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Public Comments

The inspectors assessed the licensee's process for applying operating experience to their plant.

b. Findings

No findings were identified.

2RS5 Radiation Monitoring Instrumentation (71124.05)

The activities in Sections 1 through 4 that follow constituted one complete inspection sample as defined in IP 71124.05-05.

.1 Inspection Planning (02.01)

a. Inspection Scope

The inspectors reviewed the plant USAR to identify radiation instruments associated with monitoring area radiological conditions including airborne radioactivity, process streams, effluents, materials/articles, and workers. Additionally, the inspectors reviewed the instrumentation system and the associated TS requirements for post-accident monitoring instrumentation including instruments used for remote emergency assessment.

The inspectors reviewed a listing of in-service survey instrumentation including air samplers and small article monitors, along with instruments used to detect and analyze workers' external contamination. Additionally, the inspectors reviewed personnel contamination monitors and portal monitors, including whole-body counters, to detect workers' internal contamination. The inspectors reviewed this instrumentation list to assess whether an adequate number and type of instruments were available to support operations.

The inspectors reviewed licensee and third-party evaluation reports of the radiation monitoring program since the last inspection. These reports were reviewed for insights into the licensee's program and to aid in selecting areas for review ("smart sampling").

The inspectors reviewed procedures that govern instrument source checks and calibrations, focusing on instruments used for monitoring transient high radiological conditions, including instruments used for underwater surveys. The inspectors reviewed the calibration and source check procedures for adequacy and as an aid to smart sampling.

The inspectors reviewed the area radiation monitor (ARM) alarm setpoint values and setpoint bases as provided in the TS and the USAR.

The inspectors reviewed effluent monitor alarm setpoint bases and the calculational methods provided in the Offsite Dose Calculation Manual (ODCM).

b. Findings

No findings were identified.

.2 Walkdowns and Observations (02.02)

a. Inspection Scope

The inspectors walked down effluent radiation monitoring systems, including at least one liquid and one airborne system. Focus was placed on flow measurement devices and all accessible point-of-discharge liquid and gaseous effluent monitors of the selected systems. The inspectors assessed whether the effluent/process monitor configurations aligned with ODCM descriptions and observed monitors for degradation and out-of-service tags.

The inspectors selected portable survey instruments that were in use or available for issuance and assessed calibration and source check stickers as well as instrument material condition and operability.

The inspectors observed licensee staff performance as the staff demonstrated source checks for various types of portable survey instruments. The inspectors assessed whether high-range instruments were source checked on all appropriate scales.

The inspectors walked down ARMs and CAMs to determine whether they were appropriately positioned relative to the radiation sources or areas they were intended to monitor. Selectively, the inspectors compared monitor response (via local or remote control room indications) with actual area conditions for consistency.

The inspectors selected personnel contamination monitors, portal monitors, and small article monitors and evaluated whether the periodic source checks were performed in accordance with the manufacturer's recommendations and licensee procedures.

b. Findings

No findings were identified.

.3 Calibration and Testing Program (02.03)

a. Process and Effluent Monitors

(1) Inspection Scope

The inspectors selected effluent monitor instruments (such as gaseous and liquid) and evaluated whether channel calibration and functional tests were performed consistent with radiological effluent TS/ODCM. The inspectors assessed whether: (a) the licensee calibrated its monitors with National Institute of Standards and Technology traceable sources; (b) the primary calibrations adequately represented the plant nuclide mix; (c) the sources were verified by the primary calibration when secondary calibration sources were used; and (d) the licensee's channel calibrations encompassed the instrument's alarm set-points.

The inspectors assessed whether the effluent monitor alarm setpoints were established as provided in the ODCM and station procedures.

When changes to effluent monitor setpoints were made, the inspectors evaluated the bases for the changes to ensure that an adequate justification existed.

(2) Findings

No findings were identified.

b. Laboratory Instrumentation

(1) Inspection Scope

The inspectors assessed laboratory analytical instruments used for radiological analyses to determine whether daily performance checks and calibration data indicated that the frequency of the calibrations was adequate and there were no indications of degraded instrument performance.

The inspectors assessed whether appropriate corrective actions were implemented in response to indications of degraded instrument performance.

(2) Findings

No findings were identified.

c. Whole Body Counter

(1) Inspection Scope

The inspectors reviewed the methods and sources used to perform whole body count functional checks before daily use of the instrument and assessed whether check sources were appropriate and aligned with the plant's nuclide mix.

The inspectors reviewed whole body count calibration records and evaluated whether calibration sources were representative of the plant source term and whether the appropriate calibration phantoms were used. The inspectors assessed the calibration data for anomalous results or other indications of instrument performance problems.

(2) Findings

No findings were identified.

d. Post-Accident Monitoring Instrumentation

(1) Inspection Scope

The inspectors selected containment high-range monitors and reviewed the calibration documentation since the last inspection.

The inspectors reviewed the electronic calibration data and assessed whether calibration acceptance criteria were reasonable, accounted for the large measuring range, and reflective of the intended purpose of the instruments.

The inspectors reviewed the licensee's stack effluent process monitors that were relied on by the licensee in its emergency operating procedures as a basis for triggering emergency action levels and emergency classifications in order to make protective action recommendations during an accident. The inspectors evaluated the calibration and availability of these instruments.

The inspectors reviewed the licensee's capability to collect high-range, post-accident iodine effluent samples.

As available, the inspectors observed electronic and radiation calibration of these instruments to assess conformity with the licensee's calibration and test protocols.

(2) Findings

No findings were identified.

e. Portal Monitors, Personnel Contamination Monitors, and Small Article Monitors

(1) Inspection Scope

During a review of these instruments used on site, the inspectors assessed whether the alarm setpoint values were reasonable under the circumstances to ensure that licensed material was not released from the site.

The inspectors reviewed the calibration documentation for each instrument selected and discussed the calibration methods with the licensee to determine consistency with the manufacturer's recommendations.

(2) Findings

No findings were identified.

f. Portable Survey Instruments, Area Radiation Monitors, Electronic Dosimetry, and Air Samplers/Continuous Air Monitors

(1) Inspection Scope

The inspectors reviewed calibration documentation for at least one of each type of instrument. In reviewing these portable survey instruments and ARMs, the inspectors reviewed detector measurement geometry and calibration methods and had the licensee demonstrate use of its instrument calibrator as applicable. The inspectors conducted comparison of instrument readings versus an NRC survey instrument if problems were suspected.

As available, the inspectors reviewed the data for portable survey instruments that did not meet acceptance criteria during calibration in order to assess whether the licensee took appropriate corrective actions with instruments that were found significantly out of calibration greater than 50 percent. The inspectors assessed whether the licensee evaluated the out of tolerance instruments for possible consequences when used during radiation surveys.

(2) Findings

No findings were identified.

g. Instrument Calibrator

(1) Inspection Scope

As applicable, the inspectors reviewed the current output values for the licensee's portable survey and ARM instrument calibrator units. The inspectors assessed whether the licensee periodically measures calibrator output over the range of the instruments used through measurements by ion chamber/electrometer.

The inspectors assessed whether the measuring devices had been calibrated by a facility using National Institute of Standards and Technology traceable sources and whether corrective factors for these measuring devices were properly applied by the licensee in its output verification.

(2) Findings

No findings were identified.

h. Calibration and Check Sources

(1) Inspection Scope

The inspectors reviewed the licensee's 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," source term to assess whether calibration sources used were representative of the types and energies of radiation encountered in the plant.

(2) Findings

No findings were identified.

.4 Problem Identification and Resolution (02.04)

a. Inspection Scope

The inspectors evaluated whether problems associated with radiation monitoring instrumentation were being identified by the licensee at an appropriate threshold and were properly addressed for resolution in the licensee's CAP. The inspectors assessed the appropriateness of the corrective actions for a selected sample of problems documented by the licensee that involve radiation monitoring instrumentation.

b. Findings

No findings were identified.

4. OTHER ACTIVITIES

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity, Emergency Preparedness, Occupational Radiation Safety, Public Radiation Safety, and Security

4OA1 Performance Indicator Verification (71151)

.1 Reactor Coolant System Specific Activity

a. Inspection Scope

The inspectors sampled licensee submittals for the RCS Specific Activity performance indicator for the period from October 2010 through September 2011. To determine the accuracy of the PI data reported during those periods, PI definitions and guidance contained in the Nuclear Energy Institute (NEI) Document 99-02, "Regulatory Assessment Performance Indicator Guideline," Revision 6, dated October 2009, were used. The inspectors reviewed the licensee's RCS chemistry samples, TS requirements, CRs, and NRC Integrated Inspection Reports for the period from October 2010 through September 2011 to validate the accuracy of the submittals. The inspectors also reviewed the licensee's condition report database to determine if any problems had been identified with the PI data collected or transmitted for this indicator. In addition to record reviews, the inspectors observed a chemistry technician obtain and analyze a reactor coolant system sample. Documents reviewed are listed in the Attachment to this report.

This inspection constituted one reactor coolant system specific activity sample as defined in IP 71151-05.

b. Findings

No findings were identified.

.2 Reactor Coolant System Leakage

a. Inspection Scope

The inspectors sampled licensee submittals for the RCS Leakage performance indicator for the period from October 2010 through September 2011. To determine the accuracy of the PI data reported during those periods, PI definitions and guidance contained in the NEI Document 99-02, "Regulatory Assessment Performance Indicator Guideline," Revision 6, dated October 2009, were used. The inspectors reviewed the licensee's operator logs, RCS leakage tracking data, condition reports and NRC Integrated IRs for the period from October 2010 through September 2011 to validate the accuracy of the submittals. The inspectors also reviewed the licensee's condition report database to determine if any problems had been identified with the PI data collected or transmitted for this indicator. Documents reviewed are listed in the Attachment to this report.

This inspection constituted one reactor coolant system leakage sample as defined in IP 71151-05.

b. Findings

No findings were identified.

4OA2 Identification and Resolution of Problems (71152)

.1 Routine Review of Items Entered into the Corrective Action Program

a. Inspection Scope

As part of the various baseline IPs discussed in previous sections of this report, the inspectors routinely reviewed issues during baseline inspection activities and plant status reviews to verify that they were being entered into the licensee's CAP at an appropriate threshold, that adequate attention was being given to timely corrective actions, and that adverse trends were identified and addressed. Attributes reviewed included: identification of the problem was complete and accurate; timeliness was commensurate with the safety significance; evaluation and disposition of performance issues, generic implications, common causes, contributing factors, root causes, extent-of-condition reviews, and previous occurrences reviews were proper and adequate; and that the classification, prioritization, focus, and timeliness of corrective actions were commensurate with safety and sufficient to prevent recurrence of the issue. Minor issues entered into the licensee's CAP as a result of the inspectors' observations are included in the Attachment to this report.

These routine reviews for the identification and resolution of problems did not constitute any additional inspection samples. Instead, by procedure they were considered an integral part of the inspections performed during the quarter and documented in Section 1 of this report.

b. Findings

No findings were identified.

.2 Daily Corrective Action Program Reviews

a. Inspection Scope

In order to assist with the identification of repetitive equipment failures and specific human performance issues for follow-up, the inspectors performed a daily screening of items entered into the licensee's CAP. This review was accomplished through inspection of the station's daily condition report packages.

These daily reviews were performed by procedure as part of the inspectors' daily plant status monitoring activities and, as such, did not constitute any separate inspection samples.

b. Findings

No findings were identified.

.3 Semi-Annual Trend Review

a. Inspection Scope

The inspectors performed a review of the licensee's CAP and associated documents to identify trends that could indicate the existence of a more significant safety issue. The inspectors' review was focused on repetitive equipment issues, but also considered the results of daily inspector CAP item screening discussed in Section 4OA2.2 above, licensee trending efforts, and licensee human performance results. The inspectors' review nominally considered the 6 month period of July 1, 2011, through December 31, 2011, although some examples expanded beyond those dates where the scope of the trend warranted.

The review also included issues documented outside the normal CAP in major equipment problem lists, repetitive and/or rework maintenance lists, departmental problem/challenges lists, system health reports, QA audit/surveillance reports, self-assessment reports, and Maintenance Rule assessments. The inspectors compared and contrasted their results with the results contained in the licensee's CAP trending reports. Corrective actions associated with a sample of the issues identified in the licensee's trending reports were reviewed for adequacy.

This review constituted a single semi-annual trend inspection sample as defined in IP 71152-05.

b. Observations

The inspectors identified a potential adverse trend related to the technical quality of the licensee's infrequently performed procedures, specifically those procedures that are potentially only utilized during a unit refuel or other outage:

- On October 20, 2011, the on-watch control room crew received an unexpected annunciator alarm, 11-3-A, which indicated a low level in the CCW surge tank. The crew entered DB-OP-02011, "Heat Sink Alarm Panel 11 Annunciators," and cut in demineralized water to the CCW system to retard the drop in surge tank level in accordance with the procedure. The lowering level in the CCW surge tank was traced to the inadvertent stroking of MOV CC2645, the train 1 auxiliary building return header isolation valve, which had unexpectedly stroked open when plant operators restored 480 Vac power to the MOV as part of system restoration following outage maintenance. Operations personnel had been misled by instructional notes on approved plant drawings that indicated that the valve would not automatically stroke open upon restoration of power. A finding associated with this issue is discussed in detail in Section 1R20.1 of this report;

- On November 17, 2011, the on-watch control room crew again received an unexpected annunciator alarm, 11-3-A, which indicated a low level in the CCW surge tank. Once again, the crew entered DB-OP-02011, "Heat Sink Alarm Panel 11 Annunciators," and cut in demineralized water to the CCW system to retard the drop in surge tank level in accordance with the procedure. Following this event, the lowering level in the CCW surge tank was traced to air intrusion into the CCW system. A complex series of fill and venting evolutions to restore the system had been required, and these evolutions had not vented all of the air from the system. A finding associated with this issue is discussed in detail in Section 1R15.1 of this report;

- On November 16, 2011, an Alert was declared by the licensee due to a fire and "explosion" with a "flash of flame" coming from safety-related MCC E11C. The fire was caused by an electrical short within one of the MCC's circuit breakers that had resulted from water intrusion. A demineralized water supply valve, PW55, located above MCC E11C had been overpressurized and leaked water onto the MCC. The overpressurization of PW55 resulted from an improper sequence of procedure steps for the switching of makeup water to the station's auxiliary boiler that relied upon a check valve to protect lower pressure rated piping and components. A finding associated with this issue is discussed in detail in Section 4OA3.2 of this report;

- On November 21, 2011, while conducting RCS fill and venting activities the licensee overpressurized the low-range suction pressure gauges on decay heat pump 1 and decay heat pump 2. The sequence of steps in procedure DB-OP-06904, "Shutdown Operations," was identified as the issue. The licensee documented this issue in their CAP as CRs 2011-05781 and 2011-05782;

- On November 19, 2011, the licensee attempted to obtain a chemistry sample to verify pressurizer dissolved oxygen concentrations during pressurizer heatup in accordance with procedure DB-CH-06002, "Sampling System Nuclear Areas." The sample was unable to be obtained due to limitations with the procedure as *written. The licensee documented this issue in their CAP as CR 2011-05726;* and

- On November 29, 2011, the licensee identified an adverse condition associated with procedure DB-PF-03811, "Miscellaneous Valves Test." The procedure as written would have overpressurized a section of piping in the decay heat system had it been performed as scheduled. Fortunately, the on-watch Operations crew identified the vulnerability before the procedure was performed and had it rescheduled for a time when plant conditions would adequately support it. The licensee entered the issue into their CAP as CR 2011-06011.

In each of these cases, the issue was of very low or minor safety significance. However, taken collectively they represent a potential adverse trend that may require a mitigation strategy.

c. <u>Findings</u>

No findings were identified.

.4 <u>Annual Sample: Review of Licensee Extent-of-Condition for Shield Building Concrete Cracking</u>

a. <u>Inspection Scope</u>

On October 10, 2011, a laminar crack was found in the flute shoulder area of the opening being cut through the SB concrete cylindrical wall for transfer of the RRVCH head. The crack was found on the vertical side of the opening (left side, looking from the outside), generally along the main reinforcing steel of the cylinder, and extending to across the top (approximately 6 feet) and across the bottom (approximately 4 feet) of the opening. After the licensee performed some minor manual chipping along the edges, the crack indication along the left and bottom edges essentially disappeared. Based on the observation, the licensee considered the crack to have been a circumferential laminar tear and not a radial 'through-thickness' direction crack. The licensee initiated CR 2011-03346 to identify this issue and informed the NRC via the Resident Inspectors' Office on site.

Based upon inspection of this crack at 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 method measured the structure's frequency at a specific location and plotted that frequency with adjacent readings to obtain any change in building frequency. Changes in frequency within a short span were possible subsurface indications of concrete cracking. To confirm the IR readings, the licensee performed core boring of the concrete in the indicated areas (where cracking was suspected) and in the adjacent areas (where no cracking was suspected). The IR 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, but was a much more generic issue for the SB as a whole. The licensee entered this extent-of-condition issue for the SB cracking into their CAP as CR 2011-03996 on October 19, 2011, and informed the NRC via the Resident Inspectors' Office on site.

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. This condition appeared to be different from the condition documented in CR 2011-03346, which had been primarily concerned with cracking at the SB opening and similar areas around the building's circumference. These new areas of concern were not similar to those previously identified, and appeared to be associated with the main steam line penetrations. The licensee entered this extent-of-condition issue for the SB cracking into their CAP as CR 2011-04402 and informed the NRC via the Resident Inspectors' Office on site.

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. This area of indications was yet another one different from the laminar cracking initially identified adjacent to the RRVCH opening. The licensee entered this extent-of-condition issue for the SB cracking into their CAP as CR 2011-04648, informed the NRC via the Resident Inspectors' Office on site, and continued to investigate further to determine if any additional adverse conditions existed.

The inspectors evaluated the licensee's implementation of their process used to identify, document, track, and resolve these challenges. The inspectors also reviewed the associated CRs and investigations for the issue to verify that the licensee's identification of the problems were complete, accurate, and timely, and that the consideration of the extent-of-condition reviews, generic implications, common causes, and previous occurrences, if any, were adequate. Throughout the entire process, the NRC Resident Inspectors' Office was augmented by structural engineering experts from the NRC

Region III Office in Lisle, Illinois, as well as structural engineering and concrete construction experts from the Office of Nuclear Reactor Regulation located at NRC Headquarters in Washington, D.C.

Inspector follow-up activities related to the laminar concrete cracking and the long-term impact on the SB are on-going. Upon completion, the inspection will be documented in a separate report, IR 05000346/2012007, along with the results of the NRC's technical assessment of the licensee's evaluation of the SB's capability to perform its designated safety functions.

The documents listed in the Attachment were reviewed to accomplish the objectives of the IP. This review constituted one annual inspection sample as defined in IP 71152-05. In addition, this sample contributed towards completion of IP 71007, "Reactor Vessel Head Replacement."

b. Findings

No findings were identified.

.5 Selected Issue Follow-Up Inspection Associated with Condition Report 07-26185 "Degradation Found on Rip-Rap sides of the Forebay and Intake Canal"

a. Inspection Scope

The inspectors reviewed the corrective actions associated with excessive settlement in a section of the safety-related Northern Wall of the Intake Canal Forebay that was identified by the licensee and documented in CR 07-26185 "Degradation Found on Rip-Rap sides of the Forebay and Intake Canal." This issue was selected for an in-depth review based on the Ultimate Heat Sink inspection (Section 1R.07) and discussions with the Division of License Renewal in the Office of Nuclear Regulation. The inspectors reviewed the troubleshooting activities and subsequent CRs to verify that the licensee was appropriately addressing the adverse condition in their corrective action program.

b. Findings and Observations

During a routine inspection of the Intake Canal in 2007, the licensee identified unexpected settlement on the North side of the embankment in the safety-related portion of the Forebay for a length of approximately 200 feet. This settlement reduced the slope of the embankment and the concern was captured in CR 07-26185. The licensee contracted an external organization to perform a stability study to ensure the operability of the embankment. In 2009, the licensee received the final report and CR 09-54330 "Slope Stability Study for the FOREBAY North Wall Found Low Strength Clay Till," was created to evaluate the conclusions of the contractor's report, Bowser- Morner Report No. 144188-0209-1575. The report documented the soil profile of the core bores taken above the affected areas were very similar to the soil profile described in the original plant design documents. The licensee concluded the condition was insignificant and did not affect operability of the canal walls; however, the licensee initiated actions to restore the canal wall. However, in 2010, the licensee rejected the initial repair plan and in March 2011, concluded additional data and analysis were necessary to understand the cause of the condition.

During the Ultimate Heat Sink inspections, the inspectors walked the length of the canal walls with the system engineer and noted that the wall had degraded further. At the NRC's prompting, the licensee initiated CR 11-97166, "Degradation of the Intake Canal North Wall in the Q/NQ Portion of the Canal." The licensee concluded the canal remained operable based on EQE Calculation 250785-C-001, "Slope Stability," dated March 31, 1999, which evaluated erosion of the earthen wall embankment in the nonsafety-related portion of the canal. However, the inspectors questioned the applicability of the EQE Calculation and subsequent licensee conclusion of current functionality because the EQE addressed a specific failure mechanism, which was not present in the safety-related section of the intake structure. The inspectors also questioned the term "stable" being used to describe what the inspectors observed as active degradation of the canal wall.

During this same time period, the licensee performed a surveillance to measure the length and width of the intake canal. The licensee concluded portions of the canal were narrower than expected; therefore, the Intake Canal did not meet the licensed design requirements due to volume reduction of approximately three percent (3 percent). Additionally, the slopes, canal toe-to-toe lengths and wall heights were not consistent with the original design requirements and documentation. The licensee initiated CR 11-00422 "Intake Canal Dike Does Not Meet Design Configuration Requirements," and a prompt operability determination. The licensee re-calculated the available volume and surface area and determined that margin was available such that the canal remained operable. However, the licensee noted UFSAR Section 2.5.1.10.2, "Foundations for Seismic Class I Structures; Seismic Class I Intake Forebay Canal Dikes," stated the intake canal was designed to have a 2.5 factor of safety against failure during the maximum possible earthquake. The current condition resulted in a factor of safety of 2.44. The licensee determined in the prompt operability determination that while this condition did not meet the UFSAR, there was reasonable assurance of operability.

Although the licensee was aware of the above issues, the inspectors were concerned that in the prompt operability determinations, the licensee narrowly assessed the current, as-found condition and did not consider whether the mechanism causing the degradation could result in a problem beyond additional sediment in the canal. As part of their corrective actions, core bores of the affected area were obtained and the November 2011 preliminary assessment found the soil profile was very similar to that described in the original plant design documents. The inspectors were also concerned with the timeliness of repairs described in the CRs because the initial plans were replaced with continued monitoring. The condition and the licensee's plans to repair the wall became the subject of several Requests for Additional Information (RAIs) associated with the License Renewal Application. As documented in a letter dated October 31, 2011, (ML11306A066), the licensee outlined a schedule to repair the canal wall while continuing to monitor for further degradation.

No findings were identified.

This review constituted one in-depth problem identification and resolution sample as defined in IP 71152 05.

4OA3 Follow-Up of Events and Notices of Enforcement Discretion (71153)

.1 (Closed) Licensee Event Report 05000346/2011-001-00: Pressurizer Code Safety Valve Setpoint Test Failures

On February 28, 2010, Davis-Besse commenced refueling outage sixteen. Per the outage plan, the site's pressurizer safety valves were removed and sent to an offsite vendor for testing and refurbishment. This testing was performed on August 16, 2010. In December 2010, the licensee received information from the testing vendor that the two pressurizer safety valves had as-found lift setpoints (2531 psig and 2535 psig respectively) that were slightly above the limits specified in TS 3.4.10 (2525 psig). The licensee attributed the as-found values to setpoint drift during operation. A past operability evaluation was completed by the licensee on January 12, 2011, and concluded that the pressurizer safety valves had been inoperable while they were installed in the plant during the previous reactor operating cycle.

The inspectors' review of this event determined that the safety significance of the issue was minimal. While both valves had as-found setpoints that exceeded the TS allowed value, the highest out-of-tolerance setpoint was only 10 psig higher than the required value, and the discrepancy would not have adversely impacted either valve's ability to have fulfilled its safety function had either been called upon to do so during the previous period of reactor operation. Consequently, the inspectors determined that this failure to comply with TS 3.4.10 was a violation of minor safety significance that was not subject to formal enforcement action in accordance with Section 2.3 of the NRC Enforcement Policy.

The licensee had entered these failures into their CAP as CR 2010-87048. Documents reviewed as part of this inspection are listed in the Attachment. This Licensee Event Report (LER) is closed.

This event follow-up review by the inspectors constituted a single inspection sample as defined in IP 71153-05.

.2 Event Notification 47443: ALERT Due to Fire in Electrical Bus Affecting Safety-Related Equipment

a. Inspection Scope

In the early morning hours of November 16, 2011, the inspectors responded to the site following the report of an electrical explosion and fire, and the licensee's declaration of an Alert per the site's Emergency Plan. In response to the event, the inspectors observed and reviewed the licensee's response to the event, plant parameters and status, including but not limited to:

- Mitigating systems and fission product barriers performance and integrity;
- The realignment of the plant's affected electrical equipment;
- All emergency notifications made to state and local government agencies as required by 10 CFR 50.72; and
- Emergency plan termination and exit.

The inspectors remained on station in the site's control room providing independent assessment of the event until after the licensee had completed determinations that the

Alert could be terminated. Documents reviewed in this inspection are listed in the Attachment.

This event follow-up review by the inspectors constituted a single inspection sample as defined in IP 71153-05.

b. Findings

Inadequate Procedure Resulted in Water Intrusion Into Safety-Related Motor Control Center

Introduction

A self-revealed finding of very low safety significance (Green) was identified for the licensee's failure to establish, implement, and maintain technically adequate procedures to permit the proper switching of FW sources for the station's auxiliary boiler, such that when the switching of FW sources from demineralized water to the station's normal condensate system took place per approved procedures there were detrimental results. Specifically, the approved procedures for this activity relied upon a check valve to keep the demineralized water header from being exposed to greater pressure than its design. When the check valve failed to function as designed, a failure of demineralized water system components and the inadvertent deluge and failure of safety-related electrical equipment resulted.

Description

At 0200 hours, the licensee switched makeup water to the auxiliary boiler from the demineralized water system, operating at approximately 95 psig, to the plant's normal condensate system, operating at approximately 300 psig. Shortly thereafter, at approximately 0205 hours, control room operators were notified of water spraying from the overhead in the auxiliary building corridor between mechanical penetration rooms 3 and 4. The operations Shift Engineer, who was dispatched to the scene, reported that the water was coming down on safety-related MCC E11C.

At about 0214 hours, the Shift Engineer witnessed an "explosion" with a "flash of flame" coming from MCC E11C. The control room was notified and operations personnel entered the site's procedures for a fire and dispatched the fire brigade. Electrical power was removed to MCC E11C by opening the feeder breaker to the entire E11 MCC string (i.e., E11A, E11B, E11C, E11D, and E11E). Power to numerous train 1 safety-related MOVs was lost as a result. However, because the plant was in cold shutdown/Mode 5 at the time of the event, these MOVs were either not required to be operable under present plant conditions and/or already in their safety-related positions. At 0222 hours, the on-watch Shift Manager declared an Alert per the site's Emergency Plan in accordance with Emergency Action Level HA4, "Fire or Explosion Affecting the Operability of Plant Safety Systems Required to Establish or Maintain Safe Shutdown."

The fire was reported out by the fire brigade at approximately 0233 hours. No extinguishing agents were required; the removal of electrical power resulted in the fire burning itself out. A subsequent investigation of the condition of MCC E11C revealed that the source of the fire was the 480 Vac breaker BE1144, "HA5261A Control Room Emergency Ventilation Fan 1-1 Inlet Valve," and that certain breaker subcomponents had shorted when they became wetted by the water spray cascading down through the

MCC from the overhead. Further investigation revealed that the source of the water was a small diaphragm valve located above MCC E11C, PW55, which served to supply demineralized water to a nearby maintenance shop. At approximately 0443 hours, the site exited from the Alert and fire response procedures.

Following the event, the licensee conducted an investigation into the cause. Station engineering personnel quickly concluded that the procedure being used to switch makeup water to the auxiliary boiler from the demineralized water system, operating at approximately 95 psig, to the plant's normal condensate system, operating at approximately 300 psig, contained a sequence of steps that relied upon a check valve to keep portions of the demineralized water system from being exposed to the much higher condensate system pressure. When the check valve failed to completely close, the excessive pressure, albeit not high enough to damage piping and other "hard" components within the demineralized water system due to that system's installed relief valve protection, was high enough to cause catastrophic failure to "soft" components, such as the soft diaphragm inside PW55. More egregious, however, was that there were no fewer than three previous occurrences (March 7, 2006, December 31, 2007, and August 28, 2008) where the licensee had identified water spraying from above MCC E11C under similar circumstances, but failed to pursue the matter sufficiently to identify the real cause and enact proper corrective actions. The licensee had entered this issue into their CAP as CRs 2006-00624, 2007-32157, 2008-45463; 2011-05456, 2011-05457, 2011-05465, 2011-05466, and 2011-05523. Corrective actions taken by the licensee included, but were not limited to, changes to the station auxiliary boiler operating procedure and repair of the affected electrical components.

Analysis

The inspectors determined that failure of the licensee to establish, implement, and maintain technically adequate procedures to permit the proper switching of FW sources for the station's auxiliary boiler was contrary to the requirements in the licensee's administrative procedure governing the content of balance-of-plant system procedures, NG-QS-00121, "Davis-Besse Procedure Writer's Guide," and as such constituted a performance deficiency that was reasonably within the licensee's ability to foresee and correct and should have been prevented.

The inspectors reviewed this issue using the guidance contained in Appendix B, "Issue Screening," of IMC 0612, "Power Reactor Inspection Reports," and determined that it was of more than minor safety significance and constituted a finding. The issue was determined to be associated with the Initiating Events cornerstone attribute of procedure quality, and had adversely affected the associated cornerstone objective to limit the likelihood of those events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, electrical power to an entire string of safety-related 480 Vac MCCs (i.e., E11A, E11B, E11C, E11D, and E11E) was forced to be interrupted when a deficient procedure for the operation of the station's auxiliary heating boiler caused a significant amount of water to be deluged onto MCC E11C, resulting in an electrical short and fire within the MCC.

The inspectors evaluated the finding using IMC 0609, Attachment 4, "Phase 1 - Initial Screening and Characterization of Findings." Because the finding involved reactor shutdown operations and conditions, the inspectors transitioned to IMC 0609, Appendix G, Attachment 1, "Shutdown Operations Significance Determination Process –

Phase 1 Operational Checklists for Both PWRs and BWRs." Since the finding was associated with an issue that occurred during the time the licensee was in a cold shutdown (Mode 5) condition, the inspectors consulted Checklist 3, "PWR Cold Shutdown and Refueling Operation: RCS Open and Refueling Cavity Level Less Than 23 Feet or RCS Closed and No Inventory in the Pressurizer; Time to Boiling Less Than 2 Hours." The inspectors determined that the finding did not adversely impact any shutdown defense-in-depth or mitigation attributes, nor did it meet any of the checklist specific requirements for a Phase 2 or Phase 3 SDP analysis. Consequently, the finding was determined to be of very low safety significance (Green).

This finding had a cross-cutting aspect in the area of Problem Identification and Resolution, CAP component, because the licensee did not take appropriate corrective actions to address the safety issue in a timely manner, commensurate with the safety significance and complexity. Specifically, the licensee had multiple previous opportunities to have appropriately diagnosed and corrected the issue, but failed to do so. (P.1(d))

Enforcement

The inspectors concluded that the licensee did not comply with the standards and expectations for establishing, implementing, and maintaining technically adequate procedures to permit the proper switching of FW sources for the station's auxiliary boiler, as required in Attachment F7 of NG-QS-00121, "Davis-Besse Procedure Writer's Guide." This finding, however, did not involve a corresponding violation of NRC requirements. Specifically, the inspectors determined that the "Davis-Besse Procedure Writer's Guide" is an administrative procedure, and not covered under the QA requirements set forth in 10 CFR 50, Appendix B. Additionally, the inspectors also determined that the "Davis-Besse Procedure Writer's Guide" is not covered under TS 5.4.1(a), which requires the licensee to establish, implement, and maintain applicable written procedures for the safety-related systems and activities recommended in RG 1.33, Revision 2, Appendix A. (FIN 05000346/2011005-06)

4OA5 Other Activities

.1 (Closed) Unresolved Item 05000346/2011-004-01: Plant Transient During High Pressure Injection Flow Instrument String Checks

On September 15, 2011, instrumentation and controls (I&C) technicians replaced the HPI 3A and 3B flow instrument signal monitors with refurbished modules. Upon insertion of the module into the cabinet, the control room received an unexpected alarm for ICS Input Mismatch. The alarm immediately cleared and was attributed to a slight disruption in voltage when the modules were inserted. A decision was made to continue replacement activities. On September 16, 2011, I&C technicians commenced PMT of the signal monitors. During the string check of the HPI flow instrument alarms, annunciator alarm 14-4-E, "ICS Input Mismatch," was received. The alarm initially cleared, then returned. Coincident with ICS Input Mismatch alarm, the plant's ICS began reducing reactor power without any operator input. On-watch plant operators entered procedure DB-OP-02526, "Primary to Secondary Plant Upset," and went through actions of placing ICS stations in manual control. The I&C technicians performing the HPI flow instrument signal monitor refurbishment were directed to stop their activities. Reactor power initially dropped to approximately 95 percent before *operators stabilized the plant, and then returned reactor power to approximately* 100 percent using manual controls.

The refurbished HPI flow instrument signal monitor modules were removed from the system and taken to the I&C shop for inspection and testing, while the original signal monitor modules were reinstalled. Inspection and testing of the refurbished modules in the I&C shop did not reveal any issues. The modules were sent to the licensee's offsite testing laboratory for further analysis.

The inspectors reviewed the licensee's analysis which identified that when the K1 "high flow" positive relay coil was energized on the refurbished signal monitor module, Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) affected the low input ICS converter module located in an adjacent slot in the cabinet. The licensee's laboratory identified that some of the signal monitor modules, including the one used that caused the plant transient, did not have ferrite suppression beads on the leads of two capacitors in the circuitry. Ferrite suppression beads are passive electrical components used to suppress high frequency noise and prevent oscillations from occurring. The licensee's laboratory confirmed that signal monitor circuit boards without ferrite beads resulted in oscillations larger in duration and amplitude than circuit boards that did contain ferrite suppression beads. These oscillations were the underlying reason why EMI/RFI was generated from the K1 "high flow" relay coil, causing the ICS circuitry to respond.

The installation of ferrite suppression beads on signal monitor circuit boards was an enhancement that the circuit card manufacturer had implemented sometime in the *1980's. Circuit boards manufactured in the 1970's did not contain ferrite beads. The* licensee's supply of signal monitor modules contains a mix of boards with and without the ferrite suppression beads installed. The licensee indicated that they did not have any prior knowledge of this design enhancement and discovered it during the investigation of the event. A review of operating experience did not reveal any similar design issues associated with the signal monitor modules at Davis-Besse or any other nuclear plant facility. Therefore, the inspectors determined that the issue was a latent problem with the refurbished circuit board and was not within the licensee's ability to foresee and correct. The licensee has initiated corrective actions to inspect all currently installed signal monitor modules of the same module and will replace boards that do not contain ferrite suppression beads. Also, an order was created to inspect all spare signal monitor modules onsite to identify any other boards that lack ferrite suppression beads. All further circuit board refurbishments at the laboratory will contain a requirement to ensure ferrite suppression beads are installed.

The inspectors did not identify a performance deficiency or violation of NRC requirements. Based on the inspectors' review of the licensee's analysis of the event, this unresolved item is closed.

.2 Reactor Vessel Head Replacement (IP 71007) – Containment Access Restoration

a. Inspection Scope

The Davis-Besse containment lacked an access opening of sufficient size to permit removal of the old vessel head and reinstallation of the RRVCH. Therefore, the licensee *cut a temporary access opening in the SB and CV of sufficient size to support the head* replacement. To restore the temporary construction opening in the CV, the licensee reused and reinstalled (by SMAW) the original plate section cut from the CV. To restore the temporary construction opening in the SB, the licensee installed new reinforcing steel (i.e., rebar) to replace the original steel reinforcement and poured new concrete fabricated at an on-site batch plant.

The inspectors reviewed the licensee activities associated with the restoration of the CV and SB access openings. Specifically, the inspectors observed activities and reviewed records as discussed below:

- Inspectors observed the cutting of the CV opening using a track-mounted welding torch to determine if the cutting activity followed the WO;
- Inspectors observed installation of the replaced CV plate to determine if the gap tolerances had been maintained in accordance with the WO and to determine if site procedures were adequate to control plate distortion;
- Inspectors observed full penetration butt welds fabricated during reinstallation of the 1.5 inch thick CV access plate to determine if the welding process followed the qualified welding procedures and to determine if weld filler materials were traceable to certified material test reports;
- Inspectors reviewed the welding procedures and welder qualification records for containment closure welding activities to determine if the welding was qualified in accordance with the ASME Code Section IX;
- Inspectors reviewed samples of the radiographic (RT) records and magnetic particle (MT) exam records of the CV welds to determine if weld acceptance criteria met the CC requirements (ASME Code 1968 Edition, 1969 Summer Addenda of Section III);
- Inspectors observed installation of mechanical rebar splices (reattachment by crimping of the steel reinforcement (rebar)) in the reinforcing steel used to restore the SB opening to determine if the licensee process conformed to the qualified procedure and design requirements;
- Inspectors observed installation of welded rebar splices in the reinforcing steel used to restore the SB to determine if the welding process followed the qualified welding procedures and that weld filler materials were traceable to certified material test reports and that welders were properly qualified;
- Inspectors reviewed the results of concrete field tests (e.g., slump and air content) during installation to determine if the concrete had the expected properties specified for the mix design;
- Inspectors observed the onsite and off-site storage and curing conditions for concrete test cylinders to determine if they met the American Society for Testing and Materials (ASTM) C31 "Making and Curing Concrete Test Specimens in the Field," and ASTM C192 "Making and Curing Concrete Test Specimens in the Laboratory," prior to acceptance testing;
- Inspectors reviewed the licensee's vendor records for the source materials (e.g., aggregate, cement, water, and admixtures) for concrete batches used in restoration of the SB to determine if it these materials conformed to the design specifications;
- Inspectors observed concrete cylinder compressive tests to determine if testing was conducted in accordance with ASTM C39 "Compressive Strength of Cylindrical Concrete Specimens," and to determine if the test results demonstrated that the concrete used for restoration of the SB opening had

adequate shear strength to meet the USAR Section 3.8.2.3.7 minimum design compressive strength (e.g., in excess of 4000 psi); and

- The records reviewed by the inspectors are identified in the Attachment to this report.

b. Findings

No findings were identified.

