

The Risks of Reviving TVA's Bellefonte Project

Report Prepared for Southern Alliance for Clean Energy (SACE)

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Introduction and Background

The Tennessee Valley Authority (TVA) has requested permission from the NRC to complete construction and begin operation of the previously terminated TVA Bellefonte Nuclear Unit 1 located in Hollywood, Alabama. At this point in time, TVA believes it may be able to have Bellefonte Unit 1 operational by 2018 if all construction timetables are met. The Babcock and Wilcox (B&W) design used at Bellefonte was originally licensed for construction in 1974. However, the original B&W nuclear design originated in the 1960s.

This report identifies seven specific areas of risk that in Fairewinds' opinion will cause further delays, additional costs and even possible suspension of the Bellefonte project if TVA decides to move forward with its construction. The seven areas of specific risk are:

- 1. Bellefonte's Unique Design**
- 2. Groundwater Intrusion That Is Weakening It's Foundations**
- 3. Missing Critical Nuclear QA Documents and Complete Records**
- 4. Cannibalization of Bellefonte's Operating Systems**
- 5. Containment Problems Unique to Bellefonte**
- 6. Historical Precedent**
- 7. Post Fukushima Lessons Learned**

Bellefonte's Unique Design

The Babcock and Wilcox (B&W) design used at Bellefonte is quite unique because B&W chose to use Once Through Steam Generators (OTSG) that have less residual (surge) volume in comparison other Pressurized Water Reactor (PWR) designs created by

competitors Westinghouse and Combustion Engineering. Unfortunately the unforgiving B&W design was a factor 1978 Three Mile Island (TMI) Unit 2 accident. By choosing the OTSG technology TVA has also chosen and created the unique and problematic Bellefonte Unit 1 containment design. Only 8 of the 104 operating United States (US) nuclear reactors have been constructed with the B&W design, and these are Three Mile Island 1 (PA), Crystal River 3 (FL), Davis Bessie 1 (OH), Arkansas Nuclear One (ANO) Units 1 and 2, and Oconee 1, 2, and 3 (SC).

After the Three Mile Island (TMI) nuclear accident, there was a nationwide mass exodus by utilities away from other previously planned B&W nuclear reactors, and the fourteen other US B&W reactors of a similar design to Bellefonte were cancelled. The cancelled B&W nuclear plants included: Washington Public Power District Units 1 and 4, Pebble Springs Units 1 and 2, Vandalia Unit 1, Crystal River Unit 4, Davis-Besse Units 2 and 3, Sears Island Unit 1, Sterling Unit 1, Sundesert Units 1 and 2, Tyrone Unit 1 and 2.

Additionally, two other US B&W nuclear plants were shutdown: Three Mile Island 2, following its accident, and Rancho Seco in Sacramento, CA, which had an overall lifetime operational reliability of less than 40%. Moreover, no other B&W reactors were ever sold within the United States after TMI, and the only B&W reactor that was ever sold outside the US was the Mulheim Karlich A-Reactor¹ located in Germany. The Mulheim Karlich A-Reactor was operated for less than two years before it was

¹ <http://www.iaea.org/cgi-bin/db.page.pl/pris.pr deta.htm?country=DE&site=MUELHEIM-KAERLICH&units=&refno=22&link=HOT&sort=Reactor.Status,&sortlong=By%20Stat us> (Last viewed August 3, 2011)

permanently shut down in 1988. The eight remaining operating B&W reactors represent less than 2 percent of nuclear power plants worldwide.

More importantly, the particular reactor at Bellefonte is even more unique than the other eight B&W reactors that are smaller than the reactor proposed at Bellefonte. The remaining eight operating B&W reactors are the 177-design, meaning that the core has 177 fuel bundles with a 15 by 15 array of fuel rods in each bundle. Bellefonte is the 205-design meaning that it has 205 bundles of nuclear fuel, each of which has a 17x17 fuel bundle array. Only five of the B&W 205-design were ever ordered and one, the Muhlheim-Karlich nuclear plant in Germany, was ever built. It operated only briefly 25 years ago before being shut down entirely in 1988. This brief operating experience with the unsuccessful Muhlheim-Karlich B&W nuclear plant 205-design occurred 25 years ago, and worldwide, its records are the only operational history of a nuclear power plant with the B&W Bellefonte 205 reactor design. Furthermore, the B&W 205 nuclear power plant that TVA is attempting to construct at Bellefonte Unit 1 was originally designed during the 1960s and is literally the only one of its design anywhere in the world.

