



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

June 30, 2014

Mr. Raymond A. Lieb  
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SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1 – STAFF ASSESSMENT OF THE FLOODING WALKDOWN REPORT SUPPORTING IMPLEMENTATION OF NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT (TAC NO. MF0220)

Dear Mr. Lieb:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued a request for information letter per Title 10 of the *Code of Federal Regulations*, Paragraph 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 that may be taken in response to lessons learned from Japan's March 11, 2011, Great Tōhoku Earthquake, resultant tsunami, and subsequent accident at the Fukushima Dai-ichi nuclear power plant. The request addressed the methods and procedures for nuclear power plant licensees 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 27, 2012, First Energy Nuclear Operating Company (FENOC) submitted a Flooding Walkdown Report as requested in Enclosure 4 of the 50.54(f) letter for Davis-Besse Nuclear Power Station, Unit 1. By letter dated January 30, 2014, FENOC provided a response to the NRC request for additional information for the staff to complete its assessments.

The staff acknowledges that the licensee intends to complete the delayed walkdown items in April 2013 (Room 102), the 18th refueling outage (containment building and annulus, Spring 2014) and December 2014 (Room 210), consistent with the regulatory commitments. The NRC staff reviewed the information provided and, as documented in the enclosed staff assessment, determined sufficient information was provided to be responsive to Enclosure 4 of the 50.54(f) letter.

R. Lieb

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If you have any questions, please contact me at (301) 415-2315 or by email at [Eva.Brown@nrc.gov](mailto:Eva.Brown@nrc.gov).

Sincerely,

*/RA/*

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Office of Nuclear Reactor Regulation

Docket No.50-346

Enclosure:  
Staff Assessment of Flooding Walkdown

cc w/encl: Distribution via Listserv

STAFF ASSESSMENT OF FLOODING WALKDOWN REPORT  
NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO  
THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT  
DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1

DOCKET NO. 50-346

1.0 INTRODUCTION

On March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information per Title 10 of the *Code of Federal Regulations* (10 CFR), Paragraph 50.54(f) (50.54(f) letter), to all power reactor licensees and holders of construction permits in active or deferred status. The request was part of the implementation of lessons learned from the accident at the Fukushima Dai-ichi nuclear power plant. Enclosure 4, "Recommendation 2.3: Flooding" (ADAMS Accession No. ML12056A050), to the 50.54(f) letter requested that the licensees conduct flooding walkdowns to identify and address degraded, nonconforming, or unanalyzed conditions using the corrective action program (CAP), verify the adequacy of monitoring and maintenance procedures, and report the results to the NRC.

The 50.54(f) letter requested licensees to include the following:

- a. Describe the design basis flood hazard level(s) for all flood-causing mechanisms, including groundwater ingress.
- b. Describe protection and migration features that are considered in the licensing basis evaluation to protect against external ingress of water into structures, systems, and components (SSCs) important to safety.
- c. Describe any warning systems to detect the presence of water in rooms important to safety.
- d. 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.
- e. 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, including actions taken in response to the peer review.
- f. Results of the walkdown including key findings and identified degraded, nonconforming, or unanalyzed conditions. Include a detailed description of the actions taken or planned to address these conditions using guidance in Regulatory Issues Summary 2005-20,

Revision 1, to the NRC Inspection Manual Part 9900 Technical Guidance, "Operability Conditions Adverse to Quality or Safety," including entering the condition in the corrective action program.

- g. Document any cliff-edge effects identified and the associated basis. Indicate those that were entered into the corrective action program. Also include a detailed description of the actions taken or planned to address these effects
- h. 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.

In accordance with the 50.54(f) letter, Enclosure 4, Required Response Item 2, licensees were required to submit a response within 180 days of the NRC's endorsement of the flooding walkdown guidance. By letter dated May 21, 2012 (ADAMS Accession No. ML121440522), the Nuclear Energy Institute (NEI) staff submitted NEI 12-07, Revision 0-A, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features" to the NRC staff to consider for endorsement. By letter dated May 31, 2012 (ADAMS Accession No. ML12144A142), the NRC staff endorsed the walkdown guidance.

