UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 9, 2014

Michael J. Pacilio
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: OYSTER CREEK NUCLEAR GENERATING STATION - AUDIT REPORT REGARDING FLOODING WALKDOWNS TO SUPPORT IMPLEMENTATION OF NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT (TAC NO. MF0256)

Dear Mr. Pacilio:

On March 12, 2012, the U.S. Nuclear Regulatory Commission staff (NRC or the staff) issued a request for information letter per Title 10 of the *Code of Federal Regulations,* Subpart 50.54(f) (50.54(f) letter). The 50.54(f) letter was issued to power reactor licensees and holders of construction permits requesting addressees to provide further information to support the NRC staff's evaluation of regulatory actions to be taken in response to lessons learned from Japan's March 11, 2011, Great Tōhoku Earthquake and subsequent tsunami. The request addressed the methods and procedures for plants to conduct seismic and flooding hazard walkdowns to identify and address degraded, nonconforming, or unanalyzed conditions through the corrective action program, and to verify the adequacy of the monitoring and maintenance procedures.

By letter dated November 19, 2012, Exelon Generation Company LLC (Exelon) submitted a report documenting the flooding walkdowns as requested per Enclosure 4 of the 50.54(f) letter for the Oyster Creek Nuclear Generating Station. By letter dated March 19, 2013, Exelon submitted a supplement to the original report. On July 25, 2013, an NRC audit team completed the on-site audit to gain a better understanding of the methods and procedures used by Exelon to conduct the flooding walkdowns. The information gained during the audit will facilitate the NRC staff review of the walkdown report and allow for more concise requests for information. The NRC staff appreciates your support of the audit. The final audit report has been included as an enclosure to this letter.

If you have any questions, please contact Mr. John Lamb at 301-415-3100 or by e-mail at John.Lamb@nrc.gov.

Sincerely,

John G. Lamb, Acting Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-219

Enclosure:
Audit Report

cc w/encl: Distribution via Listserv

REPORT OF REGULATORY AUDIT ON JUNE 23 TO JUNE 25, 2013

FLOODING WALKDOWNS

EXELON GENERATING COMPANY, LLC

OYSTER CREEK NUCLEAR GENERATING STATION

DOCKET NO. 50-219

1. Introduction

This document provides a summary of the U.S. Nuclear Regulatory Commission (NRC) audit of the flooding walkdowns performed by Oyster Creek Nuclear Generating Station (OCNGS). The walkdowns were performed in response to Enclosure 4 of the NRC's request for information letter dated March 12, 2012.

1.1 Background

By letter dated March 12, 2012, the NRC issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.54(f)[1] (hence referred to as the 50.54(f) letter). The request was issued as a part of implementing lessons-learned from the accident at the Fukushima Dai-ichi nuclear power plant. Enclosure 4 of the 50.54(f) letter requested that licensees plan and perform a flooding walkdown to identify degraded, nonconforming, or unanalyzed conditions related to the licensing bases of structures, systems, and components important to safety and to verify the adequacy of the monitoring and maintenance procedures.

By letter dated November 19, 2012, Exelon Generation Company, LLC (Exelon or the licensee) submitted a report documenting the flooding walkdowns as requested in Enclosure 4 of the 50.54(f) letter for OCNGS. By letter dated March 19, 2013, Exelon submitted a supplement to the original report.

1.2 Regulatory Audit Basis

The NRC staff conducted a regulatory audit to gain a better understanding of the methods and associated procedures used by Exelon to conduct the flooding walkdowns at OCNGS and facilitate NRC staff assessment of the report documenting the site walkdowns.

The Nuclear Energy Institute (NEI) developed guidance for performing the flooding walkdowns with extensive review and input from NRC staff in numerous public meetings, webinars, and public conference calls. NEI submitted NEI 12-07, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features,"[2] for endorsement. The NRC staff subsequently endorsed the walkdown guidance by letter dated May 31, 2012.[3] By letter dated

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[1] Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340.
[2] ADAMS Accession No. ML12144A401.
[3] ADAMS Accession No. ML12144A142.