New York State Electric and Gas (NYSEG) placed the last nuclear power plant order ever made in 1978, shortly before the TMI accident. As the lead nuclear engineer for New York State Electric and Gas in 1978, I completed a thorough analysis and evaluation of the B&W design and compared it to the Westinghouse and Combustion Engineering (CE) designs. Even prior to the TMI accident it was evident during a thorough engineering evaluation that the B&W design is less than robust in comparison to both the

CE and Westinghouse designs. Thus, NYSE&G did not place its order with B&W, and instead chose CE's design.

By the time the proposed Bellefonte Unit 1 nuclear plant may become operational, five decades will have elapsed since its design was begun. Americans were walking on the moon when the Bellefonte nuclear plants were originally designed. The space shuttle was designed, flew more than 100 missions and was completely retired during the time that Bellefonte Unit 1 sat idle and unattended. Six major nuclear accidents (TMI, Browns Ferry, Chernobyl, and Fukushima 1, 2 and 3) have occurred since Bellefonte Unit 1 received its construction permit. Does such a timespan matter? Yes, just like the story of Rip Van Winkle, the world has moved on with significant technical advances while the Bellefonte nuclear power plant slept idly and unkempt.

As one drives toward the Bellefonte nuclear plant, the cooling towers, containment building, and turbine hall appear to be impressive physical structures. However, first impressions can be incredibly deceiving. Much like a wooden boat at dry dock that may look impressive yet contain significant dry rot, the long period during which the TVA Bellefonte plant has sat idle and empty has most likely caused serious degradation of its concrete foundation as evidenced at a minimum of four other aging nuclear power plants.

Groundwater Intrusion

While the structures may appear to be substantial from a distance, it is essential to the evaluation process that TVA's Board of Directors recognizes that the majority of

Bellefonte's foundation construction work was completed almost 40 years ago.

Excavating and laying the foundation for the massive power plant structures are the first stage of mechanical production during each nuclear power plant's construction phase.

Moreover, most of the excavation work at Bellefonte was completed prior to 1980.

Therefore, the concrete at Bellefonte Unit 1 has been subject to underground degradation for more than 35 years, and Bellefonte Unit 1 has not yet been subject to operational stresses.

At least four currently operating US nuclear power reactors are already experiencing significant concrete degradation in their foundations, including Millstone in Connecticut (1996), Salem (2003) and Oyster Creek (2011) in New Jersey, and Seabrook (2011) in New Hampshire. Three of these plants had only been operating 20 years or less when their concrete began to fail. The trend in concrete failure at nuclear power plants is increasing as the fleet of operating nuclear power plants continues to age. Unfortunately, foundations cannot be easily inspected unless extreme damage is already evident, so it is most likely that many other nuclear power plants are experiencing such concrete degradation, but a simple visual inspection will not likely pick up such issue.

The evidence Fairewinds reviewed in the NRC's Bellefonte file indicates that ground water has been intruding into its foundations for the past 35 years. Not only that, but in order to prevent continuous damage to the Bellefonte Unit 1 foundations, TVA installed a system to continuously remove ground water, similar to a basement sump pump but on a much larger scale. The groundwater intrusion issue was so significant that TVA installed

specialized sump-style pumps to remove foundation water beginning early in the concrete foundation construction process until they were shut off in 2006 when TVA decided to abandon its Bellefonte nuclear power plant project and cannibalize the site by selling off scrap metal. Only two years later, TVA changed its mind once again and slowly began the process of “performing repairs to eliminate water intrusion, indicating the facility has not been maintained in a manner that would prevent serious degradation” according to the Nuclear Regulatory Commission.²

Concrete foundation performance failure is the most insidious form of age related degradation in a nuclear power plant. By definition, concrete foundation performance is underground and impossible to see. The sheer size of the nuclear buildings above these foundations makes adequate foundations essential and impossible to completely repair. The risk of significant foundation problems at Bellefonte originating during construction and continuing now and into its possible operating life is threefold:

- First, TVA knowingly and deliberately allowed the foundations to deteriorate.
- Second, the foundations at Bellefonte will be 45 years old well before the reactor ever begins to generate electricity.
- Third, a 40 year initial life and possible 20 year life extension after that means that the underlying safety of this nuclear plant will be based on concrete that will be more than 100 years old. Given that much newer reactors are already

² *NON-CONCURRENCE BY JOSEPH WILLIAMS REGARDING STAFF APPROACH TENNESSEE VALLEY AUTHORITY REQUEST TO REINSTATE CONSTRUCTION PERMITS BELLEFONTE NUCLEAR PLANT. UNITS 1 AND 2, ML083230895, 2008-0041comscy-enclosure2, November 20, 2008. Attachment 2.*

experiencing concrete failures, this risk to the health and safety of the people of Alabama is significant and long lasting.

