



Beyond Nuclear Fact Sheet

What Humpty Dumpty doesn't want you to know¹: *Davis-Besse's Cracked Containment Snow Job*²

Introduction: Alas, in atomic blunderland...

Recently, numerous revelations have come to light about the likely origin(s), severity, and risks of the FirstEnergy Nuclear Operating Company's (FENOC) Davis-Besse atomic reactor's concrete containment "shield building" cracking. Many of these have surfaced thanks to a Freedom of Information Act (FOIA) request, submitted in Jan. 2012 by Beyond Nuclear, and only partially responded to by the U.S. Nuclear Regulatory Commission (NRC) beginning in June. Beyond Nuclear was forced to file the FOIA request when NRC Region 3 Acting Administrator, Cynthia Pedersen, during a public meeting at Camp Perry, Ohio, on Jan. 5, 2012, refused to provide documents, despite public requests, about her decision to approve FENOC's rushed re-start of Davis-Besse on Dec. 2, 2011.

Beyond Nuclear, in coalition with Citizens Environment Alliance of Southwestern Ontario, Don't Waste Michigan, and the Green Party of Ohio, has challenged the 20-year license extension sought by FENOC at Davis-Besse since 2010. The coalition, represented by Toledo attorney Terry Lodge, himself a 35-year watchdog on the problem-plagued atomic reactor, has closely monitored the cracking issue since it was first disclosed last Oct., submitting a contention to NRC's Atomic Safety (sic) and Licensing Board (ASLB) on Jan. 10, 2012.³ The ASLB is soon to rule on whether or not the cracking contention will be given its "day in court" (although Intervenors' eyes are open: it must be remembered that ASLBs and NRC have rubberstamped 73 license extensions at reactors across the U.S. since 2000⁴).

When FENOC claimed at the end of Feb. that the Blizzard of 1978 was the root cause of the cracking, the coalition instantly dubbed it a "Snow Job."⁵ Congressman Dennis Kucinich (D-OH) echoed this charge on the floor of the U.S. House of Representatives June 21st, the day NRC itself endorsed the theory.⁶ He questioned whether it was just another "in a series of desperate lies" by FENOC, in a bid to keep the dangerously degraded 35-year-old reactor running. While FENOC, and even NRC, had tried to downplay the cracking as non-structural, merely involving "cosmetic," "decorative" or "architectural" elements of the shield building, on Feb. 8, 2012 Kucinich revealed that it is so severe that the *structural* outer rebar layer must be considered dysfunctional.⁷ This revelation led to the coalition's first contention supplement.⁸

FENOC pressured for, and NRC approved, the rushed restart of Davis-Besse, despite not knowing the "root cause(s)," extent, or safety implications of the unprecedented, "unique" severe cracking. As more light has been shined, the illusion that Humpty Dumpty can be put back together again has begun to flicker and fade. Despite FENOC's and NRC's attempts at talking a good line, Davis-Besse's "Alas, in Atomic Blunderland" journey through the cracked Looking Glass has grown more harrowing. In their pursuit of high-risk profits, the utility and its captured "safety regulator" want to take regional residents down the rabbit hole for another quarter-century. NRC is plodding along towards yet another rubberstamp, of the proposed 2017-2037 license extension at Davis-Besse, despite the worsening "break down phase"⁹ risks at the reactor, which perhaps has experienced more close calls with catastrophe than any other in the U.S.¹⁰

Pre-operations construction flaws

FENOC's Feb. 28, 2012 root cause report (RCR)¹¹ was so half-baked, NRC ordered it back to the kitchen. This led the Union of Concerned Scientists Nuclear Safety Project Director, David Lochbaum, to charge that the failure to provide complete and correct information by the deadline was a regulatory violation, but NRC has taken no enforcement action.¹² It also led FENOC to admit many remarkable things, previously undisclosed, in a May 16th Revised RCR.¹³

Asked by NRC why it had not applied weather sealant on the exterior of the concrete shield building during construction in the 1970s, FENOC simply responded in its Revised RCR that it had not been required to do so.¹⁴ This still does not explain, however, why *all* other, less safety significant concrete buildings on-site *were* weather sealed. FENOC's only explanation, so far, is that it did so for aesthetic reasons, as those buildings appeared "splotchy."

Also in the 1970s, during licensing and construction, before operations, NRC's Advisory Committee on Reactor Safeguards (ACRS) warned that more destructive earthquake forces (0.20g bedrock ground acceleration) than the nuclear utility actually had used (0.15g) needed to be considered for design of safety significant systems, structures, and components. However, NRC let Davis-Besse fire up in 1977, *before* addressing this concern, making reactor operations a done deal. To this day, FENOC is still using such non-conservative assumptions, such as to determine the "functionality" of its severely cracked shield building.¹⁵

Over 35 years after the fact, FENOC revealed in its May 2012 Revised RCR that cracking on the shield building dome had actually first been documented in August 1976, *over a year before the Blizzard of 1978*.¹⁶ Other defects on the dome, such as poorly applied weather sealant, were admitted; photos from the 1970s revealed "standing water between roof dome and parapet and... 'freeze-thaw damage in the roof concrete.'"¹⁷ FENOC's contractor, Performance Improvement International (PII), admits the possibility of "the entire roof filling up with water."¹⁸

This standing water on the shield building roof led NRC to question whether a "top-down" water leakage pathway might also provide a partial explanation for the cracking.¹⁹ In fact, PII admitted "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." This prompted NRC to ask "Is this scenario also identified and explained in the FENOC RCR [Root Cause Report]? If so where? If not, why not?"²⁰

PII has also admitted "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."²¹

Regarding the "out of plumb" (out of level) issue, NRC Staff required FENOC to provide additional information in the Revised RCR "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."²² NRC questioned whether the added stress from the construction error might also be a root cause of the sub-surface laminar cracking, as shown possible by previous research.²³

FENOC's predecessor, Toledo Edison, and the construction contractor, Bechtel, decided to disregard the error, conducting no repairs.²⁴ 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.” But as Michael Keegan of Intervenor group Don’t Waste Michigan has commented, “The concept of ‘Use As Is,’ when it comes to operating a nuclear power plant, is a risky proposition.”²⁵

In conducting analysis of whether the out-of-plumb “lean” of the shield building might have influenced or caused some of the cracking, FENOC denied that “[f]riction forces from geometry changes and the slip-form not in level have resulted in concrete delamination.”²⁶ But PII cast doubt on this conclusion, admitting “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.”²⁷

In addition, sub-standard concrete (in terms of thermal diffusivity, conductivity and specific heat) has likely allowed damaging freezing to occur, deep into the shield building sub-surface.²⁸ What other vulnerabilities does such substandard concrete expose the Davis-Besse shield building to on an ongoing basis?