By letter dated November 27, 2012, (ADAMS Accession No. ML13008A029), as supplemented by a letter dated January 30, 2014 (ADAMS Accession No. ML14030A559), First Energy Nuclear Operating Company (FENOC, the licensee), provided a response to Enclosure 4 of the 50.54 (f) letter Required Response Item 2, for Davis-Besse Nuclear Power Station (DBNPS).

The NRC staff evaluated the licensee's submittals to determine if the information provided in the walkdown report met the intent of the walkdown guidance and if the licensee responded appropriately to Enclosure 4 of the 50.54(f) letter.

## 2.0 REGULATORY EVALUATION

The SSCs important to safety in operating nuclear power plants are designed either in accordance with, or meet the intent of, Appendix A to 10 CFR Part 50, General Design Criteria (GDC) 2, "Design Bases for Protection Against Natural Phenomena," and Appendix A "Seismic Geological Criteria for Nuclear Plants," to 10 CFR Part 100. It is stated in GDC 2 that SSCs important to safety at nuclear power plants shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions.

For initial licensing, each licensee was required to develop and maintain design bases that, as defined by 10 CFR 50.2, identify the specific functions to be performed by an SSC, and the specific values or ranges of values chosen for controlling parameters as reference bounds for the design.

The design bases for the SSCs reflect appropriate consideration of the most severe natural phenomena that have been historically reported for the site and surrounding area. The design bases also reflect sufficient margin to account for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

The current licensing basis (CLB) is the set of NRC requirements applicable to a specific plant, and the licensee's written commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design basis, that are in effect.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Design Basis Flooding Hazard for DBNPS

The licensee stated that the design basis flood hazards for the DBNPS site are: flooding from Lake Erie, local intense precipitation, and flooding on the Toussaint River. Flooding analyses from Lake Erie resulted in a probable maximum water level of 583.7 feet (ft) International Great Lakes Datum (IGLD). Maximum wave runup was calculated to be 6.6 ft above the probable maximum water level, resulting in a maximum water runup of 590.3 ft IGLD.

The licensee stated that local intense precipitation analysis resulted in a theoretical water buildup of 584.5 ft IGLD which accounts for surface drainage offsite to surrounding areas ranging in elevation from 570.0 to 575 ft IGLD. Local intense precipitation over a period of 6 hours is the only time-dependent flooding hazard considered in the licensing basis.

The licensee stated that although within the licensing basis, Toussaint River, which borders the site to the south, is considered to be an unlikely hazard due to its small size, as well as the fact that it is relatively wide and has an open connection to Lake Erie, which controls the river levels. Using the probable maximum rainfall in the Toussaint River drainage area, the maximum water level at the DBNPS station would be 580 ft IGLD. For these reasons, ice jam induced flooding on the Toussaint River is considered unlikely. There are no dams on the Toussaint River.

Based on the NRC staff's review, the licensee appears to have described the design basis flood hazard level(s) as requested in the 50.54(f) letter, and consistent with the walkdown guidance.

#### 3.2 Flood Protection and Mitigation

##### 3.2.1 Flood Protection and Mitigation Description

The licensee reported that the DBNPS site CLB flood protection is to 585 ft IGLD which is the ground floor elevation of the station. The DBNPS site structures were built up 6 to 14 ft above existing grade to an elevation of 584 ft IGLD to provide protection from Lake Erie's maximum credible water level condition. To protect against wave runup from flooding from Lake Erie, the area around the station is protected along the north, east, and partially along the south, by an earthen breakwall built to an elevation of 591.0 ft IGLD. The front wall of the Intake Structure is designed to withstand hydrodynamic forces associated with the maximum probable hydrodynamic water level (i.e., runup).

The licensee stated that seismic Category I structures are designed to withstand a static water level of 584.0 ft, and use a variety of flood protection measures at lower elevations for the various structures, such as waterproofing, covered or sealed penetrations, water stops, floor

drains and sumps. Station drains are designed to collect site runoff in addition to roof drainage and route the effluent to ditch draining into the Toussaint River draining into nearby Lake Erie.

The licensee stated that adverse weather conditions considered include a probable maximum meteorological event to determine rise in lake level due to wind tides. The resulting maximum wind speed considered was 100 miles per hour (mph) over a 10 minute period. Ice jams on the Toussaint River were also considered. The service water tunnel and rooms utilize waterproof membranes for protection.