.3 (Closed) Unresolved Item 05000346/2011004-05: Code Surface Examination Requirements Not Applied to Closure Head Stud Holes

a. Inspection Scope

During the review of the fabrication records for the RRVCH, the inspectors identified a URI associated with the licensee's decision to not perform surface examination of the accessible surfaces of the RRVCH stud holes based upon an interpretation of the ASME Code Section III requirements. On October 6, 2011, the Agency completed a review of the licensee's interpretation of the Code, and determined that it was not correct (reference Task Interface Agreement (TIA) No. 2011-15 - ADAMS Accession No. ML11279A218). Based upon review of this issue as discussed below, Unresolved Item (URI) 05000346/2011004-05 is closed.

b. Findings

Incomplete Surface Examination of the Replacement Reactor Vessel Closure Head

Introduction

A finding of very low safety significance and an associated NCV of 10 CFR 50, Appendix B, Criterion VII, "Control of Purchased Material, Equipment, and Services," were identified by the inspectors for the licensee's failure to perform an adequate review of fabrication records to ensure material procured from a contractor (RRVCH) met the CC. Specifically, the accessible surfaces of the 60 closure head flange stud holes were not subjected to PT or MT examinations as required by the CC.

Description

The inspectors identified that the licensee had not performed PT or MT examinations of accessible surfaces for the 60 closure head flange stud holes as required by the CC. The inspectors were concerned that failure to perform these examinations could have allowed rejectable indications to be placed inservice.

On July 22, 2011, during review of RRVCH fabrication records, the inspectors identified that the licensee had not completed the surface examinations required by the CC (1989 Edition of the ASME Code Section III). Specifically, the accessible surfaces of the RRVCH flange stud holes had not been examined using MT or PT methods as required by the Articles NB-2541(a) and NB-4121.3 of Section III of the ASME Code. The inspectors were concerned that without surface examination, rejectable flaws could be placed in service. Additionally, inservice examination of stud hole surfaces is not required by Section XI of the ASME Code, so rejectable fabrication defects would not be identified once the RRVCH was placed inservice. In response to the inspectors' concern, the licensee determined that the accessible interior surfaces of the RRVCH stud holes did not require surface examination. The licensee's position was based on the ASME Code Interpretation III-1-77-162, which stated in part that drilled holes are not considered to be material form surfaces and the requirement for examination of holes (if any) resides in NX-4000 and NX-5000. The licensee concluded that the reexamination of machined surfaces as discussed in the ASME Code Section III, Article NB-4121.3 did not apply to the accessible interior surfaces of the flange stud holes because they were not material form surfaces.

On October 6, 2011, the NRC issued TIA No. 2011-15, which documented the Agency position on the application of the CC requirements. Specifically, the NRC determined that examination of the accessible surfaces of the RRVCH flange stud holes by MT or PT was required to meet the requirements of Articles NB-2541(a) and NB-4121.3 of Section III of the ASME Code. The licensee entered this issue into the corrective action system in multiple CRs (reference CR-2011-00344, CR-2011-01739 and CR 2011-04373) and subsequently completed MT examination of the accessible surfaces of the 60 RRVCH flange stud holes prior to placing the vessel head into service. At each stud hole, the accessible surface for MT examination included 3 inches in depth from the flange top and bottom surface and in total, amounted to an additional 7,917 square inches of surface area examined. No rejectable fabrication flaws were identified during this examination.

<u>Analysis</u>

The inspectors determined that failure to perform an adequate review of fabrication records to ensure material procured from a contractor (RRVCH) met the CC was contrary to 10 CFR 50, Appendix B, Criterion VII, and was a performance deficiency.

The finding was determined to be more than minor because the finding was associated with the Initiating Events Cornerstone attribute of Equipment Performance and affected the cornerstone objective to limit the likelihood of those events that upset plant stability and challenge critical safety functions. Absent NRC identification, the licensee would not have completed surface examination of the 60 flange stud holes to ensure unacceptable material flaws (e.g., cracks) were not placed in service. Because material flaws such as cracks serve as stress risers that reduce the ability of the RRVCH to withstand failure by crack propagation during design basis events (e.g., pressurized thermal shock), they would place the reactor coolant system at an increased risk for through-wall leakage and/or failure. The inspectors determined the finding could be evaluated using the SDP in accordance with IMC 0609, "Significance Determination Process," Attachment 0609.04, "Phase 1 - Initial Screening and Characterization of Findings," Table 4a for the Initiating Events Cornerstone. Because this finding was identified prior to placing the RRVCH in service and no fabrication flaws were identified, the inspectors answered "no" to the Significance Determination Process Phase 1 screening question "Assuming worst case degradation, would the finding result in exceeding the TS limit for any reactor coolant system leakage or could the finding have likely affected other mitigation systems resulting in a total loss of their safety function assuming the worst case degradation?" Therefore, the finding screened as having very low safety significance (Green).

This finding had a cross-cutting aspect in the area of Human Performance, Decision Making because the licensee staff failed to demonstrate that nuclear safety was an overriding priority in decisions affecting the RRVCH. Specifically, the failure to perform an adequate review of the RRVCH fabrication records was caused by the licensee's decision to not review the manufacturer's interpretations and application of the CC rules (IMC 0310 – Item H.1.b). The inspectors reached this conclusion based on discussions with licensee staff and review of the licensee's apparent cause evaluation documented in CR-2011-04373.

Enforcement

Appendix B of 10 CFR 50, Criterion VII, "Control of Purchased Material, Equipment, and Services," requires in part that "Measures shall be established to assure that purchased material, equipment, and services, whether purchased directly or through contractors and subcontractors, conform to the procurement documents." And: "This documentary evidence shall be retained at the nuclear power plant, or fuel reprocessing plant site and shall be sufficient to identify the specific requirements, such as codes, standards, or specifications, met by the purchased material and equipment."

Contrary to the above, as of July 22, 2011, the licensee had not established adequate measures (e.g. adequate review of vendor fabrication records) to ensure material procured from a contractor for the RRVCH conformed to the procurement documents. Specifically, licensee measures were not sufficient to ensure that surface examinations of 60 flange stud holes were completed in accordance with Section III of the ASME Code as required by Procurement Specification BUHSDB/NCC001 issued on January 22, 2002, and Purchase Order 7084643 issued on January 31, 2002. Because this violation was of very low safety significance and it was entered into the licensee's CAP (reference CR 2011-00344, CR 2011-01739, and CR 2011-04373), this violation is being treated as an NCV, consistent with Section 2.3.2 of the NRC Enforcement Policy.
(NCV 05000346/2011005-07)

4OA6 Management Meetings

.1 Exit Meeting Summary

On January 10, 2012, the inspectors presented the inspection results to the Director of Site Operations, Mr. Brian Boles, 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.

.2 Interim Exit Meetings

Interim exits were conducted for:

- Radiological Hazard Assessment and Exposure Controls Program inspections under the Occupational Radiation Safety Cornerstone with the Site Vice President, Mr. Barry Allen, on October 21, 2011;
- Radiation Monitoring Instrumentation Program and Performance Indicator Verification under both the Public Radiation Safety Cornerstone and the Occupational Radiation Safety Cornerstone with the Site Vice President, Mr. Barry Allen, on September 16, 2011. Additionally, a telephone re-exit was conducted on October 21, 2011; and
- The Reactor Vessel Head Replacement Fabrication Review (IP 71007) with the Director of Special Projects, Mr. Clark Price, and other members of the licensee's staff on November 23, 2011.

- The Triennial Heat Sink Performance Review, the inspectors presented the inspection results to Mr. Barry Allen, and other members of the licensee staff, on January 31, 2012 via telephone conference. 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
P. Boissoneault; Manager, Chemistry
B. Boles, Director, Site Operations
K. Byrd, Director, Site Engineering
T. Chowdhary, NRC Liaison
J. Dominy, Director, Site Maintenance
J. Hook, Manager, Design Engineering
R. Hovland, Manager, Training
G. Kendrick, Manager, Site Outage Management
P. McCloskey, Manager, Site Regulatory Compliance
D. Noble, Manager, Radiation Protection
W. O'Malley, Manager, Nuclear Oversight
R. Oesterle, Superintendent, Nuclear Operations
M. Parker, Manager, Site Protection
R. Patrick, Manager, Site Work Management
D. Petro, Manager, Steam Generator Replacement Project
S. Plymale, Manager, Site Operations
C. Price, Director, Special Projects
M. Roelant, Manager, Site Projects
C. Sacha, Radiation Protection Services Supervisor
D. Saltz, Manager, Site Maintenance
S. Steagall, Fleet Oversight Manager
C. Steenbergen, Superintendent, Operations Training
J. Stelmaszak, Supervisor of NSSS Plant Engineering
J. Sturdavant, Regulatory Compliance
T. Summers, Manager, Plant Engineering
L. Thomas, Manager, Nuclear Supply Chain
M. Travis, Superintendent, Radiation Protection
J. Vetter, Manager, Emergency Response
A. Wise, Manager, Technical Services
G. Wolf, Supervisor, Regulatory Compliance
K. Zellers, Supervisor, Reactor Engineering

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened

05000346/2011005-01	NCV	Inadequate Control of Weld Filler Metal Electrodes (Section 1R08.1)
05000346/2011005-02	FIN	Decay Heat Pump 1-1 Damaged and Rendered Inoperable By Personnel Climbing on Equipment (Section 1R13.1)
05000346/2011005-03	NCV	Air Voids in Component Cooling Water System Caused By Inadequate Fill and Vent Procedure (Section 1R15.1)
05000346/2011005-04	NCV	Reactivity Manipulations Performed By Non-Licensed Individual (Section 1R19.1)
05000346/2011005-05	NCV	Inadequate Information on Valve Interlocks Resulted in Inadvertent Operation and Loss of Component Cooling Water Surge Tank Inventory (Section 1R20.1)
05000346/2011005-06	FIN	Inadequate Procedure Resulted in Water Intrusion Into Safety-Related Motor Control Center (Section 4OA3.2)
05000346/2011005-07	NCV	Incomplete Surface Examination of the RRVCH (Section 4OA5.3)

Closed

05000346/2011005-01	NCV	Inadequate Control of Weld Filler Metal Electrodes (Section 1R08.1)
05000346/2011005-02	FIN	Decay Heat Pump 1-1 Damaged and Rendered Inoperable By Personnel Climbing on Equipment (Section 1R13.1)
05000346/2011005-03	NCV	Air Voids in Component Cooling Water System Caused By Inadequate Fill and Vent Procedure (Section 1R15.1)
05000346/2011005-04	NCV	Reactivity Manipulations Performed By Non-Licensed Individual (Section 1R19.1)
05000346/2011005-05	NCV	Inadequate Information on Valve Interlocks Resulted in Inadvertent Operation and Loss of Component Cooling Water Surge Tank Inventory (Section 1R20.1)
05000346/2011004-01	URI	Plant Transient During HPI Flow Instrument String Checks (Section 4OA5.1)
05000346/2011005-06	FIN	Inadequate Procedure Resulted in Water Intrusion Into Safety-Related Motor Control Center (Section 4OA3.2)
05000346/2011005-07	NCV	Incomplete Surface Examination of the RRVCH (Section 4OA5.3)
05000346/2011004-05	URI	Code Surface Examination Requirements Not Applied to Closure Head Stud Holes (Section 4OA5.3)
05000346/2011-001-00	LER	Pressurizer Code Safety Valve Setpoint Test Failures (Section 4OA3.1)

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.

1R01 Adverse Weather Protection

Condition Reports:
- 2011-06080; Technical Specification Freeze Point Reads All *****
- 2011-96566; Open Input Found on Freeze Circuit #90
- 2011-05352; Warehouse Repairs Required for ANSI N45.2.2 Storage Compliance
- 2011-04606; SH5968, Secondary Hot Water Heating Loop Recirculation Heat Exchanger Temperature Control Valve, Not Maintaining 185 Degrees Fahrenheit

Procedures:
- DB-OP-06913; Seasonal Plant Preparation Checklist; Revision 22
- DB-OP-06331; Freeze Protection & Electrical Heat Trace; Revision 20
- DB-ME-09521; Preventative Maintenance & Circuit Testing of Freeze Protection and Heat Tracing; Revision 4
- NOP-OP-1012; Material Readiness and Housekeeping Inspection Program; Revision 7
- NOP-WM-4006; Conduct of Maintenance; Revision 5

Work Orders:
- 200391823; PM 0912 Check Technical Specification Related Freeze Protection Heat Trace

1R04 Equipment Alignment

Condition Reports:
- 2011-01109; Decay Heat Pump 1 Outboard Axial Vibrations in Alert Range
- 2011-02969; Decay Heat 2733 Leakby Needs Quantified
- 2011-04403; DB-PF-03012 (DB-PF-03011) Emergency Core Cooling System Integrated Train 1 (2) Leakage Test Section 4.5 Decay Heat 2733 (Decay Heat 2734) not Performed on 24 Month Interval
- 2011-05687; Decay Heat Valve Pit Leak Test Does Not Meet Acceptance Criteria
- 2011-97140; Valves Added to Inservice Testing Program

Procedures:
- DB-SP-03019; Service Water Valve Verification Monthly Test Train 1; Revision 11
- DB-OP-06261; Service Water System Operating Procedure; Revision 47
- DB-OP-06012; Decay Heat and Low Pressure Injection System Operating Procedure; Revision 52
- DB-OP-06316; Diesel Generator Operating Procedure; Revision 50

Drawings:
- OS-020, sheet 1; Service Water System; Revision 84
- OS-004, sheet 1; Decay Heat Removal/Low Pressure Injection System; Revision 50
- OS-041A, sheet 2; Emergency Diesel Generator Systems; Revision 29
- OS-041B, sheet 1; Emergency Diesel Generator Air Start/Engine Air System; Revision 40

1R05 Fire Protection

Conditions Report:
- 2011-04510, Compressed Gas Cylinders Secured with Scaffold Wire

Pre-Fire Plans:
- PFP-CB-410; East Elevation 603' and Valve Room Elevation 636', Rooms 410 and 580, Fire Area D; Revision 4
- PFP-CB-215; Let Down Coolers Area, Room 215, Fire Area D; Revision 5

Drawings:
- A-222F; Fire Protection, General Floor Plan El. 565'-0"; Revision 15
- A-223F; Fire Protection, General Floor Plan El. 585'-0"; Revision 21
- A-224F; Fire Protection, General Floor Plan El. 603'-0"; Revision 23
- A-225F; Fire Protection, General Floor Plan El. 623'-0"; Revision 18
- A-226F; Fire Protection, General Floor Plan El. 643'-0"; Revision 13

Other:
- Fire Hazard Analysis Report; Revision 24

1R07 Heat Sink Performance

Condition Reports:
- 2011-03664; Spent Fuel Pool Heat Exchanger 1 Does Not Meet Extrapolated Heat Transfer Rate
- 2011-03776; Procedure Improvements for Spent Fuel Pool Heat Exchanger Performance Test (DB-PF-04707)

Procedures:
- DB-PF-04707; Spent Fuel Pool Heat Exchangers; Revision 3

Drawings:
- OS-007; Spent Fuel Pool Cooling System; Revision 23

Work Orders:
- 200198502; Spent Fuel Pool Heat Exchanger Performance Test; 10/14/2011

1R07T Heat Sink Performance – Triennial

Condition Reports Generated as a Result of the Inspection:
- 11-00422; Intake Canal Dike Does Not Meet Design Configuration Requirements; August 10, 2011
- 11-97166; Degradation of the Intake Canal North Wall in the Q/NQ Portion of the Canal; June 30, 2011

Condition Reports:
- 09-62045; FME: Lost 1 Screw, 1 Nut and 2 Washers in CCW Train 1; July 28, 2009
- 10-79648; CCW hx 3 Repair per CR10-79648-CA6; July 14, 2010
- 10-80388; CCW hx 3 Returned to Service with 2 Areas Below Min Wall; July 28, 2010
- 10-81143; Three CCW hx 2 Tubes Remained Blocked After Cleaning Activities; August 12, 2010

- 10-83726; NRC Questions Process Control of CCW HX Straightening Process; October 5, 2010
- 11-87861; Flange Distortion From Weld Repair On No. 3 CCW HX; January 6, 2011
- 11-89424; CCW hx Unavailable > 30 Days Risk-Evaluation; February 10, 2011
- 11-89559; CCW hx 3 Straightening and Welding Issue @ 90 and 270; February 14, 2011
- 11-90322; Crack in Weld on No. 3 CCW HX During Repair; March 2, 2011
- 11-90364; Crack in Toe of Weld On No. 3 CCW HX; March 3, 2011
- 11-95719; Corrosion Identified in CCW HX 1; May 31, 2011
- 11-95924; Below Minimum Wall Thickness On CCW HX No.1 SW Side; June 3, 2011
- 11-96284; crack In Exterior Weld During Welding of CCW hx No. 1 SW Side; June 10, 2011
- 11-96398; CCW hx 1 Outer Tube Sheet to Channel Head Weld Crack; June 14, 2011
- 11-96432; Indications on Dye Penetrant Exam on No. 1 CCWHX; June 14, 2011
- 11-96441; Dye Penetrant Test Indications Found on No. 1 CCW hx; June 15, 2011
- 06-6749; CC1467 CCW from Decay Heat Cooler 1 Solenoid Outlet Valve Would not Close; September 24, 2006
- 08-50956; Packing Loads on AF3869 Exceed Current Design Values; December 16, 2008
- 09-64856; Containment Spray Pump No. 1 "as found" Information; September 23, 2009
- 10-69758; AF 68 Check Valve Failure; January 9, 2010
- 11-88345; SFAS Ch. 3 CTMT Pressure Test Switch Required Agitation When Released From Test; January 17, 2011
- 11-90425; EDG Exhaust Missile Barrier Grating Attachment Discrepancies; March 4, 2011
- 11-00422; Intake Canal Dike Does Not Meet Design Configuration Requirements; August 10, 2011
- 11-97166; Degradation of the Intake Canal North Wall in the Q/NQ portion of the Canal; June 30, 2011
- 11-95451; S33-2DB-SS-03711; CTRM Emerg Vent Sys Train 2 Performance Test; May 27, 2011
- 07-26185; Degradation on Rip-Rap Sides of the FOREBAY and Intake Canal; August 9, 2007
- 09-54330; Slope Stability Study for the FOREBAY North Wall Found Low Strength Clay Till; February 27, 2009

Procedures:
- DB-OP-06261; Service Water System Operating Procedure; Revision 45
- DB-OP-02011; Heat Sink Alarm Panel 11 Anunciators ; Revision 09
- NORM-OP-1009; SRO Review of Condition Reports; Revision 00
- NOP-LP-2001; Corrective Action Program; Revision 27
- DB-OP-03007; Miscellaneous Instrument Daily Checks; Revision 19
- RA-EP-02820; Emergency Plan Off Normal Occurrence Procedure (Earthquake); Revision 07
- PM 8369; Inspection – Embankment Intake Canal; June 21, 2011
- PM 2694; Inspection – Intake Crib; June 21, 2011

Calculations:
- C-ICE-009.01-002; Ultimate Heat Sink Level; July 3, 2003
- 12501-703; Thermal Performance Analysis for UHS Pond; Revision 01
- 12501-M-004; Thermal Performance Analysis For UHS Station 0+00 – 10+00; Revision 01
- 12501-M-001; Thermal Performance Analysis For UHS Station 10+00; Revision 01

Other:
- 7749-M-23; CCW HX specification sheets; August 1, 1977
- Serial 1-823; Licensee Response to Bulletin 88-04 "Potential Safety-Related Pump Loss"; September 8, 1988

- 06-003; Standing Order for Limit on UHS; CREVS Train 1, Design/Licensing Basis; August 24, 2006
- 144188-0209-1575; Slope Stability Study, (Bowser Morner); February 11, 2009
- Serial 2654; Response to RAI LA 96-0008 (UHS Temp Increase); June 6, 2000
- RAS-00-00250; TeleCon NRC-FENOC LA 96-0008 (UHS Temp Increase);
- March 28-30, 2000
- Serial 2397; LAR 96-0008 (UHS Temp Increase); July 18, 2000
- RAS-98-00063; FENOC Presentation to NRR (License Basis and Design Basis of the UHS); February 17, 1998
- Serial 2347; Ultimate Heat Sink/Service Water Temperature; January 31, 1996
- 2011-01; UHS Limitation Due to CREATCS Calc Issue (CR 11-95467); Revision 00
- 154381-0811-2995; Intake Canal Study, (Bowser Morner); August 05, 2011

Work Orders:
- WO 200426314; Completed Repairs on CCW HX 3 per CR 10-80388; June 13, 2011
- WO 200423055 Addendum 1; Completed Repairs on ccw hx 3 per CR10-79648-CA6; June 13, 2011
- WO 200117165; Tubes Plugged in ccw hx 2; September 20, 2010
- WO 200284546; Work Order for Intake Canal Fix; October 5, 2007
- WO 200220528; Intake Canal Inspection; May 29, 2007
- WO 200325296; CCW HX 3 Performance Test Completed July 9, 2010; Revision 08

Audits, Assessments and Self-Assessments:
- SN-SA-11-191; Snapshot Assessment of Reliability of Heat Exchangers Cooled by Service Water and GL 89-13 Implementation; June 16, 2011

Tests:
- DB-PF-04706 Order 200325296; CCW HX 3 Performance Test Completed July 9, 2010; Revision 8

Modifications:
- C-ICE-009.01-002 A01; Ultimate Heat Sink Level; Multiplexor Replacement; February 23, 2010
- 07-00464; CAC Heat Duty at Elevated SW Inlet Temperature; January 31, 2007

Drawings:
- 7749-M-23-8-5; Struther Wells Corporation CCW HX Details Drawing; December 6, 1971
- C-1; Site Plan; Revision 21
- OS-032B; Control Room Emergency Ventilation System; Revision 18
- OS-020; SH 2 Operational Schematic Service Water System; Revision 42
- C-49; Discharge System; Revision 21
- C-46; Discharge System; Revision 28
- C-45; Flood Control Dike-Sections; Revision 11
- C-45A; Flood Control Dike-Section and Intake Structure Miscellaneous Steel; Revision 01
- C-45B; Intake Structure Miscellaneous Steel Sections and Details; Revision 00
- C-45C; Intake Structure Miscellaneous Steel Sections and Details; Revision 00
- TEC 201 B1; Water Intake and Discharge; Sh. 3 of 17 (Finkbeiner, Drawing); December 20, 1972

1R08 Inservice Inspection

Condition Reports:
- 2011-94103; SFP Pump 1-2 Seal Leak; dated May 4, 2011
- 2011-05605; NRC Question of 17M RPV UT Data (S-dim); dated November 17, 2011
- 2011-05118; Inadequate Reconciliation of E22-3 HX Repair; dated November 4, 2011
- 2011-04942; Results of BMV of the RVCH; dated November 4, 2011
- 2011-04891; NRC UT Procedure Issue; dated November 3, 2011
- 2011-04847; Reactor Head BMV Procedure Briefing; dated November 3, 2011
- 2011-04810; Incomplete Quality Record; Dated November 2, 2011
- 2011-03984; Failure to Declare Component Inoperable Due to ISI Indication; dated October 19, 2011
- 2011-03875; Results of ISI Exam of the Exterior Containment Vessel Moisture Barrier; dated October 17, 2011
- 2011-02113; Linear Indication HP92 Base Metal; dated September 19, 2011
- 2010-79648; Corrosion at T-Weld for CCW HX 1-3; dated June 26, 2010
- 2010-79012; HPI Pump 2P58-2 Boric Acid at Mechanical Seal; dated June 29, 2010
- 2010-78548; RCS to DH System Leak at DH22A Packing; dated June 20, 2010
- 2010-78373; OA for EOC 17; dated June 16, 2010
- 2010-77851; Debris on Lower Core Grid; dated June 6, 2010
- 2010-76667; Packing Leak SF 35; dated May 10, 2010
- 2010-75053; Debris at FW51; dated April 8, 2010
- 2010-74892; RCP 1-2 Boric Acid Leak at Bolted Connection; dated April 5, 2010
- 2010-73653; DH11 Packing Leak; dated March 16, 2010
- 2010-73412; 16 RFO Debris on Fuel Assembly; dated March 14, 2010

Miscellaneous Documents:
- NIS-2 Form; CCW HX 1-3; dated July 23, 2010
- Welding and NDE Services Lab Work Request; dated July 26, 2011
- Davis-Bessel Project Welder Qualification List; dated October 17, 2011
- Non Destructive Examination Records
- Liquid Penetrant Examination Report 17-PT-011; Valve HP92 to Pipe Weld; dated September 19, 2011
- Liquid Penetrant Examination Report 17-PT-012; Valve HP92 to Pipe Weld; dated September 19, 2011
- Liquid Penetrant Examination Report 17-PT-036; MU-31-CCA-18-1-FW23; dated October 13, 2011
- UT Calibration/Examination Report 17-UT-053; RC-PZR-WP-15; dated October 12, 2011
- Reactor Vessel 10 Year Ultrasonic Examination Summary Report; dated October 20, 2011

Procedures:
- CR-ASME III CL B; Nondestructive Examination Standard Computed Radiographic Examination; Revision 0
- 54-ISI-367-11; Visual Examination for Leakage of Reactor Head Penetrations; dated January 26, 2010
- 54-ISI-69-31; Administrative Procedure for Processing Nondestructive Examination Data; dated February 26, 2010
- 54-PT-200-04; Color Contrast Solvent Removable Liquid Penetrant Examination of Components; dated June 24, 2011
- 54-MT-02-08; Wet or Dry Magnetic Particle Examination Procedure; dated February 24, 2009

- 54-ISI-801-02; Automated Ultrasonic Examination of PWR Vessel Shell Welds; dated February 14, 2011
- 54-ISI-805-07; Ultrasonic Examination of Reactor Pressure Vessel Welds; Revision 7
- NOP ER-2001; Boric Acid Corrosion Control Program; Revision 9
- NOP DP-01501; Boric Acid Corrosion Control Inspection; Revision 13
- Weld Procedures and Qualification Records:
- GWS Arc Welding Standard Arc Welding of Reinforced Steel (GWS-Rebar), Revision 0
- WPS P1-Rebar (Indiret-0.57 CE); Revision 0
- WPS P1-Rebar (0.87 CE); Revision 0
- WPS P1-A-Lh(CVN 0F); Revision 1
- PQR 1310; dated June 20, 2001
- PQR 1675; dated August 12, 2011
- PQR 1359 P1-Rebar (Indiret-0.57 CE); dated June 18, 2003
- PQR 1392 P1-Rebar (0.87 CE); dated September 30, 2003

Welder Qualification Records:
- WR-1 Welder Performance Qualification Test Record- CBI-3; dated September 13, 2011
- WR-1 Welder Performance Qualification Test Record- CBI-7; dated September 13, 2011
- WR-1 Welder Performance Qualification Test Record- CBI-13; dated October 2, 2011
- WR-1 Welder Performance Qualification Test Record- CBI-14; dated October 2, 2011
- WR-1 Welder Performance Qualification Test Record- I-1; dated October 7, 2011
- WR-1 Welder Performance Qualification Test Record- I-4; dated October 10, 2011

Weld Data Records:
- Madison Inc Certified Material Test Report-A516 Grade 70 Plate - Heat 1505681; dated September 19, 2010
- WR-5C Structural Field Welding Checklist- FW13 and 14; dated October 24, 2011
- WR-5 Field Welding Checklist- FW-1; dated October 22, 2011
- WR-6 Filler Metal Withdrawal Form E 7018; dated October 23, 2011
- WR-6 Filler Metal Withdrawal Form E 7018; dated October 22, 2011
- WR-6 Filler Metal Withdrawal Form E 7018; dated October 21, 2011
- ELAB Group Inc CMTR No. 743965-E9018-B3H4R- Heat M100021; dated January 21, 2011
- GERDAU CMTR Heat No. K115877- No. 10 Rebar; dated September 1, 2011
- GERDAU CMTR Heat No. K111485- No. 11 Rebar; dated September 1, 2011
- GERDAU CMTR Heat No. C014692- No. 8 Rebar; dated September 1, 2011
- GERDAU CMTR Heat No. J112953- No. 10 Rebar; dated September 1, 2011
- Mistras CE Rebar Sample Chemical Analysis; dated November 3, 2011

1R12 Maintenance Effectiveness

Condition Reports:
- 2008-33710; Groundwater In-seepage Identified In The Annulus Sandpocket
- 2011-01540; Exterior Shield Building Inspection Findings
- 2011-03346: Fractured Concrete Found at 17M Shield Building Construction Opening
- 2011-03875; Results of ISI Examination of the Exterior of the Containment Vessel Moisture Barrier
- 2011-03996; Extent of Condition for Shield Building Fracture Indications
- 2011-04190; Surface Cracks Identified on Fluted Areas of the Shield Building
- 2011-04214; Core Bore Found Additional Crack in Architectural Flute Area
- 2011-04402; Fractured Concrete Found at 17M Shield Building at Main Steam Line Penetrations

- 2011-04507; Isolated Crack Indication Identified by Impulse Response Testing
- 2011-04648; Shield Building IR Indications above Elevation 780
- 2011-05475; Concrete Cracking at the Top of the Shield Building Wall
- 2011-05648; Concrete Cracking in Shoulder 4 / Flute 2 Region of the Shield Building (Azimuth 67.5)
- 2011-05904; Errors Identified in Shield Building Crack Calculation C-CSS-059.20-056
- 2011-06185; Error in Calculation C-CSS-099.20-056, Revision 01

Procedures:
- NOP-ER-3004; FENOC Maintenance Rule Program; Revision 01
- EN-DP-01511; Design Guidelines For Maintenance Rule Evaluation of Structures; Revision 0
- DB-PF-03009; Containment Vessel and Shield Building Visual Inspection; Revision 7

Other:
- MRPM; Maintenance Rule Program Manual; Revision 29
- Maintenance Rule Unavailability Hours Database
- Maintenance Rule Evaluation Worksheets; Containment Shield Building Dome; dated September 2, 2005 and June 14, 1999
- Maintenance Rule Evaluation Worksheets; Containment Shield Building Exterior; dated October 17, 2005 and June 14, 1999
- Maintenance Rule Evaluation Worksheets; Containment Shield Building Interior; dated May 3, 2010 and January 2, 2008
- Maintenance Rule Evaluation Worksheets; Containment Vessel Exterior; dated May 3, 2006 and May 4, 1998
- Maintenance Rule Evaluation Worksheets; Containment Vessel Interior; dated April 1, 2010, May 1, 2010, January 23, 2008, March 17, 2007 and May 12, 1998

<u>1R13 Maintenance Risk Assessments and Emergent Work Control</u>

Condition Reports:
- 2011-03022; DB-PA-11-03: Configuration Control Issue Noted During RCS Drain
- 2011-03346: Fractured Concrete Found at 17M Shield Building Construction Opening
- 2011-03465; DB-PA-11-03: Issues Identified With Containment Closure Documentation and Implementation
- 2011-03996; Extent of Condition for Shield Building Fracture Indications
- 2011-04190; Surface Cracks Identified on Fluted Areas of the Shield Building
- 2011-04214; Core Bore Found Additional Crack in Architectural Flute Area
- 2011-04402; Fractured Concrete Found at 17M Shield Building at Main Steam Line Penetrations
- 2011-04507; Isolated Crack Indication Identified by Impulse Response Testing
- 2011-04648; Shield Building IR Indications above Elevation 780
- 2011-05475; Concrete Cracking at the Top of the Shield Building Wall
- 2011-05648; Concrete Cracking in Shoulder 4 / Flute 2 Region of the Shield Building (Azimuth 67.5)
- 2011-05904; Errors Identified in Shield Building Crack Calculation C-CSS-059.20-056
- 2011-06185; Error in Calculation C-CSS-099.20-056, Revision 01
- 2011-07195; DH Pump 1-1 O/B Bearing Oil Temp Element Damaged

Procedures:
- NOP-OP-1007; Risk Management; Revision 9
- DB-MM-09234; Equipment Hatch Removal and Reinstallation; Revision 8

- NG-DB-00117; Shutdown Defense In Depth Assessment; Revision 11
- DB-OP-06904; Shutdown Operations; Revision 37
- DB-OP-1005; Shutdown Defense In Depth; Revision 13
- NOP-OP-1002; Conduct of Operations; Revision 5

Business Practices:
- DBBP-OPS-0003; On-Line Risk Management Process; Revision 10
- DBBP-OPS-0011; Protected Equipment Posting; Revision 3

Calculations:
- C-NSA-099.16-023; Risk Significant Component Matrix – Attachment 7; Revision 7
- 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-099.20-053; Evaluation of Shield Building for the Interim Condition with Outside Vertical Reinforcement Removed at Each Flute Shoulder; Revision 0
- C-CSS-099.20-054; Evaluation of Shield Building for the Permanent condition with Outside Vertical Reinforcement Removed at Cracking Areas; Revisions 0, 1, 2, and 3
- C-CSS-099.20-055; II/I Evaluation for Architectural Flute Shoulder; Revision 0
- C-CSS-099.20-056; Evaluation of Shield Building Hoop Reinforcement with Observed Cracking; Revisions 0 and 1

Drawings:
- C-111A; Shield Building Exterior Developed Elevation; Revision 0 and 1

Other:
- MRPM; Maintenance Rule Program Manual; Revision 29
- 17M Shutdown Defense In Depth Report; Revision 1
- Davis-Besse Shield Building Investigation and Technical Summary; Revisions 0 and 1
- Davis-Besse Shield Building Cracking Investigation and Assessment Report; Revisions 0 and 1

<u>1R15 Operability Evaluations</u>

Condition Reports:
- 2011-01902; Extent of Condition Concerns from CR 2011-98223
- 2011-03346: Fractured Concrete Found at 17M Shield Building Construction Opening
- 2011-03996; Extent of Condition for Shield Building Fracture Indications
- 2011-04190; Surface Cracks Identified on Fluted Areas of the Shield Building
- 2011-04214; Core Bore Found Additional Crack in Architectural Flute Area
- 2011-04402; Fractured Concrete Found at 17M Shield Building at Main Steam Line Penetrations
- 2011-04507; Isolated Crack Indication Identified by Impulse Response Testing
- 2011-04648; Shield Building IR Indications above Elevation 780
- 2011-05475; Concrete Cracking at the Top of the Shield Building Wall
- 2011-05648; Concrete Cracking in Shoulder 4 / Flute 2 Region of the Shield Building (Azimuth 67.5)
- 2011-05904; Errors Identified in Shield Building Crack Calculation C-CSS-059.20-056
- 2011-06185; Error in Calculation C-CSS-099.20-056, Revision 01
- 2011-98223; DC System Issues from NRC CDBI
- 2011-05526; Acceptance Criteria For Train 2 Service Water Flow Balance, DB-SP-03001, Not Met

- 2011-05283; DB-SP-03001 Service Water Loop 2 Integrated Flow Balance Procedure Flow Does Not Meet Minimum Acceptance Criteria
- 2011-05163; Questionable Margin of CCW SW Flow Balance Acceptance Criteria
- 2011-05183; Cycling of #2 SW Pump Strainer During Performance of DB-SP-03001

Procedures:
- NOP-LP-2001; Corrective Action Program; Revision 27
- NOP-OP-1009; Operability Determinations and Functionality Assessments; Revision 3
- NOP-OP-1014; Plant Status Control; Revision 1
- NOBP-OP-0004; Plant Status Control and Clearance Events; Revision 4
- DB-OP-02011; Heat Sink Alarm Panel 11 Annunciators; Revision 9
- DB-OP-02521; Loss of AC Bus Power Sources; Revision 17
- DB-SP-03001; Service Water Loop 2 Integrated Flow Balance Procedure; Revision 15
- DB-CH-06033; Auxiliary Systems Chemical Addition; Revision 19

Calculations:
- C-EE-001.01-010; DC Calc-Battery/Charger Size, Short Circuit, Voltage Drop; Revision 31
- 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-099.20-053; Evaluation of Shield Building for the Interim Condition with Outside Vertical Reinforcement Removed at Each Flute Shoulder; Revision 0
- C-CSS-099.20-054; Evaluation of Shield Building for the Permanent condition with Outside Vertical Reinforcement Removed at Cracking Areas; Revisions 0, 1, 2, and 3
- C-CSS-099.20-055; II/I Evaluation for Architectural Flute Shoulder; Revision 0
- C-CSS-099.20-056; Evaluation of Shield Building Hoop Reinforcement with Observed Cracking; Revisions 0 and 1
- C-NSA-011.01-016; Service Water System Design Basis Flowrate Analysis and Testing Requirements

Work Orders:
- 200379719; Service Water Train 2 Flow Balance Simple Troubleshooting

Drawings:
- E-0007; 250/125 Vdc and Instrumentation AC One Line Diagram; Revision 40
- E-642A, Sheet 1A; Nonessential 125 Vdc Distribution Panel “DAP” Channel – A; Revision 13
- E-642A, Sheet 1B; Nonessential 125 Vdc Distribution Panel “DAP” Channel – A; Revision 15
- E-642A, Sheet 2A; Nonessential 125 Vdc Distribution Panel “DBP” Channel – B; Revision 15
- E-642A, Sheet 2B; Nonessential 125 Vdc Distribution Panel “DBP” Channel – B; Revision 15
- E-642A, Sheet 3A; Nonessential 125 Vdc Distribution Panel “DAN” Channel – A; Revision 10
- E-642A, Sheet 3B; Nonessential 125 Vdc Distribution Panel “DAN” Channel – A; Revision 5
- E-642A, Sheet 4A; Nonessential 125 Vdc Distribution Panel “DBN” Channel – B; Revision 11
- E-642A, Sheet 4B; Nonessential 125 Vdc Distribution Panel “DBN” Channel – B; Revision 8
- E-640A, Sheet 1A; Essential 125 Vdc Distribution Panel “D1P” Channel – 1; Revision 22
- E-640A, Sheet 1B; Essential 125 Vdc Distribution Panel “D1P” Channel – 1; Revision 14
- E-640A, Sheet 2A; Essential 125 Vdc Distribution Panel “D2P” Channel – 2; Revision 21
- E-640A, Sheet 2B; Essential 125 Vdc Distribution Panel “D2P” Channel – 2; Revision 14
- E-640A, Sheet 3A; Essential 125 Vdc Distribution Panel “D1N” Channel – 3; Revision 11
- E-640A, Sheet 3B; Essential 125 Vdc Distribution Panel “D1N” Channel – 3; Revision 3
- E-640A, Sheet 4A; Essential 125 Vdc Distribution Panel “D2N” Channel – 4; Revision 12
- E-2013H, Sheet No. 1 of 12; Station 125 Vdc Distribution System Failure Analysis Manual Cover Sheet Introduction; Revision 2

