Davis-BesseNPEm Resource

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December 23, 2010

Ms. Paula Cooper, PE
Environmental Project Manager
Office of Nuclear Reactor Regulation
Mail Stop O-11E13
Washington, D.C. 20555-0001

Regarding: Docket No. 50-346; NRC-2010-0298

Dear Ms. Cooper:

Please find enclosed the following items:

- (1) Data Stick
- (1) DVD Disk
- (23) Pages of Supporting Documentation
- (1) Copy of a *Toledo Blade* article dated 12/19/10.

The data stick contains a video file (WMV format) of a hearing regarding FirstEnergy Nuclear Operating Company's Environmental Impact Statement submitted as part of its Application for extending Facility Operating License No. NPF-003 for an additional 20-Year Period for the Davis-Besse Nuclear Power Station, Unit 1. The hearing was held on December 18, 2010 at St Mark's Episcopal Church in the city of Toledo, Ohio. It was organized by the Sierra Club of Ohio and the Green Party of Ohio as well as their local chapters in Lucas and Wood Counties.

The digital information written on the data stick and DVD disks is a compilation of comments which are hereby submitted to the Nuclear Regulatory Commission (NRC) as part of the Scoping Process. The Supporting Documentation is a printed version of slides and reports that were presented during the hearing. As the creator of this video, I hereby give the NRC permission to display it on their website as part of the public comments available for viewing by the general public.

The DVD disk contains testimony collected on December 11, 2010 by Pat Marida in Columbus, Ohio.

The *Toledo Blade* article is presented for your information.

The video recording of the hearing has a list of speakers with a time reference for your convenience at the beginning of the video. Each speaker's name is written on the screen for the first 15 seconds of their presentation.

We are in the process of making transcripts of the hearing. However, having such a brief comment period, scheduled to begin just before Thanksgiving and ending just after Christmas has caused a great deal of hardship for the people involved in this process. We cannot afford to hire a professional transcriptionist, so we are making the transcripts ourselves. We have had to ask people to give up their holiday time with their families to put together this response. This effort has been led by ordinary citizens, not professional activists. Operating without a budget, we have managed to gather some excellent comments.

However, had this comment period occurred during a different part of the year, we would have had many more participants. Many of the people we contacted regarding the hearing had already made travel plans and were unable to attend. If the NRC's goal was to limit public participation in the process, they could not have picked a more effective time period for comments.

I would suggest that, if the NRC is seeking public participation, future relicensing application comment periods be limited to the first ten months of the calendar year.

I have one additional Scoping comment. Repeatedly, as I organized this response, I heard the same statement from many people, "The process is rigged. Trying to comment or oppose the relicensing application is a waste of time because the NRC always approves every relicensing application." There has been a loss of faith in the NRC's ability to regulate the nuclear industry. If the NRC approves this particular application, for what is arguably the worst nuclear plant in the country in terms of safety, environmental impact, and history of evasion and deception, then it will be clear to all observers that all applications will be approved. **The environmental review must include the social and cultural impact of the widespread belief that the NRC exists, not to protect the public, but to protect the nuclear industry at any cost. This loss of faith in the federal government is, at best, corrosive to the democratic process and, at worst, a cause of terrorist activities.** For Davis-Besse, the cost includes the lives of the children living near the plant who are suffering from rising thyroid cancer rates. NRC's record $33 million dollar fine is approximately one month's revenue from the plant. Nuclear plant operators will now simply be able to budget one month's revenue as the cost of doing business, because no matter how seriously a plant operator flaunts NRC directives or imperils the health and safety of the public, or how many times they lie about having "reformed" their procedures and attitudes, their license renewals will be automatically granted. Denying Davis-Besse's application will at least create a base line. Applicants will know that they have to at least be "better than Davis-Besse" in order to be approved. This

Presented with Kevin Kamp's Testimony

Davis-Besse Atomic Reactor: 20 *MORE* Years of Radioactive Russian Roulette on the Great Lakes shore?!

INTRODUCTION

FirstEnergy has applied to the U.S. Nuclear Regulatory Commission (NRC) for a 20 year operating license extension at its nearly 34-year-old Davis-Besse nuclear power plant near Oak Harbor, Ohio, just over 20 miles east of Toledo.[1] If approved, Davis-Besse would be permitted to operate for 60 years, until 2037 (its original license, granted in 1977, is currently set to expire at the end of 40 years of operations, in 2017). Beginning a decade ago, NRC has rubberstamped 59 of 59 license "renewals" sought by industry,[2] including at the oldest operating reactors in the U.S., despite some of them having very serious, documented safety risks due to age-related degradation. The NRC Office of Inspector General, however, has reported serious problems with NRC's license extension program: NRC staff have "cut and paste" the nuclear utility's own work, sometimes word for word, falsely presenting it as independent safety analysis, then once license extensions are rubberstamped, destroyed the working documents that formed the basis for "renewal" approvals.[3]

But Davis-Besse is one of the most problem-plagued atomic reactors in the entire country. For example, NRC acknowledges that Davis-Besse has suffered six (out of a total of 34 incidents so designated nationwide) "significant accident sequence precursors" between 1969 and 2005, three times more than any other American nuclear plant. This includes the September 24, 1977 "stuck-open pressurizer PORV" (Pilot-Operated Relief Valve) at Davis-Besse, an almost identical accident precursor that unfortunately did lead to a 50% core meltdown at Three Mile Island (TMI), Pennsylvania just a year and a half later. NRC has calculated that this 1977 accident precursor at Davis-Besse had a 7% "core damage probability" (CDP), making it the fourth most serious accident in the entire industry during the time period in question, surpassed only by the 1979 TMI meltdown, 1975 Browns Ferry, AL fire (assigned a 20% CDP), and the 1978 Rancho Seco, CA steam generator dryout (assigned a 10% CDP).[4] (However, it deserves mentioning that the Fermi 1 plutonium breeder reactor located in Monroe, Michigan – 30 miles across Lake Erie, and visible with the naked eye, from Davis-Besse – also suffered a partial core meltdown just a few years earlier than NRC's timeframe above, in 1966.[5]) But the 9/24/77 TMI precursor accident was but the first of numerous times "We Almost Lost Toledo," but one of many skeletons in Davis-Besse's closet.

Three Mile Island meltdown precursor incident, September 24, 1977

Very fortunately for Toledo and points downstream and downwind, including Cleveland, the fledgling, six-month-old Davis-Besse reactor was only operating at 9% power[6] when "a spurious half-trip of the steam and feedwater rupture control system initiated closure of the startup feedwater valve. This resulted in reduced water level in SG [steam generator] "2." The pressurizer PORV lifted nine times and then stuck open because of rapid cycling."[7] Obscured by such NRC techno-engineering "Nukespeak"[8] is that this unforeseen "break-in phase" accident created instant chaos in the Davis-Besse control room, bewildering the highly trained operators, leaving them in "complete confusion" for over 20 minutes as they tried to stabilize the suddenly and inexplicably out-of-control reactor. Over three hundred bells and flashing lights were simultaneously signaling alarm as a water column displaced the steam bubble "shock absorber" and filled the pressurizer on the very top of the reactor, risking any sudden jolt fracturing safety-significant pipes, and as the Number 2 Steam Generator risked boiling dry, which could cause dangerous overheating and even a "loss-of-coolant-accident" in the hellishly hot reactor core. Operators "grasped at straws," rashly deciding to chuck emergency manual procedures that only seemed to be making matters worse in this unprecedented accident situation. Luckily for the unsuspecting cities just to the east and west, an operator spotted a gauge reading that resolved the perplexing puzzle, and corrective action was taken at the 26th minute of the crisis that brought the situation under control.[9]

Despite such a wild roller coaster ride, almost no one within the industry, including at reactor design firm Babcock and Wilcox, grasped the gravity of this accident. Most NRC officials were of the mindset that Davis-Besse personnel had acted appropriately, that the situation had been satisfactorily resolved, and that there were no more lessons to learn from the incident. However, an NRC regional inspector, James Creswell, from the Chicago office refused to "shut up." After first exhausting normal channels by working, in vain, within the system, Creswell – at great personal risk to his career and livelihood – bypassed his nay-saying chain of command and

directly communicated the significance of the accident, and his unresolved concerns, to the attention of NRC Commissioners Bradford and Ahearne, as well as their technical staff, on March 22, 1979. Tragically, it was too late -- the TMI meltdown occurred just six days later, following an almost identical accident sequence as had begun to unfold at Davis-Besse 18 months earlier. Creswell was later honored by NRC for his efforts, as the agency tried to clean up its ruined image after the TMI disaster.[10]

Later in 1977, Davis-Besse experienced another "significant accident sequence precursor," when Emergency Feedwater (EFW) pumps became inoperable during a test. NRC reported "During EFW pump testing, operators found that control over both pumps was lost because of mechanical binding in the governor of one pump and blown control power supply fuses for the speed changer motor on the other pump." NRC calculated that this incident had a core damage probability of 1/200, or 0.5%.[11] But Davis-Besse's very bad *first* year of operations was just the beginning.