### 3.2.2 Incorporated and Exterior Barriers

The licensee reported that the site has incorporated and/or exterior barriers that are permanently in-place, requiring no operator manual actions. These barriers include mitigation measures such as waterproof envelope systems for building, construction joint water stops, sump pumps, flood doors, floor drains, and watertight doors. There are also elevated earthen walls along the north, east and partially on the south side for wave run-up protection. The majority of the walls and floors included in the walkdowns are credited to protect equipment from groundwater intrusion.

### 3.2.3 Temporary Barriers and Other Manual Actions

The licensee reported that the site requires no temporary barriers or equipment that requires operator action. Conditions such as rising lake levels in Lake Erie are used to initiate procedures used for flooding mitigation to verify or restore flood barriers, make notifications, arrange for alternate forms of site transportation, and other mitigative measures. A similar procedure for tornado and high winds also exists.

### 3.2.4 Reasonable Simulation and Results

The licensee did not discuss reasonable simulations and results. No operator equipment flood protection or mitigation actions are performed at DBNPS for an external flooding event.

### 3.2.5 Conclusion

Based on the NRC staff's review, the licensee appears to have described protection and mitigation features as requested in the 50.54(f) letter, and consistent with the walkdown guidance.

## 3.3 Warning Systems

The licensee stated that instrument strings provide Lake Erie water level indication and alarms for increases in water levels. The DBNPS "Flooding" procedure references these indications to determine entry into the procedures and flood level classification during a flood and/or rising water levels.

The licensee described that there are floor drains and a sump to collect seepage that might enter the service water pump room with a computer point alarm to alert the operator to an elevated water level in the intake structure sump.

Based on the NRC staff's review, the licensee appears to have provided information to describe any warning systems as requested in the 50.54(f) letter, and consistent with the walkdown guidance.

### 3.4 Effectiveness of Flood Protection Features

The licensee stated that the design basis flood hazard for the DBNPS site is based on the maximum probable static water level (583.7 ft IGLD from Lake Erie with a maximum wave run-up level on the breakwall of 590.3 ft IGLD). The effects of a CLB local intense precipitation event show that the resultant flood waters will not exceed the station floor elevation of 585 ft IGLD in buildings containing safety related equipment.

The licensee reported that the DBNPS site flood protection is based on safety-related equipment positioned above the design basis flood elevation with the balance of Seismic Class I equipment protected from external flood by passive protection features. Considering that DBNPS has a primary passive flood protection system, proper configuration of features was a primary licensee acceptance criteria. To that end, the licensee used existing drawings during visual inspections by trained personnel to confirm features were capable of performing their design function. These inspections did not identify any material degradation that compromised the flood design basis protection function. Periodic preventive maintenance activities or inspections are performed as applicable to provide assurance that the features maintain the ability to perform the intended function.

The licensee reported that the exterior barriers including wave protection dikes were inspected to ensure that rip-rap was in place and the grade and slopes remain consistent with site drawings. Exterior walls were inspected for cracks and penetrations for integrity. For incorporated barriers, a "Barrier Functional List" was used to determine the credited external flood barriers. These barriers included walls inspected for cracks, penetration seals, flood doors, and gaskets. Active incorporated barriers such as sump pumps were included in inspections to ensure the pumps were on a preventative maintenance plan. The instrument strings providing indications of Lake Erie levels and alarms for increases in water levels were also considered active components.

Based on the NRC staff's review, the licensee appears to have discussed the effectiveness of flood protection features as requested in the 50.54(f) letter, and consistent with the walkdown guidance.

### 3.5 Walkdown Methodology

By letter dated June 11, 2012 (ADAMS Accession No. ML12163A318), the licensee responded to the 50.54(f) letter that they intended to utilize the NRC-endorsed walkdown guidelines contained in NEI 12-07 Rev. 0-A (ADAMS Accession No. ML12173A215). The

licensee's walkdown submittal dated November 27, 2012, indicated that the licensee implemented the walkdowns consistent with the intent of the guidance provided in NEI 12-07. The licensee did not identify any exceptions from NEI 12-07.

Based on the NRC staff's review, the licensee appears to have presented information related to the implementation of the walkdown process as requested in the 50.54(f) letter, and consistent with the walkdown guidance.

### 3.6 Walkdown Results

#### 3.6.1 Walkdown Scope

The licensee performed walkdowns of features for the two categories of incorporated and exterior barriers. These consisted of the site, Seismic Class 1 structures, intake structure, and pipe tunnel, containment and shield building, auxiliary building, borated water storage tank, station drains, and penetrations below 585 feet IGLD. The flood features that were walked down include wave protection dikes, rip-rap, barriers, masonry walls, piping and conduit penetrations, sheet pilings, penetration seals, sump pumps, instrument strings, and flood doors. Most of the features were visually inspected for cracks, material degradation, gaps, etc. Operation of the flood doors' closure mechanism was assessed. No other significant simulations and/or activity reviews were made.

Flood prevention and mitigation measures are designed to function in all modes of operation including full-power operation, startup, shutdown, and refueling.

The licensee used acceptance criteria consistent with the intent of NEI 12-07.

#### 3.6.2 Licensee Evaluation of Flood-Protection Effectiveness, Key Findings, and Identified Deficiencies

The licensee performed an evaluation of the overall effectiveness of the plant's flood protection features. The licensee's report evaluated the features' effectiveness by visual inspection compared with site drawing specifications. Identification of minor issues associated with the flood features that do not jeopardize their operability were discussed and noted as described in condition reports. See Sections 3.4 and 3.6.1 for a brief summary of flood protection features.

The guidance in NEI 12-07 defines a deficiency as follows:

A deficiency exists when a flood protection feature is unable to perform its intended function when subject to a design basis flooding hazard.

The licensee did not identify deficiencies because of the flood walkdowns.

It is further specified in NEI 12-07, that licensees identify observations/potential deficiencies in the CAP that were not yet dispositioned at the time the walkdown report was submitted. The licensee states that there are no observations awaiting disposition at the writing of the licensee's report.

### 3.6.3 Flood-Protection and Mitigation Enhancements

The licensee stated that site modifications include buildings, facilities, and parking lots to accommodate a 2014 steam generator replacement project. The licensee issued a condition report to review the probable maximum precipitation analysis as a result of the site modifications. No planned or recommended modifications to flood protection systems or mitigation measures resulted from these walkdowns.

### 3.6.4 Planned or Newly Installed Features

The licensee did not determine that changes were necessary by the flood walkdowns.

### 3.6.5 Deficiencies Noted and Actions Taken or Planned to Address

The licensee noted no deficiencies resulting from the walkdown but did identify some issues that were either documented in the CAP or in the work process program. These issues are minor concrete spalling on east face of intake structure, minor crack observed in barrier 114F/EXT extending into 114S and the shield building, and certain auxiliary building stairwells that were not part of a structure inspection program. There were no observations awaiting disposition at the time of the walkdown report.

### 3.6.6 Walkdown Analysis

The NRC staff reviewed the licensee walkdown report dated November 27, 2012. The licensee outlined issues and items determined by comparing site drawings to visual inspections during a walkdown. Based on these inspections, the licensee confirmed that the features were properly configured, in acceptable conditions, and as applicable, are periodically maintained or inspected. The licensee noted minor defects and determined if these are currently documented in the CAP, or in the work process programs as appropriate. The licensee did not discuss reasonable simulations.

The site flooding procedure is entered when Lake Erie water level exceeds 574 ft IGLD. At this point, the Operations Shift Manager verifies the integrity of flood barriers, for service water pumps, cooling tower, makeup pumps, and the diesel fire pump. There are no required operations of installed plant equipment in response to the rise in Lake Erie levels.

Based on the NRC staff's review, the licensee appears to have provided results of the walkdown and described any other planned or newly installed flood protection systems or flood mitigation measures as requested in the 50.54(f) letter, and consistent with the walkdown guidance. Based on the information provided in the licensee's submittals, the NRC staff concludes that the licensee's implementation of the walkdown process meets the intent of the walkdown guidance.

### 3.6.7 Available Physical Margin

The NRC staff was concerned that the licensee had not determined and documented a numerical value for available physical margin (APM) for every applicable flood protection feature (e.g., wall, penetration, berm, door, etc.). In a letter dated January 30, 2014 (ADAMS Accession

No. ML14030A559), the licensee indicated that a review had been performed on the APM determination process. Any unknown APMs were entered into the CAP. The NRC staff reviewed the response and concludes that the licensee met the intent of the APM determination per NEI 12-07.

Based on the NRC staff's review, the licensee appears to have documented the information requested for any cliff-edge effects, as requested in the 50.54(f) letter consistent with the walkdown guidance. Further, staff reviewed the response and concludes that the licensee met the intent of the APM determination per NEI 12-07.

### 3.7 NRC Oversight

#### 3.7.1 Independent Verification by Resident Inspectors

On June 27, 2012, the NRC issued Temporary Instruction (TI) 2515/187, "Inspection of Near-Term Task Force Recommendation 2.3 Flooding Walkdowns" (ADAMS Accession No. ML12129A108). In accordance with the TI, NRC inspectors independently verified that the licensee implemented the flooding walkdowns consistent with the intent of the walkdown guidance. Additionally, the inspectors independently performed walkdowns of a sample of flood protection features. The inspection report dated January 25, 2013 (ADAMS Accession No. ML13025A126), documents the results of this inspection. No findings of significance were identified.

### 4.0 SSCs Not Walked Down

The licensee identified restricted access features that were considered inaccessible. In the attachment to the November 27, 2012, response, the licensee committed to complete the delayed walkdown items identified areas/rooms of restricted access in April 2013 (Room 102), the 18th refueling outage (containment building and annulus, Spring 2014) and by December 2014 (Room 210).

#### 4.1 Restricted Access

As a result of the walkdowns being conducted during plant operation, the area dose will result in some walkdowns areas in the containment building and containment annulus being conducted during an outage scheduled in 2014. The licensee identified that Room 102, the spent resin storage tank (flood barriers 102F/EXT and Ext/102W) will be inspected before the end of April 2013. In addition, Room 210, the Clean Waste Polishing and Purification Demineralizer room (flood barrier 210F/EXT) will be inspected by the end of December 2014.

In 2011, Room 205, Makeup Tank Room (flood barriers 205F/EXT and EXT/205S) was previously inspected, when evidence of groundwater intrusion was noted. The evaluation, associated with the condition report written by the licensee, determined that the wall, where the mineral deposits were noted, could perform its function as a barrier. Therefore, the licensee credited this prior walkdown as a flooding walkdown.

Although the licensee discusses Room 222, Room 223, and Room 224, as restricted access, the NRC staff found that these rooms are better classified under the "inaccessible" classification as discussed immediately below.

#### 4.2 Inaccessible Features

The following inaccessible areas are fitted with leakage monitoring instrumentation and are not amenable to visual inspection since they are filled with water. These areas include Room 222 Fuel Transfer Tube Area; Room 223 Cask Wash Pit Area; and, Room 224, Spent Fuel Storage Area. These rooms are portions of the spent fuel storage facilities (pools) that contain a stainless steel liner and a leakage detection system. The licensee concluded that detailed visual inspection is not necessary since these areas are monitored monthly for leakage.

#### 5.0 CONCLUSION

The NRC staff concludes that the licensee, through the implementation of the walkdown guidance activities, and in accordance with plant processes and procedures, verified the plant configuration with the current flooding licensing basis; addressed degraded, nonconforming, or unanalyzed flooding conditions; and verified the adequacy of monitoring and maintenance programs for protective features. Therefore, NRC staff concludes that the licensee's implementation of flooding walkdown methodology meets the intent of the walkdown guidance. Furthermore, the licensee's walkdowns, as verified by staff inspection, identified no immediate safety concerns.

The NRC reviewed the information provided and determined that sufficient information was provided to be responsive to Enclosure 4 of the 50.54(f) letter.

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If you have any questions, please contact me at (301) 415-2315 or by email at [Eva.Brown@nrc.gov](mailto:Eva.Brown@nrc.gov).

Sincerely,

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Plant Licensing III-2 and  
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Docket No.50-346

Enclosure:  
Staff Assessment of Flooding Walkdown

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