- E-2013J, Sheet No. 1 of 71; Station 125 Vdc Distribution System Failure Analysis Manual – Cover Sheet Panel D1P; Revision 3
- E-2013K, Sheet No. 1 of 118; Station 125 Vdc Distribution System Failure Analysis Manual – Cover Sheet Panel DAP; Revision 3
- E-2013L, Sheet No. 1 of 8; Station 125 Vdc Distribution System Failure Analysis Manual – Cover Sheet Panel D1N; Revision 2
- E-2013M, Sheet No. 1 of 38; Station 125 Vdc Distribution System Failure Analysis Manual – Cover Sheet Panel DAN; Revision 2
- E-2013N, Sheet No. 1 of 68; Station 125 Vdc Distribution System Failure Analysis Manual – Cover Sheet Panel D2P; Revision 3
- E-2013P, Sheet No. 1 of 103; Station 125 Vdc Distribution System Failure Analysis Manual – Cover Sheet Panel DBP; Revision 3
- E-2013Q, Sheet No. 1 of 7; Station 125 Vdc Distribution System Failure Analysis Manual – Cover Sheet Panel D2N; Revision 3
- E-2013R, Sheet No. 1 of 43; Station 125 Vdc Distribution System Failure Analysis Manual – Cover Sheet Panel DBN; Revision 3
- OS-060, Sheet 1; Operational Schematic 250/125 Vdc and 120 V Instrument AC System; Revision 17
- OS-060, Sheet 2; Operational Schematic 250/125 Vdc and 120 V Instrument AC System; Revision 17
- C-111A; Shield Building Exterior Developed Elevation; Revision 0 and 1

Other:
- Davis-Besse Shield Building Investigation and Technical Summary; Revisions 0 and 1
- Davis-Besse Shield Building Cracking Investigation and Assessment Report; Revisions 0 and 1

1R18 Plant Modifications

Condition Reports:
- 2011-02133; ICS/ULD Upgrade HLG NR TEMP Divergence Alarms
- 2011-02136; ICS/ULD Upgrade Communication Alarm to PPC
- 2011-02253: Penetration Sleeve Size Error Resulted in Nonconservative Analysis Error
- 2011-02261; Unanalyzed Failure Mode of ICS/ULD Modification
- 2011-03125; Inadvertent Short in NNI X
- 2011-04311; Service Water Pipe Project – Jacking Bolt Cannot Be Installed In Orifice Flange
- 2011-04267; Service Water Supports A-328 and A-341 Do Not Match Drawing Offsets
- 2011-04491; SW Pipe 3" –HABC-45 Not Installed Per Drawings by WSI Under Order 200432711
- 2011-03418; Service Water Replacement Piping Tie-In As Found Conditions
- 2011-05689; As Found Data Out of Tolerance – Order 204428777 – ICS ULD & V Buffer FYSP02A1-D Found Failed
- 2011-95917; ICS ECP 02-0540-00 Makeup Flow Out of Range High in New ICS Unit Load Demand

Work Orders:
- 200432023; Replace SW Piping to ECCS Room Coolers
- 200316618; Replace SW ECCS Supply/Return Piping
- 200432711; Replace SW Piping to ECCS Room Cooler #1
- 200432714; Replace SW Piping to ECCS Room Cooler #2
- 200432715; Replace SW Piping to ECCS Room 1 Coolers

- 200432716; Replace SW Piping to ECCS Room Cooler #4
- 200432717; Replace SW Piping to ECCS Room Cooler #5
- 200432718; Replace SW Piping From ECCS Room 2 Coolers

Procedures:
- NOP-OP-4106; Control of Radiography Operations; Revision 2

Engineering Change Packages:
- 02-0540-000; Integrated Control System (ICS) Unit Load Demand Replacement
- 10-0458-000; SGR – 17M – Install Shield Building Construction Opening
- 10-0459-003; SGR – 17M – Containment Vessel Opening, Cut Wall Opening
- 10-0459-004; SGR – 17M – Containment Vessel Opening, Restore Wall
- 11-0412-000; Removal of ECCS Room Cooler Check Valves
- 11-0412-003; 17M Service Water Replacement

Other:
- USAR Section 9.2.1; Service Water System

1R19 Post Maintenance Testing

Condition Reports:
- 2008-33814; Diagnostic Testing on Valve SP6B
- 2011-03878; #1 Decay Heat Pump (P42-1) Bearing Housing Has Loose/Chipping Internal Coating
- 2011-04176; Incorrect Sealant Used on the Containment Air Cooler (CAC) #3 Endbell
- 2011-04244; CTMT Spray Baseline Test, Motor Data Greater Than 100 Percent FLA and Line Voltage Greater Than 110 Percent
- 2011-04251; Containment Spray (CS) Pump 1 Baseline Test Results
- 2011-04252; Inadequate Acceptance Criteria in DB-PF-03472, Makeup Pump 1 Baseline Test
- 2011-04338; #3 CTMT Air Cooler Motor Found Damaged
- 2011-04344; MP37-1A Makeup Baseline Test, Motor Data Greater Than 100 Percent FLA and Line Voltage Greater than 110 Percent
- 2011-04400; Battery Charger DBC1N – Termination of 500 MCM Cable at D134
- 2011-04437; Test Deficiency: Battery Charger DBC1N Low AC Voltage Disconnect Did Not Function
- 2011-04501; Question on the Configuration of the Condensate Drain Plug for CTMT Air Cooler Motor #3
- 2011-04574; MP42-1 Decay Heat Pump 1-1 Baseline Test (DB-PF-03236) Line Voltage Greater than 110 Percent of the Motor Nameplate Voltage and to Evaluate the Motor and Pump Hydraulic Data from DB-PF-03236
- 2011-04591; SP6B Has In-Body Thread Damage
- 2011-04602; At Step 6.5.34 of DB-SC-10023, DBC1P AC Input Breaker Did Not Trip When AC Power Was Removed (BE 1233 Opened)
- 2011-04620; Test Deficiency: Battery Charger DBC1P
- 2011-04830; Abnormal Thermal Indications Noted Via Infrared Thermography within BE1501
- 2011-04901; Solenoid Valves Required Rebuild After Maintenance
- 2011-04993; Data Recorded For DB-PF-03236 DH Pump 1 Baseline Testing
- 2011-05228; ILRT Procedure (DB-PF-10310) Discrepancy in Attachment 3E
- 2011-05630; Decay Heat Pit Has a Crack in the caulking That May Have Been Caused By/During the ILRT
- 2011-05687; Decay Heat Valve Pit Leak Test Does Not Meet acceptance Criteria

- 2011-05693; Relative Position Indication for Control Rod 2-2 Not Responding
- 2011-05716; Penetration Boot Seal Could Not Be Performed By Procedure
- 2011-05847; EVS Train 1 Refueling Interval SFAS Drawdown Test, DB-SS-03254, Failure
- 2011-06302; Auxiliary Feedwater Pump Turbine 1 Steam/Water Casing Leakage
- 2011-06318; Trip Keylock Switch to Insert Control Rod Groups During Testing Was Not Operated by a Licensed Individual

Procedures:
- DB-PF-03437; Containment Spray Pump 1 Baseline Test; Revision 3
- DB-PF-05000; Motor Testing; Revision 3
- DB-PF-05064; Electrical Machine Testing Using PdMA Motor Tester; Revision 9
- DB-SP-03157; AFP 1 Response Time Test; Revision 18
- DB-SP-03299; Containment Air Cooling Unit 3 18 Month Test; Revision 8
- DB-SP-03296; Containment Air Cooling Unit 3 Monthly Test; Revision 11
- DB-PF-03472; Makeup Pump 1 Baseline Test; Revision 4
- DB-PF-03236; Decay Heat Pump 1 Baseline Test; Revision 7
- DB-PF-10310; Containment Integrated Leakage Rate Test; Revision 7
- DB-ME-03003; Station Battery Charger Test; Revision 12
- DB-SC-03270; Control Rod Assembly Insertion Time Test; Revision 11
- DB-SC-03272; Control Rod Exercising Test; Revision 4
- DB-SC-10023; Post-Modification Test For Battery Charger DBC1P; Revision 0
- DB-SC-10024; Post-Modification Test For Battery Charger DBC1N; Revision 0
- DB-SS-03254; Emergency Ventilation System Train 1 Refueling Interval SFAS Drawdown Test; Revision 12
- DB-SC-03270; Control Rod Assembly Insertion Time Test; Revision 11
- NOP-WM-3620; Air Operated Valve Diagnostic Testing; Revision 0
- DB-OP-02011; Heat Sink Alarm Panel 11 Annunciators; Revision 9

Work Orders:
- 200005040; Decay Heat 1: Inspect/Recoat Bearing Housings. Replace Mechanical Seals
- 200376148; Makeup Pump 1 I/B Cover to Casing Gasket Replace
- 200389986; DBC1N Replace Charger ECP 02-0707-003
- 200389987; DBC1P Replace Charger ECP 02-0707-002
- 200404473; Makeup Pump 1 Replace O/B Seal
- 200423169; PM 6095 MC1-3 Motor Testing CAC Fan 3 Motor
- 200423797; ECP 10-0578 PM 7739 Makeup Pump 1 Refurb/Replace/Rewind Motor
- 200423980; ECP 11-0467 PM 9896 Decay Heat 1 Refurb/Rewind/Replace Motor
- 200423981; Containment Spray 1 PM 9897, Refurb/Rewind/Replace Motor
- 200427977; Rod Drop CRA Insertion Time Test
- 200428009; AFP 1 Response Time Test
- 200428641; PM 4301 FVSP6B Rebuild #1 MN FW
- 200429509; Containment ILRT
- 200437806; ECP 11-0143-001 CAC Fan #3 Motor Needs Replaced

Other:
- Containment Spray Pump 1 Motor Data, dated October 24, 2011
- Makeup Pump 1 Motor Data, dated October 25, 2011
- ECP 02-0707-002; Replace Battery Charger DB-DBC1P
- ECP 02-0707-003; Replace Battery Charger DB-DBC1N
- ECP 11-0143-001; Replacement Motor For MC1-3; Revision 0

1R20 Refueling and Other Outage Activities

Condition Reports:
- 2011-04881; Violation of NOP-LP-1202, Vehicle Found With Keys in Ignition
- 2011-04886; Requirements to Enter Mode 6 for Containment Closure After Vessel Opening
- 2011-05036; Paint Thickness Requirements Outside Specification
- 2011-05173; P78A Containment Normal Sump Pump A Did Not Meet Acceptance Criteria – Failed Test
- 2011-05419; Evaluate Areas in Containment Not Coated Per Specification A-024Q
- 2011-05517; Protective Coating Applied Inside Containment Not in Compliance With Order or Requirements of Engineering Change Package
- 2011-05558; POD 10-001 Review of Mode Change or Plant Operating Restrictions
- 2011-05588; Entry Into Plant Condition Prior to Resolving Listed Restraints
- 2011-05630; Decay Heat Pit Has a Crack in the caulking That May Have Been Caused By/During the ILRT
- 2011-05652; Pressurizer Insulation Not Properly Secured
- 2011-05672; Containment Walkdown
- 2011-05675; Peeling Paint and Tape in Containment
- 2011-05687; Decay Heat Valve Pit Leak Test Does Not Meet acceptance Criteria
- 2011-05690; Containment Unacceptable Items Found During Containment Closure Walkdown
- 2011-05692; Potential Rework for CRD Rod 2-2
- 2011-05709; Containment Closeout Inspection Tour With NRC Inspectors
- 2011-05711; Removed Outer Jacket From Sealtite in Containment
- 2011-05740; Mirror Insulation Clips Damaged, Missing, and Not Clipped
- 2011-05777; Void in Concrete at the top of the Shield Building pour back (Bechtel NCR 20)
- 2011-05904; Errors Identified in Shield Building Crack Calculation C-CSS-059.20-056
- 2011-06196; Rising Reactor Coolant Drain Tank Level
- 2011-06291; Pressurizer Safety Valve Performance During Plant Heatup

Procedures:
- NG-DB-00117; Shutdown Defense in Depth Assessment; Revision 11
- NOP-OP-01005; Shutdown Defense in Depth; Revision 13
- DB-OP-06002; RCS Draining and Nitrogen Blanketing; Revision 19
- DB-OP-06003; Pressurizer Operating Procedure; Revision 28
- DB-OP-06230; Steam Generator Secondary Side Fill, Drain, and Layup; Revision 14
- DB-OP-06301; Generator and Exciter Operating Procedure; Revision 23
- DB-OP-06903; Plant Cooldown; Revision 40
- DB-OP-06904: Shutdown Operations; Revision 38
- DB-OP-06912; Approach to Criticality; Revision 16
- DB-MM-04004; Station Cranes Periodic Test; Revision 12
- DB-MM-06002; Polar Crane Operation; Revision 16
- DB-MM-09242; P&H station Crane Maintenance; Revision 2
- DB-MS-04009; Hand and Electric Operated Hoists Inspection; Revision 6
- DB-ME-09500; Installation and Termination of Electrical Cables; Revision 23

Business Practices:
- DBBP-ESAF-1010; Containment Cranes; Revision 0

Work Orders:
- 200429982; Polar Crane Inspections

Other:
- Bechtel Radiography Management Plan, Davis-Besse Containment Vessel, Fall 2011; Revision 0

<u>1R22 Surveillance Testing</u>

Condition Reports:
- 2011-03416; DB-SC-03121: Non-Conservative Computer Pt Used as Time Reference for Response Time Calcs
- 2011-04315; Required CR for IST Valve Times From 2011 SFAS Integrated Train 2 DB-SC-03121
- 2011-04935; EDG 2 Frequency High Test Deficiency in DB-SC-03121, Integrated SFAS Train 2
- 2011-05228; ILRT Procedure (DB-PF-10310) Discrepancy in Attachment 3E
- 2011-05630; Decay Heat Pit Has a Crack in the caulking That May Have Been Caused By/During the ILRT
- 2011-05687; Decay Heat Valve Pit Leak Test Does Not Meet Acceptance Criteria
- 2011-05716; Penetration Boot Seal Could Not Be Performed By Procedure
- 2011-06382; During Normal Operating Pressure, Normal Operating Temperature Walkdown Inspection the L7 Removable Insulation Panel on the Integrated Head Assembly could not be Extracted from the Installed Location
- 2011-88100; Pressurizer Code Safety Valves Setpoint Test Failure Reporting

Procedures:
- DB-PF-03008; Containment Local Leakage Rate Tests; Revision 15
- DB-SC-03121; SFAS Train 2 Integrated Response Time Test; Revision 2
- DB-SC-03074; Emergency Diesel Generator 1, ABDC1, and AC103 Appendix R Test; Revision 6
- DB-SP-03157; AFP 1 Response Time Test; Revision 18
- DB-PF-03010; RCS Leakage Test; Revision 11
- DB-PF-10310; Containment Integrated Leakage Rate Test; Revision 7

VT-2 Summary Numbers:
- B15.000.RC01; Primary Reactor Coolant System Class 1 Pipe for Leakage Test; 17-VT-286, 17-VT-287, 17-VT-288, 17-VT-289, 17-VT-290, 17-VT-291, 17-VT-292, 17-VT-293, 17-VT-294, 17-VT-295, 17-VT-297
- B15.000.DH15; Reactor Coolant System to Decay Heat Pump Suction (Bypass); 17-VT-298
- B15.000.DH14; Reactor Coolant System to Decay Heat Pump Suction (Normal); 17-VT-299
- B15.000.CF10; Core Flood and Decay Heat Train 2 Injection Lines to Reactor Vessel; 17-VT-300
- B15.000.CF09; Core Flood and Decay Heat Train 1 Injection Lines to Reactor Vessel; 17-VT-301
- B15.000.DH16; Pressurizer Spray Line; 17-VT-302

Work Orders:
- 200353901; SGR-RC2A – Replace Power Operated Relief Valve ECP 10-0309-001
- 200380790; PM 5078 RC13A Replace Pressurizer Relief Valve
- 200380791; ECP 09-0116-002 PM 5079 RC13B Replace Pressurizer Relief Valve

- 200428009; AFP 1 Response Time Test
- 200429509; Containment ILRT
- 200433297; ECP 10-0470-006 SGR – Install New Reactor Replacement Vessel Closure Head and Control Rod Drive Mechanism's Post Maintenance (Modification) Testing
- 200464590; SGR – Replace Power Operated Relief Valve (Electrical) ECP 10-0309-001

Other:
- ISTP3; Third Ten Year Inservice Testing Program; Revision 11
- ASME Operation & Maintenance Code, 1995 Edition, 1996 Addenda
- ISTB1; Pump and Valve Basis Document, Volume I – Valve Basis; Revision 10
- ISTB2; Pump and Valve Basis Document, Volume II – Pump Basis; Revision 12
- ISTB3; Pump and Valve Basis Document, Volume III – Stroke Time Basis; Revision 41

2RS1 Radiological Hazard Assessment and Exposure Controls

Condition Reports:
- 2011-02491; Unsatisfactory radiological Condition in the Aux Building 565' Elevation
- 2011-02797; Annulus Scaffolding Sealands are Inadequate for Radioactive Storage or Shipment
- 2011-02868; WSI Worker Receives Dose Rate Alarm after Coming to Contact with Piping in No. 2 MPR Pipe Chase
- 2011-03034; Potential Tritium Leak – Condenser Pit Outage Temporary Line to Settling Basin
- 2011-03200; Insulators Receives Dose Rate Alarm While Working in the East "D" Ring 565'
- 2011-03256; Bad Radiological Practice of Men in the Batwing Box with Contaminated Material such as Tool without Wearing Protective Clothing
- 2011-03270; Individual Discovered in Containment with a Rag on his Head Instead of Hood
- 2011-03401; Recent Trending Indicates Improvement is Warranted in Radworker Work Behavior in the Area of Radiological Anti-Contamination Clothing Control
- 2011-03404; Condenser Pit Sump Discharge Leak to Ground
- 2011-03429; Individual did not Meet RWP Requirements
- 2011-03459; NOP-OP-4601 Contamination Control Program Guidance was not Completely Implemented
- 2011-03533; Worker Lost Dosimeter in RCA
- 2011-03535; Contamination Boundary Violation
- 2011-03680; There were an Increased of Radworkers Coaching to use Low Dose Waiting Areas
- 2011-03687; Worker Enters Radiologically Controlled Area without Being on Proper RWP
- 2011-03808; Personnel Contamination Event 17M
- 2011-03808; Personnel Contamination Event 17M-11
- 2011-03847; Radworkers Using Electronic Alarming Dosimeters as Dose Rate Meters
- 2011-03918; Observations Indicate Additional Action is Warranted in the Area of Hoses and Cords not Being Secured at Contaminated area Boundaries
- 2011-03980; Radiological Posting Standards Not Met
- 2011-04057; Method Used to Control VHRA Access to Fuel Transfer Tube from Core Flood Tank 1-1 Area
- 2011-04083; Revise Station Vent Radiation Element Radiation Alarm Setpoints
- 2011-91281-001; Plant Health Committee to Design Engineering to Develop a Plan to Enlarge the Current 3" Diameter Piping from the Condenser Flood Pump to the Settling Basin

Procedures:
- DB-0204-0; Source Leak Test Records

- NOP-OP-4102; Radiological Posting, Labeling and Markings; Revision 7
- NOP-OP-4104; Job Coverage; Revision 0
- NOP-OP-4106; Control of Radiography Operation; Revision 2
- NOP-OP-4107; Radiation Work Permit; Revision 7
- NOP-OP-4204; Special External Exposure Monitoring; revision 5
- NOP-OP-4301; *Respiratory Protection Program;* Revision 2
- NOP-OP-4702; Air Sampling; Revision 2

Other:
- Davis Besse Methods for Measuring Effective Dose Equivalent from External Exposure for OTSG Work and Reactor Head Repair Activities
- Davis Besse Nuclear Power Station; 17 Mid-Cycle and 17 RFO In-Processing Focus Areas
- 17M Outage Daily Exposure Summary; October 18, 2011
- 17 Mid-cycle Radiation Protection Trending; October 20, 2011
- Bechtel Radiography Management Plan, Davis-Besse Containment Vessel, Fall 2011; Revision 0

<u>2RS2 *Occupational ALARA Planning and Controls*</u>

Condition Reports:
- 2010-72971; Alloy 600 Dose Delta
- 2010-73156; Elevated Dose Rates on Core Flood Shielded Work Platforms with the Incores Pulled
- 2010-74240; A Review of Alloy-600 Weld Overlays

Procedures:
- DB-HP-01801; ALARA Design Review; Revision 3
- DB-HP-01802; Control of Shielding; Revision 8
- DB-HP-04027; Installed Shielding Inspection and Engineering Evaluation; Revision 4
- DBBP-RP-0018; *Guidance for Work In Progress* (WIP) ALARA Reviews; Revision 0
- NOP-OP-417-12; ALARA Work In Progress Review; Revision 0
- NOP-OP-4005; ALARA Program; Revision 1
- NOP-WM-7002; Operational ALARA Program; Revision 1

Radiation Work Permits:
- 2010-5016; ALARA Plan: Work In Progress Review; Insulation Work Activities in the Containment; April 17, 2010
- 2010-5018; ALARA Plan: Reactor Canal Decontamination to Include ALARA Plan and associated TEDE ALARA Evaluations for RWP 10010886; Drywell Insulation Activities; Revision 1
- 2010-5104; ALARA Plan: Reactor Head Disassembly/Reassembly Work Activities; January 17, 2010
- 2010-5302; ALARA Plan: Work In Progress Review; OT Steam Generator Platform Work; March 13, 2010
- 2010-5405; All Task: Letdown Cooler Project; ALARA Work In Progress Review; April 21, 2010
- 2010-5600; ALARA Plan: ALARA Work In Progress; Weld Overlays of RCP Cold Leg (4) Suction and (4) Discharge Lines and all Support Activities such as Scaffolding, Insulation, Shielding, UT/PT, and Interference Removal; April 12, 2010
- 2010-5601; ALARA Plan: Alloy-600, Cutting to Access North and South Core Flood Nozzles, Install and Remove shielded Work Platforms; April 30, 2010

- 2010-5602; ALARA Plan; Weld Overlays of North/South Core Flood Nozzles and All Support Activities; February 17, 2010
- 2010-5603; ALARA Plan: Concrete Cutting through Bio-shield to Access North and South Core Nozzles; January 6, 2010
- 2010-5604; ALARA Plan: ALARA Work-In-Progress Review; March 14, 2010

Other:
- ALARA Work In Progress Reviews for RWP 1010-5600; Weld Overlay on Reactor Coolant Pumps; March 16, 2010
- Alloy-600-1R16; Preliminary Estimate Summary: RCP/Drain Line Overlays; Core Flood Nozzle Overlays; and Common Support Activities; April 15, 2010

2RS5 Radiation Monitoring Instrumentation

Condition Reports:
- CR-2011-02061; Flow Rate Information Could Effect Information Reported in the Annual Radiological Environmental Operating Report; September 16, 2011
- CR-11-89820; 4598AA Flow was Recorded Less than Three SCFM; February 18, 2011
- CR-11-87764; RE-4598BA Sample Pump Failed and Caused A Momentary Spurious Spike in Radiation; January 5, 2011
- CR-10-81010; RE-4598BA RIC Flowrate Indication does not Correspond with Local Flowrate Indication; August 10, 2010
- CR-10-83234; Broken Gasket was discovered on the Inner Bottom of the Charcoal Holder; September 27, 2010
- CR-10-81607; Radiological Air Sampler Documentation Deficiencies; August 23, 2010
- CR-11-94845; FT-5090 Appears to be Degraded Due to Both F885 and RIC 4598AA Reading a Spiked Indication of 145 KCFM as Compared 4598BA Which Reads a Steady 125 KCFM; May 15, 2011
- CR-10-79761; Station Vent Accident Range Radiation Appears to Have Gone to the Default Setting; July 16, 2010

Procedures:
- ED-7191-2; Toledo Edison Calculation Sheet; RE-4598AA and 4598BA Setpoint Basis; January 23, 1995
- DB-CN-03008; Station Vent Releases, Weekly Radiological Monitoring, Sampling and Analysis of RE-4598AA; Revision 10
- RA-EP-02240; Davis Besse Emergency Plan Implementing Procedure; Revision 5
- DB-MI-03414; Calibration of Flow Power Supplies and Battery Checks for RE-4597AA, RE-4597BA, RE-4598AA, and RE-4598BA Normal Range Radiation Monitors; Revision 9
- DB-OP-03007; Miscellaneous Instrument Daily Checks; Revision 19
- M-340DQ-00196-02; Instrument Manual for Hastings Linear Gas Flow Probe; Manual
- DB-OP-03011; Radioactive Liquid Batch Release; Revision 19
- DB-HP-01457; Radiation Protection Instrumentation Procedure; MGP-AMP-50/100/200 Calibration and Use; Revision 2
- DB-HP-01456; Radiation Protection Instrumentation Procedure; Calibration of Eberline AMS-4; Revision 2
- DB-HP-01460; Radiation Protection Instrumentation Procedure; RADeco Model H-810 DC Calibration and Use; Revision 0
- DB-HP-01461; Radiation Protection Instrument Procedure; PCM12 Calibration, Source Check and Use; Revision 1
- DB-HP-01455; Radiation Protection Procedure; Operation of Eberline AMS-4; Revision 1

- DB-HP-01453; Radiation Protection Instrumentation Procedure; Continuous Particulate Air Monitor AMS-3, Calibration and Use; Revision 6
- DB-HP-01456; Radiation Protection Instrumentation Procedure; Air Sampler Calibration; Revision 7
- DB-HP-01452; Radiation Protection Procedure; Small Article Monitor Calibration; Revision 3
- DB-HP-01442; Radiation Protection Instrumentation Procedure; MGP Telepole Calibration and Use; Revision 3
- DB-HP-01439; Radiation Protection Procedure; Bicron Labtech; Revision 1
- DB-HP-01438; Radiation Protection Instrumentation Procedure; Frisker Calibration; Revision 5
- DB-HP-01435; Radiation Protection Instrumentation Procedure; Calibration and Use of the Portal Monitor SPM 904C/SPM 906; Revision 3
- DB-HP-01436; Radiation Protection Procedure; DMC 90/100/2000 Calibration and Use; Revision 3
- DB-CN-03005; Radiological Monitoring Weekly, Semi-Monthly and Monthly Sampling; Revision 3
- DB-HP-01432; Radiation Protection Instrumentation Procedure; ASP-1 Calibration and Use; Revision 3
- MS-C-09-10-01; Fleet Oversight Audit Report

Other:
- Davis-Besse Offsite Dose Calculation Manual; Revision 25
- Radiation Monitor Setpoint Manual; RE-4598AAC Vent Normal Range; August 3, 2011

4OA1 Performance Indicator Verification

Forms:
- NOBP-LP-4012-52; Reactor Coolant System Specific Activity; Completed Forms for October 2010 through September 2011
- NOBP-LP-4012-53; Reactor Coolant System Leakage; Completed Forms for October 2010 through September 2011

Procedures:
- DB-CH-06002; Sampling System Nuclear Areas; Revision 28
- NOBP-LP-4012; NRC Performance Indicators; Revision 3
- NOBP-LP-4012; NRC Performance Indicators; dated April 21, 2008
- NOBP-LP-4012-52; Reactor Coolant System Specific Activity Occurrence; Revision 0; from August 2010 through August 2011

Other:
- NEI 99-02; Regulatory Assessment Performance Indicator Guideline; Revision 6
- Select Operator Logs covering the period of October 2010 through September 2011
- Maintenance Rule Unavailability Database covering the period of October 2010 through September 2011

4OA2 Identification and Resolution of Problems

Condition Reports:
- 2011-03346: Fractured Concrete Found at 17M Shield Building Construction Opening
- 2011-03996; Extent of Condition for Shield Building Fracture Indications
- 2011-04190; Surface Cracks Identified on Fluted Areas of the Shield Building
- 2011-04214; Core Bore Found Additional Crack in Architectural Flute Area

- 2011-04402; Fractured Concrete Found at 17M Shield Building at Main Steam Line Penetrations
- 2011-04507; Isolated Crack Indication Identified by Impulse Response Testing
- 2011-04648; Shield Building IR Indications above Elevation 780
- 2011-05475; Concrete Cracking at the Top of the Shield Building Wall
- 2011-05648; Concrete Cracking in Shoulder 4 / Flute 2 Region of the Shield Building (Azimuth 67.5)
- 2011-05726; Unable to Perform Section 4.14, Pressurizer Liquid Space Sampling During Pressurizer Heatup, of DB-CH-06002, Sampling System Nuclear Areas, as Written
- 2011-05735; Final Portion of Shield Building Restoration Included a Cement Not Tested By a Safety-Related (Q) Laboratory
- 2011-05777; Void in Concrete at the top of the Shield Building pour back (Bechtel NCR 20)
- 2011-05781; PI1507A For No. 1 Decay Heat Pump Over-Ranged
- 2011-05782; PI1538A For Decay Heat Pump 2 Was Over-Ranged
- 2011-05794; Bechtel Out-of-Process for Authorizing Use-as-Is on Shield Building Opening Restoration Nonconformance
- 2011-05904; Errors Identified in Shield Building Crack Calculation C-CSS-059.20-056
- 2011-06185; Error in Calculation C-CSS-099.20-056, Revision 01

Calculations:
- 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-099.20-053; Evaluation of Shield Building for the Interim Condition with Outside Vertical Reinforcement Removed at Each Flute Shoulder; Revision 0
- C-CSS-099.20-054; Evaluation of Shield Building for the Permanent condition with Outside Vertical Reinforcement Removed at Cracking Areas; Revisions 0, 1, 2, and 3
- C-CSS-099.20-055; II/I Evaluation for Architectural Flute Shoulder; Revision 0
- C-CSS-099.20-056; Evaluation of Shield Building Hoop Reinforcement with Observed Cracking; Revisions 0 and 1

Drawings:
- C-111A; Shield Building Exterior Developed Elevation; Revision 0 and 1

Procedures:
- NOP-LP-2001; Corrective Action Program; Revision 29
- NOBP-LP-2010; FENOC Trend Coding; Revision 10
- DB-CH-06002; Sampling System Nuclear Areas; Revision 28
- DB-PF-03811; Miscellaneous Valves Test; Revision 19
- DB-OP-06904; Shutdown Operations; Revision 38

Other:
- FENOC Quality Assurance Program Manual; Revision 15
- Davis-Besse Shield Building Investigation and Technical Summary; Revisions 0 and 1
- Davis-Besse Shield Building Cracking Investigation and Assessment Report; Revisions 0 and 1

<u>4OA3 Followup of Events and Notices of Enforcement Discretion</u>

Condition Reports:
- 2006-00624; Water Spray on Motor Control Centers E11B and E11C

- 2007-32157; Water Spraying Out of the Overhead Between No. 3 and No. 4 Mechanical Penetration Rooms
- 2008-45463; Water Dripping on E11C
- 2010-87048; RC13A and RC13B Fail As-Found Testing at Vendor
- 2011-05456; E11C Water Intrusion / Fire
- 2011-05457; 4-Way Ringdown Not Ringing at State and Lucas County During Alert Classification
- 2011-05465; Emergency Response Facility Computer Issues During Alert
- 2011-05466; Recovery From the 11/16/2011 Davis-Besse Alert
- 2011-05523; Second Control Power Transformer Found Damaged as a Result of MCC E11C Fire

Procedures:
- RA-EP-01500; Emergency Classification; Revision 14
- DB-OP-02529; Fire Procedure; Revision 5
- DB-OP-02501; Serious Station Fire; Revision 16
- DB-OP-06241; Auxiliary Boiler Operating Procedure; Revision 24
- DB-OP-00000; Conduct of Operations; Revision 19
- NOP-OP-01014; Plant Status Control; Revision 1
- NG-QS-00121; Davis-Besse Procedure Writer's Guide; Revision 5

<u>4OA5 Other Activities</u>

Condition Reports:
- 2011-03346: Fractured Concrete Found at 17M Shield Building Construction Opening
- 2011-03996; Extent of Condition for Shield Building Fracture Indications
- 2011-04190; Surface Cracks Identified on Fluted Areas of the Shield Building
- 2011-04214; Core Bore Found Additional Crack in Architectural Flute Area
- 2011-04402; Fractured Concrete Found at 17M Shield Building at Main Steam Line Penetrations
- 2011-04507; Isolated Crack Indication Identified by Impulse Response Testing
- 2011-04648; Shield Building IR Indications above Elevation 780
- 2011-05475; Concrete Cracking at the Top of the Shield Building Wall
- 2011-05648; Concrete Cracking in Shoulder 4 / Flute 2 Region of the Shield Building (Azimuth 67.5)
- 2011-05735; Final Portion of Shield Building Restoration Included a Cement Not Tested By a Safety-Related (Q) Laboratory
- 2011-05770; Bechtel Subcontractor Certifications not Transmitted to FENOC for Review
- 2011-05777; Void in Concrete at the top of the Shield Building pour back (Bechtel NCR 20)
- 2011-05794; Bechtel Out-of-Process for Authorizing Use-as-Is on Shield Building Opening Restoration Nonconformance
- 2011-05795; Concrete Void at Top of Shield Building Restoration Larger than Previously Reported per CR 2011-05777
- 2011-05804; Conditional Release of Concrete for Shield Building Void
- 2011-05904; Errors Identified in Shield Building Crack Calculation C-CSS-059.20-056
- 2011-06185; Error in Calculation C-CSS-099.20-056, Revision 01
- 2011-04373; NRC Potential Violation Regarding RRVCH Stud Hole Exams; dated October 26, 2011
- 2011-03772; Visual Inspection of Containment Vessel Attachment Welds not Performed; dated October 15, 2011
- 2011-03771; Missed MT on Temporary Weld; dated October 15, 2011

- 2011-01739; NRC Surface Examination of Accessible Internal Surface of RRVCH Stud Holes; dated September 9, 2011
- 2011-00344; No Surface Exam of the RRVCH Stud Holes; dated August 9, 2011

Calculations:
- 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-099.20-053; Evaluation of Shield Building for the Interim Condition with Outside Vertical Reinforcement Removed at Each Flute Shoulder; Revision 0
- C-CSS-099.20-054; Evaluation of Shield Building for the Permanent condition with Outside Vertical Reinforcement Removed at Cracking Areas; Revisions 0, 1, 2, and 3
- C-CSS-099.20-055; II/I Evaluation for Architectural Flute Shoulder; Revision 0
- C-CSS-099.20-056; Evaluation of Shield Building Hoop Reinforcement with Observed Cracking; Revisions 0 and 1

Drawings:
- C-111A; Shield Building Exterior Developed Elevation; Revision 0 and 1
- Bechtel drawing; 000-DB-1000-000001; Shield Building Temporary Construction Opening Concrete Preparation; Revision 2
- Bechtel drawing; 25539-200-C0K-1002-00048; Layer 2 Horizontals (Outside Rebar Mat); Revision 0

Other:
- Davis-Besse Shield Building Investigation and Technical Summary; Revisions 0 and 1
- Davis-Besse Shield Building Cracking Investigation and Assessment Report; Revisions 0 and 1
- AMEC Report of Concrete Mixer Uniformity Testing; dated October 12, 2011
- Bechtel Nonconformance Report 25539-200-G61-GCE-00002; dated October 13, 2011
- 25539-000-3PS-DB02-Q00001; Concrete Work for Safety-Related Applications; Revision 1
- 25539-000-3PS-DB01-Q00001; Purchase of Ready-Mix Concrete for Safety-Related Applications; Revision 5
- 25539-000-3PS-SY01-Q0001; Material Testing Services; Revision 5
- AMEC Concrete Field and Lab Test Report; dated November 2, 2011
- Production and Sister Splice Report; dated November 17, 2011
- Reinforcing Bar Mechanical Splicing Qualification Form; dated October 7, 2011
- Interim Report Camtack and Bargrip Sleeve Testing for Dayton Barsplice Inc.; dated September 18, 1979
- BASF COC Letter Pozzolith 200N; Lot 2004-78841V11; dated July 19, 2011
- BASF COC Letter Rheobuild 1000; Lot 2004-67107011; dated July 19, 2011
- BASF COC Letter Air Entraining Admixture for Concrete; Lot 2004-77071U11; dated July 19, 2011
- ECP 10-0458-002; SGR-17M- Restore Shield Building Wall at Construction Opening; Revision 0
- Procedure Demonstration Qualification Summary No. 449, Procedure 54-ISI-801-00" UT of PWR Shell Welds"; Revision 0
- 25539-200-V1A-FU00-00001-001; Type 3 Dedication Plan - No. 8 to No. 8 Bargrip XL Coupler, Barsplice Part No. 8XL
- 25539-200-V1A-FU00-00001-001; Type 3 Dedication Plan - No. 10 to No. 8 Bargrip XL Coupler, Barsplice Part No. 10/8XL
- 25539-200-V1A-FU00-00001-001; Type 3 Dedication Plan - No. 11 to No. 11 Bargrip XL Coupler, Barsplice Part No. 11XL

- 25539-200-V1A-FU00-00001-001; Type 3 Dedication Plan - No. 10 to No. 10 Bargrip XL Coupler, Barsplice Part No. 10XL
- Concrete Field and Lab Test Report 002; dated November 2, 2011
- Concrete Field and Lab Test Report 003; dated November 2, 2011
- Concrete Field and Lab Test Report 006; dated November 22, 2011
- Concrete Field and Lab Test Report 009; dated November 22, 2011
- Concrete Field and Lab Test Report 010; dated November 22, 2011
- Rebar Splice Test Inspection Record; Splice Number V-1; ID Number 190
- Rebar Splice Test Inspection Record; Splice Number V-2; ID Number 190
- Rebar Splice Test Inspection Record; Splice Number H-1; ID Number 190
- Rebar Splice Test Inspection Record; Splice Number H-2; ID Number 190
- Rebar Splice Test Inspection Record; Splice Number V-1; ID Number 204
- Rebar Splice Test Inspection Record; Splice Number V-2; ID Number 204
- Rebar Splice Test Inspection Record; Splice Number H-1; ID Number 204
- Rebar Splice Test Inspection Record; Splice Number H-2; ID Number 204
- Rebar Splice Test Inspection Record; Splice Number V-1; ID Number 114
- Rebar Splice Test Inspection Record; Splice Number V-2; ID Number 114
- Rebar Splice Test Inspection Record; Splice Number H-1; ID Number 114
- Rebar Splice Test Inspection Record; Splice Number H-2; ID Number 114
- SKZ904; Shield Building Exterior Developed Elevation; Revision 0
- SM02; Swaging Instructions; BPI-Grip Couplers; March 2010
- SP-701; Consolidated Power Supply, Dedication of Commercial Grade Items; Revision 14
- QC Record of Weld Heat Input - Door Sheet FW-1 Weld; dated November 2, 2011

Radiographic Records:
- Computed Radiographic Image Interpretation Sheets FW-1; dated November 11, 2011
- Computed Radiographic Image Interpretation Sheets FW-1 Repairs; dated November 12, 2011
- Computed Radiographic Technique Report and Evaluation Sheets FW-1; dated November 10, 2011
- Computed Radiographic Technique Report and Evaluation Sheets FW-1 Repairs; dated November 12, 2011

Non Destructive Examination Records:
- AC Magnetic Particle Examination Data Sheet Report MT-02; RRVCH Stud Holes; dated October 1, 2011
- AC Magnetic Particle Examination Data Sheet Report MT-02; RRVCH Stud Holes; dated November 1, 2011
- Magnetic Particle Examination Report MT-043; CV Plate Door Sheet Weld FW-1 Annulus Side; dated November 7, 2011
- Magnetic Particle Examination Report MT-040; CV Plate Door Sheet Weld FW-1 Containment Side; dated November 5, 2011

LIST OF ACRONYMS USED

ADAMS	Agencywide Document Access Management System
ALARA	As-Low-As-Is-Reasonably-Achievable
ARM	Area Radiation Monitor
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BACC	Boric Acid Corrosion Control
CAM	Continuous Air Monitor
CAP	Corrective Action Program
CC	Construction Code
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CR	Condition Report
CRD	Control Rod Drive
CV	Containment Vessel
DC	Direct Current
deg F	Degrees Fahrenheit
DRP	Division of Reactor Projects
ECCS	Emergency Core Cooling System
ECP	Engineering Change Package
EDG	Emergency Diesel Generator
EMI/RFI	Electromagnetic Interference/Radio Frequency Interference
ET	Eddy Current
FRV	Feedwater Regulating Valve
FW	Feedwater
HPI	High Pressure Injection
I&C	Instrumentation and Controls
ICS	Integrated Control System
IMC	Inspection Manual Chapter
IP	Inspection Procedure
IPEEE	Individual Plant Examination of External Events
IR	Inspection Report *or* Impulse Response
ISI	Inservice Inspection
LCO	Limiting Condition for Operation
LER	Licensee Event Report
MOV	Motor-Operated Valve
MT	Magnetic Particle
NCV	Non-Cited Violation
NDE	Nondestructive Examination
NEI	Nuclear Energy Institute
NRC	U.S. Nuclear Regulatory Commission
NUMARC	Nuclear Management and Resources Council
ODCM	Offsite Dose Calculation Manual
OpESS	Operating Experience Smart Sample
PARS	Publicly Available Records System
PI	Performance Indicator
PI&R	Problem Identification and Resolution
PM	Planned or Preventative Maintenance

PMT	Post-Maintenance Testing
psig	Pounds Per Square Inch Gauge
PT	Dye Penetrant
PWSCC	Primary Water Stress Corrosion Cracking
QA	Quality Assurance
RCA	Radiologically Controlled Area
RCS	Reactor Coolant System
RFO	Refueling Outage
RG	Regulatory Guide
RP	Radiation Protection
RPV	Reactor Pressure Vessel
RRVCH	Replacement Reactor Vessel Closure Head
RT	Radiographic
RWP	Radiation Work Permit
SB	Shield Building
SDP	Significance Determination Process
SG	Steam Generator
SL	Severity Level
SMAW	Shielded Metal Arc Weld
SRO	Senior Reactor Operator
SSC	Structures, Systems and Components
SW	Service Water
TIA	Task Interface Agreement
TS	Technical Specification
USAR	Updated Safety Analysis Report
URI	Unresolved Item
UT	Ultrasonic Examination
Vac	Volts Alternating Current
Vdc	Volts Direct Current
WO	Work Order

In accordance with 10 CFR 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 document system (ADAMS). ADAMS is accessible from the NRC Website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Jamnes L. Cameron, Chief
Branch 6
Division of Reactor Projects

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

Enclosure: Inspection Report 05000346/2011005
w/Attachment: Supplemental Information

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Letter to B. Allen from J. Cameron dated January 31, 2012.

