UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

May 7, 2012

Mr. Barry Allen
Site Vice President
FirstEnergy Nuclear Operating Company
Davis-Besse Nuclear Power Station
5501 North State Route 2, Mail Stop A-DB-3080
Oak Harbor, OH 43449-9760

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION REACTOR VESSEL HEAD REPLACEMENT AND SHIELD BUILDING CRACKING INSPECTION REPORT 05000346/2012007(DRS)

Dear Mr. Allen:

On April 17, 2012, the U.S. Nuclear Regulatory Commission (NRC) completed a portion of the Replacement Reactor Vessel Closure Head (RVCH) inspection and additional inspections of your activities to demonstrate operability of the containment system following your identification of subsurface concrete laminar cracks in the shield building cylindrical wall. The reactor vessel head replacement inspection discussed in this report was limited to an evaluation of your engineering change for the temporary modification and restoration of the shield building. The inspection activities conducted subsequent to your identification of laminar cracks in the shield building cylindrical wall included activities related to the shield building design and licensing bases and shield building operability (capability to perform its specified safety functions). The enclosed inspection report documents the inspection results, which were discussed on April 17, 2012, with you and other members of your staff. The remaining portions of the Reactor Vessel Head Replacement Inspection are covered in other inspection reports.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

Based on the results of this inspection, no findings of safety significance were identified by the NRC.

Prior to restart from the mid-cycle outage to replace the RVCH, the NRC issued a Confirmatory Action Letter (CAL), No. 3-11-001, dated December 2, 2011 (ML11336A355), that confirmed commitments by FirstEnergy Nuclear Operating Company (FENOC) regarding the identification of cracks in the reinforced concrete shield building at the Davis-Besse Nuclear Power Station. Based on an evaluation of FENOC's extent of condition and technical analysis of the shield building cracking, the NRC staff concluded that FENOC provided reasonable assurance that the shield building was capable of performing its safety functions. Related NRC conclusions and their basis were discussed during a public meeting held on January 5, 2012 (ML12030A141).

In order to provide continued confidence, and as noted in the CAL, FENOC agreed to provide a Root Cause Report, corrective actions, and a long term monitoring program to the NRC for our review by February 28, 2012. The NRC continues to evaluate your root cause activities and corrective actions including review of the Root Cause Report. That effort includes evaluating whether there were any performance deficiencies associated with the root cause that warrant enforcement action.

In accordance with Title 10, Code of Federal Regulations (CFR), Part 50, Section 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any), will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records System (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA by Kenneth O'Brien Acting for/

Steven A. Reynolds, Director
Division of Reactor Safety

Docket No. 50-346
License No. NPF-3

Enclosure: Inspection Report 05000346/2012007
w/Attachment: Supplemental Information

cc w/encl: Distribution via ListServ ™

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No:	50-346
License No:	NPF-3
Report No:	05000346/2012007(DRS)
Licensee: (FENOC)	FirstEnergy Nuclear Operating Company
Facility:	Davis-Besse Nuclear Power Station
Location:	Oak Harbor, OH
Dates:	July 18, 2011, through April 17, 2012
Inspectors:	J. Neurauter, Senior Reactor Inspector (Lead) D. Kimble, Senior Resident Inspector V. Meghani, Reactor Inspector A. Wilson, Resident Inspector P. Cardona-Morales, Reactor Inspector
Primary NRR Technical Specialists:	K. Manoly, Senior Level Technical Advisor A. Sheikh, Senior Structural Engineer D. Hoang, Structural Engineer W. Jessup, Mechanical Engineer A. Rezai, Materials Engineer
Approved by:	David E. Hills, Chief Engineering Branch 1 Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000346/2012007(DRS); 07/18/2011 - 04/17/2012; Davis-Besse Nuclear Power Station; Reactor Vessel Head Replacement and Shield Building Cracking.

This report covers an announced inspection of IP 71007, "Reactor Vessel Head Replacement," limited to the licensee's engineering change for the temporary modification and restoration of the shield building for the reactor vessel head replacement. In addition, this report covers inspection activities conducted subsequent to the licensee's identification of laminar cracks in the shield building cylindrical wall. The inspection was conducted by Region III-based engineering inspectors with the assistance of NRR technical specialists. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

A. NRC-Identified and Self-Revealed Findings

No findings of significance were identified.

B. Licensee-Identified Violations

No violations of significance were identified.

REPORT DETAILS

4. OTHER ACTIVITIES

Cornerstones: Initiating Events and Barrier Integrity

4OA5 Other Activities

.1 Reactor Vessel Head Replacement (Inspection Procedure 71007) – Engineering Changes for Temporary Modification and Restoration of the Shield Building and Shield Building Cracking

a. Inspection Scope

On July 18, 2011, the NRC initiated an inspection related to the engineering changes supporting the replacement of the reactor vessel closure head (RVCH). The objectives of the inspection included: (1) verification that engineering evaluations and design changes were completed in conformance with requirements in the facility license, the applicable codes and standards, licensing commitments, and the regulations, and (2) verification that RVCH removal and replacement activities maintained nuclear radiological safety.