Cracking here, cracking there, cracking everywhere

Contrary to FENOC’s attempt to focus attention exclusively on a single type of cracking, supposedly caused by the Blizzard of 1978, there are actually multiple kinds of cracking located at diverse locations across the shield building. These likely have resulted from more than one root cause, perhaps acting in combination. This would require a multi-faceted “corrective action,” but FENOC proposes a single “fix”: weather coating the shield building, 40 years late.

FENOC’s exclusive focus has been on sub-surface, laminar cracking, albeit located in different areas across the shield building: “(#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 [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...IR mapping and core boring continues as the licensee evaluates the top 20’ of the building.”²⁹

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.³⁰

In its Revised RCR, FENOC admitted, 36 years after the fact: “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...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.”³¹

NRC’s Pete Hernandez wrote on 11/4/11: “...the crack is pervasive along the entire surface, spidering in all directions, similar to a pane of tempered glass breaking...The core bores have shown that the cracks are at different depths.”³² While much focus has been on cracking at the outer layer of steel reinforcement (rebar) a few inches beneath the exterior side wall of the shield building, in fact, FENOC admits the following crack depths (in inches): 4, 5, 6, 6.3, 6.5, 7, 7.5, 8, 9, 9.25, 14, 14.5, 14.75, 15.75.³³ A 15-inch deep crack would extend a full half way through the 30-inch thick shield building side wall; it would extend about a third of the way through the thicker shoulder areas. PII acknowledges the likelihood that moisture has penetrated the shield building wall 14 inches deep, with the implication that cracking could consequently extend an inch deeper than that.³⁴

The NRC criticized FENOC 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.”³⁵ Near-surface concrete micro-cracking was also observed by another FENOC contractor, CTL.³⁶

There is indisputably a connection between micro-cracking and age-related degradation, raising the specter that cracking could grow significantly worse over the 20 -ear license extension.

The NRC Staff found that “[t]he root cause report additionally did not discuss radial cracking identified in numerous core bores.”³⁷ These longitudinal/radial cracks were attributed to concrete shrinkage during the curing process. Radial cracks run perpendicular to the cracking that FENOC addressed in the RCR. Thus the Revised RCR identifies an entirely different cracking mode which is not explained by the “Blizzard of ‘78.”

As revealed in 2011 NRC Requests for Additional Information (RAIs), and FENOC’s responses thereto, in addition to cracking of its side wall, other forms of degradation afflict the shield building. Aggressive (chemically corrosive), infiltrating and standing groundwater in the sand bed region, for example, has degraded the moisture barrier at the base of the shield building, as well as corroded the inner steel containment vessel. (In addition, other areas of the steel containment have also exhibited corrosion, as towards the top, due to a corrosive boric acid leak from the refueling channel associated with the reactor cavity.) Concrete spalling (chipping or splintering off) has been documented on the shield building, as well. At one location, bare steel rebar, exposed to air, has been observed, making it vulnerable to the elements and corrosion.³⁸

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. were to occur at Davis-Besse.³⁹

Downplaying the severity and safety risks of the cracks, versus CRAC-2

While FENOC, and even NRC Region 3 Office of Public Affairs staff, spoke of only “cosmetic,” “architectural” or “decorative” elements of the shield building being impacted by the cracking, NRC’s Pete Hernandez stated in an internal agency email on 11/4/11: “**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?”⁴⁰

Hernandez admitted that the significance of the cracking was being downplayed, and asked “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?” He warned against “[ignoring] the rest of the building altogether,” and asked “if they are ignoring all that concrete, it seems to be the opposite of conservative for evaluating the mechanical loads.”⁴¹

Finally, Hernandez asked “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...Isn’t [Impulse Response] mapping only useful at a limited depth too, so that using it to evaluate a 48” thick piece of concrete is not realistic?”⁴²

NRC’s Abdul Sheikh echoed Hernandez on 11/22/11. Sheikh quoted FENOC’s own assumption that “because the bond strength of reinforcement with laminar cracking next to it cannot be quantified, outside face hoop reinforcement in these regions is treated as ineffective --- for ultimate strength calculations.” He concluded “If this assumption is correct

only 3-4 inches of the concrete on the inside face can be used in the structural analysis.” Sheikh again quoted FENOC, “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...the reinforcement is assumed to detach itself from the outer section of the shell.” He then concluded **“I am concerned that the concrete will fail in this region due to bending in this region even under small loads.”** Is Sheikh describing the potential for failure of the outer 90% -- or 27 of 30 inches -- of the shield building wall?⁴³

Although NRC, behind closed doors, admitted to itself on 11/21/11 “we conservatively assume it can carry no load under design basis conditions,” it took U.S. Representative Dennis Kucinich’s vigilance, his confrontation of FENOC’s Nuclear Vice President Barry Allen at the Camp Perry meeting on 1/5/12, and his persistence, to cut through the obfuscation and clearly set the record straight for the public on 2/8/12: the extensive cracking at the outer steel reinforcement layer, located 3 to 4 inches deep under concrete at the exterior of the shield building wall, had rendered it incapable of performing its structural, safety function.⁴⁴

As mentioned above, Davis-Besse’s steel containment, a mere 1.5 inches thick when brand new four decades ago, is corroded. What if it were to fail during a reactor disaster, subjecting the severely cracked concrete shield building to high temperature and pressure?

Alarming, Sheikh went on to state **“[The Davis Besse] shield building has not been designed for containment accident pressure and temperature.”**⁴⁵ If the Davis-Besse concrete, steel reinforced shield building, when it was brand new four decades ago, was not even designed for the levels of pressure and temperature that would result from a steel containment vessel accidental breach, then it stands to reason that a *severely cracked* shield building would be even more vulnerable to catastrophic failure.

