Morgan, Lewis & Bockius LLP
1111 Pennsylvania Avenue, NW
Washington, DC 20004
Tel. 202.739.3000
Fax: 202.739.3001
www.morganlewis.com

Morgan Lewis
COUNSELORS AT LAW

Timothy P. Matthews
Partner
202.739.5527
tmatthews@morganlewis.com

April 5, 2012

William J. Froehlich, Chair
Nicholas G. Trikouros
Dr. William E. Kastenberg
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Docket: FirstEnergy Nuclear Operating Company, Davis-Besse Nuclear Power Station, Unit 1, Docket No. 50-346-LR

Re: Notification of Filing Related to Proposed Shield Building Cracking Contention

Dear Licensing Board Members:

The purpose of this letter is to provide notification that FirstEnergy Nuclear Operating Company (FENOC), applicant in this proceeding, sent the enclosed letter to the Nuclear Regulatory Commission (NRC) today. The letter provides FENOC's response to the NRC Staff's December 27, 2011 Request for Additional Information (RAI) B.2.39-13 regarding Shield Building cracking. The RAI response identifies revisions to the Davis-Besse License Renewal Application. FENOC is notifying the Board of the enclosed letter because it is relevant to the proposed contention that was filed by the Intervenors on January 10, 2012 in this proceeding.

Respectfully submitted,

Executed in Accord with 10 C.F.R. § 2.304(d)

Signed (electronically) by Timothy P. Matthews
Timothy P. Matthews

Counsel for FENOC

Enclosure

cc: Service List

Enclosure 1

FENOC
FirstEnergy Nuclear Operating Company

Davis-Besse Nuclear Power Station
5501 N. State Route 2
Oak Harbor, Ohio 43449

April 5, 2012
L-12-028

10 CFR 54

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Davis-Besse Nuclear Power Station, Unit No. 1
Docket No. 50-346, License Number NPF-3
Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application (TAC No. ME4640) and License Renewal Application Amendment No. 25

By letter dated August 27, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102450565), FirstEnergy Nuclear Operating Company (FENOC) submitted an application pursuant to Title 10 of the *Code of Federal Regulations*, Part 54 for renewal of Operating License NPF-3 for the Davis-Besse Nuclear Power Station, Unit No. 1 (DBNPS). By letter dated December 27, 2011 (ML11333A396), the Nuclear Regulatory Commission (NRC) requested additional information to complete its review of the License Renewal Application (LRA).

The NRC letter contained four requests for additional information (RAIs). The FENOC response to RAI 3.1.2.2.16-3 was submitted to the NRC by letter dated January 13, 2012 (ML12018A338). The FENOC responses to RAIs B.1.4-2 and B.1.4-3 were submitted to the NRC by FENOC letter L-12-015 dated March 9, 2012.

The Attachment provides the FENOC response to the fourth of four RAIs (B.2.39-13) in the NRC letter. The NRC request is shown in bold text followed by the FENOC response. The submittal date for this response was extended following discussion with Mr. Samuel Cuadrado de Jesus, NRC Project Manager, due to the need to evaluate and incorporate information from the Davis-Besse Shield Building concrete cracking Root Cause Analysis Report that was recently completed and submitted to the NRC by FENOC letter dated February 27, 2012 (ML120600056).

The Enclosure provides Amendment No. 25 to the DBNPS LRA.

There are no regulatory commitments contained in this letter. Actions discussed in this letter represent intended or planned actions by FENOC, which are documented in and managed using the FENOC Corrective Action Program. If there are any questions or if additional information is required, please contact Mr. Clifford I. Custer, Fleet License Renewal Project Manager, at 724-682-7139.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 5, 2012.

Sincerely,

David M. Imlay
Director, Site Performance Improvement

Attachment:
Reply to Request for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1 (DBNPS), License Renewal Application, Section B.2.39

Enclosure:
Amendment No. 25 to the DBNPS License Renewal Application

cc: NRC DLR Project Manager (2 copies)
NRC Region III Administrator

cc: w/o Attachment or Enclosure
NRC DLR Director
NRR DORL Project Manager
NRC Resident Inspector
Utility Radiological Safety Board

Section B.2.39

Question RAI B.2.39-13

Background:

In order to perform a scheduled reactor head replacement, a construction opening was made in the concrete shield building. During hydro-demolition of the concrete shield building, cracks were identified in the 'architectural shoulders' of the shield building. While investigating the extent of the cracking, additional cracks were identified around the shield building. These additional cracks were identified using an Impulse Response (IR) technique and core bores were used to verify the IR results.

Issue:

Extensive cracking in the shield building could affect the structural integrity of the shield building and may impact its ability to perform its intended function during the period of extended operation.

Request:

1. **Summarize the shield building degradation, the root cause, and the expected corrective actions.**

2. **Explain how the recent plant-specific operating experience impacts the Shield Building's ability to perform its intended functions during the period of extended operation. Include a list of any additional aging effects that may require management based on this operating experience.**

3. **Explain how the recent plant-specific operating experience will be incorporated into the Structures Monitoring Program AMP, and whether the current program will be adequate to manage aging of the shield building during the period of extended operation, based on this operating experience. Specifically address the following:**

   (a) Details of tests planned to determine the long term effect of the concrete cracks on the ability of the rebars to carry design loads.