Included in the engineering changes that supported installation of a replacement reactor vessel closure head (RRVCH) were temporary shield building (SB) and steel containment vessel (CV) construction openings to facilitate removal of the existing RVCH and installation of the RRVCH. The engineering changes also provided for restoration of the construction openings following removal of the existing RVCH and transport of the RRVCH to inside the steel CV.

The containment system consists of three basic structures: a steel CV, a reinforced concrete SB, and the internal structures (Figure 1). The CV is a cylindrical steel pressure vessel which houses components and systems including the reactor vessel and reactor coolant piping. The SB is a reinforced concrete structure that surrounds the CV and has a cylindrical wall nominally 30 inches thick with vertical and horizontal reinforcement on both the inside and outside faces and a shallow dome roof. An annular space is provided between the wall of the CV and the SB, and clearance is also provided between the CV and the dome of the SB. With the exception of the concrete under the CV, there are no structural ties between the CV and the SB above the foundation slab.

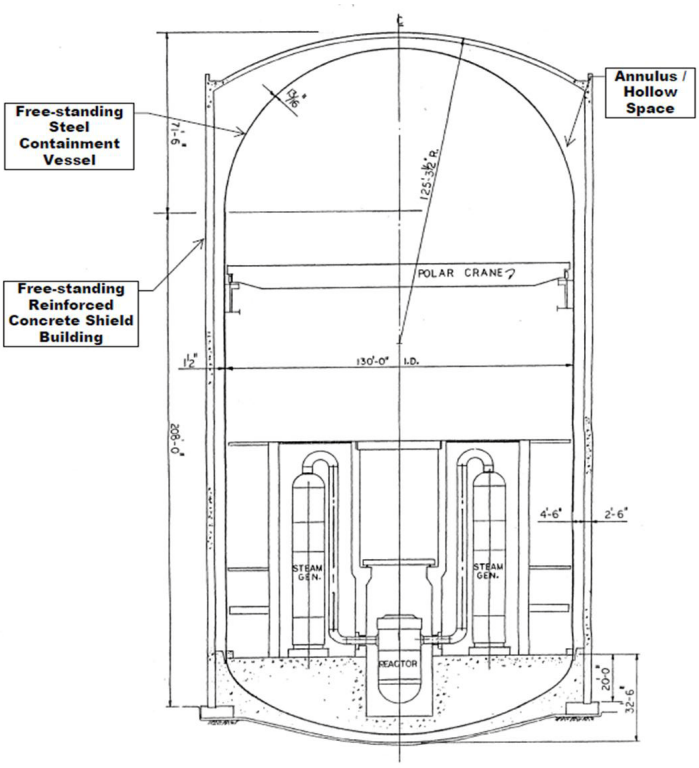

Figure 1: Simplified Davis-Besse Shield Building and Steel Containment Vessel

The containment system was designed to provide protection for the public from radiological consequences of hypothetical accidents including a break of the largest reactor coolant piping. The CV provides primary means to contain the post-accident environment and was designed to withstand and hold against accident pressure. The identified cracking did not involve the CV. The design basis of the SB provided: (1) environmental protection of the containment vessel; (2) for a controlled release of the annulus atmosphere during accidents; and (3) shielding from radiation sources within the SB. Specifically, the SB's function was to provide biological shielding and, in case radioactive leakage escapes from the CV during accident conditions, to allow the Emergency Ventilation System to draw a suction from the annulus region and filter that leakage. In addition, the SB protects the CV from external environmental hazards such as tornado winds and tornado driven missiles. The SB must also function to withstand earthquakes.

The scope of this inspection was limited to the SB including: review of engineering evaluations that verified the SB structural integrity, with the temporary construction opening; review of engineering evaluations for closure of the temporary construction opening; and inspection of the licensee's activities and actions subsequent to its discovery of SB subsurface cracks.

Prior to the SB demolition activities to create a temporary construction opening, the inspector reviewed the associated engineering change, the licensee calculation that demonstrated SB structural integrity for the temporary condition, and the plans for

restoration of the SB in conformance with requirements in the facility license and the applicable codes and standards. In addition, the inspector reviewed licensee controls for the SB demolition for consistency with the technical specifications for the containment system.