Quality Assurance (QA) Breakdown

Not only has the Bellefonte nuclear power plant been left idle and uncompleted for approximately 35 years, but also for several of those years the unit was completely abandoned and cannibalized. According to the Nuclear Regulatory Commission, no quality control system was in place at Bellefonte Unit 1 between 2006 and 2008. Those QA processes and QA systems are required by nuclear law 10-CFR-50 General Design Criteria 1 and 10-CFR-50 Appendix B to assure that the nuclear components would in fact remain usable. At TVA Bellefonte Unit 1 those QA processes were totally eliminated for two full years assuring that there is no chain of custody of nuclear components to assure that what is inside the power plant is indeed what was designed to be there and of nuclear grade material. Since the 2006 cannibalization of Bellefonte Unit 1, TVA is simply unable to provide or document the requisite formal QA process that nuclear operations occurred and there are no longer adequate records that may be relied upon to substantiate that the nuclear work that began in 1974 to facilitate this specific design has in fact not been compromised.

It should have been obvious to TVA that cannibalizing the plant would mean that 35-years of QA records were invalid and nullified according to General Design Criteria when TVA applied to the NRC to have its Bellefonte license reinstated. Instead, TVA waited until the NRC had agreed to reinstate the license for Bellefonte Unit 1 before it even began to evaluate the effects of its cannibalization. It was not until May 2009 that

TVA announced that there were no longer applicable and cohesive QA records for Bellefonte Unit 1. Calling it a *Configuration Control Lapse: Description Of Deficiency*, TVA's LER said,

Configuration control was not maintained and physical equipment issues were not documented under a Quality Assurance Plan for the period of time from in which Construction Permits CPPR-122 and CPPR-123 were withdrawn until they were reinstated.³

Suspending the QA program for several years calls into question every design document and design or equipment design change TVA has implemented throughout the lifetime of TVA Bellefonte Unit 1. Now there is absolutely no method of substantiating that QA produced equipment meets necessary and rigorous nuclear QA standards required by federal law for all nuclear power plant projects.

Bellefonte is not the only US nuclear power plant that has encountered serious problems with missing or deficient QA records. The Cincinnati Power and Light William H. Zimmer Nuclear Power Plant in Moscow, Ohio had a complete breakdown in Quality Assurance. While Zimmer was not a B&W design, it was a nuclear plant and therefore had to abide by the rigorous nuclear power plant QA protocol upon which nuclear risk, design, and licenses are predicated. However, unlike TVA Bellefonte Unit 1 where construction was completely abrogated, Zimmer's entire QA program was fully operational, yet Zimmer was still required to shut down permanently because of missing Quality Assurance records proving that the plant met all rigorous nuclear power plant QA requirements. Moreover, the NRC itself said that the quality of work at Zimmer was

³ *Configuration Control Lapse: Description Of Deficiency* LER 45066, May 14, 2009.

“indeterminate”⁴ because of breakdowns in the Quality Assurance records system.

The Zimmer plant was more than 95% complete when the Quality Assurance record problems were discovered. The QA lapse was so problematic and irreparable that Zimmer could not be operated as a nuclear power plant and was forced to convert to a coal-fired power plant because the systems, structures and components at Zimmer were unable to meet the strict Nuclear Quality Assurance Standards. While the Quality Assurance record trail for Zimmer did not meet the rigor of Nuclear Quality Assurance Standards and therefore it could not be operated as a nuclear power plant, it did meet the requirements for conversion to a coal-fired plant with its more lenient records requirements.

The several year suspension of the entire Quality Assurance Program at TVA’s Bellefonte Unit 1 is much more problematic than the lack of adequate Quality Assurance records that led to the cancelation of the Zimmer nuclear power plant and its conversion to a coal-fired power plant. When the Bellefonte unit was cannibalized, there was no NRC approved quality assurance records system in place. Reconstituting this step-by-step critical assessment of every piece of equipment within the plant, as is required by law, will be impossible to achieve without dismantling the entire plant and reconstructing it part by part.