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION INTEGRATED INSPECTION REPORT 05000346/2011005

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From:	Kevin Kamps <kevin@beyondnuclear.org>
Sent:	Friday, January 23, 2015 10:16 PM
To:	Puco Docketing
Subject:	OPPOSITION COMMENT UNDER CASE # 14-1297-EL-SSO: (#7) 3rd Cracking-Related Safety & Environmental Contention in Opposition to Risky Davis-Besse 20-Year Licence Extension.
Attachments:	June 4 2012 Motn to Amend Supp Contn 5 COMPLETE-1.pdf

Dear Public Utilities Commission of Ohio,

I have sent six previous emailed submissions re: Davis-Besse, vis a vis this proceeding.

I am now submitting for the record of this proceeding, our third Davis-Besse Shield Building concrete containment cracking related contention, titled "INTERVENORS' MOTION TO AMEND AND SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)." This document is dated June 4, 2012.

This filing was submitted in response to FENOC's woefully inadequate Aging Management Plan (AMP) for the shield building's cracks

This document is posted online at:

http://www.beyondnuclear.org/storage/June%204%202012%20Motn%20to%20Amend%20Supp%20Contn%205%20COMPLETE-1.pdf

This document is also attached to this email.

Our environmental coalition intervening against Davis-Besse's 20-year license extension includes: Beyond Nuclear; Citizen Environment Alliance of Southwestern Ontario; Don't Waste Michigan; and Green Party of Ohio.

Bowling Green, Ohio resident Phyllis Oster, a member of Beyond Nuclear, provides Beyond Nuclear standing in the Davis-Besse License Renewal Application proceeding.

Our legal counsel is Terry Lodge of Toledo, Ohio.

Given the catastrophic risks associated with Davis-Besse's severely cracked, and worsening, concrete containment Shield Building, we urge that PUCO not approve FENOC's request for a massive ratepayer bailout.

Thank you.

Sincerely,

Kevin Kamps, Beyond Nuclear

--
Kevin Kamps
Radioactive Waste Watchdog

Beyond Nuclear
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Beyond Nuclear aims to educate and activate the public about the connections between nuclear power and nuclear weapons and the need to abandon both to safeguard our future. Beyond Nuclear advocates for an energy future that is sustainable, benign and democratic.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of	)	
		Docket No. 50-346-LR
First Energy Nuclear Operating Company	)	
(Davis-Besse Nuclear Power Station, Unit 1)		June 4, 2012
	)	

* * * * *

INTERVENORS' MOTION TO AMEND AND SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)

Now come Beyond Nuclear, Citizens Environment Alliance of Southwestern Ontario (CEA), Don't Waste Michigan, and the Green Party of Ohio (collectively, "Intervenors"), by and through counsel, and move the Board to allow them to supplement and amend their proposed Contention No. 5, which addresses the shield building cracking phenomena at the Davis-Besse Nuclear Power Station ("Davis-Besse").

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Counsel for Intervenors

MEMORANDUM

A. Background

On January 10, 2012, Intervenors moved for admission of a new Contention No. 5, which states:

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.

The NRC Staff has proposed alternative wording which would transform the contention into a contention of omission. FENOC and the Staff timely responded to the original contention motion.

On February 27, 2012, First Energy Nuclear Operating Company ("FENOC") furnished the NRC with its "Root Cause Analysis Report" ("Root Cause Analysis" or "RCA"), ML 120600056. Then, on April 5, 2012, FENOC detailed its "aging management plan" to address shield building cracking in a "Reply to Requests for Additional Information" (ML12097A216) , purportedly to provide management over time of the shield building's historic cracking phenomena. For convenience' sake, Intervenors will refer to this April 5 item as "RAI AMP."

Intervenors are supplementing their cracking contention for the purpose of exposing discrepancies between FENOC's February 27, 2012 "Root Cause Analysis Report" ("Root Cause Analysis" or "RCA"), and the RAI AMP. They reserve the right to provide further supplementation of their motion in support of proposed Contention 5 upon further review of the Revised Root Cause Analysis and Performance International's analysis. They further reserve the right to supplement their contention filing with evidence from a FOIA response anticipated from the NRC Staff which was propounded to the agency on or about January 26, 2012.

B. Issues of Fact And Inconsistencies Between Root Cause Analysis And RAI AMP

1. FENOC's Credibility Is Increasingly Suspect

The RAI AMP has already been rendered suspect. In May, FENOC placed in the record "Revision 1 of Shield Building Root Cause Evaluation" (ML12142A053) and Performance

Improvement International's "Root Cause Assessment, Davis-Besse Shield Building Laminar Cracking" report (ML12138A037). Each contains troubling new information suggestive of lifelong structural and cracking idiosyncrasies at Davis-Besse, and they prove that the Aging Management Plan must be scrutinized for whether it genuinely addresses the complex troubles with the shield building. A growing body of facts undermines confidence in management arrangements for the shield building, while public concerns about the physical integrity of the building as a containment structure snowball.

The NRC staff itself has recently demonstrated why the RAI AMP should be held suspect. On May 25, 2012, the Union of Concerned Scientists complained to the NRC Region III director (letter attached) that the extensive revisions that were required to be made to the February RCA (resulting in the May 2012 Revised RCA) were made only because FENOC's incomplete and erroneous information in the February RCA was caught and corrected by the NRC staff during inspection activities. David Lochbaum, a nuclear engineer, noted in the complaint that "Had the information been deemed by the NRC to either be complete and accurate or be incomplete/inac-curate but immaterial during its inspections, the re-submittals of the root cause assessment and root cause evaluation would not have been necessary. The re-submittals under these circumstan-ces constitute *prima facie* evidence that FENOC violated §50.9."

But there is a larger question. Even though NRC - for some reason - forced FENOC to revise its February 2012 RCA to explain why it had not weather-sealed its shield building, FENOC still has not explained why. At page 5 of its May 16th revision (ML12142A053), the NRC Staff scored FENOC: "The root cause report did not document or initiate a corrective active to determine why the shield building design did not include a requirement for a protective sealant as was included in other safety related buildings."

FENOC's apparent response, also at Revised RCA p. 5, is this: "Information regarding why the shield building design did not include a requirement for an exterior protective sealant was added in section 3.3.5 -- Design [page 33], and Attachment 6 -- Shield Building Milestones [pages 86 & 88]."

But at Revised RCA p. 33, FENOC still doesn't really explain why. It merely states:

> No exterior protective sealant other than the waterproofing membrane below-grade was specified as a barrier against moisture migrating into the shield building structure from the environment. A Bechtel project meeting held on September 5, 1969 to review and estimate protective coatings for DBNPS [Davis-Besse Nuclear Power Station] determined that there would be no painting required on the inside or outside concrete walls of the shield building. Neither the Field Service Contract for field painting (FSC-21), the specification for field painting (A-24), or the specification for the shield building (C-38) describe application of an exterior protective sealant on the shield building. An exterior protective sealant on the shield building was not identified in industry standards for protective coatings for reactor containment facilities or the nuclear industry such as ANSI N5.9-1967, ANSI 101.2-1972, or ANSI N101.4-1972. Therefore, the design codes at the time of construction did not require the application of a protective coating on the exterior of the shield building.

And at Revised RCA p. 86, FENOC reports that on November 11, 1970, "The Bechtel Power Corporation revised the site architectural elevation drawing (A-20 through A-23) to specify a waterproof finish applied to the reinforced concrete exterior surfaces of various buildings, excluding the shield building."

Then, on page 88, FENOC reports that on August 15, 1976, "The Toledo Edison Company examined the shield building dome parapet area and found a small area of the latex coating at approximately 315 degrees mid-way up the dome that was peeling and chipping from being applied too heavily." But at p. 29 of the Revised RCA, FENOC reports that the dome parapet coating was laid on 1/4 inch thick. FENOC further reported that the too-thick coating was removed, and a thinner replacement applied.[1]

So the dome parapet was sealed, but inexplicably, not the exterior wall of the shield building. To Intervenors' knowledge, FENOC has never acknowledged that the shield building dome parapet had been weather sealed until the May 16 Revised RCA.

At Revised RCA p. 88, FENOC asserts that on September 07, 1976, "The Bechtel Power Corporation requested the field painting contractor to proceed with the application of a waterproof finish to the reinforced concrete exterior surfaces of various structures, excluding the shield building." So the exterior wall of the shield building - perhaps the most important structure on the entire Davis-Besse site - was never weather-sealed, when other safety-significant concrete buildings were ordered to be painted by Bechtel.

This doesn't square with the only public explanation given by FENOC. On February 28, 2012, Jennifer Young, a FENOC spokesperson, told the Toledo Blade newspaper that "she had no historical information about how the structure design decision was made but remarked that two other safety-sensitive concrete buildings at the plant complex were painted for aesthetic reasons. Unlike the shield building, which was built continuously, the other buildings' concrete was poured at different times and thus looked blotchy, she said."[2]

What emerges is the picture of a nuclear power plant corporation which has to be alternately coddled and pressured for facts and explanations. Intervenors, in their initial motion for Contention 5 to be admitted, traced the history of misleads and reluctance on FENOC's part to be

---

[1] "One small area of latex coating at approximately 315 degrees mid-way up the shield building dome was found peeling and chipping from being applied too heavily (~1/4 inch). That coating was identified for removal with the area reapplied using a thinner layer of the same latex."

[2] http://www.toledoblade.com/local/2012/02/28/Davis-Besse-cracks-blamed-on-blizzard.html

candid with the public. It is specious for FENOC to try to justify this blunder using a "blotchy", aesthetic, rationale.

So who's to blame for the most safety-significant structure in this nuclear power plant complex not being moisture-sealed 40 years ago? Why, no one. And who's expected to believe, in light of a wholly-incomplete, tokenistic investigation (detailed below) that there is no reason to be suspicious that the true extent of the cracking and deterioration of the shield building remains unknown? Why, everyone.

The conclusion that "the Blizzard of '78 did it" is viewed with skepticism because the engineering literature is disputed over how forceful the delivery of precipitation must be for it to penetrate concrete. In an article, "Quantification of Water Penetration Into Concrete Through Cracks by Neutron Radiography," *The 3rd ACF International Conference-ACF/VCA 2008,* 925, M. Kanematsu, Ph.D., I. Maruyama, Ph.D., T. Noguchi, Ph.D., H. Iikura, Ph.D. and N. Tuchiya, research engineers, found that:

> [W]ater penetrates through the crack immediately after pouring and its migration speed and distribution depends on the moisture condition in the concrete. With another detailed analysis, it is understood that the water has reached around 50mm depth in the horizontal crack, but 20-30mm depth in the vertical crack immediately after pouring water. From these result it is detected that water reaches to the 25-30mm depth in few minutes after it is exposed to water and in 30 minutes it reaches to the 80mm. ***This means water will be supplied to the rebar with few minutes' scattered showers.***[3]

(Emphasis supplied). There is no consideration nor discussion which addresses the possibility that much less than the drama of the Blizzard might have produced the damage.

2. FENOC Proposes To Plan To Have A Plan

FENOC ventures (RCA at 7) that the Blizzard of '78 is the culprit for all of the shield

---

[3]http://www.degas.nuac.nagoya-u.ac.jp/ippei/paper_e/200811_ACF_Kanematsu.pdf

building cracking:

> The conclusion of this investigation is that the cause of the concrete laminar cracking was the design specification for construction of the shield building that did not specify application of an exterior sealant from moisture. The action to prevent recurrence of the shield building concrete laminar cracking is to apply an exterior protective sealant as a barrier against moisture migrating into the concrete. Therefore, with an effective exterior protective sealant the shield building concrete laminar cracking will not repeat under the required combinations of extreme environmental conditions such as the shield building experienced during the severe blizzard of 1978.

RCA at 7. But this application of exterior sealant comes 40 years overdue. Even components which were sealed and/or protected with barriers, such as the shield building concrete located below grade, have failed and suffered water-borne degradation, some of it due to leaks of borated water inside the shield building. Also, initial coating atop the dome parapet roof failed, because it was done badly.

FENOC's February 2012 RCA further gives the lie to the RAI Aging Management Plan inasmuch as FENOC ***pronounces its own investigation to be incomplete***:

> The shield building dome lacks factors found in the architectural flute shoulders like the discontinuity stress concentration factor and high density reinforcing steel necessary for crack initiation and propagation. Therefore, only the remainder of the accessible, above-grade, exterior wall of the shield building ***should be examined*** similar to those areas previously examined.
>
> [*Id.* at 54.]
>
> *****   *****   *****   *****
>
> The remainder of the accessible shield building exterior walls ***should be examined using Impulse Response testing with confirmatory core bores to clearly define the extent of condition.***
>
> *Id.* at 57 (emphasis supplied).

The RCA concludes that "the tighter spacing of the outer face of structural reinforcing steel such as in the top 20 feet of the shield building and adjacent to openings or blockouts can facilitate propagation of laminar cracking as evident at the main steam line penetration block-outs." RCA at 41. Rebar was installed too densely in areas opened for maintenance over the plant's history and a spacing sensitivity study established that a higher density of rebar could propagate laminar cracking beyond the architectural flute region with a given stress condition. RCA 96. Rebar was also installed too densely at the main steam line penetration blackouts. This was done as an earthquake protection for the shield building structure, because the concrete was more vulnerable there due to the "discontinuities." But ironically, it facilitated crack propagation.

Notwithstanding these construction defects, FENOC insists, utterly, that the Blizzard of 1978 was the only possible cause of propulsion of moisture unusually deeply into the openings and crevices of the shield building from the southwest direction, and owing to that directionality, that the rusting and swelling of too-shallow or too-concentrated rebar and consequent concrete bursts that have caused cracking are laid at the blame of the weather. And FENOC also admits in the RCA that examination of the entire structure has not taken place - and for that, in the RAI AMP, FENOC plans only to have a plan:

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

RAI AMP at 11/29 of .pdf. (Emphasis supplied). Where one might expect immediate, priority current regulation activities to be complete, they are relegated to be dealt with in the future in the RAI AMP. And so the RAI AMP is deficient. A plan to have a plan is not a present, articulated plan for the management of the aging shield building. Not only is there no direction to conduct a thorough investigation of the entire shield building, the RAI AMP foresees scant planned testing to be done during infrequent inspections over the coming decades, as, for example, a mere handful of core bores.

3. Even The Unduly-Narrow Root Cause Investigation Was Incomplete

The credibility of having a plan-to-have-a-plan is further undermined by the limited scope of the investigation of the cracking which has taken place to date. There was no examination of cracks during the 2011-2012 investigation if they were less than 1/16" in width. RCA at 26. Earlier cracks identified in the Maintenance Rule Structure Evaluations from June 1999 and November 2005 were less than 1/16 inch, hence those cracks were deemed acceptable. *Id.* at 26. The RAI AMP states that the widest crack was .013". RAI AMP at 2 (of 8). The widest shield building exterior surface concrete crack identified in the RCA, by contrast, was measured at 0.025 inches. RCA at 26. The management plan, promulgated to encourage vigilance and responsiveness about future cracks, does not accurately reflect the known extent of cracking in the shield building exterior.

Only 15 of the 16 flute shoulders were analyzed for damage. "Impulse Response testing and cores [sic] bores taken using man-lifts from the ground and scaffold from building roofs across 15 of the 16 architectural flute shoulders confirmed that a similar concrete crack phenomenon in the architectural flute shoulders exists in other regions around the perimeter of the shield building..." But "Shoulder 14 was not accessible from the ground due to interference with a start-up transformer." RCA at 18. The absurd theme that runs throughout FENOC's management decisions over the years is constantly that convenience outweighs safety concerns. That indifference to safety is evident in the cracking problems with the shield building, from a failure to inspect in a serious fashion until the swollen and bursting rebar made it impossible to ignore.

4. Other Damage To Shield Building Exterior Goes Unconsidered In RCA

Since May 1996, surface visual inspections of the shield building exterior have identified concrete spalling above the original construction opening. *Id.* In an August 2011 reply to NRC Requests for Additional Information (RAI), (ML11242A166), at 9/54 of .pdf, FENOC indicated that spalling was noted on the exterior shield building surface in 1999 and 2005 in three areas, with the pits in the concrete as much as 2" deep. These observations predate the 2012 root cause understanding that the entire Shield Building exterior had never been sealed against moisture intrusion. The FENOC assurance in August 2011 that "the method of repair is based on the actual size, depth and amount of rebar exposed in the area to be repaired,"[4] given the potential for more exposure of and damage to exposed rebar near the exterior shield building surface than anticipated, appears not to have been clarified in subsequent documents, including the RCA. That exposed rebar could lead to more and worse cracking in the shield building, both surface and subsurface

In FENOC's May 16, 2012 revision (ML12142A053) of the February 2012 Root Cause Analysis appears this statement (at 29):

> On August 15, 1976 the Toledo Edison Company construction superintendent documented an examination of the shield building dome parapet that found a cracked and broken architectural flute shoulder corner at approximately 292 degree azimuth. There were also other hairline shrinkage cracks in the dome parapet at both corners of each architectural flute shoulder, at mid-width of each flute, and vertical around the periphery of the parapet that should not affect the structural integrity of the shield building dome parapet. . . .

Without reference to this event,[5] the February 2012 RCA consultant concluded (p. 56)

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[4]Response to RAI, *id.* At 7 (of 16).

[5]The 1976 dome cracking is not mentioned in the February RCA.

that "[t]he shield building dome lacks factors found in the architectural flute shoulders like the discontinuity stress concentration factor and high density reinforcing steel necessary for crack initiation and propagation," and that it is therefore unnecessary to examine it for cracking. Even without reinforcing steel, the dome has a history of cracking.

5. Exposure Of Shield Building Interior To Elements Goes Unconsidered In RCA

While focus of the RCA has been solely on exterior cracking, the status of the interior of the shield building may be problematic, also. Construction of the shield building commenced on April 26, 1971 with above-grade concrete pours. RAI AMP at 80. Thus for 2 years and 4 months, the shield building was exposed to the outer atmosphere, meaning the SB interior was in contact with unimpeded, repeated moisture (rains, snow, sleet, wind-driven precipitation of all forms), with no weather sealant on the inside wall of shield building. On Aug 22, 1973, the concrete pour for construction of SB dome bottom slab began. On August 6, 1975, concrete pours for closing the SB construction opening began; they were completed on December 1, 1975. RAI AMP at 81-82. The construction opening in the shield building was open for 4 years, 8 months, allowing even more exposure of the SB interior wall to the elements.

When in 2002-2003 the reactor head was replaced, there was necessarily an opening in the shield building wall for a period of five weeks, with additional consequent exposure of the shield building interior to the elements. RCA at 82. Another breach of containment that left the shield building open to the elements was the most recent vessel head swap out, which ran from October through December 2011. Thus there was another month or more of exposure of interior of the shield building to the elements. But the root cause investigation narrowly scrutinizes the shield building exterior weather factors affecting the exterior only from 1978 forward. FENOC attempts to persuade the NRC and the public at large that one iconoclastic weather event, the Blizzard of 1978, so permeated the completed, protected and enclosed shield building with moisture that it set off decades of unarrested deterioration, yet both the inside and outside of the building were repeatedly subjected to inclement weather for over seven (7) years before the Blizzard.

Moreover, Davis-Besse has other water problems inside the shield building. In RAI responses dated May 24, 2011 (ML 11151A90), the NRC staff had noted a "history of ground water infiltration into the annular space between the concrete shield building and steel containment." During a 2011 AMP audit, NRC staff also reviewed documentation that:

> [I]ndicated the presence of standing water in the annulus sand pocket region. The standing water appears to be a recurring issue of ground water leakage and areas of corrosion were observed on the containment vessel. In addition, during the audit the staff reviewed photographs that indicate peeling of clear coat on the containment vessel annulus area, and degradation of the moisture barrier, concrete grout, and sealant in the annulus area that were installed in 2002-2003.

Id. at 47/280 of .pdf.

6. Lack of QA Control 40 Years Ago Should Spur, Not Deter, Complete Investigation

FENOC states in the February RCA that:

> The failure modes for the laminar cracking of the shield building concrete wall were primarily design related from about 40 years ago under a quality assurance program *outside the control of FENOC. Therefore, the condition does not currently exist in other* applicable programs /processes, equipment / systems, organizations, environments, and individuals.

RCA at 54. Precisely because FENOC purportedly did not have QA assurance control over the shield building's construction 40 years ago, it is incumbent upon Applicant to completely investigate and identify all cracking which might be present in the structure, and to authoritatively rule out connections between interior and exterior concrete surficial damage or defects, both in the concrete above, and below, the surface. The RCA emphasizes that the shield building has undergone "long-term exposure to moisture" (p. 24) which has "migrat[ed] through concrete" (pp. 46,47, 56). What is missing is an analysis which considers and if warranted, refutes, any connection between the cracking, and spalling or the placement of too-dense rebar or the potential for moisture-caused damage to the interior of the shield building from moisture which even now may be wicking into interior concrete. The potential for concrete damage emanating outward from inside the shield building has not been addressed at all by FENOC.

C. Standards Regarding Admissibility of Supplemental Information

A new contention may be filed after the deadline found in the notice of hearing 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; (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. 10 C.F.R. § 2.309(f)(2).

Intervenors respectfully submit that their supplemental facts are timely submitted under the Commission's standard in 10 C.F.R. § 2.309(f)(2)(i)-(iii). The supplemented/amended Contention 5 meets the NRC's three-part standard for a timely contention. The information on which the contention is based was not previously available; the RCA was released on February 27, 2012, and the RAI AMP on April 5, 2012. The RCA was then extensively revised and re-released on May 16, 2012. Revision 1 RCA (ML 12142A053). The information on which the contention is based is materially different than information previously available, *see* 10 C.F.R. § 2.309(f)

(2)(ii), because it relates to findings and commitments that did not exist when Intervenors moved for admission of Contention 5 in January 2012. This amendment/supplementation of Contention 5 is timely because it is filed within sixty (60) days of the RAI AMP release on April 5, 2012, and 60 days is the period ordered by the ASLB in which Intervenors must act. *Shaw Areva MOX Services, Inc.* (Mixed Oxide Fuel Fabrication Facility), LBP-08-10, 57 NRC 460, 493 (2008). Intervenors have responded to triggering events in a manner which is timely according to 10 C.F.R. § 2.309(f)(2)(iii).

D. Conclusion

The history of crisis management at Davis-Besse - or certainly, the public perceptions of the same - is shameful. FirstEnergy is not transparent in its investigations and repeatedly has been found not to be forthright with the public. That lack of candor has even begun to trouble the NRC staff, as new reports, RAI responses, and analyses continue to emanate from FENOC over the cracking problems. There are many inconsistencies and variances between FENOC and the NRC staff, but just as disturbingly, between FENOC and its own consultants. Contention 5 should be admitted for trial.

WHEREFORE, Intervenors respectfully ask that the factual basis for their proposed Contention 5 be amended/supplemented with the information provided in support of this Motion; and that Contention 5 be admitted for hearing.

/s/ Terry J. Lodge
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Counsel for Intervenors

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of	)	
		Docket No. 50-346-LR
First Energy Nuclear Operating Company	)	
(Davis-Besse Nuclear Power Station, Unit 1)		June 4, 2012
.	)	

* * * * *

CERTIFICATE OF SERVICE OF 'INTERVENORS' MOTION TO AMEND AND SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)'

We hereby certify that a copy of the "INTERVENORS' MOTION TO AMEND AND SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)' was sent by us to the following persons via electronic deposit filing with the Commission's EIE system on the 4th day of June, 2012:

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Genesky, Donielle

From:	Kevin Kamps <kevin@beyondnuclear.org>
Sent:	Friday, January 23, 2015 10:27 PM
To:	Puco Docketing
Subject:	OPPOSITION COMMENT UNDER CASE # 14-1297-EL-SSO: (#8) 4th Cracking-Related Safety & Environmental Contention in Opposition to Risky Davis-Besse 20-Year Licence Extension.
Attachments:	3rd Motion COMPLET supp cracked concrete containment contention July 16 2012.pdf

OPPOSITION COMMENT UNDER CASE # 14-1297-EL-SSO: (#8) 4th Cracking-Related Safety & Environmental Contention in Opposition to Risky Davis-Besse 20-Year Licence Extension.

Dear Public Utilities Commission of Ohio,

I have sent seven previous emailed submissions re: Davis-Besse, vis a vis this proceeding.

I am now submitting for the record of this proceeding, our fourth Davis-Besse Shield Building concrete containment cracking related contention, titled "INTERVENORS' THIRD MOTION TO AMEND AND/OR SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)," dated July 16, 2012.

This filing was submitted in response to FENOC's revised root cause analysis report, which revealed that shield building cracking was first observed not in October 2011, but rather August 1976.

This document is posted online at:

http://www.beyondnuclear.org/storage/3rd%20%20Motion%20COMPLET%20supp%20cracked%20concrete%20containment%20contention%20July%2016%202012.pdf

This document is also attached to this email.

Our environmental coalition intervening against Davis-Besse's 20-year license extension includes: Beyond Nuclear; Citizen Environment Alliance of Southwestern Ontario; Don't Waste Michigan; and Green Party of Ohio.

Bowling Green, Ohio resident Phyllis Oster, a member of Beyond Nuclear, provides Beyond Nuclear standing in the Davis-Besse License Renewal Application proceeding.

Our legal counsel is Terry Lodge of Toledo, Ohio.

Given the catastrophic risks associated with Davis-Besse's severely cracked, and worsening, concrete containment Shield Building, we urge that PUCO not approve FENOC's request for a massive ratepayer bailout.

Thank you.

Sincerely,

Kevin Kamps, Beyond Nuclear

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Beyond Nuclear aims to educate and activate the public about the connections between nuclear power and nuclear weapons and the need to abandon both to safeguard our future. Beyond Nuclear advocates for an energy future that is sustainable, benign and democratic.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of	)	
		Docket No. 50-346-LR
First Energy Nuclear Operating Company	)	
(Davis-Besse Nuclear Power Station, Unit 1)		July 16, 2012
	)	

* * * * *

INTERVENORS' THIRD MOTION TO AMEND AND/OR SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)

Now come Beyond Nuclear, Citizens Environment Alliance of Southwestern Ontario (CEA), Don't Waste Michigan, and the Green Party of Ohio (collectively, "Intervenors"), by and through counsel, and move the Board for leave to further supplement and amend their proposed Contention No. 5, which addresses the shield building cracking phenomena at the Davis-Besse Nuclear Power Station ("Davis-Besse").

A. Background

On January 10, 2012, Intervenors moved for admission of a new Contention No. 5, which states:

> Intervenors 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.

The NRC Staff ("Staff") has proposed alternative wording which would transform the contention into a contention of omission. FirstEnergy Nuclear Operating Company ("FENOC") and the Staff timely responded to the original contention motion.

On February 28, 2012, First Energy Nuclear Operating Company ("FENOC") furnished the NRC with its "Root Cause Analysis Report" ("Root Cause Analysis" or "RCA"), ML120600056. Then, on April 5, 2012, FENOC promulgated an "aging management plan", or AMP (ML12097A216), the purpose of which is to specify arrangements prospectively to oversee and deal with the shield building's historic cracking phenomena.

Intervenors are supplementing their cracking contention for the purpose of exposing discrepancies between FENOC's February 29, 2012 "Root Cause Analysis Report" ("Root Cause Analysis" or "RCA"), and the AMP. They contend that there is serious incongruity between the cracking problems as defined by FENOC, and the proposed remedy, exemplified by the AMP. The scope of the admitted cracking is far narrower than the identified cracking, and the potential for further concrete and rebar problems in the Davis-Besse shield building may include the loss of up to 90% of the shield building walls with the collapse of outer layers of concrete and rebar, according to NRC documents.

In addition to this third motion to amend/supplement Contention 5, Intervenors intend to file, by July 23, 2012, an additional such motion which denominates inconsistencies between FENOC's February 2012 Root Cause Analysis and the findings of FENOC's consultant, Performance Improvement International. PII's report was added to the NRC's ADAMS system on May 24, 2012. Intervenors further reserve the right to supplement their Contention 5 filing with evidence from a January 26, 2012 FOIA request to which the NRC Staff has only partially responded as of this date.

B. Issues of Fact And Inconsistencies Between Revised Root Cause Analysis And AMP

On May 16, 2012, ADAMS reflected placement in its record a FENOC report entitled "Revision 1 of Shield Building Root Cause Evaluation" (ML12142A053). Intervenors are timely moving to amend/supplement their contention within the 60-day period identified in the Initial Scheduling Order in this case.[1] This filing will address inconsistencies between the Revised Root Cause Analysis ("RRCA") and the proposed AMP, referencing additional matters of record as needed for explanatory purposes.

1. Microcracking Present in Core-Bore Samples

The NRC criticized FENOC (RRCA at 6) that "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." FENOC has admitted in the revision that its contractor, CTL Group, observed micro-cracks via petrographic examination:[2]

> *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.*

RRCA at 27.

FENOC's additional information fails to answer the NRC's question, *viz.*, why multiple laminar cracks occurred in the same area as micro-cracking, only repeating that they did.

There is indisputably a connection between micro-cracking and age-related degradation. FENOC's consultant, Performance Improvement International, tacitly admitted such in its report, "Root Cause Assessment: Davis-Besse Shield Building Laminar Cracking, Vol. 1,"

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[1]From p. 12 of Initial Scheduling Order, ASLBP No. 11-907-01-LR-BD01 (June 15, 2011): "The Board directs 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 to the moving party through service, publication, or any other means. If filed thereafter, the motion and proposed contention shall be deemed nontimely under 10 C.F.R. § 2.309(c). If the movant is uncertain, it may file pursuant to both sections."

[2]Italicized in original to indicate new material.

ML12138A037.[3] The AMP, however, contains literally no reference to micro-cracking. FENOC neither explains why the micro-cracking is present, nor why it is not significant, nor how it is not a sign of age-related degradation cracking. Moreover, it appears that some of the laboratory testing by FENOC's contractors resulted in destruction of the core-bores that contained evidence of micro-cracking, RRCA at 83,[4] which was in the original, February 2012 RCA. This information is significant, though, in light of the new information in the RRCA that "*Boroscope inspection of the holes from core bores F4-794.0-3.5 and F4-791.0-2.5 were not completed due to the weather conditions (high winds)*" (Italicized in original). RRCA at 83. FENOC has made some rather sweeping conclusions about the absence of micro-cracking on fewer laboratory samples than relied upon for its conclusions respecting laminar cracking. Notably, though, the six (6) core-bores taken of the shield building, while collected from different elevations on the exterior face, are not identified as to location on the shield building from which they were taken - but FENOC has

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[3]At p. 3: "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. 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."

From p. VII-39 (164/257 of .pdf): "The process of hydro-blasting exploits the existence of micro-cracks, voids, capillaries and cracks to enable concrete demolition using high pressure water jets. This raises the question of potential damage to concrete in adjoining area through direct pressure, vibrations, or crack propagation. This document is intended to determine if hydro-blasting can cause cracking and if any occurred at Davis-Besse." Intervenors assume, based on this explanation, that FENOC's choice to hydro-blast open the shield building was to take advantage of pre-existing micro-cracks.

[4]"Measurement of crack width was inconclusive in several bores due to the affect of the drilling equipment disturbing the crack surface in combination with the tight diameter of the hole complicating use of a crack comparator and boroscope."

concluded, again sweepingly, that they were all "*considered part of a single delamination process*" (Italicized in original). RRCA at 83. To FENOC, the only cracking worthy of note or analysis in the first 35 years of operations at Davis-Besse was laminar (and especially sub-surface laminar) cracking - a fallacious perspective. FENOC has given short shrift to surface cracking, dome cracking, micro-cracking, and radial cracking.

2. Radial Cracking

The NRC Staff found that "[t]he root cause report additionally did not discuss radial cracking identified in numerous core bores." RRCA at 5. The italicized wording below was added as part of the Revised RCA:

> 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.

RRCA at 22.

Radial cracks run perpendicular to the cracking that FENOC addressed in the RCA - and radial cracks are the cracking next to, and parallel to, the outer rebar mat. Thus the RRCA identifies an entirely different cracking mode which is not explained by the "Blizzard of '78." There 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.

In effect, FENOC admits to multiple forms of cracking from multiple root causes. The

Blizzard of '78 may have caused sub-surface laminar cracking in close proximity to and parallel to the outer rebar mat; but there was concrete shrinkage cracking "during the curing process," which apparently occurred back in the early to mid-1970's during the pours for the walls of the shield building. And the shield building concrete was reinforced to limit the size and confine the longitudinal/radial cracking.

3. Deletion of Need for Further Investigation of Reinforcing Steel

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. Even FENOC had agreed that more investigation was needed; that statement was included in the February RCA.

Indisputably, the presence of high-density rebar, and small rebar spacing, causes cracking. Implicit 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 extensively checked for status, which was neither planned as part of the AMP, and for which the justification has since been deleted.

4. Laminar Cracking in Main Steam Line Room

The Revision contains this new passage (RRCA at 46):

> *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.*

There is a significant contradiction here, given the presence of laminar cracking in dissimilar regions:

shoulders v. main steam line penetration blockouts. The NRC Staff pointed out (RRCA at 6) that "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." FENOC has not provided the connection, only the conclusion.

5. Shield Building Dome Parapet Cracking

At RRCA 29, FENOC added this passage:

> *On August 15, 1976 the Toledo Edison Company construction superintendent documented an examination of the shield building dome parapet that found a cracked and broken architectural flute shoulder corner at approximately 292 degree azimuth. There were also other hairline shrinkage cracks in the dome parapet at both corners of each architectural flute shoulder, at mid-width of each flute, and vertical around the periphery of the parapet that should not affect the structural integrity of the shield building dome parapet. One small area of the latex coating at approximately 315 degrees mid-way up the shield building dome was found peeling and chipping from being applied too heavily (~1/4 inch). That coating was identified for removal with the area reapplied using a thinner layer of the same latex.*
>
> *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.*

(Italicized in original). As Intervenors have demonstrated, the concern is not solely about sub-surface laminar cracking. The larger picture is that there are several forms of cracking, including an omission from public record documents until 2011-12 of pre-Blizzard, 1976 cracking of the shield building dome. But there is little discussion of the potential interrelations of those cracking types, and where they are physically proximate, FENOC trivializes the non-laminar cracks. 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.

6. AMP Omits to Inspection of 2002 Shield Building Opening for Cracking

FENOC states (RRCA at 56) that there was no previous experience with shield building concrete laminar cracking, and that the 2002 temporary access opening for replacing the reactor pressure vessel head "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." A slide FENOC displayed during its January 5, 2012 Camp Perry presentation (see http://pbadupws.nrc.g ov/docs/ML1200/ML120050146.pdf, slide #18) shows that the 2002 temporary access opening for the lid swap out was located about equidistant between two flute shoulders of the building. There 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. The presence of cracking there might suggest either that it was missed in 2002, or was noticed but not reported officially.

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

For the first time in the RRCA, FENOC admits that the shield building dome, built in 1973, was sealed in 1976 but not before it had displayed cracking. Further, FENOC asserts that a waterproofing membrane was installed below-grade on the shield building exterior. RRCA 33. The RRCA also reveals that the decision was taken in 1969 to not seal the interior or exterior of the shield building, nor the below-grade shield building walls. 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.

Notably, while the AMP does not address examination of the below-grade shield building walls, the RRCA does. At p. 72, the RRCA contains an apparent commitment from FENOC that states, "In accordance with NOBP-LP-2011 section 4.7.4: Complete a Maintenance Rule Structures evaluation inspection of the shield building exterior sealant system per procedure (EN-DP-01511) to ensure the moisture barrier is still effective with no areas of unacceptable degradation."

Again, the AMP is unduly narrow in scope, which provides a means of avoiding issues of aging management of the whole shield building and as well, other safety-related structures at Davis-Besse.

8. Use of Other Safety-Related Structures as Comparables Instead of as Inspection Targets

In the RRCA at 66, FENOC agreed to this confirmatory examination:

> ***Extent of Condition Corrective Action #3:*** *Confirmatory Examination of a Safety-Related Structure with Waterproof Coating*
>
> *Site Projects shall arrange access to the exterior face of a safety-related structure with waterproof coating in accordance with the corresponding Engineering Change Package.*
>
> *Engineering will specify the areas of access required and the necessary work scope, such as additional Impulse Response and core bores. Using an Impulse Response (IR) vendor and method approved by Design Engineering confirm the absence of laminar cracking in a safety-related structure with waterproof coating as directed by Design Engineering.*
>
> *Provide the necessary ground and/or suspended man-lifts required to access the safety-related structure wall exterior surface.*
>
> *Perform confirmatory core bores as directed by Design Engineering.*
>
> *Facilitate the examination of the core bores by Design Engineering.*
>
> *Repair/Rework core drill holes as described in the ECP for the core bore.*

But the NRC Staff called for investigation of multiple structures.[5] FENOC disclaims any knowledge

[5]From subsection 1 of the summary of NRC critiques at the beginning of the RRCA at 7: "Extent of Condition Corrective Action #1 for additional investigation of the Shield Building lacks detail, and need 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)."

of the cracking phenomena involving the shield building from 1978 through 2011, because the cracks were not visible to the naked eye, and upon investigation has identified cracking of various types which is invisible to the naked eye and which is attributable to factors other than the Blizzard of '78. Accordingly, the scope of the AMP is insufficiently narrow, if confined merely to using one other safety structure as a comparable, instead of inspecting all safety-related structures at the Davis-Besse site for potential cracking unrelated (or even related) to the Blizzard. Intervenors' argument finds support from FENOC's revision to Section 6.3.3 (RRCA at 60). In its "Root Cause Corrective Actions #3," FENOC appears to commit as follows: "*Also, the Maintenance Rule Structures evaluation procedure shall be updated to include examination of the similar exterior coating on the other safety-related concrete structures.*" FENOC appears to be caught in a contradiction.

9. Ettringite Penetration Beyond Outer Rebar Layer

The root cause report did not document the depth of the core samples at which ettringite was present in samples that contained ettringite deposits. Ettringite is a hydrous calcium aluminium sulfate mineral. FENOC asserted in its February 2012 RCA that when ettringite is found lining the air voids in shield building concrete it "suggests long-term exposure to moisture migrating through the concrete." RRCA at 25.

Information added to the Revised RCA states (RRCA at 25) that:

> *Core F2-792.3-4.5 was approximately 4- 3/4 inches long and the secondary deposits [of ettringite] thinly lined virtually all of the air voids throughout the concrete. Core F4-791.0-2.5 was approximately 4 inches long with both ends saw cut. The air voids in core F4-791.0-2.5 contained secondary deposit linings in the same abundance and pattern as those of core F2-792.3-4.5.*

Ettringite 4-3/4 inches deep indicates "long-term exposure to moisture migrating through the concrete," in FENOC's own words. The outer rebar mat is only 3 inches beneath the concrete surface. Finding ettringite at 4 3/4"would seem to indicate potential for rebar corrosion, which would seriously worsen cracking and loss of bond strength between concrete and rebar. FENOC's conclusion that there is no problem with rebar corrosion whatsoever is not consistent with the conclusion to be drawn from the utility's core-bore samples.

10. Insufficiently-Detailed Extent of Condition Corrective Action #1

Extent of Condition Corrective Action #1 for additional investigation of the Shield Building (RRCA at 59) contains no detail; the entire Corrective Action simply says "Additional Examination of the Shield Building Exterior Wall." It 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. After what has happened, and given that what is at stake is the structural integrity of the shield building, FENOC should be required to monitor all safety-related structures.

11. Slip-Form Friction Fiction

The NRC Staff required FENOC to provide additional information in the RRCA " regarding slip-form induced friction forces resulting in laminar cracking as a potential failure mode. . . ." Nowhere throughout its height is the shield building within the required 1" plumb tolerance. According to measurements at the time of the concrete pours for the building, the "[o]ut of tolerance exceeds the 1 inch in 25 feet specified by 2-3/4 inches." RRCA at 95. Bechtel Engineering concluded at the time of the 1971 construction that "The affect this has on the shield building structural integrity were found to be insignificant. Bechtel Engineering approves the Use As Is disposition for the structure and recommends that all interface work be adjusted to meet the as-built alignment of the structure." *Id.*

In conducting analysis of whether the out-of-plumb "lean" of the shield building might have influenced or caused some of the cracking, FENOC concluded in Attachment 12 to the RRCA in response to the hypothesis that *"[f]riction forces from geometry changes and the slip-form not in level have resulted in concrete delamination"* that:

> Existing data that tends to disprove this as the cause. Plumb tolerance issues oriented different than the laminar cracking locations. *The observed cracking through aggregate indicated the laminar cracking occurred after the concrete reached sufficient maturity and not during placement.* (Italics in original)

RRCA at 109. FENOC considered the hypothesis to be "refuted" because *"[t]he rate of slip-form movement was fast enough to minimize friction problems"* (Italicized in original). *Id.* Consequently, "[t]he effect of the out of tolerance plumb was insignificant to structure integrity."

Performance Improvement International also extensively reviewed the out-of-plumb issue. PII concurred that the out-of-plumb issues did not cause the laminar cracks, but only after stating this disclaimer:

> Documentation of the Out of Plumb condition was limited to the documents provided. We do not have information regarding the method of correcting the problem and whether it caused excessive friction forces.

PII report, ML12138A037 at Appendix VI-34 (159/257 of .pdf).

FENOC's major consulting engineer contracting on shield building cracking, then, admits that its very conclusion is suspect. PII and FENOC don't really know how bad the damage was, nor how to correct for it. PII effectively has admitted that the Davis-Besse shield building may have been out of licensing conformance since before the reactor was initially fired up. PII disclaims the ability to authoritatively concluded that there is no cracking at identified slipform excessive friction areas - and the consultant's illusory reinforcement of FENOC's position appears not to be backed up by Impulse Response testing and/or core bores.

Some years ago, Senator Daniel P. Moynihan observed that "We are each entitled to our own opinion, but no one is entitled to his own facts."[6] In a matter especially dependent on scientific and engineering findings of fact, FENOC, instead, appears to be trafficking only in opinion.

C. Legal Standards Regarding Admissibility Of Supplemental Information

A new contention may be filed after the deadline found in the notice of hearing 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; (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. 10 C.F.R. § 2.309(f)(2).

Intervenors respectfully submit that their amended/supplemental facts are timely submitted under the Commission's standard in 10 C.F.R. § 2.309(f)(2)(i)-(iii). As supplemented/amended, Contention 5 meets the NRC's three-part standard for a timely contention. The information on which the contention is based was not previously available; the RRCA appeared in ADAMS on May 16, 2012 (Revision 1 RCA (ML 12142A053)). The information on which the contention is based is materially different than information previously available, *see* 10 C.F.R. § 2.309(f) (2)(ii), because it relates to findings and commitments that did not exist when Intervenors moved for admission of Contention 5 in January 2012. This amendment/supplementation of Contention 5 is timely because it is filed within sixty (60) days of the RRCA's May 16 posting date and conforms with the ASLB's Initial Scheduling Order. *Shaw Areva MOX Services, Inc.* (Mixed Oxide Fuel Fabrication Facility),

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[6]James A. Thomson, "In Political Analysis, Just the Facts, Please," http://www.rand.org/commentary/030806TH.html.

LBP-08-10, 57 NRC 460, 493 (2008). Intervenors have acted in a manner which is timely according to 10 C.F.R. § 2.309(f)(2)(iii).

If a contention satisfies the timeliness requirement of 10 C.F.R. 2.309(f)(2)(iii), then, by definition, it is not subject to 10 C.F.R. 2.309(c), which specifically applies to nontimely filings. The three (f)(2) factors are not mere elaborations on the "good cause" factor of Section 2.309(c)(1)(i), since "good cause" to file a nontimely contention may have nothing to do with the factors set forth in (f)(2). *Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), LBP-06-14, 63 NRC 568, 573 (2006).

D. Certificate of 10 C.F.R. § 2.323(b) Consultation

Counsel for Intervenors, along with Beyond Nuclear's designated representative, participated in a telephone conference concerning the prospective contents of the within Motion on July 13, 2012 with counsel for the NRC Staff and counsel for FirstEnergy Nuclear Operating Corporation. Following that conference, FENOC's counsel has stated that FENOC will oppose this Motion. The NRC Staff's counsel indicated that NRC Staff does not oppose the filing of the motion, but that based on the information from the consultation email of Intervenors, and the phone conference, the Staff does not have enough information at this time to take a position on the admissibility of the proposed contention. Further, he stated that the Staff will respond to the contention in accordance with 10 C.F.R. 2.309, when filed.

E. Conclusion

Intervenors have met all preconditions to be granted leave for receipt of the within information into the record of this matter to amend and/or supplement their Motion for Admission of Contention 5. FENOC should not be allowed to take the "path of least resistance," like the propagating cracks through the shield building concrete. FENOC must not be allowed to limit its AMP monitoring to comparisons with one single other safety-related concrete building on site, but must instead be required to inspect all other concrete buildings on site. All forms of structural degradation must be included, not just sub-surface laminar cracking.

WHEREFORE, Intevenors pray the Licensing Board grant them leave to amend and/or supplement their proffered Contention 5 in the particulars stated.

/s/ Terry J. Lodge
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of)

Docket No. 50-346-LR

First Energy Nuclear Operating Company)
(Davis-Besse Nuclear Power Station, Unit 1) July 16, 2012
.)

* * * * *

CERTIFICATE OF SERVICE

I hereby certify that a copy of the "INTERVENORS' THIRD MOTION TO AMEND AND/OR SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)" was sent by me to the following persons via electronic deposit filing with the Commission's EIE system on the 16th day of July, 2012:

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/s/ Terry J. Lodge

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From:	Kevin Kamps <kevin@beyondnuclear.org>
Sent:	Friday, January 23, 2015 10:44 PM
To:	Puco Docketing
Subject:	OPPOSITION COMMENT UNDER CASE # 14-1297-EL-SSO: (#9) 5th Cracking-Related Safety & Environmental Contention in Opposition to Risky Davis-Besse 20-Year Licence Extension.
Attachments:	4th Motion PII COMPLET.pdf; 4th Motion PII Complet FOIA attachments.pdf

OPPOSITION COMMENT UNDER CASE # 14-1297-EL-SSO: (#9) 5th Cracking-Related Safety & Environmental Contention in Opposition to Risky Davis-Besse 20-Year Licence Extension.

Dear Public Utilities Commission of Ohio,

I have sent eight previous emailed submissions re: Davis-Besse vis a vis this proceeding.

I am now submitting for the record of this proceeding, our fifth Davis-Besse Shield Building concrete containment cracking related contention, titled "INTERVENORS' FOURTH MOTION TO AMEND AND/OR SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)," dated July 23, 2012.

This filing was based on revelations in FENOC contractor Performance Improvement International's revised root cause assessment report, which revealed 27 areas of skeptical U.S. Nuclear Regulatory Commission questioning about FENOC's "Blizzard of 1978" theory of shield building cracking.

This document is posted online at:

http://www.beyondnuclear.org/storage/4th%20Motion%20PII%20COMPLET.pdf

This document is also attached to this email.

The environmental coalition Intervenors also posted documents supportive of its fourth supplement. These documents are posted online at:

http://www.beyondnuclear.org/storage/4th%20Motion%20PII%20Complet%20FOIA%20attachments.pdf

These supportive documents are also attached to this email.

Our environmental coalition intervening against Davis-Besse's 20-year license extension includes: Beyond Nuclear; Citizen Environment Alliance of Southwestern Ontario; Don't Waste Michigan; and Green Party of Ohio.

Bowling Green, Ohio resident Phyllis Oster, a member of Beyond Nuclear, provides Beyond Nuclear standing in the Davis-Besse License Renewal Application proceeding.

Our legal counsel is Terry Lodge of Toledo, Ohio.

Given the catastrophic risks associated with Davis-Besse's severely cracked, and worsening, concrete containment Shield Building, we urge that PUCO not approve FENOC's request for a massive ratepayer bailout.

Thank you.

Sincerely,

Kevin Kamps, Beyond Nuclear

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Beyond Nuclear aims to educate and activate the public about the connections between nuclear power and nuclear weapons and the need to abandon both to safeguard our future. Beyond Nuclear advocates for an energy future that is sustainable, benign and democratic.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of	)	
		Docket No. 50-346-LR
First Energy Nuclear Operating Company	)	
(Davis-Besse Nuclear Power Station, Unit 1)		July 23, 2012
	)	

*   *   *   *   *

INTERVENORS' FOURTH MOTION TO AMEND AND/OR SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)

Now come Beyond Nuclear, Citizens Environment Alliance of Southwestern Ontario (CEA), Don't Waste Michigan, and the Green Party of Ohio (collectively, "Intervenors"), by and through counsel, and move the Board for leave to further supplement and amend their proposed Contention No. 5, which addresses the shield building cracking phenomena at the Davis-Besse Nuclear Power Station ("Davis-Besse"). This supplementation focuses on a new collection of information recently added to the ADAMS library, namely, the report of Performance Improvement International on the Davis-Besse shield building cracking. That report was added to ADAMS on May 24, 2012.

A. Background

On January 10, 2012, Intervenors moved for admission of a new Contention No. 5, which states:

> Intervenors 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.

The NRC Staff ("Staff") has proposed alternative wording which would transform the contention into a contention of omission. FirstEnergy Nuclear Operating Company ("FENOC") and the Staff timely responded to the original contention motion.

On February 28, 2012, First Energy Nuclear Operating Company ("FENOC") furnished the NRC with its "Root Cause Analysis Report" ("Root Cause Analysis" or "RCA"), ML120600056. Then, on April 5, 2012, FENOC promulgated an "aging management plan", or AMP (ML12097A216), the purpose of which is to specify arrangements prospectively to oversee and deal with the shield building's historic cracking phenomena.

Intervenors moved on July 16, 2012 to supplement their cracking contention for the purpose of exposing discrepancies between FENOC's May 16, 2012 Revised "Root Cause Analysis Report" ("RRCA"), and other analyses of the shield building problems. In that July 16, 2012 filing, Intervenors indicated that by July 23, 2012, they would file an additional motion which demonstrated inconsistencies between FENOC's February 2012 Root Cause Analysis and the findings of FENOC's consultant, Performance Improvement International. PII's report, "Root Cause Assessment: Davis-Besse Shield Building Laminar Cracking, Vol. 1," was added to the NRC's ADAMS system on May 24, 2012 as ML12138A037 , which is one of multiple volumes of PII analysis added to ADAMS that day. Intervenors are timely acting to itemize the divergences and issues of fact between the proposed license action and the true status of the Davis-Besse shield building by making this filing within the 60 day period set forth in the Initial Scheduling Order in this case.[1]

[1]From p. 12 of Initial Scheduling Order, ASLBP No. 11-907-01-LR-BD01 (June 15, 2011): "The Board directs 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 to the moving party through service, publication, or any other means. If filed thereafter, the motion and proposed contention shall be deemed nontimely under 10 C.F.R. §

Intervenors maintain that there is serious incongruity between the cracking problems as defined by FENOC, and the proposed remedy, exemplified by the AMP. The scope of the admitted cracking is far narrower than the identified cracking, and the potential for further concrete and rebar problems in the Davis-Besse shield building may include the loss of up to 90% of the shield building walls with the collapse of outer layers of concrete and rebar, according to NRC documents.

B. Issues of Fact And Inconsistencies Between Root Cause Analysis And Performance Improvement International's Assessment

Although Performance Improvement International's (PII) revised root cause assessment report ("PII report") is dated April 20, 2012, it was not communicated to the U.S. Nuclear Regulatory Commission (NRC) until May 14, 2012 (attached to a cover letter by FENOC's Barry Allen), and was not publicly posted to NRC's ADAMS cache until May 24, 2012.

Barry Allen claimed in a May 16, 2012 cover letter to NRC, attached to FENOC's own revised root cause report ("RCA"), that any changes required of FENOC by NRC upon its review of FENOC's Feb. 28, 2012 root cause report were minor and did not significantly affect any findings or conclusions. But the changes and revelations prompted by statements appearing on pp. i-iv[2] of PII's report are quite significant. PII listed 27 revisions, each associated with NRC questioning, in a section entitled "Summary of Revisions in Version 2. "

At p. i, PII relates NRC's first question:

> 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 [Shield Building] core bores to confirm moisture intrusion (e.g. Ettringite)? If not,

2.309(c). If the movant is uncertain, it may file pursuant to both sections."

[2]Pp. 17-20/257 of PII report .pdf

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.

In response, PII added to F.M. [Failure Mechanism] 3.9 - Discussion - Moisture Migration, the following:

> Moisture Migration
>
> The WJE report (Exhibit 26) provides physical evidence of moisture migration uniformly through the concrete for the full depth of the cores (over 4 inches). The thin layer of secondary deposits after 40 year exposure is not considered an indication of attack since it does not create any stresses or strength reduction. The presence of deposits is not considered a strong indicator of moisture migration that should be pursued further with tests for Ettringite presence - especially since no environmental Sulfates were suspected. Ettringite may be present in concrete pores at different time periods and for different reasons, including sulfate attack and normal internal reactions.
>
> General Chemical Attack
>
> 1. Exhibit 23 presents a list of chemicals known to have a deleterious effect on concrete. None of those chemicals is known to be present in significant quantities in contact with the concrete containment structure.
>
> Conclusion:
>
> The containment structure's concrete did not undergo chemical attack. Therefore, chemical attack was not a contributor to the Laminar Cracks. Specifically, carbonation depth is small comparing with the thickness of concrete cover for the 40-year old structure, and carbonation-induced steel corrosion is not a root cause.

While PII makes qualitative, deductive arguments, which it then asserts as proof of shield building integrity, these are not backed up by empirical data. For example, "physical evidence of moisture migration uniformly through the concrete for the full depth of the cores (over 4 inches)" would seem to indicate that the outer layer of rebar, located under 3 inches of exterior concrete, has been overtaken by moisture over the life of the shield building. Such moisture interaction with the steel reinforcement would have provided a corrosive environment. Corrosion of rebar could have contributed to shield building cracking.

PII further asserts "no environmental Sulfates were suspected," and provides "a list of chemicals known to have a deleterious effect on concrete" but claims "None of those chemicals is *known to be present in significant quantities in contact with the concrete containment structure.*" One would expect that if PII or any other FENOC contractor has actually tested for environmental sulfates, or other "chemicals known to have a deleterious effect on concrete," in order to determine if they are "present in significant quantities in contact with the concrete containment structure", such information would be disclosed. It appears that no actual tests have been performed, rendering this conclusion scientifically suspect.

Given FENOC's and NRC's disclosures of chronic groundwater leakage within the sand pocket region between the shield building and the steel containment vessel, documented in 2011 RAIs and responses thereto, the lack of testing for environmental sulfates or other aggressive chemicals capable of attacking the shield building's concrete is a significant, unacceptable omission from the FENOC ER. Such unchecked chemical attack, besides comprising a potential, yet unaddressed, root cause of shield building degradation, could also worsen cracking and other shield building degradation, an aging-related failure mechanism that is not as yet addressed within this license extension proceeding.

Finally, PII implies that below a "significant quantity" threshold, aggressive chemicals could not cause chemical attack on the shield building. But, as U.S. Congressman Dennis Kucinich communicated to NRC Chairman Greg Jaczko in November, 2011, even cracks of very narrow width could enable carbon dioxide from the atmosphere to initiate a carbonation degradation of shield building structures. Congressman Kucinich's concerns were based on a study carried out at Oak Ridge nuclear lab.

PII related a second NRC question:

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?

In response, PII added to Section 2.01 - Laboratory Tests and Examination to Test for Concrete Integrity (1st paragraph, p. 3) the following:

> 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.

First, while theories of "path of least resistance" crack propagation may seem to make common sense, Intervenors hold that arguments forming the basis for a 20- year license extension at an atomic reactor with a severely cracked shield building of still-mysterious causation should be subjected to rigorous scientific review, not mere common sense assertions. The uncertainty is self-evident in PII's statement "It is possible that propagation through the aggregate requires less energy than through the interface around it." No explanation is given by PII, nor FENOC for that matter, as to why such hypotheses have not been subjected to rigorous scientific review. Such a rigorous review could be provided by a hearing on the merits of the shield building cracked concrete contention.

Second, PII's admission that "This cracking through the aggregate does not provide any reliable information about the rate of crack propagation" is disconcerting, because ignorance of whether cracks are worsening, and how fast such crack propagation is proceeding, represents an unacceptable blind spot to risk over a 20-year license extension period. This is the precise kind of dynamic which FENOC and its contractors like PII should be assessing, given the potential for worsening cracking, and consequent worsening safety risks, over the 2017-2037 time frame.

PII related a third question from NRC:

> 3. Item 20: With the conclusion that the laminar subsurface cracking was not exposed to air, what caused the trace amounts of carbonation identified on the transverse and longitudinal crack surfaces?

PII's response contains some troubling admissions. In its *"Carbonation Failure Mode"* section, PII admits:

> 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)

Only 1 inch of concrete cover over the underlying outer layer of reinforcing steel increases the vulnerability of the rebar to such degradation as moisture induced corrosion, as well as carbonation. Either case could cause or worsen shield building cracking.

PII also offers a weak explanation of the carbonation results. It attempts to dodge addressing the significance of carbonation on core bores by claiming that once extracted, "exposure to air prior to testing" could have caused the evident carbonation (see bullet #2 on page 4). PII and FENOC need to develop better testing methods. Testing methods should not destroy the subject matter being studied, rendering all results meaningless. This is a very poor scientific, technical, and engineering basis upon which to establish a sound 20-year license extension at an atomic reactor with a severely cracked shield building of still-dubious origin(s).

PII responded to this fourth NRC question:

> 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 repot (sic, report); 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 [Root Cause Report] on page 25?

PII responded by adding to Section 2.01 - Laboratory Tests and Examination to Test for Concrete Integrity (3rd paragraph) the following:

> 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.

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. This is especially so given the extensive nature of various types of cracking observed at numerous locations across the shield building. To that growing list must now be added near-surface concrete micro-cracking.

PII listed a fifth area of NRC inquiry:

> 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).

In response, PII added identical blocks of text to both (Appendix II, Section 2.05 - Exhibit 73 discussion; last bullet and Appendix II, Section 2.06 - Exhibit 61 discussion; last bullet). The block of text reads as follows:

> (ADDED TO Appendix II, Section 2.05 - Exhibit 73 discussion; last bullet):
> 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 possible failure modes are not credible. Traditional sensitivity studies were not performed since this analysis is not a design basis analysis.

PII's admission that "Traditional sensitivity studies were not performed since this analysis is not a design basis analysis" is very significant. Intervenors assert that a 20-year license extension at a 40 year old atomic reactor with a very troubled safety record, as well as a severely cracked shield building, requires that robust engineering analysis be performed, including traditional sensitivity studies. A design basis-quality analysis should be required.

As revealed by a June 12, 2012 partial response by the NRC Staff to a Freedom of Information Act (FOIA) request made to the NRC by Intervenors on January 26, 2012, the NRC staff wrestled with FENOC's "operability/functionality" approach to returning Davis-Besse to full power operations, as opposed to a "design conformance" or "licensing basis" approach. *See* Memo, NRC's Hernandez to Sanchez-Santiago, 11/17/2011 (from NRC FOIA responses).

FENOC – which admitted in its February 2012 RCA that the shield building cracking has left the shield building "non-conforming to the current design and licensing bases" - has also wrestled with this challenge. Perhaps seeking its own "path of least resistance" (not unlike a propagating crack in the Davis-Besse shield building), the nuclear utility chose the approach that allowed immediate return to full power operations, while kicking the can down the road on "re-establishing" licensing basis design conformance. The NRC Staff did not object to this, even as it struggled to understand the legal and regulatory justification for such a move. In fact, the Staff generously granted FENOC a grace period until December 2012, during which time FENOC will attempt to complete a design basis conformance re-evaluation, in order to address significant licensing non-conformances created by the severe shield building cracking.

This nonconformance has much to do with age-related degradation of the shield building, further bolstering Intervenors' call for a hearing. Analogously to the findings of NRC's Office of

Inspector General in late 2002 regarding the hole-in-the-head fiasco at Davis-Besse, the NRC Staff seems once again to have put FENOC's profits ahead of public safety. Intervenors' main interest is to see that public safety is accorded a pre-eminent place in the 20-year license extension proposal at an atomic reactor with a severely cracked shield building.

PII listed a sixth NRC concern:

> 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).

In response, PII added to (Appendix II, Section 2.06 - Exhibit 62 discussion; last bullet) the following:

> Assumptions: The pressure loads due to the 105 mph wind were calculated in a separate_ REDACTION_ model and mapped to the Abaqus _REDACTION_ 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.

Given the multi-faceted degradation of the Davis-Besse shield building, however, all stresses should be very well understood. The grand total of such diverse stresses, after all, could add up to "failing" the shield building during a natural or man-made disaster, causing a catastrophic release of radioactivity to the environment. As above, NRC should require FENOC and its contractors like PII to undertake rigorous analysis, including sensitivity studies.

Additionally, Intervenors are concerned about redactions such as those above. Such redactions make it difficult for Intervenors to review and understand PII's and FENOC's analyses, or lack thereof, and their justifications for conclusions. We call on PII and FENOC to provide all information currently redacted in their revised root cause assessment and analysis, respectively.

A seventh significant area of NRC concern is described by PII (although it neglected to number this section):

> 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 [Root Cause Report]? 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 [Shield Building] wall, but prior to dome installation (May 1971-August 1975) [and] generated sufficient forces at inner rebar mat to cause laminar cracks?** Was this investigated? Explain.

(Emphasis added).

In response, PII added to its main report, Section 2.05 - top of page 7, the following:

> ...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.

Quite significantly, this question by the NRC Staff, conveyed in PII's listing of revisions, represents the first time that the public has been told about an entirely different source of cracking potential in the shield building:

> "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 [Root Cause Report]? If so where? If not, why not?

NRC had to ask PII and FENOC why this second most likely scenario for shield building cracking during the Blizzard of 1978 was not even mentioned in FENOC's Feb. 28, 2012 RCA.

Tellingly, PII's revised response does not even answer that question.

Intervenors join the NRC Staff in demanding to know why such a significant potential source of cracking – water infiltration via pre-existent cracks in the dome of the shield building – was not even mentioned in the FENOC RCA on Feb. 28, 2012? FENOC finally did mention shield building dome cracks in its May 16, 2012 revised root cause analysis report ("RRCA"). These cracks were documented as early as 1976 – long before the Blizzard of 1978. Intervenors have noted the significance of admitted 1976 dome cracking in previous supplements to their contention.

Intervenors find PII's -- and by implication FENOC's – disinterest in rigorous and robust testing and analysis highly troubling. PII admits its "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."

Essentially, PII is arguing that because the tests would be challenging and expensive, PII -- and by extension FENOC -- simply choose not do them, and simply assume their theory is correct. Thus, PII's root cause assessment and FENOC's root cause analysis are no more than mere educated guess work, at best, un-tested, un-substantiated with empirical data. Apparently, in order to save money, time, and bother – or, perhaps to avoid revealing inconvenient truths -- PII and FENOC have chosen to not do rigorous, robust, and comprehensive testing. To make matters worse, NRC has let them get away with it. Intervenors urge that NRC require FENOC and PII to confirm their theory by direct testing, including a statistically significant quality and quantity of strength tests throughout the shield building structure. To guarantee that "the tests would be sensitive enough to identify such variation," NRC should require FENOC and PII to undertake high quality, robust sensitivity studies. Given the potentially catastrophic risks of shield building failure, such rigor is necessary, and should be required as part of this license extension proceeding.

NRC staff asked PII another question which was apparently simply not answered in its revised root cause assessment report:

> Could a third environmental scenario (e.g. wind-driven rain & freezing conditions, moisture intrusion and loading) [have] existed after completion of the SB [Shield Building] wall, but prior to dome installation (May 1971-August 1975) [and] generated sufficient forces at inner rebar mat to cause laminar cracks? Was this investigated? Explain.

Intervenors asked much the same question in previous supplements to their contention, once FENOC's RRCA (dated May 16, 2012) had revealed to them that the shield building had remained uncapped, exposing its interior to the elements, for several years before its dome was installed.

PII then went on "This mechanism was explained in Section 6.02 Failure Mode 2.7 on page 15." (Actually, it was on page 17, not page 15. Additionally, this section appears to be duplicative of #9, Item 48, below.) Following is the text PII added:

> Section 6.02
> Failure Mode [FM] 2.7 [Concrete Sealant]
> a. Discussion
>
> There are two types of moisture transport processes in the Davis Besse Shield Building that provide sufficient moisture to be entrapped in the concrete. One may be called "Top-down moisture penetration", and the other may be called "External-internal moisture penetration". The top-down penetration results in high moisture content near rebar regions and what we call the sub-mode I laminar cracking, as will be described in FM 3.6. The external-internal transport causes high moisture content in the outer layer of concrete, which leads to what we call the sub-mode 2 delamination cracking which will be described in FM 3.6 as well. The following section describes the two types of moisture transport processes in Davis-Besse Shield Building.
>
> A Third theory involved freezing of water that penetrated into roof/parapet joint, causing radial stresses. However, the two potential mechanisms identified preclude cracking on the inside since it is not exposed to the same deep freezing conditions as the outside. Three 'full-depth' cores showed no indication of cracking on the inside of the wall, and the

construction opening that originally identified the laminar cracking showed no crack at the IF [Inner Face] rebar. Cracking was only found at the OF [Outer Face] rebar.

As NRC's own question highlighted, the Inner Face of the shield building wall was exposed to freezing for a number of years, prior to installation of the dome cover, as well as prior to closure of the initial construction opening.

At Page 18 [38 of 257], PII states:

The top-down moisture penetration

The top-down moisture transport process assumes that the water comes from the top of the structure and slowly penetrates down within the concrete wall. During the construction of the Shield Building, the wall was built first and the dome was subsequently constructed two years and four months later. So, the jacking bars, dense rebar, and top of the concrete wall were all exposed to the environment. Moreover, initial defects may be generated by the jacking bars and dense rebar, together with the large aggregate used in the concrete. These factors resulted in the potential for high porosity concrete near the rebar and jacking bars allowing for water penetration. Due to the heterogeneous characteristics of concrete, the water comes down along random paths of least resistance which may tend to explain the sporadically distributed cracks in the wall. This moisture transport mechanism is illustrated in Figure 4.[3] (emphasis added)

Oddly, these revelations appearing in PII's revised root cause assessment report appear to have been omitted from FENOC's May 16, 2012 RRCA, which, just like the February 28, 2012 Root Cause Report, focused almost entirely on the Blizzard of 1978 explanation for sub-surface laminar cracking in the shield building exterior side walls. A keyword search for "top-down" and "roof" in the May 16, 2012 FENOC revised root cause analysis report revealed no hits for the former, and no relevant hits for the latter. Despite NRC's question, and PII's acknowledgement of the question, neither PII nor FENOC have given adequate, or any, attention to this additional potential root cause for shield building cracking.

In addition, PII's admission that "the wall was built first and the dome was subsequently

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[3] Fig. 4 is not on Page 16, as PII indicates, but rather on p. 19.

constructed two years and four months later. So, the jacking bars, dense rebar, and top of the concrete wall were all exposed to the environment" bolsters Intervenors' arguments along these lines introduced in previous contention supplements, pointing out the vulnerability of the shield building's interior to moisture exposure through the incomplete open dome from above, as well as through the side wall initial construction opening (and two "temporary" side wall openings, in 2002 and 2011, to swap out reactor lids).

PII's confession that "Moreover, initial defects may be generated by the jacking bars and dense rebar, together with the large aggregate used in the concrete. These factors resulted in the potential for high porosity concrete near the rebar and jacking bars allowing for water penetration," when taken into account along with such pre-operations defects as "out of plumb" construction of the shield building, cracking on the shield building dome, *etc.*, begs the question: could not the various cracking and other degradation at 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? Without a comprehensive root cause analysis, PII and FENOC cannot guarantee that age-related degradation of the shield building is comprehended, and that appropriate protections are in place to defend against it.

Intervenors also challenge the acceptability of FENOC performing only three full depth core bores. Three core bores across the entire surface of the huge shield building is not acceptable, is much too small a sample size. It provides a mere snap shot, frozen in time, of mere cubic inches (and mere square inches of surface concrete), versus the thousands or tens of thousands or hundreds of thousands of cubic feet of shield building structures, which very well may be suffering worsening cracking over time.

PII lists an eighth set of NRC questions:

> 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 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.

In response, PII added to the main report, Section 2.05 - top of page 7, the following:

> ...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.

Intervenors repeat their criticism of PII's and FENOC's lack of rigorous and robust, data-based analysis articulated above at PII's seventh point, addressing NRC's "Item 46." PII and FENOC provide convenient excuses for not performing rigorous tests, and performing robust analyses based on empirical data, an approach which flies in the face of the potential risks of Davis-Besse operating from 2017 to 2037 with a severely cracked shield building.

PII acknowledges a ninth area of very significant NRC inquiry:

> 9. Item 48: PII report 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 [shield building] 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)?

(Emphasis added). Rather than adequately answer these questions, PII again provides only the response it previously supplied in answer to "Item 46" (NRC's seventh point) above, which Intervenors reproduce in the margin.[4]

And, as with Item 46 above, PII briefly described a "Top-Down Moisture Transport Mechanism," including its Figure 4.

These are not 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.

PII has acknowledged in response to NRC questioning that the dome and parapet standing iniwater caused "freeze-thaw damage in the roof concrete." That information may provide the missing explanation for why FENOC's predecessor nuclear utilities, including Toledo Edison, weather-sealed the dome, because of documented cracking damage as early as 1976, pre-operations.

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[4]a. PII: (ADDED TO main report, Section 6.02 - bottom of page 17)
Section 6.02 Failure Mode [FM] 2.7 [Concrete Sealant]
a. Discussion

There are two types of moisture transport processes in the Davis Besse Shield Building that provide sufficient moisture to be entrapped in the concrete. One may be called "Top-down moisture penetration", and the other may be called "External-internal moisture penetration". The top-down penetration results in high moisture content near rebar regions and what we call the sub-mode I laminar cracking, as will be described in FM 3.6. The external-internal transport causes high moisture content in the outer layer of concrete, which leads to what we call the sub- mode 2 delamination cracking which will be described in FM 3.6 as well. The following section describes the two types of moisture transport processes in Davis-Besse Shield Building.

A Third theory involved freezing of water that penetrated into roof/parapet joint, causing radial stresses. However, the two potential mechanisms identified preclude cracking on the inside since it is not exposed to the same deep freezing conditions as the outside. Three 'full-depth' cores showed no indication of cracking on the inside of the wall, and the construction opening that originally identified the laminar cracking showed no crack at the IF rebar. Cracking was only found at the OF rebar.

In fact, FENOC's RRCA of May 16, 2012 acknowledges that the dome sealing had to be re-done, as it was applied too thickly (1/4 inch thick) and was peeling off. Before the issuance of the RRCA, Intervenors, as well as the public and the news media had not known about the dome cracks, documented 36 years earlier.

PII and FENOC have not answered NRC's specific questions, not even in FENOC's RRCA. Given the catastrophic risks of shield building failure during a 20-year license extension at Davis-Besse, Intervenors seek answers to these and many other questions at an adjudication on the merits.

A tenth area of NRC inquiry is listed by PII:

> 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 [Finite Element] analysis were based on work at UC Boulder that show 3-4 inch penetration with 90 mph winds?

PII responded by adding to the *main report, Section 6.02 - top of page 21,* the following:

> …region L[v]. The sum of the two depths is called L[m], (L[m] = L[w] + L[v]), representing the depth of concrete with high moisture content.
>
> Exhibit 72 shows that the water penetration depth depends on permeability of concrete and it can vary in a very large range. For solid concrete without distress, the 1D analytical results showed that the penetration depth could be 2 - 3 inches under a strong wind-driven rain. With surface distress such as microcracks and 2D moisture penetration, the depth of high moisture region could be higher. Moreover, the moisture trapped in the concrete could continue to penetrate into the concrete after the blizzard, resulting in a higher depth of the high moisture region.
>
> Therefore, in the 1978 models, the depth of moisture penetration is considered approximately 3 to 4 inches in locations subjected to 1D moisture diffusion.
>
> As a summary, based on preliminary and approximate analyses for solid concrete without major distress, the depth of high moisture region L[m] is about 2 to 3 inches after a few days of WDR [wind driven rain]. This may be considered as a reference or guideline for determining the depth of high moisture region in the concrete wall. The present results are based on 1-D analysis. The concrete in shoulder areas is subjected to 2-D moisture penetration, and thus the high moisture region L[m] in shoulder areas may be higher than that in the wall between shoulders.

NRC's questioning on this set of issues is significant. 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.

PII admits that its analyses are "preliminary and approximate." Yet, there appear to be no comprehensive and conclusive analyses planned in follow up. FENOC not only restarted the Davis-Besse reactor on December 6, 2011, with NRC's blessing, but claims that weather sealing the shield building will prevent any worsening of the extensive cracking. Intervenors are not only skeptical of PII's and FENOC's optimistic claims, but very concerned that more rigorous tests and analyses will not be required by NRC before it grants Davis-Besse a 20 year license extension.

PII lists NRC's eleventh area of inquiry:

> 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 [Finite Element] model accuracy for this application and how it was1 *(sic)* determined (e.g. benchmarked)?

In response, PII added to the main report, Section 2.04 - middle of page 6, the following:

> 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 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. (emphasis added)**

So PII admits that its analyses are not rigorous and robust: conclusions are based on "engineering judgment," not empirical data; and, "there was no sensitivity analysis performed." Therefore, PII's revised root cause assessment report is based on a weak scientific/technical/engineering basis. Where is the proof of their theories, apart from educated guesswork/conjecture? It could well be that PII has not identified actual root causes of shield building cracking, as no solid grounds for confidence in their hypotheses are provided.

NRC's questions point out compellingly that there is not a single root cause to shield building cracking, but potentially multiple root causes. Despite this, PII and FENOC cling to their ultimate root cause theory, that the Blizzard of 1978 was the only explanation for shield building cracking. But given the presence of multiple kinds of cracking, located at diverse places across the huge shield building, NRC's questions raise the specter that PII and FENOC have not adequately explained the origin of all cracking. This would leave the shield building vulnerable to yet unidentified cracking initiation and propagation dynamics.

A hearing on the merits must be convened to shed light on these many unanswered questions.

PII lists NRC's twelfth area of questioning as follows:

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?

PII responded by adding the following note to Appendix III - near center of page III-I:

> 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.

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. A hearing on the merits, with the opportunity to cross-examine FENOC's consultants and experts, would shed important light on such devils in the details.

The significance of such issues is revealed in documents provided to Intervenors by NRC in response to a request submitted pursuant to the Freedom of Information Act (FOIA; Intervenors' request submitted January 26, 2012; NRC's partial response provided June 12, 2012; Case # 2012-0121). Take, for example, FOIA response document "B/9," dated 11/04/2011 and described as "Email from P. Hernandez, NRR to E. Sanchez-Santiago, RIII on Questions about Davis Besse Shield Building Report from DORL."[5] In it, Pete Hernandez, assistant to the Lead PM [Project Manager] for Davis-Besse Mike Mahoney [as revealed in document B/8], responds to "C-CSS-099.20.054," a "calculation [of] the structural integrity of the SB [shield building]...considering the presence of an interfacial/circumferential crack between the SB structural concrete shell (*i.e.*, the 30'' thick reinforced concrete SB) and each architectural flute shoulder (16 flute shoulders in total), as described in Attachment B." He states:

> "This description makes me think that they are looking at a single crack going in a circle. From what I understood **the crack is pervasive along the entire surface, spidering in all directions, similar to a pane of tempered glass breaking.** The description in Attachment B addresses only the crack at the opening and assumes that the crack is right along the rebar line. **The core bores have shown that the cracks are at different depths so this doesn't seem to capture the current situation.** Throughout the calculation, the word

[5] Intervenors have attached a copy of this email to this motion.

Crack, singular, is used. They also mention that the extent of the crack is only 10'-12'. **This seems to greatly downplay the issue."**

(Emphasis added). Mr. Hernandez continues:

> "At this point core bores of only the shoulders have been taken. So the only crack widths we are aware of are those in the shoulders, which are not being addressed. How can an analysis be done on the structurally credited concrete if no data from that area, in the form of core bores, has been taken? Shouldn't the structural integrity of the shoulders be calculated as well?"
>
> "This seems to say that they are just doing calculations for the new concrete that is and ignores the rest of the building altogether. Is that right?"
>
> "This says to me, that they are ignoring the shoulders, if they are ignoring all that concrete, it seems to be the opposite of conservative for evaluating the mechanical loads."

Regarding C-CSS-099.20.055, the "Objective or Purpose" is stated as: "The purpose of this calculation is to demonstrate that during a seismic event, with the development of the crack in the architectural flute shoulder, the capacity of the rebar(s) can still provide adequate anchorage thus prevent **cracked concrete piece from falling**, and therefore Seismic II/I condition can be maintained." (Emphasis added).

The NRC's Hernandez responds to this explanation as follows:

> **"I think the greater concern is will the SB stay standing** and not whether or not the decorative concrete will fall off. Because the licensee has not performed core bores to see if there is cracking in the credited concrete, **do they have a basis to say that the structural concrete will maintain a Seismic II/I condition?"**
>
> "This use of singular terminology also discounts this calculation because it seems that they are looking at only 1 crack and 1 shoulder or 1 flute. **Because cracks have been found through multiple core bores, shouldn't the appropriate calculations account for the combined effects of cracks in all the shoulders** and not just one by opening and not just individually?"
>
> "From what I understand, **IR mapping is only an indicator, but must be validated by core bores.** Does basing all the calculations on a length of a 12 foot crack discount the calculations altogether, because **we have indications of cracks at distances greater than 12 feet.** This also seems to assume that there is only 1 crack and not *many as the core bores seem to prove.* Isn't **IR mapping only useful at a limited depth too,** so that using it to evaluate a 48" thick piece of concrete is not realistic? (Emphasis added).

Intervenors are concerned about the safety implications raised by Mr. Hernandez' questions. He goes so far as to speculate whether the shield building will "stay standing" if an earthquake occurs. He questions whether or not FENOC and its contractors have proven that "structural concrete will maintain a Seismic II/I condition" - earthquake concerns which are shared by Intervenors. Mr. Hernandez acknowledges limitations on Impulse Response tests, and calls for core bores to be taken across the shield building. Intervenors also call for adequate core bores to take place, to identify any and all cracking at whatever depth may be occurring. FENOC's and PII's limited IR and core bore sampling could be missing significant areas and depths of cracking.

Mr. Hernandez' concerns are echoed by NRC staff person Abdul Sheikh. In FOIA response document B/26 [dated 11/22/11, described as "Email from A. Sheikh, NRR to E. Sanchez Santiago, RIII on Questions for the Conference Call],[6] Mr. Sheikh states:

> **"If this assumption is correct only 3-4 inches of the concrete on the inside face can be used in the structural analysis.** In the response to the questions, the applicant stated that, 'Since we assume that outside reinforcement is to be treated ineffective in carrying any additional stress beyond 12.4 ksi, under accident thermal loads that may cause stresses in excess of what the rebar can carry (assumed 12.4 ksi), **the reinforcement is assumed to detach itself from the outer section of the shell.' These statements seems *(sic)* to be contradictory. In addition, I am concerned that the concrete will fail in this region due to bending in this region even under small loads."** (emphasis added)

Thus, Mr. Sheikh not only indicates he's concerned a "small load" will fail the concrete of the shield building, but he quotes FENOC itself, which admits:

> 'Since we assume that outside reinforcement is to be treated ineffective in carrying any additional stress beyond 12.4 ksi, under accident thermal loads that may cause stresses in excess of what the rebar can carry (assumed 12.4 ksi), **the reinforcement is assumed to detach itself from the outer section of the shell.'** (emphasis added)

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[6]Intervenors have attached a copy of the cited email to this Motion.

Additionally, Mr. Sheikh goes on to issue a number of related warnings (numbered this way in his email):

1. Mr. Sheikh notes internal contradictions in FENOC/contractors' documents regarding the rebar lap splice issue (which FENOC's own expert witness, Dr. Darwin, has pointed out is very significant – he has indicated that his support for FENOC's root cause conclusions hinges on cracking not being in the lap splice region).

2. Mr. Sheikh states: "If this is the assumption, stress used for lap splice calculation should account for 100% increase in the stress."

Mr. Sheikh further states:

5. "The licensee justification for ignoring the dead (DL) and normal thermal (To) in calculation of rebars splice does not appear to be justified. The stresses due to dead load and thermal loads will be locked in the rebars and cannot be ignored."

6. "The licensee considers the allowable stress in the rebar to be 60 ksi and ignores a phi factor (0.9) in his evaluation for lap splice. In addition, the licensee has not accounted for any additional uncertainty due the conditions."

7. "I am not aware of any pull tests carried out with a crack in the plane of the rebar. Can the licensee provide any documentation for this statement."

8. "The licensee is using numerous assumptions in his summary report and calculations that are not described in the UFSAR and ACI 318-63, and still calls it a design basis calculation. Can the licensee provide justification for this approach."

In a thirteenth area, PII recites NRC's questions and concerns as follows:

13. Item 52: FM [Failure Mode] 2:12 discusses Out of Plumb condition of SB [Shield Building] 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 friction 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 slip form 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 slip form is not in level"**

(emphasis added).

PII responded that this issue is "Discussed in Appendix VI, FM 2.12 – Discussion," as follows:

> Discussion:
>
> Documentation of the Out of Plumb condition was limited to the documents provided. We do not have information regarding the method of correcting the problem and whether it caused excessive friction forces.
>
> Attempts to correlate these locations to locations of cracking found no significant correlation. The out-of-plumb condition peaked at three distinct (Exhibit 18) elevations that did not correspond to cracking as determined by CTL.
>
> Exhibit 5 (Project specifications) provides information regarding design considerations that reduce friction.
>
> The rate of slip-forming (average about 4' per shift) is fast enough to minimize friction problems.
>
> The observed cracking through aggregates is further indication that the laminar cracking happened after the concrete reached sufficient maturity and not during placement.
>
> Conclusion:
>
> The out-of-plumb issues did not cause the Laminar Cracks

PII admits, "We do not have information regarding the method of correcting the problem and whether it caused excessive friction forces." Thus, out of plumb construction errors – which may have never been rectified at all -- must be added to the growing list of stresses borne by the Davis-Besse shield building (which, during construction alone, included the following):

> "Noteworthy deviations during construction of the shield building walls were issues such as concrete with the wrong water to cement ratio, concrete with smaller coarse aggregate size, concrete with the wrong type of cement, exceeding shield building wall tolerance for plumb, installation of reinforcing steel, embeds, or reglets, and omission of blockouts. The shield building construction deviations are described in attachment 8."

FENOC RRCA, May 16, 2012, p. 45/131 of .pdf). What is known, however, as admitted by FENOC in its RRCA (p. 100/131 of .pdf), comes from "Interim Field Report #5":

The shield building concrete wall outside face is not within the plumb tolerance of 1 inch in any 25 feet. Reference Specification C-38.

Bechtel Engineering has reviewed the Interim Field Report and its attached plumb plots. Out of tolerance exceeds the 1 inch in 25 feet specified by 2-3/4 inches. The affect this has on the shield building structural integrity were found to be insignificant. Bechtel Engineering approves the Use As Is disposition for the structure and recommends that all interface work be adjusted to meet the as-built alignment of the structure.

Thus, Bechtel during Davis-Besse shield building construction largely chose to ignore out-of-plumb stresses. Bechtel neither recorded any method of correcting the problem, nor whether it caused excessive friction forces. It simply proceeded to build the Davis-Besse shield building as if the out-of-plumb errors had not occurred.

It is also unclear how carefully even CTL, FENOC's contractor, checked for shield building damage due to out of plumb slip form friction forces. Not finding problems when one is not carefully checking for them is to be expected. Predictably, PII – as does FENOC itself -- continue to focus exclusively on sub-surface laminar cracking, without addressing other, yet still significant, degradation of the shield building structure due to additional forces, such as out of plumb construction flaws.

PII lists a 14th area of NRC questioning:

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 *(sic)*?

PII responded by adding the following note to Analysis I, section 9.01 - page 33 before table 3:

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.

The NRC question challenges the PII, and ultimately FENOC, root cause conclusions, even in revised form. Empirical evidence shows cracking deeper than the PII/FENOC revised root cause models admit to/explain. Thus, the explanations could very well be off base. The potentially catastrophic consequences of a shield building failure do not allow for the luxury of not addressing the still unexplained observation that cracking extends significantly more deeply than PII's/FENOC's "Blizzard of 1978" theory accounts for.

That "cracks ... may 'wander'" through the "paths of least resistance" is not a rigorous, robust analysis based on empirical evidence. Where is the supporting data, other than guesswork or so-called "expert judgment"? PII has denied the presence of significant micro-cracks (but not all micro-cracking) in shield building wall structures, which would suggest age-related degradation. But this admission by PII of "observation that some core bore laminar crack depths exist away from the rebar mat" seem to indicate cracks – in other words, ***macro***-cracks. This could indicate that initial micro-cracks grew/have grown significantly over time - an age-related degradation phenomenon. Neither PII nor FENOC have adequately addressed the as yet unexplained presence of subsurface laminar cracking at a deeper depth in the shield building wall beyond the outer rebar mat.

PII then lists a fifteenth area of NRC questioning:

> 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 [Main Steam Line] 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.

At Page iii. PII responds by adding the following note to Analysis I, section 9.01 - page 32 before table 2:

> The "motivating force" is the void fraction of elements treated as ice, *e.g.* 0.6% and 1% of the _half line of redaction_ The "rebar spacing" variable is summarized above and presented in the legend, and the "extent of cracking" is a scale from 0 to 3 that serves to simplify the extent of the damage observed in each model. The meaning of each level from 0 to 3 is described in the third legend following the table below. A level of "3" is a complete delamination along the OF [Outer Face] rebar mat similar to the center of shoulder 9 at the top of the shield building. A level of "0" is no damage.
>
> What the results show is that there is a clear trend toward more damage with tighter rebar spacing. The models with all 12" rebar spacing showed no laminar cracks at all. Accordingly, the laminar cracking identified in the MS [Main Steam Line] 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.

Thus PII has further admitted that dense spacing of rebar has inevitably led to a significant design flaw that compromises shield building integrity. But PII has not clearly communicated empirical calculations showing the safety significance of this admission – such as quantifying the "small stress," as Mr. Abdul Sheikh worded it above – that would be enough to "fail" these areas of the shield building, risking a radiological catastrophe during core meltdown conditions. Such extensive cracking in areas of dense rebar in the shield building structure certainly violates Davis-Besse's licensing design basis conformance.

And PII's redacted half line, noted above, complicates Intervenors' ability to fully understand PII's response to NRC's question. PII must provide full, transparent explanations, filling in the redaction blanks. No explanation whatsoever is given for the redactions, leaving Intervenors in the dark.

PII's revised root cause assessment report lists this sixteenth NRC question:

16. Item 56: Why was the thermal conductivity of the SB [Shield Building] 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?

PII responded as follows, added to Analysis I, section 10.02 - page 39 end of 3rd paragraph:

> ...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.
>
> Tests of moisture penetration were also performed at the University of Colorado at Boulder, which showed that a _REDACTION_ water penetration up to 3 or 4 inches is possible when there are winds in excess of 90 mph (such as during the 1978 blizzard)...

Once again, the above redaction is not even explained – no justification for the redaction is provided, leaving Intervenors doubly in the dark. But this redaction pales in comparison to a section above the quoted text: above the quoted text, more than half of the page is redacted without explanation! This violates basic democratic norms of transparency and accountability. Intervenors speculate whether the redactions represent efforts to protect legitimate business secrets, or are aimed at thwarting public access to embarrassing truths about the shabby state of the shield building. Given the shield building's fundamental role in protecting human health, safety, and the environment from radiological catastrophe, such extensive redactions are not acceptable. Intervenors call for full disclosure, in the public interest.

If Davis-Besse's shield building concrete conducts heat 50% faster than it is supposed to, this may have allowed or caused deeper cracking in the shield building. Did Davis-Besse use substandard concrete in the shield building construction? Is this another design and/or construction error in the Davis-Besse shield building? Is this also a non-conformance to licensing and design bases? Why, when FENOC has blamed the Blizzard of 1978 and lack of a weather sealant on the shield building exterior as root causes of the subsurface laminar cracking in the shield building wall, didn't the utility also mention this concrete thermal conductivity issue? What other negative properties does the substandard Davis-Besse shield building concrete have? What other natural or man-made assaults is it therefore vulnerable to? A hearing on the merits of Intervenors' cracked concrete containment contention, as supplemented, might illuminate answers to these important questions.

PII lists a seventeenth NRC question, related to the one just discussed:

> 17. Item 57: It does not appear that the FE [Finite Element] 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?

PII responded by adding the following note to Analysis III, section11.02-page 52 3rd paragraph:

> The thermal conductivity and specific heat of DB concrete were used as inputs for the FE thermal analysis. The thermal diffusivity was calculated by the FE program based on the input values for thermal conductivity and specific heat. In the linear thermal analysis for temperature distributions in the concrete structure, the important thermal parameter is the thermal diffusivity which is in the typical range for concrete, as shown in Exhibit 59. One can see from Exhibit 59 that both thermal conductivity and specific heat of DB concrete have abnormally higher values than the typical values shown in the literature. Thermal diffusivity =Thermal-conductivity/ (specific heat x density).

Once again, redactions preceding this text complicates the task of trying to understand PII's, and by extension FENOC's, root cause assessments and analyses. Full disclosure is obligatory.

PII admits that the Davis-Besse shield building concrete "thermal conductivity and specific heat...have abnormally higher values than the typical values shown in the literature." NRC already asked the significant question, did this contribute to the shield building sidewall subsurface laminar cracking, as by allowing deep freezing down to the outer rebar mat layer? Neither PII nor FENOC have answered that question adequately, if at all. Even the revised root cause assessment and analysis did not mention any significant root cause role for substandard concrete. But substandard concrete's "abnormally high" thermal conductivity and specific heat cannot be solved by the mere application of a weather sealant to the Davis-Besse exterior shield building wall 40 years late. What other vulnerabilities would such substandard concrete expose the Davis-Besse shield building to? A full hearing on the merits would shed light on these important questions.

NRC's specific questioning on the quality and strength of Davis-Besse's shield building concrete continued into an eighteenth area:

> 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?

PII responded by adding the following note to Section 2.01 Laboratory Tests and Examination to Test for Concrete Integrity-page 2:

> Section 2.01 Laboratory Tests and Examination to Test for Concrete Integrity
>
> 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 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.

PII responded above, not with specific empirical data, but rather only with qualitative arguments. As documented at the fifth area of NRC questioning (Item 26 above), tensile strength values as low as 500 to 600 psi may be more appropriate than PII's values of 836 to 962 psi. If PII, and by extension FENOC, have assumed concrete shield building concrete tensile strength values that are too high, this could mean that cracking is much more widely distributed across the shield building structures than has been admitted. This contention is deserving of a hearing on the merits, to look into such safety significant questions.

PII's admission that "the strengths of concrete can decrease over time due to aging-related mechanisms such as freeze-thaw cycles and chemical attacks" bolsters Intervenors' arguments that the cracked concrete containment contention is aging-related, and points to the obligation of a full hearing on the merits.

PII listed a nineteenth area of NRC questioning:

> 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?

PII responded by adding a new section XVII Additional Comments item 1 *(sic)* before Appendix I-page 92-93 (pp. 112-113/257 of .pdf), as follows [actually, item 3 responds to this question, not item 1 as PII indicated; the relevant item 3 states the following] (at p. 92):

> XVII. Additional Considerations
> The following are responses to issues raised after the report was finalized in its current form.
> . . . .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.

PII's statement, "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," provides no reassurance to the public interest in the integrity of the shield building. "The entire roof filling up with water" is very disturbing, considering the dome's documented cracking as early as 1976 and flaws identified in the dome's waterproof sealant identified by 1976. Any failure of the dome's/parapet's waterproof sealant would allow water to percolate down into the SB wall below. This top-down water flow could worsen cracking over time – that is, cause age-related degradation – due to rains, melting of snow, *etc.*, which are common occurrences on the shoreline of the Great Lakes. So, if "an uneven snow load" is as bad as "the entire roof filling up with water," this is of great concern to Intervenors, not only due to the weight of the snow/water, but to the potential for water to flow through roof/sealant flaws into the shield building wall, causing further damage below.

PII's flippant response to NRC's very serious question is disconcerting. "The entire roof filling up with water," which from PII's response may be a relatively "routine" occurrence at Davis-Besse, is likely due to a bad water drainage design of the dome/parapet juncture. Standing water is documented in the photo included at Figure 4: "Top-Down Moisture Transport Mechanism" on page 19 of the PII revised root cause assessment report.

As documented at NRC's seventh area of questioning (Item 46), PII itself has admitted that "The second most likely scenario [root cause for shield building laminar cracking] 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." The NRC then asked, "Is this scenario also identified and explained in the FENOC RCR [Root Cause Report]? If so where? If not, why not?"

"The second most likely scenario" for the root cause of shield building laminar cracking should not be so flippantly treated as routine by PII. Neither PII nor FENOC answered why this potentially significant "Top-Down Moisture Transport Mechanism" was not even mentioned in FENOC's root cause report.

The "calc" done by an unnamed vendor was not provided, not even in summary form. "Relatively 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. "Cracking all the way down the wall" could be due to an accumulation of "relatively small stresses" that, added together, have proven too much for the shield building to bear.

The uneven snow load stress risk is even more significant when considered in combination with the "out of plumb" shield building design flaw (the thirteenth area of questioning above, Item 52). Although FENOC has previously objected to Intervenors mentioning that Davis-Besse is located on the shoreline of Lake Erie, that fact remains: Davis-Besse, and its shield building dome, have been exposed to a large number of snow storms over the decades, including the Blizzards of 1977 and 1978, central to FENOC's root cause report of February 28, 2012, its revised root cause analysis report of May 16, 2012, and PII's revised root cause assessment report posted to ADAMS on May 24, 2012. PII has not addressed that combined stress of out-of-plumb design flaws in combination with uneven snow loading. As is the case throughout its revised root cause assessment, PII has not answered NRC's questions, and NRC has not required PII to answer its questions. Apparently, the task belongs to Intervenors, who hope to have such questions answered in a hearing.

PII acknowledged a twentieth area of NRC questioning:

> 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?

PII responded by adding to a new section XVII, Additional Comments, item 2, before Appendix I (PII report at p. 92-93, 112-113/257 of .pdf). However, it could well be that PII's reference to "Item 2" above was simply in error. PII's Item 4 in the same section seems more responsive to NRC's question:

> [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.

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.

NRC put this twenty-first question to PII:

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

PII claims to have responded by adding, in new section XVII Additional Comments item 3 before Appendix I (PII report pp. 92-93). However, Item 3, about uneven snow loads transferring load to the top of the SB wall, does not address this question, so PII's citation above seems to be in error.

Item 5 seems the most relevant answer to this question in the entire section XVII, Additional Considerations. It states:

> 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".

PII repeatedly ducks the NRC's safety-significant questions. Why wasn't the maximum potential loading assumed in PII's crack growth analysis for areas of the shield building with the lowest margin? Intervenors submit that PII, and by extension FENOC, 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.

Intervenors are troubled by PII's downplays and denials of risks in the face of tough questions asked by NRC staff in documents obtained by Intervenors via FOIA. For example, Abdul Sheikh of NRC asked if a small stress might just be enough to fail the shield building 27 inches deep, all the way down to the inner rebar mat, just 3 inches from the inside face of the shield building. Pete Hernandez of NRC pointed out that the significant question does not have to do with architectural elements of the shield building, but rather whether or not the entire structure could collapse. PII responded that "wind, seismic and tornado loads do not produce any significant stresses of any nature at the location of 30' 'crack'." But what about a combination of adverse forces acting simultaneously on a severely compromised shielding building structure, not only at the 30' crack location, but also at equally vulnerable, or even more vulnerable, locations?

PII relates a twenty-second area of NRC questioning:

> 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 [Finite Element] 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?

PII responded with this note added before XV Root Cause and Contributing Causes (page 87):

> Section 14 02 Conclusion
> As summarized in Table 6 the magnitude of maximum principal stresses increased a slight amount from σMP= 162 psi (No crack) to σMP= 184 psi (w/crack). There is only a marginal increase in the magnitude of radial stress, from σR= 76 psi (No crack) to σR= 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.

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.

NRC's questions ("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?") show that Intervenors' request for a hearing on these aging-related matters is reasonable as well. PII's inadequate responses and FENOC's AMP fail to answer or account for the NRC's safety-significant, aging-related questions. The daily and seasonal thermal forces, as well as environmental stresses, could pose a challenge to the already multiply-challenged shield building over the 2017 to 2037 license extension period. PII and FENOC, have not adequately accounted for all the cumulative loads and stresses.

Finally, "it is not believed" is not an adequate quantitative, empirical, data base answer to such significant questions.

PII lists a twenty-third area of NRC questioning:

> 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?

PII responded by adding "in new section XVII Additional Comments item 4 before Appendix I - page 92-93." But Item 4's being referenced seems to be in error, yet again. Item 6 seems to be the one PII actually meant. Item 6 states:

> 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 [Impulse Response] 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.

NRC's question bolsters Intervenors' filing of July 16, 2012, in which they documented multiple forms of cracking and other shield building degradation, located at diverse areas across the shield building, which challenged FENOC's Blizzard of 1978 root cause theory as all-explaining. The root cause of each kind of cracking and other shield building degradation must be accurately determined, so that adequate corrective actions and aging management plans can be put in place.

Even if the Blizzard of 1978 were to adequately explain the root cause of cracking in the Main Steam Line penetration areas, it does not solve the problem of corrective actions needed, including an adequate aging management plan. This should extend to other areas of the shield building with dense configurations of rebar, of course, as this is a design flaw/vulnerability located elsewhere, besides the Main Steam Line penetrations. Could these spots be the weakest link in the chain, the location(s) where a combination of adverse forces fails the shield building?

The NRC's twenty-fourth area of questioning follows:

> 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?

PII responded by adding in new section XVII Comments item 7 before Appendix I - page 92-93 (incorrect item 5 was crossed out and replaced with item 7, with a handwritten note by Tom Henry dated 5/4/12) the following:

> 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.

Intervenors assert that a rigorous sensitivity study should have been, and still should be, performed. PII and FENOC should model growth rate, as this is essential for an adequate shield building aging management plan and monitoring program over time, including any 2017 to 2037 license extension period.

Admission by PII of 14 inch deep cracking is significant, given that the shield building walls are 30 inches thick. Even if PII is referring to a thicker area, such as flute shoulders - which is not clear - 14 inch deep cracking is of concern. Intervenors question, for both environmental protection and public safety reasons, the ability of those deeply-cracked locations on the shield building to fulfill their radiologically-critical function. The NRC's questions regarding "predicted crack initiation depth or growth rate" are potentially aging-related, and hence deserving of a hearing on the merits in this license extension application proceeding.

Before leaving this section, Intervenors point out that Items #1 and 2 were not addressed in PII's "Summary of Revisions." As was mentioned a number of times above, Section XVII was newly added, so it would seem that Items #1 and 2 were also newly added as well, just as were items 3-10, all of which were addressed above. Intervenors have the following comments on points #1 and 2:

> 1. The moisture penetration test procedure and test data are shown in Exhibit 52 Fig. 3. The analysis was shown in Exhibit 72. The 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.

Intervenors 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." A hearing would allow a more careful examination of these unique problems and risks.

> 2. Six core-bores revealed evidence of multiple laminar cracks in the same area of the outside face reinforcement. Performance Improvement International (PII) considers these to be a part of a single delamination process. As explained elsewhere, cracks in concrete follow the path of least resistance and may diverge an inch or two to bypass a large piece of strong aggregate. A crack may also split under the same condition and continue on both sides of the aggregate for a short distance. Another possibility is that two distinct cracks, originating to the left and right of the core, follow a slightly different path due to localized stronger aggregates. These cracks will either converge or one will terminate beyond the stronger area.

Intervenors 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.

NRC had inquired (as at the fourth area of questioning, Item 21 above) about micro-cracking, a phenomena that FENOC itself has acknowledged is related to age-related degradation and which was documented by Intervenors in their July 16, 2012 filing in this proceeding. PII's description of crack propagation (immediately above) related to NRC questions about Item 60 and it prompts Intervenors to wonder if the cracking described – which could be called macro-cracking rather than micro-cracking – is itself evidence of age-related degradation.

PII identified a twenty-fifth area of NRC inquiry, one that directly questioned the Blizzard of 1978 root cause at a very fundamental level:

> 25. [__Three letter REDACTION__] 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?

PII responded by adding, in new section XVII Additional Comments, item 8, before Appendix I, (incorrect item 6 was crossed out and replaced with item 8, with a handwritten note, apparently by Tom Henry dated 5/4/12, although the handwritten note is illegible) the following (at *p. 93, 113/257 of .pdf*):

> 8. A qualitative elimination analysis 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. 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 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.

In the above passage, PII admits that areas of the shield building surface containing dense rebar which was not subjected to high wind, but was simply exposed to moisture, were also vulnerable to severe cracking. For this reason, the entire shield building surface containing high density rebar should be carefully examined for cracking. Davis-Besse is located on the Lake Erie shoreline. It has been exposed to countless episodes of moisture drenching, followed by freezing temperatures. Combined with information on the substandard heat transfer characteristics of Davis-Besse's shield building concrete, discussed above, allowing deep freezing of water into the thickness of the shield building, the admission that high wind was not even needed to cause extensive cracking must be addressed across the structure. Weather-sealing the shield building 40 years late does not reverse the damage already inflicted. Nor does it preclude the need for a comprehensive aging management plan and corrective actions for damaged areas of the shield building which by PII's admission above extends to all areas of dense rebar, if not beyond.

Again and again, PII presents largely qualitative arguments, not quantitative analyses based on empirical data. Rigorous analysis, robust proof which supports arguments, is indispensable to prove these causation theories, especially given the high stakes, which include the catastrophic consequences of a shield building failure.

Intervenors again object to redactions which block their ability to fully understand even the questions NRC is asking, such as the two to three character redaction noted here, as well as immediately below, as well as in the final, twenty-seventh area of NRC questioning below.

PII lists a twenty-sixth area of NRC questioning:

> 26. [3 to 4 letter redaction] 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?

PII responded by adding, in new section XVII Additional Comments, item 9, before Appendix I (incorrect item 7 was crossed out and replaced with item 9, with a handwritten note, probably by Tom Henry dated 5/4/12, although the hand written note is illegible), stating as follows:

> 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.

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 assumptions and dangerous underestimates must be addressed in a hearing.

The twenty-seventh area of NRC questioning to PII was this:

> 27. [redaction] 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?

PII responded by adding, in new section XVII Additional Comments, item 10, before Appendix I, (p. 94 of PII report, 114/257 of .pdf) the following:[7]

> 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.** (Emphasis supplied).

Intervenors again object that PII not be allowed to cherry-pick select areas of the shield building to

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[7]Incorrect item 8 was crossed out and replaced with item 10, with a handwritten note, apparently by Tom Henry dated 5/4/12 which is legible; Intervenors assume that all the rest were his signatures or initiallings along with dates.

test, which fit its predetermined theory, but exclude testing other areas of the shield building structure that could also be cracked or otherwise damaged. NRC itself has questioned the logic of PII's and FENOC's Blizzard of 1978 root cause conclusion for sub-surface laminar cracking – given that areas not in the direction of wind driven rain are also cracked, inexplicably. But the Blizzard of 1978 cannot explain shield building dome cracking that was documented as early as 1976. Nor can applying weather sealant 40 years late reverse damage already inflicted, as through the top-down moisture penetration model, where cracks and weather sealant failures in the dome area have allowed moisture penetration via that route downwards – moisture that originated not only from the Blizzard of 1978, but other precipitation events on the Lake Erie shoreline over the course of years and perhaps even decades.

Intervenors urge 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. Given the severe cracking and other degradation of the shield building, that assumption no longer holds water.

C. Legal Standards Regarding Admissibility Of Supplemental Information

1. The Contention Satisfies the NRC's Admissibility Requirements in 10 C.F.R. § 2.309(f)(1)

a. Brief Summary of the Basis for the Contention

The contention is based on the continuing technical information that has become public since October 2011 respecting cracking phenomena which were observed on the shield building at the Davis-Besse Nuclear Power Station. The early disclosures by FENOC concerning both the cause of the cracks, the extent of them, and their effects on the integrity of the shield buildling were minimal and inaccurate. The utility set as a priority the restart of commercial power production at Davis-Besse, which was approved by the NRC commencing on December 2, 2011.

b. The Contention is Within the Scope of the Proceeding

It is not disputed that maintenance of the structural stability of the shield building is within the scope of this licensing proceeding. On April 5, 2012, FENOC proposed an aging management plan (AMP) and the NRC Staff insists that any aging-related aspects of the shield building are ameliorated by that AMP. "[W]ith respect to license renewal, under the governing regulations in 10 CFR Part 54, the safety review of license renewal applications is limited to the plant systems, structures, and components (as delineated in 10 CFR § 54.4) that will require an aging management review for the period of extended operation or are subject to an evaluation of time-limited aging analyses. As to the shield building, FENOC "must demonstrate that the 'effects of aging will be adequately managed so that the *intended function(s)* [as defined in § 54.4] will be maintained consistent with the CLB [current licensing basis} for the period of extended operation.'" *Nuclear Generation Co. and Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), CLI-10-14, 71 NRC __ (June 17, 2010) (slip op. at 8) (quoting 10 C.F.R. 54.21(a)(3)) (emphasis in original)).

c. The Issues Raised Are Material to the Findings that the NRC Must Make to Support the Action that is Involved in this Proceeding

The issues raised in this contention are material to the findings the NRC must make to support the action that is involved in this proceeding, in that the NRC must render findings pursuant to NEPA and to the Atomic Energy Act covering all potentially significant environmental and safety impacts. License renewal review focuses on "those potential detrimental effects of aging that are not routinely addressed by ongoing regulatory oversight programs." *Florida Power & Light Co.* (Turkey

Point Nuclear Generating Plant, Units 3 & 4), CLI-01-17, 54 NRC 3, 7 (2001); *Entergy Nuclear Generation Co. and Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), LBP-06-24, 64 NRC 257, 275-76 (2006). Before the NRC will grant a license renewal application, the applicant must reassess safety reviews or analyses made during the original license period that were based upon a presumed service life not exceeding the original license term. *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 & 4), CLI-01-17, 54 NRC 3, 8 (2001). The reassessment must "(1) show that the earlier analysis will remain valid for the extended operation period; (2) modify and extend the analysis to apply to a longer term such as 60 years; or (3) otherwise demonstrate that the effects of aging will be adequately managed in the renewal term." *Florida Power & Light Co.* (Turkey Point NuclearGenerating Plant, Units 3 & 4), CLI-01-17, 54 NRC 3, 8 (2001) (citations omitted).

D. Concise Statement of Facts or Expert Opinion That Support the Contention

The shield building cracking was unforeseen in FENOC's license renewal application, which presumed a structure surrounding the nuclear reactor which was fissure-free and not prone to failure in the form of up to 90% collapse of its rebar and concrete. Instead of the extremely limited laminar cracking identified in the February and May 2012 root cause analyses provided the NRC by FENOC, it appears that there is widespread micro-cracking in the shield structure, that there was cracking in the dome of the building in 1976, before the supposed "root cause" of the limited cracking admitted to exist *(i.e.*, the Blizzard of 1978). The NRC Staff, relying on FENOC's representations and those of its engineering consultant, PII, has determined that there is a significant chance of collapse of the structure's walls which could leave only a 3" thick building to contain a radiological accident.

e. A Genuine Dispute Exists with the Applicant on a Material Issue of Law or Fact

The Intervenors have articulated a genuine dispute with the applicant, FENOC, regarding physical adequacy of the shield building, which is the most critical structure at the Davis-Besse plant. There is extensive information, much of which is from FENOC's own consultant, and so, of an undisputed nature, suggesting the universal presence of cracking in the shield building from different origins (from the pouring and original drying of the concrete, the construction of the shield building significantly out of plumb, microcracking, moisture infiltration, carbonation and corrosion). Until there is a thorough, global investigation of the nature, extent and causation, the muted warnings of the NRC Staff stand as creating a genuine dispute of fact.

2. The Contention Is Timely Pursuant to 10 C.F.R. § 2.309(f)(2)

The contention meets the timeliness requirements of 10 C.F.R. § 2.309(f)(2), which call for a showing that:

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

Id.

Intervenors satisfy all three prongs of this test. First, the information on which amendment or supplemention of the contention is sought is new and materially different from previously available information. A new contention may be filed after the deadline found in the notice of hearing 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; (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. 10 C.F.R. § 2.309(f)(2).

Intervenors respectfully submit that their amended/supplemental facts are timely submitted under the Commission's standard in 10 C.F.R. § 2.309(f)(2)(i)-(iii). As supplemented/amended, Contention 5 meets the NRC's three-part standard for a timely contention. The information on which the contention is based was not previously available. PII's report, "Root Cause Assessment: Davis-Besse Shield Building Laminar Cracking, Vol. 1," was added to the NRC's ADAMS system on May 24, 2012 as ML12138A037. The information on which the contention is based is materially different than information previously available, *see* 10 C.F.R. § 2.309(f) (2)(ii), because it relates to findings and provides facts which did not exist when Intervenors moved for admission of Contention 5 in January 2012. This amendment/supplementation of Contention 5 is timely because it is filed within sixty (60) days of the PII report's May 24 posting date and conforms with the ASLB's Initial Scheduling Order. *Shaw Areva MOX Services, Inc.* (Mixed Oxide Fuel Fabrication Facility), LBP-08-10, 57 NRC 460, 493 (2008). Intervenors have acted in a manner which is timely according to 10 C.F.R. § 2.309(f)(2)(iii).