What would be the consequences if both Davis-Besse’s 1.5 inch thick inner steel containment vessel, and its 2.5 foot thick, severely cracked, outer concrete shield building, were to fail during a reactor accident? The shield building would then fail to contain potentially catastrophic amounts of hazardous radioactivity escaping from the reactor core. The shield building would not be able to “sweep and filter” the radioactivity before discharging it through a venting system, into the environment. Rather, the radioactivity releases could escape directly, unfiltered, into the outside air, to blow downwind, flow downstream, and fallout over vast areas, harming people and the environment, up the food chain and down the generations.

How bad would the casualties and property damage be? The NRC-commissioned, Sandia National Lab-conducted “Calculation of Reactor Accident Consequences” (CRAC-2) report sheds terrifying light on this question. NRC actually tried to bury the report, but U.S. Congressman Ed Markey (D-MA, who wrote a four-page letter to NRC Chairman Jaczko, expressing his concerns about the recently revealed shield building cracking at Davis-Besse)⁴⁶ forced CRAC-2’s publication via his congressional hearing powers in 1982.

CRAC-2 lists the following casualty and property damage figures from a catastrophic radioactivity release at Davis-Besse: 1,400 Peak Early Fatalities; 73,000 Peak Early Injuries; 10,000 Peak Cancer Deaths; \$84 billion in property damage. But CRAC-2 was based on 1970 U.S. Census data; populations around Davis-Besse have grown significantly in the past 42 years, meaning that those casualty figures would now be much worse.⁴⁷ And when adjusted for inflation from 1982 dollar figures, property damage would today surmount \$187 billion in 2010 dollar figures.⁴⁸

FENOC recently admitted five major errors in its Severe Accident Mitigation Alternatives (SAMA) analyses, submitted with its Environmental Report in its license extension application. These include: “An inaccurate land area conversion

factor for acres to hectares was used”; “Dollar values for Ohio farmland and non-farmland used as inputs to the “MELCOR Accident Consequence Code System” (MACCS2) software used in support of the SAMA Analysis were not appropriate”; “The escalation of decontamination costs used in the SAMA Analysis was not performed per the guidance of Nuclear Energy Institute (NEI) 05-01 ‘Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document,’ November 2005, using the consumer price index”; “Use of core inventory isotopic ‘activity’ instead of isotopic ‘mass’ in the Modular Accident Analysis Program (MAAP) software code runs did not reflect updated industry guidance”; “The wind direction from the Davis-Besse Meteorological Tower was not converted from the ‘blowing from’ direction to the ‘blowing toward’ direction for use in the SAMA Analysis calculations. The data from the Davis-Besse Meteorological Tower is received in the ‘blowing from’ direction. However, the MACCS2 software requires wind direction data inputs to be provided in the ‘blowing toward’ direction. The data conversion was not performed properly.”⁴⁹ Each of these mistakes could well mean that predictions of casualties and property damage resulting from a catastrophic radioactivity release at Davis-Besse have been dangerously under-estimated by FENOC itself, a point the environmental coalition has already alleged for two years.

Remarkably, FENOC claims these errors did not change its conclusion that no safety upgrades at Davis-Besse are cost-beneficial or necessary to prepare for its proposed 20-year license extension. Shamelessly, at the same time it admitted these mistakes, FENOC had the temerity to move for summary dismissal of the environmental coalition’s intervention contention challenging its SAMA analyses as dangerously flawed.⁵⁰

Cherry-picking the most convenient root cause of the cracks, ignoring the others

Despite the comprehensive damage already known in Davis-Besse’s shield building, Intervenors are concerned that FENOC and its contractors 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.⁵¹ A comprehensive accounting of the safety significance of *all* cracking, its various root causes, and all needed corrective actions is required. 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.⁵²

NRC, FENOC, and nuclear contractors Bechtel and Sargent & Lundy first believed the cracking was due to hydro-demolition used to breach the shield building to put the third lid in a decade (2002-2011) onto the reactor. FENOC plans yet another hydro-demolition in 2014 to replace degraded steam generators, risking further damage to the shield building. (Even then, the major “organ transplant” might not work: replacement steam generators at San Onofre nuclear power plant in California have experienced dangerous and sudden premature degradation, resulting in a safety shutdown since January that could permanently close the two reactors.)

Although certain NRC staffers have warned against over-simplifying the root cause analysis,⁵³ in the end, the agency rubberstamped FENOC’s Blizzard of 1978 “snow job.”⁵⁴ While NRC had many doubts about FENOC’s exclusive theory, and wondered about numerous other potential root causes, little to none of this questioning behind closed doors has been communicated by NRC to the *public* in any meaningful way – apparently, intentionally so.

In an internal, high level briefing, NRC staff cited “Potential causes: thermal loading and structural discontinuities,” but added “OK for examples of likely causes if NRC internal presentation. Licensee likely will investigate other potential causes in their root cause evaluation.”⁵⁵ (emphasis in original) So it seems that NRC is comfortable saying one thing to itself behind closed doors, but saying another thing to the public and media – or saying nothing to them at all.

As documented at one of 27 *areas of NRC’s questioning*⁵⁶ (“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?"⁵⁷ Incredibly, FENOC didn't even mention this "second most likely" root cause in its *revised* RCR, despite PII having explicitly acknowledged NRC's question.

NRC also asked about the potential for an uneven snow load transfer causing damaging forces at the top of the shield building wall. PII responded, frighteningly, "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."⁵⁸ PII didn't provide the "vendor calc," but did dismiss the concern. However, Intervenors are concerned that standing water on the roof (documented in photos from the 1970s), combined with dome and parapet cracking, could have been a repeated root cause of cracking over years and decades of rain storms, and melting snow and ice, along the Lake Erie shore. This problem could continue into the future.

