Enclosure to
NG-12-0461

FLOODING WALKDOWN REPORT
NEE006-PR-001, Revision 0

IN RESPONSE TO THE 50.54(f) INFORMATION REQUEST REGARDING
NEAR-TERM TASK FORCE RECOMMENDATION 2.3: FLOODING
for the

Duane Arnold Energy Center

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for the

Duane Arnold Energy Center

3277 DAEC Road, Palo, IA 52324
Facility Operating License No. DPR-49
NRC Docket No. 50-331

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NTTF Recommendation 2.3 (Walkdowns): Flooding
NextEra Energy Resources
Duane Arnold Energy Center
November 14, 2012
NEE006-PR-001, Revision 0

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1. EXECUTIVE SUMMARY

This report was developed to provide information requested by the United States Nuclear Regulatory Commission (NRC) pursuant to Title 10 of the Code of Federal Regulations, Section 50.54 (f) on March 12, 2012 for the Duane Arnold Energy Center (DAEC). In response to the NRC request, Duane Arnold LLC performed walkdowns to verify that plant features credited in the current licensing basis (CLB) for protection and mitigation from external flood events are available, functional, and properly maintained. The walkdowns were performed to verify that permanent structures, systems, components (SSCs), portable flood mitigation equipment, and the procedures needed to install and or operate them during a flood are acceptable and capable of performing their design function as credited in the CLB.

Walkdowns were performed in accordance with Nuclear Energy Institute (NEI) 12-07 (Rev. 0-A), "Guidelines for Performing Verification of Plant Flood Protection Features," dated May 2012 [Ref. 1]. This document was endorsed by the NRC on May 31, 2012. Duane Arnold Energy Center plant configurations and procedures were compared to the flood protection features credited in the CLB documents for external flooding events. Site specific features credited for protection and mitigation against external flooding events were identified and evaluated. A summary of the DAEC CLB, flood protection features and the results of the inspections are provided below.

Current Licensing Basis

- The probable maximum flood (PMF) for DAEC is 764.1 feet and is caused by prolonged rainfall over the Cedar River drainage basin. The site is protected to 767 feet to account for wave action and freeboard. Additional protection is provided at openings to safety related buildings up to 773.7 feet on the southerly side, 770.5 feet on the northerly side and 769 feet on the easterly and westerly sides per NRC requirements. There exists a 6.4 day time period between the beginning of the PMF storm and the PMF per the CLB [Ref. 3].

Flood Protection Features

- The licensing basis for DAEC specifies that approximately 6.4 days exist from the beginning of the PMF storm to the PMF. The flood will remain above grade for approximately 3 days during the design basis flood. The DAEC CLB does not state specific plant modes (shutdown, refuel, startup, online) during a flood event. As a result, walkdowns took into consideration all modes of operation. DAEC employs incorporated active and passive and temporary active and passive flood protection features to meet the CLB flood requirements. Temporary features include stoplogs augmented with plastic sheeting and sandbags, sump pumps, sealing of hatches (welding/caulking), installing extensions for the diesel generator exhaust and installing a cover for the auxiliary boiler louver. Incorporated features include the sump system, walls, floors, roofs, penetration seals, water stops and membranes and a watertight door. Temporary features and incorporated active features are installed and/or implemented per the station flood protection procedure. This procedure is implemented upon receipt of a flood advisory from the National Weather Service.

Inspection Results

- Credited flood protection features in the CLB were inspected against the acceptance criteria found in the NEI 12-07 guidance [Ref. 1]. Reasonable assurance that the inaccessible features can perform their CLB intended flood protection function are provided in this report. A tabletop simulation of the station flood protection procedure was also conducted. It was confirmed that required actions can be completed in the credited time and this procedure is effective, however some enhancements to this procedure were also identified in order to streamline its implementation. Reasonable simulations

were conducted on the temporary features/actions representative of the different types of flood protection features at DAEC to validate execution times and ensure features meet their CLB intended function. With the exception to items listed below, all features were found to meet their CLB intended function without corrective action.

- The following describes the results of the walkdowns that identified degraded, non-conforming or unanalyzed conditions:
    - The installation of the steel stoplog for Door 805 was found to have fit up issues as plant personnel were not able to install the barrier per the design configuration. A functional assessment with interim actions was implemented, with permanent corrective actions initiated and incorporated into the Corrective Action Process as compensatory action for this finding.
    - Two louvers on the Intake Structure westerly wall were found to extend below the specified flood protection height of 769 feet. A functional assessment with interim actions was implemented, with permanent corrective actions initiated and incorporated into the Corrective Action Process as compensatory action for this finding.
- There were no features identified as restricted access during the walkdowns.
- The following describes features that were identified as inaccessible:
    - Floor drains in the air plenums near louvers above the diesel generators were identified as inaccessible. Reasonable assurance that this feature will function as designed is based on visual inspection of the drain pipes below the plenum and the absence of any signs of ingress. The louver in the plenum is also above the CLB wave and freeboard height of 773.7 feet.
    - Embedded water stops and waterproof membranes were identified as inaccessible. Reasonable assurance that this feature will function as designed is based on visual inspection of joints between concrete slabs, gaps between buildings and all penetrations for signs of ingress from ground water.