On October 10, 2011, a subsurface concrete crack-like indication was identified by the licensee's contractor performing concrete hydro-demolition for the SB temporary construction opening. The indication was found in the flute shoulder area on the vertical side (left side looking from the outside) generally along the main reinforcing steel of the cylindrical wall, extending to across the top (approximately 6 feet), and across the bottom (approximately 4 feet) of the opening. The issue was entered into the contractor's corrective action program (CAP) as condition report (CR) 25539-000-GCA-GAMG-00182, "Fractured Concrete Found at Shield Building Construction Opening," dated October 10, 2011. The licensee entered the issue into its CAP as CR-2011-03346, "Fractured Concrete Found at 17M Shield Building Construction Opening," dated October 10, 2011, and informed the NRC via the onsite Resident Inspectors' Office. As documented in CR-2011-03346, the SB pressure boundary was declared inoperable pending further evaluation based on the unknown impact of the cracking on the SB pressure boundary. The licensee also initiated a Mode Hold Restraint to ensure completion of evaluations necessary to demonstrate that the SB pressure boundary was operable prior to entering Mode 4, a Mode for which the containment system was required be operable per the plant's Technical Specifications.

At the time of the discovery of SB crack-like indications, a senior NRC Region III inspector was on-site for inspections related to the RRVCH. Upon notification by the licensee, the inspector immediately focused on this emergent safety concern.

Throughout the review of the SB cracking concern, the senior Region III inspector was augmented by the resident inspectors, additional Region III inspectors, and NRR engineering specialists. The NRC's independent review and observation of licensee activities related to the SB cracking included:

- maintenance of nuclear radiological safety;
- SB examinations to determine the type and extent of SB cracking, including SB examination methods and data evaluation;
- review of SB structural operability evaluations for identified cracking; and
- review of the SB original structural design and licensing bases.

The formation of an NRC technical review team, consisting of Region III inspectors and NRR technical specialists, ensured a thorough and rigorous review from multiple perspectives.

The records reviewed by the inspectors and technical specialists are identified in the Attachment to this report.

(1) Maintenance of Nuclear Radiological Safety

Because the containment system was not required to be operable during cold shutdown, demolition activities necessary to create the temporary construction opening continued to proceed after the SB cracks were identified. The inspectors confirmed that continuing this work would not prevent continued investigation of the SB cracking. The inspectors

also verified that the licensee had adequate Mode Hold Restraints in-place such that SB and CV demolition and restoration activities maintained nuclear radiological safety.

- The SB concrete demolition was completed prior to the initiation of the CV demolition.
- The CV demolition did not commence prior to defueling the reactor vessel.
- Refueling the reactor vessel did not commence prior to repairing the CV construction opening.
- Plant restart operations (Mode 4) did not commence until the SB construction opening was repaired, and the containment system was determined to be operable as required by the Technical Specifications (i.e., the SB was capable to perform its design functions with identified laminar cracking).

(2) Extent of Condition Activities

The on-site inspectors observed the licensee's activities to determine the type and extent of SB cracking. Following its initial identification of cracking, the licensee expanded SB testing based on an evaluation of the test results and the identification of cracked SB areas away from the RRVCH construction opening.

The inspectors observed the crack-like indications identified at the SB opening during the hydro-demolition process. The licensee postulated that the apparent cracks could be removed using a manual chipping process. Using this method, the crack indications along the left and bottom edges essentially disappeared, but the crack at the top of the opening did not disappear. Based on the observed crack characteristics, the licensee considered the crack to have been a circumferential laminar tear and not a radial 'through-thickness' direction crack.

Based upon inspection of the crack at the top of the SB opening, the licensee determined that the extent of the cracking warranted further examination and investigation. A contractor was contacted to perform impulse response (IR) testing. The IR testing was a nondestructive examination technique, not required or qualified by codes and standards for concrete examinations. The licensee utilized IR testing to qualitatively assess the presence and extent of potential anomalies (e.g., concrete laminar cracks) within the concrete structure.

The inspectors discussed with the IR testing contractors the capabilities and limitations of the IR testing method to identify subsurface laminar crack boundaries. The IR testing method measured the structure's frequency at a specific location and plotted that frequency with adjacent readings in order to identify any changes in building frequency. Changes in frequency within a short span were possible indications of subsurface concrete cracking. The licensee supplemented its IR testing efforts with the taking of core borings to validate the IR testing findings as well as to determine the depth of suspected laminar cracks.

The IR testing readings were performed on a representative sample of all readily accessible areas of the SB, with the progression of IR testing based upon the indications of possible cracking that were obtained. From this information, the licensee concluded that the laminar cracking initially identified adjacent to the RRVCH opening was not restricted to that area. The licensee entered this extent-of-condition issue for the SB

cracking into its CAP as CR-2011-03996 on October 19, 2011, and informed the NRC via the onsite Resident Inspectors' Office.

On October 26, 2011, during investigation actions associated with CR-2011-03346, the licensee identified additional areas of concern via IR testing in semicircular zones above the main steam line penetrations through the SB. The licensee entered this extent-of-condition issue for the SB cracking into its CAP as CR-2011-04402 and informed the NRC via the onsite Resident Inspectors' Office.