Intervenors wonder how a list of "at least 8" potential root causes for cracking, several of which "could be [in] combination," got whittled down by FENOC to its exclusive explanation, the Blizzard of 1978? It appears to Intervenors that FENOC cherry-picked a single root cause that it could claim was not aging related, thereby minimizing the needed corrective actions (to a single act, simply weather sealing the shield building, albeit 40 years late), allowing it to deny the possibility that cracking could worsen over time, as it carries out full power operations for another quarter-century (2012-2037).⁵⁹

FENOC and its contractors repeatedly demonstrate a lackadaisical approach to data collection/root cause investigation. There is a routine lack of sensitivity studies.⁶⁰ PII admits that its analyses are "preliminary and approximate," yet, there appear to be no comprehensive and conclusive analyses planned in follow up.⁶¹ Assumptions have been made that the shield building's concrete is stronger than it actually is, although supportive data is absent.⁶² This laziness even extends to FENOC's Aging Management Plan (AMP) for the cracked shield building announced on April 4, 2012: planned monitoring tests over the years and decades into the future are very few and far between.⁶³

While investigating the root cause and extent of the cracking, FENOC and its contractors chose not to do tests because they were too challenging, expensive, and time consuming.⁶⁴ Tests were even aborted because of high winds, and power failure to a test rig, but then never completed later, once the wind died down and the power was restored. (The Intervenors have shown that "high winds," also known as wind power, as well as solar PV, are excellent replacements for Davis-Besse's 908 megawatts of electricity! Although the ASLB granted a hearing on the renewable alternatives contention against the license extension, the NRC Commissioners voted 5 to 0 to block it.⁶⁵ The Intervenors plan to appeal that decision to the federal courts at the earliest opportunity.)

FENOC and its contractors' performance does not compare well with international standards, and needs to be improved. NRC asked: "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?"⁶⁶ The cracking is so little understood that FENOC's contractor PII admits it does not know how fast cracks are growing.⁶⁷

PII also offers a weak explanation of the carbonation results. Based on the result of testing at Oak Ridge Nuclear Lab, Rep. Kucinich called attention to the significance of carbonation as a potential root cause, in a letter to NRC Chairman Jaczko last November.⁶⁸ PII has attempted 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. PII and FENOC need to develop better testing methods, ones that don't 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 safe and

sound 20-year license extension at an atomic reactor with a severely cracked shield building of still-dubious origin(s).⁶⁹

Most tellingly, NRC even questions the logic of FENOC's supposed root cause explanation: "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?"⁷⁰

PII simply responded: "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."⁷¹ (emphasis added)

Thus, 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. Considering the sub-standard heat transfer characteristics of Davis-Besse's shield building concrete, 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.⁷²

"[P]hysical 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.⁷³ Finding ettringite (a hydrous calcium aluminium sulfate mineral, evidence of moisture exposure in concrete) 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 own core-bore samples.⁷⁴

The Blizzard of 1978 cannot explain shield building dome cracking that was documented as early as 1976. And, significantly, NRC has admitted that the cracking at the top of the shield building occurred due to a "**different undefined failure mechanism [than] in the shoulder[s].**"⁷⁵ That is, it also cannot be explained by the Blizzard of 1978.

NRC inquires into a potential cracking root cause which Intervenors have also raised in their contention: "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."⁷⁶

Not only was the interior of the shield building exposed to the elements for 4 years and 3 months, as it awaited installation of the dome covering; such exposure continued even longer, due to the sidewall's "initial construction opening," as well as two "temporary openings" for reactor vessel head closure (lid) replacements in 2002 and 2011.⁷⁷ Another temporary opening is planned for 2014 to replace degraded steam generators.

NRC acrobatic "aligning" on a regulatory tightrope

In the aftermath of Davis-Besse's 2002 Hole-in-the-Head Fiasco, NRC's Office of Inspector General, in charge of investigating allegations of NRC wrongdoing, concluded that not only FENOC, but also NRC itself, was guilty of

prioritizing FENOC profits over public safety.⁷⁸ With so-called “safety regulators” like that, who needs industry-captured rubberstamps? Intervenors fear this NRC attitude of “reactor operations approval at any cost,” so clearly exemplified by the rushed December 2, 2011 Confirmatory Action Letter (CAL) authorizing Davis-Besse’s rushed restart, despite its recently revealed cracking, will prevail in decision making regarding the proposed 2017 to 2037 license extension, as well.

Originally, FENOC had wanted to begin restarting the reactor as early as 11/18/11, and pressured NRC for approval. Although NRC didn’t agree instantly,⁷⁹ it did work overtime – evenings, weekends, and through the Thanksgiving holiday – to rush its approval by December 2, 2011, despite many unanswered questions and unresolved concerns.

NRC’s threading the regulatory needle, its staff at all levels reaching “alignment” to allow reactor restart despite the “unique operating experience” at Davis-Besse (unprecedented cracking), is widely apparent in the FOIA response.⁸⁰

On 11/17/11, NRC’s Pete Hernandez⁸¹ revealed the confusing regulatory contortions used to support a rushed reactor restart despite the cracking’s violation of Davis-Besse’s licensing and design bases: “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 [TSs] 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 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 Operability], 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.”

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 [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.”

A master of NRC regulatory Nukespeak⁸² put it concisely: “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.”⁸³

What “restoring conformance” will entail, or when it will be completed, has yet to be worked out – but Davis-Besse is allowed to operate at full power, nonetheless, despite the cracked shield building. Regarding “The basis for continued operation should be frequently and regularly reviewed until corrective actions are successfully completed,” the *only* corrective action FENOC plans is to apply weather sealant, albeit 40 years late, and infrequently carry out a small number of monitoring tests in the future.⁸⁴

With such assistance, NRC’s credulous Pete Hernandez was able to add yet more regulatory justification to allowing the severely cracked Davis-Besse nuclear power plant (of very questionable conformance to licensing and design bases, at best) to rush restart:

“The licensee’s position is that the shield building is operational and conforming. That means it meets all design and code requirements including required safety margins. If they went down the operable but nonconforming route, and if we agreed with the conclusion, they could start up the plant, but we would expect them to have in place a plan to restore conformance at the next reasonable opportunity.