Overall, DAEC employs a number of different flooding protection features credited in the CLB that are available, functional and properly maintained respective to their CLB intended flood protection functions. The Duane Arnold Energy Center is found to be in compliance with its flood protection requirements per the current site licensing basis based on the inspections of the NEI 12-07 walkdowns and corrective actions implemented as a result of the walkdowns.

2. PURPOSE

a. Background

In response to the nuclear fuel damage at the Fukushima-Dai-ichi power plant due to the March 11, 2011 earthquake and subsequent tsunami, the United States Nuclear Regulatory Commission (NRC) established the Near Term Task Force (NTTF) to conduct a systematic review of NRC processes and regulations, and to make recommendations to the Commission for its policy direction. The NTTF reported a set of recommendations that were intended to clarify and strengthen the regulatory framework for protection against natural phenomena.

On March 12, 2012, the NRC issued an information request pursuant to Title 10 of the Code of Federal Regulations, Section 50.54 (f) (10 CFR 50.54(f) or 50.54(f)) [Ref. 2].

In Enclosure 4 of this document, the NRC requested that licensees 'perform flood protection walkdowns to identify and address plant-specific degraded, nonconforming, or unanalyzed conditions and cliff-edge effects (through the corrective action program) and verify the adequacy of monitoring and maintenance procedures. The flooding walkdowns have been completed and the results are described in this report.

b. Site Description

The DAEC is located on the west bank of the Cedar River, approximately 8 miles northwest of Cedar Rapids, IA and 133.5 miles above its confluence with the Iowa River.

Finished grade at the site is 757.0 feet with the natural grade varying near 750 feet. The grade slopes downward to the Cedar River with the intake structure at 754 feet. Based on historical Cedar River water levels, the average river level falls in the range of 731 feet to 737 feet.

The Cedar River flooding is the bounding case for external flooding at DAEC. Periodic floods have occurred at the site with the largest to date occurring in June 2008 reaching a peak stage of 751 feet. The 2008 flood was classified as a 500-yr flood by the United States Geological Survey (USGS).

3. METHODOLOGY

The walkdowns were performed in accordance with NEI 12-07 (Rev. 0-A), "Guidelines for Performing Verification of Plant Flood Protection Features", dated May, 2012 [Ref. 1]. This document was endorsed by the NRC on May 31, 2012 [Ref. 6].

4. REQUESTED INFORMATION

The information requested in Reference 2, Enclosure 4, under paragraph 2 of the 'Requested Information' section, is provided below. The contents of each item were developed in accordance with Reference 1, Appendix D. On June 8, 2012, the Duane Arnold Energy Center submitted its 90 Day Response Letter to the NRC Request for Information Pursuant to the 10 CFR 50.54(f) letter confirming its use of the NRC endorsed NEI 12-07 document as a basis for the plant flood protection features walkdowns.

a. Requested Information Item 2(a) – Design Basis Flood Hazards

Describe the design basis flood hazard level(s) for all flood-causing mechanisms, including groundwater ingress.

The DAEC site flooding analysis is based on field reconnaissance and mapping, collection and analysis of flood discharge data from the USGS, a flood hydrograph analysis of previous floods on the Cedar River, rainfall losses and retention rates and an application of the maximum probable storm documented in Appendix H of the DAEC Preliminary Safety Analysis Report (PSAR) [Ref. 4]. This results in a probable maximum flood of 764.1 feet mean sea level (msl) which corresponds to a flow rate of 316,000 cfs on the Cedar River. This flood is most likely to occur in spring or early summer based on previous flood history.

In addition to the storm generated flood, wind generated waves and freeboard are taken into account. A wave height of 2.8 feet is added to the PMF as a result of sustained wind of 45 mph over a 1.5 mile stretch resulting in the site being designed to protect against floods of 767 feet. Per additional request by the Atomic Energy Commission, additional flood protection is provided for the openings of safety related buildings up to 773.7 feet on the southerly side, 770.5 feet on the northerly side and 769 feet on the easterly and westerly sides using stoplogs augmented with plastic sheeting and sandbags.

Due to the gentle topography existing in the river valley, a landslide could not occur at a magnitude that would result in a water level at the site that would approach the PMF [Ref. 3].

The probable maximum precipitation storm will not cause the failure of any safety related structures or equipment either because of local flooding or failure of roof structures and their appurtenances. In the event of rains as severe as those that could cause a local probable maximum flood, some local flooding could occur because of the fact that the site storm drainage system is designed to accommodate the runoff from a 10-yr storm, but this flooding will have no adverse effect on any safety-related structures or equipment. A review of the DAEC Updated Final Safety Analysis Report (UFSAR) has shown that all safety-related structures are capable of supporting a water accumulation on their roofs to the depth of the parapet without failure. Above this depth, the water will spill over the parapet and down the side of the building. All roof penetrations on all plant safety-related structures extend above the roof to a height greater than the height of the parapet, thus precluding any flooding of the interior of any building from excessive precipitation. Therefore, it may be concluded that the probable maximum precipitation storm will not cause the failure of any safety-related structures or equipment [Ref. 3].