On October 31, 2011, the licensee identified additional indications of concrete cracking during IR testing towards the top of the SB wall, approximately between the 780 ft and 800 ft elevations. The licensee entered this extent-of-condition issue for the SB cracking into its CAP as CR-2011-04648, informed the NRC via the onsite Resident Inspectors' Office, and continued to investigate further to determine if any additional adverse conditions existed.

The cylindrical SB wall contains an inner and an outer rebar mat, each located approximately 3 inches into the concrete from their respective inner and outer wall surfaces. A rebar mat is a grid of reinforcing steel bars that adds strength to the concrete. In addition, the structure includes additional concrete elements (called shoulders) that extend out from the 2.5 foot thick wall to provide the appearance of 8 evenly spaced, vertical cutouts (called flutes) in the outer wall surface (Figure 2). These shoulders (16 in total) are a maximum thickness on each side of the flute (approximately 18 inches thick) and gradually blend into the 2.5 foot thick wall away from the flute. These shoulders are reinforced by additional rebar located below their concrete surfaces (Figure 3).

Figure 2: Davis-Besse Shield Building

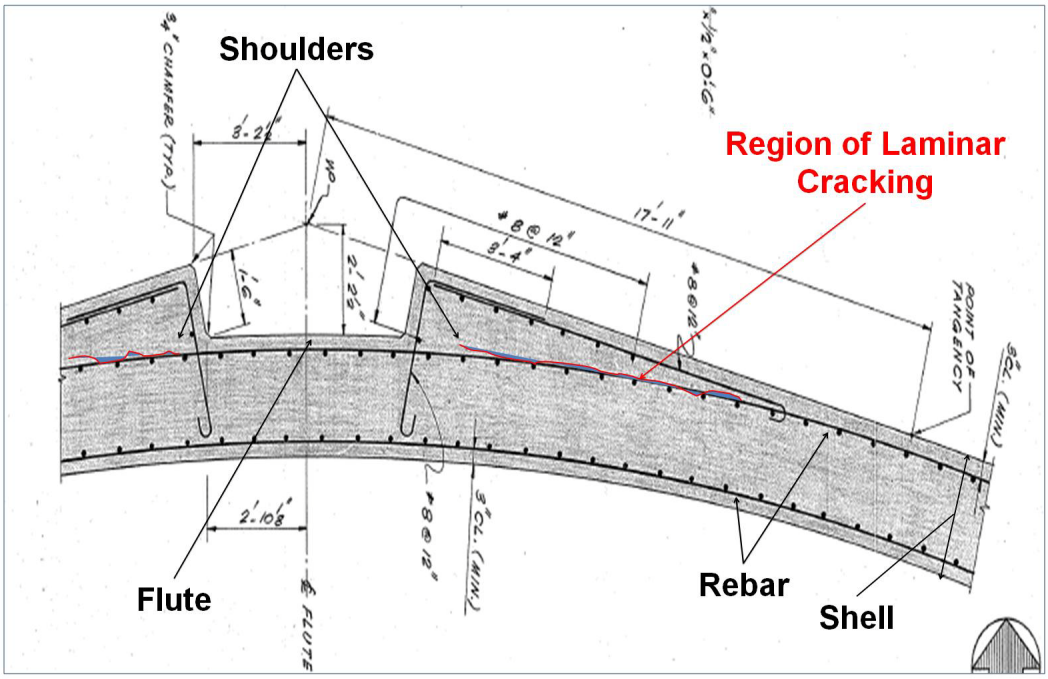

Figure 3: Flute and Shoulder Cross-Section

The NRC technical review team concluded that the licensee's method to determine the extent of SB cracking was a logical expansion of the testing, based on areas of identified cracking and the extent of identified cracking in these areas; i.e., initial IR testing mapping and core boring were performed at the SB temporary construction opening affected by hydro-demolition; IR testing mapping and core boring was expanded to SB areas near the main steam line penetrations; IR testing mapping and core boring was further expanded to upper SB regions.

In addition, the licensee performed petrographic examination of two core borings in accordance with the American Society for Testing and Materials Specification C856, "Standard Practice for Petrographic Examination of Hardened Concrete." The test results were documented in CTL Group Report: "Laboratory Evaluation of Shield Building Concrete Cores A and D," dated October 27, 2011 and were provided to the NRC for review.

Through its extent of condition activities, the licensee determined that the cracking was laminar in nature and generally extended circumferentially along or near the outer edge of the outer rebar mat for the credited concrete (2.5 foot thick cylinder). Laminar cracking is cracking of material, including concrete, in which there is a separation of layers, or planes. The laminar cracking was primarily associated with the shoulder regions, although some cracking was identified outside the shoulder regions near the main steam lines and near the top of the SB cylinder. The cracks were very tight (meaning the gap between the crack surfaces was extremely small). No cracking was identified inboard of the outer rebar mat (deeper toward the inner wall surface) around either the equipment access opening or in the core borings. The cracking was observed

to be more severe on the south facing regions of the building. The cracking was interior to the wall surface and was not visually discernable until the licensee cut into the wall to create the access opening.

