA Nuclear corrective action program process/procedure to include review on Non-Nuclear Level A and B PERs for potential impact to Nuclear. Impacts that should be considered include:

nuclear safety, radiological safety, industrial safety, regulatory interest, operability, and reportability.

The inspectors concluded that the proposed and implemented corrective actions were appropriate and addressed each root and contributing cause.

ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The licensee took corrective actions to remove the ERCW Pumping Station from degraded, nonconforming status by installing additional sump pumps to mitigate water in-leakage in the event of a DBF, sealing open conduits identified on the ERCW Pumping Station and installing new penetration seals for the areas that were initially identified as inadequate. The resident inspectors observed installation of the new penetration seals for the areas that were initially identified as inadequate.

Corrective actions CAPR-1-01 through CAPR-1-06 address RC-1 by creating a design basis document that will identify flood barriers and a new drawing series that will contain adequate information to identify a flood barrier and what it consists of to identify design basis flood barriers.

Corrective actions 682212-003, 682212-004, and 655763-006 address RC-2. The RC-2 corrective actions created a single point contact for flooding issues and a Flood Protection Program within the Corporate Nuclear Engineering Organization. The RC-2 corrective actions are planned to develop the Flood Protection Program policy to ensure that program roles and responsibilities are defined and periodic program benchmarking and self-assessment requirements are performed.

Corrective actions CAPR-1-01 through CAPR-1-06 address CC-1 by creating a design basis document that will identify flood barriers and a new drawing series that will contain adequate information to identify a flood barrier and what it consists of to identify design basis flood barriers. CA-005 will add test data to applicable vendor manuals stating what pressures that seals can withstand.

CC-2 was addressed by corrective action LTCA-001 which will create a technical instruction to provide guidance on identifying flood barriers and the impairment process. LTCA-005 will close the GAP for electrical planners by revising M&AI-13.1, "Installation of Cable Tray Penetration Seals, Pressure Seals, Flame-Retardant Cable Coating, and Mechanical Seals," Revision 13, to reference the documents created in CAPR-1-01 through CAPR-1-06.

The inspectors determined that the proposed and completed corrective actions documented in the RCA are appropriate and addressed each root and contributing cause.

- b. IP 95002 requires that the inspection staff determine that the corrective actions have been prioritized with consideration of risk significance and regulatory compliance.

i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The licensee's immediate corrective actions were to install a compensatory measure, HESCO barriers, to prevent the earthen embankments of the dams upriver from the nuclear sites from overtopping. The inspectors walked these HESCO barriers down to verify that they were adequate. The inspectors observed the storage locations and quantities of spare HESCO barriers and filler material, and reviewed the associated procedures. In December 2012, the resident inspectors observed the licensee's conduct of exercises to set up the HESCO barriers and fill them with filler material to demonstrate that timeline estimates were adequate.

Based upon the corrective actions listed in the previous section (02.03.a.i), as well as the other corrective actions identified in the RCA and sampled for inspection, the inspectors determined that the licensee prioritized corrective actions with consideration of risk significance and regulatory compliance.

The inspectors reviewed the licensee's plans for accomplishing the corrective actions and noted that the risk significance was being appropriately considered.

ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The licensee's interim corrective action resulted in installation of temporary sump pumps in the ERCW Pumping Station to mitigate the consequences of a flooding event. A permanent plant modification was then performed to replace the conduit seals in Manway 33 of the ERCW Pumping Station. Once the seal replacement was complete the ERCW Pumping Station was no longer degraded, nonconforming with respect to the current licensing basis.

The inspectors determined that the licensee prioritized corrective actions with consideration of risk significance and regulatory compliance. Work to address the EDG Building will be completed next with a current due date of January 15, 2014. Additional modifications to existing structures, including the Shield Building, are scheduled to be completed during the next refueling outage (Unit 1 outage scheduled May 1, 2015, and Unit 2 outage scheduled June 30, 2014). The Shield Building is considered degraded, nonconforming until corrective actions are complete. A functional evaluation has been performed for potential flooding scenarios and concluded that equipment required to mitigate a flood will not be adversely impacted by water intrusion into the Shield Building.