Review of the site topography shows that the safety related structures are located at a higher elevation than most of the owner controlled area with the topography sloping down toward the river to the east. Local intense precipitation described above could cause local flooding, but it would not affect safety related structures due to the site topography.

Dam failure has been screened out of the flooding hazards since the 12 low head upstream dams are submerged during the PMF. Ice effects have been screened out since the local topography does not lend itself to creating a flood wave approaching the PMF. Surges, seiches and tsunamis have been screened out as not applicable to DAEC per the UFSAR section 2.4 [Ref. 3].

Ground water ingress is not specifically mentioned in the CLB, but per the flood protection requirements of the UFSAR, walls of protected buildings are coated with a waterproofing material below grade. In addition to this, the joints between concrete slabs and structures were provided with bulb and dumbbell water stops. NEI FAQ-007 [Ref. 8] also justifies the basis for inspecting building walls against the acceptance criteria if the buildings are to be maintained in a dry condition.

b. Requested Information Item 2(b) – CLB Protection and Mitigation Features

Describe protection and mitigation features that are considered in the licensing basis evaluation to protect against external ingress of water into SSCs important to safety.

- The DAEC flooding licensing basis includes protecting the plant from flood waters up to 767 feet. Upon further review of wave actions additional specifications are defined to protect the openings of safety related buildings up to 773.7 feet on the southerly side, 770.5 feet on the northerly side and 769 feet on the easterly and westerly sides using stoplogs augmented with plastic sheeting and sandbags. The maximum river level is reached 6.4 days after the beginning of the storm causing the PMF. The CLB does not describe any specific plant configuration during the flood; however, the lead time of 6.4 days between the PMF storm and ensuing PMF is large enough to allow for flood mitigating measures to be completed as outlined in the site flood protection procedure in all plant configurations.
- The licensing basis for DAEC specifies that approximately 6.4 days exist from the beginning of the PMF storm to the PMF. The flood will remain above grade for approximately 3 days after the peak discharge is reached [Ref. 9].
- The DAEC CLB identifies actions taken in response to rising flood waters and describes temporary and incorporated, active and passive flood protection features. The flood protection procedure is entered when the national weather service issues a flood advisory. This procedure has follow up actions corresponding to various river water level heights which are coordinated by the control room supervisor. This procedure is a reference use procedure with no automatic actions. This procedure calls for the installation and implementation of both active and passive temporary and incorporated flooding protection features.

  Temporary active features:

  - Temporary sump pumps are placed in sump pits and catch basins behind specified exterior doors in the plant to control in-leakage per the station flood protection procedure.

  Temporary passive features:

  - Stoplogs are provided for entry doors to the plant flood protected areas to resist CLB flood waters.
  - Sandbags and plastic sheeting are used to augment the stoplogs. Sandbags are also used to create catch basins on the interior side of flood protection doors/stoplogs to control in-leakage.
  - Extensions are welded to the exhaust ports for the two standby diesel generators to raise the height of the exhaust ports to the CLB flood level including specified wave and run-up.
  - A steel cover is bolted and caulked over the auxiliary boiler louver since the lowest point of the louver is below the CLB flood height including specified wave and run-up heights.
  - Bracing is installed in the seismic gaps at entry ways between seismically qualified buildings. This is to prevent any ingress should the embedded water stops and sealing material between the buildings fail.
  - Hatch covers in the pump house to the Emergency Service Water (ESW) and Residual Heat Removal (RHR) pits are welded, sealed and braced shut. Hatch covers to (High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) are also sealed shut.

Incorporated active features:

- Sump pumps are credited for pumping out water from sump pits resulting from seepage of flood protection features.
- A watertight door is present in the pump house to protect the ESW and RHR pumps.

Incorporated passive features:

- Floor drains and sumps are credited to provide flow paths for seepage from penetration seals and doors/stoplogs.
- Building walls, floors, roofs and associated penetrations are credited to resist the effects of the CLB flood including hydrostatic pressure and uplift. All penetrations below the flood height, including below grade are sealed against water ingress. All roof penetrations on all plant safety related structures extend above the roof to a height greater than the height of the parapet, thus precluding any flooding of the interior of these structures.
- Bulb type water-stops and waterproofing membranes are embedded in the concrete slabs at joints to prevent ingress between wall panels and the seismic gaps between buildings. Waterproof membranes are applied on the exterior of all below grade concrete walls for credited buildings.

The UFSAR credits that all flood mitigating actions can be completed in the required time of 6.4 days, which is the time from the beginning of the PMF storm to the PMF level.