January 23, 2012, Exelon indicated that it will adopt the NRC-endorsed guidance, NEI 12-07, in order to perform walkdowns at OCNGS.[4]

1.3 Audit Logistics

An audit plan was issued to Exelon on May 31, 2013.[5] The audit plan included a proposed audit schedule and a list of information that NRC requested that the licensee make available for review during the audit. The audit plan also requested that the personnel (licensee staff and contractors) who performed the walkdowns be available for interviews.

The NRC staff performed an audit of OCNGS on July 23-25, 2013. The audit was performed in accordance with the Office of Nuclear Reactor Regulation Office Instruction LIC-111, "Regulatory Audits."[6] The NRC staff and a contractor from the Pacific Northwest National Laboratory (PNNL) participating in the audit are listed in Table 1.

An entrance meeting was held on July 23, 2013, to convey to the licensee background information and the purpose of the audit. An exit meeting was held on July 25, 2013, to convey to the licensee observations from the audit, including: (1) observations related to whether the walkdowns were performed in accordance with NEI 12-07, and (2) observations forwarded to the resident inspectors for additional action, if appropriate.

Table 1: NRC Audit Team

Auditor	Affiliation	Audit Role
Stephen Campbell	NRC/NRR/DIRS/IRIB	Audit Lead
Nebiyu Tiruneh	NRC/NRO/DSEA/RHMB	Technical Lead
Christopher Cook	NRC/NRO/DSA/RHMB	Branch Chief
Kevin Quinlan	NRC/NRO/DSA/RHMB	Team Member
Jeffrey Kulp	NRC/Region I	Sr. Resident Inspector
Amar Patel	NRC/Region I	Resident Inspector
Ed Miller	NRC/NRR/JLD/JPMB	Audit Team Member
Michelle Flanagan	NRC/RES/DSA/FSCB	Audit Team Member
Jacob Philip	NRC/RES/DRA/ETB	Audit Team Member
Lyle Hibler	PNNL	Audit Team Member

2. Audit Scope

The audit provides support for the ongoing NRC staff assessment of the licensee-submitted walkdown report. The audit scope included review of information and documents available onsite, and interviews of licensee staff and contractors to aid the NRC staff understanding of: (1) how the licensee performed the flooding hazard walkdowns, and (2) whether the walkdowns were performed in accordance with NEI 12-07.

The audit also helped to identify additional information that the NRC staff will request to be submitted on the docket via a request for additional information (RAI). Observations made by

[4] ADAMS Accession No. ML13024A365.
[5] ADAMS Accession No. ML13127A188.
[6] ADAMS Accession No. ML082900195.

the audit team that were not within the scope of the audit were transferred to the resident inspector for additional action, if appropriate.

3. Audit Activities and Remarks

Prior to the arrival of the audit team on site, the NRC staff prepared a preliminary list of questions, which were communicated to the licensee to facilitate an efficient audit once the team arrived on site. The information needs requested and reviewed include:

- Walkdown record forms (as described in Appendix B of NEI 12-07) and other supplemental forms and worksheets used to document observations from performance of the walkdowns.
- Supplemental guidelines or procedures used, in addition to NEI 12-07, for the implementation of the flooding walkdowns, including industry, fleet, or site-specific guidelines or procedures (this includes, but is not limited to "Walkdown Inspection Guidance" developed by Exelon to supplement NEI 12-07 and any site-specific acceptance criteria developed to support the walkdowns).
- Flood-specific procedures that are part of flood protection and mitigation strategy and hazardous weather response that were reviewed as part of the flooding walkdowns, including, but not limited to, ABN-31, "High Winds," Rev. 17 and ABN-32 "Abnormal Intake Level," Rev. 18.
- Listing of entries into the corrective action program (CAP) resulting from the performance of the flooding walkdowns, including condition report number, title, and brief summary of the issue or observation and its disposition.
- All engineering analyses that were used in support of the flooding walkdowns, including, but not limited to, ENERCON Services, "Turbine Basement Water Intrusion Comprehensive Study for AmerGen Oyster Creek Nuclear Station," May 31, 2002.
- Documentation of the basis that there is reasonable assurance that inaccessible flood protection features are available and will perform credited functions, including the following features: (1) Emergency Diesel Generator Building (EDGB) sump drains, and (2) Sump 1-1 and Sump 1-5.