The inspectors verified that the licensee utilized the IR testing methodology as a non-destructive screening to identify potentially cracked regions for further evaluation and that core borings were taken to confirm crack boundaries based on IR test results. The inspectors noted good correlation between the IR testing and the confirmatory core borings. The inspectors reviewed test reports for two core borings that were subjected to further laboratory examination. Additional core borings were analyzed through the licensee's root cause efforts and NRC review of those activities is a part of the ongoing NRC root cause and corrective action inspection and will be documented in the associated NRC inspection report.

The NRC technical review team engaged the licensee's engineers and consultants in technical discussions while evaluating the licensee's actions related to SB cracking extent of condition. As a result of NRC questions, the licensee performed additional SB examinations to justify licensee conclusions regarding the extent of cracking at the SB outer face wall, laminar cracks did not penetrate inside the outer face reinforcement, and the SB inner face wall was not subject to laminar cracking.

(3) SB Operability Evaluations

The licensee provided the inspectors with technical reports and calculations that evaluated the SB structural integrity based on IR testing mapping and core boring results. The NRC technical review team provided extensive review of the licensee's analysis and related calculations, and held multiple interactions with the licensee's engineers and consultants over several weeks to discuss NRC concerns and questions. As a result, the licensee's analysis and associated calculations were subject to several iterative changes during that timeframe including:

- Between November 1 and November 9, 2011, the licensee provided CR-2011-03346, "Mode Hold Resolution" dated November 2, 2011 and CR-2011-044402, "Mode Hold Resolution" dated November 3, 2011 and, "Davis-Besse Shield Building Cracking Investigation and Assessment Report," Revision 0, dated November 3, 2011, and several supporting calculations. These provided technical analysis and details to support conclusions described earlier in onsite presentations provided to NRC managers and staff entitled, "Davis Besse Shield Building Cracking – NRC Informal Presentation" and "Bechtel Structural Evaluation of Davis Besse Shield Building."

- Between November 17 and November 23, the licensee provided, "Davis Besse Shield Building Cracking Investigation and Assessment Report," Revision 1, dated November 23, 2011, "Davis Besse Shield Building and Technical Summary Report," Revision 0, dated November 17, 2011, and Revision 1, dated November 21, 2011, and several supporting calculations. On November 26 and November 27, 2011, a portion of the NRC technical review team conducted extensive onsite discussions with licensee technical staff and the licensee's contractors that performed the supporting calculations. The remainder of the NRC technical review team continued to provide offsite support.

- On December 1, 2011, the licensee provided revised calculations to address remaining concerns of the NRC technical review team. On December 1 and December 2, 2011, a portion of the NRC technical review team conducted additional onsite discussions with the licensee technical staff and the licensee's contractors to ensure appropriate understanding of the latest calculation revisions. The remainder of the NRC technical review team continued to provide offsite support.

On December 2, 2011, the NRC technical review team concluded that the licensee provided reasonable assurance that the SB had sufficient structural capacity to perform its design functions if subjected to a postulated design basis earthquake, tornado wind, or tornado generated missiles. The basis for the consensus conclusion included:

- IR testing mapping and confirmatory core borings provided sufficient characterization of the extent of cracking.

- Licensee calculations incorporated the SB extent of cracking into the structural evaluations in a conservative manner.

- The assumptions and engineering judgment used in the structural evaluations were reasonable and appropriate.

- The finite element model adequately reflected the load path through the structure for the degraded SB condition.

- The licensee calculations evaluated design basis earthquake, tornado wind and differential pressure, and tornado generated missile loads. The licensee used the alternative differential pressure design load from Regulatory Guide 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," Revision 1, applicable for the Davis-Besse site.

- The licensee calculations confirmed the calculated building stresses remained within acceptance limits specified in the original design and licensing bases.

- The licensee identified additional conservatism in the calculations that was not credited and could provide additional safety margin.

(4) SB Design and Licensing Bases

The licensee provided Calculation C-CSS-099.20-054, "Evaluation of Shield Building for the Permanent Condition With Outside Vertical Reinforcement Removed at Cracking Areas," Revision 002, dated November 20, 2011, and C-CSS-099.20-056, "Evaluation of Shield Building Hoop Reinforcement With Observed Cracking," Revision 000, dated November 21, 2011, as supporting its conclusion that the intent of the current SB design and licensing bases was still satisfied despite the cracking.