Seismic Category I structures are credited as being able to withstand the effects of the CLB flood including the effects of hydrostatic loading and uplift. The following buildings were reviewed in the UFSAR for the PMF of 767 feet:

- Reactor Building including the HPCI Structure
- Turbine Building
- Intake Structure
- Control Building
- Radwaste Building
- Pump House
- Recombiner Room
- Low Level Radwaste Processing and Storage Facility (LLRPSF) – Storage Portion

Safety buildings are provided with additional protection at building openings to CLB heights as stated in section 4a. The Intake Structure is not maintained in a dry condition as the other buildings mentioned above. Seismic Category I equipment in the intake structure is located above the peak stage of the flood at elevation 767 feet. Below this elevation the structure is allowed to flood resulting in no uplift and above this elevation the walls prevent ingress from waves and run-up.

- The flood protection procedure is a reference use procedure with no automatic actions that is coordinated by the control room supervisor (CRS). This procedure is entered upon receiving a flash flood advisory from the national weather service. Per the technical requirements manual, if the river level reaches 753 feet the river level must be monitored and if the river reaches 757 feet the unit must be in Mode 3 within 12 hours and Mode 4 within 36 hours.

- The licensing basis does not state any weather conditions present during its description of flood mitigating features. Reasonable simulations completed as a part of this effort considered adverse weather conditions likely to occur with the PMF causing mechanisms, i.e. wind, rain, mud, etc.

c. Requested Information Item 2(c) – Flood Warning Systems

Describe any warning systems to detect the presence of water in rooms important to safety.

- There are no credited room water level warning systems for external flooding at DAEC. The flood mitigation strategy is to keep all areas important to safety in a dry condition through the use of temporary and incorporated flood protection features. There are room water level indicators in the HPCI, RCIC, "A" RHR, "B" RHR and TORUS areas for internal flooding. These provide defense in depth and a secondary notification of a flood condition at the site if the external flood barriers should fail.

d. Requested Information Item 2(d) – Flood Protection System/Barrier Effectiveness

Discuss the effectiveness of flood protection systems and exterior, incorporated, and temporary flood barriers. Discuss how these systems and barriers were evaluated using the acceptance criteria developed as part of Requested Information Item 1.h [in Enclosure 4 of the March 12, 2012, 50.54(f) letter]

Visual inspections of the external flood protection features identified in the CLB were performed with the objective of comparing the observed condition of the feature to the acceptance criteria as defined in Section 6 of NEI 12-07. This approach provided the basis for assessing the feature's ability to perform its intended external flood protection function and identifying conditions warranting entry into the corrective action program. Observations entered into the corrective action program and dispositioned as deficient are discussed later in this report.

With the exception of features entered into the corrective action program which were determined to be deficient as discussed later in this report, the walkdowns found that the flood protection features meet the acceptance criteria. Topographic observations found no new features adverse to site drainage during a PMF.

Credited walls and floors and their associated penetrations were visually inspected per the acceptance criteria up to the CLB flood and wave height. Conduit penetration seals were visually inspected. Concrete structures were inspected for signs of material degradation and penetration seals were inspected for evidence of seal failure per the acceptance criteria. The DAEC Structures Monitoring program also provides periodic inspection of these features.

Credited floor drains and sumps to control seepage from penetrations and doors/stoplogs were inspected to the acceptance criteria to make sure no adverse conditions were present and the flow paths were clear.

Credited sump pumps were included in visual inspections per the acceptance criteria and preventative maintenance activities and procedures were reviewed for adequacy.

Credited doors were inspected per the acceptance criteria to ensure installation points (stoplog frames, anchor bolts) for stoplogs were functional. The watertight door in the Pump House was opened and inspected for satisfactory condition of the sealing material and latches.

The roofs of safety related structures are credited as being able to withstand the loading effects of a storm that could cause a local probable maximum flood. Annual roof inspections are conducted to identify and repair any conditions that do not meet the work order inspection criteria. The inspection did not find any

degradation or deterioration of roofs and roof drains per the acceptance criteria used in the yearly inspection. The acceptance criteria used by these work orders were reviewed for alignment with the NEI 12-07 acceptance criteria and were found to meet and exceed the criteria used by the NEI 12-07. The inspections were conducted during the months of August and September of 2012 and the results were reviewed by walkdown personnel and found to be acceptable. These work orders are attached to the record forms for the credited roof structures.

Temporary features described in section 4b were inspected in the areas where they are staged per the acceptance criteria. This inspection was further augmented by reasonable simulations.

Reasonable simulations were performed to demonstrate that credited procedures/actions are feasible and can be completed effectively in the credited time. The reasonable simulations were conducted as a part of the walkdowns to verify execution times and identify any hindrances in installation of the features. Simulations performed align with their estimated times, provided in the flood protection procedure, with the exception of Door 805 described below.

Simulations:

- Door 154

  This is a personnel door on the north side of the turbine building. This door includes the installation of wooden stoplogs augmented with plastic sheeting and sandbags. Workers retrieved and installed stoplogs and installed this barrier per station drawings with no observed difficulties. Based on the simulation, the completion time of this type of feature is 6 hours with 3 craft personnel.