The audit team reviewed documents related to the licensee's performance of the flooding walkdowns, including:

- Walkdown record forms, and other supplemental forms and worksheets generated by the licensee to document observations associated with the walkdowns.
- Supplemental guidelines or procedures used, in addition to NEI 12-07, for the implementation of the flooding walkdowns (e.g., industry, fleet, or site-specific guidelines or procedures).
- Flood-specific procedures that are part of flood protection and mitigation strategies or hazardous weather response that were reviewed or used by the licensee as part of the flood walkdowns.
- Listing of entries into the CAP resulting from the performance of the flood walkdowns.
- Self-assessment performed by OCNGS after completion of the walkdown documented in "Check-in-Self Assessment of 2.3 Flooding Walkdowns – Action Request (AR) NUMBER 01458279," dated November 21, 2012.

The audit team also interviewed site personnel and walkdown participants to inquire about how visual inspections were performed (e.g., criteria used to determine feature acceptability), calculation of available physical margin (APM), and estimation of the time required to perform manual actions. As necessary, NRC staff observed areas of the site associated with plant flood response or were examined by the licensee as part of flooding walkdowns.

Audit review responsibilities associated with flood protection features were generally divided among team members, based on plant building or area. The major buildings considered include the Reactor Building (RB), EDGB and Turbine Building (TB). OCNGS indicated that the credited flood protection systems do not require implementation of procedures involving manual actions; as a result, no reasonable simulations were performed as part of the walkdown. OCNGS provided six binders containing walkdown record forms for all the buildings and features for audit. The audit team divided the binders amongst the various team members and reviewed the contents according to the audit plan.

The audit activities included reviewing the information provided by OCNGS, visiting the various features of the plant and holding discussions with the Exelon staff of OCNGS. The licensee was also asked to address issues related to the processes used to: compute APM, identify and address potential deficiencies, assess and disposition observations not immediately judged to be acceptable, and address instances of small (or potentially negative) APM. The audit team assessed information onsite including review of documents and performance of field surveys of flood protection features. The following is a summary list of audited information:

- Flooding walkdown report documented in six binders; Package Summary (Binder #1), RB (Binder #2), TB (Binder #3, #4, #5) and EDGB (Binder #6).
- "Check-in-Self Assessment of 2.3 Flooding Walkdowns – AR NUMBER 01458279," dated November 21, 2012.
- GPUN Calculation 1302-576-5320-001, "Ponding of Reactor Building and Turbine Building Roof Loading Analysis."
- GPU Nuclear Corporation Oyster Creek Individual Plant Examination of External Events (IPEEE), December 1995.
- Results from the Systematic Evaluation Program (SEP) Hydrologic Topics (Performed by Burns and Roe and submitted by GPUN, 1982).
- ENERCON Services Turbine Building Basement Water Intrusion Comprehensive Study for AmerGen Oyster Creek Nuclear Station, May 31, 2002 (Appendix B Effects of Probable Maximum Precipitation External Flood Portion of the Oyster Creek Individual Plant Examination of External Events).
- Procedure OP-OC-108-109-1001, "Severe Weather Preparation Training and Reference Material for Oyster Creek."
- Procedure ABN-32, "Abnormal Intake."
- Procedure ER-OC-450, "Oyster Creek Structural Monitoring."
- Procedure ER-AA-200 which covers preventative maintenance (PM) programs in general.
- A total of 21 Incident Reports (IR) and AR entries generated as a result of issues identified during the licensee's NEI-12-07 Walkdown.
- IR 01409870, "Deficiency of Programmatic Issues."
- IR 01422582, APM check in order to determine the evaluation of small margin, significant consequence APM values.

The team also visited the RB, EDGB, TB and intake structures during the first and second days of the audit. During the second day of the audit, select team members visited the basement of the TB and discussed issues related to penetrations, conduits and seals, and the documentation of the APM values in the walkdown report. Team members also discussed flood protection functions of certain features such as Roll-up Door T-200 located at the Truck Loading Bay, and other roll-up doors in the TB, T-201, T-202, and T-205.

4. Audit Summary

As described in Section 2 of this report, the goal of the audit was to support the development of the NRC staff assessment of the licensee's walkdown report. Observations made by the audit team during the audit were compiled and conveyed to the licensee during the exit meeting. These observations are neither findings nor violations; however, they will be used to inform the NRC staff assessment of the licensee's walkdown report. The audit team categorized the observations into two groups: (1) observations that are directly related to the audit scope, and (2) observations that are not directly related to the audit scope.

4.1 Observations Related to NEI 12-07

The audit team made the following observations that are directly related to the scope of the audit (see Section 2 of this report).

Observation 4.1.1

This observation is related to the definition and physical meaning of APM. While reviewing the walkdown record form for the roof of the TB, which is at Elevation 105'-7", the flood height is listed as 23'-6". A flood height of 23'-6" has no physical meaning or relevance for a flood protection feature located at Elevation 105'-7" of the TB. Through discussions with licensee's staff, it was determined that 23'-6" was selected as the flood height that occurs during a probable maximum precipitation (PMP) event, and the PMP event develops 35 inches of water on the TB roof. Although the discussions were helpful in understanding the thought process that went into the determination, the team believes that the physical meaning of APMs may not have been clearly understood.

Observation 4.1.2

This observation is related to proper documentation of features by clearly describing whether they are credited for flood protection purposes. The audit team observed that the walkdown report for the TB doors (T-200, T-201, T-202 and T-205), located at elevation 23'-6," stated the following:

- Non-watertight doors represent a very significant cliff edge effect.
- Non-watertight doors do not provide a flood protection function.
- All exterior doors are kept closed to maintain a slight negative pressure.
- Therefore, the doors are incorporated passive features.

Since the licensee stated that the doors are incorporated as a passive feature, it was not clear to the audit team whether the licensee took credit for these doors as a means of flood protection and thus necessitating the need for reasonable simulation. Through discussions with the licensee's staff, the team learned that it was the door threshold, and not the door itself, that was

incorporated as a passive feature and using this consideration the licensee calculated the associated APM. Since the licensee did not mention the threshold in the walkdown form, it resulted in confusion about the incorporated passive feature. This demonstrates that documentation of the relevant features in the walkdown form was not done properly.

Observation 4.1.3

Section 5.6 of NEI 12-07 indicates that:

- the walkdowns should ensure that the flood protection feature is included in a periodic test, monitoring, or inspection program, AND
- the review should verify that the testing, monitoring, or inspection is being performed.

During the audit, the team learned that the licensee credited Procedure ER-OC-450, "Oyster Creek Structural Monitoring," in the walkdown records as a PM program for several flood protection features such as walls, seals and drains. Based on further discussion with the licensee, the team learned that floor drain inspections are not typically performed using this procedure. The licensee also indicated that implementation of the procedure would not identify obstructed drains utilizing Procedure ER-OC-450.

The audit team also learned that during the inspection, the 4" conduit Penetration 245 was found with extensive corrosion as well as very significant growth of stalactites. The walkdown record form credited a PM, under this procedure, performed in 2010. Based on the inconsistencies in implementation of the procedure, it is not clear that the frequency and breadth of implementing ER-OC-450 is adequate for this conduit penetration.

Observation 4.1.4

The team also observed that APM was not calculated on several walkdown record forms, particularly forms associated with penetration seals. Instead, terms such as "N/A" or "NONE" were included. The audit team believes that it was not necessary to assign "N/A" or "NONE" as the APM value for each seal. Instead, the licensee can rely on the design control process at the time of seal installation (NEI FAQ-005) to demonstrate the site's seals were properly rated.

When discussing sealed penetrations in the NEI 12-07 Walkdown Response Form, responses to Question 12 usually stated that "Per NEI Guidance, APM is not applicable for sealed penetrations. The seal is in good condition."