"The Worst Accident Since TMI" -- Loss of cooling to reactor core for 12 minutes, June 9, 1985

Due to a convoluted combination of equipment malfunction and unavailability resulting from deferred maintenance, inexplicable "spurious actuation" in safety critical systems, operator error, and even overzealous security precautions that interfered with emergency actions, on June 9, 1985 at Davis-Besse, "several steps had been taken along the pathway to meltdown, but fortunately that journey was halted in time."[12] Even NRC admits that Davis-Besse faced a 1% "core damage probability" when, despite the reactor being scrammed,[13] there was a complete loss of feedwater to steam generators essential for core cooling. NRC's summary of the incident states: "While at 90-percent power, the reactor tripped with main feedwater (MFW) pump "1" tripped and MFW pump "2" unavailable. Operators made an error in initiating the steam and feedwater rupture control system and isolated EFW [emergency feedwater] to both steam generators (SGs). The PORV actuated three times and did not reseat at the proper RCS [reactor coolant system] pressure. Operators closed the PORV block valves, recovered EFW locally, and used HPI [high pressure injection] pump "1" to reduce RCS pressure."[14] Such technical language obscures the fact that plant personnel had to sprint through darkened corridors with bolt cutters, not knowing if they had the proper keys or access cards to open locked security doors, in order to cut through chains securing valves, so they could manually open them to restore water flow to steam generators in order to cool the reactor core, with each passing minute increasing the risk of a loss-of-coolant-accident, nuclear fuel damage, and even a meltdown.[15]

As Dave Lochbaum at Union of Concerned Scientists clearly relates, Davis-Besse came within 37 minutes of partially uncovering the core of its cooling water supply, and 41 minutes of completely uncovering the core; as he points out, TMI's core was never fully uncovered, but it was uncovered enough to half melt down.[16] As if describing a tense scene from an Indiana Jones movie, Lochbaum also recounts how "Now that the main feedwater pumps and the backup auxiliary feedwater pumps had all crapped out, workers turned to [a dangerously substandard, previously] intentionally disabled motor-driven startup feedwater pump. An operator raced through the plant taking five manual actions in four different locations (including re-installing the fuses)."[17]

As summarized by Tom Henry in the *Toledo Blade*, "Davis-Besse experienced a 12-minute interruption in the feedwater flow to steam generators...The potentially catastrophic event idled the plant for more than a year."[18] Henry added "...***the Nuclear Regulatory Commission referred to the 1985 accident as the worst since Three Mile Island in 1979***...A report prepared for the U.S. House Subcommittee on Energy Conservation and Power just days after the June 9, 1985, event suggested that the coolant-water episode at Davis-Besse should not have surprised the NRC. The report said 48 problems concerning Davis-Besse's auxiliary feed-water system had been reported by [FirstEnergy forerunner] Toledo Edison since July, 1979. The plant unexpectedly shut down 40 times between 1980 and 1985 - at least half of those times because of hardware problems and at least nine times because of human error."[19] (emphasis added) Dubbing it "decades of decadence" at Davis-Besse, Lochbaum has emphasized that had *any* of the numerous equipment problems been addressed in a timely manner, rather than multiple simultaneous shortcuts on safety taken and maintenance jobs long deferred, the entire accident could have been avoided.[20]

In fact, two of the incidents in the early 1980s mentioned by Henry also rose to the level of "significant accident precursors," according to NRC. On April 19, 1980, Davis-Besse lost two essential busses, causing a 1/1000 core damage probability; NRC reported "When the reactor was in cold shutdown, two essential busses were lost due to breaker ground fault relay actuation during an electrical lineup. Decay heat drop line valve was shut, and air was drawn into the suction of the decay heat removal pumps, resulting in loss of a decay heat removal path."[21] And on June 24, 1981, Davis-Besse lost a vital bus, coupled with the failure of an EFW pump, as

well as a main steam safety valve lifting and failing to reseat. NRC reported "With the plant at 74-percent power, the loss of bus "E2" occurred due to a maintenance error during CRDM [control rod drive mechanism] breaker logic testing. A reactor trip occurred, due to loss of CRDM power (bus "E2"), and instrumentation power was also lost (bus "E2" and a defective logic card on the alternate source). During the recovery, EFW pump "2" failed to start due to a maladjusted governor slip clutch and bent low speed stop pin. A main steam safety valve lifted, and failed to reseat (valve was then gagged)." This resulted in a 1/500, or 0.2%, core damage probability.[22]

In addition, then-owner Toledo Edison was fined for an odd incident not unrelated to the 1985 close call. In a misguided, botched attempt to appease anti-nuclear watchdogs after the loss of coolant accident, a former U.S. Nuclear Navy submarine commander was brought onboard as plant manager, supposedly in order to make Davis-Besse "ship shape." However, his "command and control" approach left a bit to be desired with the public and even his fellow employees, and he left after just a couple of years. The final straw came during the holidays in the mid to late 1980s, when the plant manager entered the Davis-Besse control room visibly drunk, cursing the busy reactor operators, and having to be physically restrained and dragged out by plant security when he tried to pick a fight.[23]

Again, the major fiascos of Davis-Besse's first decade of operations would be followed by more.

Direct hit by tornado, June 24, 1998

An F2 tornado, with wind speeds of 113 to 157 miles per hour, scored a direct hit on Davis-Besse, with the funnel cloud passing between the cooling tower and the containment building. The control room operators, running the reactor at 99% power, had little to no advance warning of the twister, until alerted by the guard shack, which had spotted it approaching the plant. Although the reactor was then immediately scrammed, a large amount of radioactive decay heat in the core would need to be actively cooled for many hours, even days. As a safety precaution, operators immediately attempted to initiate the plant's two emergency diesel generators (EDGs). However, the first EDG initially failed to start, and was forced more than once over the course of the next day to be declared inoperable due to overheating of the room housing it. In addition, the second EDG was later declared inoperable "due to an apparent problem with the governor control." This "uncertainty of the operability of the EDGs" was a very serious concern, as the tornado had caused extensive damage to Davis-Besse's electrical switchyard, as well as to the region's electrical transmission lines, leading to a complete loss of offsite power that lasted for nearly 27 hours. Thus, the EDGs were needed to cool the thermally hot core, as well as to cool the irradiated nuclear fuel storage pool, for over a day. Complete failure of both the offsite power supply, as well as the EDGs, could lead to core damage and even a meltdown in a short period of time, as well as boil off of the radioactive waste storage pool's cooling water supply, which could cause spontaneous combustion of the irradiated nuclear fuel within a day or two. Such a reactor meltdown and/or pool fire could result in catastrophic radioactivity releases.[24] In addition to the dicey electricity supply to run vital safety and cooling systems, Davis-Besse's emergency alert system and communications were largely destroyed or inoperable. For example, most of the emergency sirens across Ottawa County no longer worked after the electrical distribution system was so severely damaged. Ironically, when needed most, the emergency sirens did not work. Thus, the public would have been "in the dark" had there been radiological releases, and Davis-Besse could not even communicate with the State of Ohio or neighboring counties to coordinate emergency response.[25]

3/16^{ths} of an inch from a meltdown?! The reactor with a hole in its head, March, 2002

The infamous 2002 "reactor hole-in-the-head" fiasco, due to Davis-Besse's "multiple conditions coincident with reactor pressure vessel (RPV) head degradation" – namely, cracked control rod drive mechanism nozzles, a massive acid corrosion hole through the reactor lid, exacerbated by potential clogging of the emergency sump, as well as degradation of the high-pressure injection (HPI) pumps during core cooling water recirculation – is considered by the U.S. Government Accountability Office as ***"the most serious safety issue confronting the nation's commercial nuclear power industry since Three Mile Island in 1979."***[26] (emphasis added) As recently summarized by Tom Henry in the *Toledo Blade*, "...in 2002, Davis-Besse's old nuclear reactor head nearly burst. The lid was weakened by massive amounts of acid that had leaked from the reactor over several years. The acid induced heavy corrosion on top of the head. Radioactive steam would have formed in a U.S. nuclear containment vessel for the first time since the 1979 half-core meltdown of Three Mile Island Unit 2 in Pennsylvania if Davis-Besse's lid had been breached. The only thing preventing that was a thin stainless steel liner that had started to crack and bulge, records show. Correcting the problem kept the Davis-Besse [reactor] idle

a record two years. Federal prosecutors later described the incident as ***one of the biggest cover-ups in U.S. nuclear history.*** Two former Davis-Besse engineers were convicted of withholding information and put on probation; the utility itself wound up paying a record $33.5 million in civil and criminal fines"; this represents the ***"largest single fine ever proposed by the NRC."***[27] (emphasis added)

NRC's own Office of Inspector General concluded that not only FirstEnergy, but also the NRC under the chairmanship of Richard Meserve, had prioritized the nuclear utility company's profits over public safety.[28] U.S. Representative Dennis Kucinich (Democrat-Ohio), responding to the GAO report entitled "NRC Needs to More Aggressively and Comprehensively Resolve Issues Related to the Davis-Besse Nuclear Power Plant Shutdown"[29] – an investigation he had requested in the first place – said "The General Accounting Office (GAO) Report highlights shocking, serious and dangerous systemic problems at the Nuclear Regulatory Commission (NRC). Problems that call into question whether the agency can, as it is currently run, continue to perform its most fundamental functions-to protect public safety. This report reveals failures at almost every rung of the bureaucratic ladder at the NRC. ***The crisis at Davis-Besse is the most serious safety issue to face a commercial nuclear power plant since Three Mile Island.*** The GAO report shows that the NRC was ill equipped, ill informed and far too slow to react. The NRC's reaction to Davis-Besse was inadequate, irresponsible and left the public at grave risk."[30] (emphasis added)

The Northeast Blackout of 2003 – caused by FirstEnergy's sagging money tree?!

The U.S.-Canada Power System Outage Task Force reported in its "Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations"[31] – regarding the second biggest power outage in history, affecting 55 million people in 8 U.S. states and Ontario – that the main cause involved FirstEnergy's failure to trim trees in its Ohio service area, combined with extensive maintenance backlogs as well as computer and communications system breakdowns. Could it be that FirstEnergy, in the midst of paying over $139,200,000 in costs[32] (replacement power, repairs, etc.) associated with the hole-in-the-head fiasco (costs which would grow to over $600,000 million altogether) at Davis-Besse due to the hole-in-the-head, and facing intense scrutiny by NRC and other government agencies such as the U.S. Department of Justice (which would eventually lead to civil and criminal charges and convictions), was experiencing "cash-flow challenges" and "other distractions" that contributed to these tree-trimming and maintenance backlogs? Ironically, the power outage forced the shutdown of dozens of atomic reactors in the U.S. and Canada – a safety pre-caution during grid instability.

Two holes in your reactor's head are better than one?! March 12, 2010

Tom Henry has also reported that "Davis-Besse resumed operation in 2004 but was unexpectedly sidelined again for several weeks earlier this year [2010] after a 25-year-old reactor head the utility had installed to replace the original one showed signs of premature aging. Officials said the device was made of an inferior alloy. Several of its metal nozzles became brittle and starting cracking."[33] Lochbaum reports "In March 2010, workers at Davis-Besse discovered indications that two CRDM nozzles in the reactor vessel head purchased to replace the original head that CRDM nozzle leakage damaged beyond repair have through-wall cracks that leaked borated water onto the carbon steel reactor vessel head."[34] In all, 24 of the 69 CRDM nozzles were found to have flaws, Henry reports. The new vessel head was supposed to last 15 years, but was failing after just 6 years. Apparently, an inferior metal alloy, now being phased out across the industry, was used in the lid's manufacture, and Davis-Besse inspectors missed the problem when the lid was purchased from Consumers Energy's built, but never operated, Midland nuclear power plant in Michigan.[35] Lochbaum points out that The CRDM nozzle leakage identified in 2002 clearly constituted "*significant conditions adverse to quality*" – the NRC imposed the majority of its $5.45 million record fine for it. This federal regulation required the licensee to take corrective action to preclude recurrence. The 2010 recurrence demonstrates that Criterion XVI (Corrective Action) in Appendix B (Quality Assurance Criteria for Nuclear Power Plants and Fuel Preprocessing Plans) to 10 CFR [Code of Federal Regulations] Part 50 -- had been violated. In response to this latest regulatory violation, on April 5, 2010, Dave Lochbaum at UCS filed a petition with the NRC entitled "Request for Restoration and Maintenance of Adequate Protection of Public Health and Safety at the Davis-Besse Nuclear Plant," citing NRC regulations and requirements that allow for "zero reactor coolant pressure boundary leakage during operation with the requirement to shut down the reactor within six hours if such leakage occurs."[36] Despite this, NRC allowed Davis-Besse to return to service in early summer, 2010.

Radioactive Risks Piling Up on the Lake Michigan Shoreline

The U.S. Department of Energy (DOE) estimates that Davis-Besse had, by the spring of 2010, generated about 557 tons of highly radioactive irradiated nuclear fuel.[37] DOE projects that if Davis-Besse operates for a total of 50 years (till 2027), it will generate over 900 tons of irradiated nuclear fuel.[38] If it operated a decade beyond that, as FirstEnergy has applied to do, the reactor would generate yet another 20 to 30 tons of irradiated nuclear fuel annually, or an additional 200 to 300 tons during that additional decade of operations.

Davis-Besse's indoor pool for storing high-level radioactive wastes was "packed to the gills" by the mid-1990s, at which point it proposed loading horizontal outdoor "bunkers" (unfortified) of concrete and steel – "dry" storage casks – to serve as "overflow parking." NRC identified serious problems with 3 of the "NUHOMS" dry storage casks, manufactured by Vectra Technologies (later taken over by Transnuclear, Inc., a subsidiary of the French government owned nuclear giant Cogema, now called Areva) fully loaded with irradiated nuclear fuel at Davis-Besse. The casks were discovered to have been built below technical specifications: the aggregate used to fabricate the casks' outer concrete walls – essential for radiation shielding -- was poor quality, and the steel alloy walls of the inner metallic canisters actually containing the irradiated nuclear fuel were ground too thin along the weld lines, in violation of technical specifications. The Toledo Coalition for Safe Energy challenged the safety and quality assurance of this proposal in 1994, but was overruled by NRC, which allowed loading of casks to begin in 1995. These faulty casks remain fully loaded with high-level radioactive waste onsite at Davis-Besse to this day, 15 years later.[39]

The vast majority of Davis-Besse's irradiated nuclear fuel is still stored in its pool – vulnerable to cooling water drain downs or boil offs due to accident (such as heavy load drops), natural disaster (such as tornadoes), or intentional terrorist attacks. Without cooling water, wastes in the pool could catch fire within hours, resulting in 25,000 latent cancer deaths, due to large amounts of such hazardous radioactive isotopes as Cesium-137 escaping in the smoke and blowing downwind, depositing lethal fallout as far away as 500 miles.[40] However, as time goes on, more and more dry casks are being loaded with older irradiated nuclear fuel at Davis-Besse, in order to free up room in the storage pool for the hellishly hot and radioactive rods just removed from the operating reactor core during re-fueling outages.

Dry casks themselves are vulnerable to accidents, are not designed to withstand terrorist attacks, and will eventually degrade with exposure to the elements and need to be unloaded and replaced with new containers.[41] NRC recently updated its "Nuclear Waste Confidence Findings and Rule," asserting that "the nation's spent nuclear fuel can be safely stored for at least 60 years beyond the licensed life of any reactor and that sufficient repository capacity will be available when necessary."[42] NRC's "confidence" in the opening of a repository is suspect: President Obama has cancelled the proposed Yucca Mountain, Nevada repository, the only "deep geologic" dumpsite to be studied for high-level radioactive waste disposal in the U.S. for the past 23 years. NRC is thus perpetrating a "con game"[43] on the American people, and blocking any consideration of irradiated nuclear fuel generation risks in new reactor combined construction and operating license application proceedings, as well as in old reactor license extension proceedings, such as the one now underway at Davis-Besse.

Thus, NRC has already "blessed" high-level radioactive wastes remaining at Davis-Besse for a century, until 2077. If NRC rubberstamps a 20 year license extension, the irradiated nuclear fuel could remain onsite until 2097. However, the NRC Commissioners have also "directed the NRC staff to conduct additional analysis for [even] longer-term storage," ordering staff to submit a "plan to the Commission for the long-term rulemaking by the end of the calendar year [2010]."[44] Thus, NRC could soon approve irradiated nuclear fuel remaining at Davis-Besse – on the shoreline of the Great Lakes, 20% of the world's surface fresh water, and drinking supply for 40 million people -- for *centuries* into the future, despite the safety, security, health, and environmental risks.

High-level radioactive wastes are one of the most hazardous substances ever generated by humankind. While electricity is but a fleeting byproduct, irradiated nuclear fuel will remain deadly and need to be isolated from the living environment "forevermore."[45] Without radiation shielding, it can deliver a lethal dose of gamma radiation in seconds or minutes, even decades after removal from the reactor. Alpha particle emitters, however, such as Plutonium-239 -- a microscopic speck of which, if inhaled, could initiate lung cancer -- will remain hazardous for hundreds of thousands of years. Other radioactive isotopes will remain deadly far longer – Iodine-129, for example, has a 157 million year hazardous persistence.

Ongoing Problems

As shown, Davis-Besse's woes are not confined to the past. Radioactive leaks have occurred in recent years.