The inspectors reviewed the SB current design and licensing bases to determine if the above calculations were in conformance with the current design and licensing bases. As part of the review of SB laminar cracking, the inspectors reviewed the original SB design calculations, the associated industry codes and standards identified in the SB design and licensing bases, and industry guidance for evaluating existing concrete structures.

The SB was designed, in-part, using rules and requirements from American Concrete Institute (ACI) 307-69, "Specification for the Design and Construction of Reinforced Concrete Chimneys." This design standard specifies both inner face and outer face reinforcement for a cylindrical wall greater than 18 inches in thickness. The inspector did not identify alternative design rules in ACI 307-69 that addresses laminar cracking in proximity to the outer face reinforcement mat. In addition, the SB design was checked by the Ultimate Strength Design Method in accordance with ACI 318-63, "Building Code Requirements for Reinforced Concrete." The inspectors did not identify industry codes or standards that addressed concrete reinforcement effectiveness in proximity to laminar cracking.

Therefore, the inspectors, after consultation with the NRC technical review team, questioned if laminar cracking in proximity to the outer face reinforcement was a condition not in conformance with the current design basis. The inspectors noted that revised calculations provided on December 1, 2011, did not include such a claim, and instead the licensee continued to review the previous conclusion.

After additional evaluation and interactions with the inspectors, the licensee concluded in its Shield Building Root Cause Report dated February 27, 2012, that the SB, with the laminar cracking in its walls, was operable but non-conforming to the current design and licensing bases with regard to the design stress analysis methodology, and the tornado allowable stress values.

- Davis-Besse's Updated Safety Analysis Report (USAR) Section 3.8.2.2.5 and Design Criteria Manual (DCM) Section II.H.2.5.1.5 specified the analysis methodologies used for the SB design. These documents stated that the SB wall was designed using, "Analysis of Spherical Shells" from Section III of the 1968 Edition of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. In the initial condition assessment, Calculations C-CSS-099.20-054 and C-CSS-099.20-056 used the "ANSYS" computer software to study the effect of the laminar cracks on the function of the SB.

- The USAR Section 3.8.2.2.6 and Design Criteria Manual (DCM) Section II.H.2.5.1.5 defined the load combinations and allowed stresses for the SB design. Study Calculation C-CSS-099.20-056 documented that the calculated stress for the tornado wind and differential pressure load exceeded the allowable stress value in the design and licensing basis, but was within the allowable limit using the alternative differential pressure design load of Regulatory Guide 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," Revision 1.

The inspectors noted that any future calculations used to evaluate the SB with the concrete laminar cracking will have to conform to the design and licensing bases. The licensee documented in its Root Cause Report its intention to generate an engineering plan by December 1, 2012, to re-establish the SB licensing basis.

(5) SB Cracking Root Cause

Prior to restart from the mid-cycle outage to replace the RVCH, the NRC issued Confirmatory Action Letter (CAL), No. 3-11-001, dated December 2, 2011 (ML11336A355), that confirmed commitments by FirstEnergy Nuclear Operating

Company (FENOC) regarding the identification of cracks in the reinforced SB at the Davis-Besse Nuclear Power Station. Based on evaluation of FENOC's extent of condition and technical analysis of the SB cracking, the NRC staff concluded that FENOC provided reasonable assurance that the SB was capable of performing its safety functions. In order to provide continued confidence, FENOC agreed to provide a root cause report, corrective actions, and a long term monitoring program to the NRC for review by February 28, 2012.

The NRC technical review team's rationale for not needing a root cause evaluation prior to startup included:

- The NRC technical review team concluded the SB could perform its safety function in the current degraded state

- The licensee took actions to monitor whether the condition was worsening over the short term and committed to develop a longer term monitoring program.

Because of the additional licensee actions with respect to extent of condition and evaluation of operability and licensing basis, resulting from NRC review and interactions with NRC staff, the licensee captured associated performance concerns in its CAP as CR-2012-1472 and CR-2012-5708.

NRC inspectors continued to evaluate the licensee's root cause activities including review of the Root Cause Report in a separate ongoing inspection. That effort included evaluating whether there are any performance deficiencies associated with the root cause that warranted enforcement action.

b. Findings

No findings of significance were identified. Specifically, the licensee revised the operability evaluation and supporting calculations including superseding its conclusion on licensing basing prior to restarting the plant. In particular, the licensee demonstrated the containment system was operable prior to the entering Mode 4.