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)**⁸⁵

Such helpful assistance by the regulator to the regulated resembles a teacher (NRC) aiding the student (FENOC) a bit too much, over and over again, to pass the test. In fact, as revealed in a 1/31/12 NRC Inspection Report, other recent examples can be cited of such behavior: had NRC inspectors not been looking over FENOC’s shoulder, an uninspected replacement lid would have been installed on the reactor, and bad rebar would have been cemented into the shield building side wall to patch the recent construction opening.⁸⁶

Just hours before NRC restart authorization was given, technical staff recognized many serious concerns remained unresolved: “...the location and direction of the crack are not clear from the diagrams...I think we should say that operability is still being discussed. **If D-B is allowed to start up, there needs to be a slide describing why it is OK...the [License Renewal] impact needs to be clearer...Degraded concrete is a Part 50 issue affecting license renewal...[Division of License Renewal] needs to understand if the degradation is age-related and progressive etc. and how the effect will be managed...DLR has prepared a draft [Request for Additional Information] asking the applicant to explain how the unique [Operating Experience] will be addressed by its AMPs [Aging Management Plans]...This will be tracked as an Open Item in SER [Safety Evaluation Report].”⁸⁷ (emphasis added) Even though these questions and concerns were written at 9:16 AM, and NRC still had technical staff doing field investigations at Davis-Besse on safety calculations only provided by FENOC the previous day, by 3:47 PM “Tech staff unanimously concurred on the decision that the licensee provided reasonable assurance for the Shield Building will (sic) perform its safety function. There are no further questions from the NRC to be answered before startup can commence.” The CAL was immediately issued approving reactor restart, Region 3 Office of Public Affairs notified the media after business hours on a Friday afternoon (stating Davis-Besse was 40 miles from Toledo, when NRC’s own website reports the distance as 21 miles), and “The licensee expects to enter Mode 4 today December 2, 2011 at 1800 and continue progressing with plant start up.”⁸⁸ The reactor had returned to full power operations by December 6th.**

Although they had worked overtime to rush the restart, afterwards it was party time, as reflected in the unfortunately worded email “With all the [holiday] parties and frequent interruptions I almost forgot to get in touch with you on the issue with the shield building [Requests for Additional Information]...”⁸⁹ Intervenor, by contrast, have been forced to work long hours through the past two holiday seasons, in December 2010 to file their original hearing request petition and contentions by the 12/27/10 deadline, and in December 2011 to prepare for the 1/5/12 Camp Perry meeting, as well as prepare their 1/10/12 cracking contention submission, in the face of efforts by FENOC as well as NRC to obscure the facts, downplay the risks, and withhold documents.

The next morning (a Saturday), NRC’s Jacob Zimmerman gloated about the 12/2/11 press release: “I think they did a nice job crafting it. I especially like that they addressed fully documenting the decision.” He concluded his email, most ironically, at least from the perspective of those concerned with safety at Davis-Besse, “Have a great weekend!”⁹⁰

In the press release, the topmost FENOC commitment to NRC is listed as: “Determine and provide the root cause of the cracks in the shield building, corrective actions, and develop a long-term monitoring program.” But NRC Region 3 Office of Public Affairs staff had previously assured the media and public that such issues would be resolved *prior to* restart. For example, as mentioned in our original contention submitted on January 10, 2012, the *Cleveland Plain Dealer* reported on October 12, 2011, two days after the shield building cracks had first been announced: “The significance of the crack is not clear at this point,” NRC spokeswoman Viktoria Mytling said. “We will review what the company and its engineers find, and we are doing our own independent assessment,” she said. “*We will have to resolve this issue before they restart the reactor.*”⁹¹ (*emphasis added*)

Similarly, Rep. Kucinich had requested a public meeting about the shield building cracking *prior to* reactor restart. Instead, NRC did not hold the Camp Perry meeting till more than a month *after* restart.

Zimmerman was previously Bulletin 2001-01 Lead Project Manager in August 2001, involving Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles. Ironically enough, these were the ill-fated orders *not* carried out at Davis-Besse, which seven months later led to what the Government Accountability Office has called the most infamous incident at a U.S. nuclear reactor since the 1979 Three Mile Island meltdown – the 2002 Hole-in-the-Head Fiasco. Strangely, Zimmerman shared the 2001 Communications Plan with NRC Region III staffer David Hills on 11/23/11, on the very eve of NRC’s Thanksgiving holiday overtime work to rush the Davis-Besse restart approval.⁹²

Over nine months later, forced to obtain the documents via FOIA, Intervenor are still trying to “fully document” how this rushed decision was made. Although Intervenor filed their FOIA request on 1/26/12, NRC did not begin to provide responses until 6/12/12. Even now, after four Appendixes (A, B, C, and D) have been provided, NRC admits “We are continuing to process your request.”

NRC continued to wrestle with attempting to justify the violation of its regulations, even weeks after they had already approved restart, as revealed in these excerpts from internal emails: “Decision was made to leave code compliance questions out of the CAL and to focus on confirming assumptions made in the operability calculations.”⁹³; “I need help filling out slides 11 & 12, especially explaining why the CAL did not address questions regarding code compliance.”⁹⁴ This begs the question, is Davis-Besse in violation of its licensing and design bases, due to the shield building cracking? If yes, then how can it be allowed to operate?

Limited by legalistic NRC proceeding rules to raising 2017-2037 issues, since 1/10/12, Intervenor have contended that the “extensive cracking of (yet) 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 ASLB has indicated it will soon rule on the admissibility of Intervenor’s cracking contention.

The SER, issued on 7/31/12,⁹⁵ includes not one, but four, open items: “management of shield building cracks during the period of extended operations; operating experience review prior to entering the period of extended operations; time-limited aging analyses of reactor vessel neutron embrittlement; and pressure-temperature limits.” An embrittled reactor pressure vessel, given its metal’s loss of ductility, can fracture like a hot glass under cold water due to pressurized thermal shock (PTS) if the emergency core cooling system is activated. Despite this, NRC has repeatedly weakened its PTS safety standards, in order to allow old, dangerously degraded reactors like Davis-Besse to keep operating.⁹⁶ Davis-Besse is the hottest operating atomic reactor in the U.S., one theory for why it has required three lids in a single decade (2002-2011). And such a sudden drop, from such high temperatures, due to ECCS activation in an emergency would exacerbate PTS risks.