- Door 805

  This is an equipment/loading door in the Low Level Radwaste Processing and Storage Facility (LLRPSF) that includes the installation of one steel stoplog over the door frame. Workers retrieved and attempted to install this feature per station calculations. Difficulties in installation were encountered as workers were not able to install the door per its design configuration. A functionality assessment and compensatory actions were implemented for the installation. This is further discussed later. Due to the alternate configuration requiring welding, an additional 12 hours is added to the installation of this feature for the purpose of verifying the feature can be installed within the available time.

- Auxiliary Boiler Louver Cover

  This cover is designed to seal the auxiliary boiler louver during the CLB flood. Workers retrieved and demonstrated the ability to install this feature. The cover was rigged and lifted against a wall of similar design to that of the louver. All necessary tools and equipment were brought to the demonstration area to show that the feature could be properly installed. Simulation per station drawings was performed with no observed difficulties.

- Standby Diesel Generator Exhaust Extension

  Two L-shaped diesel exhaust extensions are welded to the exhaust ports of the SBDGs to extend the exhaust port height to the CLB level of 773.7 feet for waves and freeboard on the south side of the turbine building. This simulation demonstrated the ability to retrieve and rig the extension for lifting. All necessary tools and equipment to weld the extension to the existing exhaust port were brought to the demonstration area to show that the feature could be properly installed. Some enhancements to this feature were identified and are documented later in this report, but this feature is fully capable of being installed in its current state.

- LLRPSF Temporary Sump Pumps

  Temporary sump pumps powered by essential power are utilized in the flood protected buildings to supplement the incorporated sump pump system and manage seepage at doors/stoplogs. The simulation for the LLRPSF included verifying all necessary materials to implement the pump arrangement were available on site. This was completed by walking down the LLRPSF and measuring required amounts of cable and hose and validating the required amounts were available. Interviews of maintenance personnel were also conducted to validate completion time for preparing, staging and laying down these required materials.

A tabletop simulation of the flood protection procedure was conducted with operations, maintenance and systems engineering to verify execution times and identify hindrances to the procedure's execution. This simulation determined that the estimated time to complete all required flood mitigating actions is 3.67 days, which meets the 6.4 day requirement in the UFSAR. The walkdown records contain the specific times and dependent and parallel actions to determine this number.

Overall, DAEC employs a number of different flooding protection features that are available, functional and implementable respective to their credited flood protection functions with consideration taken to the items discussed later in this report and their resulting compensatory actions.

The DAEC also employs the following structures, systems, components and procedures that aid in flood mitigation on site, but are not credited in the CLB for external flood mitigation.

- A step in flood protection procedure initiates the implementation of a temporary diesel generator to the intake structure and the River Water Supply (RWS) system. Since this temporary diesel generator does not meet safety related power supply requirements it is not credited as a flood protection feature in the CLB. However, in the case of a loss of power to the intake structure, this generator can provide temporary power if no further design basis accidents occur that would result in the failure of the non safety qualified generator.
- Water level indication systems for the HPCI, RCIC, "A" RHR, "B" RHR and TORUS areas are installed for internal flooding detection. These provide defense in depth and a secondary notification of a flood condition at the site if the external flood barriers should fail.
- DAEC employs a Structures Monitoring program [Ref. 5] that adheres to 10 CFR 50.65. Per Attachment 1 of this document, the inspection criteria include an inspection of cracks in concrete walls and identification of any external water ingress. This program also includes inspections of stoplogs and elastomer sealing materials on walls and roofs. These periodic inspections aid in detection of any adverse conditions in these flood protection features.
- The site drainage system is designed to withstand a 10 year storm, which does not cause the PMF, and includes storm drains and drainage ditches throughout the site. In addition to this, a number of security ditches were observed on topographic walkdowns that could aid in managing runoff water during local intense precipitation events.

e. Requested Information Item 2(e) – Implementation of Walkdown Process

Present information related to the implementation of the walkdown process (e.g., details of selection of the walkdown team and procedures) using the documentation template discussed in Requested Information Item 1.j [in Enclosure 4 of the March 12, 2012, 50.54(f) letter], including actions taken in response to the peer review.

On June 8, 2012, the Duane Arnold Energy Center submitted its 90 Day Response Letter to the NRC Request for Information Pursuant to the 10 CFR 50.54(f) letter confirming its use of the NRC endorsed NEI 12-07 document as a basis for the plant flood protection features walkdowns.

Consistent with Section 5.3 of NEI 12-07, walkdown teams consisted of at least two trained individuals with a complementary set of skills. The walkdown team consisted of two ENERCON engineers with backgrounds in nuclear, electrical, mechanical and materials science engineering. Both engineers hold Master's of Science degrees in the above fields and have previous experience with plant modifications and walkdowns.

Per Section 5.3 of NEI 12-07, personnel selected to perform walkdown inspection activities were experienced and knowledgeable of the site current licensing basis. Personnel were experienced or trained to perform visual inspections SSCs and met the knowledge requirements of Appendix C of NEI 12-07.