On July 31, 2006, FirstEnergy publicly admitted four "occurrences of inadvertent releases of radioactive liquids that had the potential to reach groundwater," adding Davis-Besse to the growing list of 102 reactors in the U.S. that have leaked radioactivity into the environment since the early 1960s (and as the reactor ages, such leaks will become more likely).[46] These four "inadvertent releases of radioactive liquids" were, specifically:

> "[1] Following a primary to secondary leak, contaminated secondary resin was transferred to the South Settling Basin, where it remains. The Davis-Besse South Settling Basin was designed to accept spent resin from backwashed secondary polishing demineralizers. Spent resins from the secondary polishers are no longer directed to this basin. [2] Water from the Backwash Receiver Tank leaked into the ground from a break in a 3-inch line located between the Backwash Receiver Tank and the South Settling Basin. The line break was excavated and repaired, and 7 cubic yards of contaminated soil was sent to a disposal facility. [3] Primary grade water was spilled onto the ground near the Borated Water Storage Tank while draining the Hydrogen Addition System. Approximately 20 cubic yards of contaminated soil was excavated from the area and shipped to a disposal facility. [4] While pumping water from the North Settling Basin to the Collection Box, the discharge hose from the pump fell out of the Collection Box and spilled water containing ***low-level*** [sic, emphasis added] tritium **(4** E+04 pCi/L) [that is 4 X 10,000 picoCuries per liter, twice the U.S. Environmental Protection Agency's permissible concentration level for tritium contamination under the Safe Drinking Water Act] onto the ground."[47]

In October, 2008, Davis-Besse admitted an uncontrolled release of tritium – carcinogenic, mutagenic, and teratogenic[48] -- discovered by a fluke when workers checked fire protection systems.[49]

Of course, Davis-Besse – as with every operating reactor in the U.S. -- has permission from NRC, EPA and other government agencies to release radioactivity into air, water, and soil on a "routine" basis,[50] despite the fact that every radiation exposure, no matter how small, carries a health risk, and those risks are cumulative.[51]

Then, on June 25, 2009, an explosion took place in Davis-Besse's electrical switchyard. Well over a year later, NRC is still investigating the accident, criticizing FirstEnergy's response as "too narrow in scope," including its failure to specify how it will prevent such explosions from happening again.[52]

And in November, 2009, a Davis-Besse security guard inexplicably managed to shoot himself in the leg, calling into question the competence, and even safety risks, associated with the reactor's security force.[53]

Conclusion

The litany of serious close calls listed above could have led to loss-of-coolant in the Davis-Besse atomic reactor's core, meltdown, and a catastrophic radioactivity release on the Great Lakes shoreline, between Toledo and Cleveland. How bad might that have been in terms of casualties and property damage? The 1982 NRC and Sandia National Lab report, "Calculation of Reactor Accident Consequences," or CRAC-2, found that a major radioactivity release from Davis-Besse could cause 1,400 "peak early fatalities," 73,000 "peak early injuries," and 10,000 "peak cancer deaths." An $84 billion figure for property damage was given. However, population growth in the past 28 years must be accounted for, which would likely make such casualty numbers even worse today. And when adjusted for inflation to present day dollar values, property damages could now top $185 billion. And it has recently been revealed that NRC, EPA, and the Federal Emergency Management Agency (FEMA) disagree about which agency would lead the longer term clean up after a major radioactivity release, and where the funding would come from, calling into question disaster planning and severe accident mitigation analysis upon which Davis-Besse's 20 year license extension approval by NRC would be based.[54]

The TMI and Fermi 1 meltdowns, the Davis-Besse Sept. 24, 1977 incident, and the 1986 Chernobyl reactor explosion and fire represent "break-in phase" accidents – new reactors, at significantly elevated risk due to unrecognized design flaws, construction mistakes, or inexperienced operators "working the bugs out" the hard way. Even during "middle age," as shown by Davis-Besse's June 9, 1985 incident – even with more experienced staff and "broken in" systems -- risks still persist at atomic reactors. However, as reactors age and their systems, structures and components degrade and wear out, "break down phase" accident risks significantly increase. Such risks are made even worse as experienced plant personnel retire from the workforce. The year 2000 Indian Point,

NY steam generator tube rupture, as well as the 2002 Davis-Besse hole-in-the-head fiasco, are examples of such "old age" breakdowns.[55]

If the first 34 years have been this troubled, what kind of unpleasant surprises does Davis-Besse have in store in the next several decades? Is an additional 20 years of operations at Davis-Besse, which has already repeatedly experienced more brushes with disaster than almost any other U.S. reactor, worth the risks? Incredibly, 60 years of risky reactor operations and radioactive waste generation at Davis-Besse may be just the beginning. The nuclear power industry, NRC, DOE, and national nuclear labs are now pushing for *80 years* of operations at U.S. atomic reactors.[56] Will the radioactive Russian roulette at Davis-Besse end before it's too late? Davis-Besse should be shut down as soon as possible, and replaced with safe, secure, clean, reliable, and ever more cost competitive energy efficiency[57] and renewable alternatives[58] such as wind[59] and solar power.[60]

Prepared 11/19/2010 by Kevin Kamps, Beyond Nuclear.

For more information, contact Beyond Nuclear's Radioactive Waste Watchdog, Kevin Kamps, by calling (301) 270-2209x1, or emailing kevin@beyondnuclear.org. You can also check out Beyond Nuclear's website at www.beyondnuclear.org.

Endnotes

[1] See http://www.nrc.gov/info-finder/reactor/davi.html.
[2] See NRC's Status of License Renewal Applications and Industry Activities at http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html.
[3] NRC OIG, AUDIT REPORT, Audit of NRC's License Renewal Program, OIG-07-A-15, September 6, 2007.
[4] NRC Commission Document SECY-05-0192, Attachment 2, "Results, Trends, and Insights from the Accident Sequence Precursor (ASP) Program," Table 11, "Significant accident sequence precursors during the 1969-2005 period," pages 20-26, http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2005/secy2005-0192/attachment2.pdf.
[5] John G. Fuller, *We Almost Lost Detroit*, Reader's Digest Books, 1975, Berkley, 1984.
[6] Mike Gray and Ira Rosen, *The Warning: Accident at Three Mile Island*, Chapter 2, "Toledo, September 24, 1977," W.W. Norton and Company, New York, 1982, 2003, page 32.
[7] NRC SECY-05-0192, ibid.
[8] Hilgartner, S., Bell, R.C., O'Conner, R., *Nukespeak: The Selling of Nuclear Technology in America*, Sierra Club Books, 1982.
[9] *The Warning*, ibid.
[10] *The Warning*, ibid.
[11] NRC, ibid., citing LER [Licensee Event Report] 346/77-110.
[12] David Lochbaum, "Davis-Besse: Back to the Future," Issue Brief, Union of Concerned Scientists, http://www.ucsusa.org/assets/documents/nuclear_power/20050609-db-ucs-backgrounder-feedwater-event.pdf.
[13] SCRAM originally referred to the "Safety Control Rod Axe Man" – literally, a man with an axe who would have chopped a rope to drop a control rod into the uranium pile in hopes of snuffing out an out of control chain reaction -- at the world's first atomic reactor, built by Enrico Fermi's team at the University of Chicago squash courts under the football stadium. Scram now refers to the automatic insertion of control rods to shut a reactor down due to off-normal conditions. Even after scramming, reactors must be actively cooled for days due to hellishly high thermal heat from radioactive decay in the core's irradiated nuclear fuel.
[14] NRC, ibid., citing LER [Licensee Event Report] 346/85-013, entitled "Reactor Trip and Total Loss of Feedwater Event at Davis-Besse," dated Dec. 18, 1985.
[15] See, for example, NRC, Loss of Main and Auxiliary Feedwater Event at the Davis-Besse Plant on June 9, 1985, Report NUREG-1154, US Nuclear Regulatory Commission, Washington, DC, July 1985, as well as NRC's Oct. 15, 1985 INFORMATION NOTICE NO. 85-80: TIMELY DECLARATION OF AN EMERGENCY CLASS, IMPLEMENTATION OF AN EMERGENCY PLAN, AND EMERGENCY NOTIFICATIONS (http://www.orau.org/ptp/PTP%20Library/library/NRC/Info/in85080.PDF), and NRC's July 10, 1986

INFORMATION NOTICE NO. 86-55: DELAYED ACCESS TO SAFETY-RELATED AREAS AND EQUIPMENT DURING PLANT EMERGENCIES (http://www.orau.org/ptp/PTP%20Library/library/NRC/Info/in86055.pdf)

[16] Lochbaum, "Davis-Besse: Back to the Future," ibid.

[17] Lochbaum, "Davis-Besse: Back to the Future," ibid.

[18] Tom Henry, *Toledo Blade*, "Public asked for its input on license extension at Davis-Besse: Nuclear plant seeks OK for 20 more years," Nov. 1, 2010, http://www.toledoblade.com/article/20101101/NEWS16/10310341.

[19] Tom Henry, *Toledo Blade*, "Davis-Besse Reactor Near to a Dismal Record," Aug. 31, 2003, http://www.ohiocitizen.org/campaigns/electric/2003/dismal.htm.

[20] Lochbaum, "Davis-Besse: Back to the Future," ibid.

[21] NRC Commission Document SECY-05-0192, ibid., citing LER [Licensee Event Report] 346/80-029.

[22] NRC, ibid., citing LER [Licensee Event Report] 346/81-037.

[23] Personal communication with Toledo Safe Energy Coalition attorney Terry Lodge, November 7, 2010.

[24] See, for example, Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants (NRC, NUREG-1738, 2001), as well as the 1982 NRC/Sandia National Lab report, "Calculation of Reactor Accident Consequences" (CRAC-2).

[25] See: NRC news releases, both dated June 25, 1998, "NRC TEAM DISPATCHED TO DAVIS-BESSE NUCLEAR PLANT," (http://permanent.access.gpo.gov/lps11598/www.nrc.gov/reading-rm/doc-collections/news/1998/98-40iii.html), and "NRC INSPECTION TEAM MONITORING DAVIS-BESSE PLANT RESPONSE TO TORNADO DAMAGE AND LOSS OF OFFSITE POWER," (http://permanent.access.gpo.gov/lps11598/www.nrc.gov/reading-rm/doc-collections/news/1998/98-40aiii.html); see also LICENSEE EVENT REPORT (LER) 1998-006-00, "Tornado Damage to Switchyard Causing Loss of Offsite Power," EVENT DATE 6/24/98, REPORT DATE 08/21/1998.

[26] U.S. General Accounting Office, Report to Congressional Requestors, "NUCLEAR REGULATION: NRC Needs to More Aggressively and Comprehensively Resolve Issues Related to the Davis-Besse Nuclear Power Plant's Shutdown," GAO-04-415, May 2004.

[27]Tom Henry, *Toledo Blade*, "Public asked for its input on license extension at Davis-Besse: Nuclear plant seeks OK for 20 more years," Nov. 1, 2010, http://www.toledoblade.com/article/20101101/NEWS16/10310341. For more information on FirstEnergy's record-breaking fines and penalties, see NRC "NOTICE OF VIOLATION AND PROPOSED IMPOSITION OF CIVIL PENALTIES - $5,450,000; (NRC OFFICE OF INVESTIGATIONS REPORT NO. 3-2002-006; NRC SPECIAL INSPECTION REPORT NO. 50-346/2002-08(DRS)); DAVIS-BESSE NUCLEAR POWER STATION," April 21, 2005, http://www.nrc.gov/reading-rm/doc collections/enforcement/actions/reactors/ea05071.html as well as U.S. Dept. of Justice press release, "Firstenergy Nuclear Operating Company to Pay $28 Million Relating to Operation of Davis–Besse Nuclear Power Station," Jan. 20, 2006, http://www.justice.gov/opa/pr/2006/January/06_enrd_029.html. For more information on this Davis-Besse near-disaster, and its aftermath, see the extensive coverage by Henry in the *Toledo Blade*, as well as by John Funk and John Mangels in the *Cleveland Plain Dealer*, beginning in early 2002 and continuing for months and even years after. Also search for Davis-Besse at www.ucsusa.org for numerous reports and backgrounders by Dave Lochbaum. For instance, Lochbaum's *Walking a Nuclear Tightrope: Unlearned Lessons of Year-plus Reactor Outages,* viewable at http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/walking-a-nuclear-tightrope.html, provides a detailed chronicle of Davis-Besse's over two year shutdown.

[28] Event Inquiry Regarding NRC's Regulation of Davis-Besse Regarding Damage to the Reactor Vessel Head, Case No. 02-03S, December 30, 2002, http://www.nrc.gov/reading-rm/doc-collections/insp-gen/2003/02-03s.pdf

[29] U.S. General Accounting Office, "NUCLEAR REGULATION: NRC Needs to More Aggressively and Comprehensively Resolve Issues Related to the Davis-Besse Nuclear Power Plant's Shutdown," ibid.

[30] "Statement of Congressman Dennis J. Kucinich on the GAO Report on the Davis-Besse Nuclear Power Plant," May 18, 2004, http://www.kucinich.house.gov/News/DocumentSingle.aspx?DocumentID=26006.

[31] April 2004, https://reports.energy.gov/BlackoutFinal-Web.pdf.

[32] See the Feb. 13, 2003 entry regarding Davis-Besse's long shutdown at http://www.ucsusa.org/assets/documents/nuclear_power/davis-besse-ii.pdf, in Dave Lochbaum of UCS's report *Walking a Nuclear Tightrope: Unlearned Lessons of Year-plus Reactor Outages,* viewable at http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/walking-a-nuclear-tightrope.html.

[33] Henry, Nov. 1, 2010, ibid.

The following eight pages reproduce the slides that were used in the presentation by A. Compaan on 12/18/2010. Minor formatting changes were made and references moved beneath the related slides.

The case for replacing Davis Besse with efficiency improvements and renewable energy sources

Davis Besse re-licensing community hearing
St. Mark's Episcopal Church, Toledo, OH
December 18, 2010

Alvin D. Compaan
Distinguished University Professor of Physics, Emeritus
The University of Toledo

Overview of presentation

1. History of Davis Besse indicates that 20 more years of operation will seriously endanger the surrounding communities.
2. Davis Besse provides only 8.3% of First Energy's base-load generation and can readily be replaced.
3. Ohio Senate Bill 221 and the Advanced Energy Standard ***requires*** FE to:
   - achieve higher efficiency by reducing demand 22% by 2025,
   - achieve 12.5% generation from renewables by 2025,
   - achieve 12.5% generation from "advanced energy" by 2025, which may include ***new advanced nuclear,*** but a continuation of D-B will not qualify.
4. Distributed Generation will qualify for SB 221 credit.
5. Alternative sources are very attractive in Ohio:
   - Wind near or in Lake Erie (class 3 to class 6 -- better than Texas!)
   - Solar PV (costs are decreasing rapidly; FE used data 14 years old!)

What happens to the highly radioactive spent fuel rods?

- Expectation when Davis Besse was built—a federal repository would be constructed for storing the high level radioactive components as needed for thousands of years.
- Yucca Mountain—still does not have an operating license and no funding was proposed in the federal 2011 budget.
- For 33 years, all high-level radioactive components including fuel assemblies have been stored on site at Davis Besse. Initially in a cooling pond and then in above-ground containers.

➢ ***No nuclear plant license extensions should be granted until a long-term storage facility is operating.***

A troubling indicator: *Where does the tritium in the Davis Besse ground water come from?*

From Appendix E: Davis Besse Environmental Report p. 2.3-2:

"Another well, MW-105A, which has been on a slow increasing trend since the spring of 2009, had a tritium level of 4,158 pCi/l. As a result, FENOC is pursuing a root cause approach to identify the source of the tritium in the wells. No tritium concentrations have been detected at or above the USEPA drinking water limit of 20,000 pCi/l (40 CFR 141.66)."

About tritium and its radioactivity:

- Tritium or hydrogen-3 (1 proton and 2 neutrons) is not naturally occurring. It has a half-life of 12.3 years.
- Tritium is produced in nuclear reactors by neutron bombardment of Lithium-6 and Boron-10. [A small amount is produced in the upper atmosphere by cosmic rays.]
- Tritium is radioactive and decays by emitting a high energy electron (beta particle) plus an anti-neutrino.
- The beta particle has an average energy of 5.7 kilo-electron volts. It will not penetrate the outermost skin layers but is very dangerous if inhaled as hydrogen (H_2 or HT) or water vapor or swallowed as water—not H_2O but as HTO.

Excellent alternatives exist to extending the license 20 years and their costs are declining

- The incident and accident record of Davis Besse and the uncharted territory of extending the life of any nuclear plant 20 years beyond the 40-year design life of the original should stimulate FE to get serious about alternatives.
- The best alternatives for Ohio are (IMHO):
  1. Energy conservation
  2. Wind
  3. Solar
- *These are already mandated by the State of Ohio. FE is required to develop these alternatives anyway AND is allowed by Ohio law to pass the costs through to the ratepayers.*

Essential features of SB221

(passed in the spring of 2008)

1. **Alternative Energy Portfolio Standard (O.R.C. 4928.64-.65)**
   - 25% electricity generation by advanced energy by 2025
   - 12.5% by renewables with solar set-aside of 0.5%
   - Remaining 12.5% may include "advanced energy" such as:
     - Clean coal (w/o CO_2 emissions)
     - Advanced nuclear (NRC Generation III technology)
       [Gen III incorporates ***passive safety systems*** and is ***designed*** for 60 years of operation]

2. **Net metering (O.R.C. 4928.67, 4905.31, 4928.01)**

3. **Energy Efficiency Standard (O.R.C. 4928.66)**
   - 22% reduction by 2025 through energy efficiency
   - 7% peak demand reduction by 2018

➢ ***Costs may be passed through to customers!***

Bricker & Eckler
ATTORNEYS AT LAW

Ohio Senate Bill 221
Alternative Energy Portfolio Standard

Alternative Energy Technologies	2025 R.P.S. Benchmarks	In-State Requirements	Renewable Energy Credits	Enforcement/ Compliance Payments
Renewable ORC 4928.01(A)(35) • Solar – Photovoltaic • Solar – Thermal • Wind • Hydropower • Certain Solid Waste • Biomass • Bio-Methane Gas • Fuel Cells • Wind Turbines – Lake Erie • Off Peak Storage Facilities Utilizing Renewables • Distributed Generation Facilities Utilizing Renewables	Renewable and Solar Benchmarks: 12.5% + ORC 4928.64(B)(2) Y R S 2009: .25% .004% 2010: .50% .010% 2011: 1.0% .030% 2012: 1.5% .060% 2013: 2.0% .090% 2014: 2.5% .120% 2015: 3.5% .150% 2016: 4.5% .180% 2017: 5.5% .220% 2018: 6.5% .260% 2019: 7.5% .300% 2020: 8.5% .340% 2021: 9.5% .380% 2022: 10.5% .420% 2023: 11.5% .460% 2024: 12.5% .500%	At least ½ of renewable energy resources to be implemented by the utilities shall be met through facilities located in Ohio. The remainder shall be met with resources that can be shown to have been delivered into this state. ORC 4928.64(B)(3)	Utilities may use R.E.C.s in any of the 5 calendar years following acquisition to comply with both the renewable and solar energy resource requirements. 1 R.E.C. shall equal 1 Mw Hour of electricity from renewable resources. ORC 4928.65	**1) Annual PUCO Review** ORC 4928.64(C)(1) **2) If Not in Compliance:** ORC 4928.64(C)(2) A) Solar Benchmark $ per Mw hour : 2009: $450 2010: $400 2012: $350 2014: $300 2016: $250 2018: $200 2020: $150 2022: $100 2024: $50 B) Renewable Benchmark 2009: $45 Adjusted annually per CPI
Advanced ORC 4928.01(A)(34) • Clean Coal • Advanced Nuclear • Energy Efficiency • Fuel Cells • Co-gen • Certain Solid Waste **Mercantile Sited** ORC 4928.01 (A)(1) • Real/Reactive Power • Waste Heat Efficiency • Demand/Load storage • Advanced/Renewable	Advanced Energy Requirement: 12.5% ORC 4928.64(B)(1)			

Key A.E.P.S. Cost Containment Mechanisms

3% Cost Cap	Force Majeure Provision
Utilities not required to comply with benchmark to the extent compliance will result in 3+% increase in electricity production or acquisition costs. ORC 4928.64(C)(3)	Utility may request PUCO to determine whether renewable resources are sufficiently available to enforce R.P.S. benchmark requirement. If utility shows good faith effort to comply with renewable benchmarks but cannot, PUCO may reduce obligation. Modification does not automatically reduce future benchmarks. ORC 4928.64(C)(4)

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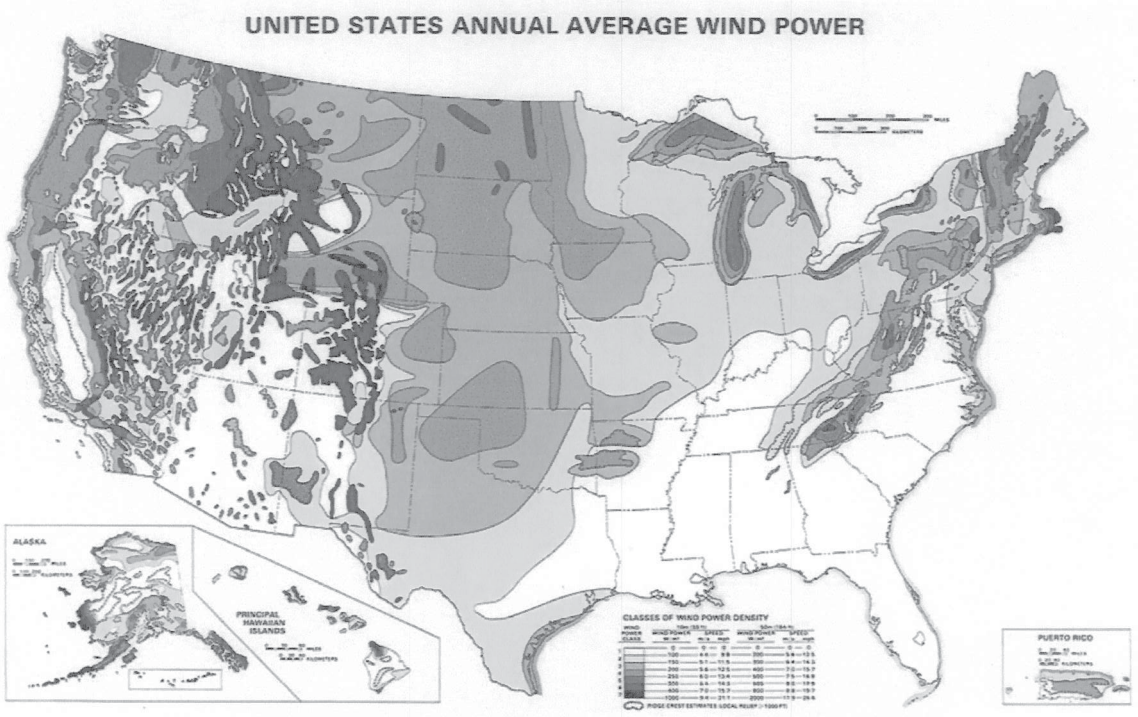
http://www.bricker.com/documents/publications/1533.pdf

Lake Erie and the Lake Erie shore is a great resource for wind energy

Map showing average wind power in Lake Erie better than Texas and the plain states



http://rredc.nrel.gov/wind/pubs/atlas/maps.html

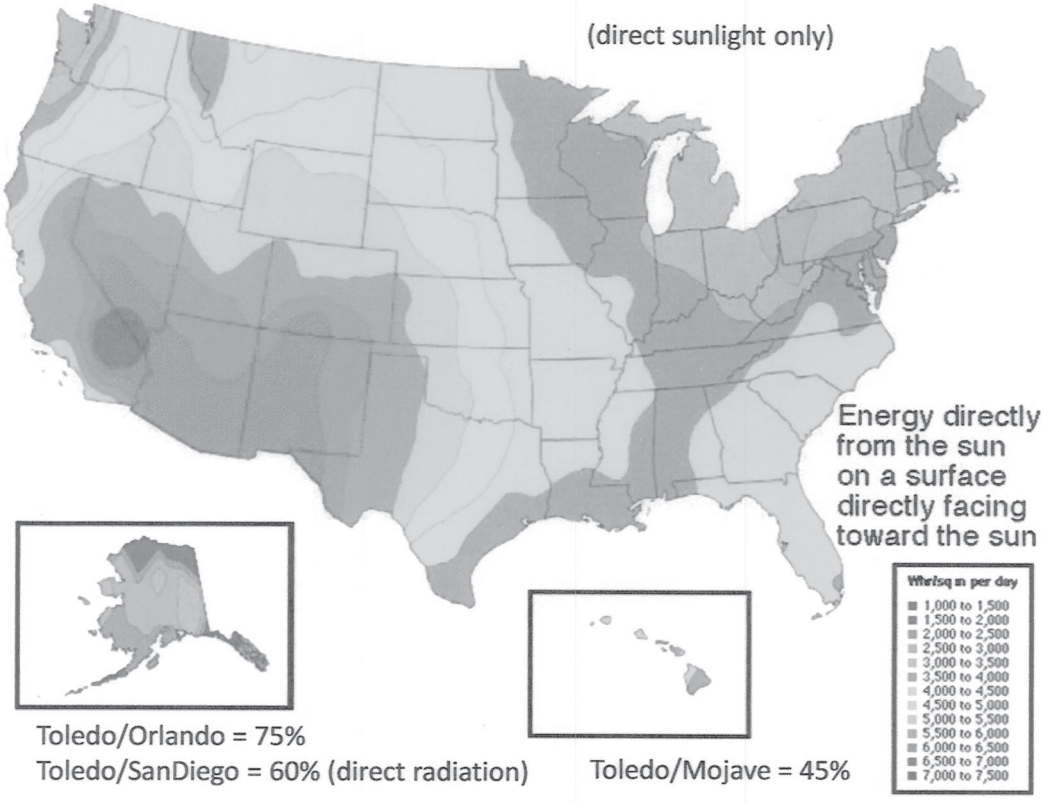
Ohio, and particularly NW Ohio, has excellent solar insolation well-suited for photovoltaics (PV)

Errors in the First Energy Environmental Report (Appendix E):

- must consider full-sky insolation, not just direct solar
- must use current costs and cost projections for PV, not data from 1998!

Average Daily Solar Radiation 1961-1990

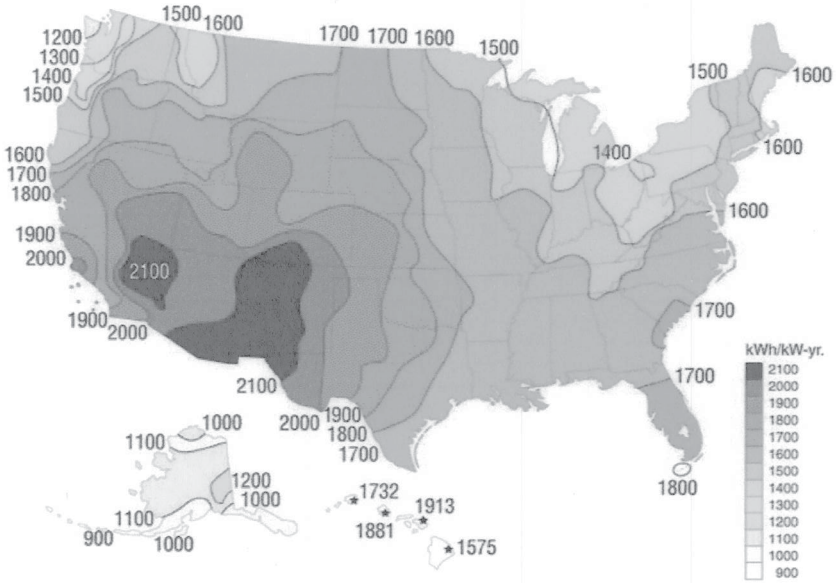
(direct sunlight only)



Toledo/Orlando = 75%
Toledo/SanDiego = 60% (direct radiation)
Toledo/Mojave = 45%

http://www.nrel.gov/gis/solar.html

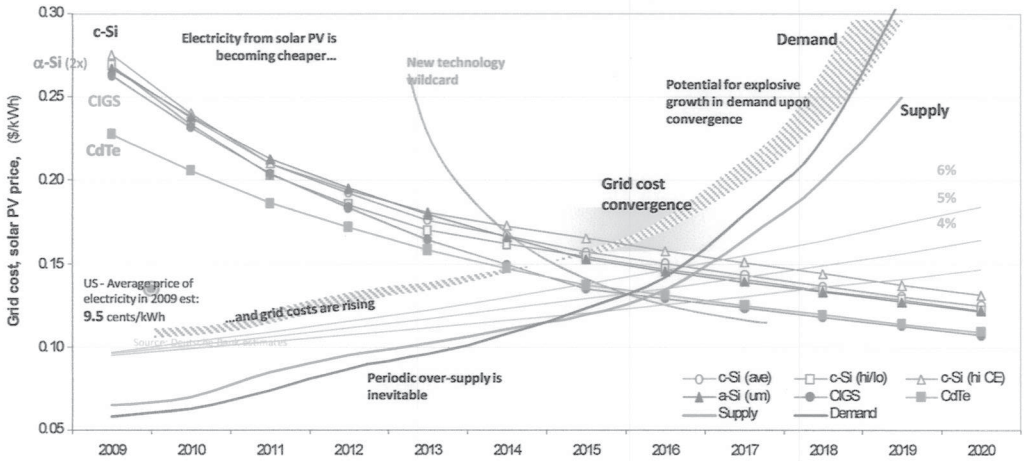
PV Energy kWh/kW-yr



Toledo/Orlando = 86%	Toledo/San Diego = 79% (full sky radiation)

Electricity Price Convergence – 5 to 6 Years

Solar PV industry – long-term outlook



Definitions:

First Generation PV: bulk crystalline silicon (monocrystalline, multicrystalline)
Second Generation PV: Inorganic thin films (CdTe, a-Si:H, a-SiGe, nc-Si:H, CIGS)
Third Generation PV: nanostructures, organic/hybrid, advanced concepts

Source: Deutsche Bank 2009

http://www.slideshare.net/gwsolar/pv-status-and-pathways-stephen-orourke

Stimulating alternatives creates Ohio jobs

- **Energy conservation / efficiency** is a big job creator and saves the consumer money.
- Ohio has a large number of manufacturers that are suppliers for **wind turbines.**
- **Maintenance** of wind turbines creates many jobs.
- In 2009 the largest PV manufacturer in the world was First Solar with all of its U.S. **manufacturing** in Perrysburg.
- Several other PV manufacturers are starting up in Ohio.
- **PV design and installation** creates many jobs.

References

http://www.bricker.com/documents/publications/1533.pdf
http://rredc.nrel.gov/wind/pubs/atlas/maps.html
http://www.nrel.gov/gis/solar.html
http://www.slideshare.net/gwsolar/pv-status-and-pathways-stephen-orourke

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December 18, 2010
Mobile: 419-265-2641

Notes from Davis Besse re-licensing community hearing

Kathryn Hoepfl

University of Toledo

December 2010

Figure Overview of Presentation on 12/18/2010

In section 7.2.2.2 of the Davis Besse Nuclear Power Station License Renewal Application, Environmental Report, First Energy dismisses all forms of renewable energy as a replacement for the 910MW from Davis Besse. Two types that are largely researched and widely used today are solar and wind power, both of which First Energy does not feel are satisfactory forms of energy production to be applied to the grid. The reasons they state are intermittency of power production, large land requirements for installation of either type, the low wind and sunlight irradiance in Ohio compared to other states, associated aesthetic impacts and the high costs per kilowatt-hour of capacity. Low wind speeds and irradiance in the area and costs are discussed in the notes by Dr. Alvin Compaan.

It is true that solar panels will only produce power during the day when the sun is shining, and that both wind speeds and solar irradiance change throughout the day and year; however, by looking at systems that are already in place in the area and around the world, we will be able to gain a better understanding of how to use these different types of renewable energy. This study specifically shows the case for Northwest Ohio and how it can in fact, be applied to the grid.

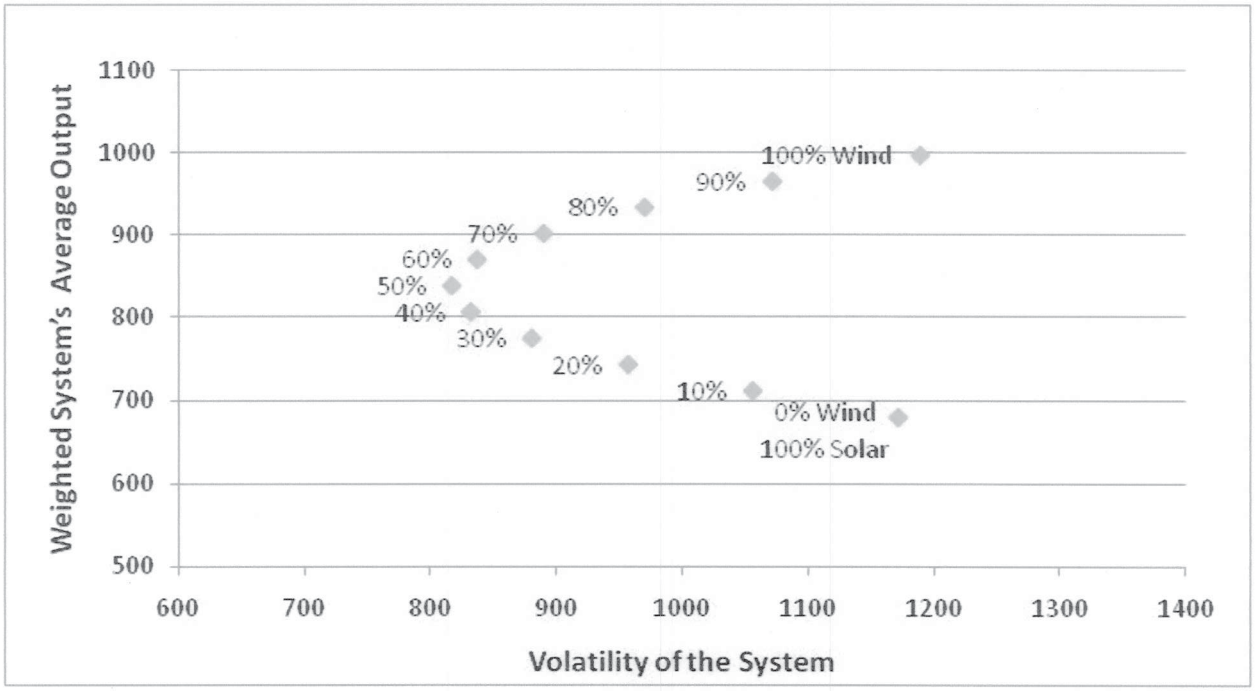

Figure Volatility vs Maximum Output of several hypothetical combination systems of solar and wind

I have used two functioning systems in the area, one wind turbine owned by Bowling Green Municipalities and one solar array on a home located about 20 miles north of the turbine in Toledo. With detailed statistical modeling, the above graph shows the volatility or intermittency of 10 hypothetical systems versus their output. Each hypothetical system is a different weighted combination of solar and wind, from 0 - 100% wind. As you can see, the system with the least volatility (most stable) is an even combination of 50% solar and 50% wind.

A single solar array follows patterns in its power production: only produces in the day, not at night and also the production is higher in the summer on average than in the winter. A single wind turbine also follows patterns: not as much predictability from day to day, however they produce more on average in the winter than they do in the summer months. By combining these two sources at the optimal ratio for the area, a much more stable and predictable output can be obtained. The slide below shows the hypothetical combination system against a large city demand curve like Toledo. We can also look at the system over an entire year and see that the standard deviation (measure of volatility) is consistently lower than either by itself.

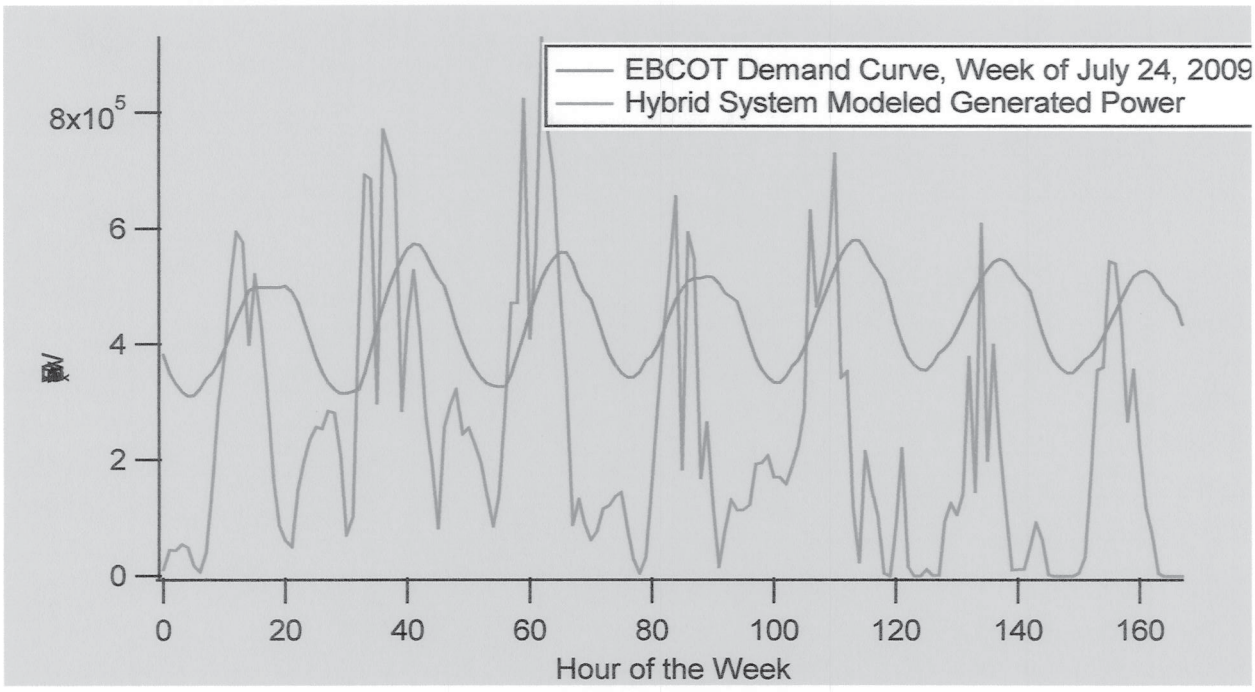

Figure Output of hypothetical system vs demand curve from central Texas, similar to that of Toledo.

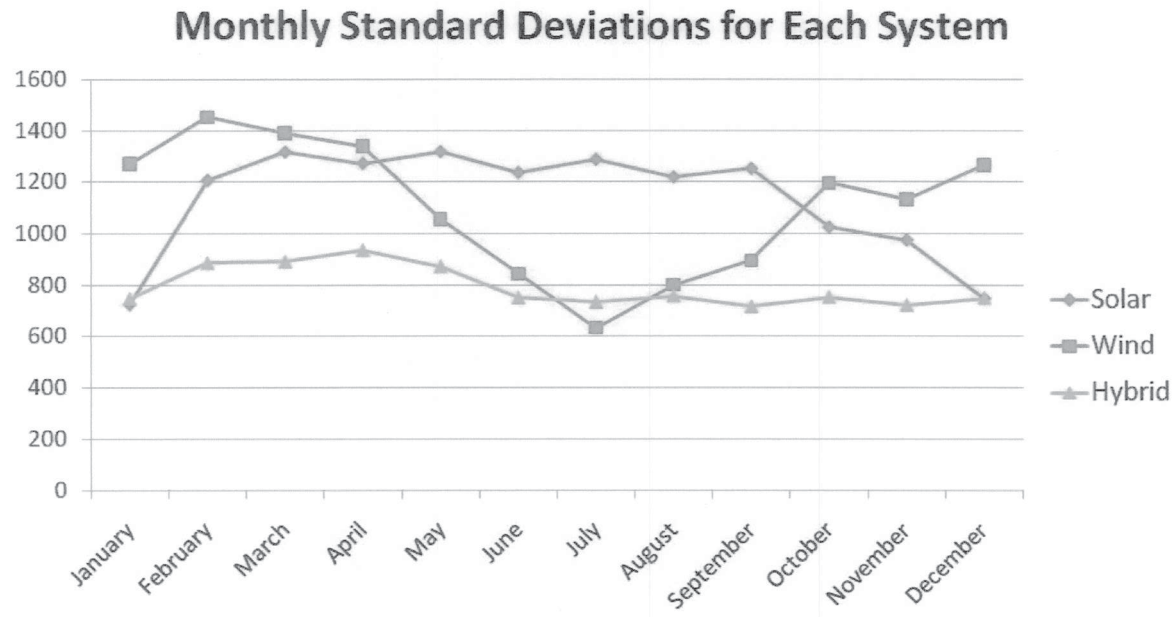

Figure Standard deviation of power production of a solar, wind and hybrid systems.

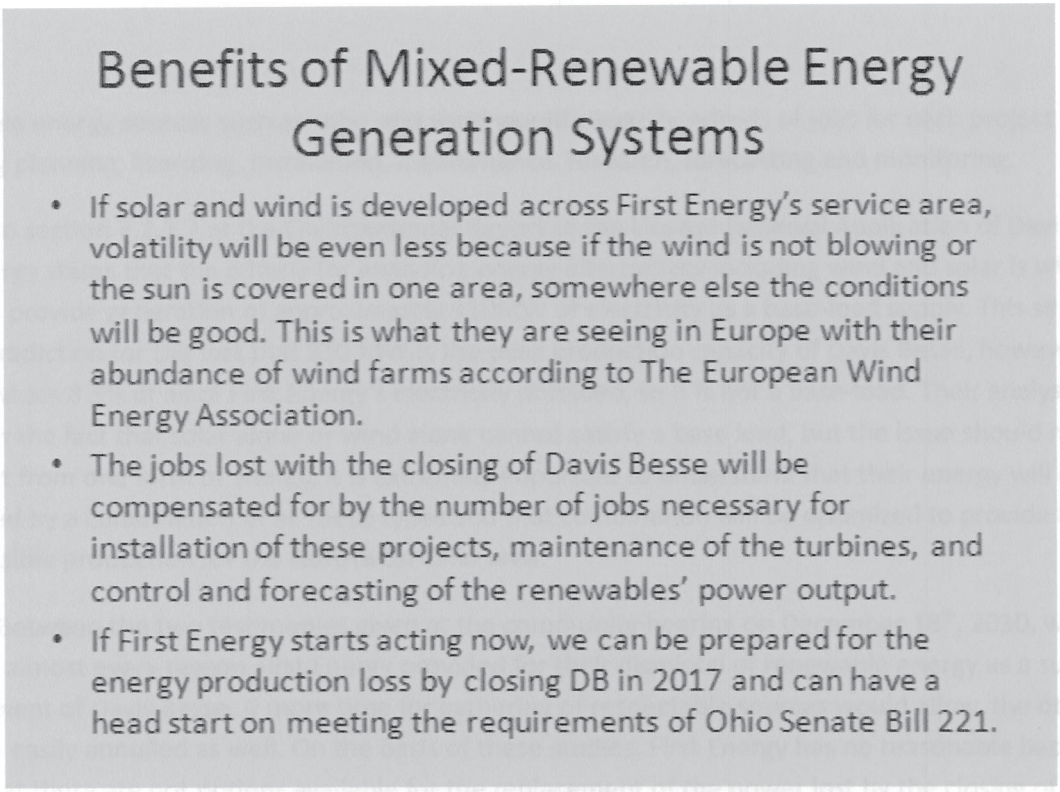

Figure Closing points

It is important to remind here that the work presented here is only based on two specific systems and not a complete representation of a solar or wind farm. If First Energy were to use its resources to install these renewable forms of energy throughout the region that they service, the volatility would be even less. The European Wind Energy Association's annual report put out in November 2010 reported that the intermittency of wind speeds in one location negligibly affects the overall base load that their wind farms produce. When wind is stale in one location, it is blowing in another so the drop in overall production is not seen as great as it is with the one single turbine I studied. The same concept can be applied to solar: when it is a severely overcast day in Toledo, it may be only partly cloudy in Cleveland (Compaan discusses how diffuse light from a cloudy day also produces power, not just direct sunlight). By expanding the area over which the power is produced, the effects of weather changes will not alter the base load as would be expected.

The EWEA report also provided a description of the forecasting which takes place to know what kind of wind speeds to expect. They are able to predict wind speeds 4 hours and up to a whole day even, in advance so they know how to plan for a sharp change. Extensive research and development would be needed in this area, however a mastering could really revolutionize the industry.

In many news articles that are being published about the re-licensing of Davis Besse, they refer back to how many jobs DB provides to the Sandusky area and the economic impact it has. Implementing

Davis-Besse licensing foes see need to gather now

40 speak at 'People's Hearing' to take videotaped testimony

Published 12/19/10 in *The Toledo Blade*

By TOM HENRY
BLADE STAFF WRITER

At first, it wasn't clear just how many people would actually show up in Toledo's Old West End Saturday for what was billed as the "People's Hearing" on FirstEnergy Corp.'s plan to extend the life of its Davis-Besse nuclear plant in Ottawa County by another 20 years.

"Certainly, we don't have enough people in this room," one of the event co-organizers, Anita Rios of Toledo, lamented just after the noon starting time.

But soon, as a succession of speakers went up to the microphone at St. Mark's Episcopal Church, an eclectic group of about 40 people settled in -- not a huge turnout, but one that pleased organizers for a variety of reasons, not the least of which is that it's hard getting people to give up valuable time on a cold Saturday afternoon in late December to hash out the pros and cons of nuclear power while most are making plans to be with families during the holidays.

That, coupled with the fact that Davis-Besse's license doesn't expire until April, 2017, and the fact the Nuclear Regulatory Commission has not yet turned down a single request for a license extension. FirstEnergy Corp., the plant's owner-operator, is seeking an extension through April, 2037.

"We, the people, will need to challenge not just FirstEnergy but also the NRC," Ms. Rios, co-chairman of the Green Party of Ohio, said.

The so-called "People's Hearing" was organized in response to a pair of officially sanctioned NRC meetings the agency held on Nov. 4 at Camp Perry, the Ohio National Guard base west of Port Clinton.