(b) Plans, if any, to repair the crack or reinforce the shield building concrete.

(c) Detailed plans to monitor the extent and thickness of cracks, and corrosion of the rebars over the long term.

(d) Plans, if any, to perform detailed structural analysis, with explicit modeling of rebars, cracks, and concrete, to demonstrate that the shield building will perform its intended design function over the long term. This analysis should also consider the effect of shrinkage and environment on the concrete and rebar during the period of extended operation.

4. Identify and explain any changes to the license renewal application based on the recent plant specific operating experience.

RESPONSE RAI B.2.39-13

1. Summarize the shield building degradation, the root cause, and the expected corrective actions.

Summary of Shield Building Degradation

The Shield Building degradation identified using an Impulse Response technique was laminar cracking located within the Shield Building cylinder wall at the outer reinforcing steel (rebar) mat. The crack widths were found to be generally tight, less than or equal to 0.010 inches, with one crack measuring 0.013 inches. The cracking that was first discovered was along the left vertical edge of the temporary construction opening being installed to facilitate the replacement of the reactor pressure vessel head on October 10, 2011. The crack was located adjacent to the outer rebar mat of the Shield Building cylinder wall in one of the architectural flute shoulders (architectural shoulders). After the initial investigation determined that this condition was not limited to the area immediately adjacent to this construction opening, an evaluation was performed to investigate other areas of the Shield Building.

The investigation determined that the laminar cracking was evident over an extended portion of the Shield Building structure. The results of this investigation were documented on Attachment #1 (Drawing C-111A) of the Root Cause Report submitted by FENOC letter dated February 27, 2012 (ML120600056). The Shield Building has sixteen architectural shoulders. Cracking was found (in varying areas) in each of the fifteen architectural shoulders that were examined; one shoulder was not examined because access was limited due to adjacent equipment. The other areas of cracking were found in portions of the structure that contained a greater amount of rebar. One of the areas was within the top 20 feet of the cylinder wall

that contains #11 horizontal hoop rebar spaced at approximately 6 inches center-to-center. The other area was adjacent to the two main steam line penetrations in the Shield Building. These areas are located just below the bottoms of shoulders and contain horizontal hoop rebar at approximately 6-inch center-to-center spacing above the wall penetration.

Summary of the Root Cause

Laminar cracking occurred due to the combination of three factors: the design configuration of the architectural shoulders; high moisture intrusion into the Shield Building concrete followed by a severe temperature drop; and, lack of moisture prevention on the exterior of the building. The root cause of the Shield Building laminar cracks was attributed to the design specification for construction of the Shield Building, which did not specify the application of an external sealant [for protection] from moisture. The design configuration of the architectural shoulders coupled with a rare combination of severe environmental factors associated with the blizzard of 1978 caused the laminar cracking. The design configuration did not include an external protective sealant on the Shield Building. Lack of an external sealant allowed moisture to be driven into the concrete, freeze, and expand. The root cause investigation was based on a comprehensive listing of potential failure scenarios. The “Fault Tree” (Attachment #11 of the Root Cause Report (ML120600056)) lists 45 potential causes for the cracking. These causes were evaluated based on plant construction, history (did an event occur?), testing of core bore samples (concrete cores), and analyses.

Concrete core bore samples were taken to confirm suspect locations identified by the Impulse Response testing. These core bore samples were analyzed and material properties were established by tests by several qualified testing facilities. The test results of the core bore samples taken from the exterior surface of the Shield Building were used to investigate various fault tree degradation mechanisms associated with the initial concrete mix design, as-placed concrete, shrinkage, chemical attack, thermal stress cycles, creep, and freeze/thaw damage. The test results found that the concrete was in good condition, consistent with the mix design, and revealed no abnormal or degraded material properties.

The Shield Building was analyzed for a number of actual and postulated events to determine if any of these events could have caused the identified laminar cracks. The analyses included reviews for thermal effects (extreme heat or cold), wind, tornado, freezing of moisture near the outer rebar mat during blizzard conditions, and excessive density of rebar. Based on the analyses, all potential causes were eliminated, except for the freezing of moisture during blizzard conditions and excessive density of rebar. Specifically, the investigation reviewed the conditions imposed on this structure by the blizzard of 1978. This storm was unique in that it was preceded by several days of rain and wind. The blizzard conditions arrived on site with additional moisture, extremely high winds (about 100 miles per hour

maximum), and a rapid temperature drop. The temperature quickly dropped from above freezing to approximately 0 degrees Fahrenheit. The analyses found that wind-driven moisture penetrated the Shield Building wall and, upon freezing, caused stresses sufficient to cause laminar cracks at the outer rebar mat in the architectural shoulder regions. This storm was the only event identified that generated sufficient stress to initiate and propagate the laminar cracking.

Additional sensitivity analyses were performed for the areas of dense rebar spacing noted above. This analysis determined that the approximately 6-inch horizontal center-to-center hoop rebar spacing would allow propagation of the laminar cracks in these areas under the conditions previously mentioned. This closer spacing allowed the concrete to provide less resistance to the propagation of cracks. The same analysis reviewed the typical reinforcement spacing of 12 inches center-to-center in the remainder of the building and determined that this spacing provided sufficient concrete between the rebar to preclude laminar cracking.

The area of the main steam line penetrations was also reviewed to evaluate the cracking that extends below the auxiliary building roof line into the cylinder walls of the main steam line rooms at the outer rebar mat. This evaluation concluded that the cracking extended downward from the bottom of the architectural shoulders just above the auxiliary building roof line. Higher density rebar of the penetration blockout contributed to crack propagation until equilibrium was reached at the top of the original wall penetrations.

As stated above, the root cause for the laminar cracks has been concluded to be the lack of an exterior sealant to preclude moisture penetration into the Shield Building wall. The only event that was found to be capable of producing the necessary forces required to cause the cracks was the 1978 blizzard. The cracking in the architectural shoulders propagated into some adjacent areas as described above.

Summary of the Expected Corrective Actions

The expected corrective actions for the Shield Building laminar cracking are summarized as follows:

- Specify and apply a protective coating or sealant to prevent moisture from penetrating the surface of the Shield Building wall and establish requirements for periodic inspection of the coating or sealant.
- Develop the necessary documents to provide for the long-term monitoring of the Shield Building laminar cracks (discussed further in response to RAI Request #3 below).
- Develop the plan and complete the activities for additional investigation of the Shield Building, including any required documentation revisions.

- Develop a plan and finalize the steps to re-establish design and licensing basis conformance for the Shield Building. Initiate additional corrective actions as required.
- Develop a testing program and complete the activities to determine the structural effect on the steel reinforcement adjacent to the laminar cracks.

2. Explain how the recent plant-specific operating experience impacts the Shield Building's ability to perform its intended functions during the period of extended operation. Include a list of any additional aging effects that may require management based on this operating experience.

Based on the investigation conducted in October and November of 2011, and analyses performed to evaluate the as-found conditions, the Shield Building is adequate to perform its intended design functions. As identified in the Root Cause Report (ML120600056) described above, there are no direct aging effects associated with the identified laminar cracks. The long term monitoring program, described below, is intended to periodically inspect the structure to confirm that there are no changes in the nature of these cracks.

3. Explain how the recent plant-specific operating experience will be incorporated into the Structures Monitoring Program AMP, and whether the current program will be adequate to manage aging of the shield building during the period of extended operation, based on this operating experience.

As noted in the response to RAI Request #2 above, evaluation of the recent Shield Building operating experience did not identify any new aging effects. Therefore, the Structures Monitoring Program will be adequate to manage aging during the period of extended operation. However, a new plant-specific aging management program titled "Shield Building Monitoring Program" is provided to periodically inspect the structure to confirm that there are no changes in the nature of the identified laminar cracks. See the response to RAI Request #4 below.

Specifically, address the following:

(a) Details of tests planned to determine the long term effect of the concrete cracks on the ability of the rebars to carry design loads.

FENOC plans to administer a testing program to be performed at two independent testing facilities to simulate the as-found cracking in the Shield Building. The test procedure is planned to test concrete beams to failure. The concrete beam failures are planned to be strictly controlled such that the laminar cracking would be established in the concrete beams in the area where the rebar lap splices are planned to be located. By closely monitoring the stresses in the rebar as the test beams undergo failure, the capacity of the rebar at the

splice location can be established. This testing program has a scheduled completion date of August 1, 2012.

(b) Plans, if any, to repair the crack or reinforce the shield building concrete.

FENOC has no plans at this time to repair the cracks or add reinforcement to the Shield Building concrete. FENOC is developing a comprehensive engineering plan to re-establish the design and licensing basis conformance of the Shield Building. Development of the plan is scheduled for completion by December 1, 2012.

(c) Detailed plans to monitor the extent and thickness of cracks, and corrosion of the rebars over the long term.

Over the long term, a plant-specific Shield Building monitoring aging management program has been developed to perform periodic monitoring of the Shield Building for potential aging effects related to this operating experience. The "Shield Building Monitoring Program" also includes inspections or testing to monitor the condition of the sealant or coating that is planned to be applied to the Shield Building. The requirements of the plant-specific Shield Building Monitoring Program are to be administered in conjunction with the existing Structures Monitoring Program. See the response to RAI Request #4, below.

Also, based on the corrective actions identified in the Shield Building Root Cause Report (ML120600056), the current Davis-Besse procedure for the evaluation of structures (EN-DP-01511) is being revised to incorporate a section specifically for the long-term monitoring of the Shield Building laminar cracks. The procedure revision has a scheduled completion date of July 11, 2012. As described in the corrective actions, current plans are for the procedure to include the following actions to monitor the cracks and ensure the rebar adequacy:

- Periodic monitoring of the Shield Building is to begin with an annual inspection cycle starting in 2012, with a second inspection in 2013.

  If the inspection results remain unchanged after the first two inspection cycles (defined as no discernable change in crack width or the confirmation that no cracks have developed in previously un-cracked core bores), the inspection cycle may be changed to two-years.

  Periodic monitoring is to be repeated every two years for a minimum of three cycles. If after those three monitoring cycles, the results of the core bore and crack examinations remain unchanged, the monitoring schedule may be changed to a five-year cycle.

  If any adverse changes are identified (as defined in the acceptance criteria) during these examinations, a condition report would be initiated

to evaluate the changes and to determine the need for revision of the inspection schedule.

- A minimum of six existing core bores of each type (un-cracked and cracked) are to be inspected during each inspection cycle. The minimum planned distribution of the core bore inspections is as follows: three in shoulder regions; one in a steam line penetration area; and, two in the top region of the building outside the shoulders.
- The examination of the core bores is to be performed by visual inspection and the use of a borescope and optical crack comparator. Any identified cracks are to be measured using an optical crack comparator and the borescope.
- For the examination of the core bores that did not contain a crack indication initially (as defined on Drawing C-111A (ML120600056)), the planned acceptance criterion for cracking is that no new crack indication is identified. If a new crack is identified, it would be measured as described above. Evaluation of the crack would determine the need for any additional inspections or required changes to the monitoring plans.

  Core bores within the sample population that have existing cracks are to be re-examined to determine the current width of the crack. The as-measured crack width would be compared to the initial crack width measurement as recorded on Drawing C-111A (ML120600056). If it is determined that the crack width has increased (a discernable change in width within the accuracy of the measurement technique), the increase would be evaluated.
- Chloride ion testing and carbonation testing is to be carried out on a minimum of two new core bore samples collected for examination. This testing is planned to be performed during alternating inspection cycles as detailed in procedural test requirements. The procedural requirements will establish the acceptance criteria for these tests.

(d) Plans, if any, to perform detailed structural analysis, with explicit modeling of rebars, cracks, and concrete, to demonstrate that the shield building will perform its intended design function over the long term. This analysis should also consider the effect of shrinkage and environment on the concrete and rebar during the period of extended operation.

As described above, FENOC is developing a comprehensive engineering plan to re-establish the design and licensing basis conformance of the Shield Building. The plan is scheduled to be completed and issued by December 1, 2012. The plan will include a detailed structural analysis of the Shield Building and consider applicable effects.

4. Identify and explain any changes to the license renewal application based on the recent plant specific operating experience.

The Davis-Besse License Renewal Application is revised as follows:

- Section 3.5.2.1.1, “Containment (including Containment Vessel, Shield Building, and Containment internal structures),” is revised to include the Shield Building Monitoring Program under the subheading, “Aging Management Programs.”
- Table 3.5.2-1, “Aging Management Review Results – Containment,” is revised to include the Shield Building Monitoring Program
- Existing Section A.1.43, “References,” is renumbered to A.1.44, “References.” New Section A.1.43, “Shield Building Monitoring Program,” is created to include a summary description of a plant-specific Shield Building monitoring aging management program. Monitoring of the Shield Building coating or sealant is included as a program activity. Appendix A, “Updated Safety Analysis Report Supplement,” Table of Contents is revised to include Sections A.1.43 and A.1.44.
- Table A-1, “Davis-Besse License Renewal Commitments,” is revised to include a license renewal future commitment to implement the Shield Building Monitoring Program prior to entering the period of extended operation.
- Tables B-1, “Correlation of NUREG-1801 and Davis-Besse Aging Management Programs,” and B-2, “Consistency of Davis-Besse Aging Management Programs with NUREG-1801,” are revised to include the new plant-specific Shield Building Monitoring Program.
- New Section B.2.43, “Shield Building Monitoring Program,” is created to include a plant-specific Shield Building monitoring aging management program. Monitoring of the Shield Building coating or sealant is included as a program activity. Appendix B, “Aging Management Programs,” Table of Contents is revised to include Section B.2.43.

See the Enclosure to this letter for the revision to the DBNPS LRA.

Enclosure

Davis-Besse Nuclear Power Station, Unit No. 1 (DBNPS)

Letter L-12-028

Amendment No. 25 to the
DBNPS License Renewal Application

License Renewal Application
Sections Affected

Section 3.5.2.1.1

Table 3.5.2-1

Table 3.5.2 Plant-Specific Notes

Appendix A Table of Contents

Section A.1.43

Section A.1.44

Table A-1

Appendix B Table of Contents

Table B-1

Table B-2

Section B.2.43

The Enclosure identifies the change to the License Renewal Application (LRA) by Affected LRA Section, LRA Page No., and Affected Paragraph and Sentence. The count for the affected paragraph, sentence, bullet, etc. starts at the beginning of the affected Section or at the top of the affected page, as appropriate. Below each section the reason for the change is identified, and the sentence affected is printed in *italics* with deleted text ~~*lined-out*~~ and added text *underlined*.

Affected LRA Section	LRA Page No.	Affected Paragraph and Sentence
3.5.2.1.1	**Page 3.5-4**	**New "Aging Management Programs" bullet**

In response to request for additional information (RAI) B.2.39-13, a new aging management program bullet is added to the "Aging Management Programs" subsection of LRA Section 3.5.2.1.1, "Containment (including Containment Vessel, Shield Building, and Containment internal structures)," as follows:

Aging Management Programs

The following programs are credited for managing the effects of aging on the Containment structural components:

- 10 CFR Part 50, Appendix J Program
- Boric Acid Corrosion Program
- Cranes and Hoists Inspection Program
- Fire Protection Program
- Inservice Inspection (ISI) Program – IWE
- Inservice Inspection (ISI) Program – IWF
- *Shield Building Monitoring Program*
- Structures Monitoring Program

Affected LRA Section	LRA Page No.	Affected Paragraph and Sentence
Table 3.5.2-1	**Pages 3.5-72 thru 3.5-74**	**Rows 77, 78, 79, 80, 82, 83, 84 and 85, "Aging Management Program" and "Notes" columns**

In response to RAI B.2.39-13, the "Aging Management Program" and "Notes" columns for eight rows of LRA Table 3.5.2-1, "Aging Management Review Results – Containment," are revised as follows:

Table 3.5.2-1 Aging Management Review Results – Containment

Row No.	Component / Commodity	Intended Function[1]	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801, Volume 2 Item	Table 1 Item	Notes
77	Shield Building Dome	EN, MB, SPB, SRE, SSR	Concrete	Air-outdoor	Loss of Material	Structures Monitoring 10 CFR Part 50, Appendix J *Shield Building Monitoring*	III.A1-9	3.5.1-23	A 0511 *0552*
78	Shield Building Dome	EN, MB, SPB, SRE, SSR	Concrete	Air-outdoor	Loss of Material Change in material properties	Structures Monitoring 10 CFR Part 50, Appendix J *Shield Building Monitoring*	III.A1-10	3.5.1-24	A 0511 *0552*

Table 3.5.2-1 Aging Management Review Results – Containment									
Row No.	**Component / Commodity**	**Intended Function[1]**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801, Volume 2 Item**	**Table 1 Item**	**Notes**
79	Shield Building Dome	EN, MB, SPB, SRE, SSR	Concrete	Air-outdoor	Loss of Material Cracking	Structures Monitoring 10 CFR Part 50, Appendix J *Shield Building Monitoring*	III.A1-6	3.5.1-26	A 0511 *0552*
80	Shield Building Dome	EN, MB, SPB, SRE, SSR	Concrete	Air-outdoor	Change in material properties	Structures Monitoring 10 CFR Part 50, Appendix J *Shield Building Monitoring*	III.A1-7	3.5.1-32	A 0509 0511 *0552*
82	Shield Building Walls (above grade)	EN, FB, MB, SHD, SPB, SRE, SSR	Concrete	Air-outdoor	Loss of Material	Structures Monitoring 10 CFR Part 50, Appendix J Fire Protection *Shield Building Monitoring*	III.A1-9	3.5.1-23	A 0511 0512 *0552*
83	Shield Building Walls (above grade)	EN, FB, MB, SHD, SPB, SRE, SSR	Concrete	Air-outdoor	Loss of Material Change in material properties	Structures Monitoring 10 CFR Part 50, Appendix J Fire Protection *Shield Building Monitoring*	III.A1-10	3.5.1-24	A 0511 0512 *0552*

Table 3.5.2-1 Aging Management Review Results – Containment									
Row No.	**Component / Commodity**	**Intended Function[1]**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801, Volume 2 Item**	**Table 1 Item**	**Notes**
84	Shield Building Walls (above grade)	EN, FB, MB, SHB, SPB, SRE, SSR	Concrete	Air-outdoor	Loss of Material Cracking	Structures Monitoring 10 CFR Part 50, Appendix J Fire Protection *Shield Building Monitoring*	III.A1-6	3.5.1-26	A 0544 *0552*
85	Shield Building Walls (above grade)	EN, FB, MB, SHD, SPB, SRE, SSR	Concrete	Air-outdoor	Change in material properties	Structures Monitoring 10 CFR Part 50, Appendix J Fire Protection *Shield Building Monitoring*	III.A1-7	3.5.1-32	A 0509 0511 0512 *0552*

Affected LRA Section	LRA Page No.	Affected Paragraph and Sentence
Table 3.5.2 Plant-Specific Notes	**Page 3.5-172**	**New Note / Row**

In response to RAI B.2.39-13, LRA Table 3.5.2 Plant-Specific Notes is revised to add a new plant-specific note as follows:

Plant-Specific Notes:	
0552	*In addition to aging management by the Structures Monitoring Program, the Shield Building concrete walls that are exposed to air-outdoor are also managed by the plant-specific Shield Building Monitoring Program. For the Shield Building dome, in addition to the Structures Monitoring Program, the plant-specific Shield Building Monitoring Program will be used to manage only the coating or sealant applied to the dome.*

Affected LRA Section	LRA Page No.	Affected Paragraph and Sentence
A.1.43 & A.1.44	**Page A-25**	**New Section / Title Revision**
Appendix A Table of Contents	**Page A-4**	**A.1.43 & A.1.44**

In response to RAI B.2.39-13, a new LRA section is created to include a new plant-specific aging management program. LRA Section A.1.43 is renamed from "References" to "Shield Building Monitoring Program." The "References" section is renumbered as Section A.1.44, "References." Although not shown below, LRA Appendix A, "Updated Safety Analysis Report Supplement," "Table of Contents" on LRA Page A-4, is revised accordingly to include the renumbered sections. New LRA Section A.1.43 reads as follows:

A.1.43 Shield Building Monitoring Program

The Shield Building Monitoring Program is a prevention and condition monitoring program. The program consists of inspections, testing or chemical analyses of the Shield Building concrete and reinforcing steel (rebar). The inspections, testing or chemical analyses conducted as part of the Shield Building Monitoring Program supplement the inspections conducted as part of the Structures Monitoring Program.