All team members that performed the visual inspections were trained to and knowledgeable of the below information:

- NANTEL lesson on Generic Flood Protection Walkdowns
- Duane Arnold Energy Center Combined Licensing Basis
- NTTF recommendation 2.3-Flooding and the NRC letter dated March 12, 2012
- NEI 12-07, Revision 0-A

ENERCON personnel were supported by site and craft personnel during the walkdown who were not required to meet the above requirements. These personnel were used because of their familiarity with plant SSCs and protective measures. Generally, these personnel met the knowledge requirements but did not undergo the required training. A pre-job brief was performed prior to conducting the walkdowns using plant human performance procedures and was tailored to the walkdown task. Each walkdown performed a specified inspection to assess the capability of the item to perform its required function. All walkdown results were documented in accordance with the recommendations of Section 7 of NEI 12-07 and using the walkdown record template in Appendix B of NEI 12-07 [Ref. 1].

f. Requested Information Item 2(f) – Findings and Corrective Actions Taken/Planned

Results of the walkdown including key findings and identified degraded, non-conforming, or unanalyzed conditions. Include a detailed description of the actions taken or planned to address these conditions using the guidance in Regulatory Issues Summary 2005-20, Rev 1, Revision to NRC Inspection Manual Part 9900 Technical Guidance, "Operability Conditions Adverse to Quality or Safety," including entering the condition in the corrective action program.

The following list of items identifies features identified during NEI 12-07 flooding walkdowns as degraded, non-conforming or unanalyzed.

Description of Deficiency	Feature Category	Disposition	Status
The intake structure houses safety related equipment for the River Water Supply (RWS) system. Per the UFSAR, the western wall is required to resist flood waters of 764.1 feet and waves and freeboard of 769 feet. Two louvers on this wall are open to the floor elevation of 767 feet, which is below the required 769 feet for waves and freeboard.	Incorporated or Exterior Passive	This non-conformance was entered into the DAEC corrective action program. This included a functionality assessment providing guidance within the station flood protection procedure to provide flood protection for the Intake Structure. A procedure change request was completed to incorporate the guidance into the station flood protection procedure for direction on how to protect the Intake Structure in the event of a flood. A permanent solution is being evaluated in the corrective action program.	Being tracked under corrective action program. Procedure change request completed.
During the reasonable simulation, the steel stoplog for door 805 was found to have fit up issues. Workers were not able to install the stoplog on the installed bolts around the door frame.	Temporary Passive	This non-conformance was entered into the DAEC corrective action program. This included a functionality assessment to ensure guidance is in place to allow installation of the stoplog in the event of a flood. A procedure change request was completed to incorporate the guidance into the station flood protection procedure for direction on how to install this feature. The current estimate for completing the installation of all flood protection features of 3.67 days includes 12 additional hours for installing this feature in this configuration. A permanent solution is being evaluated in the corrective action program.	Being tracked under corrective action program. Procedure change request completed.

There were no items identified as restricted access during the NEI 12-07 flooding walkdowns.

The following list of items identifies features that were classified as inaccessible during the NEI 12-07 flooding walkdowns and provides discussion of reasonable assurance that the feature can perform as designed.

Inaccessible Feature Description	Basis for Acceptance
Turbine Building Louver Platform Floor Drains	In each of the standby diesel generator rooms there is a louver and air plenum platform. The bottoms of the louvers are located at 773.7 feet and are located on the south wall of the turbine building. Inside each of the louver plenums are two drains located at 772 feet. Visual inspection was not possible as there is no reasonable means to access this plenum platform. Reasonable assurance exists that these drains are functioning properly since the drain piping can be seen from below the platform, which confirms the drains are installed. There are no signs of water ingress from this louver based on visual inspections. Also, the louver openings are above the CLB flood of 764.1 feet and meet the wave and freeboard height of 773.7 feet so water entry to these plenums from flood waters is unlikely.
Water Stops and Membranes	Water stops are installed in concrete below grade to prevent water ingress. Water stops are installed per design drawings between concrete slabs and between adjacent buildings during construction. There is no reasonable means to access this feature as it is embedded between concrete slabs. Reasonable assurance that this feature is installed and functioning exists since visual inspections of floors, walls and seismic gaps did not show signs of water ingress at joints between slabs or gaps between buildings. Waterproof membranes are applied to concrete structures and penetrations below grade per design specifications [Ref. 3]. There is no reasonable means to access this feature as it is installed below grade on the exterior side of concrete walls. Reasonable assurance that this feature is installed and functioning exists because there is no evidence of water ingress at joints between slabs.

g. Requested Information Item 2(g) – Cliff –Edge Effects and Available Physical Margin

In accordance with NEI 12-07, Available Physical Margins have been collected and documented in the Walkdown Record form (NEI 12-07 Appendix B). The guidance provided in NEI FAQ-006 was also followed [Ref. 7]. This information will be used in the flood hazard reevaluations performed in response to Item 2.1: Flooding in the 50.54(f) letter [Ref. 2].

h. Requested Information Item 2(h) – Planned/Newly-Installed Flood Protection Enhancements

Describe any other planned or newly installed flood protection systems or flood mitigation measures including flood barriers that further enhance the flood protection. Identify results and any subsequent actions taken in response to the peer review.