The inspectors reviewed the licensee's plans for accomplishing these activities and noted that the risk significance of the equipment was being appropriately considered.

- c. IP 95002 requires that the inspection staff determine that a schedule has been established for implementing and completing the corrective actions.
- i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The inspectors determined that all of the corrective actions listed in the RCA have been either scheduled or completed. The evaluation indicated two interim corrective actions were completed, six CAPRs were completed, and 24 planned corrective actions were either completed or scheduled to be completed by the second quarter of 2014.

- ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The inspectors determined that all of the corrective actions listed in the RCA have been scheduled or completed. The evaluation indicated that two CAPRs, two LTCAs, and 4 corrective actions were completed by the time of the inspection. Four remaining CAPRs were scheduled to be completed by the second quarter of 2014.

- d. IP 95002 requires that the inspection staff determine that quantitative or qualitative measures of success have been developed for determining the effectiveness of the corrective actions to prevent recurrence.
- i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

As documented in the licensee's RCA, quantitative and qualitative measures were established for determining the effectiveness of the corrective actions. The licensee also plans to perform a self-assessment for each corrective action. The assessment method, attributes, success criteria, and timeliness are clearly listed in the RCA for each corrective action.

The inspectors determined that quantitative and qualitative measures of success had been developed for determining the effectiveness of the corrective actions to prevent recurrence.

- ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

As documented in the licensee's RCA, quantitative and qualitative measures were established for determining the effectiveness of the corrective actions. The licensee also plans to perform a self-assessment for each corrective action. The assessment method, attributes, success criteria, and timeliness are clearly listed in the RCA for each corrective action.

The inspectors determined that quantitative and qualitative measures of success had been developed for determining the effectiveness of the corrective actions to prevent recurrence.

- e. IP 95002 requires that the inspection staff determine that the corrective actions planned or taken adequately address a Notice of Violation that was the basis for the supplemental inspection.
- i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The NRC issued an NOV to the licensee on June 4, 2013. The licensee provided the NRC a written response to the NOV on July 3, 2013. The licensee's response described: 1) corrective steps which have been taken and the results achieved; 2) corrective steps which will be taken; 3) the date when full compliance will be achieved; and 4) the reasons for the violation. During this inspection, the inspectors confirmed that the licensee's RCA and planned and taken corrective actions addressed the NOV. The licensee completed actions to ensure the adequacy of the Sequoyah abnormal condition procedure for flood mitigation on December 30, 2009, by completing installation of the HESCO barriers which raised the effective height of the earthen embankments and completing the post-HESCO PMF calculation for Sequoyah. The inspectors also noted that the licensee had submitted a license amendment request to the NRC regarding changes to the Sequoyah flood mitigation strategy

- ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The NRC issued an NOV to the licensee on June 4, 2013. The licensee provided the NRC a written response to the NOV on July 3, 2013. The licensee's response described: 1) corrective steps which have been taken and the results achieved; 2) corrective steps which will be taken; 3) the date when full compliance will be achieved; and 4) the reasons for the violation. During this inspection, the inspectors confirmed that the licensee's RCA and planned and taken corrective actions addressed the NOV. The licensee restored full compliance on September 20, 2013, by restoring the flood barrier integrity to the ERCW Pumping Station.

- f. Findings

No findings were identified.

02.04 Independent Assessment of Extent of Condition and Extent of Cause

- a. Inspection Scope

IP 95002 requires that the inspection staff perform a focused inspection to independently assess the validity of the licensee's conclusions regarding the extent of condition and extent of cause of the issues. The objective of this requirement is to independently sample performance, as necessary, within the key attributes of the cornerstone that are related to the subject performance issues to ensure that the licensee's evaluation regarding the extent of condition and extent of cause is sufficiently comprehensive.

i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

The inspectors conducted independent extent of condition and extent of cause reviews of the issues associated with the white finding and associated licensee root cause evaluation reports. Licensee root cause report for PER 682212 revealed TVA over-confidence in their flood model analysis, a lack of formal TVA process controls for flood protection, a lack of understanding of regulatory reporting requirements, and inadequate corrective action closure practices within TVA. The review focused on the primary root causes and contributing causes that involved more specific aspects of the broader root causes.

The inspectors assessed whether the licensee's extent of condition and extent of cause evaluations sufficiently identified and bounded other potential existing conditions that could adversely affect other plant SSCs, plant processes, or human performance. The inspectors assessed whether the licensee's evaluations were intrusive enough to determine if similar issues existed in other licensee programs focusing on external event initiators including freeze protection and tornado high wind protection. The inspectors reviewed the licensee's implementation of the maintenance rule program by sampling corrective action documentation, event reports, plant operating history, equipment operating history, and maintenance records to identify equipment maintenance problems that may exist relating to the selected external events.

In conducting this independent review, the inspectors interviewed station management and engineering personnel, reviewed program and process documentation, and reviewed existing station program monitoring and improving efforts, including review of corrective action documents. Based on the root and contributing causes identified by the licensee, the inspectors focused on the following key attributes of the mitigating system cornerstone to determine if the licensee adequately considered the attributes in their causal analysis:

- Design control
- Configuration control
- Equipment performance
- Procedure quality

ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The inspectors conducted independent extent of condition and extent of cause reviews of the issues associated with the white finding and associated licensee root cause evaluation reports. Licensee root cause report for PER 655763 revealed a Sequoyah Station inadequate functionality assessment of ERCW Pumping Station conduit seals, lack of sensitivity by TVA management in regards to flooding, an inadequate configuration control for design basis flooding, and inadequate maintenance of flood barriers. The inspectors' review focused on the primary root causes and contributing causes that involved more specific aspects of the broader root causes.

The inspectors performed walk down inspections of the EDG Building, ERCW Pumping Station, spent fuel pool pump pit enclosure, control room, and Unit 1 and Unit 2 steam valve vault rooms and associated equipment to assess configuration control, active deficiency tags, housekeeping, and overall readiness of the area equipment to function properly. The team reviewed a sample of work orders, PERs, operating procedures, and planned corrective actions associated with the selected areas.

In conducting this independent review, the inspectors interviewed station management and engineering personnel, reviewed program and process documentation, and reviewed existing station program monitoring and improving efforts, including review of corrective action documents. Based on the root and contributing causes identified by the licensee, the inspectors focused on the following key attributes of the mitigating system cornerstone to determine if the licensee adequately considered the attributes in their causal analysis:

- Design control
- Configuration control
- Equipment performance
- Procedure quality

b. Assessment

The inspectors determined that the licensee conducted a comprehensive extent of condition and extent of cause review that sufficiently identified relevant areas for both white findings associated with PER 682212 and PER 655763. The inspectors did not identify any substantive extent of condition and extent of cause issues that the licensee was not aware of and had not already identified with corrective action plans in place.

The inspectors found the corrective actions taken or planned by the licensee were adequate in addressing the causes of the white findings and should help address any additional issues similar to the shortfalls identified in the two subject root cause evaluation reports.

During system walk downs, the inspectors found selected areas to be well lighted, properly labeled, and overall housekeeping to be adequate. The inspectors noted some minor housekeeping, mechanical drawing, and general operating procedure deficiencies associated with the west steam valve vault rooms that were entered into the licensee's corrective action program associated with cold weather protection.

c. Findings

No findings were identified.

02.05 Safety Culture Consideration

a. Inspection Scope

IP 95002 requires that the inspection staff perform a focused inspection to independently determine that the root cause evaluation appropriately considered whether any safety culture component caused or significantly contributed to any risk significant performance issue.

The inspection staff reviewed the licensee's RCA, corrective action documents, employee concerns program entries, and conducted interviews with licensee personnel to determine if the licensee properly considered whether any safety culture component caused or contributed to the issue.

b. Assessment

i. T.S. 6.8.1, Inadequate Abnormal Condition Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (White)

As part of the root cause evaluation for the issue, the licensee evaluated the identified root and contributing causes against the safety culture components that could have contributed to the issues. The licensee's root cause evaluation included a discussion of the 13 safety culture components described in Regulatory Issue Summary 2006-013, "Information on the Changes Made to the Reactor Oversight Process to More Fully Address Safety Culture," dated July 31, 2006, (ADAMS Accession No. ML061880341) as they applied to the white finding affecting the mitigating systems cornerstone. The licensee identified several key safety culture areas in their RCA. They included:

- failure to address risk during decisions that were made affecting the PMF calculations for the nuclear sites, and
- oversight of River Operations and NPG working together on river level and dam changes that affected the nuclear sites.

The inspection staff independently confirmed that a number of other safety culture components that contributed to the issue were also identified in the RCA. These additional safety culture components included weaknesses in the corrective action program and self-assessments. For each of the identified prevalent and contributing safety culture components, the inspection staff confirmed that the licensee established corrective actions to address the issues. During the course of interviews with licensee personnel, the inspectors asked interviewees questions related to safety conscious work environment (SCWE) to determine if licensee staff were reluctant to raise safety concerns or if retaliation existed for raising safety concerns. The inspectors did not identify concerns related to SCWE.

ii. Criterion III, Degraded Intake Pumping Station Flooding Barriers (White)

The licensee performed a Safety Culture Evaluation to determine if safety culture components caused or significantly contributed to the issue. This Safety Culture Evaluation was partially responsible for the development of RC-2. Specifically, this evaluation determined that resources were not available and adequate to assure nuclear safety and maintain long-term plant safety by maintenance of design margins. Programmatic controls did not exist for the Flood Protection Program and no program owner existed to address flooding issues.

The inspection staff independently confirmed that several other safety culture components that contributed to the issue were also identified in the licensee's RCA. These additional safety culture components included maintaining complete and accurate design documentation, maintaining design margin, performing timely corrective actions, and using conservative assumptions in decision making. For each of the identified prevalent and contributing safety culture components, the inspection staff confirmed that the licensee established corrective actions to address the issues. During the course of interviews with licensee personnel, the inspectors asked interviewees questions related to SCWE to determine if licensee staff were reluctant to raise safety concerns or if retaliation existed for raising safety concerns. The inspectors did not identify concerns related to SCWE.

c. Findings

No findings were identified.

02.06 Evaluation of IMC 0305 Criteria for Treatment of Old Design Issues

For both findings, the licensee requested credit for self-identification of an old design issue during the Regulatory Conference conducted on April 22, 2013, as noted in the public meeting summary (ADAMS Accession No. ML13115A020). The NRC evaluated these issues against the IMC 0305 criteria for treatment of an old design issue in IR 05000327/2013011 and 05000328/2013011 (ADAMS Accession No. ML13155A560) and determined that the findings would not be treated as old design issues.

40A5 Other Activities

.01 Follow-up on Traditional Enforcement Actions Including Violations, Deviations, Confirmatory Action Letters, Confirmatory Orders, and Alternative Dispute Resolution Confirmatory Orders (92702)

a. Inspection Scope

In accordance with IP 92702, the inspectors conducted a follow-up inspection of enforcement action EA-13-023, which was a Severity Level III violation of 10 CFR 50.72(b)(3)(ii)(B), for the licensee's failure to report within eight hours an unanalyzed condition that significantly degraded plant safety related to an increase in the postulated PMF level.

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This issue was documented as an NOV in inspection reports 05000327/2013011 and 05000328/2013011 (ADAMS Accession No. ML13155A560). The inspectors reviewed TVA's response, dated July 3, 2013, (ADAMS Accession No. ML13192A035) to determine whether the stated corrective and preventative actions were timely and appropriate. The inspectors evaluated whether the response described the conduct of a root cause analysis and implementation of appropriate changes in training and procedures. The inspectors assessed whether generic implications were addressed and whether the licensee programs and practices have been enhanced to prevent recurrence.

The inspectors reviewed PER 682202 and the associated RCA to determine whether: 1) TVA management assigned responsibility for implementing corrective actions, including changes in procedures and practices; 2) corrective actions have been fully implemented; 3) the RCA was adequate to address the deficiency and prevent recurrence; and 4) the generic implications identified were adequate.

TVA's response to the NOV included a discussion of the root causes for the failure to report the unanalyzed condition related to PMF. The reasons for the violation described in the response included a cultural bias within the corporate NPG towards not reporting events and conditions when the consequences were uncertain and not analyzed, procedural inadequacies, and a weak understanding of unanalyzed conditions and the relationship to reportability. The corrective actions described in the response include making a notification to the NRC on February 6, 2013 (Emergency Notification Report 48725), the development of a structured oversight program to assess reportability decisions, and procedural and training revisions.

The inspectors reviewed the licensee's changes to various implementing procedures to verify the inclusion of appropriate guidance from NUREG-1022, "Event Reporting Guidelines: 10 CFR 50.72 and 50.73," dated January 2013, and other sources. The inspectors also reviewed updates to training plans to verify that the appropriate emphasis on reportability was incorporated. The inspectors observed a portion of a training session that used the violation as a case study. The inspectors interviewed individuals from TVA corporate, Sequoyah senior management, licensing, operations, and engineering personnel to understand how corrective actions taken address the cultural bias toward not reporting events and conditions if the consequences were uncertain.

b. Findings

No findings were identified.

The inspectors concluded that the corrective actions implemented by TVA were adequate. In addition, the inspectors concluded that the root causes of the violation were identified, that generic implications have been addressed, and that the licensee's programs and practices have been appropriately enhanced to prevent recurrence.

Enclosure

4OA6 Exit Meeting

On December 13, 2013, the inspectors presented the inspection results to Mr. John Carlin and other members of his staff. The inspectors verified no proprietary information was reviewed or documented in the report.

SUPPLEMENTARY INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel:

J. Carlin, Vice President, Sequoyah
T. Cosby, Senior Program Manager, Nuclear Safety Culture, TVA Corporate
E. Craig, Engineering, Sequoyah
J. Dempsey, Employee Concerns, Sequoyah
D. Dimopoulos, Design Engineering Manager, Sequoyah
K. Dutton, 95002 Project Manager, TVA Corporate
G. Garner, Operations Superintendent, Sequoyah
M. Hayes, Flood Program Point of Contact, Sequoyah
M. Henderson, Acting Program Engineering Manager, Sequoyah
K. James, Systems Engineering Manager, Sequoyah
M. McBrearty, Licensing Manager, Sequoyah
B. McCreary, Employee Concerns, Sequoyah
M. Meade, Site Flooding/95002 Lead, Sequoyah
T. Rieger, Operations, Sequoyah
A. Robinson, Senior Manager Engineering Programs, TVA Corporate
P. Selman, Program Manager, Nuclear Design Engineering, TVA Corporate
J. Shea, Vice President, Nuclear Licensing, TVA Corporate
P. Simmons, Plant Manager, Sequoyah
P. Wagner, Senior Program Manager, Organizational Effectiveness, TVA Corporate
B. Wetzel, Manager, Emerging Regulatory Issues, TVA Corporate

NRC Personnel:

G. Smith, Senior Resident Inspector

LIST OF REPORT ITEMS

Closed

05000327, 328/2013009-01	VIO	Inadequate Abnormal Operating Procedure for Flood Mitigation Strategy Prior to Installation of HESCO Barriers (Section 4OA4)
05000327, 328/2013009-02	VIO	Failure to Report Unanalyzed Condition Related to External Flooding (Section 4OA5)
05000327, 328/2013010-01	VIO	Degraded Intake Pumping Station Flooding Barriers (Section 4OA4)

05000327/2012-001-00	LER	Unanalyzed Condition Affecting Essential Raw Cooling Water System due to External Flooding (Section 4OA3.01)
05000327/2013-001-00	LER	Latent Design Input Inconsistencies Adversely Affect Probable Maximum Flood Analysis (Section 4OA3.02)

LIST OF DOCUMENTS REVIEWED

Problem Evaluation Reports (PERs) and Service Requests (SRs):

PER 020470, Drawing 47W920-43 Note 2
 PER 120915, Perform and document review for applicability of NRC Information Notice 2007-01
 PER 516598, Dunage for Missile Shields
 PER 610005, NTF-2.3-Flood walk down ERCW leak path
 PER 626186, Missile Shield Lifted Without Load Test Inspection
 PER 655763-006, Shield building actions and improved completion dates
 PER 655763-033, Issue a DBD which will address ERCW in-leakage
 PER 655763-034, Issue new exterior flood barrier drawing series
 PER 655763-035, Implement design output to seal U1 shield building
 PER 655763-036, Implement design output to seal U1 shield building
 PER 655763-037 & -038, Issue a DBD to identify flood hazard barriers at the Diesel Generator Building
 PER 655763-039, Assign a single point owner of the external flood protection program
 PER 661589, Missile Shield Gap Seal Plates Missing
 PER 665633, Implementation of Freeze Protection
 PER 682202, Failure to Report an Unanalyzed Condition as Required by 10 CFR 50.72
 PER 682212, Unrecognized Increase in Probable Maximum Flood Levels Resulted in Unanalyzed conditions at TVA Nuclear Stations
 PER 682212-003, Revise conduct of engineering organization procedure
 PER 682212-004, Develop formal flood protection program management implementing procedure
 PER 682212-028, Develop inventory of programs and processes that are important to nuclear safety
 PER 687979, Freeze Protection
 PER 690276, NSRB Identified External Events
 PER 722431, Fire Hydrant embedded in ERCW Missile Shield
 PER 731483, Untimely Corrective Actions for Hydrology Issues
 PER 736309, Rebar eyelets on Missile Shield is Barely Visible
 PER 805995, Missile Shield Bolt Would not Thread in
 PER 806263, Unit 2 Missing Boot Seal in Annulus
 SR 818664, Ladder location not consistent with procedure FPMI-12.15
 SR 819538, Procedure discrepancy for required supplies
 SR 819897, Initial extent of condition review for flood preparation procedures discrepancies
 SR 820059, Lack of critical thinking in flood seal evaluation documentation
 SR 820082, Freeze protection panels need to be permanently removed
 SR 820084, Impact review of DCN 22404

SR 820086, Drawing note incorrectly removed for detail
 SR 820257, Discrepancy between maintenance and operations procedures for cabinet seals
 SR 820860, Missing boot seal impact on EGTS
 SR 820866, Critical thinking regarding SFPCP enclosure

Procedures:

0-GO-7, "Unit Shutdown from Hot Standby to Cold Shutdown," Rev 73
 0-GO-1, "Unit Startup from Cold Shutdown to Hot Standby," Rev 71
 1-PI-EFT-234-706.0, "Freeze Protection Heat Trace Functional Test," Rev 38
 0-PI-MIN-000-001.0, "Flood Preparation Equipment Inventory," Rev 1
 0-PI-OPS-000-006.0, "Freeze Protection," Rev 55
 0-PI-OPS-000-006.1, "Summer Operation," Rev 7
 0-PI-OPS-510-001.0, "Operations Flood Preparation Equipment Inventory," Rev 16
 0-SI-OPS-067-117.0, "ERCW System Operation," Rev 5
 0-SI-OPS-082-007.M, "Diesel Generator Operability Verification," Rev 13
 0-SI-OPS-244-215.0, "Flood Protection Communications," Rev 5
 0-TI-DXX-000-922.0, "EFPP Bases Document," Rev 0
 0-TI-DXX-000-922.1, "External Flood Protection Program," Rev 0
 FPMI-12.15, "Flood Preparation Reactor Building Floor Equipment Drain Pumps," Rev 9
 FPMI-12.15, "Flood Preparation Reactor Building Floor Equipment Drain Pumps," Rev 10
 Job Familiarization Guide, "External Flood Protection," Rev 0
 M&AI-13.1, Installation of Cable Tray Penetration Seals, Pressure Seals, Flame-Retardant
 Cable Coating, and Mechanical Seals," Rev 13
 M&AI-27, "Freeze Protection," Rev 13
 NEDP-20, "Conduct of the Engineering Organization," Rev 22
 NEDP-22, "Operability Determinations and Functional Evaluations," Rev 15
 NLDP-7, "Licensing Personnel Training and Qualification," Rev 1
 NPG-SPP-03.5, "Regulatory Reporting Requirements," Rev 9
 NPG-SPP-07.1.7, "Station Seasonal Readiness," Rev 1
 NPG-SPP-09.0, "Conduct of Operations," Rev 4
 NPG-SPP-09.0.1.1, "System Monitoring and Trending," Rev 0
 NPG-SPP-09.0.6, "Conduct of Engineering Programs," Rev 1
 NPG-SPP-09.0.8, "Risk Reviews for Engineering Tasks to Develop Engineering Documents,"
 Rev 0
 NPG-SPP-09.2, "Equipment Environmental Qualification (EQ) Program," Rev 4
 NPG-SPP-09.22, "External Flood Protection Program," Rev 0
 NPG-SPP-09.22, "External Flood Protection Program," Rev 1
 NPG-SPP-10.14, "Freeze Protection," Rev 0
 NPG-SPP-13.0, "Integrated Risk Management Program," Rev 0
 NPG-SPP-22.302, "Corrective Action Program Screening and Oversight," Rev 0
 NPG-SPP-22.302, "Corrective Action Program Screening and Oversight," Rev 1
 NPG-SPP-22.306, "Root Cause Analysis," Rev 0
 OPDP-8, "Operability Determination Process and Limiting Conditions for Operation Tracking,"
 Rev 16
 PHYSI-33, "Requirements Associated with Safety Related Missile Protection Panels," Rev 9
 QADP-2, "Internal Audits," Rev 8
 RvS-SOP-10.05.06, "Nuclear Notifications and Flood Warning Procedure," Rev 0
 SQN-DC-V-1.1, "General Criteria for Design of Reinforced Concrete Structures," Rev 19

SQN-DC-V-13.6, "Seismic/Structural Qualification of Tank and Vessel Assemblies," Rev 5
 TI-4, "Maintenance Rule Performance Indicator Monitoring, Trending and Reporting," Rev 25
 TVA-SPP-20.009, "Coordination of Hydrology Issues," Rev 0
 TVA-SPP-20.2, "Hydrologic Support," Rev 0
 TVA-IGA-09.002, "TVA Intergroup Agreement (IGA) Nuclear Power Group and River Operations & Renewables," Rev 1
 TVA-SPP-01.005, "TVA Intergroup Agreements (IGA)," Rev 0
 TVA-SPP-10.010, "NERC Standard Compliance Processes Shared by TVA's Nuclear Power and Energy Delivery Organizations," Rev 2

Work Orders:

10-770862-00, U2C17 RFO WO to Cut Shield Building Boot Bellows
 113790445, Implement Minor Mod DCN 22404
 113857719, Sealant Where Sense Lines for 2-PDI-30-151 Needs Repair
 114307954, EDG Building Door Elevation 722 Modification

Drawings:

1, 2-47W920-43, "Mechanical Heating, Ventilation, and Air Conditioning," Rev 0
 1, 2-47WHYD-ERCW, "External Flood Hazard Barriers ERCW Pumping Station," Rev 0
 1-47W470-10, "Mechanical Sleeves and Seals Shield Building," Rev 7
 1-47W470-15, "Mechanical Seals Shield Building," Rev 4
 31W211-5, "Concrete ERCW Pumping Station Outline," Rev 8
 31W211-6, "Concrete ERCW Pumping Station Outline," Rev 9
 47W920-43, "Mechanical Heating, Ventilation, and Air Conditioning," Rev 4
 48W1216-6, "Platform Modification for Flood Protection," Rev 3
 DCA No. 23253-00614, "External Flood Hazard Barriers – DGB," Rev 0
 DCA No. 23253-00616, "External Flood Hazard Barriers – DGB," Rev 0

Root Cause Analysis (RCAs):

RCA PER 655763, ERCW Building Potential In-Leakage Through conduits in MNWY 33, Rev 4
 RCA PER 682202, Failure to Report an Unanalyzed Condition as Required by 10 CFR 50.72, Rev 3
 RCA PER 682212, Unrecognized Increase in Probable Maximum Flood Levels Resulted in Unanalyzed Conditions, Rev 6

Miscellaneous Documents:

0-MISC-317-0001-BOAT, Preventative Maintenance Work Instruction for Flood Mode Boat DCN 22404A, EDG Building Flood Protection Barrier
 DS-C1.1.3, Design Basis Flood, Rev 1
 EDMS B87 080612003, Sequoyah Plant Combustible Loading Calculation
 Electrical Design – Limited Walkdown of Diesel Generator to Identify Potential In-Leakage (DCN D D23253), dated July 15, 2013
 Functionality Evaluation for PER 655763, PER 610005 and PER 818082, Rev 6, dated November 20, 2013
 IDO Documentation for PER 806263/SR 820230
 Lesson plan for SOER 10-2
 Lesson Plan OPL071NPG-SPP-03.5, Regulatory Reporting Requirements

Memorandum - Seal Material for M.E.L.B. Flood Penetrations – Sequoyah Nuclear Plant, dated June 22, 1989
 Reportability Determination Oversight Plan, PER Action 682202-007
 Training Material RA270RPT.LP1, 10 CFR 50.72 and 10 CFR 50.73 Reporting, Rev 5
 VM-D217-4609, Information Bulletin – RTV Submergence Testing, dated December 1979
 WDP-SQN-0-2013-003, Identification of Civil SSCs Required to Mitigate PMF Impacts at DG Bldg, Revision 0, dated September 11, 2013
 WDP-SQN-0-2013-004, DG Building Flood Barrier Walkdown - Mechanical, Rev 1, dated September 26, 2013

LIST OF ACRONYMS

ACE	Apparent Cause Evaluation
CAPR	Corrective Action to Prevent Recurrence
CC	Contributing Cause
COLA	Combined Operating License Application
DBF	Design Basis Flood
EDG	Emergency Diesel Generator
ERCW	Essential Raw Cooling Water
IN	Information Notice
IP	Inspection Procedure
IR	Inspection Report
LER	Licensee Event Report
NOV	Notice of Violation
NPG	Nuclear Power Group
NRC	Nuclear Regulatory Commission
NTTF	Near Term Task Force
OE	Operating Experience
PER	Problem Evaluation Report
PMF	Probable Maximum Flood
QA	Quality Assurance
RC	Root Cause
RCA	Root Cause Analysis
SCWE	Safety Conscious Work Environment
SOCH	Simulated Open Channel Hydraulics
SSC	Systems, Structures, Components
TVA	Tennessee Valley Authority