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)	)	August 17, 2012

FENOC'S ANSWER OPPOSING INTERVENORS' THIRD AND FOURTH MOTIONS TO AMEND AND/OR SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)

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I. INTRODUCTION

On January 10, 2012, Beyond Nuclear, Citizens Environment Alliance of Southwestern Ontario, Don't Waste Michigan, and the Green Party of Ohio ("Intervenors") moved for the Atomic Safety and Licensing Board ("Board") to admit proposed Contention 5 ("Original Contention") regarding Shield Building laminar cracking.[1] Intervenors have requested to amend and/or supplement the Original Contention five times now—on February 27, 2012,[2] June 4, 2012,[3] July 16, 2012,[4] July 23, 2012,[5] and most recently on August 16, 2012.[6] FirstEnergy Nuclear Operating Company ("FENOC") has filed Answers opposing the Original Contention,

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1 Motion for Admission of Contention No. 5 on Shield Building Cracking (Jan. 10, 2012).

2 Intervenors' Motion to Amend 'Motion for Admission of Contention No. 5' (Feb. 27, 2012) ("First Supplement").

3 Intervenors' Motion to Amend and Supplement Proposed Contention No. 5 (Shield Building Cracking) (June 4, 2012) ("Second Supplement").

4 Intervenors' Third Motion to Amend and/or Supplement Proposed Contention No. 5 (Shield Building Cracking) (July 16, 2012) ("Third Supplement").

5 Intervenors' Fourth Motion to Amend and/or Supplement Proposed Contention No. 5 (Shield Building Cracking) (July 23, 2012) ("Fourth Supplement").

6 Intervenors' Fifth Motion to Amend and/or Supplement Proposed Contention No. 5 (Shield Building Cracking) (Aug. 16, 2012) ("Fifth Supplement").

the February 27, 2012 First Supplement, and the June 4, 2012 Second Supplement.[7] Pursuant to 10 C.F.R. § 2.309(h)(1) and the Board's June 15, 2011 Initial Scheduling Order ("ISO"), FENOC files this timely Answer in opposition to the Third and Fourth Supplements, dated July 16, 2012 and July 23, 2012, respectively (collectively, "Supplements").[8]

In these Supplements, Intervenors proffer 38 arguments, none of which does anything more than repeat and comment on Nuclear Regulatory Commission ("NRC") Staff questions or observations about FENOC's evaluation of the Shield Building laminar cracking. As such, the Supplements fail to satisfy the standards governing admissibility of contentions. The Supplements should be rejected by the Board, as summarized below, for several reasons:

- First, parts of the Supplements are untimely under 10 C.F.R. § 2.309(f)(2). Contrary to the ISO, Intervenors filed them more than 60 days after the public availability of the information upon which they are based, or the information itself is not materially different than that previously available to Intervenors. Intervenors have yet again failed to even plead, much less demonstrate, good cause under 10 C.F.R. § 2.309(c)(1) justifying the late filing of these arguments, despite the plain language of the ISO.[9] Moreover, Intervenors already raised, or could have raised, some of the arguments in the Second Supplement.

- Second, the Supplements fail to proffer an admissible contention, because they raise some issues that are outside the scope of this license renewal proceeding, contrary to 10 C.F.R. § 2.309(f)(1)(iii).

- Third, the Supplements fail to proffer an admissible contention, because they are utterly devoid of supporting law or fact, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors have not brought expert support to bear on this highly-technical subject. Nor do they reference any documents or other information in support of their arguments, except for those developed by FENOC, its contractors, or the NRC Staff—none of which support Intervenors' claims. Boiled down to their essence, the Supplements are nothing more

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7 *See* FENOC's Answer Opposing Intervenors' Motion for Admission of Contention No. 5 on Shield Building Cracking (Feb. 6, 2012) ("FENOC's Original Contention Answer"); FENOC's Answer Opposing Intervenors' Motion to Amend Proposed Contention 5 on Shield Building Cracking (Mar. 8, 2012) ("FENOC's Answer to First Supplement"); FENOC's Answer Opposing Intervenors' Motion to Amend and Supplement Proposed Contention No. 5 (Shield Building Cracking) (June 29, 2012) ("FENOC's Answer to Second Supplement").

8 Under 10 C.F.R. § 2.309(h)(1), an applicant may file an answer to a proffered contention within 25 days of the service of the contention. The ISO in this proceeding reiterates that FENOC may file an answer to a motion for leave to file a new contention and a proposed contention within 25 days after service of those pleadings. Initial Scheduling Order, at 13 (June 15, 2011) ("ISO") (unpublished).

9 ISO at 12.

than speculative, non-expert, arguments of counsel opining on revisions to the Root Cause Evaluation or to the contractor report supporting the Root Cause Evaluation.

- Finally, the Supplements fail to proffer an admissible contention, because Intervenors have, yet again, failed to challenge the Davis-Besse License Renewal Application ("LRA"), including the new Shield Building Aging Management Program ("AMP"), contrary to 10 C.F.R. § 2.309(f)(1)(vi). This glaring omission has been repeatedly noted in FENOC's and the NRC Staff's Answers to the First and Second Supplements.[10] Rather than challenge the LRA itself, Intervenors attempt to fly speck the evaluations of the Shield Building laminar cracking without ever identifying the requisite nexus between their commentary and any purported deficiency in the Shield Building AMP. Although Intervenors make passing reference to the Shield Building AMP in a few places, nowhere do they challenge its adequacy with the requisite bases or specificity. This failure to challenge the very means by which FENOC addresses the Shield Building laminar cracking for purposes of license renewal renders the Supplements fatally defective.

For these reasons, the Supplements fail not only to cure the deficiencies in the Original Contention, which remains mooted by the Shield Building AMP, but are defective themselves and should be rejected in their entirety.

II. BACKGROUND

A. Procedural Background

Davis-Besse is located in Ohio, and generates 908 MWe of baseload electrical power.[11] The current operating license for Davis-Besse runs through April 22, 2017.[12] On August 27, 2010, FENOC submitted its LRA,[13] requesting that the NRC renew the Davis-Besse operating license for an additional 20 years (*i.e.*, until April 22, 2037).[14] The NRC accepted the timely

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[10] *See* FENOC's Answer to First Supplement at 8-9; FENOC's Answer to Second Supplement at 2, 25-26, 28-30, 32-33, 35, 37-38; NRC Staff's Answer to Motion to Amend and Supplement Proposed Contention No. 5 (Shield Building Cracking), at 22-23 (June 29, 2012) ("Staff's Answer to Second Supplement").

[11] Applicant's Environmental Report, Operating License Renewal Stage, Davis-Besse Nuclear Power Station, at 3.1-1, 7.2-1 (Aug. 2010) ("ER"), *available at* ADAMS Accession No. ML102450568.

[12] *Id.* at 1.1-1, *available at* ADAMS Accession No. ML102450563.

[13] Notice of Acceptance for Docketing of the Application, Notice of Opportunity for Hearing for Facility Operating License No. NPF-003 for an Additional 20-Year Period; FirstEnergy Nuclear Operating Company, Davis-Besse Nuclear Power Station, Unit 1, 75 Fed. Reg. 65,528, 65,529 (Oct. 25, 2010) ("Hearing Notice"). The LRA is available at ADAMS Accession No. ML102450572.

[14] ER at 1.1-1.

LRA as sufficient for docketing, and published a Hearing Notice in the *Federal Register* on October 25, 2010.[15]

On December 27 and 28, 2010, Intervenors filed a Request for Public Hearing and Petition for Leave to Intervene. In LBP-11-13, dated April 26, 2011, the Board admitted Intervenors as parties to the proceeding and admitted two contentions regarding alternative energy sources and Severe Accident Mitigation Alternatives ("SAMAs").[16] FENOC appealed that ruling to the Commission.[17]

Subsequently, on April 14, 2011, Intervenors submitted a request to suspend the proceeding based on publication of the Fukushima Task Force Report.[18] This request was rejected by the Commission on September 9, 2011.[19] On August 11 and 12, 2011, Intervenors submitted a motion and a proposed contention also related to the Fukushima Task Force Report.[20] The Board rejected that proposed contention on November 23, 2011.[21]

In CLI-12-08, dated March 27, 2012, the Commission ruled on FENOC's appeal.[22] The Commission rejected the admitted contention regarding alternative energy sources and two of

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15 *See* Hearing Notice, 75 Fed. Reg. at 65,528-529.

16 *See FirstEnergy Nuclear Operating Co.* (Davis-Besse Nuclear Power Station, Unit 1), LBP-11-13, 73 NRC __, slip op. at 64-65 (Apr. 26, 2011).

17 FirstEnergy's Brief in Support of the Appeal of LBP-11-13 (May 6, 2011).

18 Emergency Petition to Suspend All Pending Reactor Licensing Decisions and Related Rulemaking Decisions Pending Investigation of Lessons Learned from Fukushima Daiichi Nuclear Power Station Accident (dated Apr. 14-18, 2011, served Apr. 14, 2011); Amendment and Errata to Emergency Petition to Suspend All Pending Reactor Licensing Decisions and Related Rulemaking Decisions Pending Investigation of Lessons Learned from Fukushima Daiichi Nuclear Power Station Accident (Apr. 21, 2011); Letter from T. Lodge, Counsel for Intervenors, to the NRC (dated Mar. 21, 2011, served Apr. 21, 2011).

19 *See Union Elec. Co.* (Callaway Plant, Unit 2), CLI-11-05, 74 NRC __, slip op. at 3, 41-42 (Sept. 9, 2011).

20 Motion to Admit New Contention Regarding the Safety and Environmental Implications of the Nuclear Regulatory Commission Task Force Report on the Fukushima Dai-ichi Accident (Aug. 11, 2011); Contention in Support of Motion to Admit New Contention Regarding the Safety and Environmental Implications of the Nuclear Regulatory Commission Task Force Report on the Fukushima Dai-ichi Accident (Aug. 12, 2011).

21 *FirstEnergy Nuclear Operating Co.* (Davis-Besse Nuclear Power Station, Unit 1), LBP-11-34, 74 NRC __, slip op. at 2, 18 (Nov. 23, 2011).

22 *FirstEnergy Nuclear Operating Co.* (Davis-Besse Nuclear Power Station, Unit 1), CLI-12-08, 75 NRC __, slip op. at 1-2 (Mar. 27, 2012).

three parts of the admitted SAMA contention.[23] The only part of the SAMA contention that remains in this proceeding relates to the MAAP code.[24] On July 26, 2012, FENOC submitted a motion for summary disposition of the remaining part of the SAMA contention.[25]

Intervenors also submitted a petition for suspension of final licensing decisions[26] and a proposed contention[27] in response to the D.C. Circuit's decision remanding certain waste confidence issues. In CLI-12-16, dated August 7, 2012, the Commission granted the petition in part, and will not issue licenses dependent on the remand until the remand is appropriately addressed.[28] The Commission also directed the Board to hold the proposed contention in abeyance pending its further order.[29] Accordingly, on August 8, 2012, the Board ordered that any further replies for the proposed contention be suspended.[30]

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23 *Id.* at 5-34.

24 *Id.* at 20-21.

25 FirstEnergy's Motion for Summary Disposition of Contention 4 (SAMA Analysis Source Terms) (July 26, 2012).

26 *See* Petition to Suspend Final Decisions in All Pending Reactor Licensing Proceedings Pending Completion of Remanded Waste Confidence Proceedings (June 18, 2012); FENOC Answer Opposing Petition to Suspend Final Licensing Decisions Pending Completion of Remanded Waste Confidence Proceedings (June 25, 2012); NRC Staff's Answer to Petition to Suspend Final Decisions in All Pending Reactor Licensing Proceedings Pending Completion of Remanded Waste Confidence Proceedings (June 25, 2012).

27 Intervenors' Motion for Leave to File a New Contention Concerning Temporary Storage and Ultimate Disposal of Nuclear Waste at Davis-Besse Nuclear Power Station (July 9, 2012); FENOC's Answer Opposing New Contention Concerning Temporary Storage and Ultimate Disposal of Nuclear Waste at Davis-Besse Nuclear Power Station (Aug. 3, 2012); NRC Staff's Answer to Intervenors' Motion for Leave to File a New Contention Concerning Temporary Storage and Ultimate Disposal of Nuclear Waste at Davis-Besse Nuclear Power Station (Aug. 2, 2012).

28 *Calvert Cliffs Nuclear Project, LLC* (Calvert Cliffs Nuclear Power Plant, Unit 3), CLI-12-16, 76 NRC __, slip op. at 4 (Aug. 7, 2012).

29 *Id.* at 6.

30 Order (Suspending Procedural Date Related to Proposed Waste Confidence Contention), at 2 (Aug. 8, 2012) (unpublished).

B. Davis-Besse Shield Building Laminar Cracking

On October 1, 2011, Davis-Besse shut down for a scheduled outage to complete maintenance activities.[31] During hydro-demolition activities on October 10, 2011, workers identified indications of laminar cracking below the exterior surface of the Shield Building.[32]

As stated in the LRA:

> The Shield Building is a concrete structure surrounding the Containment Vessel. It is designed to provide biological shielding during normal operation and from hypothetical accident conditions. The building provides a means for collection and filtration of fission product leakage from the Containment Vessel following a hypothetical accident through the Emergency Ventilation System, an engineered safety feature designed for that purpose. In addition, the building provides environmental protection for the Containment Vessel from adverse atmospheric conditions and external missiles.[33]

Upon the initial identification of the cracking, FENOC promptly notified the NRC Resident Inspector, placed the issue into the Corrective Action Program, and mobilized a team of experts to investigate,[34] including extensive visual inspections, Impulse Response testing, and concrete sampling of the building's walls in addition to its architectural elements.[35] FENOC's assessments demonstrated that the Shield Building is structurally sound, meets all applicable

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31 Additional details on the background of the Shield Building laminar cracking are provided in FENOC's February 6, 2012 Answer opposing the Original Contention. *See* FENOC's Original Contention Answer at 4-7.

32 *See* Letter from R. Seeholzer, FirstEnergy, to the Investment Community, at 1 (Oct. 31, 2011) ("Investment Community Letter") (provided as Attachment 1 to FENOC's Original Contention Answer); *see also* FENOC Presentation Slides, NRC Public Meeting, at 19 (Jan. 5, 2012) ("January FENOC Slides") (provided as Attachment 2 to FENOC's Original Contention Answer).

33 License Renewal Application, Davis-Besse Nuclear Power Station, at 2.4-3 (Aug. 2010), *available at* ADAMS Accession No. ML102450572. The Shield Building is a reinforced concrete structure with 2 1/2-foot thick walls that surrounds the 1 1/2-inch carbon steel containment vessel. Investment Community Letter at 1; January FENOC Slides at 15. There is a 4 1/2-foot annulus (*i.e.*, air space) between the Shield Building walls and the containment vessel. Investment Community Letter at 1; January FENOC Slides at 15. The outer surface of the Shield Building includes "flute shoulders," which are non-structural, architectural elements on the façade of the Shield Building. *See* January FENOC Slides at 16-17; *see also* Investment Community Letter at 1.

34 January FENOC Slides at 20.

35 *See id.* at 22-29.

strength requirements, and is capable of performing its safety functions.[36] The cracking is tight and located outside of the outer reinforcing rebar mat, generally in the flute shoulder regions, top 20 feet of the Shield Building wall, and in small regions adjacent to the Main Steam Line penetrations.[37]

On December 2, 2011, the NRC Staff issued a Confirmatory Action Letter that documented FENOC's commitments to provide its Root Cause Evaluation to the NRC and to perform future examinations of the cracking.[38] Following issuance of the Confirmatory Action Letter, Davis-Besse restarted on December 5, 2011.

On January 10, 2012, Intervenors filed a motion for admission of the Original Contention challenging various purported environmental and aging management issues associated with newly-identified laminar cracking of the Davis-Besse Shield Building.[39] Intervenors claimed therein that "the cracking should be considered as an aging feature at Davis-Besse, which requires explicit plans for remediation and management."[40]

Both FENOC and the NRC Staff filed answers to the Original Contention on February 6, 2012.[41] FENOC's Original Contention Answer demonstrated that the Original Contention is untimely and does not satisfy the contention admissibility requirements of Section 2.309(f), and therefore should be rejected in its entirety.[42] The Staff's Original Contention Answer also concluded that much of the Original Contention is inadmissible, but did not object to admission

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36 *See id.* at 31-38.

37 *Id.* at 30; *see also* Investment Community Letter at 1-2.

38 Letter from NRC to FENOC, Confirmatory Action Letter – Davis-Besse Nuclear Power Station, at 1-3 (Dec. 2, 2011) (provided as Attachment 4 to FENOC's Original Contention Answer).

39 *See generally* Original Contention.

40 *Id.* at 2.

41 FENOC's Original Contention Answer; NRC Staff's Answer to Motion to Admit New Contention Regarding the Safety Implications of Newly Discovered Shield Building Cracking (Feb. 6, 2012) ("Staff's Original Contention Answer").

42 *See* FENOC's Original Contention Answer at 1-3.

of a limited portion of the Original Contention, stating: "To the extent Contention 5 identifies FENOC's failure to describe how the Structures AMP will account for the shield building cracks during the period of extended operation, Contention 5 is an admissible contention of omission."[43] Intervenors filed a Combined Reply on February 13, 2012.[44] The Parties subsequently filed pleadings related to FENOC's motion to strike portions of the Reply[45] and Intervenors' First Supplement, which was based on a February 8, 2012 press release and a January 31, 2012 NRC Staff Inspection Report.[46]

In the interim, on February 29, 2012, FENOC notified the Board and Parties to this proceeding that it had submitted the Root Cause Evaluation for Shield Building laminar cracking to the NRC on February 27, 2012.[47] The Root Cause Evaluation concludes that the direct cause of the laminar cracking "is the integrated affect of moisture content, wind speed, temperature, and duration from the blizzard of 1978," and the root cause was a "design specification for construction of the shield building (C-038) that did not specify application of an exterior sealant from moisture."[48] Of note, the Root Cause Evaluation concludes that "[t]here was no evidence of typical concrete time-dependent aging failure modes."[49] Stated more simply, the Root Cause Evaluation conclusively demonstrates that the laminar cracking phenomenon is *not* the result of

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43 Staff's Original Contention Answer at 1-2, 16.

44 Intervenors' Combined Reply in Support of Motion for Admission of Contention No. 5 (Feb. 13, 2012).

45 FENOC's Motion to Strike Portions of Intervenors' Reply for the Proposed Contention 5 on Shield Building Cracking (Feb. 23, 2012); Intervenors' Answer to FENOC 'Motion to Strike' (Feb. 27, 2012); NRC Staff's Answer to FENOC's Motion to Strike Portions of Intervenors' Reply for the Proposed Contention 5 on Shield Building Cracking (Mar. 5, 2012). This motion remains pending before the Board.

46 *See* First Supplement; FENOC's Answer to First Supplement; NRC Staff's Answer to Intervenors' Motion to Amend 'Motion for Admission of Contention No. 5' (Mar. 8, 2012). The First Supplement remains pending before the Board.

47 *See* Submittal of Shield Building Root Cause Evaluation (Feb 27, 2012) ("Root Cause Evaluation") (submitted as an enclosure to Letter from T. Matthews, FENOC Counsel, to Board, Notification of Filing Related to Proposed Shield Building Cracking Contention (Feb. 29, 2012)).

48 *Id.* at 59.

49 *Id.* at 6.

aging effects.[50] As discussed in the Root Cause Evaluation, Performance Improvement International ("PII") was the prime contractor for the Root Cause Evaluation and prepared a report ("PII Report") to support the Root Cause Evaluation.[51]

On April 5, 2012, FENOC notified the Board[52] of a letter it had submitted to the NRC to: (1) respond to RAI B.2.39-13, which the NRC Staff issued to FENOC on December 27, 2011, related to the Shield Building laminar cracking ("April RAI Response")[53]; and (2) revise the Davis-Besse LRA to include, among other things, a new AMP in LRA Section B.2.43, "Shield Building Monitoring Program" ("Shield Building AMP").[54]

The FENOC April RAI Response addresses four NRC Staff requests related to Shield Building laminar cracking, specifically to: (1) summarize the shield building degradation, the root cause, and the expected corrective actions; (2) explain how the cracking experience impacts the Shield Building's ability to perform its intended functions during the period of extended operation; (3) explain how the cracking experience will be incorporated into the existing Structures Monitoring AMP, and whether this existing AMP will be sufficient to manage aging of the Shield Building; and (4) identify any planned changes to the LRA based on the Shield Building laminar cracking.[55] Of note, the April RAI Response reiterates the Root Cause Evaluation's conclusion that "there are no direct aging effects associated with the identified

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50 *See id.* at 25 ("There was no evidence of typical concrete time-dependent aging failure modes such as chemical attack including reinforcing steel corrosion, physical attack, chronic freeze/thaw, and vibration /fatigue.").

51 *See id.* at 8, 40.

52 Letter from T. Matthews, FENOC Counsel, to the Board, Notification of Filing Related to Proposed Shield Building Cracking Contention (Apr. 5, 2012) ("Board Notification for April RAI Response").

53 *See* Letter from D. Imlay, FENOC, to NRC, 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, Attachment L-12-028 (Apr. 5, 2012) ("April RAI Response") (provided as an enclosure to the Board Notification for April RAI Response).

54 Amendment No. 25 to the DBNPS License Renewal Application, at 10-15 (Apr. 5, 2012) ("Shield Building AMP") (provided as an enclosure to the April RAI Response).

55 April RAI Response at 1-2.

laminar cracks."[56] Nonetheless, the April RAI Response explains that the Shield Building AMP "is provided to periodically inspect the structure to confirm that there are no changes in the nature of the identified laminar cracks."[57]

The Shield Building AMP is a plant-specific prevention and condition monitoring program for Davis-Besse that supplements the existing Structures Monitoring AMP, to "ensure that the intended functions of the Shield Building are maintained during the period of extended operation."[58] The Shield Building AMP consists of inspections of the Shield Building concrete and reinforcing steel to monitor the newly-identified laminar cracking, change of material properties, and loss of material.[59] The Shield Building AMP also requires inspection of the Shield Building exterior concrete coatings for evidence of loss of effectiveness.[60] The AMP concludes: "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."[61]

Based on the new Shield Building AMP, FENOC filed an unopposed motion to supplement its Original Contention Answer.[62] As explained in that motion, the new AMP moots both: (1) the Original Contention's challenges to whether FENOC specifically addressed aging management of the newly-identified Shield Building laminar cracking; and (2) the alternative

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56 *Id.* at 5.

57 *Id.*

58 Shield Building AMP at 10.

59 *Id.*

60 *Id.*

61 *Id.* at 15.

62 FENOC's Unopposed Motion for Leave to Supplement Its Answer to the Proposed Shield Building Cracking Contention (Apr. 16, 2012) ("FENOC Supplemental Answer").

contention of omission postulated by the NRC Staff.[63] The Board granted FENOC's motion to supplement FENOC's Original Contention Answer.[64]

On May 10, 2012, the NRC Staff notified the Board and Parties to this proceeding that it had issued an Inspection Report, dated May 7, 2012, that addressed inspection activities conducted subsequent to FENOC's identification of the Shield Building laminar cracks.[65] The NRC Staff did not identify any findings or violations of significance.[66]

Thereafter, on May 17, 2012, FENOC notified the Board and Parties to this proceeding that it had submitted Revision 1 of the Root Cause Evaluation to the NRC on May 16, 2012.[67] The Revised Root Cause Evaluation includes additional clarifying information in response to observations made during a recent NRC Staff inspection regarding the evaluation.[68] For example, the Revised Root Cause Evaluation provided additional background information regarding the lack of a protective sealant in the Shield Building design.[69] The revisions did not invalidate the methodology, assessment and analysis, or conclusions of the evaluation.[70] PII similarly revised the PII Report ("Revised PII Report") to address NRC Staff observations.[71]

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63 *Id.* at 6-9.

64 Order (Granting FENOC's Unopposed Motion for Leave to Supplement Its Answer) at 3 (Apr. 17, 2012) (unpublished). Neither Intervenors nor Staff responded to the motion to supplement.

65 Davis-Besse Nuclear Power Station Reactor Vessel Head Replacement and Shield Building Cracking Inspection Report 05000346/2012007 (DRS) (May 7, 2012) ("May 2012 NRC Inspection Report") (provided as enclosure to Letter from B. Harris, Staff Counsel, to Board (May 10, 2012)).

66 *Id.*, Enclosure, at 1.

67 *See* Letter from B. Allen, FENOC, to C. Pederson, NRC, Submittal of Revision 1 of Shield Building Root Cause Evaluation, Enclosure (May 16, 2012) ("Revised Root Cause Evaluation") (submitted as an enclosure to Letter from T. Matthews, FENOC Counsel, to Board, Notification of Filing Related to Proposed Shield Building Cracking Contention (May 17, 2012)).

68 *See* Revised Root Cause Evaluation at 5-7.

69 *See id.*

70 *See id.* at 5.

71 *See* Performance Improvement International, Root Cause Assessment, Davis-Besse Shield Building Laminar Cracking (Rev. 2.1, Apr. 20, 2012), *available at* ADAMS Accession No. ML12138A090. Due to its size (> 1000 pages and > 300 megabytes), FENOC has not attached the Revised PII Report, but instead has

Intervenors subsequently filed their Second Supplement on June 4, 2012.[72] FENOC and the NRC Staff filed their answers opposing the Second Supplement on June 29, 2012.[73] Of note, the Staff also agreed that FENOC's new Shield Building AMP mooted the Staff's alternative contention of omission set forth in the Staff's Original Contention Answer.[74] Intervenors then replied on July 6, 2012.[75]

On June 21, 2012, the NRC Staff issued another Inspection Report describing its review of FENOC's Root Cause Evaluation and the associated corrective actions.[76] A team of NRC inspectors conducted the review over the course of a 5-month period.[77] Regarding causes, the June 2012 NRC Inspection Report states that FENOC "established a sufficient basis for the causes of the shield building laminar cracking related to: the environmental factors associated with the 1978 blizzard, the lack of an exterior moisture barrier, and the structural design elements of the shield building."[78] Regarding corrective actions, the June 2012 NRC Inspection Report states: "Overall, the team concluded that your corrective and preventative actions for the causes of the shield building laminar cracking, if adequately implemented, would prevent

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provided the ADAMS Accession Number. If the Board would like FENOC to submit the Revised PII Report through the electronic filing system, FENOC would be happy to do so.

72 *See* Second Supplement.

73 *See* FENOC's Answer to Second Supplement; Staff's Answer to Second Supplement.

74 *See* Staff's Answer to Second Supplement at 21-22.

75 Intervenors' Combined Reply to FENOC and NRC Staff Opposition to 'Motion to Amend and Supplement Proposed Contention No. 5 (Shield Building Cracking)' (July 6, 2012). Intervenors generally reply that their arguments are within the scope of this proceeding and they have adequately challenged FENOC's aging management plans. *See id.* at 3-9. On July 9, 2012, the Board clerk e-mailed the Parties to inform them that the Board did not plan to hold oral argument on proposed Contention 5, and that it planned to issue a decision on the proposed contention within 45 days.

76 Inspection Report 05000346/2012009, Davis-Besse Nuclear Power Station – Inspection to Evaluate the Root Cause Evaluation and Corrective Actions for Cracking in the Reinforced Concrete Shield Building of the Containment System (June 21, 2012) ("June 2012 NRC Inspection Report"), *available at* ADAMS Accession No. ML12173A023 (provided as Attachment 1 to FENOC's Answer to Second Supplement).

77 *Id.*, Enclosure, at 1.

78 *Id.* at 1.

recurrence, and provide reasonable assurance for maintaining the shield building safety functions."[79]

Intervenors then filed their Third and Fourth Supplements on July 16, 2012 and July 23, 2012, respectively. This Answer responds to those Supplements.

After Intervenors filed the Supplements, two related events occurred. The NRC held a public meeting on August 9, 2012 near Davis-Besse to discuss the Shield Building laminar cracking with the public. The meeting included a presentation by FENOC with some updated information on the corrective actions from the Root Cause Evaluation.[80] Additionally, on August 16, 2012, FENOC responded to RAIs B.2.43-1, 2, and 3 regarding the Shield Building laminar cracking and license renewal.[81] As part of the RAI responses, FENOC revised the Shield Building AMP to make it consistent with the responses.[82]

III. LEGAL STANDARDS

As discussed below, and as required by the ISO, Intervenors must satisfy the requirements in: (1) 10 C.F.R. §§ 2.309(f)(2) and (c) governing timeliness of late-filed

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79 *Id.* at 2.

80 FENOC, Shield Building Crack Investigation and Root Cause Presentation, Davis-Besse Nuclear Power Station (Aug. 9, 2012) ("August FENOC Slides"), *available at* ADAMS Accession No. ML12221A268 (provided as FENOC Attachment 1).

81 *See* Letter from D. Imlay, FENOC, to NRC, 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) Attachment L-12-284 (Aug. 16, 2012) ("August RAI Response") (provided as FENOC Attachment 2).

82 *Id.*, Enclosure A, at 5-12 ("Revised Shield Building AMP").

contentions; and (2) 10 C.F.R. § 2.309(f)(1) to demonstrate contention admissibility.[83] Failure to satisfy any of these requirements compels the rejection of the Supplements.[84]

A. Timeliness

Pursuant to the Hearing Notice and 10 C.F.R. § 2.309(b)(3), the deadline for timely petitions to intervene in this proceeding expired on December 27, 2010, over a year and a half ago. Therefore, the Supplements must satisfy 10 C.F.R. § 2.309(f)(2) and 10 C.F.R. § 2.309(c), which govern nontimely requests and/or petitions and contentions.[85] Intervenors bear the burden of successfully addressing the "stringent" late-filing criteria.[86]

Under the Board's ISO,[87] a new or amended contention must meet the requirements of 10 C.F.R. § 2.309(f)(2)(i) through (iii), which provide that a petitioner may submit a new or amended contention only with leave of the presiding officer upon a showing that:

> (i) The information upon which the amended or new contention is based was not previously available;

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[83] FENOC recognizes that the Commission has published a final rule with revisions to 10 C.F.R. Part 2, but those revisions are not yet effective. *See* Amendments to Adjudicatory Process Rules and Related Requirements, 77 Fed. Reg. 46,562, 46,562 (Aug. 3, 2012) (stating that the effective date of the revisions is September 4, 2012, and "in ongoing adjudicatory proceedings, if there is a dispute over an adjudicatory obligation or situation arising prior to the effective date of the new rule, the former rule provisions would be used").

[84] *See, e.g.*, *Entergy Nuclear Generation Co.* (Pilgrim Nuclear Power Station), CLI-12-15, 75 NRC __, slip op. at 6-7 (June 7, 2012) (stating that contentions must meet the "strict contention standards under 10 C.F.R. § 2.309(f)," including the admissibility and timeliness standards); *see also* ISO at 12.

[85] The Commission has indicated that for new contentions filed by an admitted party, the timeliness standard is 10 C.F.R. § 2.309(f)(2), not 10 C.F.R. § 2.309(c). *See Pa'ina Hawaii, LLC* (Materials License Application), CLI-10-18, 72 NRC 56, 86 n.171 (2010) (discussing the applicability of Section 2.309(f)(2) versus Section 2.309(c), and stating: "To be clear, in the circumstances presented here, where [the intervenor] was admitted to this case as a party at the time it filed [the new contention], consideration of the contention's admissibility is governed by the provisions of § 2.309(f)(2), as well as the general contention admissibility requirements of § 2.309(f)(1)."). Therefore, because the Supplements do not meet the timeliness requirements of Section 2.309(f)(2), the analysis should end. To be conservative and consistent with the ISO, however, FENOC also evaluates the timeliness requirements of Section 2.309(c).

[86] *AmerGen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), CLI-09-7, 69 NRC 235, 260-61 (2009); *see also Pilgrim*, CLI-12-15, slip op. at 13 ("At the threshold contention admission stage, the burden for providing support for a contention is on the petitioner."); *Entergy Nuclear Vt. Yankee, LLC* (Vt. Yankee Nuclear Power Station), CLI-11-02, 73 NRC __, slip op. at 5 & n.19 (Mar. 10, 2011).

[87] *See* ISO at 12.

(ii) The information upon which the amended or new contention is based is materially different than information previously available; and

(iii) The amended or new contention has been submitted in a timely fashion based on the availability of the subsequent information.

The Board specified a generous, but finite, period for determining timeliness. The ISO provides that "a motion and proposed new contention shall be deemed timely under 10 C.F.R. § 2.309(f)(2)(iii) if it is filed within sixty (60) days of the date *when the material information on which it is based first becomes available*."[88] The ISO further states that if a motion and amended contention are filed after the 60 day time period, then they "shall be deemed nontimely under 10 C.F.R. § 2.309(c)."[89]

Section 2.309(c) sets forth an eight-factor balancing test for nontimely filings.[90] The burden is on Intervenors to demonstrate "that a balancing of these factors weighs in favor of granting the petition."[91] The eight factors in Section 2.309(c)(1) are not of equal importance. The first factor, whether "good cause" exists for the failure to file on time, is entitled to the most weight.[92]

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88 *Id.* (emphasis added). This Board has strictly interpreted timeliness requirements that are based on information availability, as exhibited in its January 10, 2012 Order. *See* Memorandum and Order (Denying Motion to Dismiss Contention 1), at 3-7 (Jan. 10, 2012) (unpublished) (denying a Motion to Dismiss because it was submitted more than 10 days after the event triggering the motion).

89 ISO at 12.

90 These factors are: (i) Good cause, if any, for the failure to file on time; (ii) The nature of the requestor's/petitioner's right under the Act to be made a party to the proceeding; (iii) The nature and extent of the requestor's/petitioner's property, financial or other interest in the proceeding; (iv) The possible effect of any order that may be entered in the proceeding on the requestor's/petitioner's interest; (v) The availability of other means whereby the requestor's/petitioner's interest will be protected; (vi) The extent to which the requestor's/petitioner's interests will be represented by existing parties; (vii) The extent to which the requestor's/petitioner's participation will broaden the issues or delay the proceeding; and (viii) The extent to which the requestor's/petitioner's participation may reasonably be expected to assist in developing a sound record. 10 C.F.R. § 2.309(c)(1).

91 *Tex. Utils. Elec. Co.* (Comanche Peak Steam Elec. Station, Units 1 & 2), CLI-88-12, 28 NRC 605, 609 (1988).

92 *Pilgrim*, CLI-12-15, slip op. at 25 n.96 ("The standard for new or amended contentions involves a balancing of eight factors set forth in 10 C.F.R. § 2.309. The factor given the most weight is whether there is 'good cause'

B. Contention Admissibility

Separate and apart from satisfying the late-filing criteria set forth above, a newly-proposed contention also must meet the fundamental admissibility requirements set forth in 10 C.F.R. § 2.309(f)(1)(i) to (vi) applicable to all contentions.[93] Specifically, under 10 C.F.R. § 2.309(f)(1), Intervenors "must set forth with particularity the contentions sought to be raised." The regulation specifies that each contention must:

> (1) provide a specific statement of the legal or factual issue sought to be raised;
>
> (2) provide a brief explanation of the basis for the contention;
>
> (3) demonstrate that the issue raised is within the scope of the proceeding;
>
> (4) demonstrate that the issue raised is material to the findings the NRC must make to support the action that is involved in the proceeding;
>
> (5) provide a concise statement of the alleged facts or expert opinions, including references to specific sources and documents that support the petitioner's position and upon which the petitioner intends to rely; and
>
> (6) provide sufficient information to show that a genuine dispute exists with regard to a material issue of law or fact.[94]

As the Commission recently explained in several proceedings, including this one, failure to comply with any one of the six admissibility criteria is grounds for rejection.[95] The Commission explained that its "strict contention rule is designed to avoid resource-intensive

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for the failure to file on time."); *see also Dominion Nuclear Conn., Inc.* (Millstone Power Station, Unit 3), CLI-09-5, 69 NRC 115, 125-26 (2009).

93 *See Pilgrim*, CLI-12-15, slip op. at 6-7 (explaining that late-filed contentions must meet the standards under 10 C.F.R. § 2.309(f), including the admissibility factors in Section 2.309(f)(1) and the timeliness factors in Section 2.309(f)(2)). These requirements are discussed in detail in FENOC's January 21, 2011 answer opposing Intervenors' petition to intervene.

94 10 C.F.R. § 2.309(f)(1)(i)-(vi).

95 *See Davis-Besse*, CLI-12-08, slip op. at 3 (stating that proposed contentions "must satisfy all six of the [admissibility] requirements"); *see also* Final Rule, Changes to Adjudicatory Process, 69 Fed. Reg. 2182, 2221 (Jan. 14, 2004).

hearings where petitioners have not provided sufficient support for their technical claims, and do not demonstrate a potential to meaningfully participate and inform a hearing."[96] The NRC revised the admissibility rules in 1989 "to prevent the admission of 'poorly defined or supported contentions,' or those 'based on little more than speculation.'"[97] The Commission further explained that it properly "reserve[s] our hearing process for genuine, material controversies between knowledgeable litigants."[98]

IV. THE THIRD AND FOURTH SUPPLEMENTS SHOULD BE REJECTED

Given the large number of individual arguments presented by Intervenors in the Supplements, FENOC has organized its response in two parts below. The first part discusses, in general terms, the failure of the Supplements to satisfy the timeliness and contention admissibility requirements set forth in 10 C.F.R. Part 2. The second part then demonstrates how each of the individual arguments presented in the Supplements fails to specifically satisfy 10 C.F.R. Part 2, and therefore does not provide an adequate basis for admissibility.

A. General Timeliness and Contention Admissibility Deficiencies of the Supplements

As a threshold matter, the Supplements should be rejected because the arguments are untimely under 10 C.F.R. §§ 2.309(f)(2) and (c) and/or do not satisfy the contention admissibility requirements in 10 C.F.R. § 2.309(f)(1). For these reasons alone, the Supplements should be rejected in their entirety.

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96 *Davis-Besse*, CLI-12-08, slip op. at 31; *Dominion Nuclear Conn., Inc.* (Millstone Nuclear Power Station, Units 2 & 3), CLI-01-24, 54 NRC 349, 358 (2001) (explaining that the Commission's rules on contention admissibility are "strict by design").

97 *Davis-Besse*, CLI-12-08, slip op. at 3-4 (citations omitted) (quoting *Duke Energy Corp.* (Oconee Nuclear Station, Units 1, 2 & 3), CLI-99-11, 49 NRC 328, 334 (1999)).

98 *Davis-Besse*, CLI-12-08, slip op. at 4 (quoting *Dominion Nuclear Conn., Inc.* (Millstone Nuclear Power Station, Unit 2), CLI-03-14, 58 NRC 207, 219 (2003)).

1. Parts of the Supplements Should Be Rejected as Untimely

As acknowledged by Intervenors,[99] the Supplements are subject to the timeliness requirements of 10 C.F.R. § 2.309(f)(2). Section 2.309(f)(2) requires that an amended contention be *based on* previously unavailable and materially-different information.[100] Further, the ISO requires the Supplements to be "filed within sixty (60) days of the date when the material information on which it is based first becomes available" in order to satisfy Section 2.309(f)(2)(iii).[101] As the Board recently explained in its January 10, 2012 Order, these regulatory requirements "are strict by design and must be applied *rigorously*."[102]

The Third and Fourth Supplements were filed on July 16, 2012 and July 23, 2012, respectively. Therefore, only information that first became available within 60 days before July 16, 2012 (*i.e.*, on or after May 15, 2012, after accounting for weekend) for the Third Supplement, or within 60 days before July 23, 2012 (*i.e.*, on or after May 22, 2012, after accounting for the weekend) for the Fourth Supplement, is timely under Section 2.309(f)(2).

The issuance of the Revised Root Cause Evaluation on May 16, 2012, or publication of the Revised PII Report, do not reset the clock for determining the timeliness of identical information previously set forth in the Root Cause Evaluation, dated February 27, 2012, or other documentation. Any unchanged information in the Revised Root Cause Evaluation or the Revised PII Report is not "new" or "materially different" than identical information set forth in the earlier revisions. In this regard, the Commission has reiterated that the publication of a new

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99 Third Supplement at 13; Fourth Supplement at 47.

100 *See, e.g.*, *Crow Butte Res., Inc.* (North Trend Expansion Project), LBP-08-6, 67 NRC 241, 255-60 (2008) (considering the timeliness of individual documents under 10 C.F.R. §§ 2.309(c) and (f)(2) to determine whether the documents should be considered with respect to admissibility of a proposed contention), *aff'd in relevant part*, CLI-09-12, 69 NRC 535, 549 (2009) (stating that the Commission agrees "that a late-filed document that allegedly supports or provides a basis for a proposed contention should be considered under [10 C.F.R. § 2.309(c) and (f)(2)]").

101 ISO at 12.

102 Memorandum and Order (Denying Motion to Dismiss Contention 1), at 5 (citation omitted) (emphasis added).

document, standing alone, does not meet the requirements of 10 C.F.R. § 2.309(f)(2) unless the information in that document is new and materially-different from what was previously available.[103]

Herein, Intervenors incorrectly calculate the timeliness of the Supplements entirely on the timing of submission of the Revised Root Cause Evaluation and Revised PII Report, even though many of their arguments are based on *earlier* information set forth in the original Root Cause Evaluation, and unchanged by the subsequent revision. As a result, many of Intervenors' arguments in the Supplements are untimely, as they are based on information pre-dating May 15, 2012 for the Third Supplement, or May 22, 2012 for the Fourth Supplement. Each of the untimely arguments is identified in Section IV.B below as part of the analysis of the individual arguments in the Supplements.

Nontimely arguments must satisfy the late-filing criteria in Section 2.309(c)(1)(i)-(viii).[104] Yet again, however, Intervenors fail to address the requirements of Section 2.309(c), even though these requirements are identified in the ISO and acknowledged by Intervenors in the Original Contention.[105] This failure to address the requirements of Section 2.309(c) is alone a sufficient basis to reject the late arguments, as the Commission has affirmed rejection of late-filed contentions for failure to address late-filing criteria.[106]

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[103] *See, e.g.*, *Vt. Yankee*, CLI-11-02, slip op. at 13; *see also N. States Power Co.* (Prairie Island Nuclear Generating Plant, Units 1 & 2), CLI-10-27, 72 NRC 481, 493-96 (2010).

[104] *See supra* Section III.A; *see also* ISO at 12; 10 C.F.R. § 2.309(c)(2) ("The requestor/petitioner shall address the factors in paragraphs (c)(1)(i) through (c)(1)(viii) of this section in its nontimely filing.").

[105] *See* FENOC's Original Contention Answer at 17; ISO at 12; Original Contention at 7-8.

[106] *See, e.g.*, *Millstone*, CLI-09-5, 69 NRC at 126 ("The Board correctly found that failure to address the requirements [of 10 C.F.R. §§ 2.309(c) and (f)(2)] was reason enough to reject the proposed new contentions."); *Balt. Gas & Elec. Co.* (Calvert Cliffs Nuclear Power Plant, Units 1 & 2), CLI-98-25, 48 NRC 325, 347 & n.9 (1998) ("Indeed, the Commission has itself summarily dismissed petitioners who failed to address the . . . factors for a late-filed petition.").

Nonetheless, even if the Section 2.309(c)(1) factors are considered, the late arguments should be dismissed as untimely by the Board. Intervenors have not demonstrated the necessary "good cause" under 10 C.F.R. § 2.309(c)(1)(i) for filing these arguments late. To show "good cause," Intervenors must show that they raised these arguments in a timely manner, following the availability of new information.[107] The Commission has explained that to demonstrate good cause, a petitioner must show not only that it "acted promptly after learning of the new information, but the information itself must be *new* information, not information already in the public domain."[108] Intervenors have provided *no* explanation for raising these arguments at this late date. Thus, for the same reasons that Intervenors have not satisfied the timeliness requirements in 10 C.F.R. § 2.309(f)(2), discussed above, they have not demonstrated good cause under 10 C.F.R. § 2.309(c)(1)(i).[109]

Further, Intervenors have made no "compelling" showing as to the remaining factors to outweigh the lack of good cause.[110] The late arguments, if included as part of an admitted contention, would broaden the scope of or delay the current proceeding (factor seven) by raising additional challenges on Shield Building cracking. Intervenors provide no indication that their participation on this technical issue would contribute to the development of a sound record (factor eight). The content of their multiple Supplements demonstrates their lack of familiarity with the fundamental subject matter of the contention. Contrary to the

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107 *See Exelon Generation Co.* (Early Site Permit for Clinton ESP Site), LBP-05-19, 62 NRC 134, 162-63 (2005) (finding that the requirements for a good cause showing under 10 C.F.R. § 2.309(c)(1)(i) "are analogous to the requirements of Sections 2.309(f)(2)(i) (information not previously available) and (f)(2)(iii) (submitted in a timely fashion)"), *review denied*, CLI-05-29, 62 NRC 801 (2005), *aff'd sub nom. Envtl. Law & Policy Ctr. v. NRC*, 470 F.3d 676 (2006).

108 *Tex. Utils. Elec. Co.* (Comanche Peak Steam Elec. Station, Units 1 & 2), CLI-92-12, 36 NRC 62, 70 (1992) (emphasis added).

109 *See Clinton ESP*, LBP-05-19, 62 NRC at 162-63.

110 *Pilgrim*, CLI-12-15, slip op. at 26 n.96 ("A failure to demonstrate 'good cause' for a late-filed contention requires a 'compelling' showing on the remaining factors."); *see also Commonwealth Edison Co.* (Braidwood Nuclear Power Station, Units 1 & 2), CLI-86-8, 23 NRC 241, 244 (1986).

Commission's requirements, Intervenors have not specified the precise issues they plan to contest, have not identified any prospective witness, and have not summarized their proposed testimony.[111] Accordingly, a balancing of the factors under 10 C.F.R. § 2.309(c)(1) demands rejection of the late arguments.[112]

Additionally, as discussed in greater detail below, some of Intervenors' arguments in support of the Supplements were previously made in their Second Supplement and rely upon the same support. "Good cause" for a nontimely supplemented contention cannot be shown when it relies on the same support as an earlier argument.[113] By simply rephrasing the same arguments in the Supplements that it made in its Second Supplement, Intervenors are attempting to repeat arguments when they have no right to do so.[114]

In this regard, NRC regulations provide for only three pleadings that can be filed "as of right" regarding admissibility of contentions.[115] The reply brief is "*the final* of these three."[116] Here, Intervenors already replied to FENOC's and the NRC Staff's answers to their Second

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111 *See Braidwood*, CLI-86-8, 23 NRC at 246 ("When a petitioner addresses this criterion it should set out with as much particularity as possible the precise issues it plans to cover, identify its prospective witnesses, and summarize their proposed testimony." (quoting *Miss. Power & Light Co.* (Grand Gulf Nuclear Station, Units 1 & 2), ALAB-704, 16 NRC 1725, 1730 (1982))).

112 The other factors in 10 C.F.R. § 2.309(c)(1) are less important and do not outweigh Intervenors' failure to demonstrate good cause or meet factors seven and eight. *See, e.g.*, *Pac. Gas & Elec. Co.* (Diablo Canyon Power Plant Indep. Spent Fuel Storage Installation), CLI-08-1, 67 NRC 1, 8 (2008); *Tex. Utils. Elec. Co.* (Comanche Peak Steam Elec. Station, Unit 2), CLI-93-4, 37 NRC 156, 165 (1993). Factors two through four speak towards standing; therefore, their applicability is limited here because Intervenors are already parties to this proceeding and are seeking admission of nontimely contentions, rather than nontimely intervention. Factors five (availability of other means) and six (interests represented by other parties) are entitled to the least weight. *See Private Fuel Storage, L.L.C.* (Indep. Spent Fuel Storage Installation), LBP-00-8, 51 NRC 146, 154 (2000) (citing *Braidwood*, CLI-86-8, 23 NRC at 244-45).

113 *See Pac. Gas & Elec. Co.* (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), 67 NRC 193, 200-01, CLI-08-8 (2008) (finding that the intervenor did not satisfy the good cause factor for a late-filed contention because the late-filed contention was very similar to an earlier contention and relied on nearly identical support), *aff'd sub nom.*, *San Luis Obispo Mothers for Peace v. NRC*, 635 F.3d 1109 (9th Cir. 2011).

114 *See Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), Licensing Board Memorandum (Denying Admission of Late-Filed Contentions), at 6 (July 24, 2003) (unpublished) (rejecting a contention in part because the intervenor had submitted a similar contention earlier in the proceeding).

115 *See* 10 C.F.R. § 2.309(h); *Entergy Nuclear Operations, Inc.* (James L. FitzPatrick Nuclear Power Plant), CLI-08-19, 68 NRC 251, 261 (2008).

116 *FitzPatrick*, 68 NRC at 261 (emphasis in original).

Supplement, but now seek to file additional replies in the Supplements based on the same arguments and support. By filing multiple pleadings with similar arguments relying on identical support, Intervenors are attempting to circumvent the regulations regarding contention admissibility. The Board should reject these unauthorized arguments as untimely.

In summary, the Board should not consider the untimely information or corresponding arguments proffered by Intervenors in the Third and Fourth Supplements when determining their admissibility. Furthermore, as discussed below, none of the arguments in the Supplements, whether timely or untimely, supports admission of this proposed contention due to a variety of fatal flaws.

2. Parts of the Supplements Are Outside the Scope of this Proceeding

Some of Intervenors' arguments in the Supplements are outside of the scope of this license renewal proceeding, contrary to 10 C.F.R. § 2.309(f)(1)(iii). Specific arguments in the Supplements that are outside of the scope of this proceeding are identified below in Section IV.B.[117] The Commission has stated that "[a]djudicatory hearings in individual license renewal proceedings will share the same scope of issues as our NRC Staff review, for our hearing process (like our Staff's review) necessarily examines only the questions our safety rules make pertinent."[118] The Commission has specifically limited its license renewal safety review to the matters specified in 10 C.F.R. §§ 54.21 and 54.29, which focus on the management of aging of certain systems, structures, and components during the period of extended operation, and the

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[117] Intervenors provide a brief discussion as to why the Shield Building laminar cracking is within the scope of the proceeding. *See* Fourth Supplement at 45. FENOC does not dispute that some issues related to the Shield Building are within the scope of license renewal. Some of Intervenors' arguments, however, go beyond the scope. These are identified in Section IV.B below.

[118] *Fla. Power & Light Co.* (Turkey Point Nuclear Power Plant, Units 3 & 4), CLI-01-17, 54 NRC 3, 10 (2001); *see also* Final Rule, Nuclear Power Plant License Renewal; Revisions, 60 Fed. Reg. 22,461, 22,482 n.2 (May 8, 1995).

review of time-limited aging analyses.[119] Thus, the "potential detrimental effects of aging that are not routinely addressed by ongoing regulatory oversight programs" are the issues that define the scope of the safety review in license renewal proceedings.[120]

The NRC's license renewal regulations deliberately and sensibly reflect the distinction between *aging management issues*, on the one hand, and the *ongoing regulatory process* on the other.[121] The NRC's license renewal framework is premised upon the notion that, with the exception of aging management issues, the NRC's ongoing regulatory process is adequate to ensure that the current licensing basis ("CLB") of operating plants provides and maintains an acceptable level of safety.[122]

3. The Supplements Are Not Adequately Supported

The entirety of the Supplements are not adequately supported, contrary to 10 C.F.R. § 2.309(f)(1)(v). Section 2.309(f)(1)(v) requires a contention to "[p]rovide a concise statement of the alleged facts or expert opinions which support the requestor's/petitioner's position on the issue and on which the petitioner intends to rely at hearing, together with references to the specific sources and documents on which the requestor/petitioner intends to rely to support its position on the issue." Intervenors have identified no expert opinion whatsoever to support the Supplements. Additionally, Intervenors have provided absolutely no documentary support for the Supplements, but instead simply reference the documents prepared by FENOC or its

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119 *See Turkey Point*, CLI-01-17, 54 NRC at 7-8; *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 & 2), CLI-02-26, 56 NRC 358, 363 (2002).

120 *Turkey Point*, CLI-01-17, 54 NRC at 7. Detrimental aging effects can result from, for example, metal fatigue, erosion, corrosion, thermal and radiation embrittlement, microbiologically induced effects, creep, and shrinkage. *See id*. at 7-8.

121 Specifically, in developing Part 54, the NRC sought "to develop a process that would be both efficient, avoiding duplicative assessments where possible, and effective, allowing the NRC Staff to focus its resources on the most significant safety concerns at issue during the renewal term." *Id.* at 7.

122 *See* Final Rule, Nuclear Power Plant License Renewal; Revisions, 56 Fed. Reg. 64,943, 64,946 (Dec. 13, 1991). The term "current licensing basis" is defined in 10 C.F.R. § 54.3. *See also* 10 C.F.R. §§ 54.29, 54.30.

contractors regarding the Shield Building cracking and the Staff's observations regarding these documents.

The Commission has stated that a contention "will be ruled inadmissible if the petitioner 'has offered no tangible information, no experts, no substantive affidavits,' but instead only 'bare assertions and speculation.'"[123] Herein, Intervenors have presented only the latter—bare assertions and speculation. Given the lack of expert or other documentary support, the Supplements boil down to speculation by counsel. The lack of any support is particularly stark given the technical nature of the underlying Shield Building laminar cracking issues.

Moreover, Intervenors inappropriately rely upon NRC Staff informal observations on the Root Cause Evaluation and PII Report as support for admission of the Supplements.[124] These observations are akin to NRC Requests for Additional Information ("RAIs"). It is a long-standing NRC adjudicatory principle that RAIs are a common and expected feature of the licensing review process and do not alone form the basis for admissible contentions.[125] This conclusion equally applies to the NRC Staff's observations on the Root Cause Evaluation and PII Report.

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123 *Fansteel, Inc.* (Muskogee, Okla. Site), CLI-03-13, 58 NRC 195, 203 (2003); *see also Pilgrim*, CLI-12-15, slip op. at 13 ("'Bare assertions and speculation,' even by an expert, are insufficient to trigger a full adjudicatory proceeding." (quoting *AmerGen Energy Co. LLC* (Oyster Creek Nuclear Generating Station), CLI-08-28, 68 NRC 658, 674 (2008)).

124 Indeed, all of the arguments proffered by Intervenors in the Third and Fourth Supplements are linked to an NRC Staff observation or question reproduced in the Revised Root Cause Evaluation or the Revised PII Report. *See, e.g.*, Third Supplement at 3 (reproducing a comment about micro-cracking); Fourth Supplement at 3-4 (reproducing a question about presence of Ettringite).

125 *See Dominion Nuclear Conn., Inc.* (Millstone Nuclear Power Station, Unit 3), CLI-08-17, 68 NRC 231, 242 (2008) ("The mere issuance of RAIs does not mean an application is incomplete for docketing."); *Nuclear Mgmt. Co., LLC* (Monticello Nuclear Generating Plant), CLI-06-6, 63 NRC 161, 164 (2006) ("[W]e have held repeatedly that the mere issuance of a staff RAI does not establish grounds for a litigable contention."); *Oconee*, CLI-99-11, 49 NRC at 336-37 (stating that RAIs are a standard part of NRC licensing reviews and do not suggest that the application is incomplete, and petitioners must do more than rest on the mere existence of RAIs as a basis for contentions).

Intervenors also appear to misunderstand the status of the NRC Staff observations and questions identified in the Revised Root Cause Evaluation and Revised PII Report. The Staff raised these observations and questions *during* its inspection of the Shield Building laminar cracking issues. It did so in order to have FENOC clarify or supplement the Root Cause Evaluation and PII Report, which FENOC has done. An NRC Staff Inspection Report regarding the Shield Building laminar cracking explains that the Staff identified "minor weaknesses" in the Root Cause Evaluation "generally associated with the level of detail in the documentation recorded, but these weaknesses did not constitute performance deficiencies or findings because they did not adversely affect the outcome (e.g., conclusions) of the root cause process."[126] Therefore, Intervenors' reliance on these observations and questions is misplaced, and does not provide support for the proposed contention, contrary to 10 C.F.R. § 2.309(f)(1)(v).[127]

4. The Supplements Do Not Raise a Genuine Dispute with the Davis-Besse LRA

The arguments in the Supplements do not demonstrate a genuine dispute with the LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). To raise a *genuine* dispute admissible under Section 2.309(f)(1)(vi), a petitioner must "read the pertinent portions of the license application, . . . state the applicant's position and the petitioner's opposing view," and explain why it disagrees with the applicant.[128] If a petitioner believes the license application fails to adequately address a relevant issue, then the petitioner is to "explain why the application is deficient."[129] A

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126 June 2012 NRC Inspection Report, Enclosure, at 16-17.

127 Intervenors provide a single paragraph for its "Concise Statement of Facts or Expert Opinion That Support the Contention." *See* Fourth Supplement at 46. This paragraph does not provide the required support, but includes additional conclusory statements that cannot be used to support a contention under 10 C.F.R. § 2.309(f)(1)(v).

128 Rules of Practice for Domestic Licensing Proceedings – Procedural Changes in the Hearing Process, 54 Fed. Reg. 33,168, 33,170 (Aug. 11, 1989); *see also Millstone*, CLI-01-24, 54 NRC at 358.

129 Rules of Practice for Domestic Licensing Proceedings – Procedural Changes in the Hearing Process, 54 Fed. Reg. at 33,170; *see also Ariz. Pub. Serv. Co.* (Palo Verde Nuclear Generating Station, Unit Nos. 1, 2 & 3), CLI-91-12, 34 NRC 149, 155-56 (1991).

contention that does not directly controvert a position taken by the applicant in the application—such as the Supplements before the Board in this proceeding—is subject to dismissal.[130] Section 2.309(f)(1)(vi) also requires that a proposed contention "include references to specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute."

Here, Intervenors have not done this. Although they clearly acknowledge that FENOC submitted a new Shield Building AMP on April 5, 2012,[131] Intervenors' arguments do not identify disputes with it. Because the Shield Building AMP is part of the Davis-Besse LRA, according to Commission precedent, Intervenors' failure to challenge it is fatal to the proposed contention.[132] In a few places, Intervenors broadly claim that issues were omitted from the Shield Building AMP, but they do not adequately explain why or how the issues should have been included, nor do they explain why or how the Shield Building AMP is inadequate for purposes of license renewal. In this regard, Intervenors focus exclusively on the Revised Root Cause Evaluation and the Revised PII Report—instead of challenging the Davis-Besse LRA and/or the Shield Building AMP. To the extent Intervenors disagree with FENOC's root cause for the laminar cracking, they have not even attempted to claim a nexus between such disagreement and the LRA. Therefore, the Supplements should be rejected on this basis alone.[133]

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130 *See S.C. Elec. & Gas Co.* (Virgil C. Summer Nuclear Station, Units 2 & 3), CLI-10-1, 71 NRC 1, 21-22 (2010).

131 Third Supplement at 2.

132 *See Summer*, CLI-10-1, 71 NRC at 21-22; *see also* 10 C.F.R. § 2.309(f)(1)(vi).

133 Intervenors provide a brief discussion of why they claim that there is a genuine dispute. *See* Fourth Supplement at 46-47. Even there, however, Intervenors fail to identify a challenge with the Shield Building AMP or any other part of the Davis-Besse LRA.

B. Timeliness and Contention Admissibility Deficiencies of the Specific Arguments in the Supplements

This section addresses the contention admissibility deficiencies in each of the specific arguments raised in the Supplements. The Third Supplement includes 11 separate arguments, and the Fourth Supplement includes 27 separate arguments. None of the arguments, separately or collectively, supports admission of a contention. As such, they all should be rejected by the Board.

1. The Third Supplement Fails to Proffer an Admissible Contention

a. Argument 1 – "Microcracking Present in Core-Bore Samples"

Intervenors reference the following NRC Staff observation about the Root Cause Evaluation: "The root cause report did not address micro-cracking that was identified in PII Exhibit 2. The root cause report contradicts this evidence, and states that micro-cracking was not identified."[134] Intervenors also reference FENOC's response to this observation in the Revised Root Cause Evaluation:

> *The micro-cracks observed in the CTL Group petrographic examination are not representative of the areas examined by PhotoMetrics Laboratories from locations exposed to repetitive loading versus near surface concrete. The core bores with evidence of multiple laminar cracks in the same area of outside face reinforcement were considered part of a single delamination process.*[135]

Intervenors then jump to the conclusion that FENOC ignores the micro-cracking and fails to address the micro-cracking in the Shield Building AMP.[136]

Intervenors' conclusion, however, is unfounded.[137] As stated in the Revised Root Cause Evaluation, "[t]he fracture analysis found no evidence of microcracks with magnifications up to

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[134] Third Supplement at 3; Revised Root Cause Evaluation at 6.

[135] Third Supplement at 3; Revised Root Cause Evaluation at 27. The new information in the Revised Root Cause Evaluation is italicized. These italics are retained in this Answer.

[136] *See* Third Supplement at 3-5.

500 times on virtually all the samples."[138] As quoted above, the identified micro-cracking in the petrographic examinations commented on by the NRC Staff are not representative of other areas examined. The Revised PII Report further explains:

> The core-bores showed no signs of micro-cracking which, in combination with factors to be discussed in subsequent sections, eliminates a fatigue / progressive failure mechanism. The micro-cracks observed in the CTL report (Exhibit 2) are not representative of the areas observed by PII. The cores observed by PII were from locations exposed to repetitive loading and not the near-surface concrete observed by CTL.[139]

Thus, the evaluation did not identify micro-cracking of concern related to the Shield Building laminar cracking.[140] CTL even characterized the examined concrete as in "good condition."[141] Intervenors provide no information or additional facts to support a contrary conclusion. For these reasons, this argument is based on a faulty premise and lacks adequate support, contrary to 10 C.F.R. § 2.309(f)(1)(v).

Finally, this argument does not sufficiently challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

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137 Intervenors also make the unsupported claim that "[t]here is indisputably a connection between micro-cracking and age-related degradation" and this was admitted by PII. *Id.* at 3-4. Intervenors' references do not support this conclusion.

138 Revised Root Cause Evaluation at 27. This is supported by Exhibit 78, at 2, to the Revised PII Report, which states: "Laboratory examinations were conducted to determine whether or not micro cracks existed on the samples received from Davis-Besse. . . . There was no evidence of micro cracking on any of the samples received."

139 Revised PII Report at 3.

140 *See* Revised Root Cause Evaluation at 41 ("there is no significant amount of micro-cracking in the concrete"); *see also* FENOC August Slides at 25.

141 Revised PII Report, Exh. 2, at 1.

b. Argument 2 – "Radial Cracking"

Intervenors reference the following NRC Staff observation about the Root Cause Evaluation: "The root cause report additionally did not discuss radial cracking identified in numerous core bores."[142] Intervenors also reference FENOC's response to this observation in the Revised Root Cause Evaluation:

> Evidence of subsurface cracking, other than a laminar crack in the shield building concrete, was also identified on five core bores. Longitudinal / radial cracks, attributed to concrete shrinkage, were discovered in core bores F7-633.08 and F2-790.0-4.5 as described in Condition Reports 2011-04507 and 2011-05648. Longitudinal / radial cracks of the material extracted from core bores F4-794.0-3.5, and F5-791.0-4 *were seen which was also attributed to concrete shrinkage. The concrete in the shield building was reinforced to limit the size and confine the longitudinal / radial cracking observed attributed to shrinkage during the curing process.* Another imperfection located approximately one inch below the surface was discovered in core bore S10-672.0-34 as described in Condition Report 2011-04507. Each of these five cores, with indications other than laminar cracking in the shield building concrete, were sent off-site for further independent examination.[143]

Only the italicized statement in this quotation was new in the Revised Root Cause Evaluation.

Based on this information, Intervenors allege that "[t]here is no disclosure in the RRCA of the results of the additional tests performed on the five core-bores mentioned above. So the RCA and RRCA remain incomplete, even now."[144] The statement about these core-bores, however, was not new in the Revised Root Cause Evaluation, but was included in the Root Cause Evaluation dated February 27, 2012.[145] Therefore, this entire argument is untimely because it was filed well after the 60 day time limit specified in the ISO, and does not satisfy 10 C.F.R. § 2.309(f)(2)(iii).

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142 Third Supplement at 5; Revised Root Cause Evaluation at 5.

143 Third Supplement at 5; Revised Root Cause Evaluation at 22.

144 Third Supplement at 5.

145 *See* Root Cause Evaluation at 19.

Aside from the alleged omission of the results of the examination of the core bores referenced above, Intervenors simply discuss the Revised Root Cause Evaluation.[146] Intervenors do not challenge this information, nor do they explain why it is inconsistent with the Davis-Besse LRA, such as the Shield Building AMP or the Structures Monitoring AMP. Additionally, the Revised Root Cause Report and the Revised PII Report provide the results of the testing of the core bores that Intervenors claim to be missing.[147] For these reasons, Intervenors fail to adequately support this argument, contrary to 10 C.F.R. § 2.309(f)(1)(v), and fail to identify a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi).

c. Argument 3 – "Deletion of Need for Further Investigation of Reinforcing Steel"

Intervenors state: "At the suggestion of the NRC Staff, the RRCA was revised at one point by deleting a statement from Section 3.3.9 - Failure Modes Analysis (pp. 50-51), which had stated that further investigation was needed regarding high-density reinforcing steel and small reinforcing steel spacing failure modes."[148] Intervenors then state that this further evaluation is necessary because the presence of high-density rebar, and small rebar spacing, causes cracking, and that "[i]mplicit in this truism is that all the areas of the shield building surface and subsurface which have such rebar are vulnerable to cracking and should be

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146 *See* Third Supplement at 5-6.

147 *See* Revised Root Cause Evaluation at 80-82; Revised PII Report, Exhs. 58, 76. Exhibit 58 provides the results of carbonation testing for longitudinal cracks on Core Bores F2-790.0-4.5, F4-794.0-3.5, and F5-791.0-4, and concludes that there are no carbonation layers formed at the examined distances within the samples. Revised PII Report, Exh. 58, at 6. Exhibit 76 provides a list of the concrete core samples tested by PII (Core Bores F2-790.0-4.5, F4-794.0-3.5, and F5-791.0-4) and the corresponding activities performed. *See generally* Revised PII Report, Exh. 76. One part of the Revised Root Cause Evaluation incorrectly states that "five cores . . . were sent off-site for further independent examination." Revised Root Cause Evaluation at 22. Consistent with Attachment 3 of the Revised Root Cause Evaluation and the Revised PII Report exhibits, however, this should have stated that three cores (Core Bores F2-790.0-4.5, F4-794.0-3.5, and F5-791.0-4) were sent off-site. *See id.* at 80-82; Revised PII Report, Exhs. 58, 76. As correctly explained in the Revised Root Cause Report, the other two cores (Core Bores F7-633.08, S10-672.0-34) were evaluated by FENOC as part of a Condition Report. *See* Revised Root Cause Evaluation at 22. The Revised Root Cause Report further explains that the cracking in Core Bore F7-633-08 was attributed to concrete shrinkage and an imperfection in Core Bore S10-672.0-34 was determined not to be a structural concern. *See id.* at 22, 30.

148 Third Supplement at 6.

extensively checked for status, which was neither planned as part of the AMP, and for which the justification has since been deleted."[149]

Intervenors misunderstand the reason for deleting the statements about further investigation of certain failure mechanisms. These statements were deleted from Section 3.3.9 of the Root Cause Evaluation, which provides the Failure Modes Analysis for the Shield Building laminar cracking. That section discusses the various failure mechanisms evaluated by FENOC, and whether the mechanisms could be ruled out as the cause of the Shield Building laminar cracking.[150] With respect to Failure Mode 1.5 (Density of rebar) and Failure Mode 2.11 (Small rebar spacing), Root Cause Evaluation Section 3.3.9 concluded that the failure modes could not be ruled out and required further investigation.[151] The further investigation at issue is the rebar sensitivity study that already had been performed and is summarized in Root Cause Evaluation Section 3.8, "Shield Building Modeling and Analysis," and in the Revised PII Report.[152] No further investigation is needed. The wording regarding "further investigation" was removed from the Root Cause Evaluation to avoid the very misinterpretation raised by Intervenors that additional investigation beyond the Root Cause Evaluation is needed.

In summary, the statements regarding further evaluation of Failure Modes 1.5 and 2.11 were deleted because that further evaluation already had been completed. Intervenors' misunderstanding of the Root Cause Evaluation in this argument cannot support an admissible contention. For these reasons, Intervenors fail to adequately support this argument, contrary to

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149 *Id.*

150 *See* Root Cause Evaluation at 45-47.

151 *Id.* at 45-46. On page 46, the Root Cause Evaluation incorrectly stated "3.11" instead of "2.11." This was corrected in the Revised Root Cause Evaluation. *See* Revised Root Cause Evaluation at 51.

152 *See* Revised PII Report, Exh. 51.

10 C.F.R. § 2.309(f)(1)(v), and fail to identify a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi).[153]

d. Argument 4 – "Laminar Cracking in Main Steam Line Room"

Intervenors reference the following NRC Staff observation about the Root Cause Evaluation: "The root cause report has insufficient Impulse Response documentation to conclude that laminar cracking initiated in the shoulder regions and propagated to areas of high density reinforcement, specifically in the areas of the Main Steam Line Penetrations."[154] Intervenors also reference FENOC's response to this observation in the Revised Root Cause Evaluation:

> *The presence of laminar cracking in the main steam line room does not contradict the freezing mechanism. In places where there exists a very high density of reinforcing steel in a single plane (and therefore a very low density of concrete in that plane, like a perforated paper towel) it is possible for a crack to propagate due to initiation of cracking in an adjacent region. Based upon the Impulse Response test results, the cracking in the concrete adjacent to the main steam line penetration blockouts coincides with regions of very high density reinforcing steel and have arrested near the boundary of these regions.*[155]

Based on the above information, Intervenors simply conclude that "FENOC has not provided the connection, only the conclusion."[156] This conclusory statement does not support an admissible contention. First, this statement is untimely. Intervenors waited for the NRC Staff to raise a question on the February 27, 2012 Root Cause Evaluation, when they could have raised

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153 Intervenors also seem to imply that no further investigation of the laminar cracking is being performed. *See* Fourth Supplement at 6. This is simply not true. For example, Extent of Condition Corrective Action #1 requires additional examination of the Shield Building exterior wall, including additional Impulse Response testing. *See* Revised Root Cause Evaluation at 66. In fact, this Impulse Response testing of all accessible areas of the Shield Building has been completed with over 60,000 individual readings to fully characterize the Shield Building. *See* FENOC August Slides at 40; August RAI Response at 9. This Impulse Response mapping has validated the original conclusions in the Root Cause Evaluation regarding the locations and extent of the Shield Building laminar cracking. FENOC August Slides at 41-42; August RAI Response at 9.

154 Third Supplement at 7; Revised Root Cause Evaluation at 6.

155 Third Supplement at 6; Revised Root Cause Evaluation at 46.

156 Third Supplement at 7.

the same issue themselves based on the initial Root Cause Evaluation. Therefore, this argument is untimely because it was filed well after the 60 day time limit specified in the ISO, and does not satisfy 10 C.F.R. § 2.309(f)(2)(iii).

Second, Intervenors' statement is vague and unsupported, contrary to 10 C.F.R. § 2.309(f)(1)(v). Additional information regarding the rebar spacing and laminar cracking is provided in the Revised PII Report, and has not been challenged by Intervenors.[157]

Finally, the statement does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

e. Argument 5 – "Shield Building Dome Parapet Cracking"

Intervenors reference information added to the Revised Root Cause Evaluation regarding the Shield Building dome, including information about a cracked and broken architectural flute shoulder corner, shrinkage cracks, and peeling latex coating that was fixed.[158] This information was added in response to an NRC Staff observation.[159] The Revised Root Cause Evaluation responds to the issue as follows:

> *None of the inspections of the shield building exterior surface identified any symptoms that would signify the presence of the concrete laminar cracking. None of the inspections of the other safety-related structures such as the auxiliary building or intake structure exterior identified any symptoms that would signify the presence of concrete laminar cracking or waterproof coating degradation.*[160]

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157 *See* Revised PII Report at 30-36.

158 *See* Third Supplement at 7; Revised Root Cause Evaluation at 29.

159 *See* Revised Root Cause Evaluation at 6.

160 Third Supplement at 7; Revised Root Cause Evaluation at 29.

Based on the above information, Intervenors then speculate: "The presence of so many different forms of cracking/degradation all across the shield building may comprise a cumulative effect wherein they could all add up (especially where they are close together) to 'fail' the shield building if a powerful enough force, such as an earthquake, tornado, internal meltdown related pressures, *etc.* would occur at Davis-Besse."[161]

This conclusory statement does not support an admissible contention. First, the statement has no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors do not explain, much less provide the required support for, why the disparate issues might have some cumulative effect. In this regard, Intervenors merely speculate, stating that cracking "may" comprise a cumulative effect.[162] This bare speculation is not sufficient to support a contention.

Additionally, the statement does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and does not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi).[163]

Finally, Intervenors already raised an argument in their Second Supplement regarding cracking on the Shield Building dome parapet based on this same information from the Revised Root Cause Evaluation.[164] As discussed above in Section IV.A, Intervenors are not permitted to re-argue this issue when the admissibility pleadings for the Second Supplement have been completed. For this reason as well, this repeat argument should be rejected as untimely.

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161 Third Supplement at 7-8.

162 *Id.* at 7.

163 Moreover, any cracking on the Shield Building dome is managed by the Structures Monitoring AMP and the 10 C.F.R. Part 50, Appendix J AMP, not the Shield Building AMP. *See* LRA Table 3.5.2-1 (Rows 76-80) and §§ B.2.1, B.2.39. The Revised Shield Building AMP includes inspection of only the exterior concrete coating on the Shield Building dome. *See, e.g.*, Revised Shield Building AMP at 6.

164 *Compare* Second Supplement at 10-11, *with* Third Supplement at 7-8.

f. Argument 6 – "AMP Omits to Inspection of 2002 Shield Building Opening for Cracking"

Intervenors reference the following statement in the Revised Root Cause Evaluation:

> There was no previous DBNPS experience with shield building concrete laminar cracking. In 2002, a similar temporary access opening was created using hydrodemolition for the replacement of the reactor pressure vessel closure head. The 2002 temporary access opening was confined within the blockout used for the original construction opening and was not in an area exposed to similar regions where laminar cracks were found in 2011.[165]

Intervenors then conclude that "[t]here evidently has been no re-examination of this access opening since October 2011 to confirm that there is no cracking of any type in that area using impulse response testing or core-bore sampling."[166] This information does not support an admissible contention.

First, the statements relied upon by Intervenors and quoted above were not new in the Revised Root Cause Evaluation, but were provided in the original February 27, 2012 Root Cause Revaluation.[167] Therefore, this argument was filed more than 60 days after the information was first available, and is late under the ISO and 10 C.F.R. § 2.309(f)(1)(iii).

Second, the argument has no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors do not explain why the lack of re-examination of the access opening is a concern. If Intervenors believe the lack of re-examination changes the conclusions in the Root Cause Evaluation or other FENOC evaluation, then they must explain why and support their explanation. Additionally, Intervenors ignore entirely the corrective actions specified in the Revised Root Cause Evaluation, which specify additional examination of the Shield Building

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165 Third Supplement at 8; Revised Root Cause Evaluation at 56.

166 Third Supplement at 8. Intervenors also speculate that "[t]he presence of cracking there might suggest either that it was missed in 2002, or was noticed but not reported officially." *Id.* Intervenors have provided no support for these baseless allegations, and they cannot support an admissible contention.

167 *Compare* Root Cause Evaluation at 51, *with* Revised Root Cause Evaluation at 56.

exterior wall.[168] In fact, this Impulse Response testing of all accessible areas of the Shield Building has been completed, including testing of the area of the 2002 temporary access opening.[169] This testing did not identify laminar cracking in the area of that temporary access opening.[170]

Finally, the statement does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and does not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their claims about inspection of the 2002 opening are correct.

g. Argument 7 – "No Examination of Admitted Cracking of SB Dome Or Below-Grade Shield Building Walls"

Intervenors reference information in the Revised Root Cause Evaluation regarding non-laminar cracking on the Shield Building dome and the existence of a waterproofing membrane for the below-grade Shield Building walls that FENOC included in response to a Staff observation.[171] Intervenors then state: "Despite these signs from 40 years ago, FENOC has illogically excluded from the AMP any examination of the dome or the below-grade shield building walls."[172] This information does not support an admissible contention.

First, information regarding the existence of a waterproofing membrane was not new in the Revised Root Cause Evaluation, but was included in the February 27, 2012 Root Cause

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168 *See* Revised Root Cause Evaluation at 66.

169 *See* FENOC August Slides at 41-42; August RAI Response at 9.

170 *See* FENOC August Slides at 42.

171 *See* Third Supplement at 8; Revised Root Cause Evaluation at 5, 33.

172 Third Supplement at 8.

Evaluation.[173] Therefore, this argument is untimely because it was filed well after the 60 day time limit specified in the ISO, and does not satisfy 10 C.F.R. § 2.309(f)(2)(iii).

Second, the argument has no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). The Revised Root Cause Evaluation includes an extent of condition analysis of the laminar cracking, and explains that "only the remainder of the accessible, above-grade, exterior wall of the shield building should be examined similar to those areas previously examined," because the dome lacks the susceptibility to the cracking causal factors and the below-grade walls have the waterproofing membrane.[174] Intervenors have provided no support to challenge this conclusion.

Third, although Intervenors claim that the Shield Building AMP fails to encompass cracking of the dome and below-grade wall, Intervenors fail to recognize that an entirely separate AMP, the Structures Monitoring AMP, addresses these very issues.[175] Intervenors have not challenged the Structures Monitoring AMP. Therefore, the argument does not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi).

Finally, Intervenors already raised an argument in their Second Supplement regarding the Shield Building dome parapet and below-grade Shield Building walls based on this same information from the Revised Root Cause Evaluation.[176] As discussed above in Section IV.A, Intervenors are not permitted to re-argue this issue when the admissibility pleadings for the Second Supplement have been completed. For this additional reason, this argument should be rejected as untimely.

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173 Root Cause Evaluation at 29 ("A waterproofing membrane is used around the below-grade portion of the shield building exterior.").

174 Revised Root Cause Evaluation at 59.

175 *See* LRA Table 3.5.2-1 (Rows 76-80, 86-89) and §§ B.2.1, B.2.39. The Revised Shield Building AMP includes inspection of only the exterior concrete coating on the Shield Building dome. *See, e.g.*, Revised Shield Building AMP at 6.

176 *Compare* Second Supplement at 4-5, *with* Third Supplement at 8-9.

h. Argument 8 – "Use of Other Safety-Related Structures as Comparables Instead of as Inspection Targets"

Intervenors reference FENOC's Extent of Condition Corrective Action #3, which requires a confirmatory examination of a safety-related structure with waterproof coating, and was added to address a Staff observation.[177] Intervenors complain that FENOC has inappropriately limited the confirmatory examination to just one structure.[178] Intervenors' complaint is based on the NRC observation: "Extent of Condition Corrective Action #1 for additional investigation of the Shield Building lacks detail, and need[s] to be expanded to confirm the conclusions of the Root Cause Report. (That is, to perform Impulse Response Testing in other safety related structures not subject to the Root and/or contributing causes)."[179] This argument does not support an admissible contention.

First, it is untimely. Intervenors are complaining that the AMP is insufficiently narrow because it does not encompass all safety-related structures.[180] Nothing has changed on this issue since the publication of the Shield Building AMP on April 5, 2012, and this information was not new in the Revised Root Cause Evaluation. Therefore, this argument is untimely because it was filed well after the 60 day time limit specified in the ISO, and does not satisfy 10 C.F.R. § 2.309(f)(2)(iii).

Second, this argument is unsupported, contrary to 10 C.F.R. § 2.309(f)(1)(v). There was no indication from the NRC Staff that it expected additional inspection on more than one safety-related structure. Intervenors have provided no basis for their assumption that multiple safety-related structures need be inspected. In fact, FENOC has completed its Impulse Response

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177 *See* Third Supplement at 9; Revised Root Cause Evaluation at 7, 66.

178 *See* Third Supplement at 9-10.

179 *Id.* at 9 n.5; Revised Root Cause Evaluation at 7.

180 Third Supplement at 10.

mapping and core bores of the other structure (Auxiliary Building), which confirmed that no laminar cracking was present.[181]

Finally, although Intervenors claim that the scope of the Shield Building AMP is insufficiently narrow, they provide no basis for this conclusion.[182] For example, Intervenors do not provide any explanation for why the Shield Building AMP must address confirmatory analyses on other buildings. Therefore, the argument does not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi).

i. Argument 9 – "Ettringite Penetration Beyond Outer Rebar Layer"

Intervenors repeat one of the NRC Staff's observations on the Root Cause Evaluation: "The root cause report did not document the depth of the core samples at which ettringite was present in samples that contained ettringite deposits."[183] Intervenors then quote additional language in the Revised Root Cause Evaluation that explains that some cores were 4-3/4" deep, which is deeper than some rebar in the Shield Building walls.[184] Intervenors then speculate that this "would seem to indicate potential for rebar corrosion, which would seriously worsen cracking and loss of bond strength between concrete and rebar."[185]

This argument does not support an admissible contention, because it is entirely unsupported and speculative, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors have provided no basis for rebar corrosion, other than their naked speculation about its "potential" for corrosion.[186] FENOC specifically considered "Corrosion of Rebar" as Failure Mode 3.10, and

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181 FENOC August Slides at 39, 41; *see also* August RAI Response at 12.

182 Third Supplement at 10.

183 *Id.*; Revised Root Cause Evaluation at 6.

184 *See* Third Supplement at 10-11.

185 *Id.* at 11.

186 *Id.*

concluded that it was not the cause of the laminar cracking.[187] Intervenors ignore the Revised Root Cause Evaluation, which explains that this failure mode was refuted for multiple reasons, including: "Visual examination of the shield building exterior did not observe excessive cracking, staining or spalling"; "Visual examination of the shield building exterior did not observe excessive rebar corrosion or material loss"; "Sufficient barriers for minimizing rebar corrosion were established including low water permeability concrete mix design, and adequate rebar cover"; and "Destructive examination of concrete cores found an inconsequential carbonation depth."[188] Intervenors have provided nothing to challenge these conclusions, other than counsel's speculation.

Additionally, Intervenors' argument does not challenge either the Shield Building AMP or any other part of the Davis-Besse LRA, and does not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be insufficient to address aging issues related to the Shield Building laminar cracking even if their speculation about rebar were correct.

j. Argument 10 – "Insufficiently-Detailed Extent of Condition Corrective Action #1"

Intervenors repeat one of the NRC Staff's observations on the Root Cause Evaluation: "Extent of Condition Corrective Action #1 for additional investigation of the Shield Building lacks detail, and need[s] to be expanded to confirm the conclusions of the Root Cause Report. (That is, to perform Impulse Response Testing in other safety related structures not subject to the

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187 Revised Root Cause Evaluation at 114.

188 *Id.* Because this information also was included in the February 27, 2012 Root Cause Evaluation, Root Cause Evaluation at 109, any challenge to it now is untimely under the ISO and 10 C.F.R. § 2.309(f)(2)(iii).

Root and/or contributing causes)."[189] Intervenors then assert that "[i]t needs considerable exposition in order to confirm or disaffirm the conclusions of the Root Cause Report – that is, to perform Impulse Response Testing and core-bore analysis in other safety-related structures."[190] This argument does not support an admissible contention.

First, it is untimely. Intervenors could have identified the alleged omission of this additional testing and analysis based on the February 27, 2012 Root Cause Evaluation. Therefore, this argument is untimely because it was filed well after the 60 day time limit specified in the ISO, and does not satisfy 10 C.F.R. § 2.309(f)(2)(iii).

Second, this argument is unsupported, contrary to 10 C.F.R. § 2.309(f)(1)(v), because the Revised Root Cause Evaluation fully addressed the observation that Extent of Condition Corrective Action #1 lacks detail. Specifically, FENOC added a new Extent of Condition Corrective Action #3 to perform the confirmatory examination of a safety-related structure with a waterproof coating.[191] Intervenors provide no basis for why this additional corrective action does not address the NRC's observation. In fact, FENOC has completed its Impulse Response mapping of the other structure (Auxiliary Building), which confirmed that no laminar cracking was present.[192]

Finally, the argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and does not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi).[193] In this regard, Intervenors have not identified a genuine material dispute,

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189 Third Supplement at 9 n.5, 11; Revised Root Cause Evaluation at 7.

190 Third Supplement at 11.

191 *See* Revised Root Cause Evaluation at 66.

192 FENOC August Slides at 39, 41; August RAI Response at 12.

193 Intervenors also fail to even adequately challenge the Revised Root Cause Evaluation. Intervenors claim that Extent of Condition Corrective Action #1 "contains no detail." Third Supplement at 11. Intervenors, however, point to page 59 of the Revised Root Cause Evaluation, which only lists the corrective action. Intervenors ignore Chapter 8 of the Revised Root Cause Evaluation that provides the "Corrective Action Plan" and

because they have not explained why the Shield Building AMP would be insufficient to address aging issues related to the Shield Building laminar cracking even if their claims about insufficient detail for the corrective actions are correct.

k. Argument 11 – "Slip-Form Friction"

Intervenors reference the NRC Staff observation about the Root Cause Evaluation not documenting "all the reviews and evaluations performed that evaluated slip forming induced cracking as a potential failure mode."[194] Intervenors also reference FENOC's response to this observation in the Revised Root Cause Evaluation to provide additional details for Failure Mode 2.12 (Plumb).[195] The Revised Root Cause Evaluation refutes this failure mode for multiple reasons.[196] Intervenors take issue with a disclaimer in the Revised PII Report that PII's evaluation was limited to the documents it had received.[197] This argument does not support an admissible contention.

The only challenge identified by Intervenors relates to PII's disclaimer about available documentation.[198] This argument is not supported, contrary to 10 C.F.R. § 2.309(f)(1)(v). Notwithstanding the limitation to available construction documents, PII was able to make a definitive conclusion that "[t]he out-of-plumb issues did not cause the Laminar Cracks."[199] PII did not assert that some other, unavailable, document was necessary to a conclusion. Additionally, the Revised Root Cause Evaluation provides the following justifications for refuting the out-of-plumb failure mode: "Plumb tolerance issues oriented different than the

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additional details regarding the corrective actions, including Extent of Condition Corrective Action #1. *See* Revised Root Cause Evaluation at 66.

194 Third Supplement at 11; Revised Root Cause Evaluation at 5.

195 *See* Third Supplement at 12; Revised Root Cause Evaluation at 109.

196 Revised Root Cause Evaluation at 109.

197 Third Supplement at 12.

198 *See id.* at 11-13.

199 Revised PII Report at App. VI-34.

laminar cracking locations"; "*The observed cracking through aggregate indicated the laminar cracking occurred after the concrete reached sufficient maturity and not during placement*"; "The effect of the out of tolerance plumb was insignificant to structure integrity"; and "*The rate of slip-form movement was fast enough to minimize friction problems*."[200] Intervenors have provided no basis for disputing any of these conclusions.

Additionally, the argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and does not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be insufficient to address aging issues related to the Shield Building laminar cracking even if their claims about available documentation are correct.

2. The Fourth Supplement Fails to Proffer an Admissible Contention

a. Argument 1 – Ettringite Testing

Intervenors reference the following NRC observations that are reproduced in the Revised PII Report:

> 1. Item 15: Were fracture surfaces or concrete voids tested near the subsurface laminar crack surfaces for the presence [of] Ettringite as was done along the outer surface of the SB core bores to confirm moisture intrusion (e.g. Ettringite)? If not, why was this test not done to confirm that moisture had penetrated to location/depth of laminar cracks? If this testing was done provide the results.[201]

In response to these NRC observations, PII added information to the section of the Revised PII Report that addresses Failure Mode 3.9 (Chemical Attack).

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[200] Revised Root Cause Evaluation at 109.

[201] Fourth Supplement at 3-4; Revised PII Report at i.

Intervenors first allege that the information in this section that states that there is evidence of moisture migration through the concrete for the full depth of the cores over 4 inches indicates that the outer rebar layer has been "overtaken by moisture," "provided a corrosive environment," and "could have contributed to shield building cracking."[202] This is a repeat of an argument Intervenors made in the Third Supplement, which is addressed above in Section IV.B.1.i. Therefore, this argument in the Fourth Supplement is untimely because it was raised more than 60 days after the same underlying information was presented in the May 16, 2012 Revised Root Cause Evaluation, contrary to the ISO and 10 C.F.R. § 2.309(f)(2)(iii).

Nonetheless, as discussed above, this argument also is entirely unsupported, contrary to 10 C.F.R. § 2.309(f)(1)(v), because Intervenors have provided no basis for their concern about rebar corrosion, other than speculation, and have not disputed the detailed explanation in the Revised Root Cause Evaluation of why this failure mode was refuted.[203] Additionally, Intervenors' argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and does not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi).

Intervenors next make a series of unsupported assertions, such as that no actual testing for chemicals has been performed, and that carbonation degradation could affect the Shield Building.[204] These statements are unfounded and contrary to information otherwise provided in the Revised PII Report, and therefore do not provide the required support for an admissible contention, contrary to 10 C.F.R. § 2.309(f)(1)(v). Specifically, Section 3.9 of the Revised PII Report provides a fulsome technical discussion of moisture migration and chemical attack. The discussion of this potential failure mode concludes that a chemical attack did not adversely affect

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202 Fourth Supplement at 4.

203 *See* Revised Root Cause Evaluation at 114.

204 *See* Fourth Supplement at 4-5.

the Shield Building, and that this failure mode did not contribute to the identified cracking.[205] Intervenors have not challenged this extensive technical evaluation in the Revised PII Report. Their argument is entirely unsupported and fails to demonstrate a genuine dispute. Finally, for this argument as well, Intervenors do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi).

b. Argument 2 – Crack Propagation Through Coarse Aggregate

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 2. Item 19: Why did the observed laminar cracking propagate "through" the coarse aggregate instead of around the aggregate? Does this suggest any information about the rate of crack propagation?[206]

Intervenors then reference information in the Revised PII Report that specifically addresses this question:

> Furthermore, examination of the core bores revealed that the cracks propagated through the aggregate which demonstrates a strong bond between the cement paste and aggregate. The propagation of cracks through aggregates is common in mature concrete. In cases like this one, the location and direction of the stresses and resultant cracks is predetermined and, depending on the orientation of the aggregates, may make propagation through the aggregate the 'path of least resistance'. It is possible that propagation through the aggregate requires less energy than through the interface around it.
>
> This cracking through the aggregate does not provide any reliable information about the rate of crack propagation.[207]

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[205] Revised PII Report at App. VII-54.

[206] Fourth Supplement at 6; Revised PII Report at i.

[207] Revised PII Report at 3.

Ironically, Intervenors—who have never themselves advanced any scientific basis, whatsoever, for their myriad speculative concerns—complain that PII's analysis is only "common sense" and does not represent "rigorous scientific review."[208] Additionally, Intervenors complain about PII's conclusion that "[t]his cracking through the aggregate does not provide any reliable information about the rate of crack propagation."[209] Incidentally, Intervenors do not draw any contrary conclusion from the evidence.

This argument does not support an admissible contention. Intervenors generally complain about the technical evaluation of the cracks through aggregates, but provide nothing to dispute or contradict the information in the Revised PII Report. If Intervenors believe that the methodology or conclusions in the Revised PII Report are incorrect, then they need to provide an appropriately supported explanation for why it is incorrect. They have not done so. Therefore, this argument does not provide the requisite support for an admissible contention, contrary to 10 C.F.R. § 2.309(f)(1)(v). Additionally, Intervenors also do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be insufficient to address aging issues related to the Shield Building laminar cracking even if their claims about the crack propagation path are correct.

c. Argument 3 – Carbonation

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 3. Item 20: With the conclusion that the laminar subsurface cracking was not exposed to air, what caused the trace amounts of

[208] Fourth Supplement at 6.

[209] *Id.*; Revised PII Report at 3.

> carbonation identified on the transverse and longitudinal crack surfaces?[210]

Intervenors simply complain about the "troubling admissions" in the PII response regarding carbonation, including the amount of concrete covering the rebar in some places and the testing methods.[211] This information does not support an admissible contention.

Intervenors ignore the significant amount of information and evaluation in the Revised PII Report on this issue. For example, the Revised PII Report explains: "Paste along the fracture surfaces of both cores, associated with those crack locations identified in the core holes, exhibits the same mottled carbonation pattern observed in the body of the cores; however, the paste does not appear to have carbonation due to exposure along the fracture surfaces."[212] The Revised PII Report further explains:

> Observations of 83 fracture surfaces by PII (Exhibit 58) noted [a] similar pattern of carbonation on 23 samples. This thin layer may be related to exposure after the cores were cut and is not considered an indication of deep significant carbonation. The source of carbon dioxide at the observed fracture carbonation is unclear. The carbon dioxide could have been introduced into the fracture dissolved in water, through limited surface cracks or by exposure to air prior to testing.
>
> Since the depth of cover to main reinforcement was 3 inches, the observed rate of carbonation is considered very slow and does not present a problem for the structure. In some locations, cover to outer surface of rebar was found to be as low as 1 inch (25.4mm). This reduced cover is likely the result of exceptional conditions (such as reinforcement overlaps, bundling, or misaligned forms), and is not a problem considering that carbonation reached less than a third of the reduced cover in 40 years.[213]

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210 Fourth Supplement at 7; Revised PII Report at i.

211 Fourth Supplement at 7.

212 Revised PII Report at 4 (quoting CTL Report (Exh. 2)).

213 Revised PII Report at 4.

Based on this information, the Revised PII Report concluded that carbonation of concrete is not a problem at the Davis-Besse Shield Building.[214]

Intervenors fail to challenge or provide any support for a challenge to this information in the Revised PII Report, contrary to 10 C.F.R. § 2.309(f)(1)(v). Additionally, Intervenors also do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be insufficient to address aging issues related to the Shield Building laminar cracking even if their claims about carbonation are correct.

d. Argument 4 – Micro-cracks

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 4. Item 21: States that the lack of micro-cracks on the fracture surfaces eliminates a progressive aging failure mechanism or fatigue. However, in PII repo[r]t; Exhibit 2; page 20 Figure 6b for cores A and D identified micro-cracks and Exhibit 2 Page 30 describes these cracks. Explain the presence/cause of these micro-cracks and why they are not considered or discussed in your conclusions in the RCR on page 25?[215]

Intervenors reproduce the response to these questions in the PII Report, but then claim: "This documented contradiction between CTL & PII regarding micro-cracking is quite significant. The near-surface concrete micro-cracking observed by CTL is almost certainly aging related, and should be addressed for risk significance in a hearing on the merits of this contention."[216]

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214 *Id.* at 5.

215 Fourth Supplement at 7; Revised PII Report at i.

216 Fourth Supplement at 8.

This argument is a repeat of the first argument in the Third Supplement, which addresses the same issue of micro-cracking and the CTL examination.[217] Therefore, this argument in the Fourth Supplement is untimely because it was raised more than 60 days after the same underlying information was presented in the May 16, 2012 Revised Root Cause Evaluation, contrary to the ISO and 10 C.F.R. § 2.309(f)(2)(iii). Nonetheless, as discussed above in Section IV.B.1.a with respect to this argument in the Third Supplement, the argument is based on Intervenors' misunderstanding of the existence and significance of micro-cracking, and is unsupported, contrary to 10 C.F.R. § 2.309(f)(1)(v). Additionally, Intervenors fail to identify the Shield Building AMP or any other part of the Davis-Besse LRA, much less challenge them, and therefore do not raise a genuine dispute on this issue, contrary to 10 C.F.R. § 2.309(f)(1)(vi).

e. Argument 5 – Finite Element Analyses Assumptions Regarding Blizzard Events

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 5. Item 26: Provide and explain the input assumptions for the finite element analyses performed by your vendor (Exhibits 61 and 73) associated with the 1977 and 1978 blizzards events. Also, identify how sensitive your analysis conclusions were to each input assumption (e.g. sensitivity study).[218]

Intervenors then quote the response PII added to the Revised PII Report to state:

> Assumptions: For the assumed depth of penetration of water (3-4"), PII performed a Rilem tube test and got a number very similar to our assumption (2-3"). For the strength we assumed 600-900 psi and tensile tests showed a range of 500-1000 psi. For the strain energy, we performed a calibration to a known crack. The elastic stiffness is validated by test data as well. Moreover, our conclusions are based on a reasonable set of input parameters that result in a plausible failure scenario. There is reasonable assumptions information, but we have determined that all other

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217 *See* Third Supplement at 3-5.

218 Fourth Supplement at 8; Revised PII Report at i.

> possible failure modes are not credible. Traditional sensitivity studies were not performed since this analysis is not a design basis analysis.[219]

Intervenors take issue with the lack of traditional sensitivity studies because this is not a design basis analysis, and state that the Shield Building cracking "requires that robust engineering analysis be performed."[220] This conclusory statement does not support an admissible contention.

The statement has no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). As quoted above from the Revised PII Report, the analyses performed for this root cause evaluation were based on reasonable assumptions based in part on physical testing performed during this investigation. The PII investigation was performed to evaluate potential root causes. This was the appropriate evaluation for the circumstances, and Intervenors have not provided any support for a contrary conclusion. That Intervenors may prefer an alternate approach is irrelevant. Additionally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi).

Intervenors next provide some discussion of the current design and licensing bases for the Davis-Besse Shield Building, but do not identify any problem with any evaluation or other action.[221] These statements do not support an admissible contention, as they do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). These statements also are untimely in that the information upon which they are based was available much earlier than 60 days before the Fourth Supplement. For example, the

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219 Fourth Supplement at 8; Revised PII Report at App. II-5, App. II-6.

220 Fourth Supplement at 9.

221 Issues related to the design and licensing basis by definition are part of the CLB, and therefore are outside the scope of this license renewal proceeding, contrary to 10 C.F.R. § 2.309(f)(1)(iii). This is not an aging management issue for the period of extended operation. *See* Nuclear Power Plant License Renewal, 56 Fed. Reg. at 64,946.

Root Cause Evaluation (dated February 27, 2012) explained as part of Direct Cause Corrective Action #2 that the Shield Building currently does not conform to the plant's licensing basis, and therefore the FENOC Corrective Action Program contains corrective actions to track the return to conformance to the design and licensing basis of this structure.[222] Therefore, these statements are untimely because they were filed well after the 60 day time limit specified in the ISO, and do not satisfy 10 C.F.R. § 2.309(f)(2)(iii). For these reasons, these statements do not support an admissible contention.[223]

f. Argument 6 – Finite Element Analyses Assumptions Regarding Tornado Event

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 6. Item 27: Provide and explain the input assumptions for the finite element analysis performed by your vendor (Exhibit 62) associated with wind loading and the 1998 tornado event. Also, identify how sensitive your analysis conclusions were to each input assumption (e.g. sensitivity study).[224]

Intervenors then quote the response PII added to the Revised PII Report to state:

> Assumptions: The pressure loads due to the 105 mph wind were calculated in a separate [] model and mapped to the Abaqus [] Model. The assumptions and modeling details are provided in Exhibit 67. Page 15, Figure 23 shows the surface pressure contours due to the 105 mph wind speed. Since the stresses are benign (<1 psi) there is no need to perform a sensitivity study. Even a factor of 2 difference in any input parameter will not result in a significant stress change.[225]

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222 *See* Root Cause Evaluation at 62. Intervenors also ignore the calculations discussed in the Root Cause Evaluation, which concluded that the Shield Building remains adequate to perform its design basis functions. *See id.* at 30-31.

223 Intervenors also include baseless allegations about FENOC putting profits ahead of safety. *See* Fourth Supplement at 9-10. As FENOC has explained repeatedly in this proceeding, such statements are outside the scope of this proceeding. *See, e.g.*, *Prairie Island*, CLI-10-27, 72 NRC at 491 ("We specifically indicated that other broad-based issues akin to safety culture – such as operational history, quality assurance, quality control, management competence, and human factors – were beyond the bounds of a license renewal proceeding.").

224 Fourth Supplement at 10; Revised PII Report at i.

225 Fourth Supplement at 8; Revised PII Report at App. II-6.

Intervenors make generalized statements that "all stresses should be very well understood," and "NRC should require FENOC and its contractors like PII to undertake rigorous analysis, including sensitivity studies."[226] These conclusory statements do not support an admissible contention. These statements have no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). As quoted above, the Revised PII Report provides a justified basis for why sensitivity studies are not needed. Intervenors have not challenged this basis. Additionally, the Revised PII Report provides a detailed stress analysis based upon an assumed 105 mph wind load,[227] which also has not been challenged by Intervenors. Furthermore, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi).[228] In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements about stresses and sensitivity studies are correct.

g. Argument 7 – Additional Environmental Scenarios

Intervenors next reference the following NRC observation that is reproduced in the Revised PII Report:

> Item 46: PII states "The second most likely scenario is that during the blizzard, water intruded from the cracks in the dome of the structure and trapped in small gaps between the rebar and concrete. Upon freezing, the volume expansion of ice produced significant radial stresses that resulted in the observed cracking." Is this scenario also identified and explained in the FENOC RCR? If so where? If not, why not? Could a third environmental scenario (e.g. wind-driven rain & freezing conditions, moisture intrusion and loading) [have] existed after completion of the SB wall, but prior

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226 Fourth Supplement at 10.

227 *See* Revised PII Report, Exh. 62.

228 Intervenors complain about the redactions in the Revised PII Report. *See* Fourth Supplement at 10. These redactions were necessary in order to publicly release the PII Report. This is a common practice.

> to dome installation (May 1971-August 1975) [and] generated sufficient forces at inner rebar mat to cause laminar cracks? Was this investigated? Explain.[229]

Intervenors then quote part of the following information in the Revised PII Report that addresses these questions by describing the most likely scenario:

> The primary, most likely scenario, which led to the observed laminar cracking in the Davis-Besse Shield Building, is described in what follows. During the 1978 blizzard, a significant amount of moisture penetrated the wall of the Shield Building. In addition, the Shield Building concrete was also subjected to below freezing temperatures. With the combination of moisture penetration and below freezing temperatures, the outer layers of the Shield Building expanded due to crystallization of the diffused moisture trapped in the concrete. The volume expansion in the outer layer of the concrete, especially in the thick shoulder areas, produced significant radial stresses, which initiated and propagated the laminar cracking in the outer rebar mat. This theory could not be confirmed by direct testing since the limited number of strength tests precluded the possibility of making a statistically significant analysis of such damage. A very large number of tests throughout the structure would have been required and there is no guarantee that the tests would be sensitive enough to identify such variation. The variation in the tests performed points to this problem.[230]

Intervenors first take issue with why the second scenario was not included in the Root Cause Evaluation.[231] As explained above, this second scenario was not determined to be the most likely scenario, and therefore was discussed in the underlying contractor report (PII Report) rather than in the Root Cause Evaluation itself. Intervenors' unsupported allegation does not support an admissible contention.

Intervenors further take issue with the lack of discussion of the top-down moisture penetration scenario in the Revised Root Cause Evaluation.[232] This is similar to their complaint

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229 *Id.* at 11; Revised PII Report at i.

230 Fourth Supplement at 11; Revised PII Report at 6-7.

231 *See* Fourth Supplement at 12.

232 *Id.* at 14.

discussed above about why the second environmental scenario was not included in the Root Cause Evaluation. Similar to this second environmental scenario, the top-down scenario was not determined to be the most likely, and therefore although discussed in the underlying contractor report (PII Report), it was not included in the Root Cause Evaluation itself. Intervenors' unsupported allegation again does not support an admissible contention.

Intervenors also claim that the Revised PII Report does not adequately address a third environmental scenario.[233] This scenario is directly addressed in the Revised PII Report, which states:

> A third environmental scenario assumed that wind-driven rain & freezing conditions, moisture intrusion and loading existed after completion of the SB wall, but prior to dome installation (May 1971-August 1975) and generated sufficient forces at inner rebar mat to cause laminar cracks. This scenario was also addressed in Section 6.02 Failure Mode 2.7 on page 16 and by Fig. 4 on page 17 of the PII Report. Historical records relative to significant snow storms in the Toledo area were reviewed dating back to 1870. Prior to the 1977 blizzard, there was only one major snow storm that struck on December 1st 1975. However, this blizzard was accompanied by milder temperatures (above 20 deg F), relatively weak winds, and was of very short duration (less than 2 days).[234]

Thus, the Revised PII Report provides the alleged missing information.[235] Intervenors have not identified or challenged this information. This cannot support an admissible contention.

Intervenors next state that they "find PII's – and by implication FENOC's – disinterest in rigorous and robust testing and analysis highly troubling" and "NRC has let them get away with it."[236] Similarly, Intervenors question: "could not the various cracking and other degradation at

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233 *See id.* at 13.

234 Revised PII Report at 7.

235 Additionally, the PII Report documents that core boring and inspection of the construction opening revealed no indications of cracking at the inner rebar mat. *See id.* at 17. Additionally, it concludes that "the two potential mechanisms [top-down and external-internal moisture penetration] identified preclude cracking on the inside since it is not exposed to the same deep freezing conditions as the outside." *Id.* Intervenors have provided no information to the contrary.

236 Fourth Supplement at 12-13.

diverse locations on the shield building be attributable to not only the Blizzard of 1978's wind-driven precipitation into the exterior side walls, but also to a top-down dynamic, if not other causes to boot?"[237] Intervenors also "challenge the acceptability of FENOC performing only three full depth core bores."[238] These conclusory and speculative statements do not support an admissible contention.

As quoted above, the Revised PII Report provides a justified basis for determining which scenario was the most likely to cause the laminar cracking, and direct testing was not possible and was unnecessary. Intervenors have not challenged this basis or explained why additional testing would have had any different result. Additionally, Intervenors have provided no support, contrary to 10 C.F.R. § 2.309(f)(1)(v), for any challenge to the conclusions regarding the cause of the laminar cracking or to the number of full depth core bores required to investigate the laminar cracking, but instead simply ask questions and speculate.

Furthermore, these arguments do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). Intervenors do not assert, much less support, how the Shield Building AMP would have to be changed to address one of these alternative environmental scenarios. In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their claims about the environmental scenarios are correct.

Finally, Intervenors already raised an argument in their Second Supplement regarding cracking on the Shield Building dome parapet based on the same information from the Revised

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237 *Id.* at 15.

238 *Id.*

Root Cause Evaluation.[239] As discussed above in Section IV.A, Intervenors may not re-argue this issue when the admissibility pleadings for the Second Supplement have been completed. For this reason as well, this argument should be rejected as untimely.

h. Argument 8 – Ice Crystallization

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 8. Item 47: PII states "Shield Building expanded due to crystallization of the diffused, moisture trapped in the concrete." And on Pg 24 "when an excessive' amount of ice forms in pores, the ice generates cracks in concrete." What concrete tests were performed to confirm this assumption that freezing and crystallization of ice in pores causes internal cracking damage [to] the SB concrete? If no tests were done explain. Were SB concrete tensile and compressive properties tested in the areas assumed affected by ice crystallization? Explain.[240]

Intervenors then quote the response in the Revised PII Report:

> With the combination of moisture penetration and below freezing temperatures, the outer layers of the Shield Building expanded due to crystallization of the diffused moisture trapped in the concrete. The volume expansion in the outer layer of the concrete, especially in the thick shoulder areas, produced significant radial stresses, which initiated and propagated the laminar cracking in the outer rebar mat. This theory could not be confirmed by direct testing since the limited number of strength tests precluded the possibility of making a statistically significant analysis of such damage. A very large number of tests throughout the structure would have been required and there is no guarantee that the tests would be sensitive enough to identify such variation. The variation in the tests performed points to this problem.[241]

Intervenors again complain about "FENOC's lack of rigorous and robust, data-based analysis."[242] This conclusory statement does not support an admissible contention. This

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239 *Compare* Second Supplement at 10-11, *with* Fourth Supplement at 12.

240 Fourth Supplement at 16; Revised PII Report at i.

241 Fourth Supplement at 16; Revised PII Report at 6-7.

242 Fourth Supplement at 16.

statement has no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). As quoted above, the Revised PII Report provides a justified basis for why the crystallization causes significant radial stresses that initiated and propagated the laminar cracking, and direct testing was not possible and was unnecessary. Intervenors have not challenged this basis or explained why additional testing would have had any different result. Additionally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi).[243] In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

i. Argument 9 – Freeze-Thaw Damage

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 9. Item 48: PII, repo[r]t shows picture of standing water between roof dome and parapet and picture stating "freeze-thaw damage in the roof concrete." It appears this condition would allow water to intrude/collect in the parapet to roof joint and if followed by freezing conditions, ice would expand within this joint. What effect would this have on the stress applied to the SB: structures? Was this condition analyzed by FE [Finite Element] techniques? If not, why not? It appears if ice forms within this joint it would create radial stress on the parapet and top of SB wall, at roof (and tensile loads on inside SB wall near roof). Were any examinations (other than visual) performed on the roof or parapet? If not why not. Were any type of examinations conducted at the inside surface of the SB wall just below the parapet to identify cracking? If not why. not? What actions proposed preclude this scenario from causing further cracking (e.g. is top surface sealing identified)?[244]

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[243] Intervenors complain about the redactions in the Revised PII Report. *See id.* at 10. These redactions were necessary in order to publicly release the PII Report. This is a common practice.

[244] *Id.* at 16-17; Revised PII Report at ii.

Intervenors complain that the Revised PII Report does not provide "adequate answers to NRC's important questions. NRC's questions have called attention to a neglected potential cause of significant shield building damage over the past years and decades with portents for the future, *i.e.*, the proposed 20-year license extension."[245] Once again, these conclusory statements do not support an admissible contention.

The statements have no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors do not explain why the response is insufficient, but simply state that it is. Intervenors also misunderstand this analyzed failure mode. The water pictured in the Revised PII Report (Figure 4) is the result of the intentional plugging of one of the Shield Building roof drains as part of the activities required to support replacement of the reactor vessel head. Contrary to Intervenors' implications, this condition is not reflective of usual conditions on the Shield Building roof. Additionally, the Revised PII Report provides a technical evaluation of this issue. Failure Mode 2.7 includes an evaluation of top-down moisture penetration.[246] Intervenors do not challenge this information, and do not explain why it is deficient or would change the results of the root cause evaluation of the Shield Building laminar cracking. This argument is simply unsupported. Additionally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

Furthermore, Intervenors already raised an argument in their Second Supplement regarding cracking on the Shield Building dome parapet and protective sealant based on the same

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245 Fourth Supplement at 17.

246 Revised PII Report at 17-19.

information from the Revised Root Cause Evaluation.[247] As discussed above in Section IV.A, Intervenors should not be permitted to re-argue this issue when the admissibility pleadings for the Second Supplement have been completed. For this additional reason, this repetitive portion of this argument should be rejected as untimely.

j. Argument 10 – Moisture Penetration

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 10. Item 49: Why does this section of the report discuss 2-3 inch penetration for wind driven rain, but other tests used in your FE analysis were based on work at UC Boulder that show 3-4 inch penetration with 90 mph winds?[248]

Intervenors then reproduce the response to this observation in the Revised PII Report, and argue:

> There are only 3 inches of concrete cover over the outer rebar mat. FENOC has acknowledged areas of the shield building where degradation, construction errors, etc. have resulted in even less concrete cover over the outer rebar mat. A 3-4 inch penetration could thus lead to rebar exposure to moisture, which could corrode rebar, leading to crack initiation or propagation. Four (4) inches of moisture penetration could also do more structural damage to concrete than 2 inches of moisture penetration.[249]

This is a repeat of an argument Intervenors made in the Third Supplement, which is addressed above in Section IV.B.1.i. Therefore, this argument in the Fourth Supplement is untimely because it was raised more than 60 days after the same underlying information was presented in the May 16, 2012 Revised Root Cause Evaluation, contrary to the ISO and 10 C.F.R. § 2.309(f)(2)(iii). Nonetheless, as discussed above, this argument also is entirely unsupported, contrary to 10 C.F.R. § 2.309(f)(1)(v), because Intervenors have provided no basis

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247 *Compare* Second Supplement at 3-5, 10-11, *with* Fourth Supplement at 17-18.

248 Fourth Supplement at 18; Revised PII Report at ii.

249 Fourth Supplement at 19.

for rebar corrosion, other than their speculation, and have not disputed the detailed information in the Revised Root Cause Evaluation that explains that this failure mode was refuted.[250] Additionally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements about moisture penetration are correct.

k. Argument 11 – 1977 Blizzard

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 11. Item 50 (Exhibit 61): PII judged the 1977 blizzard to be the "second worst" in terms of environmental factors which can cause laminar cracking:' Could this laminar cracking have been caused by the 1977 blizzard since according to Exhibit 61 of the PII repo[r]t stresses during this blizzard approached the tensile strength of the concrete and may exceed this level when modeling accuracy is considered? Also; identify the expected FE model accuracy for this application and how it was[] determined (e.g. benchmarked)?[251]

Intervenors then reproduce the information related to this observation in the Revised PII Report:

> Out of the top 3 blizzards to which the Davis-Besse Shield Building has been subjected, the root cause investigation found that the most likely triggering event is The Toledo Blizzard of 1978. Only this scenario had the existing combination of wind, moisture and temperature extremes to generate the significant stresses required to produce the observed laminar cracking. To confirm, the second worst blizzard, occurring in 1977, was also analyzed using finite element thermal and stress analysis. The

[250] To the extent Intervenors are referring to the potential for water penetration causing rebar corrosion in the future, they entirely ignore Root Cause – Preventive Action #1 to establish a Shield Building exterior sealant system. Revised Root Cause Evaluation at 68.

[251] Fourth Supplement at 19; Revised PII Report at ii.

> results show that the radial stresses do not exceed the tensile capacity of the concrete and therefore most likely could not have contributed to the observed crack. The 1977 Blizzard stress analysis suggests that the peak max principal stress approached the tensile strength. However, the area of high stress is limited to a very small area (See Figures 14 -17). The stress contours during the 1978 Blizzard (shown in Figures 7 -13) show a significantly larger area subjected to high stresses. The difference in the stress results during the two Blizzards is significant and larger than the expected uncertainty in modeling. This is based on engineering judgement. There was no sensitivity analysis performed.[252]

Intervenors take issue with the use of engineering judgment and the lack of a sensitivity analysis to determine which of the blizzards initiated the cracking.[253] These conclusory statements do not support an admissible contention. These statements have no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). As quoted above, the Revised PII Report provides a justified basis for why it concludes that the 1978 Blizzard had higher stresses than the 1977 Blizzard, and why engineering judgment was used and sensitivity studies are not needed. Intervenors have not challenged this basis. Additionally, Intervenors provide no explanation for why they are concerned about whether the initiating event was the 1978 Blizzard or the 1977 Blizzard. Furthermore, the Revised PII Report shows that the 1978 Blizzard provided the worst case blizzard,[254] and Intervenors have not provided sufficient facts to challenge this conclusion. Finally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

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252 Revised PII Report at 6.

253 Fourth Supplement at 20.

254 *See* Revised PII Report at 23-24.

l. Argument 12 – Cracking Parameter Sc

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 12. Item 51: The equation for cracking parameter Sc uses a concrete tensile strength of 973 psi. This is not consistent with root cause and other PII report sections that indicate 600 psi is a more representative number. Why was this number used and what impact does it have on the analysis and conclusions?[255]

Intervenors then quote the response in the Revised PII Report:

> **Note:** The measured F_t value of 973 psi was replaced with 'effective strength' of 600 psi for the cracking models since experience shows that it is necessary to use a lower "effective" strength in the cracking models for multiple reasons.[256]

Intervenors make the unsupported speculation that "PII and FENOC may have used non-conservative figures/values for shield building strength, and accordingly, Intervenors urge NRC not to allow such a practice in its license extension regulatory reviews."[257] This statement does not support an admissible contention because it is speculative in nature, unsupported, and contrary to 10 C.F.R. § 2.309(f)(1)(v). As quoted above, PII explained that it replaced the value of 973 psi questioned by the Staff and replaced it with a lower effective strength of 600 psi. Intervenors' statement about non-conservative values is unfounded in fact.

Intervenors then reference and quote a couple of NRC Staff e-mails from November 2011, focused on calculations regarding the Shield Building laminar cracking, including Calculations C-CSS-099.20-054, -055, and -056.[258] These calculations are referenced in the Root Cause Evaluation.[259] Calculation C-CSS-099.20-055 evaluated the adequacy of the steel

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255 Fourth Supplement at 20; Revised PII Report at ii.

256 Fourth Supplement at 21; Revised PII Report at 6-7.

257 Fourth Supplement at 21.

258 *See id.* at 21-24, and attached e-mails.

259 *See* Root Cause Evaluation at 69.

reinforcing for attachment of the flute shoulders to the remainder of the Shield Building.[260] The overall analysis of the Shield Building walls is documented in Calculations C-CSS-099.20-054 and -056 for the vertical reinforcement and hoop reinforcement, respectively.[261]

Intervenors' discussion of these e-mails does not support an admissible contention. The e-mails are dated November 2011, and represent an in-process review by the NRC of Calculations C-CSS-099.20-054 and -056, not the final calculations that were reviewed and determined to provide a reasonable basis for functionality. The Revised Root Cause Evaluation demonstrates that the final versions of Calculations C-CSS-099.20-054 and -056 were approved on December 1, 2011 and December 5, 2011, respectively, which is after the interactions with the Staff on the calculations.[262] Moreover, in the May 2012 NRC Inspection Report, the NRC Staff documented its review of these calculations and its lack of adverse findings.[263] This is further supported by the June 2012 NRC Inspection Report that supported the causes and corrective actions in the Revised Root Cause Evaluation.[264] For all of these reasons, Intervenors' statements do not provide adequate support for an admissible contention, contrary to 10 C.F.R. § 2.309(f)(1)(v).

Finally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

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260 *See* Revised Root Cause Evaluation at 74.

261 *See id.*

262 *Id.*

263 *See* May 2012 NRC Inspection Report at 9-11, Attachment, at 3-4.

264 June 2012 NRC Inspection Report, Enclosure, at 1-2.

m. Argument 13 – Out-of-Plumb Condition

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 13. Item 52: FM 2:12 discusses Out of Plumb condition of SB walls (original construction field report No. 5), but did not investigate effect of this condition on the friction forces at the slip forms: Specifically, the out of level condition can create higher fiction forces on slip forms which can cause internal laminar tears/cracking the uncured concrete at the reinforcement steel. Identify and provide the tests/analysis performed to rule out this potential cause as the initiation site for the laminar cracking observed. If no investigation of this potential cause was performed identify planned corrective actions. Reference "Slip forming of Vertical, Concrete Structures Friction between concrete and slipform panel" by Kjell Tore Fossa -Dr. Thesis-Section Below from Chapter 2, pg 33 of this document."
> Delamination of the concrete in the cover zone is concrete separated or displaced from the substrate: A vertical crack in the cover zone parallel to the reinforcement and sometimes invisible on the surface, is delamination of concrete. Delamination is also areas where the concrete in the cover zone is lifted together with the panel and makes the cover deficiency on the wall face clearly visible. Delamination is often related to:
> -Problems during start up,
> -Geometry changes,
> -Area above embedment plates and block outs
> -the slipform is not in level"[265]

Intervenors take issue with the disclaimer in the Revised PII Report that PII's evaluation was limited to the documents it had received.[266] This is a repeat of an argument Intervenors made in the Third Supplement, which is addressed above in Section IV.B.1.k. Therefore, this argument in the Fourth Supplement is untimely because it already was raised in the Third Supplement.

Nonetheless, as discussed above, this argument also is entirely unsupported, contrary to 10 C.F.R. § 2.309(f)(1)(v), because Intervenors provide no basis for disputing the PII conclusion

[265] Fourth Supplement at 24-25; Revised PII Report at ii.

[266] *See* Fourth Supplement at 25.

that "[t]he out-of-plumb issues did not cause the Laminar Cracks" and the justification in the Revised Root Cause Evaluation for refuting the out-of-plumb failure mode.[267] Additionally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi).

Intervenors also make generalized statements about the out-of-plumb condition, allegations that Bechtel "largely chose to ignore out-of-plumb stresses," and "how carefully even CTL, FENOC's contractor, checked for shield building damage due to out of plumb slip form friction forces."[268] These conclusory statements do not support an admissible contention. Moreover, as explained in the Revised PII Report, the laminar cracks extend through the concrete aggregate, which is indicative of cracking through concrete that has attained sufficient strength and refutes the slip form friction as a potential cause for this cracking.[269] Intervenors have not disputed this conclusion. Intervenors' statements have no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors have provided no basis for disputing the evaluation of the out-of-plumb issues. Additionally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

n. Argument 14 – Debonding

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

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267 Revised PII Report at App. VI-34; Revised Root Cause Evaluation at 109.

268 Fourth Supplement at 26.

269 Revised PII Report at VI-34.

> 14. Item 54: PII, modeling suggests that SB laminar cracking initiated by debonding at the interface of concrete/ rebar along the outer reinforcement; however core bore laminar crack depths exist away from the rebar mat depth. How is this possible explain?[270]

Intervenors then quote the response in the Revised PII Report:

> Note that the models' suggestion that SB laminar cracking initiated by debonding at the interface of concrete/ rebar along the outer reinforcement may appear to conflict with the observation that some core bore laminar crack depths exist away from the rebar mat.
>
> However, in concrete, cracks that initiate at the concrete/rebar interface may 'wander' through the 'path of least resistance' as it propagates. Variation in localized material strength could readily cause such crack 'wandering'. It is likely that these cores encountered such condition.[271]

Intervenors speculate that "the explanations could very well be off base" and the explanation "is not a rigorous, robust analysis based on empirical evidence."[272] This argument does not support an admissible contention. Intervenors generally complain about PII's response, but provide nothing to dispute or contradict the information in the Revised PII Report. If Intervenors believe that the methodology or conclusions in the Revised PII Report are incorrect, then they need to identify a reason for why they are incorrect. They have not done so. Therefore, this argument does not provide the requisite support for an admissible contention, contrary to 10 C.F.R. § 2.309(f)(1)(v).

Additionally, Intervenors also do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute,

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[270] Fourth Supplement at 26; Revised PII Report at ii.

[271] Fourth Supplement at 26-27; Revised PII Report at 33.

[272] Fourth Supplement at 27.

because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

o. Argument 15 – Modeling for Crack Propagation

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 15. Item 55: PII model suggests crack propagation by freezing the void fraction available in the concrete. What modeling was done to evaluate crack propagation which did not occur by freezing (e.g.: laminar cracking identified in the MS room near areas that have been confirmed to remain above 100F during operation)? If no modeling can explain this crack propagation identify why this crack exists.[273]

Intervenors then quote the response in the Revised PII Report:

> Accordingly, the laminar cracking identified in the MS room near areas that have been confirmed to remain above 100F during operation can be explained by a weakened plane in the concrete, created by the presence of very high density rebars in the OF rebar mat plane. This plane allows a crack to propagate with relatively little motivating force.[274]

Intervenors then argue that "PII has further admitted that dense spacing of rebar has inevitably led to a significant design flaw that compromises shield building integrity," "PII has not clearly communicated empirical calculations showing the safety significance of this admission," and this "certainly violates Davis-Besse's licensing design basis conformance."[275] These statements do not support an admissible contention.

First, this information is not new. The February 27, 2012 Root Cause Evaluation identified that dense rebar spacing was Contributing Cause #3.[276] Therefore, this argument is

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[273] *Id.*; Revised PII Report at ii.

[274] Fourth Supplement at 28; Revised PII Report at 32.

[275] Fourth Supplement at 28.

[276] *See* Root Cause Evaluation at 60.

untimely because it was filed well after the 60 day time limit specified in the ISO, and does not satisfy 10 C.F.R. § 2.309(f)(2)(iii).

Second, Intervenors' statements also are unsupported, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors' allegation that there are no calculations regarding the safety significance of the cracking is false and misleading. As shown above, Intervenors themselves are aware of the calculations of the strength of Shield Building walls that are documented in Calculations C-CSS-099.20-054 and -056.[277]

Third, Intervenors' challenges regarding Davis-Besse's licensing design basis conformance are outside the scope of this license renewal proceeding, contrary to 10 C.F.R. § 2.309(f)(1)(iii), because design basis and licensing basis issues are by definition part of the CLB.

Finally, Intervenors also do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.[278]

p. Argument 16 – Thermal Conductivity Basis

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 16. Item 56: Why was the thermal conductivity of the SB concrete 50% higher than the highest range expected for concrete? Did this contribute to an increased depth of freezing such that the area susceptible to cracking was at the outer rebar mats?[279]

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277 *See* Revised Root Cause Evaluation at 74.

278 Intervenors complain about the redactions in the Revised PII Report. *See* Fourth Supplement at 28. These redactions were necessary in order to publicly release the PII Report. This is a common practice.

279 *Id.* at 29; Revised PII Report at iii.

Intervenors then quote the response in the Revised PII Report:

> The thermal properties of concrete reported in Exhibit 59 depend on many parameters such as moisture content of concrete and type of aggregate. The important thermal parameter is the thermal diffusivity which includes the effects of both conductivity and specific heat.[280]

Intervenors first complain about the existence of redactions in the Revised PII Report, even though the redactions are unrelated to the response to the Staff's observation on thermal conductivity.[281] The redactions remove confidential and proprietary information in the Revised PII Report to allow the report to be made publicly available. This is common practice.

Aside from their complaints about redactions, Intervenors pose a number of questions about thermal conductivity and Shield Building cracking.[282] A list of questions does not provide the support for an admissible contention required by 10 C.F.R. § 2.309(f)(1)(v). Intervenors also have failed to challenge the statement in the Revised PII Report, quoted above, that thermal diffusivity is the important thermal parameter,[283] and have provided no discussion or basis for why the thermal conductivity is problematic. Finally, Intervenors do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

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280 Fourth Supplement at 29; Revised PII Report at 39.

281 *See* Fourth Supplement at 29.

282 *See id.* at 29-30.

283 As stated in Exhibit 59 of the Revised PII Report, "Thermal diffusivity measures the rate at which temperature changes take place in concrete and is defined as an index of the facility with which a material will undergo temperature change." Revised PII Report, Exh. 59, at 1. Exhibit 59 includes the results of testing for thermal diffusivity of Davis-Besse concrete, which shows that the thermal diffusivity falls within typical ranges of thermal properties for normal concrete. *Id.*, Exh. 59, at 2.

q. Argument 17 – High Thermal Conductivity

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 17. Item 57: It does not appear that the FE stress analysis of the SB incorporated the abnormally high thermal conductivity measured for the SB (exhibit 59): Instead, only the measured coefficient of thermal expansion was included in the FE analysis. Why didn't the FE analysis account for the uniquely high thermal conductivity measured for the SB concrete? What effect would it have on the analysis to account for this parameter?[284]

Intervenors then quote the response in the Revised PII Report.[285] Referring to a statement about abnormally high thermal conductivity and specific heat, Intervenors state that the NRC already has asked whether this contributed to the cracking and "[n]either PII nor FENOC have answered that question adequately, if at all," and claim the root cause evaluation did not address substandard concrete.[286] These statements do not support an admissible contention.

Intervenors have not provided the support required by 10 C.F.R. § 2.309(f)(1)(v). Intervenors simply ignore the explanation in the PII Report, explaining that thermal diffusivity is the important thermal parameter.[287] Exhibit 59 of the PII Report includes the results of testing for thermal diffusivity of Davis-Besse concrete, which shows that the thermal diffusivity falls within typical ranges of thermal properties for normal concrete.[288] Intervenors have provided no basis to demonstrate the existence of substandard concrete or any negative impact of a high thermal conductivity or specific heat on conclusions in the root cause evaluation or the corrective

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284 Fourth Supplement at 30; Revised PII Report at iii.

285 Fourth Supplement at 30.

286 *Id.*

287 *See* Revised PII Report at 39.

288 *Id.*, Exh. 59, at 2.

actions. The Revised PII Report even concludes that "there is no observable material degradation in all other aspects of the concrete, such as concrete placement, creep coefficient, young's modulus of elasticity, heat capacity, *thermal diffusivity*, air entrainment, or freeze-thaw resistance."[289] Finally, Intervenors do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be inadequate to address aging issues related to the Shield Building laminar cracking even if their statements about thermal conductivity are correct.[290]

r. Argument 18 – Tensile Strength

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 18. Item 58: How was the tensile strength of the SB concrete range of (836 to 962) used in this analysis determined? Why was the tensile strength representative of the concrete properties in 1977 and 1978? Explain?[291]

Intervenors then quote the response in the Revised PII Report:

> PII performed extensive analyses of fracture-surface characterization and measurements of concrete material properties. Laboratory tests performed on concrete cores extracted from the Shield Building show that the concrete has both high compressive and tensile strength characteristics. Strength increase in concrete is larger at early ages and stabilizes after a few years; on the other hand, the strengths of concrete can decrease over time due to aging related deterioration mechanisms such as freeze-thaw cycles and chemical attacks. There was no available data to determine the strength development rate for the SB wall concrete.[292]

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289 *Id.* at 3 (emphasis added).

290 Intervenors complain about the redactions in the Revised PII Report. *See* Fourth Supplement at 30. These redactions were necessary in order to publicly release the PII Report. This is a common practice.

291 *Id.* at 31; Revised PII Report at iii.

292 Fourth Supplement at 31; Revised PII Report at 2-3.

Intervenors complain that PII responded with qualitative arguments, instead of "specific empirical data," and that "tensile strength values as low as 500 to 600 psi may be more appropriate than PII's values of 836 to 962 psi."[293] These statements do not support an admissible contention.

Intervenors have provided no support for their allegations, contrary to 10 C.F.R. § 2.309(f)(1)(v). The Revised PII Report explains: "Based on established strength development rates from long term research it is plausible to assume that between 1978 and the present the concrete may gain very little [strength]. By using current strength to model 1977 and 1978 we took a conservative approach."[294] The PII Report further explains: "The strength range of 836 to 962 was only used to set the stress contour limits for the figures in the Exhibit. The value 900 psi was chosen to represent approximate stress needed to be exceeded to crack the concrete and used as a visual indicator in the stress contour figures only."[295] Intervenors provide no basis to dispute this information and the conservative nature of this assumption, but instead provide unsupported conclusory statements. Finally, Intervenors do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

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[293] Fourth Supplement at 31.

[294] Revised PII Report at 3.

[295] *Id.*

s. Argument 19 – Radial/Bending Loads

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 19. Item 59: Can a radial/bending loads induced by off-center loads applied on the dome (e.g. uneven snow loads or unbalanced dead load for dome/parapet) be transmitted to the top of the shield building wall? If not explain. If so should this have been incorporated into the FE models?[296]

Intervenors then quote the response in the Revised PII Report:

> 3. An uneven snow load could transfer load to the top of the SB wall, but it wouldn't be any worse than the entire roof filling up with water. A previous vendor did a calc on the latter and the stresses were relatively small. This also wouldn't explain why there was cracking all the way down the wall, so it was never considered as a significant contributor to the laminar cracking.[297]

Intervenors take issue with PII's response that an uneven snow load "wouldn't be any worse than the entire roof filling up with water," disparaging this as a "flippant response."[298] Although Intervenors do not like how the Revised PII Report is worded, they have failed to provide support for why PII's explanation is faulty. Therefore, Intervenors have not provide adequate support for an admissible contention, contrary to 10 C.F.R. § 2.309(f)(1)(v).[299]

Intervenors also speculate about whether small stresses on a "shield building as cracked and otherwise degraded as Davis-Besse's could be the straw that breaks the camel's back," and that the "uneven snow load risk is even more significant when considered in combination with the 'out of plumb' shield building design flaw."[300] This speculative statement does not support

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296 Fourth Supplement at 32; Revised PII Report at iii.

297 Fourth Supplement at 32; Revised PII Report at 92.

298 Fourth Supplement at 33.

299 Intervenors also repeat statements and arguments related to the NRC seventh area of questioning (Item 46). *See id.* These issues are addressed above, and are not repeated here.

300 *Id.* at 33-34.

an admissible contention, and is entirely devoid of support, contrary to 10 C.F.R. § 2.309(f)(1)(v). As quoted above, the Revised PII Report provides a justified explanation for addressing the snow load question raised by the NRC. Intervenors have not challenged this basis, but instead ask questions and speculate.

Furthermore, these arguments do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

t. Argument 20 – Location and Crack Size Assumptions

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 20. Item 60: Why was this location and size of crack on the SB selected to evaluate crack propagation? Is it the highest stress location for this type of cracking, explain?[301]

Intervenors then quote the response in the Revised PII Report:

> 4. [Exhibit 56] [Page 79]. The size and location for the 30'x30' simulated "crack" was selected to approximate the same location as the physically observed 30' crack.[302]

The entirety of Intervenors' input for this argument is:

> Intervenors' concern still remains, that PII has cherry-picked areas of the shield building for analysis that do not represent the areas with lowest margin of safety, and loads that do not represent the most damaging potential loads, especially in combination with other loads, especially considering the comprehensive damage already known in Davis-Besse's shield building which requires an accounting.[303]

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[301] *Id.* at 34; Revised PII Report at iii.

[302] Fourth Supplement at 34; Revised PII Report at 92.

[303] Fourth Supplement at 35.

This argument does not support an admissible contention, because Intervenors have not provided the support required by 10 C.F.R. § 2.309(f)(1)(v). Intervenors have identified no problems with the evaluation, only their general statement that they remain concerned or that even more conservative assumptions would be preferable. In this regard, Intervenors provide no basis for their statement that "PII has cherry-picked the areas of the shield building for analysis that do not represent the areas with lowest margin of safety,"[304] especially when PII explains that the selected crack is based on the approximate dimensions of the cracking identified in the Shield Building (through Impulse Response testing and core bores). Additionally, Intervenors' claims of cherry-picking are at odds with FENOC's completion of Impulse Response testing of all accessible areas of the Shield Building, which validated the original conclusions in the Root Cause Evaluation regarding the locations and extent of the Shield Building laminar cracking.[305]

Additionally, Intervenors do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

u. Argument 21 – Design Loading

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 21. Item 61: Why wasn't the maximum design loading in the lowest margin areas of the SB assumed for this crack growth analysis (e.g. seismic loads/design wind loads including tornado driven missile impacts)? If the design loading was considered

304 *Id.*

305 *See* FENOC August Slides at 41-42; August RAI Response at 9.

> could the cracks propagate? (e.g. What combination of design and service loads could cause the existing cracks to propagate?[306]

Intervenors then quote the response in the Revised PII Report:

> 5. The thermal transient analysis conditions were chosen as the design load conditions because these thermal loads are the only conditions that produce radial stresses of any significant magnitude tending to open pre-existing cracks. Wind, seismic and tornado loads do not produce any significant stresses of any nature at the location of 30' "crack".[307]

Intervenors allege that "PII repeatedly ducks the NRC's safety-significant questions" and speculate that PII "may have cherry-picked less vulnerable areas of the shield building, as well as incorporating smaller assumed loads into calculations, to avoid identifying areas of the shield building particularly vulnerable to crack propagation over time."[308] This argument does not support an admissible contention, because Intervenors have not provided the support required by 10 C.F.R. § 2.309(f)(1)(v). Intervenors have not challenged the design load conditions and have identified no problems with the PII evaluation. Instead, they have provided only speculative statements about ducking questions, and that PII "may have cherry-picked" areas of the Shield Building. They provide no basis for these conclusory and speculative statements, especially when the statement quoted above explains that the design load conditions were chosen because these loads "are the only conditions that produce radial stresses of any significant magnitude tending to open pre-existing cracks."[309] Intervenors' claims of cherry-picking are at odds with FENOC's completion of Impulse Response testing of all accessible areas of the Shield Building,

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306 Fourth Supplement at 35; Revised PII Report at iii.

307 Fourth Supplement at 35; Revised PII Report at 92.

308 Fourth Supplement at 35.

309 Revised PII Report at 92.

which validated the original conclusions in the Root Cause Evaluation regarding the locations and extent of the Shield Building laminar cracking.[310]

Additionally, Intervenors do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi).[311] In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

v. Argument 22 – Stress Amplification

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 22. Item 62: States "Therefore it is not believed that the increased magnitudes in either the radial or maximum principal stresses are sufficient to propagate cracks that may have formed under normal thermal and environmental conditions, such as winter and summer." What is the magnitude of the stress amplification assumed at the tip of the laminar crack front? And what is the level of tensile stress (mode I) or shear stress (mode II) is required to drive this crack based upon the stress concentrations? Work in Sweden that indicates non-linear FE models have been used to predict cracking of reinforced concrete under shear loads. Why wasn't a similar FE model developed to evaluate the potential for growth of the existing cracking? Why isn't a more refined FE model or other applicable analysis needed as part of the corrective actions to monitor crack growth to ensure monitoring plans are adequate?[312]

Intervenors then quote from the Revised PII Report:

> As summarized in Table 6 the magnitude of maximum principal stresses increased a slight amount from σ_{MP}= 162 psi (No crack) to σ_{MP}= 184 psi (w/crack). There is only a marginal increase in the

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310 *See* FENOC August Slides at 41-42; August RAI Response at 9.

311 Intervenors also quote from the NRC e-mails discussing the Shield Building calculations. *See* Fourth Supplement at 36. As explained above, however, these e-mails pre-dated the final calculations, and therefore do not support an admissible contention.

312 *Id.*; Revised PII Report at iii.

> magnitude of radial stress, from σ_R= 76 psi (No crack) to σ_R= 92 psi (w/crack). . . .
>
> Therefore it is not believed that the increased magnitudes in either the radial or maximum principal stresses are sufficient to propagate cracks that may have formed under normal thermal and environmental conditions, such as winter and summer. The stress concentrations, mode I and mode II stresses are calculated by the solver in the cracking models.[313]

Intervenors state that the "NRC is reasonable in asking PII why state-of-the-art Finite Element models, as used in Sweden, have not been used to analyze the Davis-Besse shield building risk for crack propagation."[314] Intervenors' argument demonstrates that they misunderstand the question and PII's response. As noted in Exhibit 56 of the Revised PII Report, a three dimensional Finite Element analysis model was developed and used in the analysis of the Shield Building. Additionally, Intervenors ignore the actual response to the NRC's observation, which explains that only PII's modeling technology has been validated for predicting the cracking at issue here.[315] This statement provides PII's response to NRC questions about the modeling used in the PII Report and justifies use of the modeling. Intervenors have not challenged this explanation, and therefore this argument is not adequately supported, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors have provided no other sufficient challenges to the modeling used by PII.

Additionally, Intervenors do not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, and do not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi).[316]

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313 Fourth Supplement at 36-37; Revised PII Report at 87.

314 Fourth Supplement at 37.

315 Revised PII Report at 88.

316 Intervenors make the general statement that "FENOC's AMP fail[s] to answer or account for the NRC's safety-significant, aging-related questions." Fourth Supplement at 37. Intervenors, however, do not explain what should be changed in the Shield Building AMP, or why these changes are necessary. This general,

w. Argument 23 – Propagation into Main Steam Line Room

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 23. Item 63: Ice could not form in the main steam line room areas, where laminar cracking was identified. How did laminar cracking propagate into this area without ice formation and how long did this propagation take? (e g. minutes, hours, days, weeks?) Based on Exhibit 75 sub model near top of aux building roof, the cracking is not predicted to propagate once the crack has initiated due to differential thermal expansion and freezing process, so why did the crack propagate into the main steam line room? If this cannot be explained based upon the model developed why not?[317]

Intervenors then quote the response in the Revised PII Report:

> 6. The presence of laminar cracks in the steam room does not contradict the freezing mechanism. In places where there is a very high density of rebar in a single plane (and therefore a very low density of concrete in that plane, like a perforated paper towel) it is possible for a crack to propagate due to initiation of cracking in an adjacent region. Based on the IR mapping data provided by Davis-Besse, the cracks around the main steam lines coincide with regions of very high-density rebar and have arrested near the boundary of these regions. This is entirely compatible with the most likely failure mode identified.[318]

As acknowledged by Intervenors, this is a repeat of an argument Intervenors made in the Third Supplement, which is addressed above in Section IV.B.1.d. Therefore, this argument is untimely because it was filed well after the 60 day time limit specified in the ISO, and does not satisfy 10 C.F.R. § 2.309(f)(2)(iii). This argument also is entirely unsupported, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors provide no basis for any challenge to the adequacy of the

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unsupported statement does not support an admissible contention. In this regard, Intervenors also have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

317 *Id.*; Revised PII Report at iii.

318 Fourth Supplement at 38; Revised PII Report at 92.

Root Cause Evaluation or PII Report, and no basis to challenge the corrective actions identified in the Revised Root Cause Evaluation.

Additionally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

x. Argument 24 – Maximum Depth of Penetration

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 24. Item 64: What was the exact number used as an input to the finite element model for the maximum depth of penetration where moisture levels would generate expansion of material vice contraction, (e.g. exceeded relative humidity of 93%). How sensitive is this model to this assumed moisture penetration depth? Specifically, if the depth is one inch less or one inch more, will it change the predicted crack initiation depth or growth rate?[319]

Intervenors then quote the response in the Revised PII Report:

> 7. The exact depth of penetration used as input to the FE model varies. In "1D" areas, it is 4" or less. In "2D" areas, it is 14" or less. An inch one way or the other would shift the crack location about an inch -- but a rigorous sensitivity study was not performed since we are not modeling growth rate.[320]

Intervenors state that a "rigorous sensitivity study should have been . . . performed" and "PII and FENOC should model growth rate."[321] Intervenors also state that "14 inch deep cracking is significant, given that the shield building walls are 30 inches thick" and they question "the ability of those deeply-cracked locations on the shield building to fulfill their radiologically-

[319] Fourth Supplement at 38; Revised PII Report at iii.

[320] Fourth Supplement at 39; Revised PII Report at 92.

[321] Fourth Supplement at 39.

critical function."[322] These open-ended questions and conclusory statements do not support an admissible contention.

These statements have no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors are not correct that the 14-inch deep cracking occurs in the 30-inch thick portion of the shield building; instead, the areas where the cracks exceed approximately 4 inches from the face of the concrete occur in the shoulder areas of the structure, with the 14-inch depth of moisture penetration/cracking occurring in the thick end of the shoulders, where the concrete thickness is increased by approximately 18 inches.[323] Additionally, Intervenors provide no basis for why additional sensitivity studies are necessary or why the information regarding cracking depth is incorrect, or for disputing any other information presented in the Revised Root Cause Evaluation or Revised PII Report. Moreover, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi).

Intervenors also point to two new statements in the Revised PII Report and provide their commentary. The first item states that moisture penetration tests "performed at the University of Colorado at Boulder, followed the procedure detailed in Exhibit 52 since there is no ASTM standard test appropriate for this purpose."[324] Intervenors simply state that they need a hearing because they "are concerned that the shield building cracking at Davis-Besse is uncharted territory, as reflected in the PII statement that 'there is no ASTM standard test appropriate for this purpose.'"[325] Intervenors confuse the burden. At the contention pleading stage, the burden is theirs to show a material issue is in dispute. This completely unsupported statement about

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322 *Id.*

323 *Id.*; *see* Revised PII Report at 92.

324 Fourth Supplement at 39.

325 *Id.* at 40.

Intervenors' concerns does not provide the support for a contention or the genuine dispute that are required by 10 C.F.R. §§ 2.309(f)(1)(v) and (vi).

The second item relates to "Six core-bores [that] revealed evidence of multiple laminar cracks in the same area of the outside face reinforcement."[326] After quoting this information, Intervenors speculate that they "believe that PII may have cherry-picked locations on the shield building with less significant cracking, while intentionally avoiding other areas that may have even more significant cracking."[327] Similar to the above statement, this completely unsupported statement about Intervenors' belief does not provide the support for a contention or the genuine dispute that are required by 10 C.F.R. §§ 2.309(f)(1)(v) and (vi). Additionally, Intervenors' claims of cherry-picking are at odds with FENOC's completion of Impulse Response testing of all accessible areas of the Shield Building, which validated the original conclusions in the Root Cause Evaluation regarding the locations and extent of the Shield Building laminar cracking.[328]

y. Argument 25 – 1978 Blizzard Conditions

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 25. Item 1&2: Finite element analysis evaluated a set of parameters that resulted in laminar cracking - necessary parameters. Explain the engineering judgment and assumptions that concluded 1978 blizzard conditions (rain, wind, temperature) resulted in the finite element analysis necessary parameters that resulted in shield building laminar cracking. Explain how 1978 blizzard conditions can explain cracking in the entire shield building. For example, if blizzard wind was in a single direction, how was water driven into all flute shoulders explained?[329]

Intervenors then quote the response in the Revised PII Report:

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326 *Id.*

327 *Id.*

328 *See* FENOC August Slides at 41-42; August RAI Response at 9.

329 Fourth Supplement at 40; Revised PII Report at iii-iv.

8. A qualitative elimination analyses was performed for all possible events. The analysis concluded that the blizzard of 1978 was the only event that can possibly generate the damage. The externally necessary conditions are high speed wind driven rain which facilitated a large amount of moisture penetrated into the concrete. The internally (intrinsically) necessary condition is the expansive nature of the concrete upon the formation of ice under low temperatures.[330] The blizzard of 1978 produced a "perfect storm" that combined all necessary conditions and make them sufficient to generate the damage. All necessary parameters (external loading parameters and internal material parameters) are random variables to a certain extent, such as wind speed, wind direction, temperature, coefficient of thermal expansion, compressive strength, and modulus of elasticity of concrete. Therefore, general trends of structural responses are more important than a specific response to a combination of input parameters. In order to simulate the general trend of the damage process by the FE method, the necessary parameters used as inputs for the FE analyses are either average values of test data obtained from the concrete cores available to PII during the project period or typical values collected based on our extensive literature search. The general trend of stress output of the FE analyses showed that the blizzard of 1978 was highly likely the event to cause large laminar cracks like those found in Davis-Besse shielding building.

The blizzard of 1978 was the only event that produced a "perfect storm". Large forces were needed to propagate cracks through the aggregate and only two motivating forces were found to be capable of this - ice freezing and differential expansion due to ice freezing. In order for this scenario to happen, there need to be high winds and precipitation driving moisture into the concrete. The temperature outside has to drop to well below freezing. The blizzard of 1978 was the only event found to have all these factors in sufficient magnitude to cause large laminar cracks like those found at Davis-Besse.

2D moisture penetration in the shoulders (due to a high surface area to volume ratio) leads to more differential expansion under the shoulders. The presence of weak planes in the concrete (due to very high rebar density) gives the cracks a "perforated" path to propagate. Damage in the flute shoulders is concentrated on the southwest side of the building, which coincides with the

[330] As discussed below in this quotation and also in the Revised Root Cause Report, the architectural flute shoulder combination also is required to develop the stresses necessary for the laminar cracking. *See, e.g.*, Revised Root Cause Evaluation at 9 ("The reason for the shield building laminar cracking was the design configuration of the architectural flute shoulders coupled with a rare combination of severe environmental factors associated with the blizzard of 1978.").

> predominant wind direction. Other parts of the building will still get wet. Based on the IR mapping, the laminar cracks that are not on the southwest side of the building are limited to regions with weak planes of concrete (due to high density rebar). Weak planes of concrete will require less force to initiate cracks. Therefore, the observed result is expected.[331]

Intervenors generally state that because of the cracking on areas not subjected to high wind, "the entire shield building surface containing high density rebar should be carefully examined for cracking."[332] Intervenors presume that Davis-Besse's location on the Lake Erie shoreline will expose it to "countless episodes of moisture drenching, followed by freezing temperatures" that could cause cracking without high wind.[333] These statements do not support an admissible contention.

First, they are untimely. It should not be surprising to Intervenors that there was cracking in areas other than in the path of the 1978 Blizzard, because this was identified in the February 27, 2012 Root Cause Evaluation.[334] Therefore, this argument is untimely because it was filed well after the 60 day time limit specified in the ISO, and does not satisfy 10 C.F.R. § 2.309(f)(2)(iii).

Second, once again, these general conclusory statements do not support an admissible contention. These statements have no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors have provided no basis for why other situations of moisture drenching and freezing temperatures could have caused the laminar cracking, or why there is more cracking than that identified in the Revised PII Report or Revised Root Cause Evaluation. Additionally, FENOC has completed Impulse Response testing of all accessible areas of the

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331 Fourth Supplement at 41; Revised PII Report at 93.

332 Fourth Supplement at 42.

333 *Id.*

334 *See* Root Cause Evaluation at 6, 20.

Shield Building, which validated the original conclusions in the Root Cause Evaluation regarding the locations and extent of the Shield Building laminar cracking.[335]

Finally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi).[336] In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

z. Argument 26 – Radial Stress

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 26. Item 3: Cracking postulated at 600 psi radial stress is one component of stress tensor. Clarify how this failure stress was developed. What is the significance with respect to actual tensile stress magnitude?[337]

Intervenors then quote the response in the Revised PII Report:

> 9. The cracking models consider the entire stress tensor when calculating damage. This is done internally by the code. In all other models (non-cracking models), the failure stress being considered (regardless of its direction or magnitude) is strictly a means of comparison. The failure stress is not used as an input to any of the models other than the cracking models. The cracking models used a failure stress of 600 psi, which is not limited to radial stress.[338]

Intervenors' entire discussion supporting this argument is: "Intervenors are concerned that PII's assumption of concrete strength values, which are over-optimistically high, would tend to underestimate cracking and other damage across the shield building structure. Such faulty

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335 *See* FENOC August Slides at 41-42; August RAI Response at 9.

336 Intervenors also complain about the "two to three character redaction" in the quotations from Revised PII Report pages iii and iv related to Items 2, 3, and 4. Fourth Supplement at 42. FENOC has confirmed that these blocks are not redactions, but instead are found in the original text.

337 *Id.*; Revised PII Report at iv.

338 Fourth Supplement at 43; Revised PII Report at 93.

assumptions and dangerous underestimates must be addressed in a hearing."[339] This conclusory statement does not support an admissible contention.

This statement has no support whatsoever, contrary to 10 C.F.R. § 2.309(f)(1)(v). As quoted above, the Revised PII Report provides a justified basis for the stress values. Intervenors have not challenged this basis or explained why different stress values should be used. Additionally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi). In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

aa. Argument 27 – Computer Results

Intervenors reference the following NRC observation that is reproduced in the Revised PII Report:

> 27. Item 4: Provide clarification with respect to shield building crack initiation, crack growth, and crack arrest. Why are the computer results reasonable and reflective of identified cracking?[340]

Intervenors then quote the response in the Revised PII Report:

> 10. The models that have been run to date produce results that are reflective of the observed damage based on IR mapping data. The laminar cracks occur in essentially the same locations in the models and in reality, including in the shoulders on the southwest side of the building and in regions with very high planar rebar density, such as in the top 20' of the building and around the main steam line penetrations.[341]

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339 Fourth Supplement at 43.

340 *Id.*; Revised PII Report at iv.

341 Fourth Supplement at 43; Revised PII Report at 94.

Intervenors do not challenge this information, but instead state that they "object that PII not be allowed to cherry-pick select areas of the shield building to test, which fit its predetermined theory, but exclude testing other areas of the shield building structure that could also be cracked or otherwise damaged."[342] This unsupported statement cannot support an admissible contention.

Intervenors do not provide any explanation for why they believe that PII "cherry-picked" test areas. FENOC has performed a detailed Root Cause Evaluation on the Shield Building laminar cracking. If Intervenors dispute the evaluation, then they must provide more support than a vague, unsupported statement about "cherry-picking." As is, Intervenors do not provide the requisite support for an admissible contention, contrary to 10 C.F.R. § 2.309(f)(1)(v). Intervenors' claims of "cherry-picking" are at odds with FENOC's completion of Impulse Response testing of all accessible areas of the Shield Building, which validated the original conclusions in the Root Cause Evaluation regarding the locations and extent of the Shield Building laminar cracking.[343]

Additionally, this argument does not challenge the Shield Building AMP or any other part of the Davis-Besse LRA, contrary to 10 C.F.R. § 2.309(f)(1)(vi).[344] In this regard, Intervenors have not identified a genuine material dispute, because they have not explained why

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342 Fourth Supplement at 44.

343 *See* FENOC August Slides at 41-42; August RAI Response at 9.

344 Intervenors also claim that "their cracked concrete containment and Severe Accident Mitigation Alternatives (SAMA) contentions are inextricably interlinked because FENOC assumes a functioning shield building in its SAMA analyses." Fourth Supplement at 44. It is unclear why Intervenors are making this statement, because each contention must be admissible on its own, not simply linked to another contention. This conclusory statement on SAMAs does not provide support for an admissible contention, contrary to 10 C.F.R. § 2.309(f)(1)(v) and does not demonstrate a genuine dispute, contrary to 10 C.F.R. § 2.309(f)(1)(vi). Additionally, FENOC has already explained why Intervenors have failed to submit an admissible SAMA contention related to the Shield Building laminar cracking. *See* FENOC's Answer to Original Contention at 30-32.

the Shield Building AMP would be unable to address aging issues related to the Shield Building laminar cracking even if their statements are correct.

C. The Supplements Do Not Cure the Original Contention's or Earlier Supplements' Deficiencies

Not only are the Supplements themselves deficient, for the many and compelling reasons discussed above, they also do not cure the deficiencies plaguing the Original Contention or earlier supplements, and therefore should be rejected for this additional reason. The Supplements state that Intervenors move the Board "to further supplement and amend their proposed Contention No. 5."[345] Intervenors, however, do not set forth, describe, or otherwise present any actual amendment to the Original Contention. Instead, they simply repeat the exact wording of the Original Contention, which states:[346]

> ***Contention 5: Cracked Shield Building/Secondary Reactor Radiological Containment Structure***
>
> Interveners contend that FirstEnergy's recently-discovered, extensive cracking of unknown origin in the Davis-Besse shield building/secondary reactor radiological containment structure is an aging-related feature of the plant, the condition of which precludes safe operation of the atomic reactor beyond 2017 for any period of time, let alone the proposed 20-year license period.[347]

As explained in FENOC's Original Contention Answer, the Original Contention sets forth both environmental and non-environmental (or "safety") arguments.[348] As explained in Section IV.B.1 of FENOC's Original Contention Answer, the environmental arguments are inadmissible because they: (1) are outside the scope of this proceeding because they impermissibly challenge NRC regulations; (2) fail to challenge the Davis-Besse LRA; and (3)

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345 Third Supplement at 1; Fourth Supplement at 1.

346 *See* Third Supplement at 1; Fourth Supplement at 1.

347 Original Contention at 10-11; Third Supplement at 1; Fourth Supplement at 1.

348 FENOC's Original Contention Answer at 23.

lack adequate (*i.e.*, any) factual support.[349] As further explained in Section IV.B.2 of FENOC's Original Contention Answer, the safety arguments similarly are inadmissible because they: (1) are outside the scope of this proceeding; (2) fail to challenge the LRA; and, again, (3) lack adequate factual support.[350]

Intervenors fail to link any supplemental information in the Supplements to their earlier arguments or the Original Contention—leaving FENOC and the NRC Staff to respond to a phantom nexus. Moreover, the Supplements leave these earlier-identified deficiencies unaddressed. It is Intervenors' burden to make the arguments; this is not the role of the Board or other Parties.[351] Although Intervenors raise 38 separate arguments in the Supplements, these arguments do not support an admissible contention, as shown above. This is true of the arguments individually, but also collectively. Viewing the arguments collectively would not cure the numerous deficiencies of the individual arguments, such as their untimely filing and their failure to satisfy the contention admissibility factors (*e.g.*, they do not demonstrate a genuine material dispute with the Davis-Besse LRA).

More importantly, following FENOC's docketing of the LRA amendment providing the Shield Building AMP, FENOC supplemented FENOC's Original Contention Answer, demonstrating that the AMP moots Intervenors' unsupported challenges about aging management due to the newly-identified Shield Building laminar cracking.[352] In other words, FENOC has addressed the Original Contention, head on, and it was therefore incumbent on

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349 *See id.* at 24-32.

350 *See id.* at 32-47.

351 *See Pilgrim*, CLI-12-15, slip op. at 13 ("At the threshold contention admission stage, the burden for providing support for a contention is on the petitioner."); *see also* Policy on Conduct of Adjudicatory Proceedings, CLI-98-12, 48 NRC 18, 22 (1998) ("A contention's proponent, not the licensing board, is responsible for formulating the contention and providing the necessary information to satisfy [the contention admissibility requirements].").

352 *See* FENOC Supplemental Answer at 6-7.

Intervenors to amend their Original Contention to address the information contributing to the record in this proceeding, including the Shield Building AMP.[353] As discussed above, Intervenors do not provide an admissible argument with respect to the Shield Building AMP. For this reason, the Original Contention remains moot—even as supplemented on July 16, 2012 and July 23, 2012—and the Supplements should be rejected by the Board.

V. CONCLUSION

As demonstrated above, parts of the Supplements are untimely under 10 C.F.R. §§ 2.309(f)(2) and (c)(1). In particular, these parts are untimely under 10 C.F.R. § 2.309(f)(2) because, contrary to the ISO, Intervenors filed them more than 60 days after the public availability of material information allegedly supporting the Supplements, and Intervenors have not demonstrated good cause for their late filing. Furthermore, the Supplements utterly fail to satisfy the contention admissibility requirements specified in 10 C.F.R. § 2.309(f)(1): the arguments in the Supplements should be rejected because they are outside the scope of this proceeding, lack adequate factual support, and/or fail to challenge the Davis-Besse LRA. Finally, the Supplements do not cure the deficiencies in the Original Contention, which remains mooted by the Shield Building AMP. For these many and manifest reasons, the Supplements should be rejected in their entirety.

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353 A contention that does not directly controvert a position taken by the applicant in the application is subject to dismissal. *See, e.g.*, *Summer*, CLI-10-1, 71 NRC at 21-22. Additionally, the Commission has stated that intervenors "have an 'ironclad obligation' to review the Application thoroughly and to base their challenges on its contents." *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-05, 75 NRC __, slip op. at 14 (Mar. 8, 2012) (citing *Shaw AREVA MOX Servs.* (Mixed Oxide Fuel Fabrication Facility), CLI-09-2, 69 NRC 55, 65 n.47 (2009) (referring to intervenors' "ironclad obligation to . . . diligently search publicly available NRC or Applicant documents for information relevant to their Contention" (internal quotation marks omitted))).

Respectfully submitted,

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

Signed (electronically) by Timothy P. Matthews

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COUNSEL FOR FENOC

Dated in Washington, DC
this 17th day of August 2012

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)	)	August 17, 2012

CERTIFICATE OF SERVICE

I hereby certify that, on this date, a copy of "FENOC's Answer Opposing Intervenors' Third and Fourth Motions to Amend and/or Supplement Proposed Contention No. 5 (Shield Building Cracking)" was filed with the Electronic Information Exchange in the above-captioned proceeding on the following recipients.

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FENOC Attachment 1

Shield Building
Crack Investigation and
Root Cause Presentation

FENOC
FirstEnergy Nuclear Operating Company

Davis-Besse Nuclear Power Station

August 9, 2012

Agenda

- **Introduction**
  - **Barry Allen**, Site Vice President – Davis-Besse
- **Shield Building Condition Evaluation**
  - **Ken Byrd**, Director – Site Engineering
- **Shield Building Root Cause Investigation**
  - **Jon Hook**, Design Engineering Manager
- **Shield Building Corrective Actions**
  - **Ken Byrd**, Director – Site Engineering
- **Closing Comments**
  - **Barry Allen**, Site Vice President – Davis-Besse

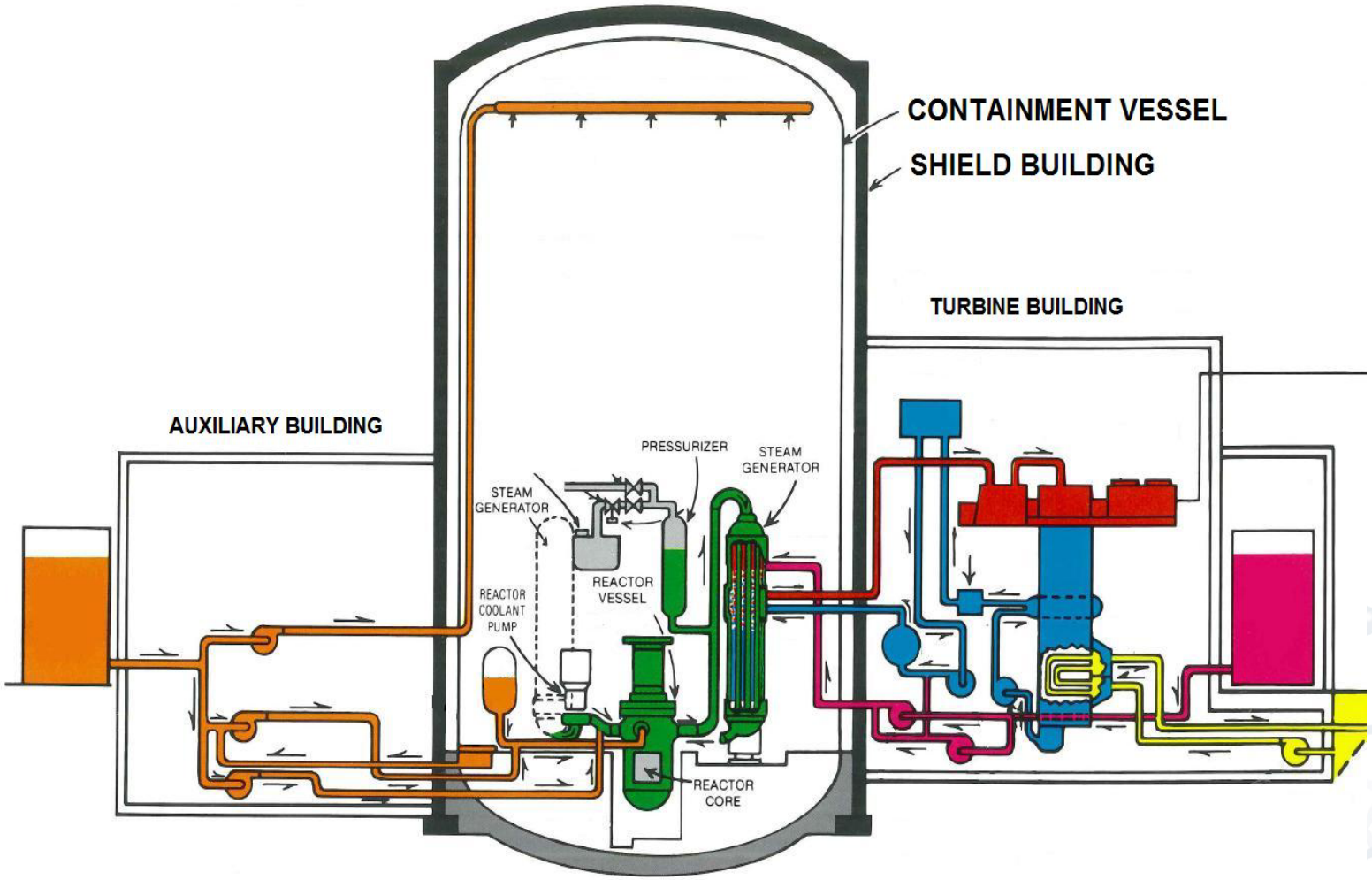
Shield Building Condition Evaluation

Ken Byrd,
Director - Site Engineering

Background

- Mid-cycle outage to replace Reactor Pressure Vessel Head
- Access opening required in concrete Shield Building
- Opening dimensions 26.5’ wide X 35.5’ high
- Hydro-demolition method employed
- Previous opening in 2002 used similar method
- Size and orientation different than in 2002

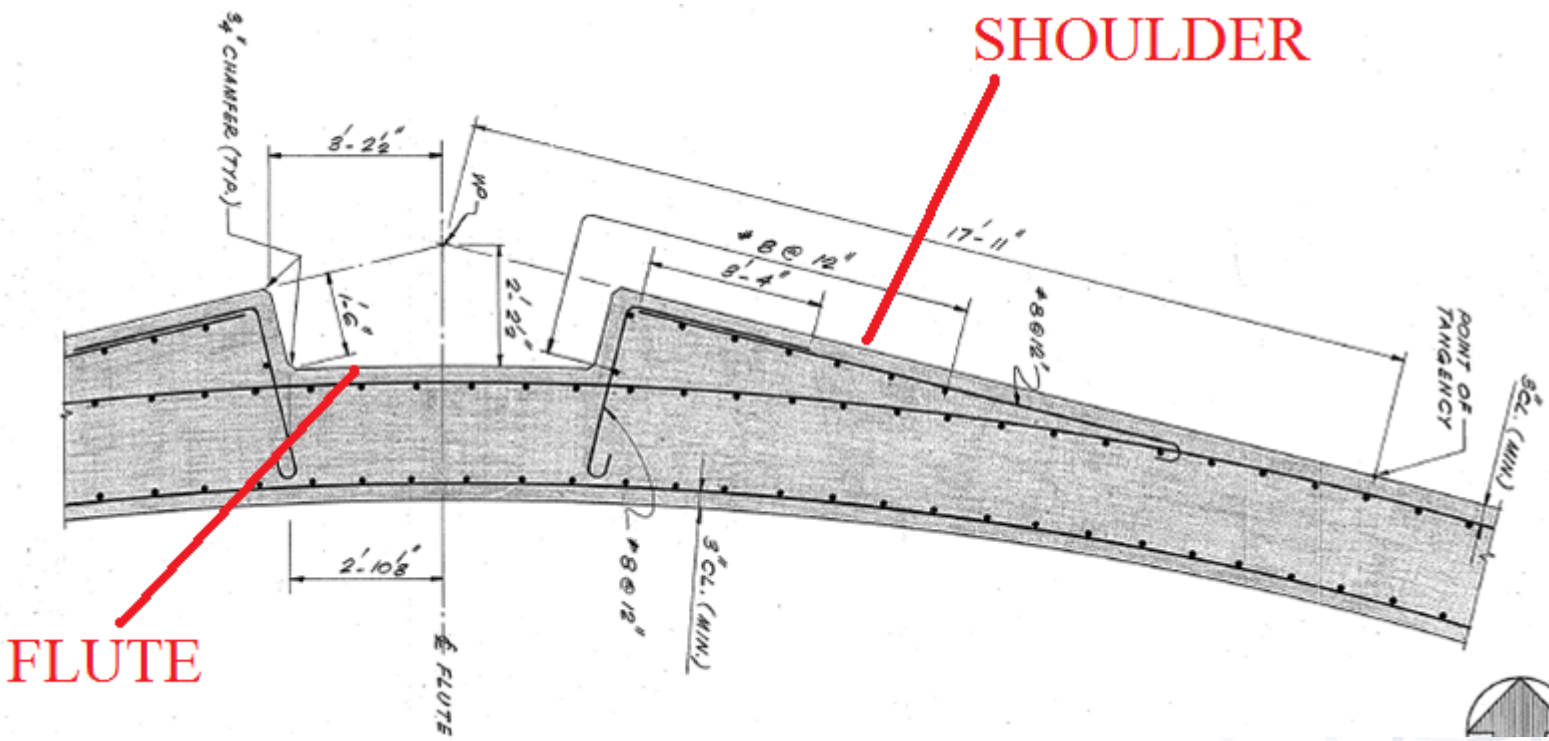
Shield Building



Shield Building

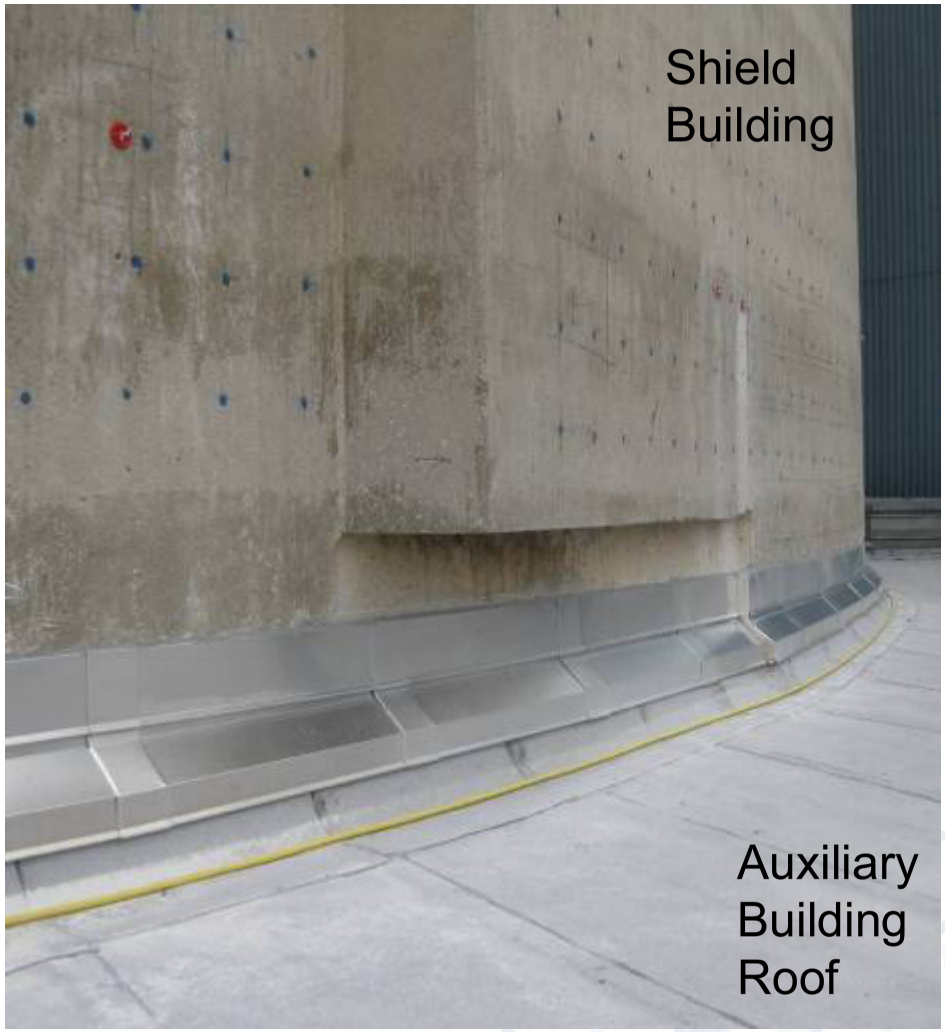
- **Purpose of Shield Building**
  - Biological shielding
  - Environmental protection for Containment Vessel
  - Controlled release of Annulus atmosphere under accident conditions

Shield Building Flutes/Shoulders



Shield Building Flute Shoulders

- **Architectural Feature**
  - The flute shoulders are a part of the Shield Building; concrete for shoulders and building shell was placed concurrently
  - Evaluation of structural capacity of Shield Building does not credit flute shoulders
  - Evaluated as a dead load in structural analysis



Discovery

- Cracking found on October 10, 2011, during hydro-demolition
- NRC resident notified
- Condition Report written
- Restraint on restart established
- Team of experts to investigate issue mobilized

Investigation

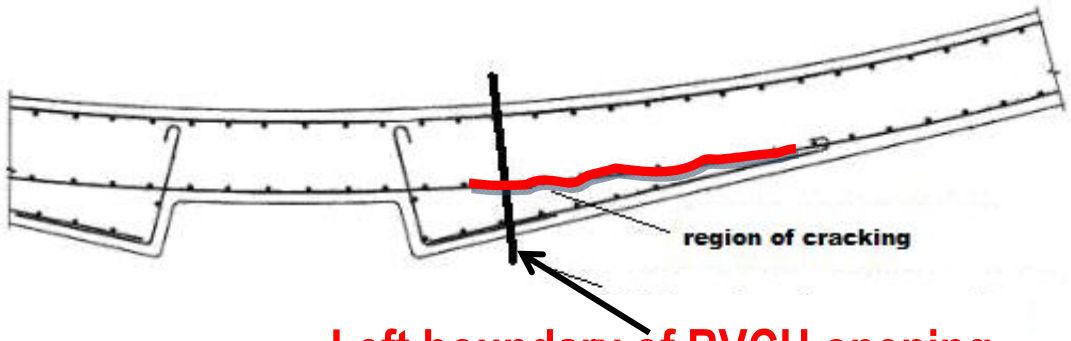
- **Impulse Response (IR) testing methodology used to investigate extent of crack**

Investigation, *continued*

- Core bores taken to validate IR testing results, to determine crack depth and to determine crack width
- Investigation results were documented in the corrective action process, and the NRC was promptly notified of findings

Summary of Shield Building Condition

- Cracking is generic to flute shoulder regions and can be assumed to be present at any elevation in the flutes shoulders; cracking was observed to be more prevalent on the south side of the building
- Cracks are located near the outer reinforcing mat; no cracking observed in interior reinforcing mat



Summary of Shield Building Condition, *continued*

- **Cracking exists at the top 20 feet of the Shield Building wall outside the flute shoulder region**
- **Two small regions adjacent to the Main Steam Line penetration have similar cracks**
  - The extent of these regions is localized and unique to these particular penetrations
- **Cracks are very tight**

Structural Evaluation

- **Original Shield Building design**
  - Building designed and constructed with significant reinforcement
  - Significant margin under design basis loads
  - Design Basis
    - Earthquake 6–6.5 on Richter magnitude scale
    - Tornado winds of 300 miles per hour
    - Tornado depressurization and missiles
- **Impact of laminar cracks on original design**
  - Potentially reduce the bond strength between concrete and reinforcing steel
  - Cracks of little impact unless reinforcing bars are spliced in the cracked region
  - Shield Building remains adequate for safety function

Bounding Building Analysis

- **Bond strength of reinforcement lap splices with adjacent cracks could not be quantified and were conservatively treated as non-existent in analysis**
- **Calculations performed to provide a bounding evaluation of the effect of cracking**
  - Vertical and horizontal reinforcement assumed ineffective for strength in flute shoulders, two steam line penetration areas and in regions at top of shield building.
- **Any bond between reinforcement and concrete in crack regions provides additional margin**

Summary of Calculation Results

- Shield Building meets strength requirements
- Any bond between the concrete and reinforcement in cracked regions would be an additional margin of safety
- Shield Building is capable of performing all safety functions with margin

Shield Building Root Cause Investigation

Jon Hook,
Manager - Design Engineering

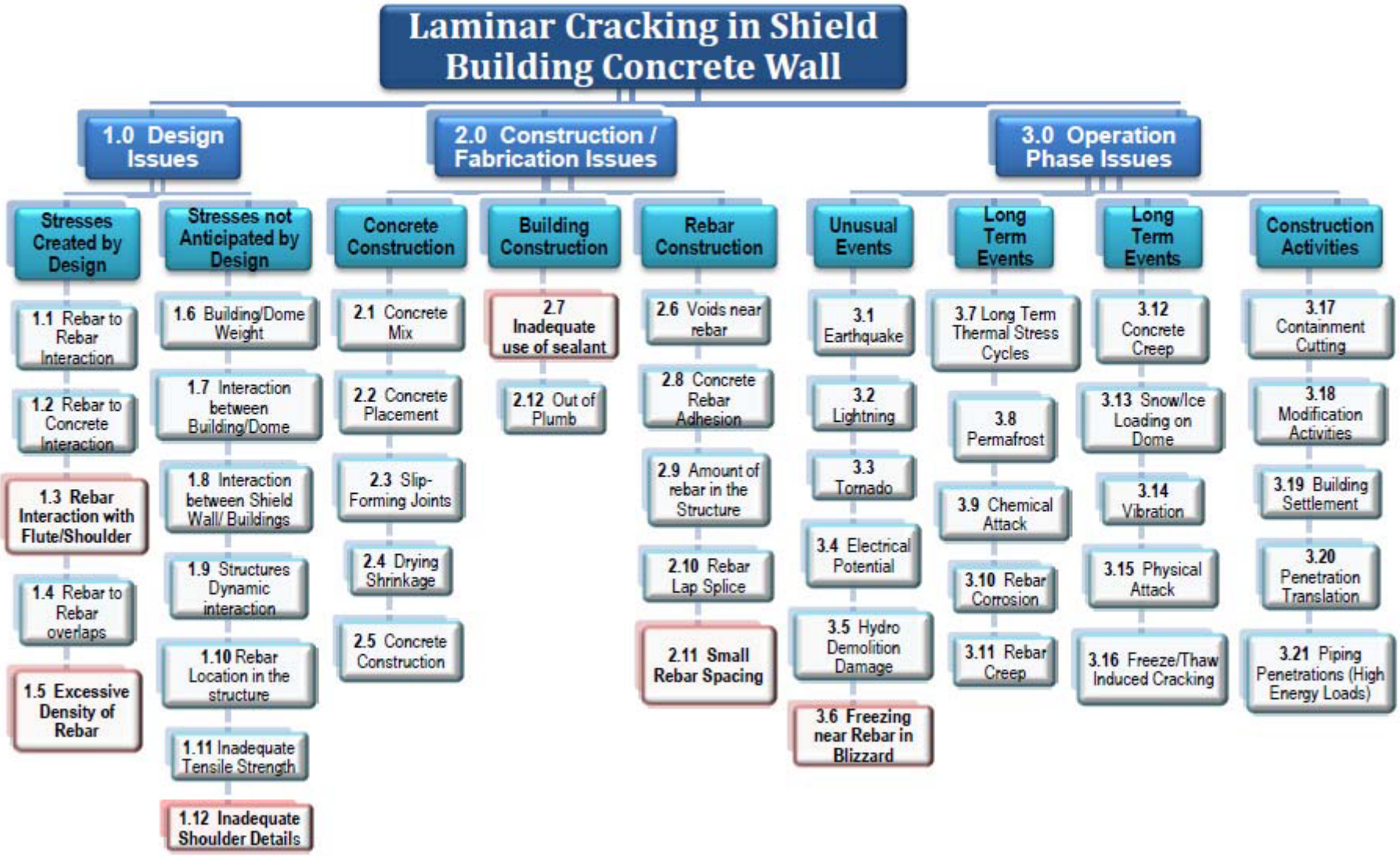
Root Cause Overview

- Established independent team of experts
- Established a comprehensive Failure Modes Analysis
- Investigated the design, materials, construction methods, and present day operational conditions
- Performed concrete tests
- Performed analyses
- Identified root cause

Root Cause Overview, *continued*

- **Performance Improvement International (PII)**
  - The PII team are experts in root cause investigation
  - Team consist of Professional Engineers, PhDs, and university professors
  - Performed more than 500 root causes
- **Industry experts as well as assistance from FENOC Engineering**
- **Followed our established and proven root cause process**

Shield Building Root Cause Fault Tree



Shield Building Concrete

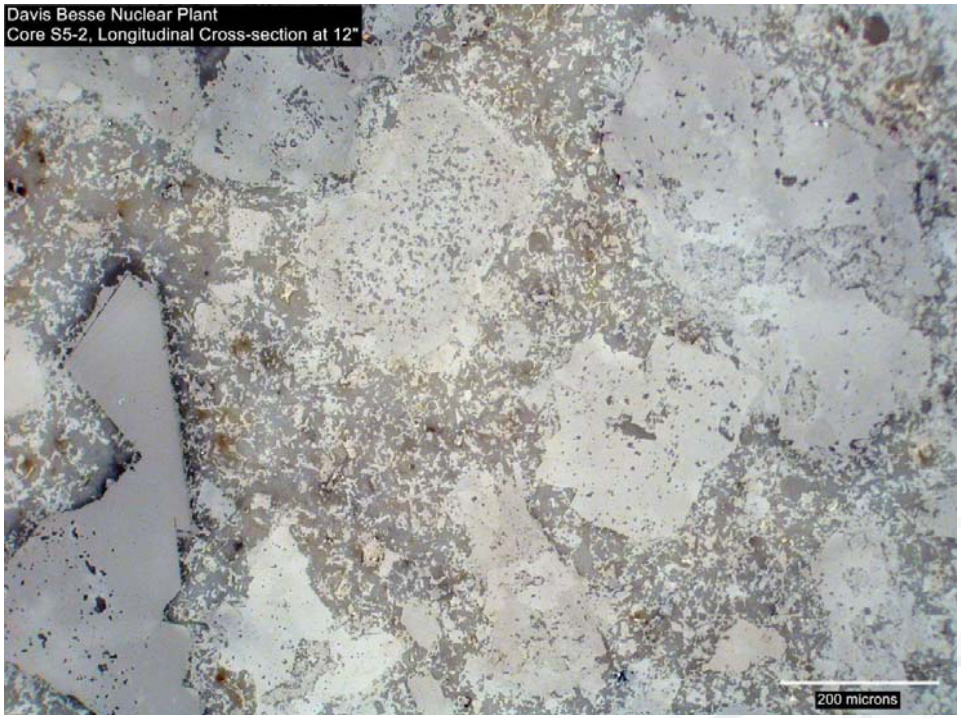
- Concrete was subjected to a series of tests
- 36 concrete cores from the Shield Building tested
- Concrete properties were determined
- Test results confirmed the concrete is sound and can be ruled out

Shield Building Concrete, *continued*

- Typical concrete sample showing the laminar crack sheared the coarse aggregate
- Therefore, laminar crack occurred after the concrete achieved it strength

Shield Building Concrete, *continued*

- No evidence of micro cracks
- No signs of cyclic load mechanism
- No cyclic freeze-thaw mechanism
- No indication of fatigue or age related events



Magnification at 100 Times

Shield Building Concrete Tests, *continued*

- **16 samples were tested for carbonation**
  - Average depth of carbonation is 8.57 mm (0.337 inches)
  - Maximum average 11.7 mm (0.46 inches)
  - Typical for concrete 40 years old

Shield Building Concrete - Conclusion

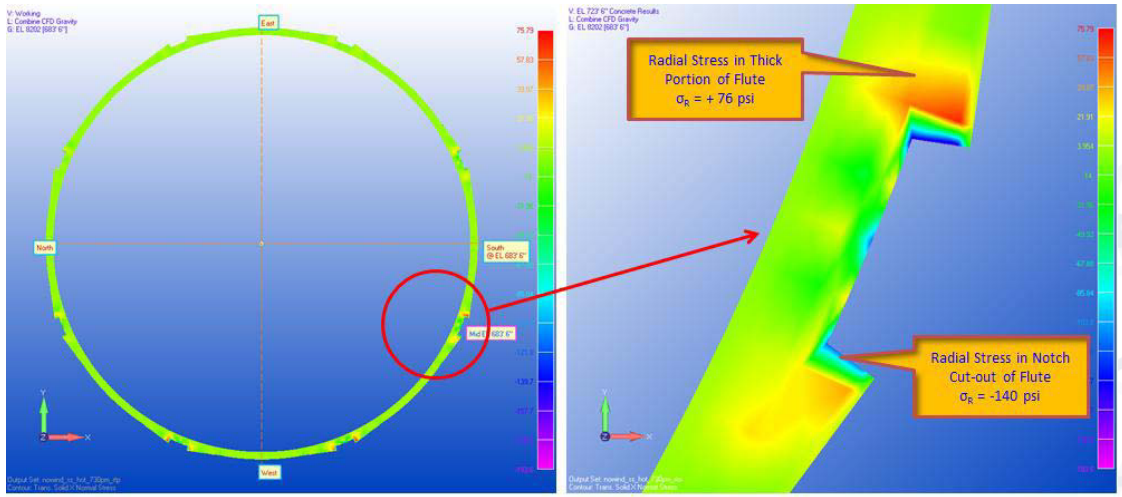
- **Crack passed through the course aggregate**
  - Strong bond between the cement paste and the coarse aggregate; therefore, initial placement concerns can be ruled out
  - Large tensile force is required to initiate the crack
- **No micro cracks identified that would indicate freeze-thaw or cyclic events**
- **Chemical properties, carbonation, corrosion, etc, were all acceptable**
- **Based on the above, concrete can be ruled out as an initiating or contributing cause**

Shield Building Configuration

- **Cracking is predominantly located in the shoulder areas, the top 20 feet of the Shield Building, and near the Main Steam Line penetration block-outs; cracking concentrated on southern exposures**
- **Shoulder areas are regions of discontinuity**
- **Limited radial reinforcing steel in the shoulder areas**
- **High rebar density (6” spacing) located at the top of the Shield Building and around the Main Steam Line penetration construction block-outs**
- **Conclusion**
  - There is a correlation between the crack locations and the physical layout of the reinforcing steel that needed to be investigated

Shield Building Analytical Analyses

- **Numerous computer analyses were performed for normal design conditions**
  - Self weight, wind loads
  - Thermal analyses (summer hot and winter cold conditions)
  - Fujita Category 2 tornado
- **Stresses were significantly below the normal tensile capacity of the concrete**



Overall View @ EL 683' 6"

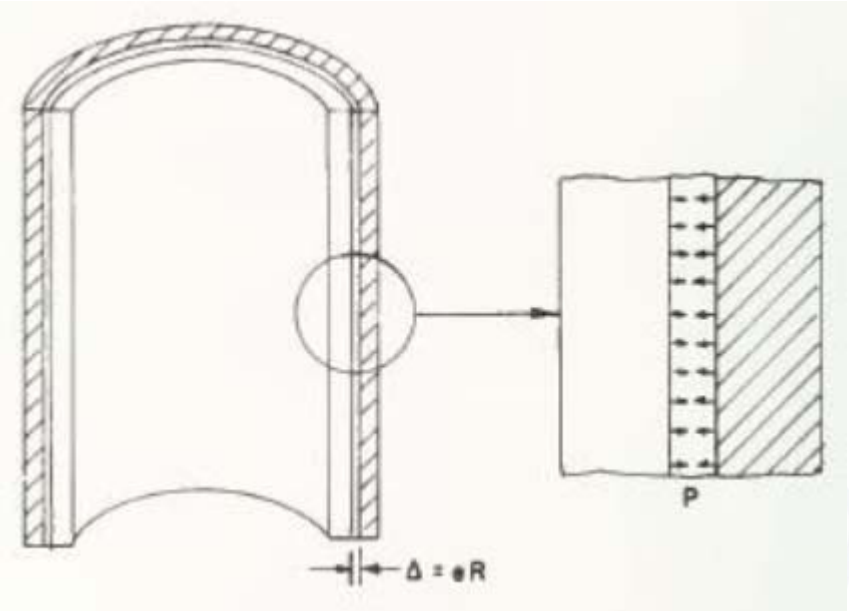
Close-Up View @ EL 683' 6"

Shield Building Analytical Analyses,
continued

- **Analysis showed:**
  - Design stresses can not initiate the laminar crack
  - Significant stresses beyond what is normally analyzed would be required to crack the concrete
- **Investigate industry experience for similar conditions**

Industry Experience with Laminar Cracks

- **Ontario Ministry of the Environment study on 50 above ground water tanks in Ontario**
- **Water migrated into the concrete from the inside**
  - Inner layer of the wall freezes and expands
  - Outer layer of wall contracts
  - Creates high radial stress
  - Results in laminar cracking



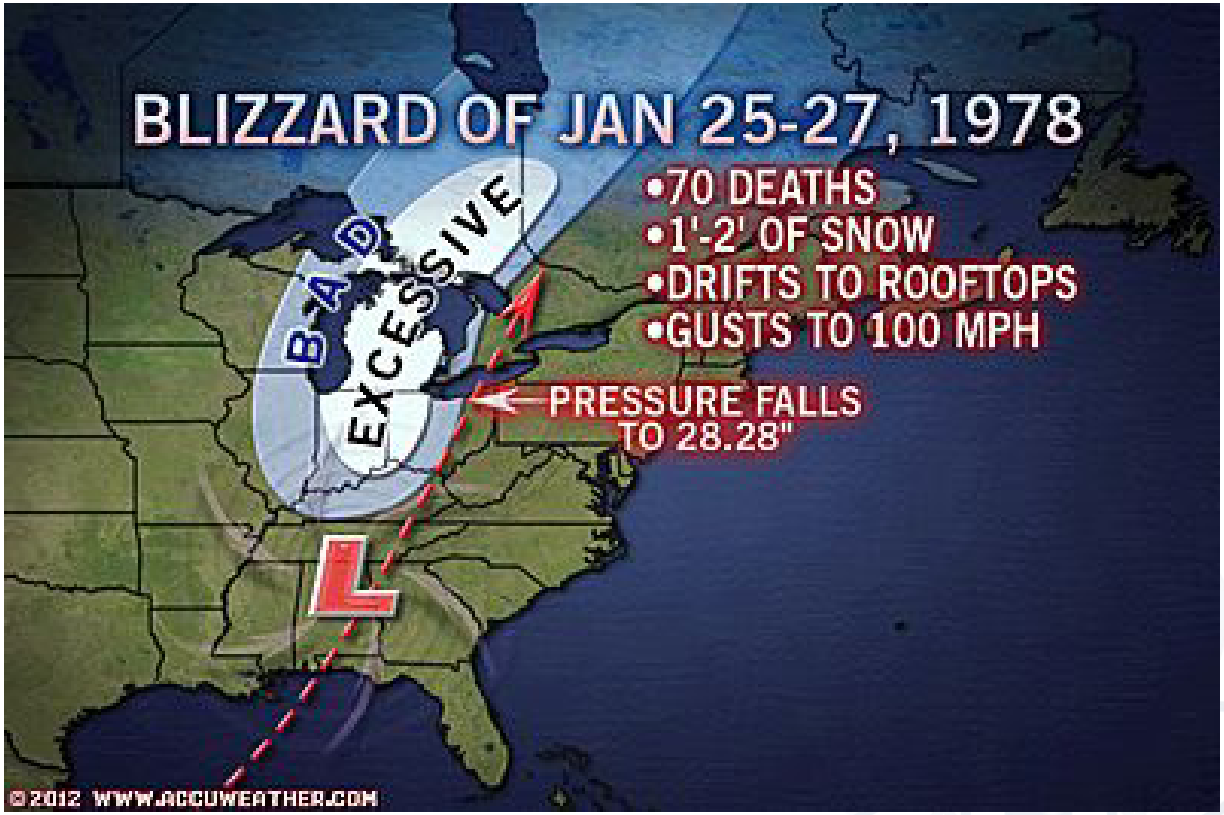
- **Conclusion: Laminar cracking as a result of water freezing is a real potential**

Shield Building Investigation into Water Intrusion/Freezing

- The effects of moisture intrusion and sub freezing temperatures was investigated as a possible cause
- The review of severe environmental conditions that the plant was exposed to was performed
- The most significant event recorded at the site and also in Ohio history was the storm of January 25-27, 1978

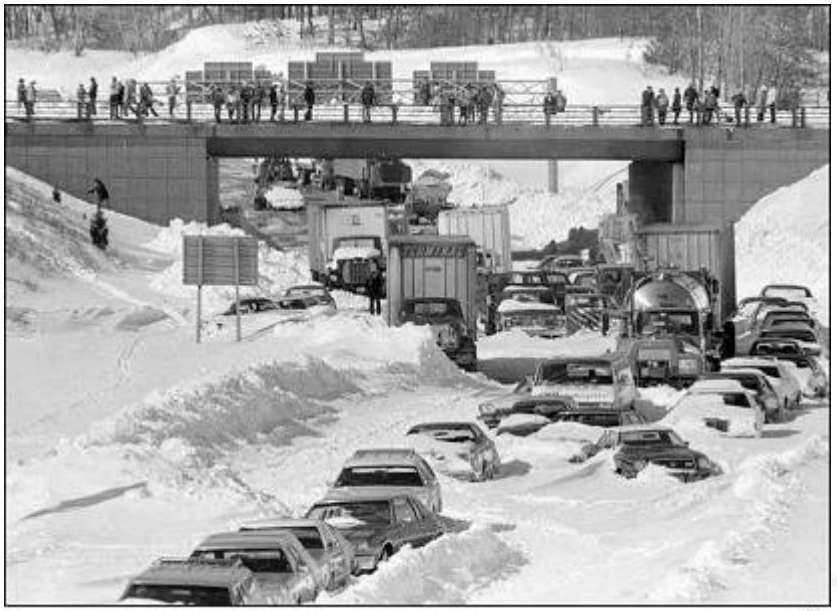
Moisture Intrusion and Low Temperatures

- **January 25-27, 1978, was the worst in terms of:**
  - Moisture
  - Winds
  - Temperature
  - Duration
  - Pressure



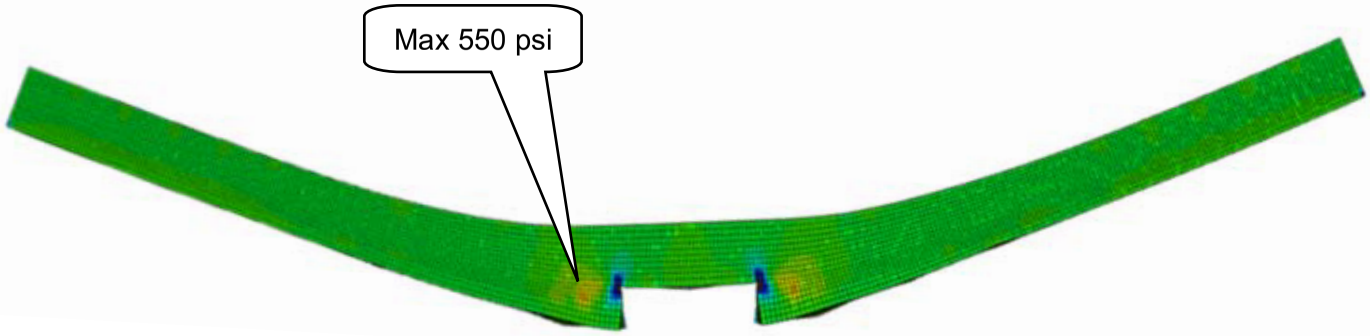
Moisture Intrusion and Low Temperatures, *continued*

- **Scenario:**
  - Temperature near zero
  - Sustained strong winds
  - Moisture penetrated the Shield Building
  - Moisture trapped in the outer layer of concrete crystallized
  - Concrete expansion exceeded the tensile capacity of the concrete and propagated the crack



Moisture Intrusion and Low Temperatures, *continued*

- A complex computer model of the Shield Building was developed
- Concrete properties from the concrete core tests were used
- Laboratory tests showed moisture infiltration up to four inches
- Maximum radial stress in the shoulder area were approximately the tensile capacity of the concrete
- High stresses were located in areas of observed cracking



Sensitivity Analysis – High Density of Rebar

- **A complex computer model evaluated the affects of rebar spacing to determine the potential for developing cracks**
- **Evaluation showed laminar cracks could:**
  - Form in regions of closely spaced rebar and
  - Less likely in areas were the rebar is spaced at 12 inches
- **This analysis establishes that rebar spacing is a probable contributing factor**

Summary of Analyses

- Normal design conditions result in low stresses which could not cause cracking
- Moisture and freezing could cause high stresses in the shoulder areas that results in cracking
- Analysis shows closely spaced reinforcing steel can be a contributor to laminar cracking
- Observed cracking coincides with the locations of high stress in the shoulder areas and in the areas of high density of rebar; cracking concentrated on southern exposures

Shield Building Root Cause

- **Root Cause:**
  - Lack of water sealant on the concrete exterior
- **Contributing Causes:**
  - Shoulder reinforcing details (discontinuity and no radial rebar)
  - High density of rebar spacing
  - High moisture, severe wind, and low temperature conditions

Shield Building Additional Actions

Ken Byrd,
Director - Site Engineering

Shield Building – Preventative Action

- **Root Cause**
  - Lack of concrete sealant
- **Preventative Action to Prevent Recurrence**
  - The exposed exterior surfaces of the Shield Building will be sealed
  - Contractor has started and is expected to be completed by the end of September of this year

Shield Building – Additional Actions

- **The Root Cause has established several additional Corrective Actions**
  - Complete Impulse Response (IR) examinations on the Shield Building wall
  - Perform IR mapping on another structure (Auxiliary Building) to confirm assumptions of our analyses
  - Develop and implement a test program to establish capacity in an area of laminar cracks
  - Develop a Long-Term Monitoring program

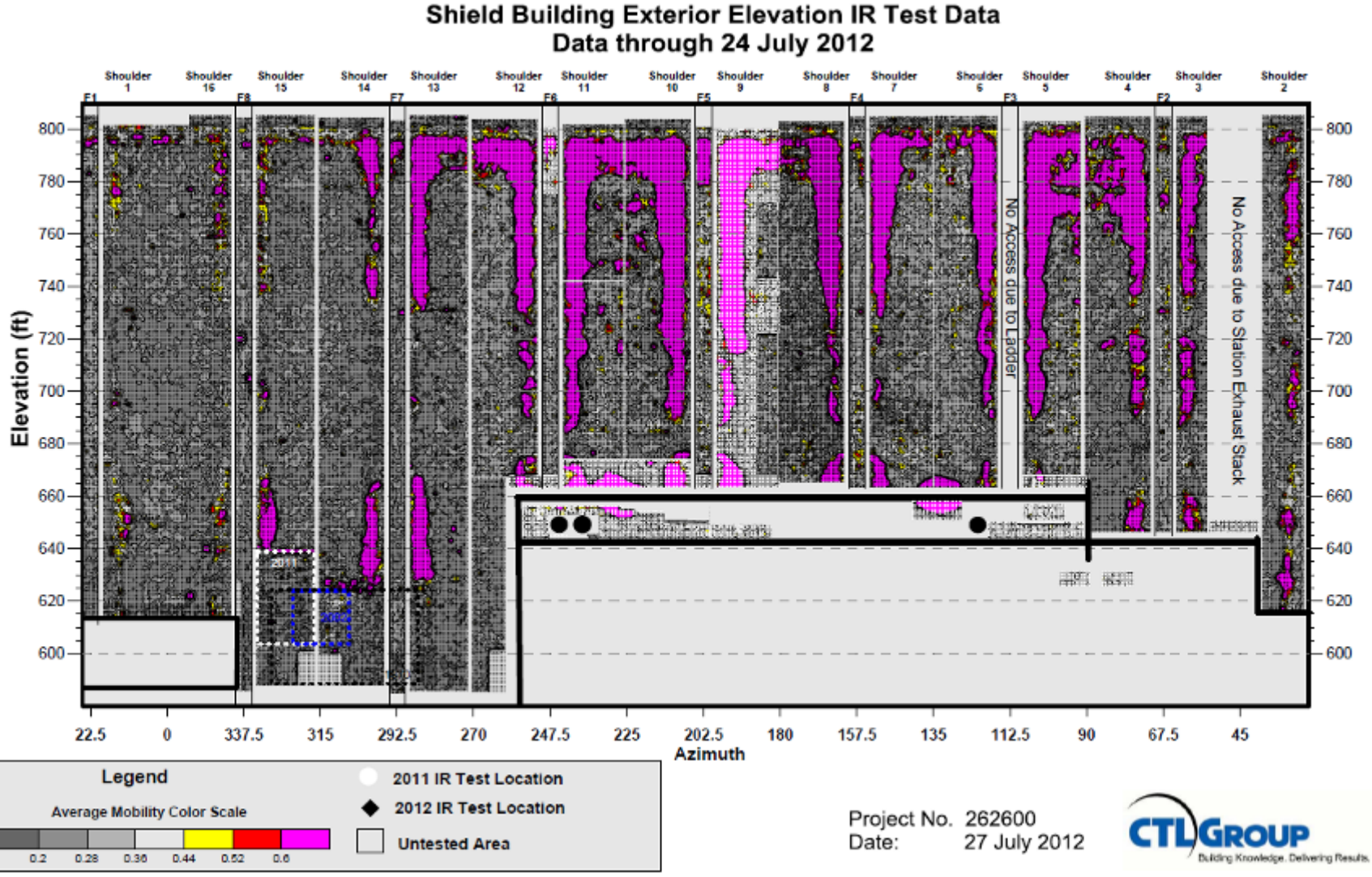
Additional Actions - IR Mapping

- **Complete IR examinations on the Shield Building wall and an independent structure**
  - All accessible areas of the Shield Building wall were mapped
  - Over 60,000 individual readings were obtained to fully characterize the condition of the building

Additional Actions - IR Mapping, *continued*

- **The IR validated our original assessment that the laminar cracks are generally confined to:**
  - The shoulder areas
  - Top of the Shield Building
  - Near one corner of the Main Steam Line penetration
- **Impulse Response reading on an independent structure validated that laminar cracks are not present**

Additional Actions - IR Mapping, *continued*



Additional Actions – Testing

- Tests were developed and conducted at two nationally recognized universities
- Professors are industry experts and are American Concrete Institute (ACI) Committee members

Additional Actions – Testing, *continued*

- **Two different methods were used to create laminar cracks in the samples to be tested**
- **Results were independently verified**

Additional Actions – Testing, *continued*

- **Testing results**
  - Full capability of reinforcement is maintained in regions with longer splice lengths (upper portion of Shield Building)
  - Results showed near to full capability of reinforcement in regions with shorter splice lengths
- **Testing conclusions**
  - The tests provide high confidence of the capability of the rebar located in regions of laminar cracking
  - Testing confirms the assumptions made in structural calculation prior to restart were very conservative

Additional Actions – Long Term Monitoring

- **Establish a Long-Term Monitoring Program**
  - FENOC has established a long-term monitoring plan that includes:
    - Monitoring existing core bores for crack propagation
    - Inspection of the integrity of the Shield Building coatings
    - Inspection of the integrity of other safety related building coatings

Summary

- **The corrective actions established will:**
  - Prevent moisture from entering the Shield Building and freezing
  - Provide comprehensive characterization of the laminar crack
  - Establish the capacity of the rebar in the area of laminar crack
  - Provide long term monitoring of the shield building

Closing Comments

Barry Allen,
Site Vice President

FENOC Attachment 2

FENOC
FirstEnergy Nuclear Operating Company

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

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

David M. Imlay
Director, Site Performance Improvement

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

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

<u>Background</u>:

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.

<u>Issue</u>:

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

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*.

Affected LRA Section	LRA Page No.	Affected Paragraph and Sentence
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 *Shield Building Monitoring*	III.A1-9	3.5.1-23	A 0511 *0552*
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 *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**
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 *Shield Building Monitoring*	III.A1-6	3.5.1-26	A 0511 *0552*
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 *Shield Building Monitoring*	III.A1-7	3.5.1-32	A 0509 0511 *0552*

Affected LRA Section	LRA Page No.	Affected Paragraph and Sentence
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 *and the Shield Building Emergency Air Lock Enclosure walls*, 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 *and the Shield Building Emergency Air Lock Enclosure walls*.

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

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

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*	*Surface condition of rebar, when exposed*	*Visual*
Loss of Coating Effectiveness	*Loss of ability to perform its protective action*	*Condition of the coatings*	*Visual*

- *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.