Throughout the walkdown process, several items were recommended to site procedures to further enhance the efficiency and effectiveness of the implementation of flood protection features. These are discussed below:

- Enhance human factors for the station flood protection procedure to streamline its implementation.
- Enhance rigging capability for diesel generator exhaust extensions by designing and installing lifting lugs.

There were no changes to the walkdown process or methodology as described in Section 7. No changes were made to the form used in Appendix B of NEI 12-07.

5. CONCLUSIONS

Walkdowns were performed in accordance with NEI 12-07 (Rev. 0-A), "Guidelines for Performing Verification of Plant Flood Protection Features", dated May, 2012 [Ref. 1]. This document was endorsed by the NRC on May 31, 2012. Configuration and procedures were compared to the flood protection features credited in the current licensing basis documents [Ref. 3] for external flooding events. Site-specific features credited for protection and mitigation against external flooding events were identified and evaluated. The results of the inspections are summarized below.

Reasonable Simulations

The capability to execute credited flood protection procedures within the available time was verified using the reasonable simulation process on five of the temporary features/actions representative of the different types of flood protection features at DAEC. Staffing levels were verified to be adequate, material condition was acceptable, and the flooding protection procedure could be implemented as written for performance of these activities prior to storm arrival.

A tabletop simulation of the flood protection procedure was also conducted to validate the activity/procedure can be executed as specified/written. It was demonstrated that required actions can be completed effectively in the credited time; however, some enhancements to this procedure were also identified in order to streamline the procedure's implementation.

Inspection Deficiencies

The flooding walkdowns verified that permanent SSCs, portable flood mitigation equipment, and the procedures needed to install and or operate them during a flood are acceptable and capable of performing their design function as credited in the CLB with these exceptions.

- The installation of the steel stoplog for Door 805 was found to have fit up issues as plant personnel were not able to install the barrier per the design configuration.
- Two louvers on the Intake Structure westerly wall were found to extend below the specified flood protection height, including free board, of 769 feet.

Corrective Actions

The following corrective actions were taken in response to the above identified deficiencies:

- Functionality assessments and compensatory actions or procedure changes for these findings have been implemented by DAEC.
- The station flood procedure was updated to protect the Intake Structure Louvers with sandbags and plastic sheeting.
- The stoplog for door 805 was provided with alternative methods for installing the barrier.

Newly installed and planned flood protection enhancements

There are no planned flood protection enhancements at DAEC.

Overall, DAEC employs a number of different flooding protection features credited in the CLB that are available, functional and properly maintained respective to their CLB intended flood protection functions. The DAEC is found to be in compliance with its flood protection requirements per the current site licensing basis based on the inspections of the NEI 12-07 walkdowns and corrective actions implemented as a result of the walkdowns.

6. REFERENCES

1. Nuclear Energy Institute (NEI), Report 12-07 [Rev 0-A]. *Guidelines for Performing Verification Walkdowns of Plant Protection Features*. May 2012 [NRC endorsed May 31, 2012; updated and re-issued June 18, 2012].
2. U.S. Nuclear Regulatory Commission. Letter to Licensees. *Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident*. March 12, 2012.
3. DAEC UFSAR, Rev. 21, Sections 2.4 and 3.4
4. DAEC PSAR Appendix H
5. DAEC Maintenance Rule Program Module 6 "Monitoring of Structures" Revision 6
6. Endorsement of Nuclear Energy Institute (NEI) 12-07, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features" May 31, 2012
7. FAQ-006, Inquiry Form-NRC Submittal, Revision 4, Applicable Features for Quantifying APM, September 13, 2012.
8. FAQ-007, Inquiry Form-NRC Submittal, Revision 0, Inspection of Exterior Walls, August 1, 2012.
9. Commonwealth Associates "Exhibit 14 Maximum Probable Flood"

7. ATTACHMENTS

Attachment 1: FAQ-006

A. TOPIC: Applicable Features for Quantifying APM

Source document: NEI 12-07 Section: 3.13 & 5.8

B. DESCRIPTION:

Sections 3.13 and 5.8 provide a definition, description, and examples for Available Physical Margin (APM). In Section 3.13, APM is defined as "the difference between licensing basis flood height and the flood height at which water could affect an SSC important to safety". This inquiry is intended to clarify the latter part of this definition, considering that that some features will not have a clearly defined exceedance height.