It is important to reinforce that when the Zimmer plant failed to have sufficient QA

⁴ *Cincinnati Magazine*, September 1983, Page 83

records in place to document its ability to be operated safely and reliably as a nuclear power plant, it was better positioned than Bellefonte is today to go through the necessarily rigorous nuclear power QA process. The Zimmer facility had hundreds of QA staff working under an NRC approved and supervised plan for the entire duration. Bellefonte, on the other hand, has had no QA plan in place and no personnel available to implement the requisite QA plan. More importantly, critical equipment, pipes, and metal parts were not stripped away at the Zimmer facility as they were at Bellefonte when it was gutted and major components were sold as scrap. Zimmer also retained all of its NRC approved records system until well after the decision was made to terminate its nuclear construction permit.

In summation, due to the lack of a viable and rigorous required nuclear Quality Assurance Program during the time that Bellefonte was shut down and cannibalized for its scrap metal value, it is my professional opinion that attempting to rebuild Bellefonte Unit 1 as a nuclear power plant is doomed to failure. Such an attempt also places a huge cost burden upon TVA's ratepayers for a product that ultimately may not be deliverable.

Cannibalization

Not only is the condition of the concrete foundation likely to be substandard and the QA records for the Bellefonte plant in complete disarray, but also the plant systems have been cannibalized. NRC Senior Project Manager Joseph Williams also identified these very same broad weaknesses when the NRC reinstated the construction permits for Bellefonte

Unit 1. In his analysis⁵ Williams said,

TVA's August 26, 2008, letter claims that it is "maintaining the site in a stable condition." However, the letter also states that TVA has taken action to dismantle parts of the facility, and describes how TVA has taken action to end degradation of the facility, including repairs to eliminate water intrusion and to seal off equipment affected by its investment recovery efforts. Therefore, the meaning of TVA's statement regarding the stable condition of the facility is not clear. However, it is apparent that the facility has not been preserved in the same state it was when the construction permits were terminated. As noted, these activities were not conducted in a manner consistent with NRC regulations.

After abrogating its construction permit in 2006, Bellefonte Unit 1 was cannibalized and gutted by transferring equipment valued at approximately \$49 Million to other TVA nuclear and fossil-fueled plants. At the same time that equipment was transferred to other TVA power plants, the company also opened the plant to contractors who came in and removed steam generator tubes, main condensers, and steel tubes from heat exchangers and sold all this equipment to scrap vendors for approximately \$16 Million. Unfortunately, the workers performing demolition work do not meet the same standard of care as workers constructing a sophisticated nuclear power plant.

When Bellefonte Unit 1 was stripped of its valuable and critical equipment, TVA clearly violated NRC regulations requiring the creation and continued maintenance of special protective environments for critical components. Simple issues such as preventing rodents from eating electrical insulation and preservation of special controlled

⁵ *NON-CONCURRENCE BY JOSEPH WILLIAMS REGARDING STAFF APPROACH TENNESSEE VALLEY AUTHORITY REQUEST TO REINSTATE CONSTRUCTION PERMITS BELLEFONTE NUCLEAR PLANT. UNITS 1 AND 2, ML083230895, 2008-0041comscy-enclosure2, November 20, 2008. Attachment 2.*

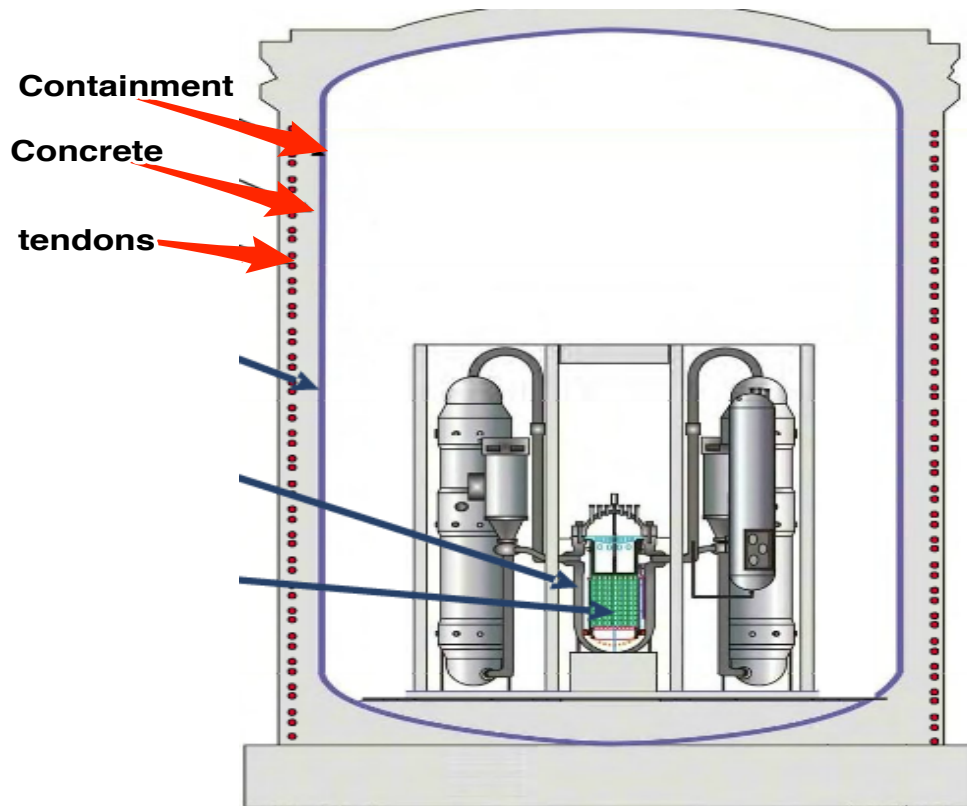
environments have immediate short-term problems such as surface rust and rodent control. Also stripping TVA Bellefonte Unit 1 did not protect the entire complex from the introduction of chemicals or other as yet unknown contaminants that could cause metallurgical or equipment problems if the building was to be used as a nuclear power plant.

For example, at a nuclear power plant with the requisite QA program in place, there are strict controls on the type of light bulbs that are allowed inside the containment. Such controls are required in order to prevent halogen contamination of the reactor vessel that may cause the vessel to fail when it is pressurized, and this is just one of thousands of critical regulations that must be enforced in order to assure nuclear safety and reliability. TVA is unable to give quantifiable assurance that every light bulb stayed in compliance with the halogen restrictions during the unsupervised dismantlement and cannibalization of Bellefonte Unit 1. Furthermore, there is no method by which to delineate that thousands of other critical maintenance requirements were performed in this unsupervised and unmonitored environment.

Containment Issues

As stated earlier, the B&W's Once Through Steam Generator (OTSG) design is unique in the nuclear industry. More than 98% of all the operating reactors do NOT use this design. In order to create this OTSG design, the pipe that takes hot water out of the nuclear reactor core and into the steam generator (called the hot leg) travels vertically up from the reactor and into the top of the steam generator. This design is called a "candy cane" design. Out of necessity, this "candy cane" design also requires a containment that

is taller than other pressurized water reactor (PWR) design that use “U Tubes” that enter the steam generator at the bottom, not the top. In addition to having a taller containment B&W’s OTSG containment is also heavier because the candy cane design requires more shielding at a higher elevations.



Since the tendons snapped on the Bellefonte Unit 1 Containment in 2009, both the NRC and TVA have been well aware that the containment at Bellefonte Unit 1 is severely degraded. First, in August 2009, a loud gunshot like noise was heard inside the containment. Finally, 100 days later, on December 10, 2009 Bellefonte acknowledged in LER 45559 that the Containment at Bellefonte Unit 1 had been compromised.

Inspection of failed Unit 1 Reactor Building Containment Vertical Tendon V9 coupling indicates a potential for an unknown common mode failure mechanism for BLN Containment vertical tendon rock anchor couplings.

Unit 1 Reactor Building Containment Vertical Tendon V9 experienced a failure of the rock anchor/tendon anchor coupling on August 17, 2009 at approximately 1400 CDT. The time of failure was identified based on a loud noise bang reported by several individuals. Initial investigation failed to reveal the source of the noise. The failed tendon was discovered on August 24, 2009 during a tour of U1 Tendon Gallery, elevation 607. Unsafe conditions previously precluded an inspection of the failed coupling for proper installation or component specific damage. The failed tendon coupling was inspected on 11/23/2009 and showed no signs of component specific damage or improper installation creating the potential for an unknown common mode failure.⁶

The magnitude of a containment failure prior to operation of a nuclear power plant cannot be underestimated. Since 2009, Bellefonte has issued four update reports to the NRC in an attempt to explain how it might resolve this problem.

1. First, TVA/Bellefonte discovered that sulfide in the grease that is used to lubricate other tendons was a contributing cause in this tendon failure.
2. Second, TVA/Bellefonte discovered that water has somehow entered some of the tendons so that the issue of moisture contamination may also have been a contributing factor in this failure.

The containment system in a nuclear power plant is meant to contain the release of unmonitored radioactivity that is generated during regular operation of a nuclear power plant and to contain any radioactivity generated during a serious nuclear power plant accident like that at Three Mile Island or Fukushima. Containments must hold their integrity in order to contain the release of radioactive isotopes and meet the corporations' and regulators' primary responsibility to protect public health and safety.

⁶ LER 45559, December 10, 2009

In order to determine the total magnitude of Bellefonte's containment degradation, a complete detensioning of the Bellefonte Unit 1 containment will be necessary. This means that every bolt throughout the containment system will have to be systematically loosened (detensioned) and then gradually and systematically retensioned in order to recreate a fully functioning containment system. Unless concrete is kept under tension, it cannot retain its form and strength. Concrete has no tensile strength but rather is effective only under compression. The TVA Bellefonte Unit 1 containment cannot retain its form and strength unless it is not correctly tensioned. Concrete will ultimately crack if it is not correctly tensioned.

In its March 2011 report, *Containment Vertical Tendon Coupling Failure - Fourth Interim Report*, to the NRC, Bellefonte still failed to resolve the magnitude of its containment tendon issue although work on a plan to detension the containment has finally been authorized.

Work has been authorized for the development of a containment vertical tendon detensioning plan, taking into consideration the Crystal River containment concrete delamination experience in which the sequence of detensioning was found to be a factor in concrete cracking. Once a detensioning plan has been developed, an independent review will be conducted prior to the start of containment detensioning activities. After approval of the final detensioning plan, TVA will detension the tendons according to the plan to perform the remaining NDE to support completion of the extent of condition evaluation.⁷

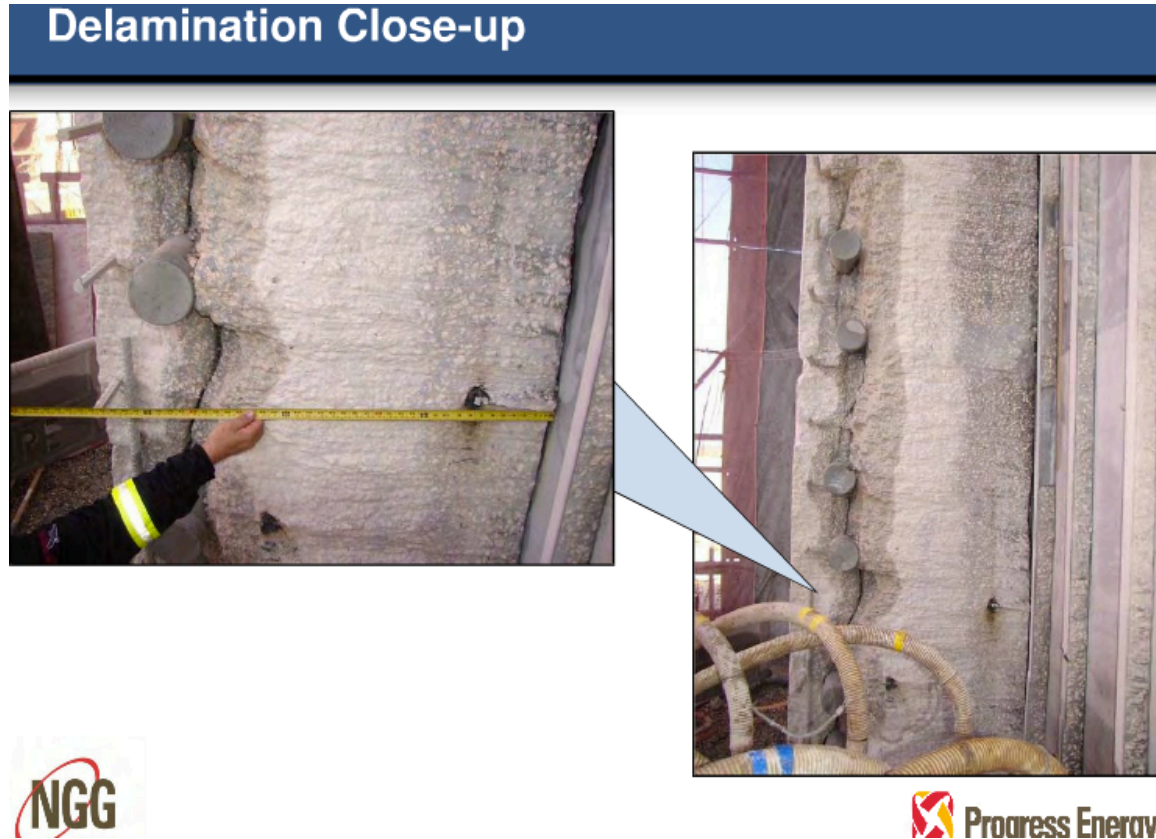
Detensioning a Babcock and Wilcox containment is an extraordinarily risky proposition.

After years of preparation and analysis, the B&W containment at Progress Energy's

Crystal River nuclear power plant in Florida was detensioned in mid 2009. This

⁷*Containment Vertical Tendon Coupling Failure - Fourth Interim Report*, TVA Letter the NRC, March 29, 2011

detensioning caused a 60-foot long by 20-foot wide crack (delamination⁸) to occur the middle of the containment wall as noted in the photo below.



Not only did this 60-foot long crack occur after Progress Energy and B&W had conducted a thorough engineering analysis that was approved by the NRC, more importantly, a second crack developed in 2011 while Progress Energy was still attempting to repair the first crack Crystal River. Once again, the recovery process was thoroughly re-engineered and approved by the NRC and yet it failed for a second time. The net effect of both of these two Crystal River cracks is that a 5-year repair process

⁸ Progress Energy Crystal River Delamination (Crack) in the concrete Containment <http://www.fairewinds.com/content/crystal-river-delamination-update>

will be required to finally repair this Babcock and Wilcox containment, if indeed they can be repaired at all. Clearly, scientific understanding of how these cracks developed is lacking.

What is known is that the two Crystal River cracks developed after one or more tendons were detensioned. Fairewinds believes that this is the same scenario that Bellefonte Unit 1 is now facing with five important distinctions:

1. TVA Bellefonte Unit 1 has already experienced a rapid detensioning worse than those forces that caused the first delamination at Progress Energy Crystal River.
2. TVA Bellefonte Unit 1 has not yet inspected its containment to see if the initial snapped tendon in 2009 caused similar cracks or delamination anywhere in the containment.
3. TVA Bellefonte Unit 1 has found systemic problems in other tendons that will require a complete detensioning of the entire containment tendon system like the one that was performed at Crystal River.
4. TVA Bellefonte Unit 1 has yet to begin the process of detensioning all its other tendons, which may induce more cracks like those that occurred at Crystal River.
5. Competent engineers have spent tens of thousands of hours at a huge cost analyzing the first and second failures at Crystal River and still are unable to anticipate or prevent cracking.

The aftermath of Fukushima has shown us that three independent containment systems failed. In the event of a design basis accident how will the public be assured that health

and safety will not be put at risk with TVA Bellefonte Unit 1 and its compromised containment system?

The financial and scheduling ramifications of the containment tendon failures at TVA Bellefonte Unit 1 have introduced enormous risk into the proposed plan to complete construction by TVA at Bellefonte Unit 1. Progress Energy's Crystal River containment integrity failure and delamination shows that it will take at least five years (2009-2014) for these cracks to be repaired, if indeed they can ever be repaired. The Crystal River repair outage on a B&W containment system similar to that at TVA Bellefonte Unit 1 will be the longest repair to any operating reactor in the history of nuclear power. It will be unclear that the repairs have been effective until 2014 at the earliest. Additionally, the lessons learned at the Crystal River nuclear power plant will not be available for review and possible transfer to TVA Bellefonte Unit 1 until at least 2014. Fairewinds believes that any problems encountered at Crystal River in its repair attempts on the B&W containment will further delay continued construction on TVA Bellefonte Unit 1.

Historical Precedent

TVA is not the only utility that has faced a decision on whether or not to revive an aging Babcock and Wilcox reactor after construction has been terminated. Washington Nuclear Project-1 (WNP-1) was mothballed when it was 63 percent complete, but its construction permit was never terminated and its environmental controls assuring that the plant did not deteriorate remained in place as did its QA management and record system. The Board of Energy Northwest, owners of WNP-1, commissioned a study to assess the risk of

renewing construction at WNP-1. The 2003 report⁹ commissioned by the Board stated:

Three separate teams of consultants (Bechtel Power Corp., R.W. Beck, and Goldschmidt Imeson) retained by the Executive Board to conduct the investigation unequivocally concluded that completing the plant was neither economically nor politically feasible.

Energy Northwest's senior management team then prepared a supplemental report examining the impact of changing assumptions and variables. The team's report did not fundamentally contradict the findings of Bechtel and R. W. Beck that the total cost to complete WNP-1 would be approximately \$4.2 billion including financing expenses.

Since moving forward on constructing WNP-1 was too risky and would take at least 6-years and cost more \$4.2 Billion, Energy Northwest requested termination of the WNP-1 construction permit and discontinuation of all QA protocols. Energy Northwest's request to end WNP-1's nuclear power plant construction license was granted by the NRC February 8, 2007.

In many ways, the 2003 WNP-1 analysis presented to the Board of Directors of Energy Northwest contained significantly less risk and uncertainty than the decision the TVA Board of Directors faces eight years later in 2011. In 2003, the Babcock & Wilcox WNP-1 still had an NRC license and a fully functioning Quality Assurance program to assure that the plant's condition met the rigorous nuclear power plant safety and QA requirement during the time period it was mothballed. In comparison, TVA not only completely terminated its Babcock & Wilcox nuclear construction permit for its Bellefonte Unit 1, it also eliminated any environmental protection for equipment,

⁹ *Energy Northwest Executive Board Review of Nuclear Program*, January 23, 2003, Energy Northwest (page I, Executive Summary)(page 3)

cannibalized large pieces of equipment, and disemboweled the entire QA department and its requisite procedures and documentation. TVA claims that attempting to revive Bellefonte in 2011 is not risky. Yet in declining to revive WNP-1, Energy Northwest's Board of Directors reached the opposite conclusion in 2003 under circumstances far less technically challenging than those facing TVA and its Bellefonte Unit 1.

Post Fukushima Lessons Learned

In the aftermath of the significant tragedy at Fukushima many lessons learned are coming to light. To begin with, three out of three containment systems failed to contain radioactivity and failed to hold their strength as the reactor went through the substantial stresses of a design-basis accident. This series of accidents has fundamentally altered the risk assessment scenario upon which licensing and operation of nuclear power plants are predicated. Prior to the Fukushima accidents, the NRC assumed that there was no likelihood that a containment system could ever fail. The energy releases from three hydrogen explosions at Fukushima were totally unexpected and have dramatic ramifications on containment integrity and design moving forward. It would be unconscionable to further skew risk factors and threaten public health and safety by licensing and operating a less than reliable 35-year old concrete containment that appears unable to properly hold its tension even prior to the stress of operations.

Conclusion

In conclusion, Fairewinds believes that TVA faces enormous financial and scheduling risks in its decision to resurrect its Bellefonte Unit 1 nuclear power plant. First, this is an enormous commitment of scarce financial resources during a period of economic turmoil.

Second, TVA Bellefonte Unit 1 is already old in terms of the age of its concrete and steel. Third, it has a unique limited design with which the nuclear industry and NRC have little actual experience making it unlikely to have lessons learned from similar nuclear power plants. Fourth, TVA Bellefonte Unit 1 has numerous structural and Quality Assurance flaws that will most likely be insurmountable. Given the historical record on QA issues, like the one in which TVA and its Bellefonte Unit 1 find themselves immersed, is already a situation that is more challenging than the one faced by Zimmer. Fifth, in the post Fukushima environment where significant radiation has been released due to a nuclear accident, it is foolhardy to take more risks in public health and safety by utilizing a more challenging nuclear power plant design that has few industry learned lessons upon which to rely. Finally, due to aging concrete, groundwater intrusion, and compromised tendons the TVA Bellefonte Unit 1 containment may be significantly compromised in a manner that will be entirely undetectable until it fails under stress.

Attachments

1. CV Arnold Gundersen
2. *NON-CONCURRENCE BY JOSEPH WILLIAMS REGARDING STAFF APPROACH TENNESSEE VALLEY AUTHORITY REQUEST TO REINSTATE CONSTRUCTION PERMITS BELLEFONTE NUCLEAR PLANT. UNITS 1 AND 2, ML083230895, 2008-0041comscy-enclosure2, November 20, 2008.*

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