The program monitors for cracking, change of material properties and loss of material of concrete. The program also will monitor for corrosion of the concrete rebar. As a preventive action of this program, the Shield Building exterior concrete sealant or coating is inspected or tested for evidence of loss of its effectiveness.

Visual inspections are performed on rebar (when exposed), core bore and core bore sample (concrete core) surfaces using plant-specific procedures implemented by inspectors qualified through plant-specific procedures.

The Shield Building Monitoring Program includes periodic scheduled inspections, testing or chemical analyses to ensure that the existing environmental conditions are not causing material degradation that could result in loss of Shield Building intended functions during the period of extended operation.

Implementation of this program ensures that the intended functions of the Shield Building are maintained during the period of extended operation.

Affected LRA Section **LRA Page No.** **Affected Paragraph and Sentence**

Table A-1 **Page A-69** **Commitment No. 46**

In response to RAI B.2.39-13, LRA Table A-1, "Davis-Besse License Renewal Commitments," license renewal future Commitment No. 46, previously identified as "not used" in FENOC letter dated October 7, 2011 (ML11285A064), is replaced in its entirety to read as follows:

Table A-1
Davis-Besse License Renewal Commitments

Item Number	Commitment	Implementation Schedule	Source	Related LRA Section No./ Comments
46	~~*Not used.*~~ *Implement the Shield Building Monitoring Program as described in LRA Section B.2.43.*	*Prior to April 22, 2017*	*LRA and FENOC Letter L-12-028*	*A.1.43 B.2.43 Response to NRC RAI B.2.39-13 from NRC Letter dated December 27, 2011*

Affected LRA Section	LRA Page No.	Affected Paragraph and Sentence
Table B-1	**Page B-17**	**New Row**

In response to RAI B.2.39-13, a new plant-specific program row is added to Table B-1, "Correlation of NUREG-1801 and Davis-Besse Aging Management Programs ," for the new "Shield Building Monitoring Program," as follows:

Table B-1
Correlation of NUREG-1801 and Davis-Besse Aging Management Programs
(continued)

Number	NUREG-1801 Program	Corresponding Davis-Besse AMP
NA	*Plant-specific Program*	*Shield Building Monitoring Program.* *See Section B.2.43.*

Affected LRA Section	LRA Page No.	Affected Paragraph and Sentence
Table B-2	**Page B-22**	**New Row**

In response to RAI B.2.39-13, a new row is added to Table B-2, "Consistency of Davis-Besse Aging Management Programs with NUREG-1801," for the new plant-specific "Shield Building Monitoring Program," as follows:

Program Name	New / Existing	Consistent with NUREG-1801	Consistent with NUREG-1801 with Exceptions	Plant-Specific	Enhancement Required
Shield Building Monitoring Program Section B.2.43	*New*	--	--	*Yes*	--

Affected LRA Section	LRA Page No.	Affected Paragraph and Sentence
B.2.43	**Page B-166**	**Entire Section**

In response to RAI B.2.39-13, new LRA Section B.2.43, "Shield Building Monitoring Program," is created to include a new plant-specific aging management program. Although not shown below, LRA Appendix B, "Aging Management Programs," "Table of Contents" on LRA Page B-4, is revised accordingly to include the new section. New LRA Section B.2.43 reads as follows:

B.2.43 SHIELD BUILDING MONITORING PROGRAM

Program Description

The Shield Building Monitoring Program is a new plant-specific prevention and condition monitoring program for Davis-Besse. The program will consist of inspections, testing or chemical analyses of the Shield Building concrete and reinforcing steel (rebar). The inspections, testing or chemical analyses conducted as part of the Shield Building Monitoring Program will supplement the inspections conducted as part of the Structures Monitoring Program.

The program will monitor for cracking, change of material properties and loss of material of concrete. The program also will monitor for corrosion of the concrete rebar. As a preventive action of this program, the Shield Building exterior concrete sealant or coating will be inspected or tested for evidence of loss of its effectiveness.

Visual inspections will be performed on rebar (when exposed), core bore and core bore sample (concrete core) surfaces using plant-specific procedures implemented by inspectors qualified through plant-specific procedures.

The Shield Building Monitoring Program will include periodic scheduled inspections, testing or chemical analyses to ensure that the existing environmental conditions are not causing material degradation that could result in loss of Shield Building intended functions during the period of extended operation.

Implementation of this program will ensure that the intended functions of the Shield Building are maintained during the period of extended operation.