D. RESOLUTION: (Include additional pages if necessary. Total pages: 2)

Inquiry number: 006 Priority: H

Sections 3.13 and 5.8 provide a definition, description, and examples for Available Physical Margin (APM). In Section 3.13, APM is defined as "the difference between licensing basis flood height and the flood height at which water could affect an SSC important to safety". The latter (underlined) part of the definition can be interpreted as the height at which the flood protection capability of a feature is exceeded. For some features, the exceedance height can be clearly defined (e.g. flood walls, levees, dikes, cofferdams, flood gates, the elevation of unsealed penetrations or other openings, etc.). For other features (e.g. seal, plug, or water-tight door pressure ratings, pump flow rates, etc.), the exceedance height cannot be clearly defined without performing an engineering analysis that is beyond the scope of the flooding walkdowns. As a result, it is appropriate to record APM as a simple measurement of height difference, however additional considerations apply.

There is a concern that recording a large APM on the Walkdown Record Form could be misleading if the APM is interpreted as margin that is available for additional flood protection without further evaluation. For example, for a flood protection wall that is 10-ft high and the CLB water height is 9.5-ft., it is reasonable to state that the APM is 6-inches for the wall. However, if the previous wall is now 20-ft high and CLB water height is still 9.5-ft, it cannot be stated that the wall's APM is 10.5-ft based on engineering judgment alone. In order to verify a large APM that is not already defined in the existing design documents, an analysis would have to be performed to evaluate the effect of the additional flood height on wall loads and pressure retention capability for any associated penetration seals. As a result, the manner in which an APM should be recorded on the Walkdown Record form depends upon whether the APM is considered large (an interpretation of what constitutes a "large" APM is at the discretion of the utility).

The following guidance applies.

For walkdowns that have not yet been performed and/or documented:

Recording APMs on the Walkdown Record Sheet as a difference in height is a reasonable statement of the available margin based on engineering judgment unless the APM is large. For large APMs , three options are available: (1) record a smaller, but defensible, APM value based

on engineering judgment with a corresponding note in the "comments" section; (2) record no value for the APM with a corresponding note in the "comments" section that an engineering analysis is necessary to determine the maximum APM the wall can withstand before a functional failure; or (3) reference the existing FSAR section or design document that supports the APM.

Note that this notation should be made in the response to Q11, Q23, or Q27 of the Walkdown Record Form, as applicable.

For walkdowns that have been completed:

Recognizing that it is not resource effective to revise completed paperwork, it is not necessary to change the way the APM was recorded in completed portions of the Walkdown Record Form. In these cases, APMs that have been recorded as simple measurements of height differences are acceptable as long as the APM determination process did not result in overlooking some potential small margins, as defined by the site per Section 5.8 of NEI 12-07.

For Walkdown Reports:

Indicate in the walkdown report if any APM information was recorded before the large APM approach described in this FAQ was developed.

Notes:

1. Typically, the CLB for the site will indicate what the probable maximum flood level is and the level to which the SSC important to safety is protected. If the recorded APM exceeds the difference between these two values and the margin is to be credited for additional flood protection, the margin must be justified by one of the following methods:
   a. Documented application of reasonable and independently verified engineering judgment
   b. Performance of new engineering analysis
   c. Reference to an existing document or analysis that supports the higher protection level

Revision: 4 Date: 9/13/12

E. NRC Review:

Not Necessary_____ Necessary____X_____
Explanation:_____

F. Industry Approval:

Documentation Method:_____Sept 13, 2012 meeting_____ Date:_____

G. NRC Acceptance:

Interpretation_____X_____ Agency Position_____

Documentation Method:_____Sept 13, 2012 meeting_____ Date:__

Attachment 2: FAQ-007

A. TOPIC: Inspection of exterior walls

Source document: NEI 12-07 Section: 5.5.2

B. DESCRIPTION:

We have a wet site where the SSCs are licensed to flood and the core is protected using mitigating actions. Some of the buildings have safety-related equipment below grade and below groundwater levels. The building's concrete walls keep groundwater from entering the structure but there is no mention of the walls being credited flood or groundwater protection features in the CLB. If the walls and any associated penetration seals are not credited in the CLB as providing protection (against surface water or groundwater flooding), do they need to be included in the walkdown scope?

On the other hand, if the walls and associated seals are performing a flood protection function, specifically for groundwater ingress, even though the CLB for flooding is silent on it, should a visual observation of the walls be performed?

C. Initiator:

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Date: 7/31/12 E-Mail: joe.bellini@amec.com

D. RESOLUTION: (Include additional pages if necessary. Total pages: 1)

Inquiry number: 007 Priority: H

Any exterior wall (above or below grade) protecting space credited as dry in the CLB from groundwater or surface water flooding should be included in the walkdown scope, even if the exterior walls are not explicitly mentioned in the CLB. The inspection of the walls should also note degrading or nonconforming conditions for associated penetrations, seals, etc., although the penetrations/seals themselves do not need to be listed as separate features, with separate walkdown record forms, unless individually credited in the CLB. The inspection applies to portions of the walls below design basis flood and/or groundwater levels.

Note that Available Physical Margin should be obtained to the lowest unsealed, unqualified and or inspected sealed penetration above the design basis water level.

Revision: 0 Date: 8/1/2012

E. NRC Review:

Not Necessary X Necessary

Explanation:

F. Industry Approval:

Documentation Method: Date: