

August 16, 2012
L-12-284

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. 31

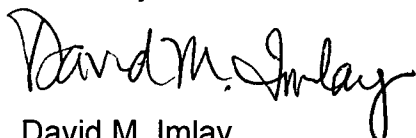
By letter dated August 27, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102450565), FirstEnergy Nuclear Operating Company (FENOC) submitted an application pursuant to Title 10 of the *Code of Federal Regulations*, Part 54 for renewal of Operating License NPF-3 for the Davis-Besse Nuclear Power Station, Unit No. 1 (Davis-Besse). By letter dated July 11, 2012 (ML12191A192), the Nuclear Regulatory Commission (NRC) requested additional information to complete its review of the License Renewal Application (LRA).

The Attachment provides the FENOC reply to the NRC request for additional information. The NRC request is shown in bold text followed by the FENOC response. The Enclosure provides Amendment No. 31 to the Davis-Besse LRA.

There are no regulatory commitments contained in this letter. 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 August 16, 2012.

Sincerely,



David M. Imlay
Director, Site Performance Improvement

A145
NR

Davis-Besse Nuclear Power Station, Unit No. 1
L-12-284
Page 2

Attachment:

Reply to Requests for Additional Information for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1 (Davis-Besse), License Renewal Application (LRA), Section B.2.43

Enclosure:

Amendment No. 31 to the Davis-Besse License Renewal Application

cc: NRC DLR Project Manager
NRC Region III Administrator

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

Reply to Requests for Additional Information for the Review of the
Davis-Besse Nuclear Power Station, Unit No. 1 (Davis-Besse),
License Renewal Application (LRA),
Section B.2.43
Page 1 of 12

Section B.2.43

Question RAI B.2.43-1

Background:

By letter dated April 5, 2012, the applicant responded to a request for additional information (RAI) regarding cracking in the shield building. The RAI response summarized the degradation and the root cause, the impact on the current licensing basis, and the applicant's plans to monitor the degradation in the future and during the period of extended operation. The response stated that the degradation was the result of water ingress and freeze-thaw cycles due to a lack of waterproofing coating on the shield building concrete. To address this issue, the applicant plans to apply a coating to the shield building and to monitor the coating and the shield building cracking. The response provided a new plant-specific aging management program (AMP), "Shield Building Monitoring Program," to monitor the protective coating during the period of extended operation.

Issue:

1. The RAI response indicates that the new shield building coating will be relied upon to manage aging; however, the coating is not called out in the scope of the new plant-specific Shield Building Monitoring Program, nor is it identified in any revised or new aging management review (AMR) line items. The response also does not discuss when the coating will be applied.
2. An analysis determined that the root cause of the degradation was a lack of an exterior sealant to preclude moisture penetration into the Shield Building wall. One of the corrective actions discussed in the response is applying a protective coating to prevent moisture from penetrating the Shield Building concrete; however, no discussion is provided that demonstrates a protective coating would be capable of preventing moisture ingress during an extreme weather event, such as the 1978 blizzard.
3. The "preventive actions" program element notes that "the Shield Building sealant or coating will be inspected or tested to verify its continuing effectiveness during the period of extended operation." The "parameters

monitored or inspected” and “detection of aging effects” program elements contain similar wording and the “acceptance criteria” element states that “the acceptance criteria for the sealant will be based on the ability of the sealant or coating to continue to be effective.” Additional information regarding how the coating will actually be inspected, what the inspection frequency will be, or how it will be determined the coating remains acceptable is necessary.

Request:

- 1. Include the coating within the scope of the Shield Building Monitoring program and include AMR line items to address the coating, or explain why it is not necessary. If the coating is being added to the scope of license renewal, outline a schedule for completing the coating application.**
- 2. Provide information that demonstrates the selected coating would be capable of preventing moisture ingress during an extreme weather event, similar to the blizzard of 1978. This should include test data that demonstrates that moisture will not ingress into the concrete if it is exposed to blizzard conditions with wind speed of 100 MPH followed by a rapid temperature drop to zero degrees Fahrenheit.**
- 3. Provide detailed information on how the coating will be inspected, when the coating will be inspected, and the acceptance criteria that will be used for the inspections. Explain what criteria will be used to determine if/when recoating is necessary. Provide qualification requirements of the engineering personnel who will inspect and evaluate the coating.**

RESPONSE RAI B.2.43-1

- 1. LRA Sections A.1.43 and B.2.43, both titled “Shield Building Monitoring Program,” are revised to include Shield Building coatings within the scope (i.e., scope element) of the Shield Building Monitoring Program. Consistent with the NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” recommendation for coatings used to protect metal, the coatings used to protect the concrete are considered part of the structural components to which the coatings are applied. Therefore, in the April 5, 2012 (ML12097A520) FENOC response to request for additional information (RAI) B.2.39-13, the Aging Management Review (AMR) line items for the coated components were revised to address the coatings by crediting the Shield Building Monitoring Program for aging management.**

The Shield Building Emergency Air Lock Enclosure walls have been added to the structural components that are scheduled to have a coating applied. Therefore, License Renewal Application Table 3.5.2-1, “Aging Management Review Results –

Containment,” is revised to credit the Shield Building Monitoring Program for aging management of the Shield Building Emergency Air Lock Enclosure in an “Air-outdoor” environment.

See the Enclosure to this letter for the revision to the Davis-Besse LRA.

The application of the Shield Building coatings is scheduled to begin in August and is scheduled to be completed in October 2012.

2. Two materials are planned to be used for coating the Shield Building. The walls of the Shield Building and the Shield Building Emergency Air Lock Enclosure are planned to be coated with a waterproofing system consisting of a latex acrylic primer and a styrene acrylic topcoat. The Shield Building Dome is planned to be coated with a high solids aliphatic polyurethane elastomeric coating system.

The Shield Building Wall and Shield Building Emergency Air Lock Enclosure coating system has been successfully tested by the manufacturer using the ASTM International (ASTM) Standard D6904-03, “Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry.” This ASTM practice is meant to simulate the ability of a coating system applied to a masonry block to withstand exposure to continuous water spray (rain) and a dynamic pressure equivalent to a 98 mile per hour (mph) wind velocity without exhibiting water leaks or weight gain, or both. The ASTM practice requires that the coated masonry be exposed for 24 hours to continuous water spray and air pressure. The combination of duration and dynamic pressure should bound any expected future storm conditions.

The coatings are being applied as a barrier against significant moisture migrating into the concrete. The moisture of concern would be from wind-driven rain. In 1978, the actual blizzard was preceded by several days of rain. The cold temperatures associated with the blizzard caused a rapid reduction in the temperature of the concrete, which froze the rain that had previously been driven into the concrete. The coating systems are not intended to influence the effects of temperature changes. The coating systems are intended to minimize the amount of moisture in the Shield Building components that may be exposed to temperature changes.

The manufacturer of the Shield Building Dome coating system has received a Notice of Acceptance (NOA) from Miami-Dade County for use of versions of its coating system in the Miami-Dade County High Velocity Hurricane Zone.

3. The Shield Building Monitoring Program requires that coatings are to be visually inspected by personnel qualified in accordance with FENOC procedures. The program includes periodic visual inspections of the Shield Building coatings at least once every five years.

The Shield Building Monitoring Program requires that personnel performing inspections of coatings are to be qualified as described in Chapter 7 of ACI Report 349.3R, "Evaluation of Existing Nuclear Safety-Related Concrete Structures." The program acceptance criteria is that the coatings do not have flaking, delamination, peeling or other degraded surface conditions. Any such defects are to be entered into the FENOC Corrective Action Program for evaluation, trending and assignment of any needed corrective actions. In addition to the inspections that are to be performed at least once every five years, a preventive maintenance task (PM) has been established to reapply the coatings on a 15-year scheduling interval. The PM scheduling interval is based on the manufacturers' 15-year warranties for the coating systems.

Question RAI B.2.43-2

Background:

By letter dated April 5, 2012, the applicant responded to an RAI regarding cracking in the shield building. The RAI response summarized the degradation and the root cause, the impact on the current licensing basis, and the applicant's plans to monitor the degradation in the future and during the period of extended operation. The response stated that the degradation was the result of water ingress and freeze-thaw cycles due to a lack of waterproofing coating on the shield building concrete. To address this issue, the applicant plans to apply a coating to the shield building and to monitor the coating and the shield building cracking. The response provided a new plant-specific AMP, "Shield Building Monitoring Program," to monitor the shield building cracking.

Issue:

1. License renewal application (LRA) Commitment 40 states that the Shield Building Monitoring Program will be implemented prior to April 22, 2017. However, the RAI response states that 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 cycles, the inspection cycle may be changed to two-years.
2. The "detection of aging effects" program element in the Shield Building Monitoring Program states:

"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 program does not clearly explain how many times the two-year interval inspections must be repeated during the period of extended operation before the interval can be extended to five years. In addition, the program does not provide technical justification for extending the inspection interval to five years.

3. The “parameters monitored or inspected,” program element of the AMP states that concrete cracking will be monitored by examining the core bores and core bore samples, and change in crack condition by visual examination. The number and locations of the cores are not identified in the AMP. The RAI response states that a minimum of six existing core bores of each type (cracked and un-cracked) will be inspected during each inspection cycle. The minimum planned distribution of the inspections is three in the shoulder regions, one in a steam line penetration area, and two in the top region of the building outside of the shoulder regions. The RAI response does not provide a technical justification for the described sample size, or the adequacy of the distribution of the samples. Also, it is not clear to the staff how core bore samples removed from the concrete will identify the crack condition, and how the concrete at existing core drill locations will be protected from the environment. The RAI response and the AMP do not discuss why additional nondestructive examinations such as the impulse response (IR) method are not planned to be used to confirm and supplement the core drill inspection, as was the case during initial investigation.
4. The “parameters monitored or inspected,” program element of the AMP states that loss of material in rebar due to corrosion will be monitored by surface examination of rebar, when exposed. However, the current plans do not include core drills of sufficient depth to expose rebar in the Shield Building concrete.
5. The “monitoring and trending,” program element of the AMP states that inspection will be performed by qualified personnel as defined in plant procedures. The AMP further states that inspection findings will be evaluated by assigned engineering personnel. The applicant has not

identified qualification requirements for engineering personnel who will inspect and evaluate core drills and cracks in the AMP.

6. The RAI response states that two new core bores will be taken every other inspection cycle for chloride and carbonation testing; however, no discussion is provided about the location of these samples and why the frequency and number of samples is adequate.
7. The “acceptance criteria,” program element of the AMP states that indications of relevant conditions of degradation detected will be evaluated and compared to pre-determined criteria. However, the applicant has not identified the criteria in the AMP.

Request:

1. Explain why the periodic monitoring of the Shield Building starting in 2012 is not included as a part of the plant-specific Shield Building Monitoring Program.
2. Identify in the Shield Building Monitoring AMP how long the two-year interval inspections will be conducted during the period of extended operation. Provide technical justification for changing to a five year interval after the given time period.
3. Provide a technical justification for the described sample size of the core bore hole inspections, as well as a justification for the adequacy of the distribution of the samples.

The response should also include the reasons for not using nondestructive methods to confirm the extent of cracking monitored by a limited number of core drill openings created during 2011. Also explain how the existing core drill openings will be protected from the environment during the period of extended operation

4. Explain how the rebar will be inspected for potential corrosion and loss of material during the period of extended operation.
5. Provide qualification requirements of the engineering personnel who will inspect and evaluate the core drills, openings, and cracks.
6. Provide a technical justification for the frequency and location of the samples for chloride and carbonation testing.
7. Describe in detail the acceptance criteria that will be used to evaluate indications of relevant conditions of degradation of Shield Building concrete and rebar.

RESPONSE RAI B.2.43-2 (The “Requests” have been repeated below for convenience)

1. **Explain why the periodic monitoring of the Shield Building starting in 2012 is not included as a part of the plant-specific Shield Building Monitoring Program.**

The results of ongoing periodic monitoring of the Shield Building provide baseline and operating experience information for the plant-specific Shield Building Monitoring Aging Management Program. Periodic monitoring started in 2012 under the jurisdiction of the current plant operating license as a corrective action. The license renewal plant-specific Shield Building Monitoring Program will be initiated in a planned and orderly fashion, utilizing the current monitoring information as site-specific operating experience input to the aging management program, in accordance with the Davis-Besse License Renewal Application Appendix A, “Updated Final Safety Analysis Supplement,” commitment date for license renewal future commitment 46.

LRA Sections A.1.43 and B.2.43, both titled “Shield Building Monitoring Program,” are revised to include additional details regarding issues raised in this RAI.

See the Enclosure to this letter for the revision to the Davis-Besse LRA.

2. **Identify in the Shield Building Monitoring AMP how long the two-year interval inspections will be conducted during the period of extended operation. Provide technical justification for changing to a five year interval after the given time period.**

A total of at least five inspections (including the original root cause inspection) are planned for completion before the five-year inspection interval can be instituted. During the period of extended operation, the two-year interval inspections are scheduled for 2017 and 2019. The interval between inspections is contingent on acceptable results from all previous inspections. Previous inspections defined by the Corrective Action Program for completion in 2011, 2012, 2013 and 2015 are to be evaluated as site-specific operating experience input to the Shield Building Monitoring Program.

Because the Shield Building is a structure, the Shield Building Monitoring Program is based on the NUREG-1801 recommendations for Structures Monitoring. NUREG-1801, Rev. 2 recommends that structures be inspected at a five-year interval. The five-year inspection interval is also in accordance with the guidance in ACI Report 349.3R, “Evaluation of Existing Nuclear Safety-Related Concrete Structures”. The existing schedule for the inspection interval is based on achieving acceptable inspection results during each of the previous baseline inspection intervals conducted as scheduled by the Corrective Action Program. Acceptable inspection results will confirm the laminar cracking was an event-driven

degradation, not influenced by any aging mechanism. That is to say that the interval will extend to five years provided no observed changes are noted during the two-year inspection intervals. This series of inspections will confirm the event-driven Root Cause basis (versus an aging mechanism) and will become the site specific operating experience used to justify an extension to a five-year inspection interval. These actions taken based on the root cause evaluation and the increased frequency of inspections from 2012 through 2019 are consistent with the ACI Report 349.3R Chapter 5, Section 5.3 and Chapter 6 guidance for monitoring of a structural condition that has been discovered, evaluated and analyzed. Performance Improvement International (PII) in their Root Cause Assessment, recommended that confirmation monitoring should be performed at a few selected locations on a periodic basis, such as once per refueling outage. PII further recommended that if the cracks have not propagated after three repetitions of monitoring interval, then further monitoring may be suspended. The PII recommendation is similar to guidance provided in Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Section XI Code), Article IWE-2000, Examination and Inspection. IWE-2420, Successive Inspection, states that when reexaminations reveal that flaws, areas of degradation, or repairs remain essentially unchanged for three consecutive inspection periods, then the areas containing such flaws, degradation or repairs no longer require augmented examination.

The confirmatory monitoring described in the Shield Building Monitoring Program is more conservative than the examination periodicity identified in the ASME Section XI Code.

3. **Provide a technical justification for the described sample size of the core bore hole inspections, as well as a justification for the adequacy of the distribution of the samples.**

The response should also include the reasons for not using nondestructive methods to confirm the extent of cracking monitored by a limited number of core drill openings created during 2011. Also explain how the existing core drill openings will be protected from the environment during the period of extended operation

The technical justification for the sample size is based on monitoring known crack locations and adjacent areas of sound concrete. Impulse-Response (IR) testing results from more than 60,000 points for the Shield Building have shown that the South-East, South, and South-West sides of the Shield Building were most susceptible to cracking and therefore these areas are concentrated in the sample distribution. The sample distribution between the flute shoulders, wall cylinder and main steam line areas was based on a relative representation of cracked areas at these locations. The sample size for the AMP was based on review of a reasonable scope to ensure that any laminar cracking changes are identified.

These core bore locations are inspected using a borescope and a crack comparator to visually inspect the structure for the existence of a crack, or a discernable change in a previously identified crack. As samples may be fractured as part of the drilling operation, removed samples are not the determining factor in the identification of a crack. Crack condition is generally characterized by the core bore internal inspection.

The internal inspection of core bores is the definitive method for identifying new cracks or growth of existing cracks. IR testing technology is a non-destructive test method that has not been qualified by an industry organization that establishes test method standards. IR testing was used only as a general indicator of crack locations. Core bore inspections are the validated method for condition monitoring.

The remainder of the accessible portions of the Shield Building Wall was examined in the summer of 2012. The examination was completed with the previously used method of IR testing and confirmatory visual inspections of seventeen new core bores. More than 60,000 points have been examined by IR testing. The results of the 2012 testing and inspection have now documented the total scope of the as-found crack conditions. The pattern of as-found cracks identified in 2012 closely match the pattern of cracking found in the 2011 testing and inspections. Therefore, the number and distribution of the planned confirmatory core bore inspections will continue to provide reasonable assurance that the observed laminar cracking is not an aging effect.

Upon removal of a core from the Shield Building the core bore is protected from the environment with a pipe plug. This offers adequate protection from wildlife and environmental influences during frequent inspection intervals.

4. Explain how the rebar will be inspected for potential corrosion and loss of material during the period of extended operation.

Inspection of rebar will be opportunistic. If rebar is exposed during any of the other Shield Building Monitoring Program inspections or during any Structures Monitoring Program inspections, the program requires that it is visually inspected for loose, flaky rust, or reinforcement section loss. Given the inherent variability of reinforcement cross section, and the encompassing concrete, no measurement technique is employed.

5. Provide qualification requirements of the engineering personnel who will inspect and evaluate the core drills, openings, and cracks.

During the period of extended operation, the Shield Building Monitoring Program requires that inspections, and evaluations of core drills, openings and cracks are to be conducted by personnel with qualifications that are commensurate with ACI

Report 349.3R, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," Chapter 7, "Qualifications of Evaluation Team."

6. Provide a technical justification for the frequency and location of the samples for chloride and carbonation testing.

For the purposes of the material assessment, samples were tested for carbonation and chloride during the Condition Assessment and Root Cause Analysis of the Shield Building Laminar Cracking. Carbonation of concrete is an expected slow change in concrete properties that is addressed by the design of concrete structures. Chloride content is a concrete parameter that is measured during initial construction as described in ACI 318-83, "Building Code Requirements for Reinforced Concrete," and later revisions.

The Shield Building Laminar Cracking Root Cause Assessment documents that the average exterior depth of carbonation over 17 samples was 9 millimeters . This value is negligible considering the life of the structure and the anticipated rate of progression of carbonation during the period of extended operation.

The Shield Building Laminar Cracking Root Cause Assessment documents that the maximum water soluble chloride content was 370 parts per million (0.037%). The ACI 318-83 limit for water-soluble chloride content criteria for reinforced concrete exposed to chloride in service is 0.15% by weight (ACI 318-83, Table 4.5.4).

The results document the properties of the concrete after approximately 40 years of exposure to the local environment. The results indicate that carbonation and chloride conditions are well within the acceptable range given the age of the structure. Therefore, carbonation testing and chloride content sampling is not included in the Shield Building Monitoring Program.

7. Describe in detail the acceptance criteria that will be used to evaluate indications of relevant conditions of degradation of Shield Building concrete and rebar.

The Shield Building Monitoring Program requires inspections of core bores with and without cracks. The program acceptance criteria for the examination of core bores without a crack is to confirm the absence of a crack. Any indication of cracking in a previously uncracked core bore requires the generation of a Condition Report to initiate the investigation process. The program acceptance criteria for the examination of core bores with a previously identified crack is "no discernable change" as a result of visual examination for general appearance and with crack comparator measurement. Any discernable change requires the generation of a Condition Report to initiate the investigation process.

The program acceptance criteria for rebar degradation is evidence of corrosion indicated by loose, flaky rust, or rebar section loss as a result of visual examination. The identification of such evidence of corrosion requires the generation of a Condition Report to initiate the investigation process. Given the inherent variability of rebar cross sections, and the encompassing concrete, no measurement technique is employed.

Any other observed conditions are to be evaluated as described in Chapter 5 of ACI Report 349.3R.

Question RAI B.2.43-3

Background:

By letter dated April 5, 2012, the applicant responded to an RAI regarding cracking in the shield building. The RAI response summarized the degradation and the root cause, the impact on the current licensing basis, and the applicant's plans to monitor the degradation in the future and during the period of extended operation. The response stated that the degradation was the result of water ingress and freeze-thaw cycles during a blizzard due to a lack of waterproofing coating on the shield building concrete. To address this issue, the applicant plans to apply a coating to the shield building and to monitor the coating and the shield building cracking. The response provided a new plant-specific AMP, "Shield Building Monitoring Program," to monitor the protective coating during the period of extended operation.

Issue:

1. The root cause was tied to a blizzard that affected structures throughout the site; however, the response did not clearly explain why similar degradation did not occur in other structures throughout the site.
2. The response provides an AMP to address aging of a new waterproof coating for the Shield Building, but does not discuss the necessity of a coating for other structures, or how other coatings would be managed for aging during the period of extended operation.

Request:

1. Explain how it was concluded that this degradation mechanism has not affected any other structures throughout the site.

2. **Explain how this degradation mechanism will be prevented during the period of extended operation for all structures within the scope of license renewal. If a waterproof coating will be relied upon, explain how the coating will be managed for aging. An adequate response should address the requests identified in RAI B.2.43-1, included in this RAI letter.**

RESPONSE RAI B.2.43-3

1. The degradation mechanism was event-driven laminar cracking inside the Shield Building wall that did not involve any aging mechanism. There were four conditions required to cause the laminar cracks inside the Shield Building wall. The four conditions were significant moisture intrusion, low temperatures, the Shield Building flute shoulder configuration and an unsealed concrete surface. The root cause (no sealant or coating on the Shield Building concrete wall surface) was only one of the four required conditions. The Shield Building is the only plant structure that is within the scope of license renewal that has all four of the conditions required to support the formation of the event-driven laminar cracks. Therefore, other in-scope structures have not been affected by the event-driven degradation mechanism. This was confirmed by evaluation of inspection results for other in-scope structures. The evaluation included a review of historical inspection results and of recent core bores from an Auxiliary Building wall that were examined in July, 2012. Also, in July, 2012, Impulse Response testing of the same Auxiliary Building wall showed no indications of laminar cracking.
2. The Shield Building Wall degradation mechanism was a result of event-driven sub-surface laminar cracking, and required four conditions for the cracking to occur (i.e., significant moisture intrusion, low temperatures, the Shield Building flute shoulder configuration and an unsealed concrete surface). The design features of all other concrete structures within the scope of license renewal prevent the occurrence of similar cracking. Although some other in-scope structures do have exterior coatings, the coating is not relied upon to prevent sub-surface laminar cracking. However, the Structures Monitoring Program applied to the other in-scope structures includes an enhancement to perform visual inspection of the coatings in accordance with American Concrete Institute Report ACI 349.3R, as described in the existing license renewal future commitment 20 (reference ML11151A090).

Enclosure A

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

Letter L-12-284

Amendment No. 31 to the Davis-Besse License Renewal Application

Page 1 of 12

License Renewal Application Sections Affected

Table 3.5.2-1

Table 3.5.2 Plant-Specific Notes

Section A.1.43

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*.

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
Table 3.5.2-1	Page 3.5-72	Rows 72 - 75, "Aging Management Program" and "Notes" columns

In response to request for additional information (RAI) B.2.43-1, the "Aging Management Program" and "Notes" columns for four 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
72	Shield Building Emergency Air Lock Enclosure	EN, MB, SSR	Concrete	Air-outdoor	Loss of Material	Structures Monitoring 10 CFR Part 50, Appendix J <u>Shield Building Monitoring</u>	III.A1-9	3.5.1-23	A 0511 <u>0552</u>
73	Shield Building Emergency Air Lock Enclosure	EN, MB, SSR	Concrete	Air-outdoor	Loss of Material Change in material properties	Structures Monitoring 10 CFR Part 50, Appendix J <u>Shield Building Monitoring</u>	III.A1-10	3.5.1-24	A 0511 <u>0552</u>