NUREG-1801 Consistency

The Shield Building Monitoring Program is a new plant-specific Davis-Besse program for license renewal. While NUREG-1801 includes a Structures Monitoring Program (XI.S6), the Davis-Besse Shield Building Monitoring Program is considered plant-specific, and is evaluated against the ten elements described in Appendix A of the Standard Review Plan of License Renewal Applications for Nuclear Power Plants, NUREG-1800.

Aging Management Program Elements

The results of an evaluation of each program element are provided below.

- *Scope*

  The scope of the Shield Building Monitoring Program includes the Shield Building reinforced concrete and rebar.

  The program will include periodic inspections, testing or chemical analyses to ensure that the existing environmental conditions are not causing material degradation that could result in a loss of any of the intended functions of the Shield Building during the period of extended operation.

- *Preventive Actions*

  As part of the Shield Building Monitoring Program, the Shield Building sealant or coating will be inspected or tested to verify its continuing effectiveness during the period of extended operation.

- *Parameters Monitored or Inspected*

  The Shield Building Monitoring Program will inspect parameters directly related to potential degradation of the components under review, including visual evidence of cracking, change of material properties, loss of material and corrosion. Also, since visual inspection may not detect change of material properties prior to a loss of function, chemical analyses of concrete will be used, as applicable. In addition, the Shield Building exterior concrete sealant or coating will be inspected or tested for loss of its effectiveness.

  The parameters to be inspected will include visual evidence of surface degradation, such as cracking, change in material properties, loss of material and corrosion. Chemical analyses may be used, as needed, to determine chloride content and carbonation of concrete. Observed conditions, testing results or chemical analyses results may indicate a need to conduct

augmented inspections, testing or analyses. American Concrete Institute (ACI) Report 349.3R, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," and ANSI/ASCE 11-90, "Guideline for Structural Condition Assessments of Existing Buildings," provide guidance for the selection of parameters to be monitored or inspected.

Parameters Monitored or Inspected and Potential Aging Effects			
Potential Aging Effect	***Potential Aging Mechanisms***	***Parameters Monitored***	***Inspection and Testing Method(s)***
Cracking (concrete)	*Freezing of water that has permeated the concrete*	*Surface condition of core bores and core bore samples, and change in crack conditions*	*Visual*
Change of Material Properties	*Leaching of calcium hydroxide from concrete*	*Surface condition of core bores and core bore samples*	*Visual*
Loss of Material (concrete)	*Freezing of water that has permeated the concrete*	*Surface condition of core bores and core bore samples*	*Visual*
Loss of Material (rebar)	*Corrosion*	*Chlorides in concrete and carbonation of concrete*	*Chemical analysis, as needed*
Loss of Material (rebar)	*Corrosion*	*Surface condition of rebar, when exposed*	*Visual*
Loss of Sealant or Coating Effectiveness	*Loss of ability to perform its protective action*	*Condition of the sealant or coating*	*[To be developed once the coating or sealant is selected and applied]*

- *Detection of Aging Effects*

  The Shield Building Monitoring Program provides for detection of aging effects prior to the loss of Shield Building intended functions. The inspections, testing and analyses of the Shield Building concrete and rebar that was done to support the root cause evaluation will provide a baseline for future Shield Building Monitoring Program activities.

  Periodic visual inspections, testing and chemical analyses will be performed using plant-specific procedures implemented by inspectors qualified through plant-specific procedures.

Visual inspections will be supplemented by other established nondestructive examination (NDE) techniques and testing, as appropriate.

The initial frequency of visual inspection of core bores and core bore samples will be based on the results of inspections conducted before the period of extended operation. If no aging effects were identified by these visual inspections, then visual inspections will continue to be conducted at least once every two years during the period of extended operation. If no aging effects are identified by the two-year interval visual inspections (defined as no discernable change in crack width or the confirmation that no visible cracks have developed in core bores that previously had no visible cracks), then the frequency of visual inspections may be changed to at least once every five years. The initial frequency of chloride ion testing and carbonation testing of concrete will be based on the results of chloride ion testing and carbonation testing conducted before the period of extended operation. Any evidence of degradation will be documented and evaluated through the FENOC Corrective Action Program. The evaluation will include a determination of the need for any required change to the inspection schedule.

The inspection or testing method and frequency of the Shield Building exterior concrete sealant or coating will be established prior to entering the period of extended operation. The frequency of the sealant or coating inspection or testing may be adjusted based on observed sealant or coating conditions, any required reapplication of the sealant or coating, or on the recommendations of the sealant or coating manufacturer.

- *Monitoring and Trending*

  The Shield Building Monitoring Program will include a baseline inspection, followed by periodic inspections, testing or chemical analyses. Visual inspections, testing or chemical analyses will be performed by qualified personnel, as defined by plant-specific procedures. Inspection, testing and analytic findings will be documented and evaluated by assigned engineering personnel such that the results can be trended. Inspection findings that do not meet acceptance criteria will be evaluated and tracked using the FENOC Corrective Action Program.

- *Acceptance Criteria*

  Indications of relevant conditions of degradation detected during the inspections, tests or analyses will be evaluated and compared to pre-determined acceptance criteria. The acceptance criteria will be defined to ensure that the need for corrective actions is identified before loss of structure or component intended functions. If the acceptance criteria are not met, then

the indications or conditions will be evaluated under the FENOC Corrective Action Program.

Engineering evaluation by qualified personnel will be used for disposition of inspection findings, test results or analytic results that do not meet the acceptance criteria. Unacceptable inspection findings will include evidence of new cracking, growth of previously identified cracks, loss of material, change of material properties and corrosion that could lead to loss of a Shield Building intended function during the period of extended operation. Evidence of new cracking is defined as a visual inspection finding that visible cracks have developed in core bores that previously had no visible cracks. Growth of previously identified cracks is defined as a visual inspection finding that there has been a discernable change in crack width.

The acceptance criteria for the sealant or coating will be based on the ability of the sealant or coating to continue to be effective.

- *Corrective Actions*

  This element is common to Davis-Besse programs and activities that are credited with aging management during the period of extended operation and is discussed in Section B.1.3.

- *Confirmation Process*

  This element is common to Davis-Besse programs and activities that are credited with aging management during the period of extended operation and is discussed in Section B.1.3.

- *Administrative Controls*

  This element is common to Davis-Besse programs and activities that are credited with aging management during the period of extended operation and is discussed in Section B.1.3.

- *Operating Experience*

  Review of Davis-Besse operating experience identified degradation of the Shield Building concrete wall (above grade) due to internal laminar cracking. The degradation had not been identified by the existing Structures Monitoring Program, which is based on visual inspection of the external surfaces of structures. Although the laminar cracking degradation of the concrete for the Shield Building was not caused by an aging mechanism, it is prudent to establish a plant-specific Aging Management Program to include monitoring

methods to identify aging effects that may occur in the future. The Shield Building Monitoring Program is designed to identify and evaluate potential aging effects within the Shield Building walls. The program is also designed to identify and evaluate any loss of preventive action effectiveness of the exterior Shield Building concrete sealant or coating, once it has been selected and applied.

Industry operating experience regarding similar structures was evaluated for applicability at Davis-Besse. The only other similar instance of concrete delamination discovery associated with creating a temporary access opening in the containment structure occurred at Crystal River Unit 3. The root cause of the Crystal River containment concrete delamination was the design of the structure in combination with the type of concrete used, and the acts of detensioning and opening the containment structure. As part of the root cause analysis of the Davis-Besse Shield Building laminar cracking, FENOC concluded that the subject Crystal River operating experience was not applicable to the Davis-Besse Shield Building.

The elements that comprise the Shield Building Monitoring Program inspections, testing or analyses will be consistent with industry practice. Industry and plant-specific operating experience will be considered in the implementation of this program. As additional operating experience is obtained, lessons learned will be incorporated, as appropriate.

Enhancements

None.

Conclusion

Implementation of the Shield Building Monitoring Program will provide reasonable assurance that the existing environmental conditions will not cause aging effects that could result in a loss of component intended function. Aging effects that are discovered will be managed such that the component intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket No. 50-346-LR
FIRSTENERGY NUCLEAR OPERATING COMPANY	)	
	)	
(Davis-Besse Nuclear Power Station, Unit 1)	)	April 5, 2012

CERTIFICATE OF SERVICE

I hereby certify that, on this date, a copy of the "Notification of Filing Related to Proposed Shield Building Cracking Contention" was filed with the Electronic Information Exchange in the above-captioned proceeding on the following recipients.

Administrative Judge
William J. Froehlich, Chair
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: wjf1@nrc.gov

Administrative Judge
Nicholas G. Trikouros
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: nicholas.trikouros@nrc.gov

Administrative Judge
Dr. William E. Kastenberg
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: wek1@nrc.gov

Office of the Secretary
U.S. Nuclear Regulatory Commission
Rulemakings and Adjudications Staff
Washington, DC 20555-0001
E-mail: hearingdocket@nrc.gov

Office of the General Counsel
U.S. Nuclear Regulatory Commission
Mail Stop O-15D21
Washington, DC 20555-0001
Brian G. Harris
Megan Wright
Emily L. Monteith
Catherine E. Kanatas
E-mail: Brian.Harris@nrc.gov;
Megan.Wright@nrc.gov;
Emily.Monteith@nrc.gov;
Catherine.Kanatas@nrc.gov

Office of Commission Appellate Adjudication
U.S. Nuclear Regulatory Commission
Mail Stop: O-16C1
Washington, DC 20555-0001
E-mail: ocaamail@nrc.gov

Michael Keegan
Don't Waste Michigan
811 Harrison Street
Monroe, MI 48161
E-mail: mkeeganj@comcast.net

Kevin Kamps
Paul Gunter
Beyond Nuclear
6930 Carroll Avenue, Suite 400
Takoma Park, MD 20912
E-mail: kevin@beyondnuclear.org;
paul@beyondnuclear.org

Terry J. Lodge
316 N. Michigan St., Ste. 520
Toledo, OH 43604
E-mail: tjlodge50@yahoo.com

Signed (electronically) by Jane T. Accomando

Jane T. Accomando
Morgan, Lewis & Bockius LLP
1111 Pennsylvania Avenue, N.W.
Washington, DC 20004
Phone: 202-739-5815
E-mail: jaccomando@morganlewis.com

Counsel for FENOC

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