4OA6 Management Meetings

.1 Exit Meeting Summary

On April 17, 2012, the inspectors presented the inspection results via telephone to the Site Vice President, Mr. Barry Allen, and other members of the licensee staff. The licensee acknowledged the issues presented. The inspectors confirmed that none of the potential report input discussed was considered proprietary.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee

B. Allen, Site Vice President
R. Baird, Staff Engineer, Design Engineering
B. Boles, Director, Site Operations
K. Byrd, Director, Site Engineering
T. Chowdhary, NRC Liaison
C. Daft, Component Engineering
J. Dominy, Director, Site Maintenance
B. Hennessy, Supervisor, Fleet Oversight
T. Henry, Advanced Nuclear Engineer, Design Engineering
J. Hook, Manager, Design Engineering
D. Imlay, Director, Site Performance Improvement
D. Pace, FENOC Senior Vice President, Engineering
G. Wolf, Supervisor, Regulatory Compliance

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened

None

Closed

None

Discussed

None

LIST OF DOCUMENTS REVIEWED

The following is a partial list of documents reviewed during the inspection. Inclusion on this list does not imply that the NRC inspector reviewed the documents in their entirety, but rather that selected sections or portions of the documents were evaluated as part of the overall inspection effort. Inclusion of a document on this list does not imply NRC acceptance of the document or any part of it, unless this is stated in the body of the inspection report.

Corrective Action Program Documents Reviewed:

- Bechtel Condition Report 25539-000-GCA-GAMG-00182; Fractured Concrete Found at Shield Building Construction Opening; dated October 10, 2011
- CR-2011-3232; Shield Building Rebar Cover Less Than Drawing Requirement; dated October 8, 2011
- CR-2011-3346; Fractured Concrete Found at 17M Shield Building Construction Opening; dated October 10, 2011
- CR-2011-3996; Extent of Condition for Shield Building Fracture Indications; dated October 19, 2011
- CR-2011-4190; Surface Cracks identified on Fluted Areas of Shield Building; dated October 23, 2011
- CR-2011-4214; Core Bore Found Additional Crack in Shield Building Architectural Flute Area; dated October 24, 2011
- CR-2011-4402; Fractured Concrete Found at 17M Shield Building at Main Steam Line Penetrations; dated October 26, 2011
- CR-2011-4507; Isolated Crack Indication Identified by Impulse Response Testing of Shield Building; dated October 28, 2011
- CR-2011-4648; Shield Building Impulse Response Indications Above Elevation 780; dated October 31, 2011
- CR-2011-4973; As-Found Concrete Cover and Spacing of Reinforcement Steel (Rebar) Do Not Meet Specified Design Requirements of 17M Shield Building Construction Opening; dated November 6, 2011
- CR-2011-5475; Concrete Cracking at Top of Shield Building Wall; dated November 16, 2011
- CR-2011-5648; Concrete Cracking in Shoulder 4/Flute 2 Region of Shield Building (Azimuth 67.5); dated November 18, 2011
- CR-2011-5904; Errors Identified in Shield Building Crack Calculation C-CSS-059.20-056; dated November 25, 2011
- CR-2011-6185; Error in Calculation C-CSS-059.20-056 Revision 01; dated December 1, 2011
- CR-2012-0071; As-Found Concrete Cover and Spacing of reinforcement Steel (Rebar) Do Not Meet Specified Design Requirements in Locations Adjacent to the 17M Shield Building Opening; dated January 3, 2012

Corrective Action Program Documents Issued during Inspection:

- CR-2012-1472; NRC Potential Violation of 50.59 on the Shield Building Cracking; dated February 29, 2012
- CR-2012-5708; NRC Observation Regarding Design Control of Shield Building Calculation; dated April 13, 2012

Calculations:

- C-CSS-099.20-045; Evaluation of Shield Building for the Construction Opening – SGR – RVCH Replacement; Revision 0
- C-CSS-099.20-046; Evaluation of Shield Building for the Permanent Condition; Revision 0
- C-CSS-099.20-047; Restoration of Shield Building Construction Opening; Revision 0
- C-CSS-099.20-048; Seismic II/I Evaluation of Shield Building Framework in Annulus; Revision 0
- C-CSS-099.20-050; Tornado Depressurization for the RV Head Replacement; Revision 0
- C-CSS-099.20-053 Evaluation of Shield Building for the Interim Condition with Outside Vertical Reinforcement Removed at Each Flute Shoulder; Revision 0 dated November 7, 2011
- C-CSS-099.20-054; Evaluation of Shield Building for the Permanent Condition with Outside Vertical Reinforcement Removed at Each Flute Shoulder; Revision 0 dated October 31, 2011
- C-CSS-099.20-054; Evaluation of Shield Building for the Permanent Condition with Outside Vertical Reinforcement Removed at Each Flute Shoulder; Revision 1 dated November 8, 2011
- C-CSS-099.20-054; Evaluation of Shield Building for the Permanent Condition with Outside Vertical Reinforcement Removed at Each Flute Shoulder; Revision 2 dated November 20, 2011
- C-CSS-099.20-054; Evaluation of Shield Building for the Permanent Condition with Outside Vertical Reinforcement Removed at Each Flute Shoulder; Revision 3 dated December 1, 2011
- C-CSS-099.20-055; II/I Evaluation for Architectural Flute Shoulder; Revision 0 dated October 31, 2011
- C-CSS-099.20-056; Evaluation of Shield Building Hoop Reinforcement with Observed Cracking; Revision 0 November 21, 2011
- C-CSS-099.20-056; Evaluation of Shield Building Hoop Reinforcement with Observed Cracking; Revision 1 dated December 1, 2011
- C-CSS-099.20-056; Evaluation of Shield Building Hoop Reinforcement with Observed Cracking; Revision 2 dated December 5, 2011
- C-EE-099.01-001; Containment Conduits Affected by Tornado Missiles - Containment Vessel construction Opening – 17M and18 RFO; Revision 0
- VC01-B01-001; Shield Building – Thermal Stresses – Shield Wall (Independent Checking); Revision 0
- VC02-B01-005; Shield Building – Thermal Stresses; Revision 0
- VC03-B01-003; Membrane Stress in Shield Building Wall; Revision 0
- VC03-B01-004; Shield Building: Summarized Stresses and Reinforcement Design; Revision 0
- VS01-B01-003; Seismic Analysis of the Containment Structure; Revision 0