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
74	Shield Building Emergency Air Lock Enclosure	EN, MB, SSR	Concrete	Air-outdoor	Loss of Material Cracking	Structures Monitoring 10 CFR Part 50, Appendix J <u>Shield Building Monitoring</u>	III.A1-6	3.5.1-26	A 0511 <u>0552</u>
75	Shield Building Emergency Air Lock Enclosure	EN, MB, SSR	Concrete	Air-outdoor	Change in material properties	Structures Monitoring 10 CFR Part 50, Appendix J <u>Shield Building Monitoring</u>	III.A1-7	3.5.1-32	A 0509 0511 <u>0552</u>

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
Table 3.5.2 Plant-Specific Notes	Page 3.5-172	Note 0552

In response to RAI B.2.43-1, Note 0552 of LRA Table 3.5.2 Plant-Specific Notes is revised to read 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 <u>and the Shield Building Emergency Air Lock Enclosure walls</u> , in addition to the Structures Monitoring Program, the plant-specific Shield Building Monitoring Program will be used to manage only the coatings or sealant applied to the dome <u>and the Shield Building Emergency Air Lock Enclosure walls</u> .

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
A.1.43	Page A-25	Entire Section

In response to RAIs B.2.43-1 and 2, LRA Section A.1.43, "Shield Building Monitoring Program," previously added by FENOC letter dated April 5, 2012 (ML12097A520), is replaced in its entirety to read as follows:

A.1.43 Shield Building Monitoring Program

The Shield Building Monitoring Program is a prevention and condition-monitoring program for Davis-Besse. The program consists of inspections of the Shield Building Wall concrete and reinforcing steel (rebar). The inspections 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 monitors for corrosion of the concrete rebar. As a preventive action of this program, the Shield Building Wall, Shield Building Dome and Shield Building Emergency Air Lock Enclosure wall exterior concrete coatings are inspected for evidence of loss of effectiveness.

Visual inspections are performed on rebar (when exposed), coatings, core bore and core bore sample surfaces in accordance with an implementing procedure by inspectors qualified as described in Chapter 7 of American Concrete Institute (ACI) Report ACI 349.3R.

The Shield Building Monitoring Program includes periodic scheduled inspections 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.

As a preventive action of this program, the Shield Building Wall, Shield Building Dome and Shield Building Emergency Air Lock Enclosure wall exterior concrete coatings are inspected for evidence of loss of effectiveness.

Implementation of this program ensures that the intended functions of the Shield Building and Shield Building Emergency Air Lock Enclosure are maintained during the period of extended operation.

<u>Affected LRA Section</u>	<u>LRA Page No.</u>	<u>Affected Paragraph and Sentence</u>
B.2.43	Page B-166	Entire Section

In response to RAIs B.2.43-1 and 2, LRA Section B.2.43, "Shield Building Monitoring Program," previously added by FENOC letter dated April 5, 2012 (ML12097A520), is replaced in its entirety to read 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 of the Shield Building concrete and reinforcing steel (rebar). The inspections, 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 Wall, Shield Building Dome and Shield Building Emergency Air Lock Enclosure wall exterior concrete coatings will be inspected for evidence of loss of effectiveness.

Visual inspections will be performed on rebar (when exposed), core bore and core bore sample (concrete core) surfaces in accordance with an implementing procedure by inspectors qualified as described in Chapter 7 of American Concrete Institute (ACI) Report ACI 349.3R.

The Shield Building Monitoring Program will include periodic scheduled inspections 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 and Shield Building Emergency Air Lock Enclosure 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 Wall reinforced concrete and rebar, and the exterior concrete coatings on the Shield Building Wall, the Shield Building Dome and the Shield Building Emergency Air Lock Enclosure walls.

The program will include periodic inspections 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 or the Shield Building Emergency Air Lock Enclosure during the period of extended operation.

- **Preventive Actions**

As part of the Shield Building Monitoring Program, the coatings on the exterior concrete Shield Building Wall, Shield Building Dome and Shield Building Emergency Air Lock Enclosure walls will be inspected to verify continuing effectiveness during the period of extended operation. The inspections will be conducted in accordance with the implementing procedure by inspectors qualified as described in Chapter 7 of ACI Report 349.3R.