Conclusion: Make a killing while getting away with murder

From Robert Pollard’s *The Nugget File* to David Lochbaum’s *Fission Stories*, Union of Concerned Scientists has a way with words, coming up with some catchy and clever titles for their nuclear safety (or lack thereof) reports. As NRC OIG documented at Davis-Besse in 2002, NRC putting profits first, and “Safety Second,”⁹⁷ nearly led to the breach of the reactor lid, and a Loss of Coolant Accident. Allowing a rogue regulator to spin the “wheel of misfortune”⁹⁸ for another 20 years of “Regulatory Roulette”⁹⁹ at a reactor deep in its “Break Down Phase” on the “Bath Tub Curve”¹⁰⁰ means “Living on Borrowed Time.”¹⁰¹

How many radioactive bullets can we dodge at Davis-Besse? We cannot let this 35-year long “game” of Radioactive Russian Roulette go on for another 25 years.¹⁰²

As the environmental coalition intervening against the license extension defended its renewable alternatives and Severe Accident Mitigation Alternatives analyses contentions before the ASLB in Port Clinton, Ohio on March 1, 2011, they could not have known that the Fukushima nuclear catastrophe would begin ten days later. And yet, every day that Davis-Besse continues to operate with its severely cracked concrete containment is invitation for disaster. God forbid the worst happen, but if it does, it can’t be called an “accident” any longer,¹⁰³ after decades of repeated near-misses, and countless warnings by concerned Downwinders and environmental groups.

Why are such risks being taken? So that FENOC executives and shareholders can make killer profits, salaries, and returns on their investment (thanks to almost all costs, risks, and liabilities being transferred to the public), from electricity sales by a reactor that should have long ago been shut down for good. Intervenor has already proven beyond the shadow of a doubt that wind and solar PV power can readily replace Davis-Besse’s 908 megawatts of electricity, cost-effectively, reliably (without 2 year safety shutdowns, as at Davis-Besse from 2002-2004),¹⁰⁴ and much more safely, securely, and cleanly. Germany is showing that a major economy, the 4th largest in the world, can strive to be nuclear-free within a decade, and even fossil fuel-free by mid-century to reach climate goals, while growing the economy and creating large numbers of jobs via green energy – a visionary future northwest Ohio and southeast Michigan can and should pursue as well.¹⁰⁵

Perched, as Davis-Besse is, on the shoreline of the Great Lakes, 20% of the world’s surface fresh water, and drinking water supply for 40 million people in the U.S., Canada, and numerous Native American/First Nations, there is a lot to lose.

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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.

End Notes

¹ "... 'When I use a word,' Humpty Dumpty said, in rather a scornful tone, 'it means just what I choose it to mean — neither more nor less.'"

'The question is,' said Alice, 'whether you **can** make words mean so many different things.'

'The question is,' said Humpty Dumpty, 'which is to be master — that's all.'"

Through the Looking Glass, by Lewis Carroll; see also Beyond Nuclear board member and investigative journalist Karl Grossman's book, *Cover Up: What You are Not Supposed to Know about Nuclear Power*, <http://www.thepermanentpress.com/p-354-cover-up.aspx>.

² Snow Job: A systematic deception; an effort to deceive, persuade, or overwhelm with elaborate, often insincere talk. This slangy expression, originating in the military during World War II, presumably alludes to the idiom "snow under."

³ Press release:

<http://www.beyondnuclear.org/storage/crack%20contention%201%2010%202012%20press%20release.pdf>; contention: http://www.beyondnuclear.org/storage/Davis-Besse_Contention_5_Cracked_Shield_Building1.pdf

⁴ <http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html#completed>

⁵ <http://www.beyondnuclear.org/home/2012/3/2/davis-besse-blames-blizzard-of-78-for-containment-cracks-but.html>

⁶ <http://kucinich.house.gov/news/documentsingle.aspx?DocumentID=300471>

⁷ <http://www.beyondnuclear.org/home/2012/2/22/congressman-kucinich-outs-the-truth-at-davis-besse.html>

⁸ Intervenors' Motion to Amend 'Motion for Admission of Contention No. 5,' Feb. 27, 2012,

<http://www.beyondnuclear.org/home/2012/2/27/environmental-coalition-supplements-davis-besse-cracked-cont.html>

⁹ "Break down phase" and "Bath tub curve" are phrases coined by David Lochbaum, director of the Nuclear Safety Project at the Union of Concerned Scientists. Learn more at this link:

<http://www.beyondnuclear.org/home/2012/6/7/davis-besse-kept-from-re-starting-due-to-reactor-coolant-sys.html>

¹⁰ <http://www.beyondnuclear.org/storage/Davis%20Besse%2020%20More%20Years%20of%20Radioactive%20Russian%20Roulette%20Nov%202010%20corrected%20Dec%2028%202010.pdf>

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- ¹¹ FENOC Root Cause Report, RCR, 2/28/2012, <http://www.beyondnuclear.org/storage/Feb%2028%20Snow%20Job.pdf>
- ¹² <http://www.beyondnuclear.org/storage/20120525-db-ucs-nrc-50-9-violation.pdf>
- ¹³ NRC ADAMS accession number ML12142A053.
- ¹⁴ FENOC RCR, page 38 of 131 on PDF counter.
- ¹⁵ NRC FOIA response, Appendix B, Document B/1, Undated, Davis-Besse Nuclear Power Plant, Unit Licensing Basis Seismic Ground Motion Concern, 3 pages.
- ¹⁶ FENOC RRCR, page 34 of 131 on PDF counter.
- ¹⁷ INTERVENORS' FOURTH MOTION TO AMEND AND/OR SUPPLEMENT PROPOSED CONTENTION NO. 5 (SHIELD BUILDING CRACKING), July 23, 2012: <http://www.beyondnuclear.org/storage/4th%20Motion%20PII%20COMPLET.pdf>, pages 16-17; see also PII revised root cause assessment report: NRC ADAMS Accession Number ML12138A037. PII's RRCAR is dated 4/20/12. However, it was not sent to NRC by FENOC until 5/14/2012. It was not docketed at ADAMS until 5/24/2012.
- ¹⁸ INTERVENORS' FOURTH MOTION, page 32.
- ¹⁹ PII revised root cause assessment report, RRCAR; INTERVENORS' FOURTH MOTION.
- ²⁰ INTERVENORS' FOURTH MOTION, page 11.
- ²¹ INTERVENORS' FOURTH MOTION, beginning at page 25.
- ²² FENOC Revised RCR, page 95. FENOC's RRCR is dated May 16, 2012. Its NRC ADAMS Accession Number is ML12142A053.
- ²³ PII RRCAR, Item 13, page ii.
- ²⁴ PII Revised Root Cause Assessment Report, April/May 2012, page ii; FENOC RRCR, page 5, 95, etc.
- ²⁵ "Davis-Besse allowed to restart operations," BY DAVID PATCH, BLADE STAFF WRITER, Toledo Blade, Dec. 3, 2011.
- ²⁶ Intervenors' Third Motion to Amend and/or Supplement Proposed Contention No. 5 (Shield Building Cracking), July 16, 2012, <http://www.beyondnuclear.org/storage/3rd%20%20Motion%20COMPLET%20supp%20cracked%20concrete%20containment%20contention%20July%2016%202012.pdf>, pages 11 to 12.
- ²⁷ PII RRCAR, ML12138A037 at Appendix VI-34 (159/257 of .pdf).
- ²⁸ INTERVENORS' FOURTH MOTION, pages 29-30.
- ²⁹ NRC FOIA response, Appendix B, Document B/25, 11/21/11, Davis-Besse Nuclear Power Station Containment Shield Building Issue, 1 page.