This response was questioned by the audit team, and the licensee staff provided NEI guidance (FAQ-005), which stated that it is not necessary to check the pressure rating of seals during flooding walkdowns. FAQ-005 also states that quantifying APM for seals is not considered part of the flooding walkdowns, even if the current licensing basis contains a rating for seals.

Based on the information provided in FAQ-005, a value of zero APM would have been acceptable in lieu of calculating an APM based on seal specifications. The licensee can rely on the design control process at the time of seal installation to demonstrate the site's seals were properly rated. The audit team believes that the licensee should have used the appropriate APM value instead of marking Question 12 "N/A."

Observation 4.1.5

The Near-Term Task Force (NTTF) explicitly noted that flooding is associated with a cliff-edge effect in Recommendation 2.3. Cliff-edge effects were defined by the NTTF Report, which noted that "the safety consequences of a flooding event may increase sharply with a small increase in the flooding level." In consultation with industry, it was decided that cliff-edge effects would be difficult to evaluate by November 2012, as part of the walkdowns. As a result, the term cliff-edge effect was replaced by evaluation of APM, and both cliff-edge effects and APM are defined in NEI 12-07. The team notes that evaluation of APM is an important component of Recommendation 2.3 and also important to the licensee's efforts to prepare responses to Flooding Recommendation 2.1, which involves a flood hazard reassessment.

In several instances, an evaluation was not performed on seals where the margin was small with potentially significant safety consequences in accordance with NEI 12-07. The team noted that an APM value of zero for credited seals, with commensurate documentation of small margin would have been more appropriate, based on the NEI guidance. This observation would have been discussed in the site's IR for all small-margin flood features.

4.2 Observations Communicated to Resident Inspectors

The audit team made observations related to the plant response to flooding hazards that were not directly related to the scope of the audit. These observations were forwarded to the site resident inspectors for additional action, if appropriate. The audit team made one observation that was communicated to the licensee at the end of the audit. The observation is summarized as follows.

Observation 4.2.1

The audit team noted that flood protection features (8 penetrations with 6 of those covered in fire wrap) located on the southwest corner of the TB basement had water intrusion at about 40 drops per minute. This issue was captured in IR014019031. The audit team also understands that this conduit is associated with cables from Emergency Diesel Generator #2 (EDG #2), and the vault containing these cables fills with water during a rainstorm, if the drain clogs. Consequently, when the drain is clogged, this places an almost continuous water head on the seals. The team questioned whether this condition contributes to accelerated degradation of the seals.

5. Potential Additional Information Needs

In response to the observations described in Section 4.1 of this audit summary, and to support the NRC staff assessments of the licensee walkdown reports, the NRC staff may require additional information from the licensee regarding the methodology used to evaluate APM and responses to Question 27 for the walkdown record form in Appendix B of NEI 12-07 for flood protection features with small or zero APM. In addition, the NRC staff may require additional information regarding the flood heights used to calculate APM for certain flood protection features. Moreover, the NRC staff may require additional information to clarify whether deficiencies were identified during the site walkdowns.

6. Conclusions

The audit provided NRC staff and contractors with information that is relevant to the NRC staff assessment of the licensee's walkdown report. The audit team identified and communicated to the licensee five observations, one observation to the OCNGS NRC Resident Inspectors for further follow-up, and two potential requests for additional information. This audit summary will be used as an input to the NRC staff assessment for OCGS.

6. Conclusions

The audit provided NRC staff and contractors with information that is relevant to the NRC staff assessment of the licensee's walkdown report. The audit team identified and communicated to the licensee five observations, one observation to the OCNGS NRC Resident Inspectors for further follow-up, and two potential requests for additional information. This audit summary will be used as an input to the NRC staff assessment for OCGS.

If you have any questions, please contact Mr. John Lamb at 301-415-3100 or by e-mail at John.Lamb@nrc.gov.

Sincerely,

/ra/

John G. Lamb, Acting Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
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Docket No. 50-219

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Audit Report

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