Drawings:

- C-0100;Shield Building Foundation Plan & Details, Sheet 1; Revision 5
- C-0110; Shield Building Roof Plan Wall Sections & Details; Revision 6
- C-011A; Shield Building Developed Elevation; Revision 1 dated November 22, 2011
- C-011A; Shield Building Developed Elevation; Revision 2 dated November 29, 2011
- C-0112; Shield Building Details, Sheet 1; Revision 10

Miscellaneous:

- CTL Impulse Response Mobility Plot; Revision 1 dated November 23, 2011
- Sketch SKZ904; Shield Building Developed Elevation; Revision 0 dated November 3, 2011

Modifications:

- ECP 10-0458-000; SGR-17M-Shield Building Construction Opening; Revision 0
- ECP 10-0458-001; SGR-17M-Install Shield Building Construction Opening; Revision 0
- ECP 10-0458-002; SGR-17M-Restore Shield Building Construction Opening; Revision 0
- ECP 10-0458-003; SGR-17M-Ventilation of Annulus during Construction; Revision 0

Reports:

- CTL Group Report: Laboratory Evaluation of Shield Building Concrete Cores A and D; dated October 27, 2011
- Davis-Besse Shield Building Cracking Investigation and Assessment Report; Revision 0 dated November 3, 2011
- Davis-Besse Shield Building Cracking Investigation and Assessment Report; Revision 1 dated November 23, 2011
- Davis-Besse Shield Building Investigation and Technical Summary; Revision 0 dated November 17, 2011
- Davis-Besse Shield Building Investigation and Technical Summary; Revision 1 dated November 21, 2011

References:

- ACI 307; Specification for the Design and Construction of Reinforced Concrete Chimneys; 1969 Edition
- ACI 318; Building Code Requirements for Reinforced Concrete; 1963 Edition
- ACI 349.3R; Evaluation of Existing Nuclear Safety-Related Concrete Structures; 2010 Edition
- Davis Besse Updated Final Safety Analysis Report; Revision 28

LIST OF ACRONYMS USED

ACI	American Concrete Institute
ADAMS	Agencywide Document Access Management System
CAL	Confirmatory Action Letter
CAP	Corrective Action Program
CFR	Code of Federal Regulations
CR	Condition Report
CV	Containment Vessel
DCM	Design Criteria Manual
DRS	Division of Reactor Safety
FENOC	FirstEnergy Nuclear Operating Company
IR	Impulse Response
NRC	U.S. Nuclear Regulatory Commission
NRR	Division of Nuclear Reactor Regulation
PARS	Publicly Available Records System
RRVCH	Replacement Reactor Vessel Closure Head
RVCH	Reactor Vessel Closure Head
SB	Shield Building
USAR	Updated Safety Analysis Report

In order to provide continued confidence, and as noted in the CAL, FENOC agreed to provide a Root Cause Report, corrective actions, and a long term monitoring program to the NRC for review by February 28, 2012. NRC inspectors continue to evaluate your root cause activities and corrective actions including review of the Root Cause Report in a separate ongoing inspection. That effort includes evaluating whether there are any performance deficiencies associated with the root cause that warrant enforcement action.

In accordance with Title 10, Code of Federal Regulations (CFR), Part 50, Section 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any), will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records System (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,
/RA by Kenneth O'Brien Acting for/

Steven A. Reynolds, Director
Division of Reactor Safety

Docket No. 50-346
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Enclosure: Inspection Report 05000346/2012007
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Letter to Barry Allen from Steven Reynolds dated May 7, 2012.

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION REACTOR VESSEL HEAD REPLACEMENT AND SHIELD BUILDING CRACKING INSPECTION REPORT 05000346/2012007(DRS)

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