³⁰ Intervenors' Third Motion, see page 5.

³¹ FENOC RRCR, page 34 of 131 on PDF counter.

³² See also INTERVENORS' FOURTH MOTION, page 27.

³³ Attachment 3, Shield Building Core Bore Summary, FENOC Revised RCR, beginning at page 80.

³⁴ INTERVENORS' FOURTH MOTION, page 39.

³⁵ See Intervenors' Third Motion, page 3 and 6.

³⁶ INTERVENORS' FOURTH MOTION, page 8.

³⁷ Intervenors' Third Motion, Page 5.

³⁸ See, for example, NRC FOIA response, Appendix A, Document A/5, 11/30/11, NRC ADAMS Accession Number ML11356A037, Email from S. CuadradoDeJesus, NRR to R. Plasse, RIII on Davis-Besse Request for Additional Information Response, 775 pages.

³⁹ Intervenors' Third Motion, page 7 to 8.

⁴⁰ NRC FOIA response Appendix B, 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.

⁴¹ Ibid.

⁴² Ibid.

⁴³ NRC FOIA response Appendix B, Document B/26, 11/22/11 Email from A. Sheikh, NRR to E. Sanchez Santiago, RIII on Questions for the Conference Call, 1 page; and pages 23-24 of ⁴³ INTERVENORS' FOURTH MOTION.

⁴⁴ <http://www.beyondnuclear.org/home/2012/2/22/congressman-kucinich-outs-the-truth-at-davis-besse.html>.

⁴⁵ NRC FOIA response, Appendix B, Document B/44, 12/13/11, Email from M. Galloway, NRR to A. Sheikh, NRR et al., RE: Davis-Besse Shield Building, 1 page.

⁴⁶ NRC FOIA response, Appendix A, Document A/2, 10/14/11, NRC ADAMS Accession Number ML1129sA005, Letter from Sen. (sic) Markey to Chairman Jaczko on Safe Operation of Davis-Besse, 4 pages.

⁴⁷ <http://www.ap.org/company/awards/part-iii-aging-nukes>

⁴⁸ <http://www.beyondnuclear.org/storage/CRAC%20%20chart%20for%20drop%20final.pdf>.

⁴⁹ http://www.beyondnuclear.org/storage/L-12-244%20Amd%20%20%20ER%20SAMA%20Update_FINAL%202012-07-16.pdf, page 4 of 117 on PDF counter.

⁵⁰ Ibid.

⁵¹ INTERVENORS' FOURTH MOTION, page 35.

⁵² INTERVENORS' FOURTH MOTION, page 38.

⁵³ "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/feedback from NRC staff, and from ongoing engineering assessments by the licensee (sic, licensee) and its consultants. The changing nature of the licensee's approach has added time and complexity to the review." NRC FOIA response, Appendix B, Document B/28, 11/23/11, Email from A. Howe, NRR to M. Evans, NRR et al., on Call with Steve West on Davis Besse.

⁵⁴ NRC press release, "NRC Concludes its Review of FENOC'S Root Cause Analysis of Davis-Besse Shield Building Cracks," Document Number III-12-023, 6/21/2012.

⁵⁵ Slide 21, NRC FOIA response, Document B/48, 12/15/11, Email from P. Hernandez, NRR to A. Erickson, NRR, FW: ET/LT Brief 12-22-11 – Containment Delamination Davis-Besse/CR-3, 5 pages.

⁵⁶ See "Summary of Revisions in Version 2," PII Revised Root Cause Assessment Report, 4/20/12, pages i to iv (17 to 20 on PDF counter); these "Revisions" provided the new information which formed the basis for INTERVENORS' FOURTH MOTION.

⁵⁷ INTERVENORS' FOURTH MOTION, Page 33.

⁵⁸ INTERVENORS' FOURTH MOTION, page 32.

⁵⁹ NRC FOIA response, Appendix B, Document B/51, 01/19/12, Davis-Besse Root Cause Review – Status Call 1/19/2012, 3 pages.

⁶⁰ INTERVENORS' FOURTH MOTION, page 8-9.

⁶¹ INTERVENORS' FOURTH MOTION, page 19.

⁶² INTERVENORS' FOURTH MOTION, page 31.

⁶³ FENOC's Aging Management Plan (AMP), April 4, 2012, NRC ADAMS Accession Number ML12097A216.

⁶⁴ INTERVENORS' FOURTH MOTION, Pages 11-12, and 16.

⁶⁵ <http://www.beyondnuclear.org/home/2012/4/10/toledo-blade-editorializes-in-support-of-consideration-of-re.html>

⁶⁶ INTERVENORS' FOURTH MOTION, page 36.

⁶⁷ INTERVENORS' FOURTH MOTION, page 6.

⁶⁸ <http://kucinich.house.gov/news/documentsingle.aspx?DocumentID=270017>; it was this letter that ultimately led to the public meeting at Camp Perry on 1/5/12.