If a contention satisfies the timeliness requirement of 10 C.F.R. 2.309(f)(2)(iii), then, by definition, it is not subject to 10 C.F.R. 2.309(c), which specifically applies to nontimely filings. The three (f)(2) factors are not mere elaborations on the "good cause" factor of Section 2.309(c)(1)(i), since "good cause" to file a nontimely contention may have nothing to do with the factors set forth in (f)(2). *Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), LBP-06-14, 63 NRC 568, 573 (2006).

D. Certificate of 10 C.F.R. § 2.323(b) Consultation

Counsel for Intervenors, along with Beyond Nuclear's designated representative, participated in a telephone conference concerning the prospective contents of the within Motion on July 13, 2012 with counsel for the NRC Staff and counsel for FirstEnergy Nuclear Operating Corporation. Following that conference, FENOC's counsel has stated that FENOC will oppose this Motion. The NRC Staff's counsel indicated that NRC Staff does not oppose the filing of the motion, but that based on the information from the consultation email of Intervenors, and the phone conference, the Staff does not have enough information at this time to take a position on the admissibility of the proposed contention. Further, he stated that the Staff will respond to the contention in accordance with 10 C.F.R. 2.309, when filed.

E. Conclusion

Intervenors have met all preconditions to be granted leave for receipt of the within information into the record of this matter to amend and/or supplement their Motion for Admission of Contention 5. FENOC has offered up a very partial explanation to widespread shield building cracking which ignores or downplays forms of structural degradation besides sublaminar corrosion cracking. Moreover, the NRC Staff suggests that the state of cracking of the shield building is such that even a mild to moderate earthquake event could cause loss of 90% of the wall mass, which would comprise a tremendous failure of the structure as a protective barrier between Davis-Besse's nuclear reactor and the outer atmosphere, land and water.

WHEREFORE, Intevenors pray the Licensing Board grant them leave to amend and/or supplement their proffered Contention 5 in the particulars stated.

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Terry J. Lodge (Ohio Bar #0029271)
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Toledo, OH 43604-5627
Phone/fax (419) 255-7552
tjlodge50@yahoo.com
Counsel for Intervenors

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of	)	
		Docket No. 50-346-LR
First Energy Nuclear Operating Company	)	
(Davis-Besse Nuclear Power Station, Unit 1)		July 23, 2012
.	)	

*　　　　*　　　　*　　　　*　　　　*

CERTIFICATE OF SERVICE

We hereby certify that a copy of the "INTERVENORS' FOURTH MOTION TO AMEND AND/OR SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)" was sent by me to the following persons via electronic deposit filing with the Commission's EIE system on the 23rd day of July, 2012:

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

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

Administrative Judge
Nicholas G. Trikouros
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
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Respectfully submitted,

/s/ Kevin Kamps
Kevin Kamps, *in pro per*
Radioactive Waste Watchdog
Beyond Nuclear
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Takoma Park, MD 20912
Tel. 301.270.2209 ext. 1
Email: kevin@beyondnuclear.org
Website: www.beyondnuclear.org

/s/ Terry J. Lodge
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Counsel for Intervenors

Hernandez, Pete

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

From: Hernandez, Pete
Sent: Thursday, November 17, 2011 7:58 AM
To: Sanchez Santiago, Elba
Subject: Davis Besse Operability question

Good afternoon Michele,

I understand that the question of Operability vs design basis was posed and that if ~~this~~ these issue ~~was~~ is in operations space, are qualitative evaluations the extent of review required by the licensee?

To answer that, the distinction between Operability and Functionality needs to be understood. The most clear way I've had it explained is that the determination of Operability is tied to the Tech Specs for the specific plant. If the Tech Specs are met, then it is operable. (An operability determination is usually prompted by degraded conditions, nonconforming conditions or the discovery of an unanalyzed condition.) Functionality is tied to the design bases documented in the FSAR and thereby tied to the Current Licensing Basis.

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The licensee decided to not enter into an Operable but Degraded or Nonconforming determination and that the cracking issue is a design basis question hence functionality.

Speculating: The cracks in the building qualify as an unanalyzed condition so for the licensee to Operate with a degraded or nonconforming condition, they would have to develop a plan to fix the issue through their CA process. However, the licensee has stated that the SB is Operable as is, so there is nothing to fix. This still leaves the issue of the cracks unresolved so they are trying to prove that the cracks do not affect the functionality of the building. This led them to the design basis evaluations.

B/22

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From: Hernandez, Pete
Sent: Friday, November 04, 2011 9:35 AM
To: Sanchez Santiago, Elba
Cc: Zimmerman, Jacob; Mahoney, Michael
Subject: Questions about Davis Besse Shield Building Report from DORL

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Thanks,

Pete

Questions about Davis Besse Shield Building Report

C-CSS-099.20.054

Objective or Purpose (paragraph 3): In this calculation the structural integrity of the SB is evaluated considering the presence of an interfacial/circumferencial crack between the SB structural concrete shell (i.e., the 30" thick reinforced concrete SB) and each architectural flute shoulder (16 flute shoulders in total), as decribed in Attachment B.

This description makes me think that they are looking at a single crack going in a circle. From what I understood the crack is pervasive along the entire surface, spidering in all directions, similar to a pane of tempered glass breaking. The description in Attachment B addresses only the crack at the opening and assumes that the crack is right along the rebar line. The core bores have shown that the cracks are at different depths so this doesn't seem to capture the current situation. Throughout the calculation, the word Crack, singular, is used. They also mention that the extent of the crack is only 10'-12'. This seems to greatly downplay the issue.

Scope of Calculation/Revision (bullet 4): Maximum concrete crack width under flexure is calculated and compared with the allowable value (Section 7.5). Note that this maximum crack width evaluation only applies to the structural concrete (i.e., the 30" thick reinforced concrete SB shell). In particular, the width of any cracks in the 16 nonstructural architectural flute shoulders is not addressed.

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This seems to say that they are just doing calculations for the new concrete that is and ignores the rest of the building altogether. Is that right?

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B/9

This use of singular terminology also discounts this calculation because it seems that they are looking at only 1 crack and 1 shoulder or 1 flute. Because cracks have been found through multiple core bores, shouldn't the appropriate calculations account for the combined effects of cracks in all the shoulders and not just one by the opening and not just individually?

Section 6.2 (page 7): Based on Impulse Response testing, the actual crack length is 10 to 12 feet long.
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From:	Sheikh, Abdul
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Cc:	Hoang, Dan; Manoly, Kamal; Sakai, Stacie
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B/26

Genesky, Donielle

From:	Kevin Kamps <kevin@beyondnuclear.org>
Sent:	Friday, January 23, 2015 10:58 PM
To:	Puco Docketing
Subject:	OPPOSITION COMMENT UNDER CASE # 14-1297-EL-SSO: (#10) 6th Cracking-Related Safety & Environmental Contention in Opposition to Risky Davis-Besse 20-Year Licence Extension.
Attachments:	FOIA Appendix B contention supplement 8 16 2012.pdf

OPPOSITION COMMENT UNDER CASE # 14-1297-EL-SSO: (#10) 6th Cracking-Related Safety & Environmental Contention in Opposition to Risky Davis-Besse 20-Year Licence Extension.

Dear Public Utilities Commission of Ohio,

I have sent nine previous emailed submissions re: Davis-Besse vis a vis this proceeding.

I am now submitting for the record of this proceeding, our sixth Davis-Besse Shield Building concrete containment cracking related contention, titled "INTERVENORS' FIFTH MOTION TO AMEND AND/OR SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)," dated August 16, 2012.

This document posted online at:

http://www.beyondnuclear.org/storage/FOIA%20Appendix%20B%20contention%20supplement%208%2016%202012.pdf

This document is also attached to this email.

This filing cited U.S. Nuclear Regulatory Commission (NRC) documents revealed through a Freedom of Information Act (FOIA) request submitted by Beyond Nuclear.

These NRC FOIA response documents are posted online at:

http://www.beyondnuclear.org/relicensing/2012/8/11/nrc-foia-documents-regarding-davis-besse-shield-building-cra.html

Our environmental coalition intervening against Davis-Besse's 20-year license extension includes: Beyond Nuclear; Citizen Environment Alliance of Southwestern Ontario; Don't Waste Michigan; and Green Party of Ohio.

Bowling Green, Ohio resident Phyllis Oster, a member of Beyond Nuclear, provides Beyond Nuclear standing in the Davis-Besse License Renewal Application proceeding.

Our legal counsel is Terry Lodge of Toledo, Ohio.

Given the catastrophic risks associated with Davis-Besse's severely cracked, and worsening, concrete containment Shield Building, we urge that PUCO not approve FENOC's request for a massive ratepayer bailout.

Thank you.

Sincerely,

Kevin Kamps, Beyond Nuclear

--
Kevin Kamps
Radioactive Waste Watchdog
Beyond Nuclear
6930 Carroll Avenue, Suite 400
Takoma Park, Maryland 20912
Office: (301) 270-2209 ext. 1
Cell: (240) 462-3216
Fax: (301) 270-4000
kevin@beyondnuclear.org
www.beyondnuclear.org

Beyond Nuclear aims to educate and activate the public about the connections between nuclear power and nuclear weapons and the need to abandon both to safeguard our future. Beyond Nuclear advocates for an energy future that is sustainable, benign and democratic.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of	)	
		Docket No. 50-346-LR
First Energy Nuclear Operating Company	)	
(Davis-Besse Nuclear Power Station, Unit 1	)	August 16, 2012
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* * * * *

INTERVENORS' FIFTH MOTION TO AMEND AND/OR SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)

Now come Beyond Nuclear, Citizens Environment Alliance of Southwestern Ontario (CEA), Don't Waste Michigan, and the Green Party of Ohio (collectively, "Intervenors"), by and through counsel, and move the Board for leave to further supplement and amend their proposed Contention No. 5, which addresses the shield building cracking phenomena at the Davis-Besse Nuclear Power Station ("Davis-Besse"). This supplementation focuses on a new collection of information recently provided to Intervenors on the Davis-Besse shield building cracking via the U.S. Nuclear Regulatory Commission's ("NRC" or "Staff") response (FOIA/PA-2012-0121) to Intervenors' January 26, 2012 request made under the Freedom of Information Act (FOIA).

A. Background

On January 10, 2012, Intervenors moved for admission of a new Contention No. 5, which states:

> Intervenors 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.

NRC has proposed alternative wording which would transform the contention into a contention of omission. FirstEnergy Nuclear Operating Company ("FENOC") and the Staff timely responded to the original contention motion.

Intervenor's first "MOTION TO AMEND 'MOTION FOR ADMISSION OF CONTENTION NO. 5'" was filed on February 27, 2012. It is posted online at: http://www.beyondnuclear.org/storage/Coalition%20filing%20contention%20amdt%202%2027%202012.pdf. It was based on revelations of the significance of the cracking first made public by U.S. Representative Dennis Kucinich (D-OH) on February 8, 2012. Rep. *Kucinich's revelations are posted online at* http://kucinich.house.gov/news/documentsingle.aspx?DocumentID=278784.

On February 28, 2012, FENOC furnished the NRC with its "Root Cause Analysis Report" ("Root Cause Analysis" or "RCA"), ML120600056. Then, on April 5, 2012, FENOC promulgated an "aging management plan", or AMP (ML12097A216), the purpose of which is to specify arrangements prospectively to oversee and deal with the shield building's historic cracking phenomena.

On June 4, 2012, Intervenors' timely submitted their second "INTERVENORS' MOTION TO AMEND AND SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING)," in response to FENOC's AMP. This filing is posted online at http://www.beyondnuclear.org/storage/June%204%202012%20Motn%20to%20Amend%20Supp%20Contn%205%20COMPLETE-1.pdf.

Intervenors moved on July 16, 2012 to supplement (their Third Supplement) their cracking contention for the purpose of exposing discrepancies between FENOC's May 16, 2012 Revised "Root Cause Analysis Report" ("RRCA"), and other analyses of the shield building problems. This third supplement is posted online at http://www.beyondnuclear.org/storage/3rd%20%20Motion%20COMPLET%20supp%20cracked%20concrete%20containment%20contention%20July%2016%202012.pdf.

Intervenors moved on July 23, 2012, to supplement (their Fourth Supplement) their cracking contention, based on previously undisclosed information contained in FENOC contractor Performance Improvement International's (PII) report, "Root Cause Assessment: Davis-Besse Shield Building Laminar Cracking, Vol. 1." This PII report was added to the NRC's ADAMS system on May 24, 2012 as ML12138A037, which is one of multiple volumes of PII analysis added to ADAMS that day. Intervenors' July 23, 2012 motion demonstrated inconsistencies between FENOC's February 2012 Root Cause Analysis and the findings of FENOC's consultant, PII. This fourth motion is posted online at http://www.beyondnuclear.org/storage/4th%20Motion%20PII%20COMPLET.pdf; its supportive exhibits are posted online at http://www.beyondnuclear.org/storage/4th%20Motion%20PII%20Complet%20FOIA%20attachments.pdf.

Intervenors are now moving to itemize the divergences and issues of fact between the proposed license action and the true status of the Davis-Besse shield building, in light of the NRC's response to Intervenors' January 26, 2012 FOIA request regarding Davis-Besse shield building cracking (FOIA/PA-2012-0121).

NRC's FOIA Response Number 1 is dated June 12, 2012, is postmarked June 14, 2012, mailed via U.S. Postal Service PRIORITY MAIL (a form of First Class mail), and received some days later by Intervenors.

Intervenors are timely acting to itemize these divergences and issues of fact between the proposed license action and the true status of the Davis-Besse shield building by making this filing within the 60-day period set forth in the Initial Scheduling Order in this case, as complemented by the additional 3 days provided *by NRC's licensing proceeding regulations regarding "Computation of time,"* 10 CFR 2.306(b), subpart (1).[1]

Intervenors maintain that there is serious incongruity between the cracking problems as defined by FENOC, and the proposed remedy, exemplified by the AMP. The scope of the admitted cracking is far narrower than the identified cracking, and the potential for further aging-related concrete and rebar problems in the Davis-

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[1] *From p. 12 of Initial Scheduling Order, ASLBP No. 11-907-01-LR-BD01 (June 15,* 2011): "The Board directs 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 to the moving party through service, publication, or any other means. If filed thereafter, the motion and proposed contention shall be deemed nontimely under 10 C.F.R. §2.309(c). If the movant is uncertain, it may file pursuant to both sections." 10CFR2.306(b), *subpart* (1), *reads:* "(1) If a notice or document is served upon a participant, by first-class mail only, three (3) calendar days will be added to the prescribed period for all the participants in the proceeding."

Besse shield building may include the loss of up to 90% of the shield building walls with the collapse of outer layers of concrete and rebar, or in other words, the shield building could fall, according to NRC documents revealed to Intervenors by FOIA/PA-2012-0121, Response Number 1.

B. Issues of Fact And Inconsistencies Between Proposed License Action And Revelations Documented In NRC FOIA Response Number 1, Appendix B

1. Timeliness

Intervenors hereby supplement their Davis-Besse concrete shield building cracking contention with the following points from NRC's initial, partial response (Response Number 1, dated June 12, 2012; postmarked June 14, 2012; sent via U.S. Postal Service Priority Mail, a category of First Class Mail; and received some days later by Intervenors) to Intervenors' FOIA request (FOIA/PA-2012-0121) dated January 26, 2012. Intervenors note that NRC's FOIA Response Number 1, Appendix B, mentions many additional documents which have not yet been provided to them. Although it should not be necessary, Intervenors will explicitly request from NRC's FOIA office those named documents, in a follow on FOIA request, if they are not provided in the near future. NRC's withholding of documents, potentially significant to Intervenors' cracked concrete containment contention, puts Intervenors at a distinct disadvantage in this proceeding, in contravention of applicable laws and regulations.

This contention supplement does not include issues raised in FOIA Response Number 1, Appendix A, "Agency records subject to the request that are...already available for public inspection...". Appendix A documents were more than 60 days old, and, according to NRC's FOIA officer, had been previously made available to the public, via the NRC Public Document Room and ADAMS system.

Likewise, this contention supplement does not include issues raised in NRC FOIA Response Number 2 (date stamped July 12, 2012), Appendix C, "Agency records subject to the request that are...already available for public inspection...". Appendix C documents were more than 60 days old, and, according to NRC's FOIA officer, had been previously made available to the public, via the NRC Public Document Room and ADAMS system.

This fifth supplement also does not include supplementation associated with NRC FOIA Response Number 3 (date stamped July 27, 2012; postmarked August 1, 2012; sent via U.S. Postal Service First Class Mail; received some days later by Intervenors), Appendix D. Although Appendix D does contain documents previously not made available to the public, Intervenors have not yet been able to analyze their contents for relevance and applicability to their concrete containment cracking contention. Intervenors reserve the right to submit a contention supplement based on relevant revelations in Appendix D, by the 60-day deadline, complemented by 10 CFR 2.306 provisions.

Yet again, as with the previous appendixes, Appendix D indicates that, as of July 27, 2012, NRC is "... continuing to process your request." As the FOIA response is incomplete, Intervenors also reserve the right to further supplement their contention, based on applicable revelations contained in future appendixes provided by NRC regarding FOIA/PA 2012-0121.

Such additional new information, contained in Appendix D/Response Number 3, and Appendixes/Response Numbers beyond that, could well derive from the additional relevant documents mentioned in NRC's FOIA Response Number 1/Appendix B, but not yet provided to Intervenors in Appendix B.

Rather, this contention supplement focuses exclusively on Appendix B, "Agency records subject to the request that are ... being made available" for the first time. As newly available information, Appendix B revelations afford Intervenors 60 days in which to supplement their contention, per the ASLB's Initial Scheduling Order, as complemented by 10 CFR 2.306 provisions. Thus, Intervenors' fifth contention supplement is timely, as it is submitted within the 60 days allowed for by the ASLB's Initial Scheduling Order, considering the time period required for the mailed FOIA Response Number 1 documents to reach Intervenors via the U.S. Postal Service PRIORITY MAIL, a form of First Class Mail. The 60 days allowed by the Initial Scheduling Order in this proceeding is complemented by 10 CFR 2.306(b), subpart (1), which allows an additional three calendar days.

2. Issues of Fact and Inconsistencies

Per the NRC FOIA officer's format, Intervenors refer to NRC's Appendix B FOIA Response Number 1 documents as B/1, B/2, etc. In addition, Intervenors restate the DATE and DESCRIPTION/(PAGE COUNT), as provided by the NRC FOIA officer on the cover sheet/table of contents for APPENDIX B, RECORDS BEING RELEASED IN THEIR ENTIRETY, as provided to Intervenors.

Document B/1 [undated; Davis-Besse Nuclear Power Plant, Unit Licensing Basis Seismic Ground Motion Concern, (3 pages)]:

Although undated, this document is almost certainly from October 10, 2011 or thereafter, as that was the date range of Intervenors' FOIA request (October 10, 2011 to January 26, 2012).

In its section titled "Concern," NRC states:

> During original review prior to operation, ACRS Committee believed 0.20g bedrock ground acceleration was more appropriate for Davis-Besse (DB) site than 0.15g used for design of structures, systems, and components.
>
> Paragraph 2C.3.4 of DB USAR [Revision 28] indicates Maximum Possible Earthquake (SSE [Safe Shutdown Earthquake]) design acclerograms *(sic)* were derived using 0.15g maximum ground acceleration. DB USAR specifies seismic design based on 0.15g not 0.20g for SSE. OBE seismic response spectra derived from SSE spectra using 0.08g/0.15g ratio.

In its section titled "Discussion," NRC states:

> During review to determine current design and licensing bases for DB shield building, Supplement No. 1 to NUREG-0136 documented ACRS Committee concern that 0.20g ground acceleration was more appropriate than 0.15g used in design.
>
> The Committee recommended that the staff review in detail the plant systems needed to accomplish safe shutdown of the reactor and continued heat removal for a safe shutdown earthquake acceleration of 0.2g and that Regulatory Guide 1.60, "Design response Spectra for Seismic Design of Nuclear Power Plants," should be applied at the foundation level of the facility.
>
> Staff agreed with Committee and conditioned the license to require that analysis and evaluation be completed prior to startup following the first regularly scheduled refueling outage.
>
> Of note, the licensee documented the position that 0.15g was appropriate – see above references. However, these letters predate the removal to the license condition and the NRR Safety Evaluation.

In its section entitled "Concern," NRC states:

What is the appropriate <u>licensing basis</u> maximum ground acceleration (SSE) at bedrock, 0.20g per ACRS Committee and licensing condition or 0.15g per Paragraph 2C.3.4 of DB USAR?

Non-conservative design scenario:

- Licensee modifies one of the reanalyzed systems or components
- Licensee uses Regulatory Guide 1.61 higher damping values
- Using seismic loading based on 0.15g ground motion would not be in accordance with ACRS Committee or prior licensing condition

Of note, recent functionality evaluations for shield building laminar (sic) indicated additional margin could be captured using higher SSE damping 7% damping (sic) for reinforced concrete permitted by current revision of Regulatory Guide 1.61.

- The functionality evaluation based on 0.15 not 0.20 maximum ground acceleration – shield building is anchored to bedrock.
- Will licensee use 7% damping for revised design

Document B/1 reveals that both ACRS and NRC Staff were concerned about seismic risks at Davis-Besse long before the revelation of shield building cracking in October 2011. In fact, these concerns date back to the mid-1970s, prior to Davis-Besse's operations. However, as revealed by the passage "Staff agreed with [ACRS] Committee and conditioned the license to require the analysis and evaluation be completed **prior to startup following the first regularly scheduled refueling outage**" (emphasis added), despite these seismic risk concerns, NRC allowed Davis-Besse to commence operations before addressing them. In that way, NRC allowed for "facts on the ground" (Davis-Besse's operational status) to preclude fundamental seismic safety upgrades, as impossible or un-economic, especially considering irradiation of plant systems, structures, and components. After all, Davis-Besse was already constructed, operational, and radioactive. But even then, NRC agrees that FENOC's *post hoc* pencil whipping and paper fixes are "non-conservative."

NRC FOIA Response Number 1's inclusion of Document B/1 shows that 36 years after ACRS and NRC Staff first expressed seismic risk concerns at Davis-Besse, these concerns still haunt the facility – now, frighteningly, in the context of a severely cracked shield building.

Document B/2 [10/14/11; Email from P. Hernandez, NRR to J. Zimmerman, NRR RE: 2011-10-13, POP – Davis-Besse Containment Shield Building, (1 page)]:

NRC's Pete Hernandez initially downplayed the risk of Davis-Besse shield building cracking revealed just days earlier:

> ...After discussion it was decided that if no structural cracks were found through the chipping process, then we would be satisfied. If they were found, then we have to reevaluate. No one expects any cracks to be found...The expectation right now is that there will be no structural cracks found and this will be a non-issue...

However, as U.S. Rep. Dennis Kucinich (D-OH) not only revealed to the public, but also clearly explained (as opposed to NRC and FENOC) on February 8, 2012 (as cited above), the Davis-Besse shield building cracks *are structural.* In fact, *the outer rebar layer of the shield building is assumed to be dysfunctional.*

Document B/3 [10/18/11; Email from J. Zimmerman, NRR to P. Hernandez, NRR Re: FYI – Davis Besse Shield Building issue update, (1 page)]:

Intervenors note the significance of this 10/18/11 NRC internal Staff discussion of PN [Public Notification] about the shield building cracking. The cracking was first discovered on 10/10/11, and yet more than a week later, NRC had still not done public notification. Thus, not only were Intervenors still being left in the dark about this safety significant aging issue, but so was the general public.

Document B/4 [10/18/11: Email from S. CuardadoDeJesus (sic), NRR to R. Auluck, NRR et al. on Davis-Besse Shield Building Issue Summary. (2 pages)]:

In this one- page summary, NRC reported:

> ...Per their ["industry experts from Sargent and Lundy, and Bechtel"] expert opinion the indications found in the concrete were a product of the hydro-blasting operations and not a pre-existing condition...The NRC inspectors concur with the actions taken to date by the licensee and continue to evaluate the licensee's preliminary conclusions that the indications are related to the hydro-demolition and do not appear to be preexisting flaws in the concrete shield building.

Of course, this directly contradicts FENOC's Blizzard of 1978 root cause explanation. It's significant that Bechtel admitted the "hydro-demolition" or "hydro-blasting" operations caused the cracking, as they were the very contractor carrying out the hydro-blasting. If Bechtel could have avoided blame for the cracking, it stands to reason that it would not have pointed to its own hydro-blasting operations as the root cause.

NRC Staff's, FENOC's, Bechtel's, and Sargent and Lundy's initial conclusion, that hydro-blasting had caused the sub-surface laminar cracking first discovered on 10/10/11, is solid evidence and strong support for a hearing on the merits of a significant license extension aging issue. FENOC plans a 2014 hydro-blasting demolition of the shield building, in order to replace Davis-Besse's already age-degraded steam generators. As NRC, FENOC, Bechtel, and Sargent and Lundy each admitted was not only possible, but even probable, in the referenced "Davis-Besse Shield Building Potential Cracking Issue" summary included in Document B/4, this planned 2014 hydro-blasting breach of the shield building could well exacerbate the shield building cracking.

FENOC has stated that it "voluntarily" replaced its second reactor lid with a third one "early," ahead of its original 2014 time schedule for doing so. But FENOC's "voluntary" action was necessitated by the fact that the second lid had already suffered premature, significant degradation (due to primary coolant boric acid leakage, similar to the 2002 Davis-Besse Hole-in-the-Head Fiasco), and thus lasted only from 2004 to 2011, rather than to the planned 2014. Thus, it appears that FENOC had planned to breach the shield building just once – in 2014 – in order to replace both the second reactor lid with a third one, as well as to replace the original, degraded steam generators with a new, second set. But now, given the 2011 breach to swap out reactor lids, FENOC will have to breach the shield building not once, but twice, in 2011 and 2014. This added breach by hydro-blasting in 2014 risks inflicting yet more damage on the shield building. This is an aging-related safety issue that could very well increase the safety and environmental risks of the proposed license extension operations from 2017 to 2037.

Document B/9 [11/04/11, Email from P. Hernandez, NRR to E. Sanchez Santiago, RIII on Questions about Davis Besse Shield Building Report from DORL. (2 pages)]:

In this email, written a month after the sub-surface laminar cracks were first announced, NRC's Pete Hernandez asks significant questions and makes important observations regarding calculation C-CSS-099.20.054:

> This description makes me think that they are looking at a single crack going in a circle. From what I understood **the crack is pervasive along the entire surface, spidering in all directions, similar to a pane of tempered glass breaking.** The description in Attachment B addresses only the crack at the opening and assumes that the crack is right along the rebar line. **The core bores have shown that the cracks are at different depths so this doesn't seem to capture the current situation.** Throughout the calculation, the

word Crack, singular, is used. They also mention that the extent of the crack is only 10'-12'. **This seems to greatly downplay the issue.**

> At this point core bores of only the shoulders have been taken. So the only crack widths we are aware of are those in the shoulders, which are not being addressed. **How can an analysis be done on the structurally credited concrete if no data from that area, in the form of core bores, has been taken? Shouldn't the structural integrity of the shoulders be calculated as well?**
>
> This seems to say that they are just doing calculations for the new concrete that is and **ignores the rest of the building altogether.** Is that right?
>
> This says to me, that they are ignoring the shoulders, **if they are ignoring all that concrete, it seems to be the opposite of conservative for evaluating the mechanical loads. (emphasis added)**

Regarding calculation C-CSS-099.20.055, it is written: "The purpose of this calculation is to demonstrate that during a seismic event, with the development of the crack in the architectural flute shoulder, the capacity of the rebar(s) can still provide adequate anchorage thus *prevent cracked concrete piece from falling*, and therefore Seismic II/I condition can be maintained." (emphasis added)

NRC's Pete Hernandez responded, alarmingly:

> **I think the greater concern is will the SB stay standing** and not whether or not the decorative concrete will fall off. Because the licensee has not performed core bores to see if there is cracking in the credited concrete, **do they have a basis to say that the structural concrete will maintain a Seismic II/I condition?"**
>
> This use of singular terminology also discounts this calculation because it seems that they are looking at only 1 crack and 1 shoulder or 1 flute. **Because cracks have been found through multiple core bores, shouldn't the appropriate calculations account for the combined effects of cracks in all the shoulders** and not just one by opening and not just individually?
>
> From what I understand, **IR [Impulse Response] mapping is only an indicator, but must be validated by core bores.** Does basing all

> the calculations on a length of a 12 foot crack discount the calculations altogether, because we have indications of cracks at distances greater than 12 feet. This also seems to assume that there is only 1 crack and not many as the core bores seem to prove. **Isn't IR mapping only useful at a limited depth too, so that using it to evaluate a 48" thick piece of concrete is not realistic? (emphasis added)**

Hernandez' questions echo concerns of Intervenors, such as the need for a comprehensive understanding of the cause(s), location(s), and the structural, safety, and environmental significance of cracking across the entire shield building, not just arbitrarily narrow, supposedly non-structural parts of the shield building. His questions also point to the need for empirical data, not just qualitative arguments, as Intervenors have also asserted in previous filings pertaining to this contention.

Hernandez also questions the limitations of Impulse Response mapping, emphasizing the need for complementary core bore sampling. Intervenors assert that such in depth testing needs to happen at not just an arbitrarily small number of locations, on an inadequately infrequent basis, but across the shield building on a regular basis, given the risk significance, as captured in his own words: "**the greater concern is will the SB stay standing**"?

Document B/10 [11/07/11: Davis Besse Shield Building Issue NRC Technical Reviewer Focus Questions. (1 page)]:

NRC's question, "Is extent of condition adequately understood, given limited data points?" echoes Intervenors' questions along the same lines. It is noteworthy that not only this question, but also those below, remain unanswered—at least in terms of the documents provided by NRC in Response Number 1/Appendix B, to Intervenors' FOIA request.

NRC then asked:

Does the licensee's analysis provide reasonable assurance that the shield building will perform its design function? Why or why not?

a. If yes, does the shield building remain in conformance with all licensing and design basis requirements including required Codes and required safety margins? **Note that if the shield building is functional but nonconforming, then the licensee would be able to restart the plant, but would be expected to have a plan in place to restore conformance (additional analysis, repairs, or license amendment) at the next reasonable opportunity. (emphasis added)**

NRC's generous allowance to FENOC until "the next reasonable opportunity" to have a plan for restoring conformance is akin to the mid-1970s permissiveness (see Document B/1) which allowed Davis-Besse to commence operations, despite significant lingering questions about seismic risks. It makes a mockery of NRC's regulations, which should strictly require Davis-Besse to operate at all times under its original licensing and design bases.

Finally, NRC asked:

3. Has the licensee provided reasonable assurance that the shield building will remain capable of performing its design function **in the near and distant future (i.e. the condition will not worsen)?** Why or why not? If not, are we comfortable until the next refuel outage (May 2012) and why, and **what additional actions from the licensee, if any, do we think are necessary going forward? (emphasis added)**

On their face, NRC's questions show that these matters are aging related and unresolved, bolstering Intervenors' contention as worthy of a hearing on the merits.

Document B/13 [11/09/11; Email from P. Hernandez, NRR to R. Auluck, NRR et al. Re: Davis Besse Shield Building teleconference. (1 page)]:

In a classic example of the tail wagging the dog, NRC's Pete Hernandez wrote: "Though the licensee wants to button up this issue and plans to go to Mode 4 on Nov. 18^{th}, please review the evaluations as thoroughly as possible."

This email's revelation that FENOC desired to begin to restart Davis-Besse on November 18, 2011 is significant. As reflected in Intervenors' original contention (January 10, 2012), about this very same time, NRC Region 3's tone in media coverage changed significantly – and inexplicably, at least to Intervenors and the public -- from one of questioning the root cause, extent of condition, and corrective actions necessary, to one that yielded to FENOC's right to decide when it wanted to restart Davis-Besse. In fact, just two weeks later, NRC approved Davis-Besse's restart, via the December 2, 2011 Confirmatory Action Letter.

Document B/15 [11/11/11: Email from J. Zimmerman, NRR to M. Evans, NRR re: DB shield building. (1 page)]:

This document reveals "alignment" at NRC Region 3 on the Davis-Besse shield building cracking issue, as well as a sense of urgency, as indicated by overtime work by NRC staff on the weekend ("We authorized them to work OT [overtime] (Saturday) to listen into that call."). Based on the revelation in Document B/13 above, that FENOC desired commencing restart by 11/18/11, Intervenors are most concerned that a "tail wagging the dog" dynamic effectively pressured NRC to sign off on a hasty "rush to restart," despite significant lingering safety questions and concerns not only related to current operations, but also aging management during the proposed license extension. Many of these questions and concerns have still not been resolved.

Document B/16 [11/12/11: Discussion points relayed to the licensee after our internal technical discussion (1 page)]:

The sense of urgency created by FENOC's desired rush to restart clearly pressured NRC Staff, as shown by NRC's and FENOC's conference call, unusually held on a weekend, Sunday, November 13, 2012.

NRC's significant, lingering concerns, its questioning of FENOC's illogical arguments, as well as its need to push back against FENOC's pressure to rush restart approval, are exemplified by NRC's statements "Current 12/12/11 (sic, 11/12/11?) completion as part of CR-2011-3346 is **not acceptable for justification for earlier restart**," and "NRC needs this clear and concise report ["Compilation of calculations, testing, etc."] with sufficient time for review **prior to startup." [emphasis added]** It is remarkable that NRC had to explicitly demand sufficient time for safety review prior to restart, begging the question, who had actual, ultimate restart authority, NRC or FENOC? Shouldn't that authority reside with the federal government's regulatory agency, charged with protecting public health and safety against nuclear risks? This bodes ill for NRC's safety and environmental enforcement vis a vis the proposed 20-year license extension, bolstering the worthiness of Intervenors' contention for a hearing on the merits.

NRC's "Technical concern," that "ACI [American Concrete Institute] 349.3R [is] not applicable to laminar cracking," confirms Intervenors' fear that Davis-Besse's cracking problem is unprecedented and unique. This uncharted territory is deserving of the most rigorous aging management program possible, especially given the proposal for a 20-year license extension. FENOC's efforts thus far fall far short of what is needed to ensure ongoing functionality of the shield building, especially under accident or disaster conditions.

NRC's "technical concerns" continued:

> b. 360°degree laminar crack does not address Prf. Darwin's concern that circumferential steel be located outside crack region to support the conclusion that "no mode change or operating restrictions" are required.
>
> > i. Were the professors aware of the 360° postulated laminar cracking in upper shield building?
> > ii. Appear Prof. Darwin stipulates cracking to be outside spliced region.

Given that cracking, and other shield building degradation and flaws, have been documented in areas of spliced rebar, NRC's expressed concerns are most significant.

Such concerns are elaborated further in NRC's "Technical Notes":

a. Top of shield building – 360° around 20′ down from the top
   i. Challenges Prof. Darwin concern that rebar splices be outside cracked region
   ii. No ACI standard for evaluation and no licensee structural evaluation
b. Concern that sampling did not eliminate I.F. cracking at top of SB **(different undefined failure mechanism Then [sic] in the shoulder)**
c. Outside shoulder area at top, what is the technical explanation of why the cracking is limited to the outer rebar mat and does not extend through the rebar mat thickness.
d. Any splice in cracked regions require further evaluation – Prof. Darwin
   i. Design calc – fully effective rebar, **unverified assumption (ACI 349.3R not applicable to laminar cracking) [emphasis added]**

As alleged by Intervenors in previous contention supplements, NRC has here confirmed that the cracking at the top of the shield building represents a "**different undefined failure mechanism [than] in the shoulder.**" This challenges FENOC's overly simplistic Blizzard of 1978 root cause explanation for the different kinds of cracking found across the shield building. In fact, if "I.F." stands for "Inner Face" of rebar, that would deepen Intervenors' concerns. After all, the "Outer Face" of rebar has already been declared structurally dysfunctional by NRC and FENOC – although it took Rep. Kucinich's persistence to clearly communicate this basic, most safety- and environmentally-significant fact to the public.

Significantly, cracking at the "Top of shield building – 360° around 20' down from the top ... Challenges Prof. Darwin concern that rebar splices be outside cracked region," and there is "No ACI standard for evaluation and no licensee structural evaluation." The cracking is indeed most safety- and environmentally-significant, unique, and unprecedented, all reasons to hold a hearing on these matters.

Document B/18 [11/15/11: Email from P. Hernandez, NRR to J. Zimmerman, NRR on Draft email. (1 page)]

This document states "The licensee requested a delay of the public meeting to give them more time to finish the splice evaluation. The NRC accepted so that we would have time to review the documents before the meeting."

This coordination between FENOC and NRC regarding the timing of a public meeting on the shield building cracking is evidence of collusion that is disconcerting to Intervenors. Neither Intervenors, nor the public, had even been informed in any way that a public meeting would be held on the issue, and yet NRC agreed to FENOC's request to delay the yet-to-be-announced public meeting. Instead, Intervenors were left to scramble for information about the cracking, in the 60-day time window allotted for contention submission based upon new information.

Intervenors remain thankful to U.S. Representative Dennis Kucinich (D-OH), who on November 21, 2011 [see

http://kucinich.house.gov/news/documentsingle.aspx?DocumentID=270017]
requested of then NRC Chairman Jaczko a public meeting in northern Ohio about the shield building cracking prior to Davis-Besse's restart. In the end, however, NRC suddenly, and inexplicably, approved restart with the issuance of its Confirmatory Action Letter (CAL) on December 2, 2011, despite unresolved questions of root cause, extent, safety significance, and corrective actions associated with the shield building cracking. FENOC then began restarting Davis-Besse immediately. The long-delayed public meeting was not held until January 5, 2012 – a month *after* Davis-Besse's restart. Intervenors incorporated revelations from the January 5th meeting into its cracking contention, and submitted it five short days later, on January 10, 2012.

Document B/19 [11/15/11: Email from P. Hernandez, NRR to M. Evans, NRR et al. RE: Updated Davis-Besse Containment Shield Building POP. (1 page)]

This document sheds more light on this lack of public accountability and transparency, and the collusion between NRC and FENOC. On November 15th, NRC's Michele Evans informed NRC's Pete Hernandez *et al.* that "a public meeting will be held tomorrow afternoon from 2pm – 6pm (eastern) in Region 3" regarding the "Updated Davis-Besse Containment Shield Building POP."

But then later that same day, Hernandez informed Evans *et al.* that the "public meeting" had been "postponed until Thursday [Nov. 17] ... so that the licensee has more time to finish their calculations of the rebar splices and so that we can review them beforehand. It was at the licensee's request that it was changed."

This begs the question, how "public" was this "public meeting"? Isn't NRC supposed to announce "public meetings" 10 days in advance, so that the public has the opportunity to hear about it, and make preparations for attending? In this case, at most a mere one or two day's notice could have been given: after all, the meeting, apparently originally scheduled for Nov. 16th, was postponed on Nov. 15th till Nov. 17th, at FENOC's request. To the best of Intervenors' knowledge, absolutely no public notice of the meeting was given in advance.

Suffice it to say, no members of the public – including Intervenors, who are parties to the Davis-Besse license extension proceeding, and who have filed environmental as well as safety contentions unrelated to the issue of shield building cracking – even knew about the "public meeting" until long after it was over. It is telling to compare and contrast FENOC's ability to pressure NRC for "public meeting" postponements on short notice, as well as NRC's lack of public notice about such "public meetings," with the very "strict by design" deadlines faced by Intervenors in this very proceeding. As NRC hurriedly checked a box on this "public meeting" in its rush to approve Davis-Besse's restart (a mere two weeks after this un-announced "public meeting"), Intervenors and the public were left in the dark; any pretense of openness and transparency were steamrolled. Especially considering the economic – NRC is a federal agency with a billion dollar annual budget and 4,000 staff persons; FENOC is a multi-billion dollar corporation, with thousands of executives, managers, employees, and contractors -- this is beyond unfair. It is unjust. In the end, Intervenors had to learn about a November 17, 2011 "public meeting" 8 months after it took place, through a FOIA request.

<u>Document B/21 [11/16/11: Email from P. Hernandez, NRR to R. Auluck, NRR et al., on Davis Besse conf call. (1 page)]</u>

This document reflects the complexity of the shield building cracking problem, as NRC staff reserved a conference room "for the rest of the day" in order to conduct a 7-hour-long conference call, from 10am to 5pm on November 16, 2011. This is significant, given Document B/15's revelation that FENOC desired to commence restart as early as November 18, 2011. This day-long NRC Staff meeting took place just one day before the unannounced "public meeting" mentioned immediately above, and a mere two days before FENOC desired to commence restart operations.

Document B/22 [11/17/11; Email from P. Hernandez, NRR to E. Sanchez Santiago, RIII on Davis Besse Operability question. (1 page)] and Document B/24 [11/17/11; Email from P. Hernandez, NRR to M. Evans, NRR et al., on Davis Besse Operability question. (2 pages)]

This document provides important insight into NRC Staff members' struggle to understand the regulatory and legal basis (or lack thereof) for allowing Davis-Besse to continue operating, given its severely cracked shield building. (Comparing Document B/24 [11/17/11; Email from P. Hernandez, NRR to M. Evans, NRR et al., on Davis Besse Operability question. (2 pages)] to B/22, it appears to Intervenors that the former was the final version, while the latter was a draft.)

NRC's Pete Hernandez wrote:

> I understand that the question of Operability vs design basis was posed and that if the SB issue is in operations space, are qualitative evaluations the extent of review required by the licensee?
>
> To answer that, the distinction between Operability and Functionality needs to be understood. The most clear way I've had it explained is that the determination of Operability is tied to the Tech Specs for the specific plant. If the Tech Specs are met, then it is operable. (An operability determination is usually prompted by degraded conditions, nonconforming conditions or the discovery of an

unanalyzed condition.) Functionality is tied to the design bases documented in the FSAR [Final Safety Analysis Report] and thereby tied to the Current Licensing Basis.

From IMC9900

> "If an SSC [System, Structure, or Component] described in the TSs [Tech Specs] is determined to be operable even though a degraded or nonconforming condition is present, the SSC is considered "operable but degraded or nonconforming." An SSC that is determined to be operable but degraded or nonconforming is considered to be in compliance with its TS LCO [Limiting Condition for Operation, defined at NRC's website Glossary as "The section of Technical Specifications that identifies the lowest functional capability or performance level of equipment required for safe operation of the facility."] and the operability determination is the basis for continued operation. **The basis for continued operation should be frequently and regularly reviewed until corrective actions are successfully completed.**" (emphasis added)

The licensee decided to not enter into an Operable but Degraded or Nonconforming determination and that the cracking issue is a design basis question hence functionality. [this section was denoted by a hand written bracket by someone at NRC]

Speculating: The cracks in the building qualify as an unanalyzed condition so for the licensee to Operate with a degraded or nonconforming condition, they would have to develop a plan to fix the issue through their CA [Corrective Action] process. However, the licensee has stated that the SB is Operable as is, so there is nothing to fix. This still leaves the issue of the cracks unresolved so they are trying to prove that the cracks do not affect the functionality of the building. This led them to the design basis evaluations.

It is evident from NRC's internal wrestling match that not only FENOC, but also the regulatory agency itself, were walking a regulatory tightrope, or threading the needle, in their efforts to justify a rushed restart at Davis-Besse. But rush the restart they did: NRC granted its approval via a Confirmatory Action Letter (CAL) just two weeks after this email was written, and FENOC began restarting Davis-Besse immediately.

However, playing fast and loose with "operable" versus "functional," or "operability" versus "design basis," nonetheless leaves the shield building at risk of not working when required, especially with age-related worsening of cracking over the proposed 20 year license extension.

As NRC's Hernandez said, "**The basis for continued operation should be frequently and regularly reviewed until corrective actions are successfully completed.**" Of course, few if any corrective actions were "successfully completed" between this November 17, 2011 email, and Davis-Besse's restart. But the corrective action schedule leading up to, and during, the proposed 2017-2037 license extension period also leaves a lot to be desired. FENOC's Aging Management Plan for shield building cracking includes only infrequent and irregular reviews of the basis for continued operation. In fact, apart from than applying weather sealant 40 years late, there are no corrective actions planned by FENOC. Impulse Response monitoring tests and bore hole sampling are very few and far between under the proposed FENOC AMP.

NRC's woefully inadequate requirements for quantitative support for FENOC's largely qualitative arguments fall far short of what should be required, given the safety significance of the shield building cracking.

Most likely, FENOC's assertion that the shield building is "operational and conforming" was made in order to avoid not only the stigma, but also the added regulatory burden, of admitting it was "operable but *nonconforming*." This would have required, in Hernandez' words, FENOC "to have in place a plan to restore conformance at the next reasonable opportunity," although NRC would hurriedly bless operating the reactor in the meantime.

(At NRC's special public meeting on Davis-Besse's shield building cracking held in Oak Harbor High School in Oak Harbor, Ohio on August 9, 2012, under pointed questioning by Intervenors, an NRC Staff member admitted that merely a "plan for a plan" is being required of FENOC to restore conformance to Davis-Besse's design and licensing bases, given the shield building's severe cracking. The deadline is a generous December 2012. Intervenors should be allowed to scrutinize the safety and environmental implications of this "plan for a plan" for Davis-Besse's 2017 to 2037 extended operations, in a hearing on the merits of this contention.)

Hernandez' concluding paragraph on page 1 of Document B/24 shows how NRC is allowing FENOC to show either "functionality" or "operability," whichever is easier, for the applicant for a 20 year license extension at the problem-plagued Davis-Besse atomic reactor:

> Currently they've given us a qualitative analysis to support their position that the shield building is functional and fully conforming. For NRC to accept and agree, which would mean no additional actions would be necessary to restore conformance, the licensee must provide reasonable assurance to show **operability or functionality** and provide a logical, supported basis that allows our technical reviewers to reasonably reach the same conclusion. In this case, **the qualitative arguments did not provide the logical, supported basis for our technical reviewers to reach the operability conclusion. So we asked them if they could provide additional assurance by in some way quantifying their analysis based upon good engineering principles. (emphasis added)**

As Intervenors asserted in a recent contention supplement, FENOC must be alternately coddled and/or pressured to address the significant safety risks of shield building cracking. And the teacher (NRC) helps the student (FENOC), over and over again, to pass the test. Again, at the August 9, 2012 Oak Harbor High School public meeting cited above, NRC Staff bragged about how closely it had worked with FENOC to address the shield building cracking problem. In fact, this collaboration may be inappropriately close – NRC is repeatedly helping a nuclear utility licensee meet its standards. This raises the specter that unless NRC is constantly looking over FENOC's shoulder, safety and environmental regulations will be violated.

FENOC tried to get off easy, but NRC's questioning unraveled the utility's illogical arguments. Even FENOC's own academic expert "informed the licensee that with the assumptions they are making, no credit for the rebar impacted by the cracks is warranted. In light of this, the licensee has started to do more mapping and core bores to better analyze the SB." Although this loss of outer rebar layer function was clearly articulated in this November 17, 2011 internal NRC email, it was not until U.S. Rep. Kucinich issued a press release on February 8, 2012 that the significance of the loss of function of the outer rebar layer due to the shield building cracking was clearly explained to Intervenors, and the general public at risk. Intervenors utilized Rep. Kucinich's revelation to submit a contention supplement on February 27, 2012.

Despite these admissions by NRC and FENOC, that the outer rebar layer is dysfunctional, FENOC executives inexplicably expressed "confidence" in it at Davis-Besse in the August 9, 2012 Oak Harbor High School public meeting. So FENOC persists in spinning the cracking as non-structural, over six months after that lie was publicly exposed. Amazingly, NRC Staff did not contradict or challenge FENOC's renewed expressions of "confidence" in Davis-Besse's outer rebar layer, although Rep. Kucinich was in attendance, and set the record straight, yet again.

Document B/23 [11/17/11; Davis-Besse Containment System Primary Steel Containment and Shield Building. (1 page)]

This document reveals numerous internal NRC contradictions. For example, Document B/23 lists Davis-Besse's steel containment vessel as 2.5 inches thick. But Document B/4 reports the thickness as 1.5 inches, which appears to be the correct figure, given the countless times NRC, and even FENOC, cite it. Given the significant risks of shield building cracking for radiological containment, and the late date of this document (over five weeks after sub-surface laminar cracking was first announced; just a couple weeks prior to NRC CAL approval and FENOC restart), it is disconcerting that such a significant error could occur in a decision-making document.

Document B/23 contains another significant discrepancy. It reports a 4.5' annulus between the inner steel containment vessel and the outer shield building. But Document B/4 lists a 4' wide annulus. Such a discrepancy introduces confusion, at best, to safety decision-making, and such license extension significant issues as SAMA calculations, given the role of the severely cracked shield building "to ensure that anything [radioactivity] leaking, post-accident, from the steel vessel, is swept and filtered prior to release to the environment." Davis-Besse's radiological containment (which includes both the inner steel containment vessel and the outer shield building) must also withstand the internal buildup of heat, steam, and pressure under accident conditions. Use of the correct figure for annulus width (and hence volume) is critical to these safety significant calculations and analyses.

This document also claims "The shield building was designed to withstand forces generated by design bases seismic events," but this assertion is challenged, if not outright undermined, by Document B/1's revelations.

Intervenors cite NRC's admission, "The existing as-found condition of cracking in the concrete of the shield building has raised questions on the ability of the structure to maintain its ability to perform its design functions under conditions that would introduce active forces (such as a seismic event or potentially rapid changes in the environmental conditions)," as supportive of its call for a hearing on the merits of these issues.

Document B/25 [11/21/11 (date barely visible on actual document, due to it being printed on top of NRC's letterhead): Davis-Besse Nuclear Power Station Containment Shield Building Issue. (8 pages)]:

On page 1 of this document, at footnote 1, NRC states "The steel containment is a separate structure approximately 5 feet inside the SB...". But the shield building annulus is actually 4.5 feet wide, as reported in Document B/23 (and many other places, such as NRC Region 3's press release on December 2, 2011, announcing the CAL reactor restart approval, so presumably 4.5 feet is the correct figure). But Document B/4 reports the annulus as 4 feet wide. In addition to the confusion created by variously listing the shield building annulus as 4, 4.5, and 5 feet wide, Intervenors point out that claiming a 5 foot width when reality it is merely 4.5 feet wide significantly exaggerates the shield building's ostensible strength by increasing the volume for withstanding buildup of heat and pressure as from a reactor disaster combined with a steel containment vessel breach.

Document B/25 is described as "Davis-Besse Nuclear Power Station Containment Shield Building Issue, To inform NRR senior management of situation at Davis-Besse with the Containment Shield Building cracks identified, and licensee response." Reporting to senior decisionmakers a 6-inch overestimate of the actual value for the annulus width is a significant non-conservatism, *vis-a- vis* the shield building's ability to withstand heat and pressure build up during an accident, for example. Given the safety-significance of the cracking, such an overly optimistic inaccuracy is unacceptable.

NRC admitted, under "Background":

> (#1) Extensive cracking in the shoulder region, **(#2) Cracking in the structural region** outside the flute shoulder region near the main steam piping penetrations, **(#3) Cracking indications via Impact [sic, Impulse] Response (IR) mapping in the cylindrical portion of the building near the top of the building at the interface between the domed roof and the cylindrical wall.** Items 2 and 3 are being evaluated separately. IR mapping and core boring continues as the licensee evaluates the top 20' of the building."

As U.S. Rep. Kucinich has repeatedly made clear for many months now, the cracking at Davis-Besse is ***structural***, despite FENOC's and NRC's downplaying to the contrary, utilizing various "non-structural" euphemisms (such as "architectural" or "decorative").

Despite NRC's assertion, it does not seem that #2 and #3, above, have actually been dealt with separately by FENOC. It seems #1, #2, and #3 have all been lumped together, and supposedly explained by the Blizzard of 1978 root cause theory, even though NRC has posed serious questions about that, as revealed in the revised Performance Improvement International (PII) root cause assessment report. There, the NRC listed 27 areas of questioning which formed the basis of Intervenors' fourth contention supplement, submitted on July 23, 2012. As NRC itself has asked, how could the Blizzard of 1978 explain three significantly different forms of cracking, located at widely different areas of the shield building? In addition, as raised by Intervenors in a previous contention supplement, shield building cracking at the dome parapet was documented (although concealed from the public for 36 more years) in *1976* – before the Blizzard of 1978!

Under "NRC Questions," the agency Staff asks:

> Has the licensee provided reasonable assurance that the SB will remain capable of performing its design function in the near and distant future (i.e. the condition will not worsen)? Why or why not?

As acknowledged by NRC itself, these matters are aging related, and deserve to be addressed in a hearing on the merits.

NRC concludes: "They have submitted a plan, but we have raised the question of whether or not we need to approve the plan." Disconcertingly, the agency charged with protecting public health and safety and the environment against radiological risks at Davis-Besse is not even clear about whether or not it needs to approve FENOC's plan for aging management of the critical safety and environmental functions of the shield building. This underscores the need to convene a hearing on the merits, because NRC responsibilities are evidently being assumed by the NRC.

On page 2 of Document B/25, NRC Staff again mistakenly reports to NRR senior management that the steel containment vessel is 2.5 inches thick on the sides.

Also regarding the steel containment vessel, NRC assures it would "limit the release of radionuclides that might exist outside the reactor system after an accident to a very small percentage of the total volume of the steel vessel." But "a very small percentage" of such a catastrophic quantity of hazardous radioactivity would still represent a disastrous radioactivity release within the shield building. If the shield building were to fail due to its cracking, this catastrophic radioactivity release could escape into the environment, to cause widespread harm downwind, downstream, up the food chain, and down the generations.

Confusing matters, on page 2, a 4.5 foot wide annulus (presumably the correct figure) is mentioned – contradicted just one page earlier, where a 5 foot wide annulus is reported in footnote 1. Did NRR senior management not notice the contradiction? Why was the mistake not corrected?

NRC reports that the shield building is supposed to contain radioactivity, so that it can be "swept and filtered" before release to the environment. But there is legitimate concern that the cracks in the shield building might allow direct leakage to the environment before "sweeping and filtering" can be carried out. FENOC's February 28, 2012 root cause report documents cracking that penetrates the shield building nearly one-half of its thickness (depending on whether the crack is located at a thicker shoulder, or on the main body of the side wall) through its wall thickness (in some cases, nearly 16 inches deep). If the shield building fails, as questioned by NRC's Pete Hernandez above, and NRC's Abdul Sheikh below, it appears to be an open question how much hazardous radioactivity might escape into the environment.

In this sense, the shield building cracking is also SAMA-related, for FENOC's Severe Accident Mitigation Alternatives analyses undoubtedly assumed an intact and functional shield building, not the severely cracked one of doubtful functionality that exists in reality. In fact, NRC concludes page 2 by acknowledging this:

> The existing as-found condition of cracking in the concrete of the shield building has raised questions on the ability of the structure to maintain its ability to perform its design functions under conditions that would introduce active forces in the structure (such as a seismic event or potentially rapid changes in environmental conditions).

On page 3 of B/25, NRC accepts, at face value, FENOC's presentation of Drs. Darwin and Sozen's judgments. But Darwin and Sozen are working as experts for FENOC (and presumably being paid for their service). In addition, NRC itself, not just FENOC, opposes Intervenors' cracking contention. In these circumstances, the noticeable lack of truly independent, unbiased peer review of Darwin's and Sozen's testimony as well as the rest of FENOC's revised root cause analysis report, and their conclusions about extent of cracking, its safety and environmental significance, and the corrective actions that may needed, emphasizes material disputes with the license application.

Dr. Darwin is quoted: "Thus, if the splices in the circumferential steel are located outside of the crack region, I agree with and support the conclusion..." But NRC itself (as in Document B/16, above) confirmed rebar splices are located *inside* the crack region: cracking at the "Top of shield building – 360° around 20' down from the top ... Challenges Prof. Darwin concern that rebar splices be outside cracked region."

Dr. Darwin is also quoted: "they [the lap splices in the laminar crack region] are currently carrying the normal environmental loading (such as seasonal thermal gradient) and have since the structure was constructed." In other words, since the building is still standing, it must be strong enough to handle relatively normal circumstances. But given the severe cracking, can the shield building withstand added stresses, such as due to natural disasters (earthquakes, tornadoes, tornado missiles, etc.) or a reactor accident?

From page 4 to page 5 of B/25, FENOC responded to NRC questioning, that "Although Drs. Darwin and Sozen both indicated that the capacity of reinforcement steel after it is cracked is still in the range of 20 to 30 percent, **since it is not quantifiable based on current industry knowledge, we conservatively assume it can carry no load under design basis conditions."** As previously mentioned, although NRC NRR senior management was provided this clear understanding on 11/21/11, that outer rebar layer function had been lost due to the cracking, the public and Intervenors were not so informed until U.S. Rep. Kucinich's press announcement on February 8, 2012. FENOC's response also indicates that much is still not understood about the shield building cracking.

In Paragraph 2 on page 5, FENOC responds to NRC questioning:

> Lap splices entirely within the crack zone are conservatively assumed to give way and fail to transfer load. In a large concrete structure the reinforcement steel and concrete act in a membrane fashion. If a local lap splice is ineffective the load will transfer to the adjacent load carrying members. Local structural failures would only exist if a large number of lap splices were to line up in the same crack area. The horizontal reinforcement bars in the shield building were well staggered to preclude this very issue.

This is an entirely qualitative argument – and a very optimistic one at that -- not backed up by empirical data. Intervenors seek a more rigorous, conservative analysis, such as might occur via a hearing on the merits.

Page 5, paragraph 3 carries forth in the same qualitative manner. No empirical data is provided to ensure that cracks will not line up in a catastrophic way. Although FENOC and its experts assure us that the risk is low, no probability figure is actually given for the risk of a shield building failure with potentially catastrophic consequences.

Page 5, paragraph 4 of FENOC's response states:

> Since the reinforcement steel development specified staggered bar splices and the reinforcement steel is lightly loaded, Dr. Darwin suggested that the development could be evaluated on a percentage basis. That is, if the loading in the section is one third of the allowable, then at least one third of the section must contain solid (uncracked) regions to fully utilize the reinforcement steel.

To Intervenors, such an overly simplistic analysis, based on unsupported assumptions, is a very risky basis for reasonable assurance of shield building function for the next quarter century (2012 to 2037).

FENOC goes on to state in the fifth paragraph on page 5, "Conservative assumptions have been made to limit the extremely difficult data collection efforts." Intervenors are concerned that, due to the expense and time required to undertake such "extremely difficult data collection efforts," FENOC's assumptions are not conservative, and its data collection efforts (IR testing, core bore sampling) are too few and far between, both spatially across the shield building structure, but also temporally (testing is much too infrequent under FENOC's AMP) over months, years, and even decades.

Under "3)" on page 5, NRC asks: "How will your extent of Shield Building mapping demonstrate that you have sufficient uncracked concrete if the entire area is not mapped? If the entire shield building is not mapped what is the justification to extrapolate to other areas of the building?"

FENOC responded "Dr. Darwin ... stated that we needed to estimate the percent of cover and that there was no need to inspect every square inch of concrete." Intervenors assert that assumptions, estimates, and educated guesses are a poor basis for ensuring shield building function from now till 2037, and expense, time, and difficulty are poor excuses for not collecting sufficient empirical data, given the potentially catastrophic consequences of shield building failure.

On page 6 of B/25, NRC quotes FENOC as stating "There is no evidence to support that the cracking is present generally in the remainder of the shield building shell regions." But it appears that FENOC did not explore beyond "the shoulder regions, the small areas at the end of the shoulders near the blockouts for the Main Steam Lines, and near the spring line of the building", and the NRC has not required such an investigation. FENOC asserts "Additional exploration is being performed to determine the extent of the cracking near the spring line of the building. Accessible areas are being IR tested and confirmed with core bores." The results, if any, have not been communicated to Intervenors or the public. The same is true of inaccessible areas. It is curious that the NRC did not require investigation of less-accessible areas, as well as whole sections of the shield building that FENOC simply assumes are not cracked, given the safety and environmental risks.

On page 6 at "4)", even though NRC requests that FENOC "Confirm that both vertical and horizontal rebar if located in a crack region are not considered in the strength evaluation," FENOC nonetheless responds by assuming that half of the outside hoop reinforcement is effective, even though it has not investigated to make sure that cracking in those areas has not rendered outside hoop reinforcement completely ineffective.

In the second paragraph under "4)", FENOC explicitly states that the only places on the shield building where zero credit is taken for vertical reinforcement credit is at the flute shoulders and main steam penetrations. But this does not account for the cracked upper 20 feet of the shield building and the large uninvestigated portions of the remainder of it. Under the circumstances, FENOC should be made to empirically verify that the portions of the shield building being counted on to maintain safety margins are, in reality, still solid.

FENOC's statement, "Note that the vertical and hoop reinforcement is actually present and sufficiently bonded and will provide the necessary serviceability requirements such as crack control as it has under normal operating conditions since the structure was built," appears to assume, inappropriately, that the cracks will not grow worse over time. That question and concern, and the risks it raises, are at the very heart of Intervenors' contention, as supplemented. Not only does the "It-Must-Still-Be-Functional-Because-It-Hasn't-Failed-Yet" approach fail to account for worsening cracking over time from 2012 to 2037, but it also fails to address the impact of added stresses on the severely cracked shield building, such as natural disasters, reactor accident conditions, daily/seasonal/annual thermal cycles, and freeze/thaw cycles. These are aging-related concerns and disputes with the application.

On page 7, under "5)", NRC requests that FENOC "Ensure that the required rebar bond strength will carry the entire design load (18.5 ksi) plus adjacent load from adjacent rebar in cracked area. FENOC responds that 12.4 ksi loads due to normal circumstances have been supported since the shield building was constructed, so the shield building is proven capable of withstanding at least that much stress. But:

> ...The Table also shows that a maximum stress of 21.7 ksi is expected in this reinforcement under combined dead, seismic and thermal load and 13.7 ksi for dead, wind and normal thermal load. Since we assume that outside reinforcement is to be treated ineffective in carrying any additional stress beyond 12.4 ksi, under accident thermal loads that may cause stresses in excess of what the rebar can carry (assumed to be 12.4 ksi), **the reinforcement is assumed to detach itself from the outer section of the shell.** Because there is no restraint provided by the reinforcement, the accident thermal gradient will tend to self relieve, albeit trying to cause an increase in the crack width until the section finds a new balance. (emphasis added)

Such an admission, that additional stress could "increase ... the crack width," is an admission of age-related degradation potential. It is also evidence that a strong enough stress could even "fail" the shield building, at least to the extent that the rebar will detach from the outer section of the concrete shell. The risk of such a failure would grow more likely, even under small additional stresses, if cracking worsens over time, such as during the license extension.

FENOC attempts to explain why a crack could not go through-wall: "Because of the rigidity of the shell and compression on the inside face due to a moment gradient, it is impossible to develop a through thickness crack in a localized region."

This appears to be a very optimistic assumption which, in fact, is presented as a solely qualitative argument, with little to no empirical data provided for support, especially considering the admission in the February 28, 2012 root cause report that cracking already extends nearly halfway to a third of the way through the shield building wall in certain locations (15 inches deep or more), as documented by core bore sampling. A through-wall breach of the shield building would defeat its vital safety and environmental function of containing radioactivity, so that it can be "swept and filtered," before release to the environment during reactor accident conditions and steel containment vessel failure.

At the bottom of page 6/top of page 7, FENOC admits: "However, one region [of cracking] has been identified which is longer than the reinforcement steel. The following is offered to support the soundness of using percentages in development even in significantly cracked areas." But what actually follows is, yet again, mostly qualitative argument, with only the most basic quantitative support, and little actual data. FENOC's conclusion on page 8, that "there is significant margin ... to carry this additional load to keep the cracks tight and provide the required shielding and allow the shield building to perform its intended safety function" appears based on overly-optimistic assumptions, the removal of any one of which could bring the entire house of cards tumbling down, both literally and figuratively. FENOC appears to be *hoping* cracks will not widen over time, even to the point of breaching the shield building through-wall. But overly optimistic assumptions and mere hope are poor foundations upon which to base a 20-year license extension at a historically problem-plagued atomic reactor with this unprecedented and unique problem of a severely cracked shield building.

Document B/26 [11/22/11; Email from A. Sheikh, NRR to E. Sanchez Santiago, RIII on Questions for the Conference Call. (1 page)]:

This document calls the very structural integrity of the shield building into question. As this email was written just two weeks before Davis-Besse was actually restarted, it seems that most or all of these serious questions were not answered before restart. But most of these questions remain unanswered even now, and are of significant concern related to the proposed 20-year license extension.

NRC's Abdul Sheikh asks at "1.", "What is the actual condition of the concrete 20 feet below the spring line based on field verification"? It's incredible that a clear understanding of "the actual condition" of an area of the shield building, admitted by FENOC to be severely cracked, was still lacking this late in the decision making process prior to restart, and bolsters Intervenors' call for comprehensive testing of the entire shield building.

At "2.", Sheikh wrote:

> **...If this assumption is correct only 3-4 inches of the concrete on the inside face can be used in the structural analysis.** In the response to the questions, the applicant stated that, 'Since we assume that outside reinforcement is to be treated ineffective in carrying any additional stress beyond 12.4 ksi, under accident thermal loads that may cause stresses in excess of what the rebar can carry (assumed 12.4 ksi), **the reinforcement is assumed to detach itself from the outer section of the shell.'** These statements seems (sic) to be contradictory. In addition, **I am concerned that the concrete will fail in this region due to bending in this region even under small loads. (emphasis added)**

Intervenors are most concerned that, despite an NRC NRR inspector warning that "only 3-4 inches of the concrete on the inside face can be used in the structural analysis," and "I am concerned that the concrete will fail in this region due to bending in this region even under small loads," Davis-Besse was allowed to restart with so many questions unanswered (in fact, as will be shown below, Abdul Sheikh himself was still deployed on-site at Davis-Besse, reviewing safety-related calculations and presumably checking out those very field conditions he asked about above, when the December 2, 2011 CAL was issued, approving rushed reactor restart). However, the concerns identified by Sheikh certainly also extend to the 2017- 2037 license extension period. If instead of a 2.5 foot thick concrete shield building, all that can be counted on in terms of structural integrity is the inner rebar layer, and a mere 3 to 4 inches of concrete on the inside face of the structure, wil the resulting "shield" be thick enough to withstand environmental threats, such as tornados, tornado missiles, or earthquakes? Is it enough to withstand the forces of a reactor accident which get past the inner steel containment vessel? How small a load is nonetheless big enough to "fail" the concrete "due to bending" a full 90% (27 of 30 inches) through the shield building side wall, as Sheikh warns?

At "3.", Sheikh seems to identify problems with FENOC's work regarding the "lap splice issue." This is most significant, for FENOC's own expert, Dr. Darwin, emphasized the importance of lap splice regions, pointing out that his endorsement of FENOC's hypotheses only holds so long as the cracking does not exist in lap splice regions. At "4.", Sheikh identifies a related disconnect, stating: "If this is the assumption, stress used for lap splice calculation should account for 100% increase in the stress."

At "5.", Sheikh wrote: "The licensee justification for ignoring the dead (DL) and normal (To) in calculation of rebars splice does not appear to be justified. The stresses due to dead load and thermal loads will be locked in the rebars and cannot be ignored." Given that Sheikh had already warned of his concern that even "small loads" could cause concrete failure "due to bending," and Dr. Darwin's warning on the significance of lap splice regions, Intervenors are most concerned about FENOC unjustifiably ignoring *any* stresses on the shield building in its analyses and calculations.

Similar concerns are elaborated in Sheikh's point "6.": "The licensee considers the allowable stress in the rebar to be 60 ksi and ignores a phi factor (0.9) in his evaluation for lap splice. In addition, the licensee has not accounted for any additional uncertainty due the field conditions." Per Sheikh's concerns, it is imperative that there be a full account of all such phi factors and uncertainties due to the field conditions.

Sheikh's point "7." identifies yet another FENOC disconnect: "I am not aware of any pull tests carried out with a crack in the plane of the rebar. Can the licensee provide any documentation for this statement." Intervenors are not aware of an answer yet to this question.

And Sheikh's point "8." states: "The licensee is using numerous assumptions in his summary report and calculations that are not described in the UFSAR and ACI 318-63, and still calls it a design basis calculation. Can the licensee provide justification for this approach." Intervenors share Mr. Sheikh's concern that FENOC's analysis is incomplete at best, and believe that they deserve answers to these questions at hearing.

<u>Documents B/27 [11/23/11; Email from A. Howe, NRR to S. West, RIII et al. on Where do we stand on Davis Besse? (1 page)] and B/28 [11/23/11; Email from A. Howe, NRR to M. Evans, NRR et al., on Call with Steve West on Davis Besse. (1 page)]</u>

Documents B/27 and B/28 show the increasing pressure on NRC to rush the approval of FENOC's restart of Davis-Besse, despite the deepening complexity of the questions and concerns swirling around the shield building cracking. Wednesday, November 23, 2011 was the day before Thanksgiving, a federal holiday. It was also just nine calendar days (including the holiday, and the holiday weekend) before NRC issued its December 2nd Confirmatory Action Letter blessing Davis-Besse's restart, which FENOC began immediately, and completed just four days later, on December 6th.

B/27, an email marked "Importance: High," was sent just before 1 p.m. on November 23. It revealed that the Office of the Executive Director of Operations Staff had "stopped by and asked ... Where do we stand on Davis Besse?"

B/28, written at 7:31 p.m. that evening, gives the requested update, stating that "RIII [NRC Region 3] senior management is engaged and has had several inter-acttions with OEDO [Office of the Executive Director of Operations]." "1." reveals that NRC had to make certain that FENOC understood that NRC's review of the shield building cracking was ongoing, that review would take time given the deepening complexity of the cracking, and that NRC had not yet approved restart. It is disconcerting that – "tail wag the dog" style -- FENOC had to be reminded that

NRC must approve restart approval, and that such approval requires review, which takes time.

The second point reveals: "The technical review by NRC staff in RIII and NRR continues. Over the course of the past several days the licensee has changed its approach for evaluating/analyzing the observed cracking in the shield building. The changes are driven by **identification of additional cracking, challenges/feed-back from NRC staff, and from ongoing engineering assessments by the license (sic, licensee) and its consultants. The changing nature of the licensee's ap-proach has added time and complexity to the review.**" (emphasis added).

Intervenors note that their previous three supplements to this contention are based on revelations of new information contained in FENOC's April 4 AMP, FENOC's revised root cause analysis report (May 16), as well as PII's revised root cause assessment report (docketed at ADAMS on May 24). The publication of each of these was directly related to "identification of additional cracking, challenges/feed-back from NRC staff, and from ongoing engineering assessments by the [licensee] and its consultants." It is only now, thanks to FOIA Response Number 1/Appendix B, that Intervenors can begin to unravel the chronology of the decision-making process, carried out behind closed doors by NRC and FENOC, regarding the shield building cracking investigation of root cause, extent of condition, safety and environmental significance, and corrective actions; the rushed reactor restart; and prospective plans addressing the cracking in the 2017-2037 timeframe. Given "the changing nature of the licensee's approach," and the "complexity" of the analytical review, Intervenors seek a hearing to best illuminate matters in the context of the license extension.

At "3." and "4.", it is revealed that "Technical staff has several questions related to the current information we have on the structural calculations," and "Staff from RIII and NRR will conduct a conference call on Friday [Nov. 25] to discuss the status of the technical review. RIII (Steve West) will lead the call with the focus on identifying the appropriate issues/questions/conclusions to facilitate passing them on to the licensee." This important conference call, a day after Thanksgiving, amidst a long holiday weekend, highlights the rush to reactor restart approval.

"5." is NRC's first mention of the draft CAL known to Intervenors. It was suddenly finalized and issued, much to the surprise and consternation of Intervenors and the public, on December 2nd. Intervenors note that this was the same time period during which NRC Region 3's Office of Public Affairs spokespeople changed their messaging regarding Davis-Besse's shield building cracking. Before, they had assured the media and public that NRC's questions about root cause, extent of condition, safety and environmental significance, and corrective actions must be answered before reactor restart would be authorized. But shortly before Thanksgiving, NRC Region 3's message changed to one of restart timing being FENOC's decision to make. NRC's shift in attitude has yet to be explained.

Under "6.", NRC is already aware that Davis-Besse's restart would likely occur prior to a public meeting on the shield building cracking requested by U.S. Rep. Kucinich. However, Rep. Kucinich had requested that the public meeting take place *prior* to restart.

Document B/29 [11/23/11: Email from J. Zimmerman, NRR to D. Hills, RIII on NSLAOrdersCommPlan.wpd. (5 pages)]:

Document B/29 is most puzzling. It is a "Communications Plan" regarding "Notice of Significant Licensing Action (NSLA) and Orders for Licensees associated with Bulletin 2001-01, Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles, dated August 3, 2001." It is noteworthy that Jacob Zimmerman of NRR, who sent this email and its attachment to David Hills at RIII, is identified in the "Communications Plan" as NRR, Bulletin 2001-01 Lead Project Manager for the project that occurred over a decade earlier. That project also involved cracking - the cracking that allowed the boric acid to leak out of the reactor core and corrode through nearly seven inches of carbon steel on the Davis-Besse reactor lid, a near-disaster not revealed to the world until nearly seven months after this "Communications Plan" was published. Often dubbed the Hole-in-the-Head Fiasco, this fiasco at Davis-Besse was the most serious nuclear incident since the Three Mile Island meltdown of 1979, resulted in the largest fine in NRC history ($33.5 million, levied against FENOC), as well as $600 million in repairs (including a reactor lid replacement which necessitated a breach of the shield building) and replacement power expenses associated with the two-year safety shutdown.

Intervenors assume that B/29 tends to show that Davis-Besse's 2011 shield building cracking discovery is the most significant safety and environmental scandal to beset FENOC since the 2002 Hole-in-the-Head Fiasco, hence NRC's refresher on the earlier "Communications Plan." Such a significant issue, which will extend into, and may grow worse during, the 2017-2037 extended operations license period, is deserving of a hearing on the safety and environmental risks.

Document B/30 [11/27/11; Email from J. Zimmerman, NRR to M. Evans, NRR Re: Davis-Besse Draft CAL. (2 pages)]

This document again reveals the pressure of the rushed reactor restart approval. B/30 reveals not only that emails and individual phone calls were actively exchanged between NRC Staff on the Saturday and Sunday of Thanksgiving weekend (including during evening hours), but also that NRC Region 3 inspectors were sent to Davis-Besse to review calculations and analyses, and that a NRC internal conference call attended by multiple staff persons took place, as well as a conference call between Region 3 and FENOC management.

NRC's Jacob Zimmerman wrote: "FENOC has relied significantly on engineering judgment throughout much of the issue. This has been appropriately challenged by NRC staff to ensure FENOC's assumptions are reasonable and include an appropriate basis to support them. In several cases this has caused FENOC to rethink their approach and provide additional documentation with sufficient detail to support their engineering judgment." This admission bolsters Intervenors' previous assertions that FENOC's arguments are largely qualitative, lacking empirical support. If such support exists, Intervenors have yet to obtain it, perhaps due to the long delay in receiving a complete FOIA response from NRC.

Zimmerman continued: "... more work remains for FENOC. Most notably, FENOC needs to provide updates to two calculations previously submitted to NRC for review. The current schedule would have the calcs submitted to NRC this Wed.-Thurs." Intervenors note that those dates are Nov. 30-Dec. 1 – that is, as little as one day before NRC issued the CAL allowing restart. In fact, much of this internal NRC communication during the holiday weekend following Thanksgiving involved rushed coordination to finalize the CAL, despite the lingering, unanswered, complex, safety- and environmentally-significant questions and concerns related to the shield building cracking.

Document B/31 [11/28/11: Email from B. Lehman, NRR to S. CuadradoDeJesus, NRR RE: Shield building discussion with Melanie next week. (1 page)]

This email exchange reveals that NRC Office of General Counsel (OGC) attorney Brian Harris, who has led OGC's opposition to our intervention and contentions in this proceeding, requested to participate in a conference call involving NRC Staff from NRR (Division of Nuclear Reactor Regulation), DLR (Division of License Renewal, a sub-division of NRR), and perhaps other NRC staff subdivisions.

Bryce Lehman of NRR asked Samuel Cuadrado de Jesus of DLR if this was even appropriate: "please discuss with Dennis, Stacie or Melanie to *make sure it is ok if OGC is on the phone.* Melanie may prefer if this initial brief is internal to the division." (emphasis added)

Not only NRC NRR Staff, but also Intervenors, wonder why NRC counsel was so interested in this issue on November 28, 2011, in light of the collusory appearance of the restart. Intervenors by that time were tracking the shield building cracking issue closely. It took Intervenors filing a FOIA request – after the Acting Region 3 Administrator refused to provide decision-making documents at the January 5, 2012 Camp Perry meeting – to even learn the facts of the rush to restart. Then, it took NRC over six months to provide even the first FOIA response (Response