- **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, the Shield Building Wall, Shield Building Dome and Shield Building Emergency Air Lock Enclosure walls exterior concrete coatings will be inspected for loss of effectiveness in accordance with the

implementing procedure by inspectors qualified as described in Chapter 7 of ACI Report 349.3R.

The parameters to be inspected will include visual evidence of surface degradation, such as cracking, change in material properties, loss of material and corrosion. Observed conditions 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.

<u>Parameters Monitored or Inspected and Potential Aging Effects</u>			
<u>Potential Aging Effect</u>	<u>Potential Aging Mechanisms</u>	<u>Parameters Monitored</u>	<u>Inspection and Testing Method(s)</u>
<u>Cracking (Concrete)</u>	<u>Freezing of water that has permeated the concrete</u>	<u>Surface condition of core bores and core bore samples, and change in crack conditions</u>	<u>Visual</u>
<u>Change of Material Properties</u>	<u>Leaching of calcium hydroxide from concrete</u>	<u>Surface condition of core bores and core bore samples</u>	<u>Visual</u>
<u>Loss of Material (Concrete)</u>	<u>Freezing of water that has permeated the concrete</u>	<u>Surface condition of core bores and core bore samples</u>	<u>Visual</u>
<u>Loss of Material (Rebar)</u>	<u>Corrosion</u>	<u>Surface condition of rebar, when exposed</u>	<u>Visual</u>
<u>Loss of Coating Effectiveness</u>	<u>Loss of ability to perform its protective action</u>	<u>Condition of the coatings</u>	<u>Visual</u>

- **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 report, "Concrete Crack within Shield Building Temporary Access Opening", will provide a baseline for future Shield Building Monitoring Program activities.

Periodic visual inspections will be performed in accordance with an implementing procedure by inspectors qualified as described in Chapter 7 of ACI Report 349.3R.

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. The first inspection conducted during the period of extended operation is scheduled for 2017 and the next inspection is scheduled for 2019. 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. 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 exterior concrete coatings of the Shield Building Wall, Shield Building Dome, and Shield Building Emergency Air Lock walls, will be inspected at least once every five years in accordance with the implementing procedure. The coatings inspectors will be qualified as described in Chapter 7 of ACI Report 349.3R, "Evaluation of Existing Nuclear Safety-Related Concrete Structures." The frequency of the coatings inspections may be adjusted based on observed coating conditions, any required reapplication of a coating, or on the recommendations of a coating manufacturer.

- Monitoring and Trending

The Shield Building Monitoring Program will include a baseline inspection, followed by periodic inspections. Visual inspections will be performed in accordance with the implementing procedure by personnel qualified as described in Chapter 7 of ACI Report 349.3R. Inspection 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 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 that do not meet the acceptance criteria.

For core bore inspections, unacceptable inspection findings will include any indication of new cracking or a "discernable change" in previously identified cracks. Any indication of new cracking is defined as a visual inspection finding that visible cracks have developed in core bores that previously had no visible cracks. A discernable change in a previously identified crack is defined as a visual inspection finding that there has been a discernable change in general appearance or in crack width as identified by crack comparator measurement.

The acceptance criteria for any identified loss of material or change of material properties will be as described in Chapter 5 of ACI Report 349.3R.

The acceptance criteria for rebar corrosion found during visual inspections will be that there is no evidence of corrosion indicated by loose, flaky rust or reinforcement section loss. Given the inherent variability of reinforcement cross section, and the encompassing concrete, no measurement technique is employed.

The acceptance criteria for Shield Building Wall, Shield Building Dome and Shield Building Emergency Air Lock Enclosure wall coatings will be based on the ability of the coatings to continue to be effective. The acceptance criteria will be that the coatings do not have flaking, delamination, peeling or other degraded surface conditions.

- 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 maintenance rule structural inspections which are 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 coatings, which will be applied in 2012.

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 post-tensioned containment structure 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 existing long-term corrective actions for Shield Building laminar cracking include inspections of the Shield Building concrete, rebar and coatings. The results of those activities may provide operating experience relevant to the Shield Building Monitoring Program.

The elements that comprise the Shield Building Monitoring Program inspections 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 Shield Building intended functions will be maintained consistent with the current licensing basis during the period of extended operation.