⁶⁹ INTERVENORS' FOURTH MOTION, page 7.

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- ⁷⁰ INTERVENORS' FOURTH MOTION, page 40.
- ⁷¹ INTERVENORS' FOURTH MOTION, page 41.
- ⁷² INTERVENORS' FOURTH MOTION, page 41 to 42.
- ⁷³ INTERVENORS' FOURTH MOTION, page 4.
- ⁷⁴ Intervenor's Third Motion, page 10 to 11.
- ⁷⁵ NRC FOIA response, Appendix B, Document B/16, 11/12/11, Discussion points relayed to the licensee after our internal technical discussion, 1 page.
- ⁷⁶ INTERVENORS' FOURTH MOTION, page 11.
- ⁷⁷ FENOC's slide show presentation at Camp Perry, 1/5/12, showing breaches of the shield building since construction.
- ⁷⁸ NRC OIG, "Event Inquiry Regarding NRC's Regulation of Davis-Besse Regarding Damage to the Reactor Vessel Head," OIG-02-03S, 12/30/2002, <http://www.nrc.gov/reading-rm/doc-collections/insp-gen/2003/02-03s.pdf>
- ⁷⁹ "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/feedback from NRC staff, and from ongoing engineering assessments by the licensee (sic, licensee) and its consultants. The changing nature of the licensee's approach has added time and complexity to the review." NRC FOIA response, Appendix B, Document 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.
- ⁸⁰ Examples of the "unique OE" include: "No ACI [American Concrete Institute] standard for evaluation and no licensee structural evaluation," NRC FOIA response, Appendix B, Document B/16, 11/12/11, Discussion points relayed to the licensee after our internal technical discussion, 1 page; "...there is no ASTM standard test appropriate for this purpose," INTERVENORS' FOURTH MOTION, pages 39-40.
- ⁸¹ NRC FOIA response, Appendix B, Document B/22, 11/17/11, Email from P. Hernandez, NRR to E. Sanchez Santiago, RIII on Davis Besse Operability question, 1 page.
- ⁸² <http://www.consortiumnews.com/2011/031511b.html>
- ⁸³ NRC FOIA response, Appendix B, Document B/10, 11/07/11, Davis Besse Shield Building Issue NRC Technical Reviewer Focus Questions, 1 page.
- ⁸⁴ FENOC's AMP, April 4, 2012.
- ⁸⁵ NRC FOIA response, Appendix B, Document B/24, 11/17/11, Email from P. Hernandez, NRR to M. Evans, NRR et al., on Davis Besse Operability questions, 2 pages.
- ⁸⁶ <http://www.beyondnuclear.org/home/2012/2/25/nrc-inspection-report-reveals-more-problems-at-davis-besse-i.html>

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- ⁸⁷ NRC FOIA response, Appendix B, Document B/35, 12/02/11, Email from D. Morey, NRR to B. Lehman, NRR et al RE: Davis-Besse Shield Building, 1 page.
- ⁸⁸ NRC FOIA response, Appendix B, Document B/36, 12/02/11, Email from B. Lehman, NRR to S. Sakai, NRR et al. FW: Davis Besse POP, 2 pages.
- ⁸⁹ NRC FOIA response, Appendix B, Document B/45, 12/13/11, Email from A. Sheikh, NRR to B. Lehman, NRR et al RE: Davis-Besse Shield Building RAI, 2 pages.
- ⁹⁰ NRC FOIA response, Appendix B, Document B/37, 12/03/11, Email from J. Zimmerman, NRR to M. Evans, NRR et al., Fw: Press Release has been issued. Attachment is publicly available at (sic), 3 pages.
- ⁹¹ http://www.cleveland.com/business/index.ssf/2011/10/nrc_firstenergy_concerned_abou.html
- ⁹² FOIA response, Appendix B, Document B/29, 11/23/11, Email from J. Zimmerman, NRR to D. Hills, RIII on NSLAOrdersCommPlan.wpd, 5 pages.
- ⁹³ NRC FOIA response, Appendix B, Document B/48, 12/15/11, Email from P. Hernandez, NRR to A. Erickson, NRR, FW: ET/LT Brief 12-22-11 – Containment Delamination Davis-Besse/CR-3, 5 pages.
- ⁹⁴ FOIA response, Appendix B, Document B/46, 12/14/11, Email from P. Hernandez, NRR to E. Sanchez Santiago, RIII et al., FW: ET/LT Brief 12-22-11 – Containment Delamination Davis-Besse/CR-3, 1 page.
- ⁹⁵ See NRC press release, “NRC Issues Safety Evaluation Report with Open Items for Davis-Besse Nuclear Plant License Renewal Application,” August 1, 2012, ADAMS Accession Number ML12214A274.
- ⁹⁶ “Aging Nukes,” by Jeff Donn, AP, Part I: <http://www.ap.org/company/awards/aging-nukes>
- ⁹⁷ <https://www.kirkusreviews.com/book-reviews/union-of-concerned-scientists/safety-second-the-nrc-and-america-nuclear-power/#review>
- ⁹⁸ Thanks to Beyond Nuclear Launch Partner Keith Gunter for coming up with that one!
- ⁹⁹ http://www.ucsusa.org/assets/documents/nuclear_power/nuclear-power-radioactive-releases.pdf
- ¹⁰⁰ <http://www.beyondnuclear.org/home/2012/6/4/the-nrcs-latest-crazy-idea-an-80-year-license-to-kill.html>
- ¹⁰¹ <http://www.beyondnuclear.org/nrc/2012/3/7/living-on-borrowed-time-us-nuclear-power-safety-one-year-aft.html>
- ¹⁰² <http://www.beyondnuclear.org/storage/Davis%20Besse%2020%20More%20Years%20of%20Radioactive%20Russian%20Roulette%20Nov%202010%20corrected%20Dec%2028%202010.pdf>
- ¹⁰³ Thanks to Dave Kraft, Ex. Dir. of NEIS in Chicago for the concept.
- ¹⁰⁴ http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/walking-a-nuclear-tightrope.html
- ¹⁰⁵ <http://ieer.org/projects/carbon-free-nuclear-free/>